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ARISTOTLE

HISTORY OF ANIMALS
BOOKS IV-VI

WITH AN ENGLISH TRANSLATION BY
A. L. PECK



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SIGLA

Manuscripts cited throughout

A (= A ^a)	Marcianus graecus Z 208.
C (= C ^a)	Laurentianus LXXXVII. 4.
P	Vaticanus graecus 1339.
D (= D ^a)	Vaticanus graecus 262.

Manuscripts occasionally cited

Rhen.	Rhenani, nunc Parisinus suppl. graecus 212.
m	Parisinus graecus 1921.
Ambr.	Ambrosianus 46 (I. 56 sup.)
F (= F ^a)	Vaticanus graecus 506.

Readings and emendations

Σ	Michael Scot's Latin translation.
Gul.	William of Moerbeke's Latin translation.
vulg.	The reading of Bekker's Berlin edition.
A.-W.	Wimmer, in Aubert and Wimmer's edition.
Buss.	Bussemaker.
Camot.	Camotius.
Cs.	Camus.
Dt.	Dittmeyer.
Pi.	Piccolos.
Scal.	Scaliger.
Sn.	Schneider.
Sylb.	Sylburg.
Th.	D'Arcy Thompson.

Other names are unabbreviated.

INTRODUCTION

IN these Books a large number of animals, particularly birds and fishes, are mentioned, and the identification of many of them is uncertain. A full zoological commentary is impossible in a work such as the present; to produce such a commentary much observation and research by an expert on the spot would be required, and much time would need to be devoted to it. The reader must not expect, therefore, to find in these volumes any new contributions on this aspect of the *H.A.* For the most part I have relied upon D'Arcy Thompson's invaluable compilations, *A Glossary of Greek Birds* (Oxford Univ. Press, new edition, 1936), and *A Glossary of Greek Fishes* (*ibid.*, 1947), supplemented occasionally by articles on individual animals by other writers and by discussions with scientific friends. In many cases, however, it is still impossible to say with certainty what animal Aristotle is referring to, and hence many transliterated Greek names will be seen in the translation. With regard to fishes, the uncertainty of many identifications is evident from the work of Prof. Alfred C. Andrews, who in the course of his detailed investigations cites a great variety of interpretations of individual names by different writers.^a Readers with first-hand knowledge of the fauna of the Mediterranean area may be able to recognize some of the species from Aristotle's descriptions. It would be absurd to pretend that I have such knowledge myself.

The Notes, to the paragraphs of which reference is frequently made in the footnotes to the translation, will be found in the introductory part of the first volume. In an Appendix to the present volume I

^a See, e.g., *Trans. Amer. Philol. Assoc.* LXXIX (1948), pp. 232-253.

INTRODUCTION

have given an account of the risings and settings of the stars, which I hope may be useful to the reader in elucidating Aristotle's references, and also more generally, as providing for the unastronomical layman an intelligible explanation of a somewhat complicated subject.

As I explained in the Introduction to the first volume, the text has been thoroughly worked through. In the present volume a few passages, where the text appears to have suffered exceptional corruption, are discussed at some length.

I should like to record here my very sincere gratitude for a year's membership of the Institute for Advanced Study at Princeton, N.J., where I was able under ideal conditions to continue my work on the introductory part of the first volume and to complete the work for the present volume ; and to express my thanks to those who have helped me with particular problems, as will be seen in the Additional Notes, and especially p. 382.

A. L. P.

INSTITUTE FOR ADVANCED STUDY,
PRINCETON, N.J.
May 19th, 1964

HISTORIA ANIMALIUM

ΤΩΝ ΠΕΡΙ
ΤΑ ΖΩΙΑ ΙΣΤΟΡΙΩΝ

Δ

523 a

I Περὶ μὲν οὖν τῶν ἐναίμων ζώων, ὅσα τε κοινὰ
32 ἔχουσι μέρη καὶ ὅσα ἴδια ἕκαστον γένος, καὶ τῶν
ἀνομοιομερῶν καὶ τῶν ὁμοιομερῶν, καὶ ὅσα ἐκτὸς
523 b καὶ ὅσα ἐντὸς,¹ εἴρηται πρότερον· περὶ δὲ τῶν ἀναί-
μων ζώων νυνὶ λεκτέον. ἔστι δὲ γένη ταῦτα² πλείω,
ἐν μὲν τὸ τῶν καλουμένων μαλακίων· ταῦτα δ' ἔστιν
ὅσα ἄναιμα ὄντα ἐκτὸς ἔχει τὸ σαρκῶδες, ἐντὸς δ' εἴ-
τι ἔχει στερεόν, καθάπερ καὶ τὰ ἔναιμα τῶν ζώων,³
5 οἷον τὸ τῶν σηπιῶν γένος. ἐν δὲ τὸ τῶν μαλα-
κοστράκων· ταῦτα δ' ἔστιν ὅσων ἐκτὸς τὸ στερεόν,
ἐντὸς δὲ τὸ μαλακὸν καὶ σαρκῶδες· τὸ δὲ σκληρὸν
αὐτῶν ἔστιν οὐ θραυστὸν ἀλλὰ θλαστὸν, οἷον ἔστι
τὸ τε τῶν καράβων γένος καὶ τὸ τῶν καρκίνων.

¹ sic AC: ἐντὸς καὶ ὅσα ἐκτὸς PD, vulg.

² ταῦτα AC: om. PD, vulg.

³ τῶν ζώων AC: om. PD, vulg.

^a In the present passage Aristotle uses *γένος* both (a) for the main groups of blooded and bloodless animals (cf. 490 b 7 ff., 505 b 25), and also (b) for the smaller groups within the larger bloodless groups. I have here, as previously, used "group" for the former; and for the latter I have used "tribe." In discussing the various sorts of animals comprised by the fourth bloodless group Aristotle here uses the word

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BOOK IV

So far as blooded animals are concerned, we have I described the parts common to them all and those A. 3. peculiar to each group,^a and both the uniform and the BLOODLESS non-uniform parts, internal and external. We now ANIMALS. have to speak of the bloodless animals, and of these The four groups. there are several groups. One group is the Softies as they are called.^b This consists of bloodless animals whose fleshy part is exterior, and the hard part (if any) is interior—just as in the blooded animals. An example is the tribe of cuttlefish. Another group is the Softshells. These have their hard part on the outside, and the soft fleshy part inside. This hard substance cannot be broken by a clean crack; it has to be crushed. Examples are the tribe of crayfish^c and that

εἶδη; perhaps because he is thinking especially of their physical appearance. See Notes, §§ 5 ff.

^b Here, as in Book I, 490 b 11 ff. (where see note), the passage requires a literal translation of Aristotle's terms. For him, these terms are not "names" but descriptive epithets; cf. also Introd., vol. i, p. vii, and Notes, § 11.

^c This word is sometimes spelt "crawfish," a spelling which appears to date from 1860. The second syllable has become assimilated to "fish," with which it has no connexion. Earlier forms were "crevice," "crevisse," derived from the same stem as "crab."

ἔτι δὲ τὰ ὀστρακόδερμα· τοιαῦτα δ' ἐστὶν ὧν ἐντὸς
 10 μὲν τὸ σαρκῶδες ἐστίν, ἐκτὸς δὲ τὸ στερεόν, θραυσ-
 τὸν ὃν καὶ κατακτόν, ἀλλ' οὐ θλαστόν· τοιοῦτον δὲ
 τὸ τῶν κοχλιῶν γένος καὶ τὸ τῶν ὀστρέων ἐστίν.
 τέταρτον δὲ τὸ τῶν ἐντόμων, ὃ πολλὰ καὶ ἀνόμοια
 περιεῖληφεν εἶδη ζώων. ἔστι δ' ἔντομα ὅσα κατὰ
 τοῦνομά ἐστὶν ἐντομὰς ἔχοντα ἢ ἐν τοῖς ὑπτίοις ἢ ἐν
 15 τοῖς πρᾶνέσιν ἢ ἐν ἀμφοῖν, καὶ οὔτε ὀστῶδες ἔχει¹
 κερωρισμένον οὔτε σαρκῶδες, ἀλλὰ μέσον ἀμφοῖν·
 τὸ σῶμα γὰρ ὁμοίως καὶ ἔσω καὶ ἔξω σκληρόν ἐστίν
 αὐτῶν. ἔστι δ' ἔντομα καὶ ἄπτερα, οἷον ἰούλος καὶ
 σκολόπενδρα, καὶ πτερωτά, οἷον μέλιττα καὶ μηλο-
 λόνθη καὶ σφήξ· καὶ ταῦτ' ὁ γένος ἐστὶ καὶ πτε-
 20 ρωτὸν καὶ ἄπτερον, οἷον μύρμηκες εἰσι καὶ πτερωτοὶ
 καὶ ἄπτεροι, καὶ αἱ καλούμεναι πυγολαμπίδες.

Τῶν μὲν οὖν μαλακίων καλουμένων τὰ μὲν ἔξω
 μόρια τὰδ' ἐστίν, ἐν μὲν οἱ ὀνομαζόμενοι πόδες,
 δεύτερον δὲ τούτων ἐχομένη ἢ κεφαλὴ, τρίτον δὲ
 τὸ κύτος, ὃ περιέχει πάντος, καὶ καλοῦσιν αὐτὸ
 25 κεφαλὴν τινες, οὐκ ὀρθῶς καλοῦντες· ἔτι δὲ πτερύγια
 κύκλω περὶ τὸ κύτος. συμβαίνει δ' ἐν πᾶσι τοῖς
 μαλακίοις μεταξὺ τῶν ποδῶν καὶ τῆς γαστρὸς εἶναι
 τὴν κεφαλὴν. πόδας μὲν οὖν ὀκτώ πάντ' ἔχει, καὶ
 τούτους δικοτύλους πάντα, πλὴν ἐνὸς γένους πολυ-
 πόδων. ἰδίᾳ δ' ἔχουσιν αἱ τε σηπταὶ καὶ αἱ τευθίδες
 30 καὶ οἱ τεῦθοι δύο προβοσκίδας μακράς, ἐπ' ἄκρων
 τραχύτητα ἐχούσας δικότυλον, αἷς προσάγονται τε

¹ ἐν inser. vulg.: ἐγ PD. om. AC.

^a See nn. on 487 a 26, 490 b 11.

^b Perhaps a kind of centipede; cf. P.A. 682 b 3.

of crabs. Then there are the Potsherd-skins. These have their fleshy part inside and their hard part outside: the latter will break by cracking but does not crush. Examples are the tribe of snails and that of shellfish.^a The fourth group is that of Insects; this includes many and dissimilar kinds of animals. Insects, as their name indicates, are animals which have insections either on their under or their upper surface, or in both places; they have no separate bony part nor fleshy part, but consist of something intermediate between the two; in other words, their body is uniformly hard both within and without. Some insects are wingless (as the *ioulos*,^b and the millipede), others winged (as the bee, the cockchafer, and the wasp); and sometimes one and the same kind of insect is found both winged and wingless (as the ant and the glowworm).

The following are the external parts of the Softies as Cephalopods: (1) the so-called feet; (2) the head, which is continuous with the feet; (3) the sac, which contains the internal parts, and is called by some the head, wrongly^c; (4) the fins, which encircle the sac. In all Softies or Cephalopods the head is placed between the feet and the belly. All of them have eight feet, and these always have a double row of suckers—except for one kind^d of octopus. A peculiarity in the cuttlefish, the *teuthides*, and the *teuthoi*^e is the two long tentacles, at the end of which is a rough part with two rows of suckers; these tentacles they use for taking their food and conveying it to their

^a But see P.A. 685 a 5, "the sac, which in the octopuses, and in them alone, is called the head."

^b This is the *heledōnē*; see 525 a 17.

^c Species of calamary; for the difference between them see 524 a 25 ff. below.

καὶ λαμβάνουσιν εἰς τὸ στόμα τὴν τροφήν, καὶ ὅταν
χειμῶν ἤ, βαλλόμενοι πρὸς τινα πέτραν ὥσπερ
524 a ἀγκύρας ἀποσαλεύουσιν. τοῖς δὲ πτερυγίοις, ἀ¹
ἔχουσι περὶ τὸ κύτος, νέουσιν. ἐπὶ δὲ τῶν ποδῶν
αἱ κοτυληδόνες ἅπασιν εἰσιν.

Ὁ μὲν οὖν πολύπους καὶ ὡς ποσὶ καὶ ὡς χερσὶ
χρῆται ταῖς πλεκτάναις. προσάγεται μὲν οὖν ταῖς
δυσὶ ταῖς ὑπὲρ τοῦ στόματος· τῇ δ' ἐσχάτῃ² τῶν
5 πλεκτανῶν, ἣ ἔστιν ὀξύτατη τε καὶ μόνη παράλευ-
κος αὐτῶν καὶ ἐξ ἄκρου δικρόα—ἔστι δὲ λυτῇ³ ἐπὶ
τῇ ῥάχῃ (καλεῖται δὲ ῥάχῃς τὸ λεῖον, οὐ πρόσω αἱ
κοτυληδόνες εἰσὶν)—ταύτῃ⁴ τῇ πλεκτάνῃ χρῆται
ἐν ταῖς ὀχθείαις. πρὸ τοῦ κύτους δ' ὑπὲρ τῶν πλεκ-
10 τανῶν ἔχουσι κοῖλον αὐλόν, ᾧ τὴν θάλατταν ἀφίαισι
δεξιόμενοι τῷ κύτει, ὅταν τι τῷ στόματι λαμβάνου-
σιν. μεταβάλλει δὲ τοῦτον ὅτε μὲν εἰς τὰ δεξιὰ ὅτε
δ' εἰς τὰ ἀριστερά⁵· ἀφίησι⁶ δὲ καὶ τὸν θολὸν ταύτῃ.
νεὶ δὲ πλάγιος ἐπὶ τὴν καλουμένην κεφαλὴν, ἐκτείνων
τοὺς πόδας· οὕτω δὲ νέοντι συμβαίνει προορᾶν μὲν
15 εἰς τὸ πρόσθεν (ἐπάνω γὰρ εἰσιν οἱ ὀφθαλμοί), τὸ
δὲ στόμα ἔχειν ὀπίσθεν. τὴν δὲ κεφαλὴν, ἕως ἂν ζῆι,
σκληρὰν ἔχει (καὶ)⁸ καθάπερ ἐμπεφυσημένην. ἅπ-

¹ sic PD: τοῖς δ' ὡσπερ πτ. οἷς vulg.

² δ' ἐσχάτῃ] δὲ σχιστῇ suspic. Th. (GGF 206): cf. 525 b 16.

³ λυτῇ scripsi: αὐτῇ codd., edd. (αὐτῇ ἢ ἐπὶ P): τοιαύτη
coni. Dt.: ἐσχίσται δ' αὐτῇ malunt A.-W.: ἔστι δ' αὐτῇ coni.
Th.: et eorum extrema sunt fissa in duo et est radix eorum
in parte spondilii Σ (unde crederes Arab. ἀρχή vertisse).

⁴ δὲ add. P, vulg.: δὴ D, om. AC.

⁵ sic AC: εὐώνυμα PD, vulg.

⁶ sic A: ἀφίαισι PD, vulg.

⁷ ἔχειν Pi. e Scal.: ἔχει codd.

⁸ καὶ add. Sn.

^a Cf. P.A. 685 a 33 ff.

^b Aristotle is here referring to the remarkable phenomenon

mouth, and when the weather is stormy they throw
them out to fasten on a rock like anchors and ride
the storm.^a With their fins, which are around the sac,
they swim. In all of them the suckers are on their feet.

The octopus uses its tentacles both as feet and as
hands; it draws in its food with the two that are
placed over its mouth. The last of them, which is very
sharp and is the only one which is whitish in colour
and bifurcated at the tip^b—it is made so as to uncoil
on the *rhachis* side (the *rhachis* being the smooth
surface of the tentacle away from the suckers)—this
one it uses in the act of copulation. In front of the
sac and above the tentacles they have a hollow tube,
by means of which they discharge from the sac any
sea-water which may have come in while taking food
into the mouth. The animal can move this tube to
right and to left; it also discharges its "ink" through
it. It swims obliquely in the direction of the so-called
head,^c stretching out its feet; and by swimming in
this way it can see forwards (since its eyes are on top),
while its mouth is at the rear. So long as the animal
is alive, the head is hard and as it were inflated. It

in the Dibranchiata of the "hectocotylization" of one of the
arms of the male, by means of which copulation is effected.
At *G.A.* 720 b 33 ff., however, where the subject is again
mentioned, Aristotle denies that copulation is effected by
means of this arm; and at *H.A.* 541 b 9 he seems non-
committal: cf. also 544 a 12. For details and diagrams see
P. Pelseneer, *Mollusca* (tr. G. Bourne), pp. 323 ff., F. J. Cole,
A history of comparative anatomy, pp. 28-33, where he
relates the history of the slow rediscovery of the phenomenon
during the 19th century; and the diagrams in Thompson's
translation.—I have written here in the Greek text λυτῇ
(AYTH) instead of the mss.' αὐτῇ (AYTH), which gives no
sense. The filament is at first contained in a sac in which it
develops. The motion of uncoiling or undoing therefore
seems appropriate.

^c Cf. 459 b 35.

τεται δὲ καὶ κατέχει ταῖς πλεκτάναις ὑπτίαις, καὶ ὁ μεταξὺ τῶν ποδῶν ὑμῆν διατέταται πᾶς· ἐὰν δ' εἰς τὴν ἄμμον ἐμπέσῃ, οὐκέτι δύναται κατέχειν.

- 20 Ἐχουσι δὲ διαφορὰν οἱ τε πολυπόδες καὶ τὰ εἰρημένα τῶν μαλακίων· τῶν μὲν γὰρ πολυπόδων τὸ μὲν κύτος μικρόν, οἱ δὲ πόδες μακροὶ εἰσι, τῶν δὲ τὸ μὲν κύτος μέγα, οἱ δὲ πόδες βραχεῖς, ὥστε μὴ πορεύεσθαι ἐπ' αὐτοῖς. αὐτῶν δὲ πρὸς αὐτά, τὰ μὲν μακρότερα¹ ἐστὶν οἶον² ἢ τευθίς, ἢ δὲ σηπία
- 25 πλατύτερον. τῶν δὲ τευθίδων οἱ τευθοὶ καλούμενοι ἐπὶ πολὺ μείζους· γίνονται γὰρ καὶ πέντε πήχειων τὸ μέγεθος. γίνονται δὲ καὶ σηπία ἔναι διπήχεις, καὶ πολυπόδων πλεκτάναι τηλικαῦται καὶ μείζους ἔτι τὸ μέγεθος. ἔστι δὲ τὸ γένος ὀλίγον τῶν τευθῶν.
- 30 διαφέρει δὲ τὸ σχῆμα τῶν τευθίδων ὁ τευθος³. πλατύτερον γὰρ ἐστὶ τὸ ὀξὺ τῶν τευθῶν, ἔτι δὲ τὸ κύκλω πτερύγιον περὶ ἅπαν ἐστὶ τὸ κύτος· τῇ δὲ τευθίδι ἐλλείπει. ἔστι δὲ πελάγιον, ὥσπερ καὶ ἡ τευθίς.

- Μετὰ δὲ τοὺς πόδας ἡ κεφαλὴ ἐστὶν ἀπάντων
- 524 b ἐν μέσῳ τῶν ποδῶν, τῶν καλουμένων πλεκτανῶν. ταύτης δὲ τὸ μὲν ἐστὶ στόμα, ἐν ᾧ ἔνεισι⁴ δύο ὀδόντες· ὑπὲρ δὲ τούτων ὀφθαλμοὶ μεγάλοι δύο, ὧν τὸ μεταξὺ μικρὸς χόνδρος ἔχων ἐγκέφαλον μικρόν. ἐν δὲ τῷ στόματι ἐστὶ μικρόν σαρκῶδες· γλώτταν
- 5 δ' οὐκ ἔχει αὐτῶν οὐδέν, ἀλλὰ τούτῳ χρῆται ἀντὶ γλώττης. μετὰ δὲ τοῦτο ἔξωθεν μὲν ἔστιν ἰδεῖν τὸ φαινόμενον κύτος. ἔστι δ' αὐτοῦ ἡ σὰρξ σχιστή,

¹ τὰ μὲν μακρότερα coni. Dt., Sn. secutus : τὸ μὲν μακρότερον codd. (-ὄσάτων C), vulg. ² οἶον P : om. ACD, vulg.

³ sic A¹C : διαφέρουσι δὲ τῷ σχήματι τῶν τ. οἱ τευθοὶ PDA², vulg. ⁴ ἔνεισι AC : εἰσι PD, vulg.

^a See n. on 525 b 20.

takes hold of things and retains them with the under-side of its tentacles, and the membrane between its feet is kept extended in its entirety. If it gets on to the sand, it can no longer retain its hold.

The octopus differs as follows from the Cephalopods already mentioned. The octopus has a small sac and long feet, whereas the others have a large sac and short feet, too short to walk with. To compare these creatures with one another: some, such as the *teuthis*, are longer, whereas the cuttlefish is broader.^a The *teuthoi*, as they are called, are much larger than the *teuthides*^b: specimens are found as long as five cubits. Some cuttlefish reach a length of two cubits, and the tentacles of the octopus can be as long as this, or even longer. The class *teuthos* is not a numerous one. The *teuthos* differs from the *teuthis* in shape: its sharp part is broader, and its encircling fin goes all round the sac, whereas in the *teuthis* it does not. Like the *teuthis*, it is a sea-creature.

In all of them the head is placed after the feet, in the middle of the feet or "tentacles" as they are called. In the head is a mouth, containing two teeth, and above these two large eyes, between which is a small cartilage containing a small brain. Inside the mouth is a small fleshy organ, which it uses instead of a tongue, since none of these animals has a proper tongue. After this, on the outside, can be seen what looks like a sac: the flesh of which this consists can

^b These are two kinds of calamary ("pen-fish") or squid. *Teuthos* appears to be *Ommastrephes sagittatus* (*Ommastrephes* d'Orbigny 1825 = *Ommastrephes* Agassiz 1846 = *Todarodes* Steenstrup 1880). *Teuthis* is probably *Loligo vulgaris*. They belong respectively to two families, viz., *Ommastrephidae* and *Loliginidae*, which are included in the sub-order *Teuthoidea*.

οὐκ εἰς εὐθύ μέντοι ἀλλὰ κύκλω· δέρμα δ' ἔχουσι πάντα τὰ μαλάκια περι ταύτην. μετὰ δὲ τὸ στόμα ἔχουσιν οἰσοφάγον μακρὸν καὶ στενόν, ἐχόμενον δὲ 10 τούτου πρόλοβον μέγαν καὶ περιφερῆ ὀρνιθώδη.¹ τούτου δ' ἔχεται ἡ κοιλία οἷον ἡνυστρον· τὸ δὲ σχῆμα² ὁμοιον τῇ ἐν τοῖς κήρυξιν ἐλίκη. ἀπὸ δὲ ταύτης ἄνω πάλιν φέρει πρὸς τὸ στόμα ἔντερον λεπτόν· παχύτερον³ δ' ἐστὶ τοῦ στομάχου τὸ ἔντερον.

Σπλάγγχον δ' οὐδὲν ἔχει τῶν μαλακίων, ἀλλ' ἦν 15 καλοῦσι μύτιν, καὶ ἐπὶ ταύτῃ θολόν. τούτον δὲ πλείστον αὐτῶν καὶ μέγιστον⁴ ἡ σηπία ἔχει· ἀφίησι μὲν οὖν ἅπαντα, ὅταν φοβηθῆ, μάλιστα δ' ἡ σηπία. ἡ μὲν οὖν μύτις κεῖται ὑπὸ τὸ στόμα, καὶ διὰ ταύτης⁵ τείνει ὁ στόμαχος· ἡ δὲ τὸ ἔντερον ἀνατείνει, κάτωθεν ὁ θολός, καὶ τῷ αὐτῷ ὑμένι περιεχόμενον 20 ἔχει τὸν θολόν⁶ τῷ ἐντέρῳ, καὶ ἀφίησι κατὰ ταυτόν τὸν τε θολόν καὶ τὸ περίττωμα· ἔχουσι δὲ καὶ τριχώδη ἄττα ἐν τῷ σώματι.

Τῇ μὲν οὖν σηπία καὶ τῇ τευθίδι καὶ τῷ τεύθω ἐντός ἐστὶ τὰ στερεὰ ἐν τῷ πραινεί τοῦ σώματος, ἀ καλοῦσι τὸ μὲν σήπιον τὸ δὲ ξίφος. διαφέρει δέ-

¹ sic AC, vulg.: παρεμφερῆ ὀρνιθι PD: *parperam magnam similem rapere avium* Σ (non igitur vertit περιφερῆ).

² ἔσχατον mavult Th.

³ πλατύτερον conl. Scal., Pi.: *spissius* Σ.

⁴ καὶ μέγιστον om. Gaza, damnant Scal., Sn., secl. Dt.: πλείστον πάντων καὶ τῶν μεγίστων Pi.

⁵ sic AC: δι' αὐτῆς PD, vulg.

⁶ θολόν Sn.: θορόν AC: πόρον PD, vulg.

^a It is interesting to note that the word *parpera* (see critical note above) which Michael Scot uses here, is not a Latin

be split, not lengthwise, but into circular pieces. All Cephalopods have a skin surrounding this part. Next after the mouth is a long narrow oesophagus, and close after that a crop,^a large and spherical, like a bird's. Next follows the stomach, like the *abomasum*^b of ruminants: in shape it resembles the convolution in the trumpet-shells. From this there leads back again upwards towards the mouth a fine gut: it is thicker than the oesophagus.

None of the Cephalopods has viscera, but they have what is called a *mytis*,^c and upon it the ink-sac; this is largest and its contents most abundant in the cuttlefish. All Cephalopods discharge such a fluid when they are alarmed, and the cuttlefish most copiously of all. Now the *mytis* is situated under the mouth, and the oesophagus passes through it; and at the point to which the gut extends, down below, is the ink-sac, which is enveloped in the same membrane as the gut: the animal discharges both ink and residue at the same place. These creatures have certain hairy growths^d in their bodies.

Now in the cuttlefish, the *teuthis*, and the *teuthos* the hard parts are inside, towards the back of the body: they are called respectively the "sepium" and the "sword." They differ as follows: the sepium is

word, but is the Spanish word for "crop." He was writing at Toledo.

^b The fourth stomach of ruminants; cf. 507 b 9, and *P.A.* 674 b 16, 678 b 25 ff.

^c The *mytis* or *mecon*, lit. "poppy," an excretory organ, the hepatopancreas or liver; cf. *P.A.* 679 b 11, 680 a 22, 681 b 15 ff. See Anna M. Bidder, "The digestive mechanism of the European Squids *Loligo vulgaris*, *L. forbesii*, *Alloteuthis media* and *A. subulata*," in *Q. Journal of Microscopical Sciences*, 91 (March 1950), pp. 1-43.

^d Probably the gills; cf. 529 a 32, 550 b 18.

524 b

25 τὸ μὲν γὰρ σήπιον ἰσχυρὸν καὶ πλατὺ ἐστὶ, μεταξὺ ἀκάνθης καὶ ὀστοῦ, ἔχον ἐν αὐτῷ ψαθυρότητα συμφήν, τὸ δὲ τῶν τευθίδων λεπτόν καὶ χονδρωδέστερον. τῷ δὲ σχήματι διαφέρουσιν ἀλλήλων ὥσπερ καὶ τὰ κύττη. οἱ δὲ πολυπόδες οὐκ ἔχουσιν εἴσω στερεὸν τοιοῦτον οὐδέν, ἀλλὰ περὶ τὴν κεφαλὴν χονδρῶδες,
30 ὃ γίνεταί, ἐάν τις αὐτῶν παλαιωθῆ, σκληρόν.

Τὰ δὲ θήλεα τῶν ἄρρένων διαφέρουσιν· οἱ μὲν γὰρ ἄρρενες ἔχουσι πόρον ὑπὸ τὸν στόμαχον, [ἀπὸ τοῦ ἐγκεφάλου]¹ τείνοντα πρὸς τὸ² κάτω τοῦ κύτους· ἐστὶ δὲ πρὸς ὃ τείνει, ὁμοίον μαστῷ· ἐν δὲ ταῖς
525 a θηλείαις δύο τε ταῦτ' ἐστὶ καὶ ἄνω. ἀμφοτέροις δ' ὑπὸ ταῦτα ἐρυθρὰ ἅττα σωματῖα πρόσεστιν. τὸ δ' ὦδον ὃ μὲν πολυπόους ἐν καὶ ἀνώμαλον ἐξῶθεν καὶ μέγα ἴσχει· ἐσω δὲ τὸ ὑγρὸν, ὁμόχρονον ἅπαν καὶ λείον, χρῶμα δὲ λευκόν· τὸ δὲ πλῆθος τοῦ ὦδου
5 τοσοῦτον ὥστε πληροῦν ἀγγεῖον μείζον τῆς τοῦ πολυπόδος κεφαλῆς. ἡ δὲ σηπία δύο τε τὰ κύττη καὶ πολλὰ ὦα ἐν τούτοις, χαλάζαις ὅμοια λευκαῖς. ἕκαστα δὲ τούτων ὡς κεῖται τῶν μορίων, θεωρεῖσθω ἐκ τῆς ἐν ταῖς ἀνατομαῖς διαγραφῆς.

Πάντα δὲ τὰ ἄρρενα ταῦτα τῶν θηλειῶν διαφέρει, 10 καὶ μάλιστα ἡ σηπία· τὰ τε γὰρ πρᾶνῆ τοῦ κύτους, ὄντα³ μελάντερα τῶν ὑπίων, τραχύτερά τ' ἔχει ὃ ἄρρην τῆς θηλείας καὶ διαποίκιλα ῥάβδοις καὶ τὸ ὀρροπύγιον ὀξύτερον.

"Ἔστι δὲ γένη πλείω πολυπόδων, ἐν μὲν τὸ μά-

¹ seclusi: a *cerebro* Σ; aut κελύφου aut ἐν κελύφῳ conī. Th. (debuīt κελύφους et ἐν κελύφῳ scribere).

² τὸ A: τὰ PD, vulg. ³ ὄντα AC: πάντα PD, vulg.

^a It is now known that the cuttlefish bone is a highly complex chambered organ, filled with a mixture of fluid and

strong and broad, and in consistency midway between bone and fish-spine: it contains a spongy crumbling substance.^a In the *teuthis* this part is thin and more like cartilage. These parts differ from one another in shape, as also the body-sacs of these animals do. The octopus has no such hard part at all inside, though it has a cartilaginous substance round its head, which becomes hard if the animal reaches an advanced age.

The females differ from the males. The males have a passage below the oesophagus, which extends [from the brain] to the lower region of the sac; and there is a part to which it extends, similar to a breast. In the female there are two of these, higher up. In both sexes there are in addition certain red objects below these. The egg of the octopus is single, uneven on the outside, and large; inside, the fluid is all of one colour, smooth, and white in colour. The egg is so multitudinous that it fills a vessel bigger than the octopus' head. The cuttlefish has two sacs and numerous eggs in them, like white hailstones. For details of the arrangement of these parts, the diagram in the *Dissections*^b should be consulted.

In all of these animals the males differ from the females, and particularly in the case of the cuttlefish. The back of the sac, which is blacker than the front, is rougher in the male than in the female; the back is striped and the rump is more pointed.

There are several kinds of octopus. One, the largest

gas, by regulating which the animal can control the level at which it swims. See E. J. Denton and J. B. Gilpin-Brown, "The buoyancy of the cuttlefish *Sepia officinalis*," in *J. Marine Biol. Assoc. U.K.*, 41 (1961), pp. 319-342; also E. J. Denton, "Buoyancy mechanisms of sea creatures," in *Endeavour*, 22 (1963), pp. 3 ff.

^b See n. on 509 b 22.

λιστ' ἐπιπολάζον καὶ μέγιστον αὐτῶν (εἰσὶ δὲ πολὺ
 15 μείζους οἱ πρόσγειοι τῶν πελαγίων), ἔτι δ' ἄλλοι
 μικροί, ποικίλοι, οἱ οὐκ ἐσθίονται. ἄλλο¹ δὲ ἡ²
 καλουμένη ἐλεδώνη, μήκει τε διαφέρουσα τῷ τῶν
 ποδῶν καὶ τῷ μονοκότυλον εἶναι μόνον³ τῶν μαλα-
 κίων (τὰ γὰρ ἄλλα πάντα δικότυλά ἐστι), ἦν καὶ⁴
 καλοῦσιν οἱ μὲν βολιταίαν οἱ δ' ὄζολιν. ἔτι δ' ἄλλοι
 20 δύο ἐν ὄστρείοις, ὃ τε καλούμενος ὑπὸ τινῶν ναυτίλος
 καὶ ποντίλος, ὑπ' ἐνίων δ' ὦν πολύποδος⁵. τὸ δ'
 ὄστρακον αὐτοῦ ἐστὶν οἶον κτεῖς κοῖλος καὶ οὐ συμ-
 φυῆς. οὗτος νέμεται πολλάκις παρὰ τὴν γῆν, εἴθ'
 ὑπὸ τῶν κυμάτων ἐκκλύζεται εἰς τὸ ξηρὸν, καὶ
 παραπεσόντος τοῦ ὄστρέου [ἀλίσκεται καὶ]⁶ ἐν τῇ
 25 γῇ ἀποθνήσκει.⁷ εἰσὶ δ' οὗτοι μικροί, τὸ εἶδος
 ὅμοιοι ταῖς βολιταίαις. καὶ ἄλλος ἐν ὄστράκῳ
 οἶον κοχλίας, ὃς οὐκ ἐξέρχεται ἐκ τοῦ ὄστράκου,
 ἀλλ' ἔνεστιν ὡσπερ ὁ κοχλίας, καὶ ἔξω ἐνίοτε τὰς
 πλεκτάνας προτείνει. περὶ μὲν οὖν τῶν μαλακίων
 εἴρηται.

¹ ἄλλο C.; ἄλλοι P.

² ἄλλο δὲ ἡ A.-W. (qui et mox v. 19 ἦν καὶ) quia nomen ὄζολις optime ἐλεδώνη convenit: ἄλλα τε δύο, ἡ τε vulg. (δὲ loco τε δύο PD). ³ μόνον APD: μόνην vulg.

⁴ ἦν καὶ A.-W.: καὶ ἦν codd., vulg.

⁵ sic PD, vulg.: ὑπ' ἐνίων ἐστὶ δ' οἶον πολύπους AC, quod et Dt. exhibet, sed καὶ ποντίλος... πολύπους secludit: ὦν δὲ ἀλκύνος suspic. Th., coll. (cum Sn.) Callim. vi. 9 seq.

⁶ secl. A.-W.: καὶ in ἡ mutat Dt.

⁷ hic lac. stat. A.-W.: καὶ παραπεσόντος... ἀποθνήσκει vertit Σ et moritur quoniam non potest redire ad aquam.

^a *Bolitaina*, alias *bolbitis*, *bolbidion*, i.e., onion. *Ozolis*, i.e., smelly. The traditional text makes the *heledōnē* and the *bolitaina* (*ozolis*) two separate animals; but *Eladone moschata* has the strong musky smell; hence A.-W.'s suggested alteration of the text, which I have adopted (see above), to make

of all, tends to keep very near the surface (those near shore are much larger than those in deep water). Others are small and variegated, and are not used for food. Another sort is that called *heledōnē*, which differs in having longer legs and in being the only Cephalopod with one row of suckers (all the rest have two); it is also known to some as *bolitaina*, to others as *ozolis*.^a There are two other sorts found in testaceous shells. One of them is called by some the nautilus or pontilus, by some the octopus' egg^b; its shell resembles a deep unattached valve of a scallop.^c This creature's habitat is often near the shore, and sometimes it gets washed up on to the beach; when the shell has fallen away the animal [gets caught and] dies where it is on the dry land. These animals are small, and similar in appearance to the *bolitainas*. There is another that is found in a shell, like a snail; this never comes out, but remains in the shell as a snail does and sometimes puts out its tentacles.^d Enough then about the Cephalopods.

bolitaina and *ozolis* alternative names for the *heledōnē* instead of names for a separate species.

^b The "mariner," the famous Paper Nautilus, *Argonauta Argo* L. For a further description see 622 b 5 ff. Cf. also the celebrated epigram of Callimachus, quoted by Athenaeus (vii. 318 c); in view of a reference in this epigram ("that in my chambers may no longer be laid, as aforesaid, the watery halcyon's egg," vi. 9-10), Th. suggests the reading ὦν ἀλκύνος, "the halcyon's egg."

^c See 529 b 7.

^d According to Thompson, this is probably the small purple-shelled snail *Ianthina*, which in two respects might be said to resemble the nautilus: (a) in protrusions from its shell; it has a large head, and gills which may be protruded; (b) in being able to float at the surface; it does this by means of a raft formed of a mass of air-bubbles of hardened mucus secreted by the foot.

525 a

II Τῶν δὲ μαλακοστράκων ἐν μὲν ἐστὶ γένος τὸ τῶν
 31 καράβων, καὶ τούτῳ παραπλήσιον ἕτερον τὸ τῶν
 καλουμένων ἀστακῶν· οὗτοι δὲ διαφέρουσι τῶν κα-
 ράβων τῷ ἔχειν χηλὰς <μεγάλας>¹ καὶ ἄλλας τινὰς
 διαφορὰς οὐ πολλὰς. ἐν δὲ τὸ τῶν καριδίων, καὶ
 ἄλλο τὸ τῶν καρκίνων. γένη δὲ πλείω τῶν καριδίων
 525 b ἐστὶ καὶ τῶν καρκίνων, τῶν μὲν καριδίων αἱ τε
 κυφαὶ καὶ αἱ κραγγόνες καὶ τὸ μικρὸν γένος (αὗται
 γὰρ οὐ γίνονται μείζους), τῶν δὲ καρκίνων παντο-
 दाπώτερον τὸ γένος καὶ οὐκ εὐαριθμητόν. μέγιστον
 μὲν οὖν ἐστὶν ἄς καλοῦσι μαίας, δεύτερον δ' οἷ τε
 5 πάγουροι καὶ οἱ Ἑρακλεωτικοὶ καρκίνοι, ἔτι δ' οἱ
 ποτάμιοι· οἱ δ' ἄλλοι ἐλάττους καὶ ἀνωθυμώτεροι.
 περὶ δὲ τὴν Φοινίκην γίνονται ἐν τῷ αἰγιαλῷ οὓς
 καλοῦσιν ἵππους² διὰ τὸ οὕτω ταχέως θεῖν ὥστε μὴ
 ῥᾶδίον εἶναι καταλαβεῖν· ἀνοιχθέντες δὲ κενοὶ διὰ
 10 τὸ μὴ ἔχειν νομήν. [ἔστι δὲ καὶ ἕτερον γένος μικρὸν
 μὲν ὥσπερ οἱ καρκίνοι, τὸ δ' εἶδος ὁμοίον τοῖς
 ἀστακοῖς.]³

Πάντα μὲν οὖν ταῦτα, καθάπερ εἴρηται πρότερον,
 τὸ μὲν στερεὸν καὶ ὀστρακῶδες ἐκτὸς ἔχει ἐν τῇ
 χώρᾳ τῇ τοῦ δέρματος, τὸ δὲ σαρκῶδες ἐντὸς, τὰ
 δ' ἐν τοῖς ὑπτίοις πλακωδέστερα, εἰς ἃ καὶ ἐκτίκ-
 τουσιν αἱ θήλειαι.

15 Πόδας δ' οἱ μὲν κάραβοι ἐφ' ἐκάτερα ἔχουσι πέντε
 σὺν ταῖς ἐσχάταις⁴ χηλαῖς· ὁμοίως δὲ καὶ οἱ καρ-
 κίνοι δέκα τοὺς πάντας σὺν ταῖς χηλαῖς. τῶν δὲ

¹ suppl. Dt.: καράβων in καριδίων mutare velit Th.

² ἵππους PAC: ἱππεῖς D, vulg.: milites Σ.

³ secl. A.-W. ut gloss. ad τοὺς ποτάμιους (v. 6) spectans:
 habet Σ: ἀντε μικρὸν vel eius loco ποτάμιον velit Th.

We go on now to the Crustacea. One class of these II
 is the Crayfish,^a and another closely resembling it is Crustacea:
 the Lobster, which differs from the Crayfish in having (a) External
 <large> claws and in a few other respects. Another parts.
 sort is the carid,^b and another the crab, of each of
 which there are many kinds. Of carids, there are the
 hunchbacks, and the *krangones*, and the small kind^c
 which never grow any larger. Of crabs, there are an
 enormous variety, and it is difficult to say how many
 there are. The largest is the one they call *maia*^d;
 next are the *pagouros*^e and the Heracleotic crab,^f and
 then the fresh-water crab. The others are smaller in
 size and tend to have no special names. In Phoc-
 nicia crabs are found on the beach which are known as
 "horses" because they run so fast that it is difficult
 to catch them. When opened up they are empty,
 because of lack of food. [There is also another sort,
 small like the crab, but in appearance similar to the
 lobster.]

All these animals, as I have already stated, have
 their hard shelly part outside, taking the place of skin,
 and their fleshy part inside. The under part of them
 is somewhat laminated: this is where the female
 deposits her eggs.

The crayfish have five feet on either side, with the
 claws at the tips: similarly, the crabs have ten feet,
 with the claws. The hunchback carids have five on

^a i.e., the sea-crayfish.

^b Small crustaceans other than crabs and lobsters.

^c *Kyphai*, "hunchbacks," i.e., prawns; *krangōn*, squilla;
 "the small kind" are shrimps.

^d i.e., "granny." ^e The common or edible crab.

^f At P.A. 684 a 10 the Heracleotic crab is said to have
 short legs whereas the *maia* has thin ones.

⁴ ὀχισταῖς suspic. Th.: cum aculeis Σ.

καρίδων αἱ μὲν κυφαὶ πέντε μὲν ἐφ' ἑκάτερα ἔχου-
 σιν, ὄξεις τοὺς πρὸς τῇ κεφαλῇ, ἄλλους δὲ πέντε
 ἐφ' ἑκάτερα κατὰ τὴν γαστέρα, τὰ ἄκρα ἔχοντας
 20 πλατέα· πλάκας δ' ἐν τοῖς ὑπτίοις οὐκ ἔχουσι, τὰ
 δ' ἐν τοῖς πρηνέσιν ὅμοια τοῖς καράβοις. ἡ δὲ
 κραγγῶν ἀνάπαλι· τοὺς πρώτους γὰρ ἔχει τέττα-
 ρας ἐφ' ἑκάτερα,¹ εἰτ' ἄλλους ἐχομένους λεπτοὺς
 τρεῖς ἐφ' ἑκάτερα, τὸ δὲ λοιπὸν πλείον² μόριον τοῦ
 σώματος ἄπουν ἐστίν. κάμπτονται δ' οἱ μὲν πόδες
 25 πάντων εἰς τὸ πλάγιον, ὡσπερ καὶ τῶν ἐντόμων,
 αἱ δὲ χηλαί, ὅσα ἔχει χηλάς, εἰς τὸ ἐντός. ἔχει δ' ὁ
 κάραβος καὶ κέρκον, πτερύγια δὲ πέντε· καὶ ἡ καρὶς
 ἡ κυφή τὴν οὐρὰν καὶ πτερύγια τέτταρα. ἔχει δὲ
 καὶ ἡ κραγγῶν πτερύγια ἐφ' ἑκάτερα ἐν τῇ οὐρᾷ·
 30 τὸ δὲ μέσον αὐτῶν ἀμφότεραι ἀκανθῶδες, πλὴν
 αὐτῆ³ μὲν πλατύ, ἡ δὲ κυφή ὀξύ. ὁ δὲ καρκίνος
 μόνος τῶν τοιούτων ἀνοροπύγιον· καὶ τὸ σῶμα τὸ
 μὲν τῶν καρίδων καὶ τῶν καράβων πρόμηκες, τὸ
 δὲ τῶν καρκίνων στρογγύλον.

Διαφέρει δ' ὁ κάραβος ὁ ἄρρην τῆς θηλείας· τῆς
 526 α μὲν γὰρ θηλείας ὁ πρῶτος ποὺς δίκρους ἐστί, τοῦ
 δ' ἄρρενος μῶνυξ, καὶ τὰ πτερύγια τὰ ἐν τῷ ὑπίω
 ἡ μὲν θήλεια μεγάλα ἔχει καὶ ἐπαλλάττοντα πρὸς
 τῷ τραχήλῳ, ὁ δ' ἄρρην ἐλάττω καὶ οὐκ ἐπαλλάτ-
 τοντα· ἐτι τοῦ μὲν ἄρρενος ἐν τοῖς τελευταίοις ποσὶ
 5 μεγάλα καὶ ὄξέα ἐστίν ὡσπερ πλῆκτρα, τῆς δὲ
 θηλείας ταῦτα μικρὰ καὶ λεῖα. ὁμοίως δ' ἔχουσιν
 ἀμφότερα κεραίας δύο πρὸ τῶν ὀφθαλμῶν μεγάλας
 καὶ τραχείας, καὶ ἄλλα κεράτια μικρὰ ὑποκάτω

¹ sic AC: τὸ ἀνάπαλι PD, vulg.

² <πλατεῖς> Sn., Dt.: non habet Σ.

³ πλείον dubit. Th.: om. Σ.

either side, those towards the head being sharp-pointed, and five more on either side in the region of the belly, and the ends of these are broad and flat.^a They have no flaps on the underside, but on the back they resemble the crayfish. It is contrariwise with the *krangōn*: it has four front legs on either side, then three thin ones next to them on either side, and the rest (and greater part) of the body is bare of feet. The feet of all these creatures bend out obliquely, as indeed occurs in insects; the claws (where present) bend inwards. The crayfish has a tail as well, with five fins. The hunchback carid has a tail, and four fins; the *krangōn* also has fins on either side on the tail. In both of these animals the middle part of the tail is spinous, though in the latter it is broad and flat and in the hunchback pointed. Of all animals in this class the crab is the only one without a rump; and whereas the body of the carid and of the crayfish is elongated, that of the crab is round.

The male crayfish differs from the female. In the female the first foot is bifurcated, in the male it is single. In the female the fins on the underside are large and overlap on the "neck"^b; in the male they are smaller and do not overlap. Further, in the male there are on the last feet large sharp projections like spurs: in the female these are small and smooth. Both sexes have two large rough antennae in front of the eyes, and other smaller antennae below, which

^a It is hardly possible to maintain a consistent translation for *πλατύς*, which means broad and/or flat; cf. 501 b 17. I have frequently translated it by "broad," especially when it describes certain Selachian fishes, to avoid confusion with "flatfish."
^b Cf. 526 b 8.

⁴ αὐτῆ Sn.: αὐται codd. (αὐται ἀμφω AC).

λεῖα. τὰ δ' ὄμματα πάντων τούτων ἐστὶ σκληρό-
φθαλμα. καὶ κινεῖται καὶ ἐντὸς καὶ ἐκτὸς¹ εἰς τὸ
10 πλάγιον· ὁμοίως δὲ καὶ τοῖς καρκίνιοις τοῖς πλεί-
στοις, καὶ ἔτι μᾶλλον.

Ὁ δ' ἀστακὸς τὸ μὲν ὅλον ὑπόλευκον ἔχει τὸ
χρῶμα, μέλανι δὲ διαπεπασμένον. ἔχει δὲ τοὺς μὲν
ὑποκάτω πόδας τοὺς ἄχρι τῶν μεγάλων ὀκτώ, μετὰ
δὲ ταῦτα τοὺς μεγάλους πολλῶ μείζους καὶ ἐξ ἄκρου
15 πλατυτέρους ἢ ὁ κάραβος, ἀνωμάλους δ' αὐτούς· ὁ
μὲν γὰρ δεξιὸς τὸ πλατὺ τὸ ἔσχατον πρόμηκες ἔχει
καὶ λεπτόν, ὁ δ' ἀριστερὸς παχὺ καὶ στρογγύλον.
ἐξ ἄκρου δ' ἐκάτερος ἐσχισμένος ὡσπερ σιαγῶν
ὀδόντας ἔχων καὶ κάτωθεν καὶ ἄνωθεν, πλὴν ὁ μὲν
δεξιὸς μικροὺς ἅπαντας καὶ καρχαρόδοντας, ὁ δ'
20 ἀριστερὸς ἐξ ἄκρου μὲν καρχαρόδοντας, τοὺς δ'
ἐντὸς ὡσπερ γομφίους, ἐκ μὲν τοῦ κάτω μέρους
τέτταρας καὶ συνεχεῖς, ἄνωθεν δὲ τρεῖς καὶ οὐ συν-
εχεῖς. κινουσι δὲ τὸ ἄνω μέρος ἀμφότεροι, καὶ
προσπιέζουσι πρὸς τὸ κάτω· βλαισοὶ δ' ἀμφότεροι
τῇ θέσει, καθάπερ πρὸς τὸ λαβεῖν καὶ πιέσαι πεφυ-
25 κότες. ἐπάνω δὲ τῶν μεγάλων ἄλλοι δύο δασεῖς,
μικρὸν ὑποκάτω τοῦ στόματος, καὶ ὑποκάτω τούτων
τὰ βραγχιώδη τὰ περὶ τὸ στόμα, δασέα καὶ πολλὰ.
ταῦτα δ' αἰεὶ διατελεῖ κινῶν· κάμπει δὲ καὶ προσ-
άγεται τοὺς δύο πόδας πρὸς τὸ στόμα τοὺς δασεῖς.
ἔχουσι δὲ καὶ παραφυάδας λεπτὰς οἱ πρὸς τῷ στό-
30 ματι πόδες. ὀδόντας δ' ἔχει δύο καθάπερ ὁ κάραβος,
ἐπάνω δὲ τούτων τὰ κέρατα μακρά,² βραχύτερα δὲ
καὶ λεπτότερα πολὺ ἢ ὁ κάραβος, καὶ ἄλλα τέτταρα
τὴν μὲν μορφήν ὅμοια τούτοις, βραχύτερα δὲ καὶ

are smooth. All these creatures have very hard eyes, which move obliquely to either side,^a in or out. The same is true of most of the crabs, to an even greater extent.

The lobster is of a dull whitish colour all over, with black mottling. Its lower feet, before reaching the large ones, are eight in number; then come the really large ones, which are much larger and broader at the tips than those of the crayfish. Their structure is irregular. In the right one the broad tip is elongated and thin, whereas the left one is thick and rounded. Each is divided at the tip like a jaw and has teeth above and below; in the right one these teeth are all small and saw-like; in the left one those at the tip are saw-like, whereas those inside are molar-shaped; in the under part of it there are four of these close together, in the upper part three with interstices between. In both feet (or claws) the upper part moves, and presses down against the lower part. Both are set asplay, like bandy legs, as being naturally designed for seizing and exerting pressure. Above the two large ones are two others, covered with hairs, a little below the mouth; and below these are the gill-like parts round the mouth, which are hairy and numerous. The animal keeps these in movement the whole time, and bends the two hairy feet and draws them in towards its mouth. The feet near the mouth have also fine appendages. The lobster has two teeth, like the crayfish, and above them are the antennae, quite long, but shorter and much finer than those of the crayfish; then four more antennae similar to these

^a Cf. 529 b 28 f.

¹ quartum *καὶ* add. APD, vulg.

² μακρά Camot., edd.: μικρά AC, om. PD.

526 b λεπτότερα. τούτων δ' ἐπάνω τοὺς ὀφθαλμοὺς μικροῦς καὶ βραχεῖς,¹ οὐχ ὥσπερ ὁ κάραβος μεγάλους. τὸ δ' ἐπάνω τῶν ὀφθαλμῶν ὀξὺ καὶ τραχύ, καθ' ἀπερεί² μέτωπον, μείζον ἢ ὁ κάραβος. ὅλως δὲ τὸ μὲν πρόσωπον ὀξύτερον, τὸν δὲ θώρακα εὐρύτερον
 5 ἔχει πολὺ τοῦ κάραβου, καὶ τὸ ὅλον σῶμα σαρκωδέστερον καὶ μαλακώτερον. τῶν δ' ὀκτώ ποδῶν οἱ μὲν τέτταρες ἐξ ἄκρου δίκροοί εἰσιν, οἱ δὲ τέτταρες οὐ. τὰ δὲ περὶ τὸν τράχηλον καλούμενον διήρηται μὲν ἕξωθεν πενταχῆ, καὶ ἕκτον ἐστὶ τὸ πλατὺ τὸ ἔσχατον, πέντε πλάκας ἔχον· τὰ δ' ἐντός, εἰς ἃ προ-
 10 ἐκτίκτουσιν⁴ αἱ θήλειαι, δασέα τέτταρα. καθ' ἕκαστον δὲ τῶν εἰρημένων πρὸς τὰ ἕξω ἄκανθαν ἔχει βραχεῖαν καὶ ὀρθήν. τὸ δ' ὅλον σῶμα καὶ τὰ περὶ τὸν θώρακα λείος,⁵ οὐχ ὥσπερ ὁ κάραβος τραχύς· ἀλλ' ἐν τοῖς μεγάλοις ποσὶ τὰ ἕξωθεν ἀκάνθας ἔχει
 15 μείζους· τῆς δὲ θηλείας πρὸς τὸν ἄρρενα οὐδεμίαν διαφορὰ φαίνεται· καὶ γὰρ ὁ ἄρρην καὶ ἡ θήλειαν ὅποτέρᾳ ἂν⁶ τύχη τῶν χηλῶν ἔχουσι μείζω, ἴσας μέντοι ἀμφοτέρας οὐδέτερος οὐδέποτε.

Τὴν δὲ θάλατταν δέχονται μὲν παρὰ τὸ στόμα πάντα τὰ τοιαῦτα, ἀφίᾳσι δ' ἐπιλαμβάνοντες κατὰ
 20 μικρὸν τοῦτο τὸ μόνιον οἱ καρκίνοι, οἱ δὲ κάραβοι παρὰ τὰ βραχγιοειδῆ· ἔχουσι δὲ τὰ βραχγιοειδῆ πολλὰ οἱ κάραβοι.

Κοινὸν δὲ πάντων τούτων ἐστὶν ὀδόντας τε πάντ' ἔχειν⁸ δύο (καὶ γὰρ οἱ κάραβοι τοὺς πρώτους δύο

¹ παχεῖς PD: *oculi debiles parui* Σ.

² sic AC: *καθαπερανεῖ* PD, vulg.

³ τὸ AC: καὶ PD, vulg.

⁴ sic C, Cs., Sn., A.-W., Dt.: *προεντ.* PA, vulg., Buss.,

Pi.: *προεντ.* D.

in shape, but shorter and finer. Above these are the eyes, small and insignificant, not large like those of the crayfish. Over the eyes is a pointed rough projection, like a forehead, larger than in the crayfish. And in general the facial part is more pointed, and the thorax is much broader than in the crayfish; and the whole body is more fleshy and softer. Of the eight feet, four are forked at the tip and four are not. The region of the "neck" as it is called is divided externally into five portions, and the sixth is the broad region at the end, which has five flaps. The inner parts, upon which the female lays its eggs, are four in number and hairy. On each of these parts just mentioned there is a short straight spine pointing outwards. Its body as a whole and particularly the parts round the thorax are smooth, not rough as in the crayfish, though on the large feet the outer portion carries larger spines. No difference can be detected between the male and female: they both have one claw (whichever it may happen to be) larger than the other, and neither sex ever has both claws equal in size.

All animals of this sort take in sea-water by the mouth, and having taken it in the crab discharges it while slightly closing up this part: the crayfish discharges it by the gill-like organs, which in this animal are numerous.

Common features to all these animals are the following: two teeth (even the crayfish have the two

(b) Internal parts.

⁵ λείος coni. Dt.: λεία AC: λείον ἔχει PD: λεία ἔχει vulg.

⁶ ὁποτέρ' ἂν PD: ὁποτέραν ἂν A, vulg.

⁷ ἐπιλαμβάνοντες Sylb.: -οντα codd., vulg.; κατὰ AC, om. PD, vulg.; τοῦτο τὸ Sn.: τούτου codd., vulg.

⁸ ἔχειν PA: ἔχει C (et vulg., quae post ἐστίν' interpungit): ἔχει δύο πάντα D.

ἔχουσι) καὶ ἐν τῷ στόματι¹ σαρκῶδες τι <μικρὸν>²
 ἀντὶ γλωττης, εἶτα κοιλίαν τοῦ στόματος³ ἐχομένην
 25 εὐθύς (πλὴν οἱ κάραβοι μικρὸν στομάχον πρὸ τῆς
 κοιλίας), εἶτ' ἐκ ταύτης ἔντερον εὐθύ. τελευτᾷ δὲ
 τοῦτο τοῖς μὲν καραβοειδέσι καὶ καρίσι κατ' εὐ-
 θυρίαν πρὸς τὴν οὐράν, ἢ τὸ περίπτωμα ἀφίᾳσι καὶ
 τὰ ψὰ ἐκτίκτουσιν, τοῖς δὲ καρκίνοις, ἢ⁴ τὸ ἐπί-
 πτυγμα ἔχουσι, κατὰ μέσον τὸ ἐπίπτυγμα. [ἐκτός
 30 δὲ καὶ οὗτοι⁵ τὰ ψὰ ἐκτίκτουσιν.]⁶ ἔτι τὰ θήλεα
 αὐτῶν παρὰ τὸ ἔντερον τὴν τῶν ψῶν χώραν ἔχουσιν.
 καὶ τὴν καλουμένην δὲ μύτιν ἢ μήκωνα πλείω ἢ
 ἐλάττω πάντ' ἔχει ταῦτα.

Τὰς δ' ἰδίας ἤδη διαφορὰς καθ' ἕκαστον δεῖ θεω-
 ρεῖν.

527 a Οἱ μὲν οὖν κάραβοι, ὡσπερ εἴρηται, δύο ἔχουσι
 ὀδόντας μεγάλους καὶ κοίλους, ἐν οἷς ἔνεστι χυμὸς
 ὁμοῖος τῇ μύτιδι, μεταξύ δὲ τῶν ὀδόντων σαρκίον
 γλωττοειδές. ἀπὸ δὲ τοῦ στόματος ἔχει οἰσοφάγον
 βραχὺν καὶ κοιλίαν τοῦτον ἐχομένην ὑμενώδη, ἣς
 5 πρὸς τῷ στόματι ὀδόντες εἰσὶ τρεῖς, οἱ μὲν δύο κατ'
 ἀλλήλους, ὁ δ' εἰς ὑποκάτω. τῆς δὲ κοιλίας ἐκ τοῦ
 πλαγίου ἔντερόν ἐστιν ἀπλοῦν καὶ ἰσοπαχές δι' ὅλου
 μέχρι πρὸς τὴν ἔξοδον τοῦ περιττώματος.

[Ταῦτα μὲν οὖν πάντα ἔχουσι, καὶ οἱ κάραβοι καὶ
 αἱ καρίδες καὶ οἱ καρκῖνοι· καὶ γὰρ ὀδόντας δύο
 10 ἔχουσιν οἱ καρκῖνοι.]⁷

¹ sic PD : τὸ στόμα AC, vulg.

² σαρκῶδες τι A.-W., Pi., Dt. (σαρκῶδες voluit Sn.) : μικρὸν
 add. Dt. : σαρκώδεστερον codd., vulg.

³ στόματος Gaza, edd. : στομάχου codd., Dt. : conferas
 527 b 22 seq.

⁴ ἢ] οἱ Pi.

⁵ add. ἢ codd., edd., secl. Th. : τούτοις, ἢ Pi., qui mox
 ἐπεὶ loco ἔτι.

front ones); a <small> fleshy object in the mouth
 instead of a tongue; the stomach is immediately next
 to the mouth (except that the crayfish has a short
 oesophagus in front of the stomach), and from the
 stomach runs a straight gut. This gut, in the crayfish
 and similar animals, and in the carids, proceeds straight
 on and terminates at the tail, where the residue is
 discharged and the eggs are produced; in the crab
 it terminates where the flap is, at the centre of the
 flap. [Further, all these animals as well deposit their
 eggs outwardly.] Furthermore, the females have
 the place for the eggs alongside the gut. And they
 all have the so-called *mytis*, or *mecon*,^a larger or smaller
 in size.

We must now go on to study the peculiar differences
 of each.

The crayfish, then, as I have said, has two teeth,
 which are large and hollow, and contain a juice similar
 to the *mytis*, and between the teeth is a fleshy object
 similar to a tongue. From the mouth there is a short
 oesophagus, and continuous with that a membranous
 stomach, and by the opening of the stomach are three
 teeth, two of them opposite each other, and one
 underneath. From the stomach there runs off ob-
 liquely a simple gut of uniform thickness throughout
 the body as far as the residual vent.

[These parts are found in all of them, crayfish,
 carids, and crabs: for the crab in fact has two tecth.]

^a See n. on 524 b 15.

⁶ haec verba Dt. corrupta videntur; secl. Th. : ἐνταῦθα
 δὲ καὶ οὗτοι τὰ ψὰ ἐκτίκτουσι voluerunt A.-W. : ἐπίπτυγμα,
 ἢ τὰ ψὰ ἐκτίκτουσιν (ἐκτός δὲ καὶ οὗτοι) Louis : vv. 18-30
 suspic. Dt. : fortasse totum secludendum.

⁷ totum secl. Dt. : καὶ γὰρ . . . καρκῖνοι om. DΣ, Ald., secl.
 Cs., Sn., Pi., A.-W. (ταῦτα v. 8 ad περιττώματος v. 13 om. P).

"Ἐτι δ' οἱ γε κάραβοι πόρον ἔχουσιν ἀπὸ τοῦ
 στήθους ἠρτημένον μέχρι πρὸς τὴν ἕξοδον τοῦ
 περιττώματος· οὗτος δ' ἐστὶ τῇ μὲν θηλείᾳ ὑστε-
 ρικός, τῷ δ' ἄρρειν θορικός. ἔστι δ' ὁ πόρος οὗτος
 πρὸς τῷ κοίλῳ τῆς σαρκός, ὥστε μεταξὺ εἶναι τὴν
 15 σάρκα· τὸ μὲν γὰρ ἔντερον πρὸς τῷ κυρτῷ ἐστίν,
 ὁ δὲ πόρος πρὸς τῷ κοίλῳ, ὁμοίως ἔχοντα ταῦτα
 ὥσπερ τοῖς τετράποσιν. διαφέρει δ' οὐδὲν ὁ τοῦ
 ἄρρενος τοῦ¹ τῆς θηλείας· ἀμφοτέρω γὰρ εἰσι λεπτοὶ
 καὶ λευκοὶ καὶ ὑγρότητα ἔχοντες ἐν αὐτοῖς ὠχράν,
 ἔτι δ' ἠρτημένοι ἀμφοτέρω ἐκ τοῦ στήθους. [ἔχουσι
 20 δ' οὕτω² τὸ ὠδὸν καὶ αἱ καρίδες καὶ τὰς ἐλίκας.]³

"Ἴδια δ' ἔχει ὁ ἄρρην πρὸς τὴν θήλειαν ἐν τῇ
 σαρκὶ κατὰ τὸ στήθος δύο λευκὰ ἄττα καθ' αὐτά,
 ὁμοία τὸ χρῶμα καὶ τὴν σύστασιν ταῖς τῆς σηπίας
 προβοσκίσιν· εἰλιγμένα δ' ἐστὶ ταῦτα ὥσπερ ἡ τοῦ
 κήρυκος μήκων. ἡ δ' ἀρχὴ τούτων ἐστὶν ἀπὸ τῶν
 25 κοτυληδόνων, αἱ εἰσὶν ὑποκάτω τῶν ἐσχάτων ποδῶν.
 ἔχει δὲ καὶ ἐν τούτῳ σάρκα ἐρυθρὰν καὶ αἱματώδη
 τὴν χροάν, τῇ δ' ἀφῆ γλίσχραν καὶ οὐχ ὁμοίαν τῇ
 σαρκί. ἀπὸ δὲ τοῦ⁴ περὶ τὰ στήθη κηρυκώδους⁵
 ἄλλος ἐστὶν ἐλιγμός, ὥσπερ ἀρπεδόνη τὸ πάχος, ὧν
 30 ὑποκάτω δύο ἄττα ψαθυρά ἐστι προσηρτημένα τῷ
 ἐντέρῳ θορικά. ταῦτα μὲν οὖν ὁ ἄρρην ἔχει· ἡ δὲ
 θήλεια ὡς ἴσχει τὸ χρῶμα ἐρυθρά, ὧν ἡ πρόσφυσις
 ἐστὶ πρὸς τῇ κοιλίᾳ καὶ τοῦ ἐντέρου ἐκατέρωθι μέχρι
 εἰς τὰ σαρκώδη, ὑμένι λεπτῷ περιεχόμενα.

¹ τοῦ Dt.: ἡ codd., edd., secl. A.-W.

² οὗτοι AC.

Further, the crayfish has a passage which is attached from the chest as far as the residual vent: in the female this passage serves the purposes of the uterus, in the male those of the seminal fluid. It is attached to the concave surface of the flesh so that the flesh is in between, the gut being on the convex side of it and the passage on the concave—an arrangement similar to that in quadrupeds. It exhibits no difference in the two sexes: in both it is thin and white and contains a yellow fluid, and is attached to the chest. [This is the arrangement of the egg and the convolutions in the carids as well.]

The male differs from the female in respect of its flesh: it has at the chest two white objects, each on its own, resembling in colour and consistency the tentacles of the cuttlefish, and they are convoluted like the *mecon* in the trumpet-shell. These take their beginning from the cotyledons, which are placed under the hindmost feet. At this place the flesh is red and bloodlike in colour, but sticky to the touch and not flesh-like. From the convoluted part at the chest another coil branches off, about as thick as a piece of string, and below these there are two friable objects fastened to the gut; these are seminal. Such are the parts in the male. The female has eggs, red in colour, which are attached to the stomach and to each side of the gut as far as the fleshy parts; these are enclosed in a thin membrane.

³ delenda censent A.-W., Th.: in verbis τὰς ἐλίκας latere credit Dt. οἱ ἀστακοὶ: similiter ἔχουσι δ' οὕτω τὸ ὠδὸν καὶ οἱ κάραβοι καὶ οἱ ἀστακοὶ conl. Th.: et in eo sunt ova, et maxime ova acchorim (= καρίδες) et involutio intestini in maribus et in feminis est similis Σ: fortasse post περιεχόμενα v. 34 locanda.

⁴ τῶν conl. Dt.

⁵ κηρυκώδης C, Dt.

527 a

Τὰ μὲν οὖν μόρια ὅσα ἐντὸς καὶ ἐκτὸς ἔχουσι,
35 ταῦτά ἐστιν.

527 b III

[Συμβέβηκε δὲ τῶν μὲν ἐναίμων τὰ ἐντὸς μόρια
ὀνόματα ἔχειν· πάντα γὰρ σπλάγχνα ἔχει τὰ ἔσωθεν·
τῶν δ' ἀναίμων οὐδέν, ἀλλὰ κοινὸν τούτοις καὶ ἐκεί-
νοις πᾶσι κοιλία καὶ στόμαχος καὶ ἔντερον.]¹

Οἱ δὲ καρκίνοι, περὶ μὲν τῶν χηλῶν καὶ τῶν
5 ποδῶν, ὅτι ἔχουσι καὶ πῶς ἔχουσιν, εἴρηται πρό-
τερον· ὡς δ' ἐπὶ τὸ πολὺ πάντες τὴν δεξιὰν ἔχουσι
μείζω χηλὴν καὶ ἰσχυροτέραν. εἴρηται δὲ πρότερον
καὶ περὶ ὀφθαλμῶν, ὅτι εἰς τὸ πλάγιον βλέπουσιν
οἱ πλείστοι. τὸ δὲ κύτος τοῦ σώματος ἐν ἐστίν²
ἀδιόριστον, ἢ τε³ κεφαλὴ, καὶ εἴ τι ἄλλο μόριον.
10 ἔχουσι δ' ὀφθαλμοὺς οἱ μὲν ἐκ τοῦ πλαγίου ἄνω ὑπὸ
τὸ πρᾶνές εὐθύς πολὺ διεστώτας, ἐνιοὶ δ' ἐν μέσῳ
καὶ ἐγγὺς ἀλλήλων, οἷον οἱ Ἡρακλεωτικοὶ καὶ αἱ
μαῖαι. ὑποκάτω δὲ τὸ στόμα τῶν ὀφθαλμῶν, καὶ
ἐν αὐτῷ ὀδόντας δύο ὡσπερ ὁ κάραβος, πλὴν οὐ
15 στρογγύλοι οὗτοι ἀλλὰ μακροί. καὶ ἐπὶ τούτων
ἐπικαλύμματά ἐστι δύο, ὧν μεταξὺ ἐστὶν οἷάπερ ὁ
κάραβος ἔχει πρὸς τοῖς ὀδοῦσιν. δέχεται μὲν οὖν
τὸ ὕδωρ παρὰ τὸ στόμα, ἀπηθῶν⁴ τοῖς ἐπικαλύμμα-
σιν, ἀφίησι δὲ κατὰ τοὺς ἄνω πόρους τοῦ στόματος,
ἐπιλαμβάνων τοῖς ἐπικαλύμμασιν, ἢ εἰσηλθεν· οὗτοι
20 δ' εἰσὶν εὐθύς ὑπὸ τοὺς ὀφθαλμοὺς· [καὶ ὅταν δέξηται
τὸ ὕδωρ, ἐπιλαμβάνει τὸ στόμα τοῖς ἐπικαλύμμασιν
ἀμφοτέροις, ἔπειθ' οὕτως ἀποπυτίζει τὴν θάλατ-

¹ secl. A.-W., Dt., ut hic aliena; totum caput plus minus suspic. Sn., A.-W.

² ἐν ἐστίν edd., ἐνεστιν codd.

³ ἢ τε PD: ἔτι δὲ vulg.

I have now described the internal and external parts of these creatures.

[It so happens that the internal parts of the blooded III animals have been given names, for all these have the internal viscera, but no bloodless animal has; the only parts which both classes have in common are the stomach, the oesophagus and the gut.]^a

With reference to the crabs, I have already stated (Crabs.) that they have claws and feet, and the character of them; and for the most part they all have the right claw bigger and stronger than the left. I have also said that in most of them the eyes are directed sideways. The trunk of the body is single and undivided: this includes the head and any other part there may be. Some of them have eyes placed sideways on the upper part, immediately under the back and a long way apart from each other; some have them in the middle and close together, as for example the Heracliotic crabs and the *maia*. The mouth is underneath the eyes, and it contains two teeth, as in the crayfish, except that they are not round but long. Over the teeth are two lids, and between these are formations such as the crayfish has beside its teeth. The crab takes in water by the mouth, straining it with the lids, and discharges it by the two passages above the mouth, while it closes the way the water came in by means of the lids. These passages are immediately under the eyes. [When it has taken in the water, it closes its mouth with the two lids, and afterwards spurts it out in this way.] Immediately

^a There appear to be a number of interpolations in this chapter, which is largely recapitulation.

⁴ ἀπηθῶν Pi.: ἀπωθῶν vulg., Dt. (ἔπι et τὰ ἐπικαλύμματα coni.); ἀπωθοῦν A, ἀποθοῦν C.

ταν.]¹ ἐχόμενος δὲ τῶν ὀδόντων ὁ στόμαχος βραχὺς
 πᾶμπαν, ὥστε δοκεῖν εὐθὺς εἶναι μετὰ τὸ στόμα τὴν
 κοιλίαν. καὶ κοιλία τούτου ἐχομένη δικρόα, ἧς ἐκ
 25 μέσης μὲν τὸ ἔντερον ἐστὶν ἀπλοῦν καὶ λεπτόν·
 τελευτᾷ δὲ τὸ ἔντερον ὑπὸ τὸ ἐπικάλυμμα [τὸ]² ἔξω,
 ὥσπερ εἴρηται καὶ πρότερον. [ἔχει δὲ τὰ³ μεταξὺ
 τῶν ἐπικαλυμμάτων, οἷάπερ ὁ κάραβος πρὸς τοῖς
 ὀδοῦσιν.]⁴ ἐν δὲ τῷ κύτει ἔσω χυμὸς ἐστὶν ὠχρὸς,
 καὶ μικρὰ ἄττα προμήκη λευκά, καὶ ἄλλα πυρρὰ
 30 διαπεπασμένα. διαφέρει δ' ὁ ἄρρη τῆς θηλείας τῷ
 τε⁵ μεγέθει καὶ τῷ πλάτει καὶ τῷ ἐπικαλύμματι⁶.
 μεῖζον γὰρ τοῦτο ἔχει ἢ θήλεια, καὶ πλέον ἀφεστη-
 κὸς καὶ συνηρεφέστερον, καθάπερ καὶ ἐπὶ τῶν
 θηλειῶν καράβων.

Τὰ μὲν οὖν τῶν μαλακοστράκων μόρια τοῦτον
 35 ἔχει τὸν τρόπον.

IV Τὰ δ' ὀστρακόδερμα τῶν ζώων, οἷον οἱ τε κοιλίαι
 528 a καὶ οἱ κόχλοι καὶ πάντα τὰ καλούμενα ὀστrea, ἐτι δὲ
 τὸ τῶν ἐχίνων γένος, τὸ μὲν σαρκῶδες, ὅσα σάρκας
 ἔχει, ὁμοίως ἔχει τοῖς μαλακοστράκοις (ἐντὸς γὰρ
 ἔχει), τὸ δ' ὀστρακὸν ἐκτὸς, ἐντὸς δ' οὐδὲν σκληρόν.
 5 αὐτὰ δὲ πρὸς αὐτὰ διαφορὰς ἔχει πολλὰς καὶ κατὰ
 τὰ ὀστρακα καὶ κατὰ τὴν σάρκα τὴν ἐντὸς. τὰ μὲν
 γὰρ αὐτῶν οὐκ ἔχει σάρκα οὐδεμίαν, οἷον ἐχίνος, τὰ
 δ' ἔχει μὲν, ἐντὸς δ' ἔχει τὴν σάρκα ἀφανῆ πᾶσαν
 πλὴν τῆς κεφαλῆς, οἷον οἱ τε χερσαῖοι κοιλίαι καὶ
 τὰ καλούμενα ὑπὸ τιῶν κοκάλια καὶ τῶν ἐν τῇ
 10 θαλάττῃ αἱ τε πορφύραι καὶ οἱ κήρυκες καὶ ὁ κόχλος
 καὶ τὰλλα τὰ στρομβῶδη. τῶν δ' ἄλλων τὰ μὲν

¹ secl. Sn., Pi., Dt.; A.-W. intellegere non possunt.

² τὸ secl. Dt. ³ τὰ AC: τὸ vulg., om. PD, Dt.

⁴ secl. Cs., Scalig. docente, A.-W., Dt.

after the teeth is the oesophagus, which is very short indeed, and in consequence it looks as though the stomach comes immediately after the mouth. After the oesophagus is the stomach, which is bifurcated, and to the middle of it is attached the gut, which is simple and fine: it terminates outwards at the lid, as has been said already. [In between the lids the crab has the parts that the crayfish has, near the teeth.] In the trunk, inside, is a yellow fluid and a few small longish white objects, and others mottled with red. The male differs from the female in size, in breadth, and in respect of the lid: this is larger in the female, and projects further and is more densely covered with hair,^a as in the female crayfish also.

We have now described the parts of the Crustacea.

We now go on to the Testacea, such as the land-
 snails and sea-snails and all those creatures which are
 known as shell-fish,^b also the tribe of sea-urchins. In
 all these—or rather in all of them that have a fleshy
 part—the fleshy part is as in the Crustacea, *i.e.*, it is
 inside, and the shell is outside: there is no hard part
 inside. Compared with one another the Testacea
 exhibit many differences, in respect both of their
 shells and their flesh within. Some have no flesh at
 all, *e.g.*, the sea-urchin; some have flesh, but it is all
 inside and invisible except for the head, *e.g.*, the land-
 snails and the *kokalía*^c (as some people call them):
 examples among sea-animals are the purpura, the
 trumpet-shell, the sea-snail, and the spiral-shelled
 animals generally. Of the rest, some are bivalves and

^a Providing better cover; *cf.* 541 b 31.

^b See n. on 490 b 11.

^c *e.g.*, periwinkles.

⁵ τε PCD; om. A, vulg.

⁶ πλάτει τοῦ ἐπικαλύμματος mavult Th.

ἔστι δίθυρα τὰ δὲ μονόθυρα· λέγω δὲ δίθυρα τὰ
 δυσὶν ὀστράκοις περιεχόμενα, μονόθυρα δὲ τὰ ἐνί·
 τὸ δὲ σαρκῶδες ἐπιπολήσ, οἷον ἡ λεπὰς. τῶν δὲ
 διθύρων τὰ μὲν ἔστιν ἀναπτυκτά,¹ οἷον οἱ τε² κτένες
 15 καὶ οἱ μύες· ἅπαντα γὰρ τὰ τοιαῦτα τῇ μὲν συμπέ-
 φυκε τῇ δὲ διαλέλυται, ὥστε συγκλείεσθαι καὶ
 ἀνοίγεσθαι. τὰ δὲ δίθυρα μὲν ἔστιν, ὁμοίως δὲ
 συγκέκλεισται ἐπ' ἀμφοτέρα, οἷον οἱ σωλήνες. ἔστι
 δ' ἅ ὅλα περιέχεται τῷ ὀστράκῳ καὶ οὐδὲν τῆς
 20 σαρκὸς ἔχει εἰς τὸ ἔξω γυμνόν, οἷον τὰ καλούμενα
 τήθηα.

Ἔτι δ' αὐτῶν τῶν ὀστράκων διαφοραὶ πρὸς
 ἄλληλά εἰσιν. τὰ μὲν γὰρ ἔστι λειόστρακα,³ ὥσ-
 περ σωλήν καὶ μύες καὶ κόγχαι ἔναι αἱ καλού-
 μεναι ὑπὸ τινῶν γάλακες, τὰ δὲ τραχύστρακα,
 οἷον τὰ λιμνόστρεα καὶ πίνναι⁴ καὶ γένη κόγχων
 25 ἔνια καὶ κήρυκες· καὶ τούτων τὰ μὲν ῥαβδωτά ἔστιν,
 οἷον κτεῖς καὶ κόγχων τι γένος, τὰ δ' ἀρράβδωτα,
 οἷον αἱ τε πίνναι καὶ κόγχων τι γένος. καὶ πάχει
 δὲ καὶ λεπτότητι τῶν ὀστράκων διαφέρουσιν, ὅλων
 τε τῶν ὀστράκων καὶ κατὰ μέρος, οἷον περὶ τὰ
 χεῖλη· τὰ μὲν γὰρ λεπτοχειλῆ ἔστιν, οἷον οἱ μύες,
 30 τὰ δὲ παχυχειλῆ, οἷον τὰ λιμνόστρεα. ἔτι τὰ μὲν
 κινητικὰ αὐτῶν⁵ ἔστιν, οἷον ὁ κτεῖς (ἔνιοι γὰρ καὶ
 πέτεσθαι λέγουσι τοὺς κτένας, ἐπεὶ καὶ ἐκ τοῦ
 ὀργάνου ὧ θηρεύονται ἐξάλλονται πολλάκις), τὰ δ'
 ἀκίνητα ἐκ τῆς προσφύσεως,⁶ οἷον ἡ πίννα. τὰ δὲ

¹ sic Dt.: ἀνάπτυκτα AC: ἀνάπτυχα PD, vulg.

² τε AC, om. PD, vulg.

³ ἔ. λ. AC: λ. ἔ. vulg.

⁴ πίνναι C: πίννα PD: πίννα vulg.

⁵ αὐτῶν vulg. per typos. errorem.

some univalves. By "bivalves" I mean those which are enclosed in two shells, by "univalves," in only one shell: the fleshy part is exposed in the latter, e.g., the limpet. Some of the bivalves can open their shells, e.g., the scallop and the mussel: all such creatures are joined on one side and free on the other, so that they can open and shut. Some, though bivalves, are closed equally on both sides, e.g., the razor-fish. Some are completely enveloped by their shell and no portion of their flesh is exposed to the outside, e.g., what are called *tethya*.^a

Further, among the shells themselves there are differences from one to another. Some have smooth shells, e.g., the razor-fish, the mussel, and some of the clams (those which are called by some people milk-shells^b), whereas others have rough shells, e.g., lagoon-oysters,^c pinnas, certain kinds of clam, and trumpet-shells. Of these, some are ribbed, e.g., the scallop and one sort of clam; some are ribless, e.g., the pinnas and another sort of clam. They also differ from one another in respect of the thickness of their shells, whether the whole shell or part of it, e.g., the lip of the shell: thus, some have thin-lipped shells, e.g., the mussels, others thick-lipped ones, e.g., the lagoon-oysters.* Furthermore, some of them can move about, e.g., the scallop (in fact, some people say these can actually fly, because they often jump right out of the device in which they are caught); others do not move about, owing to their attachment to some object, e.g., the pinna. All the spiral-shelled ones move and

^a Ascidians, or sea-squirts.

^b Probably some species of *Maetra*. ^c The edible oyster.

^d sic PD teste Bk.: προσφύης A, vulg.: ἀκίνητα καὶ προσφύη Ald., A.-W.

528 b στρομβιώδη πάντα κινεῖται καὶ ἔρπει· νέμεται δ' ἀπολυομένη καὶ ἡ λεπὰς. κοινὸν δὲ καὶ τούτων καὶ τῶν ἄλλων τῶν σκληροστράκων τὸ λεῖον εἶναι ἐντὸς τὸ ὄστρακον.¹ τὸ δὲ σαρκῶδες τοῖς μὲν μονοθύροις καὶ διθύροις προσπέφυκε τοῖς ὄστράκοις, ὥστε
5 βία ἀποσπᾶσθαι, τοῖς δὲ στρομβιώδεσιν ἀπολέλυται μᾶλλον. ἴδιον δὲ τούτοις κατὰ τὸ ὄστρακον ὑπάρχει πᾶσι τὸ ἐλίκην ἔχειν τὸ ὄστρακον τὸ ἔσχατον ἀπὸ τῆς κεφαλῆς. ἔτι δ' ἐπίπτυγμα πάντ' ἔχει ἐκ γενετῆς. ἔτι δὲ πάντα τὰ στρομβιώδη τῶν ὄστρακο-
10 δέρμων δεξιὰ, καὶ κινεῖται οὐκ ἐπὶ τὴν ἐλίκην ἀλλ' ἐπὶ τὸ καταντικρύν.²

Τὰ μὲν οὖν ἔξωθεν μόρια τούτων τῶν ζώων τοιαύτας ἔχει τὰς διαφοράς.

Τῶν δ' ἐντὸς τρόπον μὲν τινα παραπλήσιος ἡ φύσις ἐστὶ πάντων, καὶ μάλιστα τῶν στρομβιωδῶν (μεγέθει γὰρ ἀλλήλων διαφέρει καὶ τοῖς καθ' ὑπεροχὴν πάθεισιν), οὐ πολὺ δὲ διαφέρει οὐδὲ τὰ μονό-
15 θυρα καὶ δίθυρα τὰ πλείστα.³ διαφορὰν γὰρ ἔχει πρὸς ἀλλήλα μὲν μικράν, πρὸς δὲ τὰ ἀκίνητα πλείω. τοῦτο δ' ἔσται φανερόν ἐκ τῶν ὕστερον μᾶλλον.

Ἡ δὲ φύσις τῶν στρομβοειδῶν ἀπάντων ὁμοίως ἔχει, διαφέρει δ' ὡσπερ εἴρηται, καθ' ὑπεροχὴν (τὰ μὲν γὰρ μείζω <μείζω>⁴ μόρια⁵ καὶ ἐνδηλότερα ἔχει

¹ κοινὸν . . . ὄστρακον delent A.-W., post λιμνόστρεα v. 30 supra ponenda suadent Dt., Th.

² ἔτι δὲ . . . καταντικρύν secl. Dt., A.-W. docentibus, qui haec ex I.A. 706 a 13 seqq. tralata censent.

³ τὰ πλείστα δὲ AC: συγκλειστὰ δὲ PD, vulg.

⁴ suppl. A.-W.: μείζω τὰ μέρη ἐνδη. Scal., μείζω καὶ τὰ μέρη ἐνδη. Pi.

⁵ μόρια AC: μέρη PD, vulg.

creep about: even the limpet releases its hold in order to search for food. Common to these and to all hard-shelled creatures is the smooth inner surface of their shells.^a In the univalves and the bivalves the fleshy part adheres so fast to the shell that force is required to separate it; in the spiral ones it is more loosely attached. A peculiarity of all the latter is that their shell has the spiral in the part furthest away from the head. Furthermore, from birth they all have an operculum. Further, all the spirally-twisted Testacea have the shell on the right side, and their movement is not towards the spiral but in the opposite direction.^b

Such, then, are the differences exhibited by the external parts of these animals.

The internal formation is pretty much the same in (b) Internal all of them, and especially so in the spiral ones: parts. among the latter the differences are of size, and of "excess"^c in secondary characteristics.^d Nor do most of the univalves and bivalves show much difference—small differences among themselves, but much more compared with the stationary ones. This will be clearer from what I hope to say later.

The spiral-shelled Testacea are all formed in a similar way, differing only as already stated by way of "excess"—i.e., the larger ones have larger and more conspicuous parts, and the smaller ones contrari-

^a This sentence is deleted by A.-W., and transposed by Th. to * above, following a suggestion of Dittmeyer's.

^b This sentence, which is taken almost verbatim from I.A. 706 a 13 ff., is deleted by A.-W. and Dittmeyer.—There is no reference here to right-handed spirals; the meaning is that, as they move away from the spiral, and as movement is always initiated by the right side, the "right" of these animals must be the other side from the direction towards which they move.

^c See Notes, § 3.

^d See n. on 486 b 5.

528 b

20 αὐτῶν, τὰ δ' ἐλάττω τούναντίον), ἔτι δὲ σκληρότητι
καὶ μαλακότητι καὶ τοῖς ἄλλοις τοῖς τοιοῦτοις πά-
θεσιν. ἔχει γὰρ πάντα τὴν μὲν ἐξωτάτῳ ἐν τῷ
στόματι τοῦ ὀστράκου σάρκα στιφρὰν, τὰ μὲν μᾶλλον
τὰ δ' ἦττον. ἐκ μέσου δὲ τούτου ἡ κεφαλὴ καὶ
25 ἐν δὲ τοῖς ἐλάττωσι πάμπαν μικρὰ ἐστίν. ἡ δὲ
κεφαλὴ ἐξέρχεται πᾶσι τὸν αὐτὸν τρόπον· κἂν τι
φοβηθῆ, συσπᾶται πάλιν εἰς τὸ ἐντός. ἔχει δὲ στόμα
καὶ ὀδόντας ἔνια, οἷον ὁ κοχλίας, ὄξεισι καὶ μικροῦς
καὶ λεπτοῦς. ἔχουσι δὲ καὶ προβοσκίδα,¹ ὡσπερ
καὶ αἱ μύαια τοῦτο δ' ἐστὶ γλωττοειδές. ἔχουσι δὲ
30 καὶ οἱ κήρυκες τοῦτο καὶ αἱ πορφύραι στιφρὸν, καὶ
ὡσπερ οἱ μύωπες καὶ οἱ οἰστροὶ τὰ δέρματα δια-
τρυπῶσι τῶν τετραπόδων, ἔτι² τὴν ἰσχὺν τοῦτ' ἔστι
σφοδρότερον³. τῶν γὰρ δελεάτων τὰ ὀστρακα δια-
529 a τρυπῶσιν. τοῦ δὲ στόματος ἔχεται εὐθύς ἡ κοιλία.
ὁμοία δ' ἐστὶν ἡ κοιλία προλόβῳ ὄρνιθος ἢ τῶν
κόχλων. κάτω δ' ἔχει δύο λευκὰ στιφρὰ, ὁμοια
μαστοῖς, οἷα ἐγγίγνεται καὶ ἐν ταῖς σηπίαις, πλήν
στιφρὰ ταῦτα μᾶλλον. ἀπὸ δὲ τῆς κοιλίας στόμα-
5 χος ἀπλοῦς μακρὸς μέχρι τῆς μήκωνος, ἡ ἐστὶν
ἐν τῷ πυθμένι. ταῦτα μὲν οὖν δῆλα καὶ ἐπὶ τῶν
πορφυρῶν καὶ τῶν κηρύκων ἐστὶν ἐν τῇ ἐλίκῃ τοῦ
ὀστράκου. τοῦ δὲ στομάχου τὸ ἐχόμενον ἐστὶν
ἐντερον (συνεχές δ' ὅ τε στόμαχος καὶ τὸ ἐντερον)⁴
καὶ ἅπαν ἀπλοῦν μέχρι τῆς ἐξόδου. ἡ δ' ἀρχὴ τοῦ
10 ἐντέρου περὶ τὴν ἐλίκην τῆς μήκωνος, καὶ ταύτη
ἐστὶν εὐρύτερον [ἔστι γὰρ ἡ μήκων οἰονεὶ περίπτωμα
πᾶσι τοῖς ὀστρακηροῖς τὸ πολὺ αὐτῆς],⁵ εἰτ' ἐπι-

¹ correxit Pi.: προβοσκίδας codd.² ἔτι AC: ὅτι PD, vulg.

wise—also they differ in hardness and softness and in other such secondary characteristics. Thus in all the spiral ones the outermost part of the flesh at the mouth of the shell is firm and hard, in some more in others less so. From the middle of this rise the head and the two horns: these horns are large in the larger kinds, and very small in the smaller ones. In all of them the head rises up in the same way, and if the animal is scared, the head is drawn back again inside. Some of them, e.g., the snail, have mouth and teeth—small sharp teeth and delicate. They also have a proboscis, just as flies have, and it is tongue-shaped. The trumpet-shells and the purpuras have this proboscis too, and in them it is firm and hard. And just as the horse-fly and gadfly can bore through the hides of quadrupeds, this organ is even more powerful and strong in proportion: they can bore through the shells of their prey. Immediately after the mouth is the stomach; in the snail it is similar to a bird's crop. Underneath are two firm white objects, shaped like breasts, such as are also found in the cuttlefish; but they are firmer in the latter. From the stomach a simple long oesophagus extends as far as the *mecon*, which is in the fundus. All these things are clearly visible both in the purpuras and the trumpet-shells, in the spiral. The next thing after the oesophagus is the gut (indeed the oesophagus and the gut are continuous), and the gut is throughout its length simple, right down to the vent. The starting-point of the gut is around the coil of the *mecon*, and there it is broader [for the *mecon* is a sort of residue in all the shelled animals—most of it is]; it then makes a

³ sic AC: σφοδρότατον PD, vulg.⁴ συνεχές . . . ἐντερον om. AC, secl. A.-W., Dt.⁵ secl. Dt.

κάμψαν ἄνω φέρεται πάλιν πρὸς τὸ σαρκῶδες, καὶ ἢ τελευτῇ τοῦ ἐντέρου παρὰ τὴν κεφαλὴν ἐστίν, ἢ ἀφίαισι τὸ περιττώμα, πᾶσιν ὁμοίως τοῖς στρομβώ-
 15 δεσι καὶ τοῖς χερσαίοις καὶ τοῖς θαλαττίοις. παρ-
 ὕφονται δ' ἀπὸ τῆς κοιλίας τῷ στομάχῳ ἐν τοῖς
 μεγάλοις κόχλοις συνεχόμενος ὑμενίῳ μακρὸς πόρος
 καὶ λευκός, ὁμοῖος τὴν χροῶν τοῖς ἄνω μαστοειδέσιν·
 ἔχει δ' ἐντομὰς ὡσπερ τὸ ἐν τῷ καράβῳ ὦν, πλήν
 τὴν χροῶν τὸ μὲν λευκόν, ἐκεῖνο δ' ἐρυθρόν. ἔχει
 20 δ' οὐδεμίαν ἐξοδὸν τοῦτο [οὐδὲ πόρον],¹ ἀλλ' ἐν ὑμένι
 ἐστὶ λεπτῷ, κοιλότητα ἔχον ἐν αὐτῷ στενήν. ἀπὸ
 δὲ τοῦ ἐντέρου κάτω παρατείνει μέλανα καὶ τραχέα
 συνεχῆ, οἷα καὶ ἐν ταῖς χελώναις, πλήν ἦττον
 μέλανα. ἔχουσι δὲ καὶ οἱ θαλάττιοι κόχλοι ταῦτα
 25 καὶ τὰ λευκά, πλήν ἐλάττω οἱ ἐλάττους.

Τὰ δὲ μονόθυρα καὶ δίθυρα τῇ μὲν ὁμοίως ἔχει
 τοῦτοις τῇ δ' ἑτέρως. κεφαλὴν μὲν γὰρ καὶ κεράτια
 καὶ στόμα ἔχουσι καὶ τὸ γλωττοειδές· ἀλλ' ἐν μὲν
 τοῖς ἐλάττοσι διὰ μικρότητα αὐτῶν ἄδηλα, τὰ δὲ
 καὶ ἐν τεθνεώσιν ἢ μὴ κινουμένοις οὐ δηλα. τὴν δὲ
 30 μήκωνα πάντα ἔχει, ἀλλ' οὐκ ἐν τῷ αὐτῷ οὐδ' ἴσην
 οὐδ' ὁμοίως φανεράν, ἀλλ' αἱ μὲν λεπάδες κάτω ἐν
 τῷ βάθει, τὰ δὲ δίθυρα ἐν τῷ γιγγλυμῶδει. καὶ τὰ
 τριχῶδη πᾶσιν ὑπάρχει κύκλω τοῦτοις, οἷον καὶ τοῖς
 529 b κτεσίν. καὶ τὸ λεγόμενον ὦν τοῖς ἔχουσιν, ὅταν
 ἔχωσιν, ἐν τῷ ἐπὶ θάτερα κύκλω τῆς περιφερείας
 ἐστίν, ὡσπερ καὶ τὸ λευκὸν τοῖς κόχλοις· καὶ γὰρ
 ἐκεῖνοις τοῦτο ὁμοῖον ὑπάρχει. ἀλλὰ πάντα τὰ τοι-
 5 αῦτα μόρια, ὡσπερ εἴρηται, ἐν μὲν τοῖς μεγάλοις

¹ secludere velit Dt.

^a Cf. 524 b 21.

bend and continues upwards again towards the fleshy part, and its termination is by the head, where the animal discharges the residue : this description applies to all spiral-shelled Testacea both terrestrial and marine. In the large snails there is woven alongside the oesophagus from the stomach a long white passage enclosed in a membrane, similar in colour to the breast-like formations higher up : there are insections in it, as in the egg of the crayfish, only it is white and the crayfish's egg is red. This has no outlet [or passage] but is enveloped in a thin membrane, and has in it a narrow cavity. From the gut downward there extend black, rough formations, which are continuous, similar to those in the tortoise, though not so black. Sea-snails too have these, and also the white ones, though they are smaller in the smaller snails.

The univalves and bivalves are in some ways similar to the spiral-shells and in some ways dissimilar. Thus they all have a head and horns and mouth and the tongue-like organ, but in the smaller ones these are difficult to see owing to the animals themselves being so small, and some are not clearly visible even in dead specimens or when the animals are not in motion. All have the *mecon*, but not all in the same place, or of the same size, or equally visible : in the limpets it is below in the depth of the shell, in the bivalves it is the hinge-like part. They all have also the hairy growths, in a circular shape, as in the scallops.^a The so-called egg, in those that have it and when they have it, is situated in one of the semicircles of the circumference, as is the white formation in the snails : indeed the formations in the two creatures are similar. But all these parts, as I have said, while plain enough to see in the larger creatures, are wholly invisible, or visible

δηλά ἐστιν, ἐν δὲ τοῖς μικροῖς ἢ οὐδὲν ἢ μόλις. διὸ μάλιστα ἐν τοῖς μεγάλοις κτεσὶ φανερά ἐστιν· οὗτοι δ' εἰσὶν οἱ τὴν ἑτέραν θυρίδα πλατεῖαν ἔχοντες, οἷον ἐπίθεμα. ἢ δὲ τοῦ περιπτώματος ἕξοδος τοῖς μὲν ἄλλοις¹ ἐστὶν ἐκ πλαγίου· ἔστι γὰρ πόρος ἢ πορεύ-
 10 εται ἕξω· [ἢ γὰρ μήκων, ὥσπερ εἴρηται, περιπτωμά ἐστι πᾶσιν ἐν ὑμένι.]² τὸ δὲ καλούμενον ὦν οὐκ ἔχει πόρον ἐν οὐδενί, ἀλλ' αὐτῆς τῆς σαρκὸς ἐπανοι-
 δεῖ· ἔστι δ' οὐκ ἐπὶ ταῦτό³ τῷ ἐντέρῳ, ἀλλὰ τὸ μὲν ὦν ἐν τοῖς δεξιῶσι, τὸ δ' ἔντερον ἐν τοῖς ἀριστεροῖς. τοῖς μὲν οὖν ἄλλοις τοιαύτη ἢ ἕξοδος τῆς περιπτώ-
 15 σεως, τῇ δ' ἀγρία⁴ λεπάδι, ἣν τινες καλοῦσι θαλάττιον οὖς, ὑποκάτω τοῦ ὄστράκου ἢ περιπτωσις ἐξέρχεται· τετρύπηται γὰρ τὸ ὄστρακον. φανερά δὲ καὶ ἡ κοιλία μετὰ τὸ στόμα οὖσα ἐν ταύτῃ καὶ τὰ ὠσειδῆ. πάντα δὲ ταῦτα τῖνα τρόπον τῇ θέσει ἔχει, ἐκ τῶν ἀνατομῶν θεωρεῖσθω.
 20 Τὸ δὲ καλούμενον καρκίνιον τρόπον μὲν⁵ τινα κοινόν ἐστι τῶν τε μαλακοστράκων καὶ τῶν ὄστρακοδέρμων. αὐτὸ μὲν γὰρ τὴν φύσιν ὅμοιον τοῖς παραβοειδέσι καὶ γίνεταί αὐτὸ καθ' αὐτό, τῷ δ' εἰσδύεσθαι καὶ ζῆν ἐν ὄστράκῳ ὅμοιον τοῖς ὄστρακοδέρμοις, ὥστε διὰ ταῦτα ἔοικεν ἐπαμφοτερίζειν.
 25 τὴν δὲ μορφήν ὡς μὲν ἀπλῶς εἶπεῖν ὅμοιον ἐστὶ τοῖς ἀράχλαις, πλὴν τὸ κάτω τῆς κεφαλῆς καὶ τοῦ θώρακος μείζον ἔχει ἐκείνων.⁶ ἔχει δὲ κερᾶτια δύο

¹ θαλαττίοις fortasse scribendum credit Dt.

² secl. Dt.: Cs. etiam ἐστι γὰρ . . . ὑμένι suppresserat.

³ sic AC: ταῦτόν PD, vulg.

⁴ ἀγρία displicet Th., qui τῷ δ' ἀρρύγω (λεπάδι ἣν τινες . . .) coniecit, Hesychii vocabulo usus: fortasse melius τῷ δ' ἀρρύγω [λεπάδι], ὃ τινες . . . : agreste Σ. ⁵ μὲν AC: om. PD, vulg.

⁶ ἐκείνων Dt.: ἐκείνου PDA², vulg.: ἐκείνος C: ἐκείνο Sn., Pi.

only with difficulty, in the small ones. Hence they are plainest of all in the large scallops: these are those which have one of their two valves flat-shaped, like the lid of a pot. The residual vent in all these animals (with one exception) is to one side: there is a passage through which the residue makes its way out. [For the *mecon*, as has been stated, is a residue which all of them have enveloped in a membrane.] In none of them has the so-called egg any passage; it is just a swelling-up of the flesh itself; and it is not situated in the same region as the gut, for it is on the right-hand side, whereas the gut is on the left. Such then is the residual vent in all of them—except one: the wild limpet, called by some the “sea-ear”^a: in this creature the residue issues underneath the shell, the shell being perforated. In this animal the stomach can plainly be seen following upon the mouth, and so can the egg-like formations. For the way in which all these parts are situated the *Dissections* should be consulted.

The hermit-crab, as it is called, in a way shares the (The hermit-crab.) characteristics of the Crustacea and the Testacea. In its natural structure it resembles the crayfish class, and when first born it is on its own <without a hard shell>; but by its practice of entering a shell and living in it it resembles the Testacea, and so it appears to dualize.^b To put it quite simply, in shape it resembles a spider, except that the part below the head and thorax is larger. It has two thin red horns, and

^a Th. suggests that the word ἀγρία (wild) is a corruption of ἀρρύγω, a word found in Hesychius; in which case λεπάδι would be a gloss on it. Tr. then, “the *arrygon*, called by some. . . .” Probably *Haliotis tuberculata* L.

^b See Notes, §§ 28 ff.

529 b

λεπτά πυρρά, καὶ ὀφθαλμοὺς ὑποκάτω τούτων δύο μακροῦς, οὐκ εἰσδυομένους οὐδὲ κατακλινομένους ὡσπερ οἱ τῶν καρκίνων ἀλλ' ὀρθοῦς, ὑποκάτω δὲ

30 τούτων τὸ στόμα καὶ περὶ αὐτὸ καθαπερὶ τριχώδη ἄττα πλείω, τούτων δ' ἔχομένους δύο πόδας δικρούς, οἷς προσάγεται, καὶ ἄλλους ἐφ' ἑκάτερα δύο, καὶ τρίτον¹ μικρόν. τὸ δὲ κάτω τοῦ θώρακος

530 a μαλακὸν ἅπαν ἐστὶ καὶ διοιγόμενον ὠχρὸν ἔνδοθεν. ἀπὸ δὲ τοῦ στόματος πόρος εἰς ἄχρι τῆς κοιλίας· τῆς δὲ περιπτώσεως οὐ δῆλος ὁ πόρος. οἱ δὲ πόδες καὶ ὁ θώραξ σκληρὰ μὲν, ἦττον δ' ἢ τῶν καρκίνων. b πρόσφυσιν δ' οὐκ ἔχει πρὸς τὰ ὄστρακα ὡσπερ αἱ πορφύραι καὶ οἱ κήρυκες, ἀλλ' εὐαπόλυτον ἐστίν. προμηκέστερα δ' ἐστὶ τὰ ἐν τοῖς στρόμβοις τῶν ἐν τοῖς νηρείταις.²

Ἔτερον δὲ γένος ἐστὶ τὸ τῶν νηρειτῶν, τὰ μὲν ἄλλα παραπλήσιον, τῶν δὲ δικρούων ποδῶν τὸν μὲν δεξιὸν ἔχει μικρόν τὸν δ' ἀριστερὸν μέγαν, καὶ 10 ποιεῖται τὴν βάδιον μᾶλλον ἐπὶ τούτῳ. [λαμβάνεται δὲ καὶ ἐν ταῖς κόγχαις τούτων,³ ὧν ἐστὶν ἡ πρόσφυσις παραπλησία, καὶ ἐν τισιν⁴ ἄλλοις. τούτων δὲ καλοῦσι κύλλαρον.]

Ὁ δὲ νηρείτης τὸ μὲν ὄστρακον ἔχει λεῖον καὶ μέγα⁵ καὶ στρογγύλον, τὴν δὲ μορφήν παραπλησίαν τοῖς κήρυξι, πλὴν οὐχ ὡσπερ ἐκεῖνοι τὴν μήκωνα 15 μέλαιναν ἀλλ' ἐρυθρὰν· προσπέφυκε δὲ νεανικῶς κατὰ τὸ μέσον. ἐν μὲν οὖν ταῖς εὐδαίαις ἀπολυόμενα

¹ <ζεύγος> Dt.

² hinc usque ad v. 25 τοιοῦτοις secl. Dt.; a v. 10 λαμβάνεται secl. A.-W.; a v. 10 λαμβάνεται usque ad v. 12 κύλλαρον secl. Th., quae et Σ omittit.

under them two long eyes : these do not retreat inwards nor do they turn sideways like the crab's,^a but stick straight outwards. Under these is the mouth, and round it a number of formations which are as it were hairlike ; and immediately after these there are two feet, bifurcate, with which it draws things towards itself, then two more feet on each side, and then a third, small one. The whole of the part below the thorax is soft, and when opened up is pale yellow-coloured inside. From the mouth there is a single passage leading as far as the stomach ; the residual passage cannot, however, be made out. The legs and the thorax, though hard, are less hard than in the crabs. It has no attachment to the shell as the purpuras and the trumpet-shells have, but can be loosened from it quite easily. Specimens found in spiral shells are more elongated than those in the shells of neritae.

The creature which lives in the shells of neritae is another kind. It resembles the other in all respects except that of its bifurcate feet the right one is small and the left one large ; and it uses the latter more than the former for walking. [It is also found in the shells of those creatures whose method of attachment is similar, and in certain others. This one they call *kyllaros*.]

The nerites has a large smooth round shell, and its shape is comparable to the trumpet-shell, though unlike theirs its *mecon* is not black but red. It adheres with great force by the middle. In fine weather, these

^a See 526 a 9 f.

³ κρόκαις τούτων AC : κόγχαις τοιοῦτον PD, vulg.

⁴ τισιν Dt. e conj. A.-W. (qui ita tentav. : λαμβ. δὲ καὶ ἐν ταῖς κόγχαις τοιαῦτα, ὧν ἡ φύσις παραπ. καὶ ἐν τισιν ἄλλοις deinde lacunam stat.) : τοῖς codd., vulg. ⁵ nigra Σ (μέλαν).

530 a

νέμεται ταῦτα, πνευμάτων δ' ὄντων τὰ μὲν καρκίνα ἤσουχάζει πρὸς τοῖς λίθοις, οἱ δὲ νηρείται προσέχονται καθάπερ αἱ λεπάδες· ὡσαύτως δὲ καὶ αἱ αἰμορροῖδες¹ καὶ πᾶν τὸ τοιοῦτον γένος. προσφύονται δὲ ταῖς πέτραις, ὅταν ἀποκλίνωσι τὸ ἐπικάλυμμα· τοῦτο γὰρ ἔοικεν εἶναι ὡσπερεὶ² πῶμα· ὃ γὰρ τοῖς διθύροις ἄμφω, τοῦτο τοῖς στρομβώδεσι τὸ ἕτερον μέρος. τὸ δ' ἐντὸς σαρκῶδες ἐστί, καὶ ἐν τούτῳ τὸ στόμα. τὸν αὐτὸν δὲ τρόπον ἔχει ταῖς αἰμορροῖσι καὶ ταῖς πορφύραις καὶ πᾶσι τοῖς τοιούτοις.

Ἔχει δ' ἔχει μείζω τὸν ἀριστερὸν πόδα, ταῦτα ἐν μὲν τοῖς στρομβοῖς οὐκ ἐγγίγνεται, ἐν δὲ τοῖς νηρείταις ἐγγίγνεται. εἰσὶ δὲ τινες κόχλοι οἱ ἔχουσιν ἐν αὐτοῖς ὅμοια ζῶα τοῖς ἀστακοῖς τοῖς μικροῖς; οἱ γίνονται καὶ ἐν τοῖς ποταμοῖς· διαφέρουσι δ' αὐτῶν τῷ μαλακὸν ἔχειν τὸ ἔσω τοῦ ὀστράκου. τὴν δ' ἰδέαν οἰοί εἶναι, ἐκ τῶν ἀνατομῶν θεωρεῖσθωσαν.

V Οἱ δ' ἐχίνιοι τὸ μὲν σαρκῶδες οὐκ ἔχουσιν, [ἀλλ' ἴδιον αὐτῶν τοῦτ' ἐστίν· ἐστέρηται γὰρ πάντες, καὶ οὐκ ἔχουσι σάρκα ἐντὸς οὐδεμίαν·]³ τὰ δὲ μέλανα πάντες. ἐστὶ δὲ γένη πλείω τῶν ἐχίνων, ἐν μὲν τὸ ἐσθίονον· τοῦτο δ' ἐστὶν ἐν ᾧ τὰ καλούμενα ψὰ μεγάλα ἐγγίγνεται καὶ ἐδώδιμα, ὁμοίως ἐν μείζοσι καὶ ἐλάττοσιν· καὶ γὰρ εὐθὺς ἐτι μικροὶ ὄντες ἔχουσι ταῦτα. ἄλλα δὲ δύο γένη τὸ τε τῶν σπατάγγων καὶ τὸ τῶν καλουμένων βρύσσων· γίνονται δ' οὗτοι πελάγιοι καὶ σπάνιοι. ἐτι αἱ ἐχινομήτρηαι καλούμεναι, μεγέθει πάντων μέγισται. πρὸς δὲ τούτοις ἄλλο γένος μεγέθει μὲν μικρόν, ἀκάνθας δὲ μεγάλας ἔχον⁴

¹ ὡσαύτως δὲ καὶ αἱ αἰμ.] καὶ αἱ ἀπορραῖδες PD.

² ὡσπερεὶ AC : ὡσπερ PD, vulg. ³ secl. Dt.

⁴ sic Pl., A.-W., simil. Sn. : ἀκάνθας ἔχον μεγάλας PD : ἀκ. δὲ μεγ. ἔχει AC, vulg.

creatures unloose themselves and go about looking for food, but when the wind blows the hermit-crabs remain quiet by the rocks, whereas the neritae cling tight like limpets; the same is true of the haemorrhoids^a and the whole of that class. They cling to the rocks when they turn back the operculum, which appears to be rather like a lid: indeed the operculum in these spiral-shelled creatures serves the purpose of the second valve in the bivalves. The inner part is fleshy, and contains the mouth. The same structure is found in the haemorrhoids, the purpuras and all such animals.

Those <crabs> which have a larger left foot are not found living in spiral shells, but are found in the neritae. There are also certain snail-shells which have in them creatures resembling the small crayfish that are found in rivers: they differ from them in having the part inside the shell soft. To see what they look like, the *Dissections* should be consulted.

The sea-urchins have no fleshy part [—a characteristic peculiar to them: they are all completely empty, and have no flesh inside at all] : but they all have the black formations. There are several kinds of sea-urchin, one of which is the kind used at table; this is the one in which the so-called eggs are large and edible, in large and small ones alike: the eggs are present in them even while still quite small. There are two other kinds, the *spatanges*, and the *bryssos* as it is called: these are deep-sea creatures and scarce. Furthermore, there are the mother-urchins so-called, the largest of all in size. In addition to these there is another kind, small in size, but with large hard spines;

^a Two mss. read "the aporrhoids." Possibly the Venetian *zamarigola*, the *Aporrhais pes-pellicani* (von Martens).

καὶ σκληράς· γίγνεται δὲ [ἐκ]¹ τῆς θαλάττης ἐν
 10 πολλαῖς ὀργυιαῖς, ᾧ χρώνται πρὸς τὰς στραγγου-
 ρίας τινές. περὶ δὲ Τορώνη εἰσὶν ἐχίνοι λευκοὶ
 θαλάττιοι καὶ τὰ ὄστρακα καὶ τὰς ἀκάνθας καὶ τὰ
 ψά, μείζους δὲ τῶν ἄλλων εἰς μήκος· ἢ δ' ἄκανθα
 οὐ μεγάλη οὐδ' ἰσχυρά, ἀλλὰ μαλακωτέρα. τὰ δὲ
 μέλανα τὰ ἀπὸ τοῦ στόματος πλείω, καὶ πρὸς μὲν
 15 ἀπτα· τούτοις δ' ὥσπερ διελημμένους ἐστίν. κινούν-
 ται δὲ μάλιστα καὶ πλειστάκις οἱ ἐδώδιμοι αὐτῶν·
 καὶ σημεῖον δέ· αἰεὶ τι² ἔχουσιν ἐπὶ ταῖς ἀκάνθαις.

Ἐχουσι μὲν οὖν ἅπαντες ψά, ἀλλ' ἐνιοὶ πάμπαν
 μικρὰ καὶ οὐκ ἐδώδιμα. συμβαίνει δὲ τὴν μὲν λεγο-
 μένην κεφαλὴν καὶ τὸ στόμα τὸν ἐχίνον κάτω ἔχειν,
 20 ἢ δ' ἀφήσι τὸ περίττωμα, ἄνω. [ταυτό³ δὲ τοῦτο
 συμβέβηκε τοῖς τε στρομβύδεσι πᾶσι καὶ ταῖς λε-
 πᾶσιν·]⁴ ἢ γὰρ νομῆ ἐκ τῶν κάτωθεν, ὥστε τὸ μὲν
 στόμα πρὸς τῇ νομῇ, τὸ δὲ περίττωμα ἄνω πρὸς
 τοῖς πρᾶνεσι τοῦ ὄστράκου. ἔχει δ' ὁ ἐχίνος ὀδόν-
 25 τας πέντε κοίλους ἐνδοθεν, ἐν μέσῳ δὲ τούτων σῶμα
 σαρκῶδες ἀντὶ γλώττης. τούτου δ' ἔχεται ὁ στό-
 μαχος, εἶτα ἡ κοιλία εἰς πέντε μέρη διηρημένη,
 πλήρης περιττώματος· συνέχουσι δὲ πάντες οἱ κόλ-
 ποι αὐτῆς εἰς ἓν πρὸς τὴν ἔξοδον τῆς περιττώσεως,
 ἢ τετρῦπται τὸ ὄστρακον. ὑπὸ δὲ τὴν κοιλίαν ἐν
 ἄλλῳ ὑμένι τὰ καλούμενα ψά ἐστίν, ἴσα τὸν ἀριθμὸν
 30 ὄντα ἐν ἅπασιν⁵. πέντε γάρ ἐστι τὸ πλῆθος καὶ
 περιττά. ἄνω δὲ τὰ μέλανα ἀπὸ τῆς ἀρχῆς τῶν
 ὀδόντων ἤρτηται, ἃ ἐστὶ πικρὰ καὶ οὐκ ἐδώδιμα.

¹ secl. Dt., suadente Sn.: κατὰ Pi.

² ita scripsi: δέ αἰεὶ γάρ τι Sn.: σ. δέ τι AC, vulg.: σ. δέ
 τι ἂν P: σ. δέ τι αἰεὶ D: edd. alii alia.

it lives in the sea several fathoms deep, and some use
 it as a remedy for strangury. In the neighbourhood
 of Torone^a there are white sea-urchins—shells, spines,
 and eggs are all white—longer than the ordinary ones.
 The spines of these are neither large nor strong, but
 rather limp. The black objects which rise in the
 mouth are numerous, and connect with the passage
 that leads externally, though not with each other :
 as a result of these the animal is as it were divided up.
 The edible ones move about most of all and most
 often ; a proof of this is that they always have some-
 thing fixed on their spines.^b

They all have Ova, though in some these are very
 small and inedible. A curious fact is that the urchin's
 head (as it is called) and mouth are down below, and
 its residual vent at the top. [The same is true of all
 the spiral-shells and the limpets.] The reason is that
 they obtain their food from below ; thus the mouth
 is down where the food is, and the residue is up above
 by the back of the shell. The urchin also has five
 hollow teeth inside, and in the middle of them a fleshy
 organ instead of a tongue. Next to this is the oeso-
 phagus, then the stomach, which is divided into five
 parts and full of residue : all its folds unite at the
 residual vent, where the shell is perforated. Under
 the stomach, in another membrane, are the so-called
 Ova, the same number in all the urchins : there are
 five of them, an odd number. Above, the black for-
 mations are attached to the starting-point of the
 teeth ; they are bitter and unfit to eat. A similar or

^a On the next peninsula to that of Athos, to the south-west.

^b Cf. P.A. 681 a 8.

³ ταυτό AC: ταυτόν PD, vulg.

⁴ secl. A.-W., Dt.

⁵ ἅπασιν AC: πᾶσιν vulg.

530 b

ἐν πολλοῖς δὲ τῶν ζώων τὸ τοιοῦτόν ἐστιν ἢ τὸ ἀνάλογον· καὶ γὰρ ἐν ταῖς χελώναις καὶ φρύναις καὶ
 531 a βατράχοις¹ καὶ ἐν τοῖς στρομβώδεσι καὶ τοῖς μαλακίοις· ἀλλὰ τῷ χρώματι διαφέρει καὶ ἄβρωτὰ ἐστὶν ἐν πᾶσι τὰ τοιαῦτα ἢ πάμπαν ἢ μᾶλλον. κατὰ μὲν οὖν τὴν ἀρχὴν καὶ τελευτὴν συνεχῆς τὸ σῶμα τοῦ ἐχίνου ἐστὶ,² κατὰ δὲ τὴν ἐπιφάνειαν οὐ συνεχῆς
 5 ἄλλ' ὅμοιον λαμπτήρι μὴ ἔχοντι τὸ κύκλω δέρμα. ταῖς δ' ἀκάνθαις χρήται ὁ ἐχίνος³ ὡς ποσίν· ταύταις γὰρ ἐπερειδόμενος⁴ καὶ κινούμενος μεταβάλλει τὸν τόπον.

VI Τὰ δὲ καλούμενα τήθυμα τούτων πάντων ἔχει τὴν φύσιν περιττοτάτην. κέκρυπται γὰρ αὐτῶν μόνων
 10 τὸ σῶμα ἐν τῷ ὀστράκῳ πᾶν, τὸ δ' ὀστρακὸν ἐστὶ μεταξύ δέρματος καὶ ὀστράκου, διὸ καὶ τέμνεται ὡσπερ βύρσα σκληρά. προσπέφυκε μὲν οὖν ταῖς πέτραις τῷ ὀστρακῷδει,⁵ δύο δ' ἔχει πόρους ἀπέχοντας ἀπ' ἀλλήλων, πάμπαν μικροὺς καὶ οὐ ραδί-

¹ ἐν ante φ. et ante β. PD, vulg. : om. AC.

² sic P, Gul., Ald., Cs., Sn., vulg., Pi. (ἐστὶ post σῶμα D): τοῦ ἐχίνου τὸ στόμα ἐστὶ AC, A.-W., Dt., Th. (n.b. 531 b 1 loco σῶμα πᾶν habent στόμα AC) : τοῦ ἐχίνου τὸ σῶμα ἐστὶ Buss. : κατὰ μὲν οὖν κ.τ.λ. sic vertit Σ et genus hyricii est continuum in parte inferiori ; in parte vero superiori ubi sunt spine est separatum. et ipse utitur spinis loco pedum. videas et quae p. 351 scripta sunt.

³ sic AC : ὁ ἐχ. χ. vulg.

⁴ ἐπ- C : ἀπ- PD, vulg.

⁵ sic Pi., A.-W., Dt. : τὸ ὀστρακῶδες AC, Sn., Buss. : τῷ ὀστράκῳ PD, vulg.

^a See Notes, § 3.

^b The famous "Aristotle's Lantern"; cf. P.A. 680 a 5. Three interpretations have been given of this passage (see F. J. Cole, *Centaurus*, I (1950/1), p. 377) : (1) Rondelet's (1544), that the "lantern" is the mouth-apparatus. This

analogous^a thing is present in many animals, e.g., the tortoise, the toad, the frog, the spiral-shelled Testacea and the Cephalopods, though it differs in colour, and in all of them it is either completely or more or less uneatable. In respect of its beginning and end the body of the urchin is continuous, though in respect of its superficial appearance it is not continuous, but similar to a lantern lacking its surrounding skin.^b The urchin uses its spines as feet : it puts its weight on them for leverage and so moves about from place to place.

The *tethya*^c as they are called are the most extra- VI ordinary of all these animals. They are the only ones (Inter-
 whose body is completely hidden inside the shell, the mediate
 animals.) texture of which is between that of skin and shell, and consequently to the knife it cuts like hard leather. The animal clings to the rocks by its shelly part, and it has two passages some distance apart which are very small indeed and by no means easy to see, by

view has been generally adopted, and the apparatus was named *laterna Aristotelis* by Jacob Theodor Klein (1685-1759) in 1734 in his *Naturalis Dispositio Echinodermatum*. (2) Scaliger's (1619), that the lantern is the entire test. This view was adopted by T. E. Lones (*Aristotle's Researches in Natural Science*, 1912, pp. 127, 130) and at one time by F. J. Cole. It assumes that the classical lantern as a whole was the basis of the comparison. (3) Cole's own suggestion, that both the test and the mouth-apparatus resemble a lantern with its lamp. (See also his *History of Comparative Anatomy*, 1944, p. 40.) Cole remarks that the reading *στόμα* fails to make sense with what follows, whereas *σῶμα* would involve the whole test (as Scaliger), and that Aristotle refers to the apparent continuity of the "body" of the echinus, and compares it with a lantern without the surrounding skin (e.g., after the epiderm and spines have been removed). See further, Additional Note on p. 351.

^c See n. on 528 a 20.

ους ἰδεῖν, ἢ ἀφήσει καὶ δέχεται τὸ ὑγρὸν· περίπτωμα
 15 γὰρ οὐδέν ἔχει φανερόν [ὡσπερ τῶν ἄλλων ὀστρέων
 τὰ μὲν ὡσπερ ἐχίνος, τὰ δὲ τὴν καλουμένην μή-
 κωνα].¹ ἀνοιχθέντα δ' ἔσωθεν πρῶτον μὲν ὑμένα
 ἔχει νευρώδη περὶ τὸ ὀστρακῶδες². ἐν δὲ τούτῳ
 αὐτό ἐστὶ τὸ σαρκῶδες τοῦ τηθύου, οὐδενὶ ὁμοιον
 τῶν ἄλλων· αὐτῆ³ μέντοι ἢ σὰρξ πάσα⁴ ὁμοία.
 20 προσπέφυκε δὲ τοῦτο κατὰ δύο τόπους τῷ ὑμένι καὶ
 τῷ δέρματι ἐκ πλαγίου· καὶ ἡ προσπέφυκε, ταύτη
 ἐστὶ στενότερον ἐφ' ἑκάτερα, οἷς τείνει πρὸς τοὺς
 πόρους τοὺς ἔξω διὰ τοῦ ὀστράκου φέροντας, ἢ
 ἀφήσει καὶ δέχεται τὴν τροφήν καὶ τὸ ὑγρὸν, ὡς ἂν
 εἰ τὸ μὲν στόμα εἴη, τὸ δὲ τῇ περιττώσει ἔξοδος·
 25 καὶ ἐστὶν αὐτῶν τὸ μὲν παχύτερον τὸ δὲ λεπτότερον.
 ἔσω δὲ κοῖλον ἐφ' ἑκάτερα, καὶ διείργει μικρὸν τι
 συνεχές· ἐν θατέρῳ δὲ τῶν κοίλων ἡ ὑγρότης ἐγγίγ-
 νεται. ἄλλο δ' οὐδέν ἔχει μόριον οὔτε ὀργανικὸν
 οὔτε αἰσθητήριον, οὔτε, ὡσπερ ἐλέχθη πρότερον ἐπὶ⁵
 τοῖς ἄλλοις, τὸ περιττωματικόν. χρῶμα δὲ τοῦ
 30 τηθύου ἐστὶ τὸ μὲν ὠχρὸν τὸ δ' ἐρυθρόν.

Ἔστι δὲ καὶ τὸ τῶν ἀκαληφῶν γένος ἴδιον· προσ-
 πέφυκε μὲν γὰρ ταῖς πέτραις ὡσπερ ἔνια τῶν ὀστρα-
 κωδέρμων, [ἀπολύεται δ' ἐνίοτε.]⁶ οὐκ ἔχει δ' ὀστρα-
 531 b κον, ἀλλὰ σαρκῶδες τὸ σῶμα πᾶν ἐστὶν αὐτῆς.
 αἰσθάνεται δέ, καὶ συναρπάζει τὰ προσφερόμενα

¹ secl. A.-W.

² σαρκῶδες Ald., Karsch, A.-W.

³ αὐτῆ AC, A.-W., Dt.: αὐτῆ PD, vulg., Pi.

⁴ πάσα A¹C, Pi., A.-W., Dt.: πᾶσιν PDA², vulg.

⁵ ἐπὶ conl. Dt.: ἐν codd., vulg.

⁶ aut secludenda, aut ἀπολύονται (cum AC) δ' ἔναι scribendum. sequitur locus admodum corruptus, quem aliena eiciendo restituere conatus sum; v. quae pag. 352 de codd. edd. scripta sunt.

which it takes in and discharges the water, for it has no residue so far as can be seen [just as, of the other shell-fish, some are like the sea-urchin, and others <have> the so-called *mecon*]. When opened up, we find it has, in the first place, a sinewy membrane inside all round the shelly part; and within this is the actual fleshy part of the *tethyon*, similar to that of none of the others; though this flesh is similar throughout. This substance is attached at two places to the membrane and the skin obliquely; and where it is attached, the space at each side is narrower where the flesh extends towards the passages that lead out through the shell—by which the animal takes in and discharges the nourishment and liquid matter, just as if one passage were a mouth and the other the outlet for the residue. One of the passages is wider than the other. Inside, there is a cavity on each side, separated by a small continuous portion; in one of these the liquid is found. The animal has no other part, neither instrumental nor sensory, nor, as was stated before with reference to the others, has it any part for residue. Some *tethya* are pale yellow in colour, some red.

The tribe of sea-anemones ^a too is a peculiar one. This creature adheres to rocks like certain of the Testacea [though it sometimes casts loose ^b], but it has no shell: its whole body is fleshy. It has the faculty of sensation, and seizes things which come up

^a The Greek word is the same as that used for stinging-nettles.

^b These words should either be cut out, or amended to read "though some cast loose."—The whole passage has been seriously corrupted by interpolations, which I have omitted from the translation. A full discussion of the passage will be found on pp. 352-360 ff.

ταῖς χερσὶ καὶ προσέχεται, καθάπερ ὁ πολύπους
 ταῖς πλεκτάναις, οὕτως ὥστε τὴν σάρκα ἐπανοι-
 δεῖν. ἔχει δὲ τὸ στόμα ἐν μέσῳ, καὶ ζῆ ἀπὸ [τῆς
 πέτρας ὡσπερ ἀπ' ὀστρέου. κἄν τι προσπέσῃ]
 5 τῶν μικρῶν ἰχθυδίων, [ἀντέχεται ὡσπερ τῆς χει-
 ρός· οὕτω] ἑάν² τι προσπέσῃ αὐτῇ [ἐδώδιμον,
 κατεσθίει].³ καὶ ἀπολύεται δὲ γένος τι αὐτῶν,
 ὃ [ἑάν τι προσπέσῃ] κατεσθίει καὶ ἐχίνους καὶ
 κένενας. περίττωμα δὲ οὐδὲν παντελῶς⁴ φαίνεται
 ἔχουσα, ἀλλ' ὁμοία κατὰ τοῦτο τοῖς φυτοῖς ἐστίν.
 10 γένη δὲ τῶν ἀκαληφῶν ἐστὶ δύο, αἱ μὲν ἐλάττους
 καὶ ἐδώδιμοι μᾶλλον, αἱ δὲ μεγάλαι καὶ σκληραί,
 οἷαι γίνονται καὶ περὶ Χαλκίδα. τοῦ μὲν οὖν
 χειμῶνος τὴν σάρκα σπιφρὰν ἔχουσι (διὸ καὶ θη-
 ρεύονται καὶ ἐδώδιμοὶ εἰσὶ), τοῦ δὲ θέρους⁵ ἀπόλ-
 λυνται· γίνονται γὰρ μαδαραί, καὶ ἂν τις θίγῃ,
 15 διασπῶνται ταχέως καὶ οἷαι οὐ δύνανται ἀφαι-
 ρεῖσθαι· πονοῦσαι τε ταῖς ἀλέαις εἰς τὰς πέτρας
 εἰσδύονται μᾶλλον.

Περὶ μὲν οὖν τῶν μαλακίων καὶ τῶν μαλακοστρά-
 κων καὶ τῶν ὀστρακοδέρμων, ὅσα τ' ἔχουσιν ἐκτός
 μέρη καὶ ὅσα ἐντός, εἴρηται.

VII Περὶ δὲ τῶν ἐντόμων λεκτέον τὸν αὐτὸν τρόπον.
 21 ἔστι δὲ τὸ γένος τοῦτο πολλὰ ἔχον εἶδη ἐν αὐτῷ, καὶ
 ἐνίοις πρὸς ἄλληλα συγγενικοῖς οὖσιν οὐκ ἐπέξευκ-
 ται κοινὸν ὄνομα οὐδὲν, οἷον ἐπὶ μελίττῃ καὶ ἀν-
 θρήνῃ καὶ σφήκι καὶ πᾶσι⁶ τοῖς τοιούτοις, καὶ πάλιν
 ὅσα τὸ πτερόν ἔχει ἐν κολεῳ̄, οἷον μηλολόνη καὶ
 25 κάραβος καὶ κανθαρίς καὶ ὅσα τοιαῦτα.

¹ ita scripsi: προσφερομένης τῆς χειρός vulg.

² ἑάν scripsi: κἄν vulg. ³ κατεσθίει om. AC.

⁴ παντελῶς οὐδὲν C: φανερόν οὐδὲν A.

against it with its hands, just as the octopus does
 with its tentacles, in such a way that the flesh swells
 up. It has its mouth in the middle, and it lives off
 tiny fishes, if any [that is eatable] comes up against
 it. And one kind of sea-anemone casts loose; this
 kind devours both sea-urchins and scallops. As for
 residue, it plainly has none at all; in this respect it
 resembles plants. There are two kinds of sea-
 anemone: the smaller ones, which are more suitable
 for food; and the large ones which are hard, such as
 are found around Chalcis. In winter their flesh is
 firm (which is why they are hunted and suitable for
 food), but in summer they go off—they become
 soggy, and if you touch them they quickly come to
 pieces; you cannot pull them off whole. When they
 are bothered by the heat they tend to slip in between
 the rocks.

We have now spoken of the Cephalopods, the
 Crustacea and the Testacea, and have dealt with their
 parts both external and internal.

We must now go on to deal in the same way with VII
 the Insects.^a This group includes many kinds; and ^{Insects:}
 although some of them are closely akin to one another
 there is no common name that is applied to them, as
 for instance to the bee, the anthrena,^b the wasp, and
 all such insects, and again those which have their
 wings in a sheath, e.g., the cockchafer, the horned
 beetle,^c the blister-beetle, and the like.

^a It will be seen that under "Insects" Ar. includes more
 animals than are now so called in scientific zoology; some
 of his insects have more than six feet.

^b Probably the hornet.

^c Or stag-beetle.

⁵ <πολλαι> add. Pi.

⁶ πᾶσι AC: om. PD, vulg.

531 b

Πάντων μὲν οὖν κοινὰ μέρη ἐστὶ τρία, κεφαλὴ τε καὶ τὸ περὶ τὴν κοιλίαν κύτος καὶ τρίτον τὸ μεταξὺ τούτων, οἷον τοῖς ἄλλοις τὸ στῆθος καὶ τὸ νῶτόν ἐστιν. τοῦτο δὲ τοῖς μὲν πολλοῖς ἐν ἐστίν· ὅσα δὲ μακρὰ καὶ πολύποδα, σχεδὸν ἴσα ταῖς ἐντομαῖς ἔχει τὰ μεταξὺ.

Πάντα δ' ἔχει διαιρούμενα ζῶν τὰ ἐντομα, πλὴν ὅσα ἢ λίαν κατέψυκται ἢ διὰ μικρότητα ταχὺ καταψύχεται, ἐπεὶ καὶ οἱ σφῆκες διαιρεθέντες ζῶσιν. μετὰ μὲν οὖν τοῦ μέσου καὶ ἡ κεφαλὴ καὶ ἡ κοιλία 532 a ζῆ, ἄνευ δὲ τούτου ἡ κεφαλὴ οὐ ζῆ. ὅσα δὲ μακρὰ καὶ πολύποδά ἐστι, πολὺν χρόνον ζῆ διαιρούμενα, καὶ κινεῖται τὸ ἀποτμηθὲν ἐπ' ἀμφοτέρα τὰ ἔσχατα· καὶ γὰρ ἐπὶ τὴν τομὴν πορεύεται καὶ ἐπὶ τὴν οὐράν, οἷον ἡ καλουμένη σκολόπενδρα.

Ἔχει δ' ὀφθαλμοὺς μὲν ἅπαντα, ἄλλο δ' αἰσθητήριον οὐδὲν φανερόν, πλὴν ἕνια οἷον γλώτταν (ἣν καὶ τὰ ὄστρακόδερμα ἔχει πάντα) ἣ καὶ γεύεται καὶ εἰς αὐτὰ¹ τὴν τροφήν ἀνασπᾶ. τοῦτο δὲ τοῖς μὲν μαλακόν ἐστι, τοῖς δ' ἔχει ἰσχὺν πολλήν, ὡσπερ ταῖς 10 πορφύραις. καὶ οἱ μύωπες δὲ καὶ οἱ οἰστροὶ ἰσχυρόν τοῦτ' ἔχουσι, καὶ τὰλλα σχεδὸν τὰ πλεῖστα· ἐν πᾶσι γὰρ τοῖς μὴ ὀπισθοκέντροις τοῦτο ὡσπερ ὄπλον ἔχει ἕκαστον² (ὅσα δ' ἔχει τοῦτο, ὀδόντας οὐκ ἔχει, ἕξω ὀλίγων τινῶν), ἐπεὶ καὶ αἱ μυῖαι τούτῳ θιγγάνουσαι αἱματίζουσι καὶ οἱ κώνωπες τούτῳ κεντούσιν.

Ἔχουσι δ' ἕνια τῶν ἐντόμων καὶ κέντρα. τὸ δὲ κέντρον τὰ μὲν ἔχει ἐν αὐτοῖς, οἷον αἱ μέλιτται καὶ οἱ σφῆκες, τὰ δ' ἐκτός, οἷον σκορπίος· καὶ μόνον δὴ τῶν ἐντόμων τοῦτο μακρόκερρόν³ ἐστίν. ἔτι δὲ

¹ αὐτὰ Pi.: αὐτό PDC, vulg.: αὐτὴν A¹.

² ἔχ. ἕκ.] suspic. Dt., qui conii. ὑπάρχει ἕκαστῳ vel ὀξύθηκτον.

There are three parts common to all insects : the head, the trunk which contains the stomach, and a third part in between these two, which in other animals would be the chest and the back. This third part is single in most of them ; but, in the long ones with a large number of feet, the parts in between are almost equal to the insections. (a) External parts.

All insects when cut in two retain life, except those which are excessively cold to begin with, or which on account of their smallness are quickly chilled : even wasps continue to live after being cut in two. So long as it has the middle piece, the head or the stomach can live ; but without it the head cannot do so. The long insects with numerous feet live a long time after division, and the severed portion can move in either direction : the portion can move either toward the cut or toward the tail-end, as happens with the millipede as it is called.

All insects have eyes, but no other discernible sense-organ, though some insects have a sort of tongue (which all the Testacea have too), by means of which they taste and draw in their food. In some insects it is soft, in others very strong—as it is in the purpuras. In the horse-fly and gadfly it is strong, and so it is in most of the others : indeed, all those which have no sting at the rear use it as a weapon (and, except for a very few, those that have it have no teeth) ; thus the fly by a touch with it can draw blood, and the vinegar-fly^a pricks with it.

Some insects have stings as well. Some have them inside their body, as the bees and wasps, some outside, as the scorpion (which is the only insect that has

^a Konops ; see 552 b 4.

³ sic P Rhen. Σ, Pi., A.-W., Dt. : μακρόκεντρον ACD, vulg.

532 a

χηλὰς ἔχει τοῦτό τε καὶ τὸ ἐν τοῖς βιβλίοις γιγνώμενον σκορπιῶδες.

Τὰ δὲ πτηνὰ αὐτῶν πρὸς τοῖς ἄλλοις μορίοις καὶ
20 πτερὰ ἔχει. ἔστι δὲ τὰ μὲν δίπτερα αὐτῶν, ὥσπερ αἱ μυῖαι, τὰ δὲ τετράπτερα, ὥσπερ αἱ μέλιτται· οὐδὲν δ' ἔστιν ὀπισθόκεντρον δίπτερον ὄν.¹ ἔτι δὲ τὰ μὲν ἔχει τῶν πτηνῶν ἔλυτρον τοῖς πτεροῖς, ὥσπερ ἡ μηλολόνη, τὰ δ' ἀνέλυτρα ἔστιν, ὥσπερ ἡ μέλιττα· ἀνορροπύγιος δ' ἡ πτήσις αὐτῶν ἀπάντων²
25 ἔστί, καὶ τὸ πτερόν οὐκ ἔχει καυλὸν οὐδὲ σχίσιν.

Ἔτι κεραίας πρὸ τῶν ὀμμάτων ἔχει ἔνια, οἷον αἱ τε ψυχαὶ καὶ οἱ κάραβοι. ὅσα δὲ πηδητικὰ αὐτῶν ἔστι, τούτων τὰ μὲν ἔχει τὰ ὀπισθεν σκέλη μείζω, τὰ δὲ πηδάλια καμπτόμενα εἰς τοῦπισθεν
30 ὥσπερ τὰ τῶν τετραπόδων σκέλη. πάντα δ' ἔχει τὰ πρηνῆ πρὸς τὰ ὕπτια διάφορα, ὥσπερ καὶ τὰλλα ζῶα. ἡ δὲ τοῦ σώματος σὰρξ οὐτ' ὄστρακώδης ἔστιν οὐθ' οἷον τὸ ἐντὸς τῶν ὄστρακωδῶν, οὕτω σαρκώδης,³ ἀλλὰ μεταξύ. διὸ καὶ οὐτ' ἄκανθαν
532 b ἔχουσιν οὐτ' ὄστούν οὐθ' οἷον σήπιον οὐτε κύκλω ὄστρακον· αὐτὸ γὰρ αὐτὸ τὸ σῶμα διὰ τὴν σκληρότητα σώζει καὶ οὐ προσδεῖται ἑτέρου ἐρείσματος. δέρμα δ' ἔχουσι μὲν, πάμπαν δὲ τοῦτο λεπτόν.

Τὰ μὲν οὖν ἔξωθεν αὐτῶν μόρια ταῦτα καὶ τοιαῦτ' ἔστί.

5 Ἐντὸς δ' εὐθύς μετὰ τὸ στόμα ἔντερον τοῖς μὲν πλείστοις εὐθὺ καὶ ἀπλοῦν μέχρι τῆς ἐξόδου ἔστιν, ὀλίγοις δ' ἐλιγμὸν ἔχει. σπλάγχνον δ' οὐδὲν ἔχει τῶν τοιούτων οὐδὲ πιμελήν, ὥσπερ οὐδ' ἄλλο τῶν

¹ ὄν conl. Dt.: μόνον AC, vulg.: διπ. ὀπισθ. omisso μόνον PD.

² ἀπάντων AC: πάντων vulg.

a long tail). It also has claws: so has the scorpion-like creature^a which infests books.

In addition to their other parts, the flying insects also have wings. Some have two wings, as the fly, some four, as the bee; no two-winged insect has a sting at the rear. Further, some flying insects have a sheath for their wings, as the cockchafer; some have none, as the bee. All of them however without exception fly without any help from a tail or rump: and their wing has no midrib and no division.

Furthermore, some insects have antennae in front of their eyes, as the butterfly and the horned beetle. Some can jump, and of these some have the hind legs longer than the forelegs, some have "paddles,"^b which bend backwards like the legs of quadrupeds. In all insects the ventral side differs from the dorsal, just as in all other animals. The flesh of their bodies is neither shelly, nor is it fleshlike in the way that the interior of the shelly animals is, but it is something intermediate. That is why they have neither fish-spine, nor bone, nor anything like sepia-bone, nor a shell round them: their body of itself, by its hardness, ensures their safety and needs no other support. They have a skin, however, though it is very thin.

We have now enumerated and described the external parts of Insects.

Internally, immediately after the mouth is the gut. (b) Internal parts. In most of them this is straight and simple right up to the vent, but in a few it has a coil. No insect has any viscera, or fat, nor indeed has any bloodless ani-

^a *Chelifer cancroides* (Th.); cf. 557 b 10.

^b The Greek word (πηδάλια) would no doubt also have suggested a connexion with jumping (cf. πηδητικά above).

³ οὐτε σαρκώδες AC: οὕτω σαρκώδες A.-W.

ἀναίμων οὐδέν. ἓνα δ' ἔχει καὶ κοιλίαν, καὶ ἀπὸ ταύτης τὸ λοιπὸν ἔντερον ἢ ἀπλοῦν ἢ εἰλιγμένον, 10 ὡσπερ αἱ ἀκρίδες.¹

Ὁ δὲ τέττιξ μόνον τῶν τοιούτων καὶ τῶν ἄλλων ζώων στόμα οὐκ ἔχει, ἀλλ' οἶον τοῖς ἐμπροσθοκέντροις² τὸ γλωττοειδές, τοῦτο μακρὸν καὶ συμφυές καὶ ἀδιάσχιστον, δι' οὗ τῇ δρόσῳ τρέφεται μόνον· ἐν δὲ τῇ κοιλίᾳ οὐκ ἴσχει περίττωμα. ἔστι δ' αὐτῶν 15 πλείω εἶδη, καὶ διαφέρουσι μεγέθει τε³ καὶ μικρότητι καὶ τῷ τοῦς μὲν καλουμένους ἀχέτας ὑπὸ τὸ διάζωμα⁴ διηρησθαι καὶ ἔχειν ὑμένα φανερόν, τὰ δὲ τεττιγόνια μὴ ἔχειν.

Ἔστι δ' ἓνα ζῶα περιττὰ καὶ ἐν τῇ θαλάττῃ, ἀ 20 διὰ τὸ σπάνια εἶναι οὐκ ἔστι θεῖναι εἰς γένος. ἤδη γάρ φασί τινες τῶν ἐμπειρικῶν⁵ ἀλιέων [οἱ μὲν]⁶ ἑωρακέσθαι ἐν τῇ θαλάττῃ ὅμοια δοκίοις, μέλανα, στρογγύλα τε καὶ ἰσοπαχῆ· ἕτερα δὲ καὶ ἀσπίσιν ὅμοια, τὸ μὲν χρώμα ἐρυθρά, πτερύγια δ' ἔχοντα πικνά· καὶ ἄλλα ὅμοια αἰδοίῳ ἀνδρὸς τό τ' εἶδος καὶ τὸ μέγεθος, πλὴν ἀντὶ τῶν ὄρχεων πτερύγια 25 ἔχειν δύο, καὶ λαβέσθαι ποτὲ τοιοῦτον τοῦ πολυαγκίστρου τῷ ἄκρῳ.

Τὰ μὲν οὖν μέρη τῶν ζώων ἀπάντων τὰ τ' ἐκτὸς καὶ τὰ ἐντὸς⁷ περὶ ἕκαστον γένος καὶ ἰδίᾳ καὶ κοινῇ τοῦτον ἔχει τὸν τρόπον.

¹ ut verba rebus respondeant, ἢ ἀπλοῦν ὡσπερ αἱ ἀκρίδες, ἢ εἰλιγμ. ὡσπερ ὁ τέττιξ conl. A.-W.: similia Karsch.

² sic Ald., Pi., A.-W., Dt.: ἐμπροσθεν κέντροις A¹CD: ὀπισθοκέντροις PA², vulg.

³ τε om. PD, vulg.

⁴ ὑπόζωμα PD. ⁵ ἐμπειρικῶν PD, Ald., A.-W. ⁶ secl. Dt.

⁷ sic AC, addito καί: πάντων τὰ τ' ἐντὸς καὶ τὰ ἐκτὸς PD, vulg.

^a See n. on 555 b 18. A.-W. point out that the gut is

mal. Some have a stomach in addition, and the rest of the gut proceeds from this, either simple, or with a coil, as in the grasshopper.^a

The cicada is the only one of these animals—indeed it is the only animal—which has no mouth: it has a tongue-like organ such as is found in the forward-stinging insects, which is long, and of one piece, and unforked; by means of it the insect feeds on dew, its only food; no residue is ever produced in its stomach. There are several kinds of cicada, which differ in size: another difference is that the “chirper”^b as it is called has a division under the *hyposoma*,^c and a membrane which can be plainly seen, whereas the cicadelles have no such membrane.

There are also some queer animals in the sea, and (Strange animals.) these owing to their rarity it is impossible to classify. For example, some experienced fishermen have been known to say that they have seen in the sea creatures like sticks, black, round, and the same thickness throughout their length; and other creatures similar to shields,^d red in colour, with close-packed fins; and still others similar in shape and size to the male penis, with two fins in place of the testicles, and they say that on one occasion such a creature was caught on the end of a night-line.

The parts of all animals, external and internal alike of each several kind, both common and peculiar, have now been described.

simple in the grasshoppers but much coiled in the cicadas. A.-W. and Karsch suggest a corresponding emendation of the text. ^b *Achetes*, the male cicada; cf. 535 b 7, 556 a 19 ff.

^c *Διάζωμα* and *ὑπόζωμα* appear to be used indifferently to describe the division between the thorax and the abdomen.

^d “Large saucers” might be a more topical equivalent. The Greek word is the same as that for “asps.”

VIII Περὶ δὲ τῶν αἰσθήσεων νῦν λεκτέον· οὐ γὰρ
30 ὁμοίως ἅπασιν¹ ὑπάρχουσιν, ἀλλὰ τοῖς μὲν πάσαι
τοῖς δ' ἐλάττους. εἰσὶ δ' αἱ πλείσται, καὶ παρ' ἄς
οὐδεμία φαίνεται ἴδιος ἑτέρα, πέντε τὸν ἀριθμὸν,
ὄψις, ἀκοή, ὄσφρησις, γεῦσις, ἀφή.

"Ἄνθρωπος μὲν οὖν καὶ τὰ ζωοτόκα καὶ πεζά,
533 a πρὸς δὲ τούτοις καὶ ὅσα ἔναιμα καὶ ὠτοτόκα,² πάντα
φαίνεται ἔχοντα ταύτας πάσας, πλὴν εἴ τι πεπήρω-
ται γένος ἓν, οἷον τὸ τῶν ἀσπαλάκων. τοῦτο γὰρ
ὄψιν οὐκ ἔχει· ὀφθαλμοὺς γὰρ ἐν μὲν τῷ φανερωῷ οὐκ
5 ἔχει, ἀφαιρεθέντος δὲ τοῦ δέρματος ὄντος παχέος ἀπὸ
τῆς κεφαλῆς κατὰ τὴν χώραν τὴν ἔξω τῶν ὀμμάτων
ἔσωθεν εἰσιν οἱ ὀφθαλμοὶ διεφθαρμένοι, πάντ' ἔχον-
τες ταῦτα τὰ μέρη τοῖς ἀληθινοῖς· ἔχουσι γὰρ τό τε
μέλαν καὶ τὸ ἐντὸς τοῦ μέλανος, τὴν καλουμένην
κόρην, καὶ τὸ κύκλω πῖον,³ ἐλάττω μέντοι ταῦτα
10 πάντα τῶν φανερῶν ὀφθαλμῶν. εἰς δὲ τὸ ἔξω οὐδὲν
σημαίνει τούτων διὰ τὸ τοῦ δέρματος πάχος, ὡς ἐν
τῇ γενέσει πηρουμένης τῆς φύσεως· [εἰσὶ γὰρ ἀπὸ
τοῦ ἐγκεφάλου, ἧ συνάπτει τῷ μυελῷ, δύο πόροι
νευρώδεις καὶ ἰσχυροὶ παρ' αὐτὰς τείνοντες τὰς
ἑδρας τῶν ὀφθαλμῶν, τελευτῶντες δ' εἰς τοὺς ἄνω
15 χυλιόδοντας.]⁴ τὰ δ' ἄλλα καὶ τῶν χρωμάτων
αἰσθησὶν ἔχει καὶ τῶν ψόφων, ἔτι δὲ καὶ ὀσμῆς
καὶ χυμῶν. τὴν δὲ πέμπτην αἰσθησὶν τὴν ἀφήν
καλουμένην καὶ τὰλλα πάντ' ἔχει ζῶα.

¹ Ἐν μὲν οὖν ἐνίοις καὶ τὰ αἰσθητήρια φανερώτατά

¹ ἅπασιν C: πᾶσιν PD, vulg.

² ὠτοτόκα conl. A.-W.: ζωοτόκα codd., Σ, vulg.

³ κύκλω πῖον bene A.-W. e Gul. versione quod in circuitu pinguis; conferas 520 b 4: κυκλώπιον codd., vulg.

⁴ secl. A.-W., Dt., χυλιόδοντας enim non habet hoc animal.

We must now go on to speak of the senses. These VIII are not present equally in all animals. Some animals have them all, some have fewer. The full number is five; so far as is known there is no special sense beyond these: viz., sight, hearing, smell, taste, and touch.

Now man and the footed Vivipara, and in addition the blooded Ovipara, all plainly possess all these five, though there may exceptionally be a single kind which has become stunted, the mole, for example. This animal lacks the sense of sight: it has no visible eyes, but if the skin (which is thick) be removed from the head at the external place where eyes are normally, the eyes are found in an impaired condition, complete with all the parts belonging to genuine eyes: they have the "black,"^a and that which is inside the black, the pupil as it is called, and the fatty part which surrounds it, but these are all smaller than in visible eyes. There is no external sign of these owing to the thickness of the skin, which suggests that in the course of development the natural process was stunted^b; [for there are two strong sinewy passages extending from the brain where it joins the marrow, running beside the seats of the eyes, and terminating at the upper projecting teeth.]^c All the other animals mentioned have the power of perceiving colours as well as noises, and also smells and tastes. The fifth sense, that of touch, is possessed by all animals.

In some animals the actual sense-organs are very

^a The iris; see 491 b 21.

^b Cf. 491 b 34.

^c This passage, bracketed by A.-W. and Dittm., seems to be of general reference, and has no special application to the mole.

⁵ δὲ καὶ PD: δ' AC, vulg.

533 a

ἔστι, τὰ μέντοι¹ τῶν ὀρμάτων καὶ μάλιστα². διωρισ-
 20 μένον γὰρ ἔχει τὸν τόπον τῶν ὀφθαλμῶν. καὶ τὸν
 τῆς ἀκοῆς· ἕνια μὲν γὰρ ὦτα ἔχει, ἕνια δὲ τοὺς
 πόρους φανερούς. ὁμοίως δὲ καὶ περὶ ὀσφρήσεως·
 τὰ μὲν γὰρ ἔχει μυκτῆρας, τὰ δὲ τοὺς πόρους τοὺς
 25 τῆς ὀσφρήσεως, οἷον τὸ τῶν ὀρνίθων γένος. ὁμοίως
 δὲ καὶ τὸ τῶν χυμῶν αἰσθητήριον, τὴν γλῶτταν.
 ἐν δὲ τοῖς ἐνύδροις καὶ ἐναίμοις οἱ ἰχθύες³ τὸ μὲν
 τῶν χυμῶν αἰσθητήριον, τὴν γλῶτταν, ἔχουσι μὲν,
 ἔχουσι δ' ἀμυδρῶς· ὀστώδη γὰρ καὶ οὐκ ἀπολελυ-
 μένην ἔχουσιν. ἀλλ' ἐνίοις τῶν ἰχθύων ὁ οὐρανός
 ἐστ σαρικόδης, οἷον τῶν ποταμίων ἐν τοῖς κυπρί-
 30 νοις, ὥστε τοῖς μὴ σκοπουμένοις ἀκριβῶς δοκεῖν
 εἶναι γλῶτταν.

“Ὅτι δ' αἰσθάνονται γεύόμενα, φανερόν· ἰδίους τε
 γὰρ πολλὰ χαίρει χυμοῖς, καὶ τὸ τῆς ἀμίας λαμβά-
 νουσι μάλιστα δέλεαρ καὶ τὸ τῶν πόνων ἰχθύων,
 ὡς χαίροντες ἐν τῇ γεύσει καὶ ἐδωδῇ τοῖς τοιοῦτοις
 δελέασιν. τῆς δ' ἀκοῆς καὶ τῆς ὀσφρήσεως οὐδὲν
 533 b ἔχουσι φανερόν αἰσθητήριον· ἃ⁴ γὰρ ἂν τισιν εἶναι
 δόξειε κατὰ τοὺς τόπους τῶν μυκτῆρων, οὐδὲν πε-
 ραίνει πρὸς τὸν ἐγκέφαλον, ἀλλὰ τὰ μὲν τυφλά, τὰ
 δὲ φέρει μέχρι τῶν βραγχίων. ὅτι δὲ καὶ ἀκούουσι
 5 καὶ ὀσφραίνονται, φανερόν· τοὺς τε γὰρ ψόφους
 φεύγοντα φαίνεται τοὺς μεγάλους, οἷον τὰς εἰρεσίας
 τῶν τριήρων, ὥστε λαμβάνεσθαι ῥαδίως ἐν ταῖς
 θαλάμαις· καὶ γὰρ ἂν μικρὸς ἦ ὁ ἕξω ψόφος, ὅμως
 τοῖς ἐν τῷ ὑγρῷ τὴν ἀκοὴν ἔχουσι χαλεπὸς καὶ
 μέγας καὶ βαρὺς φαίνεται πᾶσιν. ὁ συμβαίνει καὶ
 10 ἐπὶ τῆς τῶν δελφίνων θήρας· ὅταν γὰρ ἀθρόως περι-

¹ μέντοι Dt., monente Sn.: μὲν codd., vulg.

clearly visible, those of sight particularly so : animals have a definite place for the eyes, and so they have for the organs of hearing—thus some have ears, others auditory passages which are plainly visible. Similarly with smell : some have nostrils, others olfactory passages, e.g., the tribe of birds. Similarly too with the sense-organ of taste, the tongue. Among aquatic blooded animals, fishes have the organ of taste, the tongue, certainly, but it is indistinct ; in other words, it is bony and not fully detached. In some fishes, however, the palate is fleshy, as in the carp (to take an example of a river-fish), and anyone who does not inspect it closely will mistake it for a tongue.

It is plain enough that fishes have the sense of taste. Many of them enjoy particular flavours, and they very readily take a bait of bonito^a or of any fat fish, obviously because they enjoy tasting and eating baits of this kind. Fish have no visible sense-organ of hearing or smell : what might in some of them be taken for nostrils in the normal places do not connect with the brain : some of these passages are mere blind alleys, some lead only to the gills. It is, however, quite evident that fishes hear and smell : they can be seen making away from loud noises, such as that produced by the rowing of a trireme, and in consequence they are easily caught in their holes. We must remember that even a small noise in the open air sounds very heavy and enormous to anything which can hear under water. This indeed is what happens when dolphins are hunted : when the huntsmen have enclosed a

^a *Amia*, a sort of small tunny ; see 506 b 13.

² μάλιστα Dt. : μάλλον codd., vulg.

³ correx. A.-W. : καλουμένοις δὲ ἰχθύσι codd., vulg.

⁴ ἃ AC : δ PD, vulg.

κυκλώσωσι τοῖς μονοξύλοις, ψοφούντες ἐξ αὐτῶν ἐν τῇ θαλάττῃ ἀθρόους ποιούσιν ἐξοκέλλειν φεύγοντας εἰς τὴν γῆν, καὶ λαμβάνουσιν ὑπὸ τοῦ ψόφου καρηβαροῦντας. καίτοι οὐδ' οἱ δελφίνες τῆς ἀκοῆς οὐδὲν
 15 φανερόν ἔχουσιν αἰσθητήριον. ἔτι δ' ἐν ταῖς θήραις τῶν ἰχθύων ὅτι μάλιστα εὐλαβοῦνται ψόφον ποιεῖν ἢ κώπης ἢ δικτύων οἱ περὶ τὴν θήραν ταύτην ὄντες· ἀλλ' ὅταν κατανοήσωσιν ἐν τινι τόπῳ πολλοὺς ἀθρόους ὄντας, ἐκτὸς τοῦ¹ τόπου τεκμαιρόμενοι καθιᾶσιν τὰ δίκτυα, ὅπως μήτε κώπης μήτε τῆς
 20 ῥύμης τῆς ἀλιάδος ἀφίκηται πρὸς τὸν τόπον ἐκείνον ὁ ψόφος· παραγγέλλουσί τε πᾶσι τοῖς ναύταις ὅτι μάλιστα συγῆ πλεῖν, μέχρι περ ἂν κυκλώσωσιν.² ἐνίοτε δ' ὅταν βούλωνται συνδραμεῖν, ταυτὸν ποιούσιν ὅπερ ἐπὶ τῆς τῶν δελφίνων θήρας· ψοφοῦσι γὰρ λίθοις, ἵνα φοβηθέντες συνθέωσιν εἰς ταῦτό, καὶ τοῖς
 25 δικτύοις οὕτω περιβάλλονται.³ [καὶ πρὶν μὲν συγκλείσαι, καθάπερ εἴρηται, κωλύουσι ψοφεῖν, ὅταν δὲ κυκλώσωσι, κελεύουσιν ἤδη βοᾶν καὶ ψοφεῖν· τὸν γὰρ ψόφον καὶ τὸν θόρυβον ἀκούοντες ἐμπίπτουσι διὰ τὸν φόβον.]⁴ ἔτι δ' ὅταν ἴδωσιν οἱ ἄλιεῖς ἐκ
 30 πάντων πολλοῦ νεμομένου ἀθρόους πολλοὺς ἐν ταῖς γαλήναις καὶ εὐδαίαις ἐπιπολάζοντας, καὶ βουλευθῶσιν ἰδεῖν τὰ μεγέθη καὶ τί τὸ γένος αὐτῶν, ἂν μὲν ἀψοφητὶ προσπλεύσωσι, λανθάνουσι καὶ καταλαμβάνουσιν ἐπιπολάζοντας ἔτι, εἰ δὲ τις τύχη ψοφή-

¹ ἐκτὸς τοῦ Jackson: ἐκ τοσούτου vulg.

² sic AC: συγκυκλώσονται PD, vulg.

³ περιβάλλονται P: περιβάλλονται ACD, vulg.

⁴ secl. A.-W., Dt.

^a Lit., "one-log boats."

shoal of them with their canoes,^a they then lean out from the canoes and make a noise on the sea, which causes the shoal to take flight towards land and run high and dry, and they are then captured while bewildered by the noise. Yet in spite of this the dolphin has no visible organ of hearing. Furthermore, fishermen when at work are particularly careful not to make any noise with their oars or nets. When they have spotted a large shoal of fish in a certain place, judging their distance,^b they cast their nets well away from the place, so as to allow no noise either from the oars or the impetus of the boat to reach the place where the fish are, and strict instructions are given to all the crew to keep as quiet as possible until they get the shoal surrounded. Sometimes, when they want the fish to crowd together, they do exactly the same as the dolphin-hunters: they make a noise with stones, to frighten the fish and make them rush to one spot, and in this way they enclose them in their nets. [And before they have got them shut in, as has been said, they allow no noise, but once they have surrounded them, then straight away the order is given to keep up a shout and noise generally, for when the fish hear the noise and general commotion they pitch into the net through mere fright.] Furthermore, when fishermen see a large shoal of fish at a considerable distance taking the benefit of the calm bright weather and staying on the surface, if they want to discover of what size and kind they are, they can, if they sail up quietly, surprise them and catch them while they are still at the surface; on the other hand, if anyone happens to have made a noise before

^b I take τεκμαιρόμενοι to mean "judging to the best of their ability how far off to do it."

σας πρότερον, φανεροί εἰσι φεύγοντες. ἔτι δ' ἐν
 534 a τοῖς ποταμοῖς εἰσὼν ἰχθύδια ἅττα ἃ καλοῦσιν τινες
 κόττους· ταῦτα θηρεύουσι τινες διὰ τὸ ὑπὸ ταῖς
 πέτραις ὑποδεδυκέναι κόπτοντες τὰς πέτρας λίθοις·
 τὰ δ' ἐκπίπτει παραφερόμενα ὡς ἀκούοντα καὶ καρη-
 βαροῦντα ὑπὸ τοῦ ψόφου. ὅτι μὲν οὖν ἀκούουσιν,
 5 ἐκ τῶν τοιούτων ἐστὶ φανερόν· εἰσι δέ τινες οἱ φασὶ
 καὶ μάλιστα δξυηκόους εἶναι τῶν ζώων τοὺς ἰχθύς,
 ἐκ τοῦ διατρίβοντες¹ περὶ τὴν θάλατταν ἐντυγχάνειν
 τοιούτοις πολλοῖς. μάλιστα δ' εἰσὶ τῶν ἰχθύων
 δξυήκοοι κεστρεύς, [χρέμψ,]² λάβραξ, σάλπη, χρο-
 μίς,³ καὶ ὅσοι ἄλλοι τοιοῦτοι τῶν ἰχθύων· οἱ δ' ἄλλοι
 10 τούτων ἦττον, διὸ μᾶλλον πρὸς τῷ ἐδάφει τῆς
 θαλάττης ποιοῦνται τὰς διαγωγὰς.

Ὅμοίως δὲ καὶ περὶ ὀσφρήσεως ἔχει. τοῦ τε γὰρ
 μὴ προσφάτου δελέατος οὐκ ἐθέλουσιν ἄπτεσθαι οἱ
 πλεῖστοι τῶν ἰχθύων, τοῖς τε δελέασιν οὐ τοῖς
 αὐτοῖς ἀλίσκονται πάντες ἀλλ' ἰδίους, διαγιγνώσκον-
 15 τες τῷ ὀσφραίνεσθαι· ἔνια γὰρ δελεάζεται τοῖς δυσ-
 ὠδεσιν, ὥσπερ ἡ σάλπη τῇ κόπρω. ἔτι δὲ πολλοὶ
 τῶν ἰχθύων διατρίβουσιν ἐν σπηλαίοις, οὓς ἐπειδὴν
 βούλωνται προκαλέσασθαι εἰς τὴν θήραν οἱ ἀλιεῖς,
 τὸ στόμα τοῦ σπηλαίου περιαλείφουσι ταριχηραῖς
 ὀσμαῖς, πρὸς ἃς ἐξέρχονται ταχέως. ἀλίσκεται δὲ
 20 καὶ ἡ ἔγχελυς τοῦτον τὸν τρόπον· τιθέασιν γὰρ τῶν
 ταριχηρῶν τι κεραμίων, ἐνθέντες εἰς τὸ στόμα τοῦ
 κεραμίου τὸν καλούμενον ἠθμόν. καὶ ὅλως δὲ πρὸς

¹ διατρίβοντες Dt. : διατρίβοντας AC, vulg. ; sed λέγειν δὲ τοῦτο
 τοὺς διατρίβοντας περὶ τὴν θ. διὰ τὸ ἐντυγχάνειν PD, A.-W.

² χρέμψ D, vulg. : χρέψ P : om. AC.

³ χρέμψ AC : χρομίς vulg.

they get there, the fish can be seen making off for safety. Again, there are certain small river-fish called by some *kotttoi*^a; these fish have a habit of slipping in under rocks and some people try to catch them by striking stones against the rocks; the fish then dash out in confusion, bewildered by the noise they obviously hear. Instances such as these show clearly that fish can hear, and indeed there are people who assert that fish have the most sensitive hearing of all living creatures: they have come to this view through living near the sea and encountering many such instances. Among fishes, the following have the most sensitive hearing: the grey mullet, [the *chremps*,] the basse, the *salpē*, the *chromis*,^b and similar kinds. The remainder hear less well, and on this account tend to spend their time nearer the bottom of the sea.

The facts are similar with regard to smell. Most fish refuse to touch a bait unless it is fresh, and the same sort of bait will not catch all fishes alike: each needs its own proper one; and they distinguish the baits by their power of smell. Thus some are attracted by evil-smelling baits: the *salpē*, for one, by dung. Further, many fishes have their habitat in caves, and when fishermen want to entice them out for a catch they smear the entrance of the cave all round with some strong-scented pickle, and this soon fetches them out. The eel too is caught in this way: the fisherman puts down a pot which has been used for pickles, and inside the neck of the pot what is called a strainer.

^a Doubtfully identified with *Cottus gobio* L., the bullhead or Miller's thumb.

^b *Chré(m)ps*, which two mss. insert after the grey mullet, is perhaps a variant form of *chromis* or *chremis*, which means the "neigher" or "grunter" (from *χρημερίζω*). Probably a kind of *Sciaena*. See also below, 535 b 17.

τὰ κνισώδη φέρονται πάντες θᾶπτον.¹ καὶ τῶν
σηπιῶν δὲ τὰ σαρκία σταθεύσαντες ἕνεκα τῆς ὁσμῆς
25 δελεάζουσι τούτοις· προσέρχονται γὰρ μᾶλλον. τοὺς
δὲ πολύπους φασὶν ὀπτῆσαντες εἰς τοὺς κύρτους
ἐντιθέναι οὐδενὸς ἄλλου χάριν ἢ τῆς κνίσης. ἔτι δ'
οἱ ρυάδες ἰχθύες, ὅταν ἐκχυθῆ τὸ πλύμα τῶν ἰχθύων,
ἢ τῆς ἀντλίας ἐκχυθείσης, φεύγουσιν ὡς ὀσφραϊνό-
μενοι τῆς ὁσμῆς² αὐτῶν. καὶ τοῦ αὐτῶν δὴ³ αἷμα-
534 b τος τάχιστα⁴ ὀσφραίνεσθαι φασὶν αὐτούς· δηλον δὲ
ποιοῦσι φεύγοντες καὶ ἐκτοπίζοντες μακράν, ὅταν
γένηται⁵ αἷμα ἰχθύων. καὶ ὅλως δ' ἐὰν μὲν σαπρῶ
τις δελέατι δελεάσῃ τὸν κύρτον, οὐκ ἐθέλουσιν εἰσ-
δύνειν οὐδὲ πλησιάζειν, ἐὰν δὲ νεαρῶ δελέατι καὶ
5 κεκνισωμένῳ εὐθὺς φερόμενοι πόρρωθεν εἰσδύνουσιν.
[μάλιστα δὲ φανερόν ἐστι περὶ τῶν εἰρημένων ἐπὶ
τῶν δελφίνων· οὗτοι γὰρ τῆς ἀκοῆς αἰσθητήριον μὲν
οὐδὲν ἔχουσι φανερόν, ἀλίσκονται δὲ διὰ τὸ καρη-
βαρεῖν ὑπὸ τοῦ ψόφου, καθάπερ εἴρηται πρότερον.
οὐδὲ δὴ τῆς ὀσφρήσεως αἰσθητήριον οὐδὲν ἔχει
10 φανερόν, ὀσφραίνεται δ' ὀξέως.]⁶

Ὅτι μὲν οὖν πάσας τὰς αἰσθήσεις ταῦτα ἔχει τὰ
ζῶα, φανερόν·

Τὰ δὲ λοιπὰ γένη τῶν ζώων ἔστι μὲν τέτταρα
διηρημένα εἰς γένη, ἃ περιέχει τὸ πλῆθος τῶν λοι-
πῶν ζώων, τὰ τε μαλάκια καὶ τὰ μαλακόστρακα καὶ
15 τὰ ὀστρακόδερμα καὶ ἔτι τὰ ἔντομα. τούτων δὲ τὰ
μὲν μαλάκια καὶ τὰ μαλακόστρακα καὶ τὰ ἔντομα
ἔχει πάσας τὰς αἰσθήσεις· καὶ γὰρ [ὄψιν]⁷ ἔχει καὶ⁸

¹ φ. π. θᾶπτον AC : π. φ. μᾶλλον PD, vulg.

² αὐτῶν... 536 b 30 γένος: haec post 539 b 1 κοινωνίας ponit C, sex follis post quam par erat A addito transponendi signo.

And generally, all fishes are more quickly attracted by savoury smells. The fleshy parts of the cuttlefish are fried and used for bait on account of the smell : the fish are definitely attracted to it. Fishermen maintain that they put roasted octopus into their weels for one reason only—its strong odour. Furthermore, gregarious fishes, whenever fish-washings or bilge are thrown overboard, make away as if disgusted by the smell. Also it is alleged that fish can very quickly smell the scent of their own blood : they make this clear enough by making off and getting a good distance away whenever the blood of fishes is about. And generally, if you bait your weel with a putrefying bait, the fish refuse to enter or to come near, whereas if you use a fresh and savoury bait, they at once come up even from a distance and go in. [This is most clearly to be observed in the dolphin. As was said, these animals have no obvious organ for hearing, yet they are caught when bewildered by noise. Nor have they any obvious organ for smell, yet their sense of smell is keen.]

It is plain, then, that these animals^a possess all the five senses.

The remaining kinds of animals have been divided (ii) Blood- into four groups,^b which comprise the majority of the rest : the Cephalopods, the Crustacea, the Testacea, less animals. and the Insects. Of these, the Cephalopods, the Crustacea and the Insects possess all the senses ; all,

^a i.e., man, footed Vivipara, and blooded Ovipara (see Chapter VIII, *init.*).

^b See Notes, §§ 5-11.

³ δὴ AC : δὲ PD, vulg.

⁴ τάχιστα AC : ταχὺ PD, vulg.

⁵ χέηται Casaub.

⁶ secl. A.-W., Dt.

⁷ ὄψιν secl. A.-W. : ὀξείαν prop. Pi.

⁸ <ἀκοὴν καὶ> Dt.

ὄσφρησιν καὶ γεῦσιν.¹ τὰ τε γὰρ ἔντομα τὰ ὄζοντα²
 πόρρωθεν αἰσθάνεται,³ καὶ τὰ πτερωτὰ καὶ τὰ
 ἄπτερα, οἷον αἱ μέλιτται καὶ οἱ κνίπες τοῦ μέλιτος
 20 ἐκ πολλοῦ⁴ αἰσθάνονται ὡς τῇ ὁσμῇ γινώσκοντα.
 καὶ ὑπὸ τῆς τοῦ θείου ὁσμῆς πολλὰ ἀπόλλυται. ἔτι
 δ' οἱ μύρμηκες ὑπ' ὀριγάνου καὶ θείου περιπατο-
 μένων λείων ἐκλείπουσι τὰς μυρμηκιάς,⁵ καὶ ἔλα-
 φείου κέρατος θυμιωμένου τὰ πλείστα φεύγει τῶν
 τοιούτων· μάλιστα δὲ φεύγουσι θυμιωμένου τοῦ
 25 στύρακος. ἔτι δ' αἱ⁶ σηπία καὶ οἱ πολύποδες καὶ
 οἱ κάραβοι τοῖς δελείσιν ἀλίσκονται καὶ οἱ γε πολύ-
 ποδες οὕτω μὲν προσέχονται ὥστε μὴ ἀποσπᾶσθαι
 ἀλλ' ὑπομένειν τεμνόμενοι· ἐὰν δέ τις κόνυζαν προσ-
 ενέγκῃ, ἀφιασιν εὐθέως ὁσμώμενοι. ὁμοίως δὲ καὶ
 535 a περὶ γεύσεως· τὴν τε γὰρ τροφήν ἑτέραν (ἕτερα)⁶
 διώκουσι, καὶ οὐ τοῖς αὐτοῖς πάντα χαίρει χυμοῖς,
 οἷον ἡ μέλιττα πρὸς οὐδὲν προσιζάνει σαπρὸν ἀλλὰ
 πρὸς τὰ γλυκέα, ὁ δὲ κώνωψ πρὸς οὐδὲν γλυκὴ ἀλλὰ
 πρὸς τὰ ὀξέα. τὸ δὲ τῇ ἀφῆ αἰσθάνεσθαι, ὥσπερ⁷
 5 καὶ πρότερον εἴρηται, πᾶσιν ὑπάρχει τοῖς ζώοις.
 τὰ δ' ὄστρακόδερμα ὄσφρησιν μὲν καὶ γεῦσιν ἔχει,
 φανερόν δ' ἐκ τῶν δελεασμῶν, οἷον ἐπὶ τῆς πορφύ-
 ρας· αὕτη γὰρ δελεάζεται τοῖς σαπροῖς καὶ προσ-
 ἔρχεται πρὸς τὸ τοιοῦτον δέλεαρ ὡς αἰσθησιν ἔχουσα

¹ καὶ γεῦσιν om. AC.

² τὰ ὄζοντα conl. Dt. (ἀπόζον τι tent. Pl.): ἀποζόντων A.-W.:
 ὄντα PD, vulg.; πεζὰ ὄντα AC.

³ ita suaserat Pl., ita scripserunt A.-W., Dt.: πόρρω συν-
 αἰσθάνεται codd., vulg.

⁴ μέλιτος· ἐκ πολλοῦ γὰρ vulg.; γὰρ del. A.-W.

⁵ μυρμηκιάς Dt.: μυρμηκίας vulg.

⁶ ἔτι δὲ αἱ AC: αἱ τε PD, vulg.

for indeed they possess [sight and]^a both smell and
 taste. Thus Insects perceive objects that have smell
 a long way off, both winged and wingless insects, e.g.,
 bees and *knipes*^b perceive honey at a great distance,
 no doubt recognizing it by its smell. Many insects are
 killed by the smell of brimstone. Further, ants, if the
 entrances to their nests are sprinkled with powdered
 origanum and brimstone, will leave them altogether;
 and most such insects take to flight if hart's horn is
 burnt; their flight is most rapid if storax is burnt.
 Further, cuttlefish, octopuses and crayfish can be
 caught by bait. Indeed, octopuses hold on so fast to
 the rocks that they cannot be pulled off, and hold on
 even while being cut; yet if you bring fleabane near
 them, they leave go as soon as they smell it. Simi-
 larly with regard to taste. Different animals go after
 different food, nor do all like the same flavours. Thus
 the bee will never settle on anything that has gone
 bad, but only on sweet things, whereas the vinegar-fly^c
 will not settle on sweet things but only on acid ones.
 Perception by means of touch, as has been said before,
 is possessed by all animals. As for the Testacea, they
 have (a) the senses of smell and taste: <that they
 possess smell> is plain from their reaction to baits,
 e.g., the case of the purpura, which can be caught
 by putrefying baits and makes for this sort of bait

^a *ὄψιν (sight) is rightly omitted by A.-W. Aristotle explicitly mentions smell and taste (and gives confirmatory examples), since there might be some doubt about their possessing these.

^b See 593 a 3, 614 b 1, and Aristophanes, *Birds* 590.

^c Cf. 532 a 14 and 552 b 5.

⁷ προσέχονται Scal., edd.: προσέρχονται codd.

⁸ ἕτερα add. Dt.

⁹ ὥσπερ AC: ὅπερ PD, vulg.

πόρρωθεν. καὶ τῶν χυμῶν δ' ὅτι αἰσθησιν ἔχει,
 10 φανερόν ἐκ τῶν αὐτῶν· πρὸς ἃ γὰρ διὰ τὰς ὀσμάς
 προσέρχεται κρίναντα,¹ τούτων χαίρει καὶ τοῖς χυ-
 μοῖς ἕκαστα. ἔτι δ' ὅσα ἔχει στόμα, χαίρει καὶ
 λυπεῖται τῇ τῶν χυμῶν αἴψει. περὶ δ' ὄψεως καὶ
 ἀκοῆς βέβαιον μὲν οὐδέν ἐστίν οὐδὲ λίαν φανερόν,
 δοκοῦσι δ' οἳ τε σωλήνες, ἂν τις ψοφήσῃ, κατα-
 15 δύεσθαι, καὶ φεύγειν κατωτέρω, ὅταν αἰσθῶνται τὸ
 σιδήριον προσιόν (ὑπερέχει γὰρ αὐτῶν μικρόν, τὸ δ'
 ἄλλο ὡσπερ ἐν θαλάμῃ ἐστίν), καὶ οἳ κτένες, ἕάν
 τις προσφέρῃ τὸν δάκτυλον χάσκουσι,² συμμύουσιν
 ὡς ὄρωντες. καὶ τοὺς νηρείτας δ' οἳ θηρεύοντες οὐ
 20 κατὰ πνεῦμα προσιόντες θηρεύουσιν, ὅταν θηρεύσω-
 σιν αὐτοὺς εἰς τὸ δέλεαρ, οὐδὲ φθεγγόμενοι ἀλλὰ
 σιωπῶντες ὡς ὀσφραϊνομένων καὶ ἀκουόντων· ἐάν δὲ
 φθέγγωνται, φασὶν ὑποφεύγειν αὐτούς. ἤκιστα δὲ
 τὴν ὀσφρησιν τῶν ὀστρακοδέρμων φαίνεται ἔχειν
 τῶν μὲν πορευτικῶν ἐχίνος, τῶν δ' ἀκινήτων τήθυα
 25 καὶ βάλανοι.

Περὶ μὲν οὖν τῶν αἰσθητηρίων τοῦτον ἔχει τὸν
 τρόπον τοῖς ζώοις πᾶσι, περὶ δὲ φωνῆς τῶν ζώων
 ὡδ' ἔχει.

IX Φωνὴ καὶ ψόφος ἕτερόν ἐστι, καὶ τρίτον τούτων
 διάλεκτος. φωνεῖ μὲν οὖν οὐδενὶ τῶν ἄλλων μορίων
 30 οὐδὲν πλὴν τῷ φάρυγγι· διὸ ὅσα μὴ ἔχει πνεύμονα
 οὐδὲ φθέγγεται· διάλεκτος δ' ἢ τῆς φωνῆς ἐστὶ τῇ
 γλῶττι διάρθρωσις. τὰ μὲν οὖν φωνήεντα ἢ φωνῆ
 καὶ ὁ λάρυγξ ἀφίησιν, τὰ δ' ἄφωνα ἢ γλῶττα καὶ τὰ
 535 b χεῖλη· ἐξ ὧν ἢ διάλεκτός ἐστιν. διὸ ὅσα γλῶτταν

¹ κρίναντα A : κρίνοντα PD, vulg.

² χάσκουσι, ita interpungendo Pi. : χάσκουσι καὶ vulg.

^a Probably a rod with a conical knob (Th.).

as obviously perceiving it from a distance ; that they can perceive tastes as well is shown by the same evidence, for if a creature is attracted to anything on account of the scent which it has distinguished, it will also like its flavour. Further, all animals possessed of a mouth like or dislike the touch of flavoured liquids. (b) With regard to sight and hearing there is no absolutely certain evidence, and the situation is not over-clear. Still, the razor-fish, if anyone makes a noise, appears to burrow down and hide deeper, when it hears the iron^a approaching (for a small portion of the animal sticks out above the surface, while the remainder is as it were in its nest) ; and scallops, if anyone puts his finger near them while they are open, at once close up as though they saw what was going on. Again, fishermen never get to windward of neritae when they are after them, once they have lured them towards the bait, and refrain from talking and keep absolutely silent, in the belief that the animal can both smell and hear. And, they say, if anyone speaks the creatures try to get away. Of the mobile Testacea the sea-urchin appears to have the weakest sense of smell ; of the stationary ones, the *tethyon* and the barnacles.

Such then are the sense-organs in all animals. We 2. Voice. now pass on to the subject of their voices.

Voice differs from sound, and speech from both. IX Now the only part of the body with which any animal can utter a voice is the pharynx ; hence those that have no lung have no voice either. Speech is the articulation of voice by means of the tongue. Now vowel sounds are produced by the voice and the larynx ; consonantal sounds by the tongue and the lips ; and of these speech consists. Hence, those animals which

μη̄ ἔχει ἢ μη̄ ἀπολελυμένην, οὐ διαλέγεται· φοφεῖν δ' ἔστι καὶ ἄλλοις μορίοις. τὰ μὲν οὖν ἔντομα οὔτε φωνεῖ οὔτε διαλέγεται, φοφεῖ δὲ τῷ ἔσω πνεύματι
 5 (οὐ τῷ θύραζε· οὐδὲν γὰρ ἀναπνεῖ αὐτῶν), ἀλλὰ τὰ μὲν βομβεῖ, οἶον μέλιττα καὶ τὰ πτηνὰ αὐτῶν, τὰ δ' ἄδειν λέγεται, οἶον οἱ τέττιγες. πάντα δὲ ταῦτα φοφεῖ τῷ ὑμένι τῷ ὑπὸ τὸ ὑπόζωμα, ὅσων διήρηται, οἶον τῶν τεττίγων τι γένος τῇ τρίψει τοῦ πνεύματος,
 10 καὶ αἱ μυῖαι δὲ καὶ αἱ μέλιτται καὶ τὰλλα πάντα, τῇ πτήσει³ αἶροντα καὶ συστέλλοντα³. ὁ γὰρ ψόφος

¹ ita Cs., Sn., Pi., A.-W., Dt.: οὔτε φωνεῖ οὔτε διαλέγεται codd., vulg.: error fortasse ex omissione male correctæ ortus, nam A οὔτε φωνεῖ hic usque ad ἔντομα omittit.

² τρίψει D, fortasse melius.

³ αἶρονται καὶ συστέλλονται AD: fortasse melius αἶροντος καὶ συστέλλοντος (sc. τοῦ πνεύματος); conferas 475 a 7 ἐν αὐτῷ γὰρ τῷ ὑπόζωματι, τῷ ἐμφύτῳ πνεύματι αἶροντι καὶ συνίζοντι, συμβαίνει πρὸς τὸν ὑμένα γίνεσθαι τρίψιν.

^a Cf. 532 b 17.

^b Sc., against the membrane. Actually, it is the membrane which is set in vibration, and the abdomen (which is filled with air) acts as a resonator (Th., note on 532 b 17). Cf. also the following note.

^c It is important to notice that according to Aristotle the buzzing of bees, etc. is caused not by their wings but by the connate *pneuma* inside the body striking against the membrane of the hypozoma. This is brought out even more clearly in two other passages, which I quote: (1) *De somno et vigiliis*, 456 a 11 ff. "In bloodless animals and in insects, i.e., creatures which do not respire, the connate *pneuma* can be observed swelling up and sinking in the part which is analogous [sc., to the heart in blooded animals]. This is evident in the case of the holoptera, such as wasps and bees, and also in flies and similar creatures. Now it is impossible to cause movement or to perform any action without strength; and it is the holding of the breath (*pneuma*) that provides strength—the *pneuma* that comes from outside in those animals which

have no tongue, or a tongue which cannot move freely on its own, cannot produce speech; though of course they may be able to produce sounds by other parts of the body. Thus insects produce neither voice nor speech, though they produce a sound by their internal *pneuma* (not by externally emitted *pneuma*, for none of them breathes), but some of them buzz, e.g., the bee and other winged insects, and some "sing" as the saying is, e.g., the cicada. All these insects produce the sound by means of the membrane which is under the *hypozoma*^a (this of course refers to those whose bodies are divided at this point), e.g., a certain kind of cicada, which makes the sound by friction of the *pneuma*^b; and so do flies and bees and all the others, as by their flying they produce the lifting and contracting movement^c: the noise is actually the

respire, the connate *pneuma* in those which do not. (And this is why winged insects of the holoptera class are observed to buzz when they move about: the buzzing is caused by the friction of the *pneuma* as it strikes against the hypozoma.)" (2) *De Respiratione*, 474 b 31 ff. "The longer-lived insects (for all insects are bloodless) have a division under the hypozoma, so that they may be cooled through the membrane which is comparatively thin. For being hotter they need more cooling, e.g., bees, and the other buzzing insects, e.g., wasps, cockchafers, and cicadas. They make the sound by means of *pneuma*, like creatures panting: for in the hypozoma itself, as the innate *pneuma* causes rising and sinking, there is produced friction against the membrane; for they move this region, just as the animals which breathe in from outside do with their lung and as fishes do with their gills. What happens is as if one were to suffocate one of the animals that breathe, by stopping up its mouth: such animals too will produce the same rising movement with the lung. But whereas for these such movement does not produce sufficient cooling, for the others it does. So it is by means of the friction against the membrane that they produce the buzzing, as we have been saying, as children do through pierced reeds

τρίψις ἐστὶ τοῦ ἔσω πνεύματος. αἱ δ' ἀκρίδες τοῖς πηδαλίοις τρίβουσαι ποιοῦσι τὸν ψόφον.

Οὐδὲ δὴ τῶν μαλακίων οὐδὲν οὔτε φθέγγεται οὔτε ψοφεῖ οὐδένα φυσικὸν ψόφον, οὐδὲ τῶν μαλακοστράκων. οἱ δ' ἰχθύες ἄφωνοι μὲν εἰσιν (οὔτε γὰρ
15 πνεύμονα οὔτε ἀρτηρίαν καὶ φάρυγγα ἔχουσι), ψόφους δὲ τινὰς ἀφιάσι καὶ τριγμούς οὓς λέγουσι φωνεῖν, οἷον λύρα καὶ χρώμις¹ (οὔτοι γὰρ ἀφιάσι ὡσπερ γρυλισμὸν) καὶ ὁ κάπρος ὁ ἐν τῷ Ἀχελώῳ, ἔτι δὲ χαλκεὺς² καὶ κόκκυξ· ὁ δὲ μὲν γὰρ ψοφεῖ οἷον συριγμὸν, ὁ δὲ παραπλήσιον τῷ κόκκυγι ψόφον,
20 ὅθεν καὶ τοῦνομα ἔχει. πάντα δὲ ταῦτα τὴν δοκοῦσαν φωνὴν ἀφιάσι τὰ μὲν τῇ τρίψει τῶν βραγχίων (ἀκανθώδεις γὰρ οἱ τόποι), τὰ δὲ τοῖς ἐντὸς τοῖς περὶ τὴν κοιλίαν πνεῦμα γὰρ ἔχει τούτων ἕκαστον, ᾧ⁴ προστρίβοντα καὶ κινοῦντα ποιεῖ τοὺς ψόφους.
25 καὶ τῶν σελαχῶν δ' ἓνα δοκεῖ τρίζειν. ἀλλὰ ταῦτα φωνεῖν μὲν οὐκ ὀρθῶς ἔχει φάναι, ψοφεῖν δέ. καὶ γὰρ οἱ κτένες ὅταν φέρωνται ἀπεριδόμενοι τῷ ὑγρῷ, ὁ καλοῦσι πέτεσθαι, ροιζοῦσι, καὶ αἱ χελιδόνες αἱ

¹ χρώμις A : χρώμις C : χρομίς vulg.

² χαλκεὺς Rhen., Sn., Buss., Pi., probat J. Müller : χαλκίς codd., vulg., A.-W., Dt.

³ δ C, Ald., Sn., Buss., Pi. : ἡ vulg., A.-W., Dt.

⁴ ᾧ C : δ vulg., edd.

after they have put a fine membrane over them. For the same reason those cicadas which sing do so : these creatures are quite hot, and they are divided under the hypozoma. Those which do not sing have this part undivided.—The effort of the *pneuma* is required for causing all physical movement (and change) within the living organism (see *G.A.*, Loeb ed., App. B), and clearly more effort is required for causing

friction of the internal *pneuma*. The noise made by grasshoppers is produced by rubbing with their "paddles."^a

Nor of course can any of the Cephalopods or Crustacea produce any voice or any natural sound. Fish, though voiceless (because they have no lung, wind-pipe, or pharynx) emit certain noises and squeaks—this is what is called their "voice," e.g., the gurnard and the *chromis* (these fishes make a sort of grunting noise), and the *kapros*^b which is found in the Achelōs, and the *chalkeus*^c and the cuckoo-fish^d : the *chalkeus* makes a kind of whistling noise, and the other a noise like the cuckoo—whence its name. In all these what appears to be the voice is caused in some of them by rubbing their gills (which are spiny), in others by internal parts round their stomach, for every one of them has *pneuma* inside it, and by rubbing and causing movement with this they produce their sounds. Some of the Selachia seem to squeak. But to say that these creatures emit a voice is incorrect ; it should be called a sound. Thus the scallop, when it passes along supporting itself on the water (this is what they describe as "flying"^e), makes a whizzing sound ; so does the

locomotion, such as flying. Thus the swelling up or rising and the sinking or subsiding of the *pneuma*, which goes on continually, is greater at such a time, and it is this which is responsible for the buzzing sound.—Aristotle's theory was rightly understood by Pliny (*N.H.* xi. 112, § 266), as is shown by the following phrases : *intus immeante spiritu*, and (of flies) *sonum enim attritu et interiore aura, non anima, reddi.*

^a See note on 532 a 28.

^b Possibly *kapros* is another name for the *glanis*, which inhabits the Achelōs ; see notes on 490 a 5, 568 b 14.

^c The *chalkeus* (as many edd. read instead of *chalkis*), lit. "copper-smith," is probably the *Zeus faber*, or John Dory.

^d Another kind of gurnard.

^e Cf. 528 a 31, 621 b 10.

θαλάττιαι ὁμοίως· καὶ γὰρ αὐταὶ πέτονται μετέωροι, οὐχ ἀπτόμεναι τῆς θαλάττης· τὰ γὰρ πτερυγία 30 ἔχουσι πλατέα καὶ μακρά. ὥσπερ οὖν τῶν ὀρνίθων πετομένων ὁ γινόμενος ταῖς πτέρυξι ψόφος οὐ φωνή ἐστίν, οὕτως οὐδὲ τῶν τοιούτων οὐδενός.

Ἄφίησι δὲ καὶ ὁ δελφίς τριγμόν καὶ μύζει, ὅταν 536 a ἐξέλθῃ, ἐν τῷ ἀέρι, οὐχ ὁμοίως δὲ τοῖς εἰρημένοις· ἐστὶ γὰρ τούτῳ φωνή· ἔχει γὰρ καὶ πνεύμονα καὶ ἀρτηρίαν, ἀλλὰ τὴν γλῶτταν οὐκ ἀπολελυμένην οὐδὲ χεῖλη ὥστε ἄρθρον τι τῆς φωνῆς ποιεῖν.

Τῶν δ' ἐχόντων γλῶτταν καὶ πνεύμονα ὅσα μὲν 5 ῥοτόκα ἐστὶ καὶ τετράποδα (ἢ ἄποδα),¹ ἀφίησι μὲν φωνήν, ἀσθενῆ δέ,² καὶ τὰ μὲν συριγμόν, ὥσπερ οἱ ὄφεις, [τὰ δὲ λεπτήν καὶ ἀσθενῆ φωνήν,]³ τὰ δὲ συγμόν⁴ μικρόν, ὥσπερ αἱ χελῶναι. ὁ δὲ βάτραχος ἰδίαν ἔχει τὴν γλῶτταν· τὸ μὲν γὰρ ἔμπροσθεν προσπέφυκεν ἰχθυωδῶς, ὃ τοῖς ἄλλοις ἀπολέλυται, τὸ δὲ 10 πρὸς τὸν φάρυγγα ἀπολέλυται καὶ πέπτυκται,⁵ ᾧ τὴν ἰδίαν ἀφίησι φωνήν. καὶ τὴν ὀλολυγόνα δὲ τὴν γινομένην ἐν τῷ ὕδατι οἱ βάτραχοι οἱ ἄρρενες ποιοῦσιν, ὅταν ἀνακαλῶνται τὰς θηλείας πρὸς τὴν ὀχεῖαν· εἰσὶ γὰρ ἐκάστοις τῶν ζώων ἴδιαι φωναὶ 15 πρὸς τὴν ὀμιλίαν καὶ τὸν πλησιασμόν, ὅλον καὶ ὕσι καὶ τράγοις καὶ προβάτοις. [ποιεῖ δὲ τὴν ὀλολυγόνα, ὅταν ἰσοχειλῆ τὴν κάτω σιαγόνα ποιήσας ἐπὶ τῷ ὕδατι περιτείνῃ τὴν ἄνω. δοκεῖ δὲ διαλαμπου-

¹ ἢ ἄποδα add. A.-W.: καὶ πεζά voluit Scal. (ex Gaza, aut omnino pedestres). videas et quae p. 360 de hoc loco scripta sunt.

² δέ AC: μέντοι D, vulg.: μὲν P.

³ secl. A.-W.: στενήν loco ἀσθενῆ Pi. (ἀσθενῆν A).

⁴ συριγμόν A.

sea-swallow^a: this fish flies quite clear of the water, without touching it, having long broad fins. So, just as the sound made by the wings of birds when in flight is not voice, neither is the sound which any of these creatures makes.

The dolphin too makes a squeak and moans when it is out of the water and exposed to the air, but not in the same way as the examples mentioned above. The difference is that this animal possesses a voice, since it has both lungs and windpipe; but as its tongue cannot move freely, and as it has no lips, it cannot utter any articulated voice.

Of animals which have a tongue and lungs, those which are oviparous and have four feet (or none) emit a voice, albeit a weak one: some a whistling noise, as the serpents do, [others a thin, weak voice], others a faint hiss, as the tortoises do.^b The frog has a tongue of peculiar formation: the front part is firmly attached as in fishes (whereas in other animals it can move freely), but the part towards the pharynx can move freely, and has a fold in it,^c and with this they produce their peculiar cry. The croaking that is heard going on in the water is made by the male frogs, and is their call to the females at breeding time: all animals have special cries for this purpose, of which examples are goats, swine, and sheep. [It makes its croak by putting its lower jaw on a level with the surface of the water, and then distending the upper one as far as possible. As a result of the

^a Probably *Exocoetus volitans* (Th., G.G.F. 287).

^b See Additional Note on the text of this passage, p. 360.

^c A.-W. and Th. read ἐκπίπτειται, "is spat outwards."

^d πέπτυκται AC, vulg., Buss., Pi.: ἐπέπτυκται PD, Ald., Cs., Sn., Dt.: ἐκπίπτειται coni. A.-W.

σῶν τῶν σιαγόνων ἐκ τῆς ἐπιτάσεως ὡσπερ λύχνοι φαίνεσθαι οἱ ὀφθαλμοί· ἢ γὰρ ὀχρεία τὰ πολλὰ γίνονται νύκτωρ.]¹

20 Τὸ δὲ τῶν ὀρνίθων γένος ἀφήσει φωνήν· καὶ μάλιστα ἔχει διάλεκτον ὅσοις ὑπάρχει² ἢ γλῶττα πλατεῖα, καὶ ὅσα ἔχουσι τὴν γλῶτταν αὐτῶν λεπτήν.³ ἔνια μὲν οὖν τὴν αὐτὴν ἀφιάσι φωνήν τὰ τε θήλεα καὶ τὰ ἄρρενα, ἔνια δ' ἑτέραν. πολύφωνα δ' ἐστὶ καὶ λαλιώτερα τὰ ἐλάττω τῶν μεγάλων· καὶ μάλιστα
25 περὶ τὴν ὀχρείαν ἕκαστον γίννεται τῶν ὀρνέων τοιοῦτον, καὶ τὰ μὲν μαχόμενα φθέγγεται, οἷον ὄρνυξ, τὰ δ' <ἢ>⁴ πρὸ τοῦ μάχεσθαι προκαλούμενα, <οἷον πέρδικες>⁵, ἢ νικῶντα, οἷον ἀλεκτρύονες. ἄδουσι δ' ἔνια μὲν ὁμοίως τὰ ἄρρενα τοῖς θήλεσιν, οἷον καὶ ἀηδῶν ἄδει καὶ ὁ ἄρρην καὶ ἡ θήλεια, πλὴν ἡ θήλεια
30 παύεται ὅταν ἐπιτάσῃ καὶ τὰ νεόττια ἔχη· ἐνίων δὲ τὰ ἄρρενα μόνον,⁶ οἷον ἀλεκτρύονες καὶ ὄρνυγες, αἱ δὲ θήλειαι οὐκ ἄδουσιν.

Τὰ δὲ ζωοτόκα καὶ τετράποδα ζῶα ἄλλο ἄλλην
536 b ἀφήσει φωνήν, διάλεκτον δ' οὐδὲν ἔχει, ἀλλ' ἴδιον τοῦτ' ἀνθρώπου ἐστίν· ὅσα μὲν γὰρ διάλεκτον ἔχει, καὶ φωνήν ἔχει, ὅσα δὲ φωνήν, οὐ πάντα διάλεκτον. ὅσοι δὲ κωφοὶ γίνονται ἐκ γενετῆς, πάντες καὶ ἔνεοι γίνονται· φωνήν μὲν οὖν ἀφιάσι, διάλεκτον
5 δ' οὐδεμίαν. τὰ δὲ παιδία ὡσπερ καὶ τῶν ἄλλων μορίων οὐκ ἐγκρατῆ ἐστίν, οὕτως οὐδὲ τῆς γλώττης τὸ πρῶτον· καὶ <γάρ>⁷ ἐστὶν ἀτελής⁸ καὶ ἀπολύεται

¹ fortasse corrupta ; secl. A.-W., Dt.

² ὑπάρχει μετρίως PD, vulg. : ὑπάρχει AC, A.-W., Dt. : *et quoad est ex eis late lingue latitudine parva loquitur* Σ.

³ sic AC : ὅσοι ἐχ. λεπτήν τὴν γλ. αὐτῶν PD, vulg. : ἀπολελυμένην vel μαλακωτέραν loco αὐτῶν λεπτήν malunt A.-W.

tension the jaws become diaphanous, and the eyes look like lamps, since copulation occurs mostly at night.]

Birds utter a voice, and those which have a broad tongue can articulate best ; so too those that have a thin fine tongue. In some species the male and the female have the same note, in others, different ones. The smaller birds are more vocal and chatter more than the larger ones, and every kind of bird is noisier of all at the pairing season. Some utter a cry while fighting, e.g., the quail, others when challenging before a fight, <e.g., partridges>, or when they have won their fight, e.g., the domestic cock. Some male birds have the same song as the females. Thus both the cock and the hen nightingales sing, except that the hen ceases when sitting on the eggs or rearing her young. In some instances only the cock sings, e.g., the domestic fowl and quails, and the hen does not sing at all.

The different viviparous quadrupeds utter different voices, but they have no power of speech ; this power is peculiar to man. The possession of this power implies the possession of a voice, but the converse is not true. All persons who are deaf from birth are dumb as well : though they can utter a sort of voice, they cannot talk. Children, just as they have not proper control over their limbs generally, so cannot at first control their tongue, which is imperfect and attains

⁴ ἢ add. Dt.

⁵ add. e Gaza Plinioque Sn., Pi., A.-W., Dt. : *ut coaf* (v.l. *chios*) Σ.

⁶ m² Gaza, Dt. : μάλλον vulg., edd. : olim μόνον ἢ μάλλον fuisse credunt A.-W.

⁷ καὶ <γάρ> ἐστίν Dt. : ἢ ἐστίν Pi.

⁸ ἀτελής Pi., A.-W., Dt. : ἀτελή codd., vulg.

ὀψιμαίτερον, ὥστε ψελλίζουσι καὶ τραυλίζουσι τὰ πολλά.

Διαφέρουσι δὲ κατὰ τοὺς¹ τόπους καὶ αἱ φωναὶ καὶ αἱ διάλεκτοι. ἡ μὲν οὖν φωνὴ ὀξύτητι καὶ βαρύτητι
10 μάλιστα ἐπίδηλος, τὸ δ' εἶδος οὐδὲν διαφέρει τῶν αὐτῶν γενῶν· ἡ δ' ἐν τοῖς ἄρθροις, ἣν ἂν τις ὥσπερ διάλεκτον εἴπειεν, καὶ τῶν ἄλλων ζώων διαφέρει καὶ τῶν ἐν ταύτῳ γένει ζώων κατὰ τοὺς² τόπους, οἷον τῶν περδίκων οἱ μὲν κακκαβίζουσιν οἱ δὲ τρίζουσιν. καὶ τῶν μικρῶν ὀρνιθίων ἔνια οὐ τὴν αὐτὴν
15 φωνὴν ἀφιάσιν³ ἐν τῷ ἄδειν τοῖς γεννήσασιν, ἂν ἀπότροφα γένωνται καὶ ἄλλων ἀκούσωσιν ὀρνίθων ἄδόντων. ἤδη δ' ὥπται καὶ ἀηδῶν νεοττὸν προδιδάσκουσα, ὡς οὐχ ὁμοίας φύσει τῆς διαλέκτου οὐσης καὶ τῆς φωνῆς, ἀλλ' ἐνδεχόμενον πλάττεσθαι. καὶ οἱ ἄνθρωποι φωνὴν μὲν τὴν αὐτὴν ἀφιάσι, διά-
20 λεκτον δ' οὐ τὴν αὐτὴν. ὁ δ' ἐλέφας φωνεῖ ἄνευ μὲν τοῦ μυκτῆρος αὐτῷ τῷ στόματι πνευματώδες ὥσπερ ὅταν ἄνθρωπος ἐκπνέῃ καὶ αἰάζῃ, μετὰ δὲ τοῦ μυκτῆρος ὁμοιον σάλπιγγι τετραχυσμένη.

X Περὶ δ' ὕπνου καὶ ἐγρηγόρσεως τῶν ζώων, ὅτι
25 μὲν ὅσα περὶ καὶ ἔναιμα πάντα καθεύδει καὶ ἐγρηγορεν, φανερόν ποιοῦσι κατὰ τὴν αἴσθησιν. πάντα γὰρ ὅσα ἔχει βλεφαρίδας, μόνοντα ποιεῖται τὸν ὕπνον. ἔτι δ' ἐννυπιάζειν φαίνονται οὐ μόνον ἄνθρωποι, ἀλλὰ καὶ ἵπποι καὶ κύνες καὶ βόες, ἔτι δὲ πρόβατα καὶ αἴγες καὶ πᾶν τὸ τῶν ζωοτόκων καὶ τετραπόδων
30 γένος· δηλοῦσι δ' οἱ κύνες τῷ ὕλαγμαφί. περὶ δὲ τῶν

¹ τοὺς C, om. PD, vulg. ² τοὺς AC, om. PD, vulg.

³ sic AC: ἀφίησι φ. PD, vulg.

complete freedom of motion later on; until then they mumble and lisp for the most part.

Voices and modes of speech differ according to locality. Voice is distinguished chiefly by its pitch, high or low; it does not differ in kind in one and the same sort of animal. But articulated voice, which one might describe as a sort of "speech," differs in different animals, and also within one and the same kind of animal according to locality: thus, some partridges cackle, others make a shrill noise. Among the small birds, some when singing utter a different voice from their parents, if they have been reared away from the nest and have heard other birds singing.^a A hen nightingale has before now been observed teaching her chick to sing, which suggests that the "song" does not come naturally in the same way as the voice, but is capable of being trained. Men have the same voice the world over, but different varieties of speech. If the elephant utters its voice without using its trunk but its mouth merely, it makes a wind-like sound, similar to that which a man makes when sighing and groaning. If it uses its trunk, the noise is like a trumpet which has become raucous.

Sleeping and waking in animals. All animals that **X** are footed and blooded sleep and wake: this is plain ^{3.} Sleep. to observation. Thus, all animals that have eyelids close them when they go to sleep. Furthermore, it appears that not only men, but horses, dogs and oxen, dream, indeed sheep too, and goats and the whole group of viviparous quadrupeds. Dogs betray the fact by barking while asleep. As for the Ovipara, it is not

^a This is of interest in view of modern experiments with bird-song. See W. H. Thorpe, *Bird-Song*, Cambridge, 1961, E. A. Armstrong, *A Study of Bird Song*, London, 1963.

ψοτοκούντων τοῦτο μὲν ἄδηλον, ὅτι δὲ καθεύδουσι, φανερόν. ὁμοίως δὲ καὶ τὰ ἐνυδρα, οἷον οἱ τ' ἰχθύες
 537 a καὶ τὰ μαλάκια καὶ τὰ μαλακόστρακα, κάραβοι τε καὶ τὰ τοιαῦτα. βραχύπνα μὲν οὖν ἔστι πάντα ταῦτα, φαίνεται δὲ καθεύδοντα. σημεῖον δὲ κατὰ μὲν τὰ ὄμματα οὐκ ἔστι λαβεῖν (οὐδὲν γὰρ ἔχει βλέφαρα αὐτῶν), ἀλλὰ ταῖς ἀτρεμίαις· [ἀλίσκονται¹
 5 γὰρ οἱ ἰχθύες, εἰ μὴ διὰ τοὺς φθείρας καὶ τοὺς καλουμένους ψύλλους, κἂν ὥστε² τῇ χειρὶ λαμβάνειν ῥαδίως· νῦν δ', ἂν χρονίζωσι, οὗτοι τῆς νυκτὸς κατεσθίουσι προσπίπτοντες, πολλοὶ τὸ πλήθος ὄντες. γίνονται δ' ἐν τῷ βυθῷ τῆς θαλάττης, καὶ τοσοῦτοι τὸ πλήθος ὥστε καὶ τὸ δέλεαρ, ὃ τι ἂν
 10 ἰχθύος ἦ, ἐὰν χρονίσῃ ἐπὶ τῆς γῆς, κατεσθίουσιν· καὶ ἀνέλκουσι πολλάκις οἱ ἀλιεῖς περὶ τὸ δέλεαρ ὥσπερ σφαῖραν συνεχομένων αὐτῶν.³ ἀλλ' ἐκ τῶν τοιῶνδε μᾶλλον ἔστι τεκμήρασθαι ὅτι καθεύδουσιν].
 πολλάκις γὰρ ἔστιν ἐπιπεσόντα τοῖς ἰχθύσι λαθεῖν οὕτως ὥστε καὶ τῇ χειρὶ λαβεῖν ἢ πατάξαντα λαθεῖν·
 15 ὑπὸ δὲ τὸν καιρὸν τοῦτον ἡρεμοῦσι σφόδρα, καὶ κινουῦσιν οὐδὲν πλὴν ἡρέμα τὸ οὐραῖον. δῆλον δὲ γίγνεται ὅτι καθεύδουσι⁴ καὶ ταῖς φοραῖς, ἂν τι κινήθῃ ἡσυχάζόντων αὐτῶν⁵. φέρονται γὰρ ὥσπερ

¹ ἀλίσκονται olim proposui: ἀλίσκονται coni. Th., omissis κἂν ὥστε . . . ῥαδίως. sequitur locus admodum corruptus.

² κἂν ὥστε vulg.: <ἀτρεμίζοντες οὕτως> ὥστε κἂν Pi., Sn. docente: <ἀτρ. οὕτως> ὥστε Dt.

³ ἀλίσκονται hucusque secl. A.-W., Dt., ut proposito ali-ena, ego usque ad καθεύδουσιν. vide et quae p. 362 scripta sunt.

clear whether they dream, but it is obvious that they sleep. Similarly with the water-animals, such as fish, and the Cephalopods, and the Crustacea (crayfish and the like). All these animals, no doubt, do not spend much time asleep, but that they sleep is plain. No indication of it can be obtained from their eyes, because none of them has any eyelids: it is shown by the periods when they remain motionless; [for fish are caught, unless on account of lice^a and the so called "fleas,"^b even so that one can take them up easily in the hand; but as it is, if they remain for some time, these attack them at night and devour them, being very numerous. They are formed in the depths of the sea, and in such large numbers that they devour even the bait, provided it consists of fish, if it remains some time on the sea-bed; and often fishermen haul up as it were a ball of them packed round the bait. But the following points afford better evidence that they sleep.]^c Thus, it is often possible to approach fishes unawares so that one can catch them in the hand, or to strike them unawares; during that time they are perfectly still and make only a slight movement of the tail. It also becomes quite obvious that they sleep from the way they start off if any disturbance occurs while they are resting: they start as though suddenly awakened from sleep. Furthermore, fish are caught

^a For sea-lice cf. 557 a 22 ff.

^b Probably small amphipod crustacea, sandhoppers.

^c I have translated this passage without attempting to touch it up. There is obviously much confusion in the text; see note on p. 362.

⁴ οὕτως . . . λαθεῖν fortasse secludenda.

⁵ καθεύδουσιν fortasse C: καθεύδει vulg.

⁶ αὐτῶν AC: om. PD, vulg.

537 a

ἐξ ὕπνου ὄντες.¹ ἔτι δ' ἐν ταῖς πυρίαις ἀλίσκονται
 διὰ τὸ καθεῦδειν. πολλάκις δὲ καὶ οἱ θυννοσκόποι
 20 περιβάλλονται καθεῦδοντας· δῆλον δ' ἐκ τοῦ ἡσυ-
 χάζοντας καὶ τὰ λευκὰ ὑποφαίνοντας ἀλίσκεσθαι.
 καθεῦδουσι δὲ τῆς νυκτός μᾶλλον ἢ τῆς ἡμέρας οὐ-
 τως ὥστε βαλλόντων μὴ κινεῖσθαι. τὰ δὲ πλείστα
 καθεῦδουσι τῆς γῆς ἢ τῆς ἄμμου ἢ λίθου τινὸς ἐχό-
 μνοι ἐν τῷ βυθῷ, ἢ ἀποκρύψαντες ὑπὸ πέτραν ἢ
 25 θίνα ἑαυτοῦς, οἱ δὲ πλατεῖς ἐν τῇ ἄμμῳ· γιγνώσκον-
 ται δὲ τῇ σχηματίζει τῆς ἄμμου, καὶ λαμβάνονται
 τυπτόμενοι τοῖς τριώδουσιν. λαμβάνονται δὲ καὶ
 λάβραξ καὶ χρύσοφρυς καὶ κεστρεὺς καὶ ὅσοι τοιοῦ-
 τοι τριώδοντι ἡμέρας πολλάκις διὰ τὸ καθεῦδειν·
 εἰ δὲ μὴ, οὐδὲν δοκεῖ τῶν τοιούτων ληφθῆναι ἂν τρι-
 30 ὡδοντι. τὰ δὲ σελάχη οὕτω καθεῦδει ἐνίοτε ὥστε
 καὶ λαμβάνεσθαι τῇ χειρὶ. δελφῖς δὲ καὶ φάλαινα,
 537 b καὶ ὅσα αὐλὸν ἔχει, ὑπερέχοντα τὸν αὐλὸν καθεῦδει
 τῆς θαλάττης, δι' οὗ² ἀναπνεύουσιν ἡρέμα κινουντες
 τὰς πτέρυγας· καὶ δελφίνος γε καὶ ῥέγχοντος ἤδη
 ἠκρόανταί τινες.

Καθεῦδει δὲ καὶ τὰ μαλάκια τὸν αὐτὸν τρόπον
 5 ὄνπερ οἱ ἰχθύες· ὁμοίως δὲ καὶ τὰ μαλακόστρακα
 τοῦτοις. καὶ τὰ ἔντομα δὲ τῶν ζώων ὅτι τυγχάνει
 ὕπνου, διὰ τοιούτων σημείων ἐστὶ φανερόν· ἡσυχά-
 ζουσί τε γὰρ καὶ ἀκινήτιζουσιν ἐπιδήλως. μάλιστα
 δ' ἐπὶ τῶν μελιττῶν τοῦτο δῆλον· ἡρεμοῦσι³ γὰρ καὶ
 παύονται βομβοῦσαι τῆς νυκτός. δῆλον δὲ καὶ ἐπὶ
 10 τῶν ἐν ποσὶ μάλιστα τῶν τοιούτων· οὐ γὰρ μόνον διὰ
 τὸ μὴ ὀξὺ βλέπειν ἡσυχάζουσι τῆς νυκτός (ἅπαντα

¹ φέρονται et ὄντες Dt.: φέρεται et ὄντα codd., vulg.

by torchlight, and this happens because they are asleep. Often too the tunny-watchers manage to get the net round the fish as they sleep: the fact is plain because they let themselves be caught without moving and while showing their white under-surface. They sleep more at night than in the day, so soundly that they make no movement when the net is cast. In general, fishes sleep close to the earth or to the sand or to some stone, on the bottom, or else in a hide-away under some rock or sandbank. Flat fish sleep in the sand: you can tell them by their outline in the sand; they are caught by a stroke with a three-pronged instrument. The basse, the gilthead, the grey mullet, and similar fish are caught by this same method in daytime, thanks to their being asleep—if it were otherwise, surely none of these fish could be caught by the prong-method. The Selachia sometimes sleep so soundly that they can actually be caught by hand. The dolphin and the whale and all that have a blowhole sleep with their blowhole protruding from the surface of the water, and through it they breathe while gently moving their fins. Indeed there are people who have actually heard a dolphin snoring.

Cephalopods sleep in the same way as fishes; so do Crustacea. That insects also sleep is plain from the following indications: they can be clearly seen resting and motionless. This is most evident in the case of bees: they remain quiet at night and cease their buzzing. The fact is also plain to see in the commonest of such creatures: not only do they remain quiet at night because their vision is poor (all

² καὶ add. PDA², vulg., om. A¹C.

³ τε add. A, vulg., om. CPD.

γὰρ ἀμυδρῶς βλέπουσι τὰ σκληρόφθαλμα), ἀλλὰ καὶ πρὸς τὸ φῶς τὸ τῶν λύχνων ἡσυχάζοντα φαίνονται οὐδὲν ἦττον.

Ἐνυπνιάζει δὲ τῶν ζῴων μάλιστα ἄνθρωπος. καὶ νέοις μὲν οὐσι καὶ παιδίοις ἔτι πάμπαν οὐ γίγνεται
 15 ἐνύπνιον, ἀλλ' ἄρχεται τοῖς πλείστοις περὶ τέτταρα ἔτη ἢ πέντε· ἤδη δὲ γεγόνασι καὶ ἄνδρες καὶ γυναῖκες οἱ ὅλως οὐδὲν πώποτε ἐνύπνιον εἶδον. συνέβη δὲ τισι τῶν τοιούτων προιούσης τῆς ἡλικίας ἰδεῖν ἐνύπνιον, καὶ μετὰ ταῦτα γενέσθαι περὶ τὸ σῶμα
 20 μεταβολὴν τοῖς μὲν εἰς θάνατον τοῖς δ' εἰς ἀρρωστίαν.

Περὶ μὲν οὖν αἰσθήσεως καὶ ὕπνου καὶ ἐγρηγόρσεως τοῦτον ἔχει τὸν τρόπον·

XI Τὸ δ' ἄρρεν καὶ θῆλυ τοῖς μὲν ὑπάρχει τῶν ζῴων, τοῖς δ' οὐχ ὑπάρχει, ἀλλὰ καθ' ὁμοιοτήτά τινα καὶ τίκτειν λέγονται καὶ κύειν. ἔστι δ' οὐδὲν ἄρρεν καὶ
 25 θῆλυ ἐν τοῖς μονίμοις, οὐδ' ὅλως ἐν τοῖς ὄστρακοδέρμοις. ἐν δὲ τοῖς μαλακίοις καὶ τοῖς μαλακοστράκοις ἔστι τὸ μὲν θῆλυ τὸ δ' ἄρρεν, καὶ ἐν τοῖς πεζοῖς καὶ ἐναίμοις,¹ δίποσι καὶ τετράποσι, καὶ πᾶσιν ὅσα ἐκ συνδυασμοῦ τίκτει ζῶον ἢ ᾧον ἢ σκώληκα.

Ἐν μὲν οὖν τοῖς ἄλλοις γένεσιν ἀπλῶς ἢ ἔστιν ἢ
 30 οὐκ ἔστιν, οἷον ἐν μὲν τοῖς τετράποσι πᾶσιν ἔστι τὸ μὲν θῆλυ τὸ δ' ἄρρεν, ἐν δὲ τοῖς ὄστρακοδέρμοις οὐκ ἔστιν, ἀλλ' ὥσπερ ἐν φυτοῖς τὰ μὲν εὐφορὰ ἔστι
 538 a τὰ δ' ἀφορὰ, οὕτω καὶ ἐν τούτοις. ἐν δὲ τοῖς

¹ τὸ PD, vulg., om. AC.

² ἐναίμοις Dt.: ἐν τοῖς codd., vulg.

^a See *G.A.* 715 b 17 ff., where the phrase used is καθ' ὁμοιότητα καὶ καθ' ἀναλογίαν. Cf. the following note.

hard-eyed animals have indistinct vision), but even when exposed to the light of lamps they are clearly seen to be at rest none the less.

The animal which dreams most of all is man. Children and infants do not dream at all; but dreaming begins in most cases about the age of four or five. Instances have been known of full-grown men and women who have never had a dream in their lives. Some people of this sort have in fact come to dream later in life, and this has been followed by some physical change, resulting in death for some and general debility for others.

We have now described sensation, and sleep and awaking.

In some animals the two sexes are found, in others XI not; the latter are said to bring forth young and to 4. Distinction of sex. be pregnant only in the sense of there being a certain similarity.^a In stationary animals there is no division of sex; there is none at all in the Testacea. Male and female are found in the Cephalopods and the Crustacea and in all blooded animals that have feet, whether two-footed or four-footed, in fact in all animals which as the result of copulation produce live young or an egg or a larva.

In many of the groups of animals we find an absolutely clear-cut situation: either they have the two sexes or they have not: thus all the quadrupeds have them, and none of the Testacea has them: here, as in plants, some individuals bear and some do not.^b

^b Cf. *G.A.* 715 b 17 ff., "the Testacea . . . because they are in their essence similar to plants, like them have no male and female; they are called such merely by way of similarity and analogy, for they have some small difference of this sort." Cf. previous note, and 538 a 18 below.

ἐντόμοις καὶ τοῖς ἰχθύσι ἐστὶ τὰ μὲν ὅλως οὐκ
 ἔχοντα ταύτην τὴν διαφορὰν ἐπ' οὐδέτερον, οἷον
 ἔγγελος οὐτ' ἄρρεν ἐστὶν οὔτε θῆλυ, οὐδὲ γενιᾶ ἐξ
 αὐτοῦ¹ οὐδέν, ἀλλ' οἱ μὲν φάσκοντες² ὅτι τριχῶδη
 5 καὶ ἐλμινθῶδη πρασῶδη τ'³ ἔχουσαί ποτέ τινες
 φαίνονται, οὐ προσθεωρήσαντες τὸ ποῦ ἔχουσι
 ἀσκέπτως λέγουσιν. οὔτε γὰρ ζωτοκεῖ ἀνευ ὤσο-
 κίας οὐδὲν τῶν τοιούτων, ὧν δ' οὐδεμία πώποτε
 ὠπται ἔχουσα· ὅσα τε ζωτοκεῖ, ἐν τῇ ὑστέρα ἔχει
 καὶ προσπεφυκότα, ἀλλ' οὐκ ἐν τῇ γαστρὶ· ἐπέττετο
 10 γὰρ ἂν ὡσπερ ἡ τροφή. ἦν δὲ λέγουσι διαφορὰν
 ἄρρενος ἐγγέλως καὶ θηλείας τῶ τὸν μὲν μείζω κε-
 φαλήν ἔχειν καὶ μακροτέραν, τὴν δὲ θήλειαν μικρὰν
 καὶ σιμοτέραν, οὐ τοῦ θήλεος καὶ⁴ ἄρρενος λέγουσιν,
 ἀλλὰ τοῦ γένους. εἰσὶ δὲ τινες ἰχθύες οἱ καλοῦνται
 ἐπιτραγίαι, γίνονται δὲ τῶν ποταμίων τοιοῦτοι
 15 κυπρίνος καὶ βάλαγρος· οὐκ ἔχουσι δ' οἱ τοιοῦτοι
 οὔτε ὧν οὔτε θορὸν οὐδέποτε, ἀλλ' ὅλοι⁵ στερεοί
 εἰσι καὶ πίνες, ἔντερον μικρὸν ἔχοντες,⁶ καὶ δοκοῦ-
 σιν ἄριστοι οὗτοι εἶναι. ἔτι δ' [ἔνια]⁷ καθάπερ ἐν

¹ αὐτοῦ ACD, A.-W., Dt.: αὐτῆς Ald., vulg., edd.

² φάσκοντες AC; λέγοντες PD, vulg.

³ πρασῶδη τ' A¹C: προσπεφυκότ' PDA², vulg.: fortasse ἐν τῇ
 γαστρὶ scribendum; cf. v. 9. ⁴ καὶ PD: ἢ AC, vulg.

⁵ ὅλοι A.-W., Dt.: ὅσοι codd., vulg.

⁶ ἔχοντες A.-W.: ἔχουσι codd., vulg.

⁷ ἔνια secl. Dt.

^a See note on 517 b 8.

^b Lit., "helminth-like"; see 551 a 8. Those here referred to are nematodes, also found in plants (where they are in fact normally called "eelworms").

^c Πράσον is a leek-like seaweed or ribband-weed. Theophrastus (*H.P.* iv. 6) mentions two kinds of φῦκος called πράσον, one of which (also known as ζωστήρ) may be the

But among the Insects and Fishes some, and only some, kinds are found which do not exhibit this distinction of sex at all, e.g., the eel is neither male nor female, and engenders nothing.^a People who assert that at times some eels (females) are to be observed with objects similar to hair, or worms,^b or strips of seaweed^c in them^d are speaking without proper consideration through having failed to observe where precisely these objects are. In fact no animal of this sort is ever viviparous unless it is previously oviparous; and no eel has ever been seen that carried an egg. And all viviparous animals carry their young in the uterus and closely attached to it, not in the belly, otherwise the embryo would get concocted^e just as the food does. Some base the alleged difference of male and female in the eel on the size and shape of the head: the male is supposed to have a larger and longer head, the female a small snub one. The fact quoted however indicates difference not of sex but of kind. There are also certain fishes called *epitragiae* (capon-fish^f); fresh-water fish of this sort are the carp and the *balagros*.^g These fish never have either egg or milt; they are completely hard and fat, and have a small gut. They are considered first-class fish.

one referred to here and at 591 a 16.—As A.-W. suggest, some phrase such as "in the belly" has probably fallen out of the text here.

^d The verb *ἔχειν*, which is used four times in the present passage (lines 5-9), is certainly used with reference to pregnancy in the third and fourth instances, and no doubt it has the same reference here. One might therefore translate "carrying objects . . . inside them."

^e See Notes, § 19.

^f So called because of their sterility and consequent fatness; see below.

^g Probably a kind of carp.

τοῖς ὄστρακοδέρμοις καὶ φυτοῖς τὸ μὲν τίκτον ἐστὶ καὶ γεννῶν, τὸ δ' ὄχευον οὐκ ἔστιν, οὕτω καὶ ἐν τοῖς
 20 ἰχθύσι τὸ τῶν ψηττῶν¹ γένος καὶ τὸ τῶν ἐρυθρίνων καὶ αἱ χάνναι· πάντα γὰρ τὰ τοιαῦτα ᾧ φαίνεται ἔχοντα.

Ἐν μὲν οὖν τοῖς πεζοῖς καὶ ἐναίμοις τῶν ζώων ὅσα μὴ ᾠοτοκεῖ, τὰ πλείστα μείζω καὶ μακροβιώ-
 25 τερα τὰ ἄρρενα τῶν θηλειῶν εἰσι, πλὴν ἡμίονος· τούτων δ' αἱ θήλειαι μακροβιώτεραι καὶ μείζους· ἐν δὲ τοῖς ᾠοτόκοις καὶ τοῖς σκωληκοτόκοις, οἷον ἐν τε τοῖς ἰχθύσι καὶ ἐπὶ τῶν ἐντόμων, μείζω τὰ θήλεα τῶν ἀρρένων ἐστίν, οἷον ὄφεις καὶ φαλάγγια καὶ ἀσκαλαβῶται καὶ βάτραχοι. καὶ ἐπὶ τῶν ἰχθύων δ' ὡσαύτως, οἷον τὰ τε σελάχη τὰ μικρὰ καὶ τῶν
 30 ἀγελαίων τὰ πλείστα, τὰ δὲ πετραῖα πάντα. ὅτι δὲ
 538 b μακροβιώτεροι τῶν ἰχθύων αἱ θήλειαι τῶν ἀρρένων, δῆλον ἐκ τοῦ παλαιότερα ἀλίσκεσθαι τὰ θήλεα τῶν ἀρρένων. ἔστι δὲ τὰ μὲν ἄνω καὶ πρόσθια πάντων τῶν ζώων τὰ ἄρρενα κρείττω καὶ ἰσχυρότερα καὶ εὐσπλότερα, τὰ δ' [ὡς ἂν]² ὀπίσθια καὶ κάτω ἔνια³
 5 τῶν θηλέων. τοῦτο δὲ καὶ ἐπ' ἀνθρώπων καὶ ἐπὶ τῶν ἄλλων ζώων τῶν πεζῶν καὶ ζωοτόκων πάντων ἔχει τὸν αὐτὸν τρόπον. καὶ ἀνευρότερον δὲ καὶ ἀναρθρότερον τὸ θῆλυ μᾶλλον, καὶ λεπτοτριχώτερον, ὅσα τρίχας ἔχει· τὰ δὲ μὴ τρίχας ἔχοντα κατὰ τὸ ἀνάλογον. καὶ ὑγροσαρκότερα δὲ τὰ θήλεα τῶν
 10 ἀρρένων καὶ γονυκροτώτερα, καὶ αἱ κνήμαι λεπτότεραι· τοὺς δὲ πόδας γλαφυρωτέρους, ὅσα τὰ μόρια

¹ περκῶν ut cum erythrino et channa congruat suadet Th.

² secl. Dt.

³ ἔνια AC; λεχθέντα PD, vulg.; λεπτότερα conl. Dt.: fortasse λεπτοτριχώτερα.

Furthermore, just as in Testacea and plants we find individuals which bring forth and produce, but none that impregnate, so it is in fishes with the *psetta*, the *erythrinus*, and the *channa*: all individuals of these sorts can be seen to carry eggs.^a

In the footed animals which are blooded but are not oviparous, for the most part the males are larger and longer-lived than the females, except for the mule: here the females are longer-lived and larger. On the other hand, among the Ovipara and Larvipara, just as among fishes and insects, the females are larger than the males: examples are the serpent, the *phalangion*,^b the *askalabotes*^c and the frog. And similarly with fishes, e.g., the small Selachia and most of the gregarious kinds, and all that haunt rocks. That female fish live longer than male is shown by the fact that more older females are caught than males. Furthermore, in all animals the upper and front parts of the males are better, stronger and more fully equipped than the females', in some females the rear and lower parts are stronger. This also applies to man and all other footed Vivipara. Also, the female is less sinewy and less articulated, and if hair is present it is finer, if no hair is present then its counterpart is finer. The female also has looser flesh than the male and is more knockkneed, and the calves are thinner; the feet (if present) are more delicately fashioned.

^a The *erythrinus* and *channa*, both of the Serranidae family to which sea-perches belong, are, as Aristotle says, hermaphrodite, a fact rediscovered by Cavolini (*Memoria sulla generazione dei pesci e dei granchi*, 1787). The third fish mentioned, the *psetta*, is a flatfish, a sole or flounder, and is not hermaphrodite. Thompson therefore suggests that ψηττῶν may be an error for περκῶν, perch.

^b A venomous spider; cf. 555 b 8 ff., 622 b 28 ff.

^c The spotted lizard or gecko.

ταῦτ' ἔχει τῶν ζώων. καὶ περὶ φωνῆς δέ, πάντα τὰ
θήλεια λεπτοφωνότερα καὶ ὀξυφωνότερα, πλὴν βοός,
ὅσα ἔχει φωνήν· οἱ δὲ βόες βαρύτερον φθέγγονται αἱ
15 θήλειαι τῶν ἀρρένων. τὰ δὲ πρὸς ἄλκην ἐν τῇ φύσει
ὑπάρχοντα μόρια, ὅλον ὀδόντες καὶ χαυλιόδοντες καὶ
κέρατα καὶ πλήκτρα καὶ ὅσα ἄλλα τοιαῦτα μόρια, ἐν
ἐνίοις μὲν γένεσιν ὅλως τὰ μὲν ἄρρενα ἔχει τὰ δὲ
θήλεια οὐκ ἔχει, ὅλον κέρατα ἔλαφος θήλεια οὐκ ἔχει
καὶ τῶν ὀρνίθων τῶν πλήκτρα ἐχόντων ἐνίων αἱ
20 θήλειαι ὅλως πλήκτρα οὐκ ἔχουσιν· ὁμοίως δὲ καὶ
χαυλιόδοντας αἱ θήλειαι οὐκ ἔχουσι τῶν ὑῶν. ἐν
ἐνίοις δ' ὑπάρχει μὲν ἀμφοῖν, ἀλλὰ κρείττω καὶ
μᾶλλον τοῖς ἀρρεσιν, ὅλον τὰ κέρατα τῶν ταύρων
ἰσχυρότερα τῶν θηλειῶν βοῶν.

With regard to voice (where present) all females have a slighter and higher-pitched voice, except for the cow, whose lowing is deeper than that of the bull. With regard to parts naturally provided for combat, such as teeth, tusks, horns, spurs, etc., in some kinds of animals the male has them and the female has none at all: thus the hind has no horns, and in some cases where the cock-bird has spurs the hen will have none at all; similarly the sow has no tusks. In other animals both sexes have them, but they are better and bigger in the male: *e.g.*, a bull's horns are stronger than a cow's.

538 b

I Ὅσα μὲν οὖν ἔχουσι μόρια τὰ ζῶα πάντα καὶ τῶν ἐντὸς καὶ τῶν ἐκτὸς, ἔτι δὲ περὶ τε τῶν αἰσθήσεων 30 καὶ φωνῆς καὶ ὕπνου, καὶ ποῖα θήλεα καὶ ποῖα 539 a ἄρρενα, πρότερον εἴρηται περὶ πάντων· περὶ δὲ τῶν γενέσεων αὐτῶν λοιπὸν διελθεῖν, καὶ πρῶτον περὶ τῶν πρῶτων.

Εἰσὶ δὲ πολλαὶ καὶ πολλὴν ἔχουσαι ποικιλίαν, καὶ τῇ μὲν ἀνόμοιοι, τῇ δὲ τρόπον τινα προσοίκασιν ἀλλήλαις. ἐπεὶ δὲ διήρηται τὰ γένη πρότερον,¹ τὸν 5 αὐτὸν τρόπον καὶ νῦν πειρατέον ποιεῖσθαι τὴν θεωρίαν· πλὴν τότε μὲν τὴν ἀρχὴν ἐποιούμεθα σκοποῦντες περὶ τῶν μερῶν ἀπ' ἀνθρώπου, νῦν δὲ περὶ τούτου τελευταῖον λεκτέον διὰ τὸ πλείστην ἔχειν πραγματείαν.

Πρῶτον δ' ἀρκτέον ἀπὸ τῶν ὀστρακοδέρμων, μετὰ 10 δὲ ταῦτα περὶ τῶν μαλακοστράκων, καὶ τὰ ἄλλα δὴ² τούτου τὸν τρόπον ἐφεξῆς· ἔστι δὲ τὰ τε μαλάκια καὶ τὰ ἔντομα, καὶ μετὰ ταῦτα τὸ τῶν ἰχθύων γένος, τό τε ζωοτόκον καὶ τὸ ὠοτόκον αὐτῶν, εἶτα τὸ τῶν ὀρνίθων· μετὰ δὲ ταῦτα περὶ τῶν πεζῶν λεκτέον, ὅσα τ' ὠοτόκα καὶ ὅσα ζωοτόκα. ζωοτόκα δ' ἔστι 15 τῶν τετραπόδων ἕνια,³ καὶ ἄνθρωπος τῶν διπόδων μόνον.

Κοινὸν μὲν οὖν συμβέβηκε καὶ ἐπὶ τῶν ζώων,

We have now spoken of all the parts, both internal I and external, which animals have, and of the senses, C. DIFFER- of the voice, of sleep, of male and female differences; ENCES OF and it now remains to discuss their modes of repro- REPRO- duction, beginning with the first of them. DUCTION :

These modes are many and diverse, in some ways General. similar to one another, in others dissimilar. And since the group-divisions have previously been made,^a we must endeavour to follow the same method in our present study—except that then we began our consideration of the parts with those of man, whereas now we must discuss man last of all because this is the most complicated part of our task.

We will begin then with the Testacea, after that go on to the Crustacea, and so on in the same way with the rest in order, which are : the Cephalopods and the Insects, then the fishes both viviparous and oviparous, then the birds. After that we must treat of the footed animals, oviparous and viviparous. Certain of the quadrupeds are viviparous, but the only viviparous biped is man.

We find a feature which is common to animals as

^a e.g., at 490 b 7 ff., b 32, 505 b 26 ff., 523 b 1 ff. See Notes, §§ 5-11.

¹ πρότερον C: πρῶτον PD, vulg.

² δὴ A: δὲ PD, vulg.

³ "immo πολλά" Dt.

ὥσπερ καὶ ἐπὶ τῶν φυτῶν· τὰ μὲν γὰρ ἀπὸ σπέρματος ἐτέρων φυτῶν, τὰ δ' αὐτόματα γίνεταί, συστάσης τινὸς τοιαύτης ἀρχῆς, καὶ τούτων τὰ μὲν ἐκ τῆς γῆς λαμβάνει τὴν τροφήν, τὰ δ' ἐν 20 ἐτέροις ἐγγίγνεται φυτοῖς, ὥσπερ εἴρηται ἐν τῇ θεωρίᾳ τῇ περὶ φυτῶν. οὕτω καὶ τῶν ζώων τὰ μὲν ἀπὸ ζώων γίνεταί κατὰ συγγένειαν τῆς μορφῆς, τὰ δ' αὐτόματα καὶ οὐκ ἀπὸ συγγενῶν, καὶ τούτων τὰ μὲν ἐκ γῆς σηπομένης καὶ φυτῶν, ὥσπερ πολλὰ συμβαίνει τῶν ἐντόμων, τὰ δ' ἐν τοῖς ζώοις αὐτοῖς 25 ἐκ τῶν ἐν τοῖς μορίοις περιττωμάτων.

Τῶν δὲ τὴν γένεσιν ἐχόντων ἀπὸ συγγενῶν ζώων ἐν οἷς μὲν αὐτῶν ἐστὶ τὸ θῆλυ καὶ τὸ ἄρρεν, ἐκ συνδυασμοῦ γίνονται· ἐν δὲ τῷ τῶν ἰχθύων γένει ἕνια γίνεταί οὐτ' ἄρρενα οὔτε θήλεα, τῷ γένει μὲν ὄντα ἐτέροις τῶν ἰχθύων τὰ αὐτά, τῷ εἶδει δ' ἕτερα, 30 ἕνια δὲ καὶ πάμπαν ἴδια. τὰ δὲ θήλεα μὲν ἐστίν,

^a See Notes, §§ 12 and 27.

^b Cf. *G.A.* 762 b 18 ff., "Those plants which are generated spontaneously . . . come into being out of a part of something, and some of it forms into the 'principle,' some into the first nourishment of the germinating plants." With the phrase "seed-like principle" cf. *G.A.* 761 b 32 ff., where Ar. mentions a "seminal substance" produced by certain shell-fish, which however is not to be regarded as semen (in this passage also there is a comparison with plants).

^c Not extant; but cf. *G.A.* 715 b 26 ff., "Some plants are formed out of seed, others as it might be from some spontaneous activity of Nature: they are formed when either the soil or certain parts in plants become putrescent, since some

well as plants. Some plants come into being from seed produced by other *plants*, whereas some are spontaneously generated—*i.e.*, when some seed-like "principle" ^a has taken shape ^b; and of these spontaneously-generated plants some derive their nourishment from the earth, while some come into being in other plants: this has been dealt with in my treatise on *Plants*.^c So also with animals: some come into being from animals whose natural form is of the same kind as their own; others spontaneously and not from animals of the same kind as themselves: and the latter are subdivided into (*a*) those which arise out of putrefying ^d earth and plants, which is the case with many of the Insects; and (*b*) those which arise inside animals themselves out of the residues ^e in their parts.

In those animals where generation takes place from animals of the same kind, (*a*) where there are the two sexes, generation is the result of copulation; (*b*) in the group of fishes, however, there are some which are not male and female ^f; they are identical generically with other fishes, but differ from them specifically ^g; others again are entirely peculiar to themselves. There are yet others which are female and have no

of them do not take shape independently on their own, but grow upon other trees, as for instance the mistletoe does."

^d We should remember the qualification stated at *G.A.* 762 a 10 ff., "Nothing however is formed by being putrefied but by being concocted: the putrefaction and the putrefied matter are a residue of that which has been concocted"; and a detailed account of the process follows.

^e See Notes, §§ 22 ff., and cf. 551 a 6.

^f A certain kind of *kestreus* or mullet; the "entirely peculiar" ones are the cels. See, *e.g.*, 569 a 17, 570 a 3 ff., *G.A.* 741 a 38 f., 762 b 22 ff.

^g Here the distinction between *γένος* and *εἶδος* is the technical one. See Notes, § 5.

539 a

ἄρρενα δ' οὐκ ἔστιν¹. ἐξ ὧν γίνεταί (ῥᾶ)² ὡσπερ ἐν τοῖς ὄρνεσι τὰ ὑπηνέμια. τὰ μὲν οὖν τῶν ὄρνιθων ἅπαντά ἐστιν ἄγονα³. μέχρι γὰρ τοῦ ῥὸν γεννησαί⁴ δύναται ἢ φύσις αὐτῶν ἐπιτελεῖν, ἐὰν μὴ τις αὐτοῖς

539 b

συμβῆ τρόπος ἄλλος τῆς κοινωνίας πρὸς τοὺς ἄρρενας· περὶ ὧν ἀκριβέστερον ἔσται δηλοῦν⁵ ἐν τοῖς ὑστερον. τῶν δ' ἰχθύων ἐνίοις, ὅταν αὐτόματα γεννήσωσιν ῥᾶ, συμβαίνει ἐκ τούτων καὶ ζῶα γίνεσθαι, πλὴν τῶν μὲν καθ' αὐτά, τῶν δ' οὐκ ἄνευ

ἄρρενος· ὃν δὲ τρόπον, καὶ περὶ τούτων ἐν τοῖς ἐχομένοις ἔσται φανερόν· σχεδὸν γὰρ παραπλήσια συμβαίνει καὶ ἐπὶ τῶν ὄρνιθων. ὅσα δ' ἀπὸ ταύτοματου γίνεταί ἐν ζώοις ἢ γῆ ἢ φυτοῖς ἢ τοῖς τούτων μορίοις, ἔχουσι δὲ τὸ ἄρρεν καὶ τὸ θῆλυ, ἐκ τούτων συνδυαζομένων γίνεταί μὲν τι, οὐ ταῦτο δ' ἐξ οὐδενὸς ἄλλ' ἀτελές, οἷον ἐκ τε τῶν φθειρῶν ὀχευομένων αἱ καλούμεναι κονίδες καὶ ἐκ τῶν μυιῶν σκώληκες καὶ ἐκ τῶν ψυλλῶν⁶ σκώληκες ὡοειδεῖς, ἐξ ὧν οὔτε τὰ γεννήσαντα γίνεταί οὔτε ἄλλο οὐδὲν ζῶον, ἀλλὰ τὰ τοιαῦτα μόνον.

Πρῶτον μὲν οὖν περὶ τῆς ὀχείας λεκτέον, ὅσα ὀχέεται, εἶτα μετὰ ταῦτα περὶ τῶν ἄλλων ἐφέξεῖς, τὰ τε καθ' ἕκαστα καὶ τὰ κοινῇ συμβαίοντα περὶ αὐτῶν.

II Ὀχέεται μὲν οὖν ταῦτα τῶν ζῶων ἐν οἷς ὑπάρχει τὸ θῆλυ καὶ τὸ ἄρρεν, εἰσὶ δ' αἱ ὀχείαι οὗθ' ὅμοιαι πᾶσιν οὗθ' ὁμοίως ἔχουσαι. τὰ μὲν γὰρ ζωτόκα

¹ οὐκ ἔστιν A.-W.: οὐκέτι PD, vulg.: οὐ AC.

² supplev. A.-W. (sed ante ὑπηνέμια et non in textu): hic Dt.

³ sic Dt.: ἅπαντα ἐστὶ δηλα A¹C: ἄγονα πάντα εἰσὶ ταῦτα PDA³: ἄγονα πάντα ἐστὶ ταῦτα vulg.

⁴ sic A, Dt.: ῥὸν γεννησαί C: ῥὸν γέννησιν PD, vulg.

⁵ δηλοῦν scripsi: δηλον codd., edd.

⁶ ψυλλῶν D: ψυλλῶν P: ψυχῶν A¹C.

males^a: these produce eggs just as birds produce wind-eggs. With birds all such eggs are infertile (their nature is capable of generation up to and including the egg), unless some other mode of intercourse with the male is available to them: it will be possible to explain this in greater detail later.^b With certain fishes, however, when they have generated spontaneous eggs, living animals do in fact come to be formed out of them, except that some do it of themselves, others need the male. How this occurs is another point which will be made clear later: the process is practically parallel to what occurs with birds. But whenever we find creatures spontaneously generated in living animals or in the earth or in plants, or in the parts^c of these, and when they have male and female, then when these copulate a product results which is never the same as the parents, but imperfect. Thus, when lice copulate, they produce nits, flies produce larvae, fleas^d produce egg-like grubs; and from these the parent kind is never produced, nor indeed any animal at all, but simply the sort of thing I have mentioned.

First then we must treat of copulation where it occurs; then of the other matters in order, both those which are applicable to certain kinds and those which are common to all.

Copulation, then, occurs with those animals that II have the two sexes; but its modes are not the same in all of them nor really comparable. Those blooded

¹ Coition:
⁽ⁱ⁾ Blooded
animals:

^a e.g., *erythrinus* and *channa*: see 538 a 20 f., *G.A.* 741 a 35 ff.

^b e.g., at 541 a 26 ff., where see note.

^c See notes on 539 a 18, a 20, above.

^d Reading *ψυλλῶν*; butterflies (*ψυχᾶί*) are not spontaneously generated according to Aristotle (see 551 a 14 ff.); fleas are (see 556 b 21 ff.).

539 b

20 καὶ περὶ τῶν ἐναίμων ἔχει μὲν ὄργανα πάντα πρὸς τὴν τοιαύτην πράξιν,¹ οὐ μὴν ὁμοίως γε πάντα πλησιάζουσιν, ἀλλὰ τὰ μὲν ὀπισθορηγτικὰ συνιόντα πυγῆδόν, οἷον λέοντες τε καὶ δασύποδες καὶ λύγκες· τῶν δὲ δασυπόδων καὶ πολλάκις ἢ θήλεια προτέρα ἀναβαίνει ἐπὶ τὸν ἄρρενα.

25 Τῶν δ' ἄλλων τῶν μὲν πλείστων ὁ αὐτὸς τρόπος· τὸν ἐνδεχόμενον γὰρ ποιοῦνται συνδυασμὸν τὰ τε πλείστα τῶν τετραπόδων, ἐπιβαίνοντος ἐπὶ τὸ θῆλυ τοῦ ἄρρενος, καὶ τὸ τῶν ὀρνίθων ἅπαν γένος οὕτω τε² καὶ μοναχῶς. εἰσὶ δὲ διαφοραὶ τιναε καὶ περὶ τοὺς ὀρνίθια· τὰ μὲν γὰρ συγκαθείσης τῆς θηλείας

30 ἐπὶ τὴν γῆν ἐπιβαίνει τὸ ἄρρεν, ὥσπερ αἱ ὠτίδες καὶ οἱ ἀλεκτρούνες, τὰ δ' οὐ συγκαθείσης τῆς θηλείας, οἷον αἱ γέρανοι· ἐν τούτοις γὰρ ὁ ἄρρην ἐπιτηδῶν ὀχεύει τὴν θήλειαν, καὶ συγγίγνεται ὥσπερ καὶ τὰ στρουθία ὀξέως. τῶν δὲ τετραπόδων αἱ ἄρκτοι

540 a παρακεκλιμένοι τὸν αὐτὸν τρόπον ὄνπερ τὰλλα ἐπὶ τῶν ποδῶν ποιούμενα τὴν ὀχείαν, πρὸς τὰ πρηνῆ τῶν θηλειῶν τὰ ὑπτια τῶν ἀρρένων· οἱ δὲ χερσαῖοι ἐχῖνοι ὀρθοὶ τὰ ὑπτια πρὸς ἄλληλα ἔχοντες.

Τῶν δὲ ζωοτόκων καὶ μέγεθος ἔχόντων οὔτε τοὺς
5 ἄρρενας ἐλάφους αἱ θήλεια ὑπομένουσιν, εἰ μὴ ὀλιγάκις, οὔτε τοὺς ταύρους αἱ βόες διὰ τὴν τοῦ αἰδοίου συντονίαν, ἀλλ' ὑπάγοντα τὰ θήλεια δέχονται τὴν γονὴν· καὶ γὰρ ἐπὶ τῶν ἐλάφων ὠπται τοῦτο συμβαῖνον, τῶν γε τιθασῶν. λύκος δ' ὀχεύει καὶ ὀχεύεται τὸν αὐτὸν τρόπον ὄνπερ καὶ κύων. οἱ δ'

10 αἰλουροὶ οὐκ ὀπισθεν συνιόντες, ἀλλ' ὁ μὲν ὀρθός,

¹ sic voluerunt A.-W.: πρὸς τὴν τ. π. (πρόσαξιν P) ἅπαντα τὰ
102

animals which are viviparous and footed all have (a) Vivipara. organs for this purpose, but they do not all copulate in the same way: thus, the retromingent animals copulate rear to rear, for example, the lion, the hare and the lynx, though the female hare actually often first mounts the male.

In most other animals the method is the same: most of the quadrupeds perform the act in the best way that offers, the male mounting the female: this is the method, and indeed the only method, used by birds. Still, there are differences even among them. In some species the female squats down on the ground for the male to mount, e.g., the bustard and the domestic fowl; in others the female does not squat, e.g., the crane: in these birds the male mounts upon the female and copulates, and coition is soon accomplished, as also in the case of sparrows. To take a case from the quadrupeds: bears lie prone on one another just as the others which copulate standing: i.e., the under-side of the male is in contact with the back of the female. Hedgehogs copulate erect, under-sides together.

Considerations on some of the large-sized Vivipara. The female hind only very rarely allows the male to complete the act, nor does the cow allow the bull to do so, owing to the rigidity of the latter's penis. Actually the females receive the semen as they withdraw, and in fact this has been observed to occur in the case of the stag and hind, at any rate in domesticated ones. The manner of copulation of wolves is the same as that of dogs. Cats are different: they do not copulate hindways, but the male stands erect

ἄρρενα τὴν γεννητικὴν PD: πάντα τὰ ἄρρ. πρὸς τὴν π. τὴν γ. AC, vulg. ² γε A.-W., Dt.

ἡ δὲ θήλεια ὑποτιθεῖσα¹ αὐτήν· εἰσὶ δὲ τὴν φύσιν²
αἱ θήλειαι ἀφροδισιαστικάι, καὶ προσάγονται τοὺς
ἄρρενας εἰς τὰς ὀχείας, καὶ συνοῦσαι κράζουσιν. αἱ
δὲ κάμηλοι ὀχεύονται τῆς θηλείας καθημένης· περι-
βεβηκῶς δ' ὁ ἄρρην ὀχεύει, οὐκ ἀντίπτυγος, ἀλλὰ
15 καθάπερ καὶ τὰ ἄλλα τετράποδα· καὶ διημερεύει τὸ
μὲν ὀχεῖον τὸ δ' ὀχευόμενον. ἀποχωροῦσι δ' εἰς
ἐρημίαν, ὅταν ποιῶνται τὴν ὀχείαν, καὶ οὐκ ἔστι
πλησιάζειν ἀλλ' ἢ τῷ βόσκοντι. τὸ δ' αἰδοῖον ἔχει
ὁ κάμηλος νεῦρον³ οὕτως ὥστε καὶ νευρὰν ποιοῦνται
20 ἐκ τούτου⁴ τοῖς τόξοις. οἱ δ' ἐλέφαντες ὀχεύονται
μὲν ἐν ταῖς ἐρημίαις, μάλιστα δὲ περὶ τοὺς ποτα-
μοὺς οὐ καὶ⁵ διατρίβειν εἰώθασιν· ὀχεύεται δ' ἡ μὲν
θήλεια συγκαθιέσα καὶ διαβαίνουσα, ὁ δ' ἄρρην
ἐπαναβαίνων ὀχεύει. ὀχεύεται δὲ καὶ ἡ φώκη καθ-
άπερ τὰ ὀπισθορηγτικὰ τῶν ζώων, καὶ συνέχονται
25 ἐν τῇ ὀχείᾳ πολὺν χρόνον, ὥσπερ καὶ αἱ κύνες·
ἔχουσι δὲ τὸ αἰδοῖον μέγα οἱ ἄρρενες.

III Τὸν αὐτὸν δὲ τρόπον καὶ τῶν πεζῶν τὰ τετράποδα
καὶ ψοτόκα ποιεῖται τὴν ὀχείαν. τὰ μὲν γὰρ ἐπι-
βαίνοντα καθάπερ τὰ ζωοτόκα, οἷον χελώνη καὶ ἡ
30 θαλαττία καὶ ἡ χερσαία⁶. . . ἔχουσι δὲ τι εἰς ὃ οἱ
πόροι συνάπτουσιν καὶ ᾧ ἐν τῇ ὀχείᾳ πλησιάζουσιν,
[οἷον τρυγόνες καὶ βάτραχοι καὶ πᾶν τὸ τοιοῦτον
γένος.]⁷

IV Τὰ δ' ἄποδα καὶ μακρὰ τῶν ζώων, οἷον ὄφεις τε
540 b καὶ σμύραιναι, περιπλεκόμενα⁸ τοῖς ὑπτίοις πρὸς τὰ

¹ sic PD : ὑποτίθησιν AC, vulg.

² τὴν φύσιν AC : τῆ φύσει PD, vulg.

³ νευρῶδες Camot.

⁴ sic AC : ἐκ τούτου ποιείσθαι PD, vulg.

⁵ οὐ καὶ Scal., Pi., A.-W., Dt. : καὶ οὐ codd., vulg.

⁶ lacunam suspic. A.-W., statuit Dt. : nulla lac. in S.

and the female places herself under him. Female cats are naturally lecherous, and lure the males on to sexual intercourse, during which time they caterwaul. Camels copulate with the female seated : the male covers the female astride, not in the rearward position, but like the other quadrupeds ; and they spend the whole day over it. When copulating they withdraw to some unfrequented place, and it is unsafe for anyone but their keeper to go near them. The camel's penis is so sinewy that bowstrings are actually made out of it. Elephants also copulate in unfrequented places, and particularly near rivers which they normally haunt ; the female lowers herself with her legs apart, and the male mounts and covers her. The seal copulates like the retromingent animals : seals remain together in coition for a long time, as dog and bitch also do. The male's penis is large.

The oviparous quadrupeds copulate in the same III way. Some males mount the female, as the Vivipara (b) Ovipara. do : e.g., the land tortoise and the sea tortoise ; <others >.^a These animals have an organ in which the passages converge, and with it they unite in copulation [e.g., the trygon,^b the frog, and all of that class.]

The long-bodied footless animals, such as serpents IV and muraenae, intertwine with their under-parts in

^a At this point clearly some words have disappeared from the text.

^b Trygon cannot here be either the turtle-dove or the sting-ray (540 b 8) ; it may refer to some unidentified animal, or be a mistake for φρόνοι, toads.

⁷ secl. A.-W., Dt. : fortasse φρόνοι loco τρυγόνες scribendum (Gesner).

⁸ -μενα Sn. : -μεναι A : -μενοι PD, vulg.

540 b

ὑπτια. οὕτω δὲ σφόδρα οἱ γ' ὄφεις περιελίττονται ἀλλήλοις, ὥστε δοκεῖν ἐνὸς ὄφews δικεφάλου εἶναι τὸ σῶμα ἅπαν. τὸν αὐτὸν δὲ τρόπον καὶ τὸ τῶν σαύρων γένος· ὁμοία γὰρ περιπλοκῆ ποιοῦνται τὴν ὀχείαν.

V Οἱ δ' ἰχθύες ἅπαντες,² ἔξω τῶν πλατέων σελαχῶν, παραπίπτοντες τὰ ὑπτια πρὸς τὰ ὑπτια ποιοῦνται τὸν συνδυασμόν. τὰ δὲ πλατέα καὶ κερκοφόρα, οἷον βάτος καὶ τρυγῶν καὶ τὰ τοιαῦτα, οὐ μόνον παραπίπτοντα ἀλλὰ καὶ ἐπιβαίοντα τοῖς ὑπτίοις ἐπὶ τὰ πρᾶνῃ τῶν θηλειῶν, ὅσοις μὴ ἐμποδίζει τὸ οὐραῖον μείζον³ ἔχον⁴ πάχος. αἱ δὲ ῥῖναι, καὶ ὅσοις τῶν τοιούτων πολὺ τὸ οὐραῖον, παρατριβόμενα μόνον ὀχεύονται τὰ ὑπτια πρὸς τὰ ὑπτια. εἰσὶ δὲ τινες οἱ ἑωρακεῖν φασὶ καὶ ὀπισθεν⁵ συνεχόμενα τῶν σελαχῶν ἔνια, ὥσπερ τοὺς κύνας. ἔστι δ' ἐν πᾶσι τοῖς σελαχῶδεσι μείζον τὸ θῆλυ τοῦ ἄρρενος· σχεδὸν δὲ καὶ ἐν τοῖς ἄλλοις ἰχθύσι τὰ θῆλα μείζω τῶν ἄρρένων. σελάχη δ' ἐστὶ τὰ τ' εἰρημένα καὶ βοῦς καὶ λάμια καὶ ἄετος καὶ νάρκη καὶ βάτραχος καὶ πάντα τὰ γαλεώδη. τὰ μὲν οὖν σελάχη πάντα τεθεώρηται ὑπὸ πολλῶν τούτους ποιούμενα τοὺς τρόπους τὴν ὀχείαν· χρονιωτέρα γὰρ ἢ συμπλοκῆ πάντων τῶν ζωοτόκων ἐστὶν⁶ ἢ τῶν ὠσοτόκων.

Καὶ δελφίνες δὲ καὶ πάντα τὰ κητώδη τὸν αὐτὸν τρόπον παραπίπτοντα γὰρ ὀχεύει παρὰ τὸ θῆλυ τὸ ἄρρην, καὶ χρόνον οὕτ' ὀλίγον οὔτε λίαν πολύν.

Διαφέρουσι δ' ἐν ἐνίοις⁷ τῶν σελαχωδῶν ἰχθύων

¹ οἱ γε C : οἱ τε A : οἱ PD, vulg.

² ἅπαντες AC : πάντες vulg.

³ μείζον coni. Dt. : οὐθὲν codd., edd. : nisi prohibea(n) hoc pinguedo et spissitudo caude Σ.

⁴ ἔχουσι A¹.

contact. Serpents coil round one another so tightly that the whole thing looks like one serpent with two heads. The same method obtains with the tribe of saurians : they copulate similarly intertwined.

All fishes, with the exception of the broad Selachia, V copulate lying side by side, with their under-sides in (c) Fishes. contact. Those broad ones, however, which have tails —e.g., the ray, the sting-ray, and the like—copulate not only lying side by side, but also by the mounting of the male upon the female, under-side to rear side, in those species where the tail is not so thick as to be an obstruction. The angel-fish, however, and other such fishes which have a large tail, copulate only by rubbing together their under-sides. Some people allege that they have seen some of the Selachia copulating hindways, as dogs do. In all the Selachia the female is larger than the male ; and the same is true of most other fishes. The Selachia include, beside those already mentioned, the ox-fish,^a the lamia,^b the eagle-ray, the torpedo-fish, the fishing-frog, and all the dogfish. Very well then : the Selachia have all been observed by many people copulating in the ways described—such observation being possible because the process takes longer with all the Vivipara than with Ovipara.

The dolphin and all the Cetacea use the same (d) Cetacea. method : they copulate lying side by side, and the time taken by the process is neither short nor overlong.

In some Selachia the male differs from the female (e) Varia.

^a The horned ray.

^b A large shark.

⁵ ὀπισθεν hic P, post ἔνια AC, vulg.

⁶ ἐστὶν AC : om. PD, vulg.

⁷ ἐν ἐνίοις coni. Dt. : ἐνίοι codd.

25 οἱ ἄρρενες τῶν θηλειῶν τῷ τοὺς μὲν ἔχειν ἀποκρεμώμενα ἄττα δύο περὶ τὴν ἔξοδον τῆς περιττώσεως, τὰς δὲ θηλείας ταῦτα μὴ ἔχειν, οἷον ἐν τοῖς γαλεώδεσιν· ἐπὶ γὰρ τούτων ὑπάρχει πάντων τὸ εἰρημένον.

"Ὀρχεῖς μὲν οὖν οὗτ' ἰχθύς οὗτ' ἄλλο τῶν ἀπόδων
30 ἔχει οὐδέν, πόρους δὲ δύο καὶ οἱ ὄφεις καὶ οἱ ἰχθύες οἱ ἄρρενες ἔχουσι, οἳ γίνονται θοροῦ πλήρεις περὶ τὴν τῆς ὀχείας ὥραν, καὶ προίενται ὑγρότητα γαλακτώδη πάντες. οὗτοι δ' οἱ πόροι εἰς ἓν συνάπτουσι, ὡσπερ καὶ τοῖς ὄρνεσιν· οἱ γὰρ ὄρνεθες ἐντὸς ἔχουσι

541 a τοὺς ὄρχεῖς, καὶ τὰ ἄλλα πάντα ὅσα ὤτοκεῖ πόδας ἔχοντα. τοῦτο δὴ συμπεραίνει¹ καὶ ἐπεκτείνεται εἰς τὴν τοῦ θήλεος χώραν καὶ ὑποδοχὴν.

"Ἔστι δὲ τοῖς μὲν ζωτόκοις καὶ πεζοῖς ὁ αὐτὸς πόρος τοῦ τε σπέρματος καὶ τῆς τοῦ ὑγροῦ περιττώσεως ἕξωθεν, ἔσωθεν δ' ἕτερος,² ὡσπερ ἐλέχθη καὶ πρότερον ἐν τῇ διαφορᾷ τῇ τῶν μορίων. τοῖς δὲ μὴ ζωτοκοῦσιν³ ὁ αὐτὸς καὶ τῆς ξηρᾶς περιττώσεως πόρος ἕξωθεν· ἔσωθεν δὲ (δύο)⁴ σύνεγγυς ἀλλήλων. ὁμοίως δὲ ταῦτα ἔχει τοῖς θήλεσιν αὐτῶν καὶ τοῖς ἄρρεσιν· οὐ γὰρ ἔχουσι κύστιν πλην⁵ χελώνης, τούτων δ' ἡ θήλεια ἓνα πόρον ἔχει, καίτοι κύστιν ἔχουσα· αἱ χελῶναι δὲ τῶν ὤτοκων εἰσίν.

10 Ἡ δὲ τῶν ὤτοκων ἰχθύων ὀχεία ἦττον γίνεταί κατάδηλος· διόπερ οἱ πλεῖστοι νομίζουσι πληροῦσθαι τὰ θήλεα τῶν ἀρρένων ἀνακάπτοντα⁶ τὸν θορόν. τοῦτο γὰρ πολλάκις ὁρᾶται γιγνόμενον· περὶ μὲν γὰρ
15 τὴν τῆς ὀχείας ὥραν αἱ θήλειαι τοῖς ἄρρεσιν ἐπό-

¹ ἕξω add. Dt.

² add. πόρος PD, vulg.

³ ζωτοκοῦσιν conl. Dt. : ἔχουσι κύστιν codd., Σ, edd.

⁴ δύο add. Σ, Sn., Pi., Dt.

⁵ πλην ἐπὶ ACP, vulg. : ἐπὶ om. A.-W., Dt.

in having two appendages hanging down near the residual vent, whereas these are not present in the females. The dogfishes illustrate this : it is a difference found in all such fishes.

Now no fish, and no other footless animal, has testicles : instead, there are, in male serpents and fishes, two passages which get filled with semen or milt at the breeding season, and all emit a milky fluid. These passages unite, as in birds ; for birds have their testicles within ; so too have all footed Ovipara. This united passage continues right along^a and is extended into the receptive part of the female.

In the footed Vivipara, one and the same passage serves externally for the semen and for the fluid residue ; internally, however, there are separate passages, as was stated previously in our discussion on the differences of the parts.^b In the non-viviparous animals the same passage serves also for the solid residue—again, externally, while internally there are (two) passages, close to one another. This holds for both male and female ; for none of these animals has a bladder except the tortoise ; and the female tortoise has one passage only, although it has a bladder. Tortoises, of course, belong to the class of Ovipara.

The copulation of the oviparous fishes is less easily observable. In consequence, most people suppose that the female is impregnated by swallowing the milt of the male ; indeed, this is often seen to be happening : at the breeding season the females do

^a The meaning of the verb so translated is uncertain.

^b At 497 a 26. It is interesting to notice Aristotle's method of referring to that part of his treatise.

⁶ ἀνακάπτοντα vulg., edd. : ἀνακάμπτοντα codd. : simil. v. 18 infra.

μεναι τούτο δρῶσι, καὶ κόπτουσι ὑπὸ τὴν γαστέρα τοῖς στόμασι, οἱ δὲ θᾶπτον προΐενται καὶ μᾶλλον· κατὰ δὲ τὸν τόκον οἱ ἄρρενες τοῖς θήλεσι, καὶ ἀποτικτουσῶν ἀνακάπτουσι τὰ ῥά· ἐκ δὲ τῶν παραλειπομένων γίνονται οἱ ἰχθύες. περὶ δὲ τὴν Φοινίκην 20 καὶ θήραν ποιοῦνται δι' ἀλλήλων· ἄρρενας μὲν γὰρ ὑπάγοντες κεστρέας τὰς θηλείας περιβάλλονται συναγοντες, θηλείας δὲ τοὺς ἄρρενας. τοῦτο μὲν οὖν διὰ τὸ πολλάκις ὄρασθαι τὴν δόξαν ἐποίησε τῆς ὀχείας ταύτην, ποιεῖ δὲ τι τοιοῦτον¹ καὶ τὰ τετράποδα τῶν ζώων· περὶ γὰρ τὴν ὥραν τῆς ὀχείας 25 ἀπορραίνουσι καὶ τὰ ἄρρενα καὶ τὰ θήλεα, καὶ τῶν αἰδοίων ὁσμῶνται ἀλλήλων.

[Αἱ δὲ πέρδικες ἂν κατ' ἀνεμον στῶσι αἱ θήλειαι τῶν ἀρρένων, ἔγκυοι γίνονται· πολλάκις δὲ καὶ τῆς φωνῆς (ἀκούουσαι),² ἐὰν ὀργῶσαι τύχῳσι, καὶ ὑπερπετομένων ἐκ τοῦ καταπνεῦσαι τὸν ἄρρενα· χάσκει 30 δὲ καὶ ἡ θήλεια καὶ ὁ ἄρρην, καὶ τὴν γλῶτταν ἔξω ἔχουσι περὶ τὴν τῆς ὀχείας ποίησιν.]³

¹ τι τοιοῦτον Pi., A.-W., Dt.: τὸ τοιοῦτον AC: τοῦτο PD, vulg.

² add. Sn., Dt. (ἀκούουσαι A.-W.): κάκ loco και coni. Pi.

³ secl. Dt. ut hic aliena; cf. St. Hilaire.

^a This paragraph seems to be out of place. The belief that animals can be impregnated by the wind is very ancient and very widespread. Its first appearance in classical literature is in Homer, where the wind is personified: *Iliad*, xvi. 150 ff., "... the horses that the harpy Podargē bore to Zephyr the wind, as she grazed on the meadow beside the stream of Oceanus," and *ibid.* xx. 221 ff., "three thousand mares he had, that pastured along the marshy meadow, rejoicing in their tender foals. Of them Boreas became enamoured as they grazed, and in semblance of a dark-maned stallion he covered them; then they conceived and bore twelve fillies." Cf. Vergil, *Georg.* iii. 273 ff., *ore omnes versae in Zephyrum*

this as they follow the males, and strike them under the belly with their mouths: this makes them produce the milt more quickly and more plentifully. Also, at spawning-time the males follow the females, and as the females produce their eggs the males swallow them: the young fish are produced out of the eggs that are left over. (Off Phoenicia fish are actually caught by playing off the two sexes against each other: fishermen hold the male grey mullet as a decoy and so collect and net the females, and vice versa.) From frequent observation of this, the idea has arisen that it is copulation; yet the quadrupeds too do something similar; at the breeding season both males and females produce a liquid secretion, and they smell at each others' genital parts.

[When female partridges stand to leeward of the males, they become impregnated; they often do so too when they hear the voice of the male, if they are on heat, or when the male flies over them and breathes down on them. Both the male and female partridge open their mouths wide and keep the tongue out during coition.^a]

stant rupibus altis | exceptantque leves auras et saepe sine ullis | coniugiis vento gravidae (mirabile dictu) | ... diffugiunt. . . The only animal of which Aristotle records alleged wind-impregnation is the mare (see *H.A.* 572 a 13 ff., a passage followed by Vergil), though in the present passage (541 a 26; cf. 560 b 14 and *G.A.* 751 a 13) he appears to say that if the hen partridge stands to leeward within scent of the male she conceives and produces fertile eggs. Aristotle frequently mentions "wind-eggs" (*ὑπηνέμια*) as occurring in birds (some, he says, call them *zephyria*, 560 a 5). The names clearly indicate the belief which underlies them; but for Aristotle all such wind-eggs are infertile. He speaks of them as occurring in the domestic fowl, the partridge, the pigeon, the peahen, the goose, and the vulpanser (*H.A.* 559 b 27 ff.), and he gives his own explanation of them in the *G.A.* (see

541 a

Ἡ δ' ἀληθινὴ σύνοδος τῶν φωτόκων ἰχθύων ὀλιγάκις ὁράται διὰ τὸ ταχέως ἀπολύεσθαι παραπεσόντας, ἐπεὶ ὄπται καὶ ἡ ἐπὶ τούτων ὀχεία γιγνομένη τὸν εἰρημένον τρόπον.

VI
541 b Τὰ δὲ μαλάκια, οἷον¹ πολυπόδες καὶ σηπία καὶ τευθίδες, τὸν αὐτὸν τρόπον πάντα πλησιάζουσιν ἀλλήλοις· κατὰ τὸ στόμα γὰρ συναρμόττονται, τὰς πλεκτάνας πρὸς τὰς πλεκτάνας συναρμόττοντες. ὁ
5 μὲν οὖν πολυπόους ὅταν τὴν λεγομένην κεφαλὴν ἐρείσῃ πρὸς τὴν γῆν καὶ διαπετάσῃ τὰς πλεκτάνας, ἄτερος ἐφαρμόττει ἐπὶ τὸ πέτασμα τῶν πλεκτανῶν, καὶ συνεχεῖς ποιοῦνται τὰς κοτυληδόνας πρὸς ἀλλήλας. φασι δὲ τινες καὶ τὸν ἄρρενα ἔχειν αἰδοιωδὲς τι ἐν μιᾷ τῶν πλεκτανῶν, ἐν ἣ δύο αἱ μέγιστα κοτυλη-
10 δόνες εἰσὶν· εἶναι δὲ τὸ τοιοῦτον ὥσπερ νευρώδες, μέχρι εἰς μέσσην τὴν πλεκτάνην προσπεφυκὸς ἅπαν, ἣν² ἐσπιφράναι εἰς τὸν μυκτῆρα τῆς θηλείας.

Αἱ δὲ σηπία καὶ αἱ τευθίδες νέουσιν ἅμα συμπεπλεγμένοι, τὰ στόματα καὶ τὰς πλεκτάνας ἐφαρμόττουσαι καταντικρῶ ἀλλήλαις, [νέουσαι ἐναντίως]³.
15 ἐναρμόττουσι δὲ καὶ τὸν καλούμενον μυκτῆρα εἰς τὸν μυκτῆρα. τὴν δὲ νεῦσιν ἡ μὲν ἐπὶ τὸ ὄπισθεν ἡ δ' ἐπὶ τὸ στόμα ποιεῖται. ἐκτίκτει δὲ κατὰ τὸν φυσητῆρα καλούμενον, καθ' ὃν ἐνιοὶ καὶ ὀχεύεσθαι φασιν αὐτάς.

VI Τὰ δὲ μαλακόστρακα ὀχεύεται, οἷον κάραβοι [καὶ

¹ οἷον om. ACP: αἱ post οἷον vulg.; om. ACD.

² ἣν A.-W., Dt.: ἣν C: ἡ A: ἡ vulg., om. PD.

³ secl. Dt.

G.A. index). For a full investigation of the belief, see Conway Zirkle, "Animals impregnated by the wind," in Sarton's *Isis*, XXV (1936), pp. 95-130.

⁴ See 524 a 28 ff.

The real act of coition in oviparous fishes is seldom seen owing to the fact that once they have got alongside each other they will quickly discharge; though even in their case copulation has been observed to occur in the way described.

The Cephalopods, such as the octopus, the cuttlefishes, and the *teuthides*,^a all copulate in the same way: they intertwine by the mouth, fitting their tentacles into each other's. Thus one octopus will rest its so-called head^b upon the ground and spread out its tentacles, and then the other one will fit itself on to these spreading tentacles, and they bring their suckers into mutual contact. Some people allege that the male octopus has a sort of penis on one of his tentacles,^c i.e., the one on which the two largest suckers are: they say that this organ is more or less sinewy, and that the whole of it is attached up as far as the middle of the tentacle, which it thus admits into the nostril^d of the female.

The cuttlefishes and *teuthides* swim about intertwined, with their mouths and tentacles fitted on to each other exactly opposite [swimming in contrary directions]. They fit their so-called nostrils the one's into the other's, and when swimming one swims tail foremost and the other mouth foremost. The female produces its spawn by the "blowhole"^e as it is called—and some assert that it is by this that they actually copulate.

Crustacea copulate, e.g., the crayfish, [the lobsters, VII

^b The body or sac; cf. 523 b 23 f.

^c Cf. 524 a 5 and note, and G.A. 720 b 33 n. In the former passage the tentacle is said to be used in copulation, in the latter not.

^d Elsewhere called the funnel (αὐλός); cf. 524 a 10, G.A. 720 b 32.

^e i.e., the funnel.

20 ἀστακοὶ καὶ καρίδες]¹ καὶ τὰ τοιαῦτα, ὡς περ καὶ τὰ
ὀπισθοθηρικά² τῶν τετραπόδων, ὅταν ὁ μὲν ὑπτίαν
ὁ δὲ πρηνῆ³ ποιήσῃ τὴν κέρκον. ὀχεύεται δὲ τοῦ
ἔαρος ἀρχομένου πρὸς τῆ γῆ (ἤδη γὰρ ὤπται ἡ ὀχεία
πάντων τῶν τοιούτων), ἐνιαχοῦ δὲ καὶ ὅταν τὰ σῦκα
ἀρχῆται πεπαίνεσθαι. τὸν αὐτὸν δὲ τρόπον καὶ οἱ
25 ἀστακοὶ καὶ αἱ καρίδες ὀχεύονται.

Οἱ δὲ καρκίνοι κατὰ τὰ πρόσθια ἀλλήλων συνδυά-
ζονται, τὰ ἐπικαλύμματα τὰ πτυχώδη πρὸς ἀλληλα
συμβάλλοντες. πρῶτον δ' ὁ καρκίνος ἀναβαίνει ὁ
ἐλάττων ἐκ τοῦ ὀπισθεν· ὅταν δ' ἀναβῆ ὁ ὑψίς, ὁ
μείζων πλάγιος ἐπιστρέφει. ἄλλο μὲν οὖν οὐδὲν⁴
30 ἢ θήλεια τοῦ ἄρρενος διαφέρει· τὸ δ' ἐπικάλυμμα
μείζον ἐστὶ τὸ τῆς θηλείας καὶ μᾶλλον ἀφεστηκὸς
καὶ συνηρεφέστερον, εἰς ὃ ἐκτίκτουσι καὶ ἢ τὸ περίτ-
τωμα ἐξέρχεται. μόριον δ' οὐδὲν προῖεται θάτερον
εἰς θάτερον.

VIII Τὰ δ' ἔντομα συνέρχεται μὲν ὀπισθεν, εἴτ'⁵ ἐπι-
542 a βαίνει τὸ ἔλαττον ἐπὶ τὸ μείζον· τοῦτο δ' ἐστὶ τὸ
ἄρρεν. ἐναφίησι δὲ τὸν πόρον κάτωθεν τὸ θῆλυ εἰς
τὸ ἄρρεν τὸ ἐπάνω, ἀλλ' οὐ τὸ ἄρρεν εἰς τὸ θῆλυ,
ὡς περ ἐπὶ τῶν ἄλλων. καὶ τοῦτο τὸ μόριον ἐπὶ μὲν
ἐνίων καὶ φαίνεται μείζον ὃν ἢ κατὰ λόγον τοῦ ὅλου
5 σώματος, καὶ πάνυ μικρῶν ὄντων, ἐπ' ἐνίων δ' ἦττον.
τοῦτο δ' ἐστὶ φανερόν, ἂν τις διαιρῆ τὰς ὀχευομένας
μυίας. ἀπολύονται δ' ἀπ' ἀλλήλων μόλις· πολλὴν γὰρ
χρόνον ὁ συνδυασμὸς ἐστὶ τῶν τοιούτων. δῆλον δ'
ἐπὶ τῶν ἐν ποσίν, οἷον μυιῶν τε καὶ κανθαρίδων.
10 πάντα δὲ τὸν τρόπον τοῦτον ὀχεύεται, αἶ τε μυῖαι καὶ

¹ secl. Dt. ² ὀπισθου-|τικά Bk. per typos. errorem.

³ δὲ πρηνῆ scripsi, coll. G.A. 720 b 10: δ' ἐπὶ ταύτην A¹C:
δ' ἐπὶ ταύτης PDA², vulg.

the carids] and the like, as the retromingent quadru- (b) Crusta-
peds do, i.e., when one animal turns its tail supine and cea.
the other prone. They copulate in early spring near
the land. This can be asserted, for the copulation of
all creatures of this sort has been observed. Some-
times it occurs when the figs begin to ripen. Lobsters
and carids copulate in the same way.

Crabs copulate by their front parts, placing their
layered opercula together. To begin with, the smaller
crab mounts the larger one from the rear; when it
has done this, the larger one turns over on to its side.
The female differs in no respect from the male, except
that the operculum is larger, more projecting, and
more densely covered with hair^a; into it the eggs are
laid and by it the residue^b comes out. No part of
either is inserted into the other.

Insects copulate at the rear, and then the smaller VIII
(i.e., the male) mounts on the larger. The female (c) Insecta.
pushes up her passage from below into the male which
is on top, not the other way round as in other animals.
(In some of them this part is clearly disproportion-
ately large compared with the body as a whole, even
when the latter is quite small; in others the dispro-
portion is less.) This is plain to anyone who tries to
pull apart flies that are copulating. They are reluc-
tant to separate from each other; for the copulation
of such creatures goes on a long time. This can be
plainly seen in the commonest of them, e.g., flies and
blister-beetles. They all copulate in this way, flies,

^a Cf. 527 b 33.

^b See Notes, §§ 22 ff.

⁴ ἄλλο et οὐδὲν CPDA², Dt.: ἄλλω A¹, vulg., A.-W.: οὐδενί
Rhen., vulg., A.-W., om. A¹.

⁵ σ. οὐκ ὀπισθεν, ἀλλ' prop. Dt.

542 a

αἱ κανθαρίδες καὶ αἱ σπονδυλαί [καὶ τὰ φαλάγγια],¹
καὶ εἴ τι ἄλλο τοιοῦτόν ἐστι τῶν ὀχουμένων. ποι-
οῦνται δὲ τὰ φαλάγγια τὴν ὀχείαν τόνδε τὸν τρόπον,
ὅσα γ' ὑφαίνει ἀράχνια· ὅταν ἡ θήλεια σπᾶση τῶν
ἀποτεταμένων ἀραχνίων ἀπὸ τοῦ μέσου, πάλιν ὁ
15 ἄρρην ἀντισπᾶ· τοῦτο δὲ ποιήσαντα πολλάκις οὕτω
συνέρχεται καὶ συμπλέκεται ἀντίπυγα²· διὰ γὰρ τὴν
περιφέρειαν τῆς κοιλίας οὗτος ἀρμόττει ὁ συνδυα-
σμός αὐτοῖς.

Ἡ μὲν οὖν ὀχεία τῶν ζώων τοῦτον γίνεταί τὸν
τρόπον πάντων, ὧραι δὲ καὶ ἡλικίαί τῆς ὀχείας ἐκά-
στοις εἰσὶ διωρισμένοι τῶν ζώων.

- 20 Βούλεται μὲν οὖν ἡ φύσις τῶν πλείστων περὶ τὸν
αὐτὸν χρόνον ποιεῖσθαι τὴν ὀμίλιαν ταύτην, ὅταν ἐκ
τοῦ χειμῶνος μεταβάλλῃ πρὸς τὸ θέρος· αὕτη δ'
ἐστὶν ἡ τοῦ ἔαρος ὥρα, ἐν ἣ τὰ πλείστα καὶ πτηνὰ
καὶ πεζὰ καὶ πλωτὰ ὄρμα πρὸς τὸν³ συνδυασμόν.
ποιεῖται δ' ἕνια τὴν ὀχείαν καὶ τὸν τόκον καὶ μετο-
25 πύρου καὶ χειμῶνος, οἷον τῶν τ' ἐνύδρων γένῃ ἅττα
καὶ τῶν πτηνῶν· ἄνθρωπος δὲ μάλιστα πάσαν ὥραν,
καὶ τῶν συνανθρωπευομένων ζώων πολλά διὰ τὴν
ἀλέαν καὶ εὐτροφίαν, ὅσων καὶ αἱ κυήσεις ὀλιγο-
χρόνιοί εἰσιν, οἷον ὑὸς καὶ κυνός, καὶ τῶν πτηνῶν
30 ὅσα πλεονάκις ποιοῦνται τοὺς τόκους. πολλά δὲ
καὶ πρὸς τὰς ἐκτροφὰς τῶν τέκνων στοχαζόμενα
ποιεῖται⁴ τὸν συνδυασμόν ἐν τῇ ἀπαρτιζούσῃ ὥρᾳ.
ὄργα δὲ πρὸς τὴν ὀμίλιαν τῶν ἀνθρώπων τὸ μὲν
542 b ἄρρην ἐν τῷ χειμῶνι μᾶλλον, τὸ δὲ θήλυ ἐν τῷ θερεί.

¹ secl. Dt., coll. a 16 infra.

² ἀντίπυγα om. A¹.

blister-beetles, knuckle-beetles,^a [venom-spiders] and
any similar ones that copulate. The venom-spiders,
i.e., those kinds which spin webs,^b copulate in the
following way: the female will pull the stretched-
out web from the middle, then the male will give a
counter-pull; and when they have done this several
times they meet and unite rear to rear, which is a
method of copulation that suits them owing to the
roundness of their stomachs.

I have now described the method of copulation of
all animals. As for the seasons and ages at which this
takes place, these are clearly defined for each kind
of animal.

The natural tendency in most of them is to have ^{2. Breeding}
intercourse at about the same time of year, when ^{SEASONS :}
winter is changing over to summer, in other words, in
spring, which is the time when most creatures that
fly or walk or swim feel the urge for pairing. Some
copulate and breed in autumn and also in winter, *e.g.*,
some kinds of aquatic animals and some kinds of birds.
Human beings pair and breed at any and every season,
and so also do many domesticated animals owing to
the shelter and the plentiful food they get by their
association with man: I refer to those whose gesta-
tion periods are short, such as the sow and the bitch,
and those birds which raise several broods. Many
animals have in view the upbringing of their young
and choose a season for pairing which will fit in with
their requirements.^c In human beings the male feels
the urge for intercourse more in the winter, the
female more in the summer.

^a Unidentified.

^b See 623 a 2 ff.

^c Cf. 558 a 3.

³ τὸν CPD: om. A, vulg.

⁴ ποιεῖται C; ποιοῦνται PD, vulg.

Τὸ δὲ τῶν ὀρνίθων γένος, ὡς περ εἴρηται, τὸ πλεῖστον περὶ τὸ ἔαρ ποιεῖται καὶ ἀρχομένου τοῦ θέρους τὴν ὀχείαν καὶ τοὺς τόκους, πλὴν ἀλκύνος. ἢ δ' ἀλκυὼν τίκτει περὶ τροπᾶς τὰς χειμερινάς. διὸ καὶ
 5 καλοῦνται, ὅταν εὐδιδεῖναι γένωνται αἱ τροπαί, ἀλκυονίδες¹ ἡμέραι ἐπτὰ μὲν πρὸ τροπῶν, ἐπτὰ δὲ μετὰ τροπᾶς, καθάπερ καὶ Σιμωνίδης ἐποίησεν

Ὡς ὁπότεναι χειμέριον κατὰ μῆνα² πινύσκη
 Ζεὺς ἤματα τεσσαρακάδεκα,
 λαθάνεμόν τε³ μιν ὦραν καλέουσιν ἐπιχθόνιοι,
 10 ἱεράν παιδοτρόφον ποικίλας
 ἀλκύνος.⁴

γίνονται δ' εὐδιδεῖναι, ὅταν συμβῆῖ νοτίους γίνεσθαι τὰς τροπᾶς, τῆς Πλειάδος βορείου γενομένης. λέγεται δ' ἐν ἐπτὰ μὲν ἡμέραις ποιεῖσθαι τὴν νεοττιάν,⁵ ἐν δὲ ταῖς λοιπαῖς ἐπτὰ ἡμέραις τίκτειν καὶ ἐκτρέφειν τὰ νεόττια. περὶ μὲν οὖν τοὺς ἐνταῦθα τόπους
 15 οὐκ αἰεὶ συμβαίνει γίνεσθαι ἀλκυονίδας ἡμέρας περὶ τὰς τροπᾶς, ἐν δὲ τῷ Σικελικῷ πελάγει σχεδὸν αἰεὶ τίκτει δ' ἢ ἀλκυὼν περὶ πέντε ὥρα.

IX [Ἡ δ' αἴθυια καὶ οἱ λάρροι τίκτουςι μὲν ἐν ταῖς περὶ θάλατταν πέτραις, τὸ δὲ⁶ πλῆθος δύο ἢ τρία· ἀλλ' ὁ μὲν λάρρος τοῦ θέρους, ἢ δ' αἴθυια ἀρχομένου

¹ ἀλκυονίδες AC: ἀλκυόνειοι D, vulg.: ἀλκυόνειαι P.

² κατὰ μῆνα χ. AC.

³ δέ Schneidewin, Buss., Pi.

⁴ ἀλκύνος AC. — "versuum divisio incerta" D. L. Page, P. M. G., Sim. 508, qui aliter dividit; Dt. ut supra.

⁵ νεοττιάν A.-W.: νεοττιάν APD, vulg.: νεοττιάν C.

Birds as a group, as has been said already, pair and (a) Birds. breed for the most part in spring and early summer, except the halcyon. This bird breeds at the time of the winter solstice. Hence when calm weather occurs at this period, the name "halcyon days" is given to the seven days preceding and the seven days following the solstice,^a as Simonides^b says in his poem:

As when in the wintry month
 Zeus admonishes the fourteen days
 and men on earth name it the windless, the holy season,
 the season when the many-hued halcyon nurtures her
 young.

And these days are calm when it so happens that southerly winds blow at the solstice, after the Pleiad has been northerly.^c It is said that the halcyon takes seven days to build her nest, and the other seven to lay the eggs and hatch the brood. In our part of the world, it is true, we do not in fact always get halcyon days at the solstice, but in the Sicilian sea this period is pretty regular. The halcyon lays five eggs on the average.

[The *aithyia*^d and the gull lay their eggs on rocks IX near the sea, two or three in number, but whereas the gull lays in summer, the *aithyia* lays at the beginning

^a See Additional Note, p. 368.

^b D. L. Page, *Poetae Melici Graeci*, Simon. no. 508.

^c This appears to be shorthand for "northerly winds have prevailed at the time of the morning setting of the Pleiades" (cf. below, line 23), which in Aristotle's time took place in early November. If it refers to their evening rising, the date indicated would be the end of September or the beginning of October. (See App. A, p. 399.) Spring is described as "northerly" at Hippocr. *A.W.P.* ch. 10. Cf. 598 b 7, n.

^d Probably the great shearwater; see Thompson, *G.G.B.*² (1936), pp. 27 ff., and *ibid.*, pp. 88 ff., *Διομήδειοι ὄρνιθες*.

^e δέ PD: μὲν AC, vulg.

542 b

20 τοῦ ἔαρος εὐθύς ἐκ τροπῶν, καὶ ἐπικαθεύδει¹ ὡσπερ αἱ ἄλλαι ὄρνιθες. οὐδέτερον δὲ φωλεύει² τούτων τῶν ὄρνέων.]³

Πάντων δὲ σπανιώτατον ἰδεῖν ἀλκυόνα ἐστίν· σχεδὸν γὰρ περὶ Πλειάδος δύσιν καὶ τροπὰς ὄραται μόνον, καὶ ἐν τοῖς ὑφόρμοις⁴ ὅσον περιπταμένη περὶ τὸ πλοῖον ἀφανίζεται εὐθύς, διὸ καὶ Στησίχορος

25 τοῦτον τὸν τρόπον ἐμνήσθη περὶ αὐτῆς.

Τίττει δὲ καὶ ἡ ἀηδὼν τοῦ θέρους ἀρχομένου, τίττει δὲ πέντε καὶ ἕξ ὥα· φωλεύει δ' ἀπὸ τοῦ μετοπώρου μέχρι τοῦ ἔαρος.

Τὰ δ' ἔντομα καὶ τοῦ χειμῶνος ὀχεύεται καὶ γίγνεται, ὅταν εὐημερία γένωνται καὶ νότια, ὅσα μὴ φωλεύει αὐτῶν, ὅλον μυῖαι καὶ μύρμηκες. τίττει

30 δ' ἅπαξ τοῦ ἐνιαυτοῦ τὰ πολλὰ τῶν ἀγρίων, ὅσα μὴ ἐπικυύσκειται ὡσπερ δασύπους.

Ὁμοίως δὲ καὶ τῶν ἰχθύων οἱ πλείστοι ἅπαξ, ὅλον

543 a οἱ χυτοὶ (καλοῦνται δὲ χυτοὶ οἱ τῷ δικτύῳ περιεχόμενοι), θύννος, πηλαμύς, κεστρεύς, χαλκίδες, κολίαι,⁵ χρώμις,⁶ ψῆττα καὶ τὰ τοιαῦτα, πλὴν ὁ

¹ ἐπικάθηται conl. A.-W.

² φωλεῖ hic et ter in seqq. A.

³ haec sine dubio ut monet Dt. post περὶ αὐτῆς vers. 25 locanda.

⁴ add. πρῶτον PD, vulg.: om. AC.

⁵ κολίαι Pl., A.-W., Dt.: κολίαι κόλλαιναί A; κτ'. [κόλ. teste Dt.] κόλλαιναί C: κοχλίαι PD, vulg.

⁶ χρώμις AC, vulg.: χρομίς PD.

^a The Greek word for "solstice" is plural, and the phrase in the present passage, "the beginning of spring," seems to suggest that the time intended is when the days have begun to lengthen noticeably after the solstice.

of spring immediately after the solstice,^a and it sits on the eggs just as other birds do. Neither of these birds goes into hiding.]^b

It is the rarest thing to see a halcyon. It is hardly ever seen except at the time of the setting of the Pleiades and the solstice. And where ships are lying at anchor, it hovers round a boat for a while and then suddenly disappears. Stesichorus^c mentions this habit of the bird's.

Another bird that breeds at the beginning of summer is the nightingale, laying five or six eggs: it goes into hiding from autumn until spring. (b) Insecta.

As for Insects, they copulate and breed in winter too, when the weather is fine and the south wind blows—that is to say, those which do not go into hiding, e.g., flies and ants. Most wild animals breed just once a year, except those in which superfetation occurs, as in the hare.

In a similar way most fishes breed just once a year,^d (c) Fishes. e.g., the shoal-fishes (this term is applied to those which are caught by netting), the tunny, the *pelamys*, the grey mullet, the *chalkis*,^e the coly-mackerel,^f the *chromis*,^g the *psetta*,^h and the like, but not the basse:

^b This paragraph seems to be out of place, and should be read after "habit of the bird's" a few lines below.

^c No passage of Stesichorus mentioning the bird is extant. Schneider suggests that Stesichorus made the halcyon appear to the Argonauts as they were leaving harbour; see also n. on 542 b 6 above.

^d The statements in this and the two following chapters about the breeding-times of fishes are not entirely consistent, nor wholly in agreement with statements made in Book VI, chs. 11, 14, 17. ^e Perhaps a pilchard or sardine.

^f Or Spanish mackerel, *Scomber colias*.

^g Perhaps *Sciaena aquila* (Th.), or *Umbrina cirrhosa* (LSJ).

^h A flatfish, perhaps sole or flounder.

λάβραξ· οὗτος δὲ δις τούτων μόνος, γίγνεται δ' ὁ
 τόκος αὐτῷ ὁ ὑστερος ἀσθενέστερος. καὶ ὁ τριχίας
 5 δὲ καὶ τὰ πετραῖα δις, ἢ δὲ τρίγλη¹ μόνη τρίς.
 τεκμαίρονται δ' ἐκ τοῦ γόνου· τρίς γὰρ φαίνεται ὁ
 γόνος περὶ τινὰς τόπους. ὁ δὲ σκορπίος τίκτει δις.
 τίκτει δὲ καὶ ὁ σαργὸς² δις, ἔαρος καὶ μετοπώρου· ἢ
 δὲ σάλπη μετοπώρου ἄπαξ. ἢ δὲ θυννὶς ἄπαξ τίκτει,
 ἀλλὰ διὰ τὸ τὰ μὲν πρῶτα τὰ δ' ὄψια προῖεσθαι δις
 10 δοκεῖ τίκτειν· ἔστι δ' ὁ μὲν πρῶτος τόκος περὶ τὸν
 Ποσειδεῶνα πρὸ τροπῶν, ὁ δ' ὑστερος τοῦ ἔαρος.
 διαφέρει δ' ὁ θύννος ὁ ἄρρην τοῦ θήλεος, ὅτι ἢ μὲν
 ἔχει ὁ δ' οὐκ ἔχει ὑπὸ τῇ γαστρὶ πτερύγιον,³ ὁ
 καλοῦσιν ἀφαρέα.

X Τῶν δὲ σελαχῶν ἢ ῥίνη μόνη τίκτει δις· τίκτει γὰρ
 15 καὶ ἀρχομένου τοῦ φθινοπώρου καὶ περὶ Πλειάδος
 δύσιν, εὐήμερεῖ δ' ἐν τῷ φθινοπώρῳ μᾶλλον· ὁ δ'
 εἰς τόκος γίγνεται περὶ ἑπτὰ ἢ ὀκτώ. δοκοῦσι δ'
 ἔνιοι τῶν γαλεῶν, οἷον ὁ ἀστερίας, δις τοῦ μηνὸς
 τίκτειν· τοῦτο δὲ συμβαίνει, ὅτι οὐχ ἅμα πάντα λαμβάνει
 τελέωσιν τὰ ψά.

Ἔνια δὲ τίκτει πᾶσαν ὥραν, οἷον ἡ σμύραϊνα.

¹ sic Sn., edd.: codd. varia.

² σαργός AC: σάργος PD, vulg.

³ τὰρίχιον con. Th.

^a See 543 b 11 below.

^b Probably an *atherinæ*; cf. 569 b 26, 598 b 12.

^c Probably *Scorpaena scrofa* and *S. porcus*, bullhead or sculpin.

^d *Sargus Rondeletii*. This statement is at variance with 543 b 7, b 15, and 570 a 32.

^e *Bon salpa*, the saupe. ^f See Appendix B, p. 409.

^g These statements about the tunny do not agree with what is said at 543 b 11 and 571 a 13, where the tunny is alleged to breed about the time of the summer solstice.

this is the only one of these fishes that breeds twice^a a year, and the second brood is weaker than the first. The sand-smelt^b too and the rock-fishes breed twice a year; the red mullet alone breeds three times, a fact established by the evidence of its spawn, which is observed in certain places three times a year. The *skorpios*^c breeds twice. The sargue too breeds twice,^d in the spring and autumn. The *salpē*^e breeds once only, in autumn. The female tunny breeds once, but owing to the fact that some fish spawn early and some late, it appears to breed twice. The first breeding occurs in Poseideon^f before the solstice, the second one in spring.^g The male tunny differs from the female in not having under the belly the fin known as the *aphareus*.^h

The angel-fish is the only Selachian that breeds X twice,ⁱ once at the beginning of autumn and once at the setting of the Pleiades: it is in better condition at the former time. One brood consists of seven or eight young. Some of the dogfishes, e.g., the starry dogfish, appear to breed twice a month^j: this happens because not all the eggs reach maturity simultaneously.

Some fishes lay at any season, e.g., the *smyraina*.^k

^a No such fin can be identified; it is probably another part of the fish which was considered a delicacy.

^b Only the autumn breeding ("before the equinox") is mentioned at 543 b 9; at 566 a 20 two are mentioned, one "in late autumn about the winter setting of the Pleiades" (i.e., the morning setting, early in November), and one in spring. If the "setting of the Pleiades" in the present passage refers to their evening setting (early in April) it is more or less in agreement with the latter passage. See also Appendix A, p. 399.

^c Cf. 566 a 17.

^k Identical with the sea-eel or murry.

543 a

20 τίκτει δ' αὐτὴ ψὰ πολλά, καὶ ἐκ μικροῦ ταχεῖαν τὴν
αὐξήσῃ λαμβάνουσι τὰ γενόμενα, ὥσπερ καὶ τὰ τοῦ
ἵππουρου· καὶ γὰρ ταῦτα ἐξ ἐλαχίστου μέγιστα γί-
γνεται τάχιστα, πλὴν ἢ μὲν σμύραινα πᾶσαν ὥραν
τίκτει, ὁ δ' ἵππουρος ἔαρος. διαφέρει δ' ὁ σμῦρος
25 καὶ ἡ σμύραινα· ἡ μὲν γὰρ σμύραινα ποικίλον καὶ
ἀσθενέστερον, ὁ δὲ σμῦρος ὁμόχρους καὶ ἰσχυρός,
καὶ τὸ χρῶμα ἔχει ὁμοιον τῇ πίτυϊ, καὶ ὀδόντας ἔχει
καὶ ἔσωθεν καὶ ἔξωθεν. φασὶ δ' ὥσπερ καὶ τᾶλλα,
τὸν μὲν ἄρρενα τὴν δὲ θήλειαν εἶναι. ἐξέρχονται¹
δὲ ταῦτα εἰς τὸ ξηρόν,² καὶ λαμβάνονται πολλάκις.³

30 Συμβαίνει μὲν οὖν σχεδὸν πᾶσι ταχεῖαν γίνεσθαι
τὴν αὐξήσῃ τοῖς ἰχθύσιν, οὐχ ἥκιστα δὲ κορακίνω
543 b τῶν μικρῶν· τίκτει δὲ πρὸς τῇ γῇ ἐν⁴ βρυώδεσι καὶ
δασέσιν. ταχὺ δὲ καὶ ὁ ὀρφῶς ἐκ μικροῦ γίγνεται
μέγας, αἱ δὲ πηλαμύδες καὶ οἱ θύννοι τίκτουσιν ἐν
τῷ Πόντῳ, ἄλλοθι δ' οὐ· κεστρεῖς δὲ καὶ χρυσόφρυνες
καὶ λάβρακες μάλιστα οὐ ἂν ποταμοὶ ῥέωσιν· οἱ δ'
5 ὄρκυνες καὶ σκομβρίδες⁵ καὶ ἄλλα πολλὰ γένη ἐν τῷ
πελάγει.

XI Τίκτουσι δ' οἱ πλείστοι τῶν ἰχθύων ἐν μηνὶ τρισί,
Μουνυχιῶνι, Θαργηλιῶνι, Σκιρροφοριῶνι· μετοπώ-
ρου δ' ὀλίγοι, οἷον σάλπη καὶ σαργός⁶ καὶ ὅσα ἄλλα
τοιαῦτα μικρὸν πρὸ ἰσημερίας τῆς φθινοπωρινῆς,

¹ sic C : ἐξέρχεται PD, vulg.

² τὸ ξηρόν AC : τὴν ξηράν PD, vulg.

³ πλὴν ἢ μὲν v. 23 hucusque secl. A.-W., Th.

⁴ ἐν A.-W., Dt. : τοῖς AC : καὶ vulg. : καὶ πρὸς τοῖς PD.

⁵ σκομβρίδες AC : σκορπίδες vulg.

⁶ σαργός C : σάργος PD, vulg. : σαργίνος Cs., Gesnerum secutus.

This lays a great many eggs, and the young though small when hatched grow very quickly, as do those of the horsetail^a : these are very small to begin with, but get very large very quickly. The only difference is that the *smyraina* breeds at any season, whereas the horsetail does so only in spring. The *smynos*^b differs from the *smyraina* : the latter is mottled and somewhat weak, the former is uniform in colour and strong: its colour is like that of the pine tree, and it has teeth outside as well as inside. As in other instances, people say that the one is male and the other female.^c These creatures come out on to dry land and are often caught.

Most fishes, we can say, quickly reach their full growth, and this is particularly true of the crowfish,^d one of the small fishes : this fish spawns near the shore in thickly weeded places. The sea-perch, too, is small to begin with, and quickly gets large. The *pelamys* and the tunny breed in the Pontus, but nowhere else ; the grey mullet, the gilthead and the basse breed best where rivers run out into the sea ; the *orkys*,^e the mackerel and many other sorts in the open sea.

Most fish breed in the three months Mounychion, XI Thargelion, and Skirrophorion.^f A few breed in the autumn, such as the *salpē*, the sargue, and others of this sort, which breed shortly before the autumn equinox ; also the torpedo-fish and the angel-fish.

^a *Coryphaena hippurus*.

^b *Muraena* (or *Gymnothorax*) *unicolor*.

^c *i.e.*, that the *smynos* is the male, and the *smyraina* the female, of the same species.

^d *Chromis castanea* ; and (or) *Corvina nigra* and *Umbrina cirrhosa*.

^e A large-sized tunny.

^f See Appendix B, p. 409.

10 καὶ νάρκη καὶ ῥίνη. τίκτει δ' ἔνια καὶ χειμῶνος καὶ
 θέρους, ὡσπερ ἐλέχθη πρότερον, οἷον χειμῶνος μὲν
 λάβραξ (καὶ) κεστρεύς, βελόνη δὲ θέρους περὶ τὸν
 Ἑκατομβαιῶνα, θυννίς δὲ περὶ τροπᾶς θερινᾶς¹.
 τίκτει δὲ θυλακοειδές, ἐν ᾧ πολλὰ ἐγγίγνεται καὶ
 μικρὰ ψά. καὶ οἱ ῥυάδες τοῦ θέρους τίκτουςιν.

15 Ἀρχονται δὲ κύειν τῶν κεστρέων οἱ μὲν χελώνες
 τοῦ Ποσειδεῶνος καὶ ὁ σαργός² καὶ ὁ σμύξων³ καλού-
 μενος καὶ ὁ κέφαλος· κύουσι δὲ τριάκοντα ἡμέρας.
 ἔνιοι δὲ τῶν κεστρέων οὐ γίγνονται ἐκ συνδυασμοῦ,
 ἀλλὰ φύονται ἐκ τῆς ἰλύος καὶ τῆς ἄμμου.

Ἦς μὲν οὖν ἐπὶ τὸ πολλὸν τοῦ ἔαρος τὰ πλείστα
 κυτσκεται, οὐ μὴν ἀλλὰ, καθάπερ εἴρηται, καὶ θέρους
 20 ἔνια καὶ φθινοπύρου καὶ χειμῶνος· ἀλλ' οὐθ' ἅπασιν
 ὁμοίως τοῦτο συμβαίνει οὐθ' ἀπλῶς οὔτε καθ' ἕκα-
 στον γένος, ὡσπερ τοῖς πλείστοις τοῦ ἔαρος· οὐδὲ
 δὴ κύουσι πολλὰ κηήματα ὁμοίως ἐν τοῖς ἄλλοις
 χρόνοις. ὅλως δὲ δεῖ μὴ λελθῆναι ὅτι, ὡσπερ καὶ
 25 τῶν φνομένων καὶ τῶν ζώων τῶν τετραπόδων πολ-
 λὴν αἰ χῶραι ποιοῦσι διαφορὰν οὐ μόνον πρὸς τὴν
 ἄλλην τοῦ σώματος εὐημερίαν ἀλλὰ καὶ πρὸς τὸ
 πλεονάκις ὀχεύεσθαι καὶ γενῆαν, οὕτω καὶ περὶ τοὺς

¹ <καὶ> addidi: λ. κ. β., θέρους δὲ περὶ τὸν Ἑκ. θυννίς, περὶ
 τροπᾶς θ. vulg.: βελόνη δὲ A: θυννίδες AC: θυννίς δὲ PD:
 scribere ut supra vellet Dt., recte ut mihi videtur, si <καὶ>
 addideris; nam vix cum aliis locis congruere facias.

² σαργός AC: σάργος PD, vulg.

³ σμύξων A, vulg.: σμύζων C: μύζων PD.

^a It is unnecessary to suppose that καὶ χειμῶνος καὶ θέρους
 means that some fishes breed both in winter and in summer
 (cf. a very similar phrase at line 20 below); indeed, the fol-
 lowing words show that this cannot be intended, although it
 has been stated (above 543 a 2, a 9 ff.) that the basse and the
 tunny breed twice. In that passage, however, no times were
 126

Some breed even in winter and summer,^a as already
 stated; thus the basse and the grey mullet breed in
 winter, the pipefish in summer about Hekatombaion,^b
 and the female tunny about the summer solstice: it
 produces a wallet-like object containing a large num-
 ber of small eggs. The shoal-fishes too breed in
 summer.

Of the grey mullets the *chelon*^c begins to be in roe
 in the month Poseideon; so do the sargue, the
smyxon^d as it is called, and the *kephalos*^e; the period
 lasts thirty days. Some of the grey mullets do not
 reproduce sexually, but arise out of mud and sand.

In general, then, most fishes are in roe in the spring,
 though some, as we have stated, are in roe in summer,
 in autumn, and in winter. In these three seasons,
 however, the manner of it varies, and it is not the
 same in all of them, or even within any one kind, as it
 is with most of those that breed in the spring; nor at
 these other seasons is the number of fetations which
 they carry as large. And generally, we must not
 forget that as in the case of plants and quadrupeds
 differences of locality exert much diversity of influence,
 not only upon general physical well-being but also
 upon the frequency of copulation and breeding, so in

given for the basse, and the two given for the tunny are
 different from that given here, which tallies with 571 a 13.
 See note on 542 b 32 above. The point Aristotle is making
 here is that winter and summer are unusual times for fish to
 breed, though some breed even then.

^b See Appendix B, p. 409.

^c Probably *Mugil Chelo*, the thick-lipped grey mullet;
 cf. 591 a 23. "the *kephalos*, called by some the *chelon*,"
 though in the present passage two lines below (543 b 16) the
kephalos seems to be a different fish.

^d Perhaps *Mugil saliens* or *auratus*.

^e See note on *chelon* above; a kind of grey mullet.

543 b

ἰχθύς πολλήν ποιούσι τὴν διαφορὰν αὐτοὶ οἱ τόποι
οὐ μόνον κατὰ μέγεθος καὶ εὐτροφίαν ἀλλὰ καὶ κατὰ
30 τοὺς τόκους καὶ τὰς ὀχείας, τοῦ ἔνθα μὲν πλεονάκεις
ἔνθα δ' ἑλαττονάκεις γεννᾶν τὰ αὐτά.

XII
544 a

Τίττει δὲ καὶ τὰ μαλάκια τοῦ ἔαρος, καὶ ἐν τοῖς
πρώτοις τίττει τῶν θαλαττίων ἢ σηπία. τίττει δὲ
πάσαν ὥραν, ἀποτίττει δ' ἐν ἡμέραις πέντε καὶ δέκα.
ὅταν δὲ τέκη τὰ ὤα, ὁ ἄρρην παρακολουθῶν κατα-
5 φυσᾷ τὸν θορόν,¹ καὶ γίγνεται στιφρά. βαδίζουσι δὲ
κατὰ ζυγά· ἔστι δ' ὁ ἄρρην τῆς θηλείας ποικιλώτερος
καὶ μελάντερος τὸν νῶτον.

Ὁ δὲ πολύπους ὀχεύεται τοῦ χειμῶνος, τίττει δὲ
τοῦ ἔαρος, ὅτε καὶ φωλεύει περὶ δύο μῆνας. τίττει
δὲ τὸ ὦν καθάπερ βοστρύχιον, ὅμοιον τῷ τῆς λεύ-
10 κης καρπῷ. ἔστι δὲ πολύγονον τὸ ζῶον· ἐκ γὰρ τοῦ
ἀποτικτομένου ἄπειρον γίγνεται τὸ πλῆθος. δια-
φέρει δ' ὁ ἄρρην τῆς θηλείας τῷ τε τὴν κεφαλὴν
ἔχειν προμηκεστέραν καὶ τὸ καλούμενον ὑπὸ τῶν
ἀλιέων αἰδοῖον ἐν τῇ πλεκτάνῃ λευκόν. ἐπῳάζει δέ,
ὅταν τέκη· διὸ καὶ χεῖριστοὶ γίγνονται· οὐ γὰρ νέ-
μονται κατὰ τοῦτον τὸν χρόνον.

15 Γίγνονται δὲ καὶ αἱ πορφύραι περὶ τὸ ἔαρ, καὶ
οἱ κήρυκες λήγοντος τοῦ χειμῶνος. καὶ ὅλως τὰ
ὄστρακόδερμα ἐν τε τῷ ἔαρι φαίνεται τὰ καλούμενα
ὤα ἔχοντα καὶ ἐν τῷ μετοπώρῳ, πλὴν τῶν ἐχίνων
τῶν ἐδωδίμων· οὗτοι δὲ μάλιστα μὲν ἐν ταύταις
ταῖς ὥραις, οὐ μὴν ἀλλὰ καὶ αἰεὶ ἔχουσι, καὶ μάλιστα

¹ θορόν AC (*insufflat super ea suum semen* Σ): θόλον
PD: θολόν vulg.

^a Cf. 549 b 33.

^b Cf. 524 a 6.

the case of fishes locality alone produces great differ-
ences not only in respect of size and general vigour
but also of parturition and copulation, so that the
same kinds will breed more frequently in one place
and less frequently in another.

Another group that breeds in spring is the Cephalo-
pods. The earliest of the marine Cephalopods is the
cuttlefish, which spawns at every hour of the day, and
all is completed in fifteen days. When the female has
laid the eggs, the male following on behind discharges
his milt on them, and they harden. Cuttlefish go
about in pairs. The male is more variegated than the
female, and darker on the back.

The octopus mates in winter and lays in spring ;
at that time it lurks away for about two months. It
lays an egg like the twisted inflorescence of a grape-
vine,^a similar to the fruit of the white poplar. It is a
very prolific animal : an enormous multitude of pro-
geny is produced from the spawn. The male differs
from the female in having a more elongated head, and
in having a white ^b penis (so the fishermen call it) on
one of its tentacles. The female having laid her eggs
broods over them, which results in the creatures get-
ting into very poor condition : at this period they do
not go out in search of food.

The purpuras also are produced ^c about spring-
time, and the trumpet-shells when winter is ending.
And generally, the Testacea are observed to be
carrying their eggs (so-called) in spring and late
autumn, except the edible sea-urchin, which, though
it carries its "eggs" most abundantly at these times,
always has some, and most plentifully at the times of

^c Lit., "come into being"; Testacea, according to Aris-
totle, do not "breed": see 546 b 17 ff.

544 a

20 ταῖς πανσελήνοις καὶ ταῖς ἀλειναῖς ἡμέραις, πλὴν τῶν ἐν τῷ εὐρίπῳ τῶν Πυρραίων· ἐκεῖνοι δ' ἀμείνους τοῦ χειμῶνος. εἰσὶ δὲ μικροὶ μὲν, πλήρεις δὲ τῶν ὠῶν.

Κύοντες δὲ φαίνονται καὶ οἱ κοχλῖαι πάντες ὁμοίως τὴν αὐτὴν ὥραν.

XIII 25 Τῶν δ' ὀρνέων τὰ μὲν ἄγρια, ὡς περ εἴρηται, ἅπαξ ὀχεύεται καὶ τίκτει τὰ πλείστα, χελιδῶν δὲ δις τίκτει καὶ κόττυφος. τὰ μὲν οὖν πρῶτα τοῦ κοττύφου ὑπὸ χειμῶνος ἀπόλλυται (πρωϊαίτατα γὰρ τίκτει τῶν ὀρνέων ἀπάντων), τὸν δ' ὕστερον τόκον εἰς τέλος ἐκτρέφει. ὅσα δ' ἢ ἡμέρα ἢ ἡμεροῦσθαι δύναται, 30 ταῦτα δὴ² πλεονάκις, οἷον αἱ περιστεραι καθ' ἅπαν τὸ θέρος, καὶ τὸ τῶν ἀλεκτορίδων γένος· ὀχεύουσι γὰρ οἱ ἄρρενες καὶ ὀχεύονται αἱ θήλειαι τῶν ἀλεκτορίδων καὶ τίκτουσιν αἰεὶ, πλὴν τῶν ἐν τῷ³ χειμῶνι τροπικῶν ἡμερῶν.

544 b ⁴ Τῶν δὲ περιστεροειδῶν πλείω τυγχάνει ὄντα γένη· ἔστι γὰρ ἕτερον περιστερὰ καὶ πελειάς. ἐλάττων μὲν οὖν ἢ πελειάς, τιθασὸν δὲ γίγνεται μᾶλλον ἢ περιστερά· ἢ δὲ πελειάς καὶ μέλαν καὶ μικρὸν καὶ ἐρυθρόπουλον καὶ τραχύπουν, διὸ καὶ οὐδεὶς τρέφει.

¹ ἢ C: om. PD, vulg.

² δὴ conl. Dt.: δὲ ACD, vulg.: om. P.

³ τῷ CPD: om. A, vulg.

⁴ hinc ad finem cap. secl., totum caput suspic. Dt.

^a At *P.A.* 680 a 33 Aristotle says the eggs are larger at the time of full moon because the nights are warmer owing to the moonlight. (In this passage he again mentions the sea-urchins in the Strait of Pyrrha as being exceptional.) It is true of the sea-urchins in the Red Sea that their eggs increase in size at the time of full moon, though not of the Mediterranean ones. The former have a cycle corresponding

full moon^a and when the days are warm and sunny. This does not apply to the sea-urchins in the Strait of Pyrrha,^b which are at their best in winter. They are small, it is true, but full of eggs.

Snails, too, are observed to be carrying fetations universally at the same season.

With regard to birds: the wild ones, as has been **XIII** stated, mostly pair and breed once a year, though the swallow and the blackbird breed twice. The black- **(f) Birds (resumed).** birds' first brood, sure enough, succumbs to the wintry weather, as it is the earliest of all birds to breed, but it manages to bring up its second brood. Tame birds, or birds which can be domesticated, breed frequently, e.g., pigeons breed all through the summer; so does the domestic hen: the cock and hen have intercourse and the hen breeds at all times except the days about the winter solstice.

There are many different kinds in the pigeon family: thus the pigeon and the *peleias* are different birds. The *peleias* is smaller (whereas the other is easily domesticated), and it is black and small, and its feet are red and rough, so no one bothers to keep it.

exactly to that of the moon. The five roes, ovaries, or testes are large and swollen during the week preceding each of the summer full moons, and the spawning of the eggs takes place during the few days before and after full moon. See the discussion of this and kindred matters in Harold Munro Fox, *Selene*, esp. pp. 35 ff., and *id.*, *Proc. Royal Soc. B*, 95 (1923), pp. 523-550. For a more general account of the influence of the moon according to Aristotle see *G.A.* 777 b 24 ff.

^b The lagoon at Pyrrha in Lesbos seems, as Thompson (prefatory note to his translation of *H.A.*) suggests, to have been one of the chief places where Aristotle carried on his researches. The strait leading to it is mentioned again at 548 a 9, 603 a 21, 621 b 12, and *P.A.* 680 b 1; cf. *G.A.* 763 b 1, 761 b 4 ff.

5 μέγιστον μὲν οὖν τῶν τοιούτων ἡ φάττα ἐστὶ, δεύ-
 τερον δ' ἡ οἰνάς· αὕτη δὲ μικρῶ μελλῶν ἐστὶ τῆς
 περιστερᾶς· ἐλάχιστον δὲ τῶν τοιούτων ἡ τρυγῶν.
 τίκτουσι δ' αἱ περιστερὰὶ πᾶσαν ὥραν καὶ ἐκτρέ-
 φουσιν, εἰς τόπον ἔχωσιν ἀλεινὸν καὶ τὰ ἐπιτήδεια·
 εἰ δὲ μή, τοῦ θέρους μόνον. τὰ δ' ἔκγονα τοῦ ἔαρος
 10 βέλτιστα καὶ τοῦ φθινοπύρου· τὰ δὲ τοῦ θέρους καὶ
 ἐν ταῖς θερμημερίαις χεῖριστα.

XIV Διαφέρουσι δὲ καὶ κατὰ τὴν ἡλικίαν τὰ ζῶα πρὸς
 τὴν ὀχείαν. πρῶτον μὲν οὖν οὐχ ἅμα τοῖς πολλοῖς
 ἀρχεται τε τὸ σπέρμα ἐκκρίνεσθαι καὶ γεννᾶν δύνα-
 15 ται, ἀλλ' ὕστερον· τὸ γὰρ τῶν νέων ἐν πᾶσι τοῖς
 ζῴοις τὸ μὲν πρῶτον ἄγονον, γονίμων δ' ὄντων
 ἀσθενέστερα καὶ ἐλάττω τὰ ἔκγονα. τοῦτο δὲ μά-
 λιστα δῆλον ἐπὶ τε τῶν ἀνθρώπων καὶ τῶν ζωοτόκων
 τετραπόδων καὶ ἐπὶ τῶν ὀρνίθων· τῶν μὲν γὰρ τὰ
 ἔκγονα ἐλάττω, τῶν δὲ τὰ ὠά.

Αἱ δ' ἡλικίαι τοῖς ὀχεύουσιν αὐτοῖς μὲν πρὸς αὐτὰ¹
 20 (ἐν)² τοῖς γένεσι τοῖς πλείστοις σχεδὸν κατὰ τὸν
 αὐτὸν γίνονται χρόνον, εἰς μὴ τι προτερῆ³ διὰ τι

¹ αὐτὰ Syll., Sn., Dt.: αὐτοῖς PD, vulg.: αὐτοῖς AC, A.-W.

² ἐν add. Pi.

³ ἢ add. P.

^a The same birds, with the exception of the *πελειάς*, are mentioned again at 558 b 22; and it seems clear that Aristotle considered them to be five different birds. There can be little doubt that the *φάττα* is the ring-dove or wood-pigeon, and the *τρυγῶν* the turtle-dove; but it is not at all clear from Thompson's *G.G.B.* what the others are, although he discusses the subject at considerable length. Thompson thinks the *περιστερᾶ*, which remains all the year round (see 597 b 4), is the rock-dove, the wild stock of the domesticated pigeon; and it is true that in the present passage it is said to be more easily domesticated than the *πελειάς*. *Οἰνάς* Thompson thinks

The largest of this family is the ring-dove; next largest is the *oinas*, which is a little larger than the common pigeon. The smallest of them all is the turtle-dove.^a Pigeons breed and hatch at all seasons, if they can get a warm sunny place and everything they need: otherwise in summer only. The spring and autumn broods are the best; the summer brood and those hatched in the hot periods are the worst.^b

A further point. Animals differ from one another XIV
 in respect of the age for sexual intercourse. To begin 3. Ages and
 with, in most of them the time at which the semen is signs of
 first secreted does not coincide with its ability to maturity.
 generate: this comes later. The earliest secretion
 in the young of all animals is infertile, or even if it is
 fertile, the offspring tend to be weak and small. This
 is particularly clear in the case of human beings, the
 viviparous quadrupeds, and birds: with the two former,
 the offspring themselves, with birds, the eggs,
 are smaller.

With regard to the age for sexual intercourse within
 any one kind of animal: it is pretty well standard,
 unless it is advanced on account of some monstrous

is a sailor's name, of Semitic origin, for the same bird. But
 what then is *πελειάς*? *Πελειάς* or *πέλεια* seems often to be a
 general term for pigeon, e.g., in Homer, where it is a wild
 bird, therefore the rock-dove. Thompson thinks the stock-
 dove was not recognized as a separate species, but was
 included under *φάττα*. In view of this confusion, I have
 thought it best not to attempt to translate *πελειάς* and *οἰνάς*.
 Thompson also refers to legendary and astronomical associa-
 tions of the *πελειάς* (the Pleiades, sometimes called *Peleiades*),
 for which his *Glossary* should be consulted. For a suggested
 derivation of the name *περιστερᾶ* ("the bird that lives near or
 around the house"), see A. C. Moorhouse, *C.Q.* XLIV (1950),
 pp. 73 ff.

^b Dt. considers the latter part of this chapter to be spurious,
 and the former part to be misplaced.

τερατώδες πάθος ἢ διὰ βλάβην τῆς φύσεως. τοῖς
 μὲν οὖν ἀνθρώποις ἐπισημαίνει κατὰ τε τὴν τῆς
 φωνῆς μεταβολὴν καὶ τῶν αἰδοίων οὐ μόνον μεγέθει
 ἀλλὰ καὶ εἶδει, καὶ ἐπὶ τῶν μαστῶν ὡσαύτως, μά-
 25 λιστα δὲ τῇ τριχώσει τῆς ἡβης. ἄρχεται δὲ φέρειν
 τὸ σπέρμα περὶ τὰ δις ἑπτὰ ἔτη, γεννητικὸς^a δὲ περὶ
 τὰ τρις ἑπτὰ. τοῖς δ' ἄλλοις ζώοις ἡβὴ μὲν οὐ
 γίννεται (τὰ μὲν γὰρ ὅλως οὐκ ἔχει τρίχας, τὰ δ'
 οὐκ ἔχει ἐν τοῖς ὑπίοις, ἢ ἐλάττους τῶν ἐν τοῖς
 30 πρᾶσι, ἢ δὲ φωνὴ μεταβάλλουσα ἐν ἐνίοις ἐπι-
 σημαίνει τὴν τ' ἀρχὴν τοῦ σπέρματος ἔχειν καὶ τοῦ τὸ
 γόνιμον ἦδη. τὴν δὲ φωνὴν ὅλως ἔχει τὸ θῆλυ
 ἐν τοῖς πλείστοις ὀξυτέραν, καὶ τὰ νεώτερα τῶν
 545 a πρεσβυτέρων, ἐπεὶ καὶ οἱ ἔλαφοι οἱ ἄρρηνες τῶν
 θηλειῶν φθέγγονται βαρύτερον. φθέγγονται δ' οἱ
 μὲν ἄρρηνες, ὅταν ἡ ὥρα τῆς ὀχείας ἦ, αἱ δὲ θήλειαι,
 ὅταν φοβηθῶσιν. ἔστι δ' ἡ μὲν τῆς θηλείας φωνὴ
 βραχεῖα, ἢ δὲ τοῦ ἄρρηνος ἔχει μῆκος. καὶ ἡ τῶν
 5 κυνῶν δὲ γηρασκόντων γίννεται βαρυτέρα φωνή.
 καὶ τῶν ἵππων δὲ διαφέρουσιν αἱ φωναί· εὐθύς μὲν
 γὰρ γενόμεναι ἀφίᾳσι φωνὴν λεπτήν καὶ μικρὰν αἱ
 θήλειαι, οἱ δ' ἄρρηνες μικρὰν μὲν, μείζω μέντοι γε
 καὶ βαρυτέραν τῆς θηλείας· τοῦ δὲ χρόνου προϊόντος
 10 μείζονα· διετῆς δ' ἐπειδὴν γέννηται καὶ τῆς ὀχείας
 ἄρρηται, φωνὴν ἀφήσιν ὃ μὲν ἄρρην μεγάλην καὶ
 βαρεῖαν, ἢ δὲ θήλεια μείζω καὶ λαμπροτέραν ἢ τέως,
 ἄχρι ἐτῶν εἴκοσιν ὡς ἐπὶ τὸ πολὺ· μετὰ μέντοι τὸν
 χρόνον τοῦτον ἀσθενεστέραν ἀφίᾳσι καὶ οἱ ἄρρηνες
 καὶ αἱ θήλειαι.

development or^a by some physical injury. Now in
 human beings this stage is marked by a change in the
 voice, and by a change both in the size and in the
 appearance of the sexual organs, and similarly with
 respect to the breasts, and above all by the growth of
 the pubic hair. Man first produces semen about the
 age of fourteen, and becomes able to generate at
 about twenty-one. In other animals there is no
 growth of pubic hair—some animals have no hair at
 all, some have none on their under surface, or less
 there than on their backs—but the change of voice
 in some of them is evident; in some, other parts of
 the body indicate the beginning of semen-secretion
 and the ability to generate. Generally speaking, in
 most animals the female has a higher-pitched voice
 than the male; so, too, young ones than older ones:
 thus even stags have a deeper voice than the hind. As
 for the males, they cry at the rutting season, the
 females when they are scared; the female's cry is
 short, the male's prolonged. A dog's bark, too, gets
 deeper as the animal gets older. In horses, also,
 differences are noticed in their neighing: the females,
 as soon as they are born, have a thin, small neigh,
 whereas the males begin with a small one, though
 even so it is louder and deeper than the female's, and
 it gets louder as time goes on. When they are two
 years old and begin breeding, the male's neigh be-
 comes loud and deep, and the female's louder and
 clearer than before: this mostly continues until they
 reach about twenty years of age, after which time
 the neighing of both sexes is weaker.

^a Dt. here inserts "delayed."

¹ ἢ <ὕστερῃ> Dt., Sn. et A.-W. monentibus; <διαπλακῇ> Pl.
² γεννητικὸς Syll., edd.: γεννητικά codd.

Ὡς μὲν οὖν ἐπὶ τὸ πολὺ, καθάπερ εἵπομεν, δια-
 15 φέρει ἢ φωνῇ τῶν ἀρρένων καὶ τῶν θηλειῶν ἐν τῷ
 βαρύτερον φθέγγεσθαι τὰ ἄρρενα τῶν θηλειῶν, ὅσων
 ἐστὶν ἀπότασις τῆς φωνῆς· οὐ μὴν ἐν πᾶσι γε τοῖς
 ζώοις, ἀλλ' ἐνίοις τούναντίον, ὅλον ἐπὶ τῶν βοῶν·
 ἐπὶ γὰρ τούτων τὸ θῆλυ τοῦ ἀρρενος βαρύτερον
 φθέγγεται, καὶ οἱ μόσχοι τῶν τελείων. διὸ καὶ τὰς
 20 φωνὰς τὰ ἐκτεμνόμενα μεταβάλλουσιν ἐναντίως· εἰς
 τὸ θῆλυ γὰρ μεταβάλλουσι τὰ ἐκτεμνόμενα.

Οἱ δὲ χρόνοι τῆς ὀχείας κατὰ τὴν ἡλικίαν ἔχουσιν
 ὧδε τοῖς ζώοις. πρόβατον μὲν καὶ αἶξ αὐτοετὲς
 25 ὀχεύεται καὶ κύει, μᾶλλον δ' ἢ αἶξ· καὶ οἱ ἄρρενες
 δ' ὀχεύουσιν ὡσαύτως, τὰ δ' ἔκγονα τῶν ἀρρένων¹
 διαφέρει ἐπὶ τούτων καὶ τῶν ἄλλων². τῶν γὰρ
 αὐτοετῶν βελτίω καὶ μεῖζω γίννεται ἢ τὰ [τῶ]
 ὕστερον [ἔτει] γεννώμενα.³ ὅς δ' ὀχεύει μὲν καὶ

¹ conī. dietῶν A.-W. (et alia in sequentibus ut patet infra, sed nihil horum in textu): ἄγαν νέων Dt.

² lacunam hic statuit Pi.

³ hunc locum vexatum et ut vid. glossem. corruptum sanare conatus sum. οἱ γὰρ ἄρρενες βελτίους γίνονται (γίνεται A) ἢ (ἢ om. AC) τῷ ὕστερον ἔτει, ὅταν γηράσκωσιν (γηράσωσιν A) vulg.: ἢ om. A.-W., Dt., οἱ eius loco Scal., ἢ post ἔτει Cs., Sn.: loco γηράσκωσιν conī. κέρασ ἔχωσι A.-W., γ' ἡβάσκωσιν (vel etiam ἀκμάσωσιν) Dt.: τῷ ὕστερον ἔτει om. Σ, Gaza, ὕστερον solum vertit Σ, ὅταν γηράσκωσιν om. Σ, qui ita vertit: *inter filios caprorum et aliorum animalium est diversitas, quoniam filius capri quem (v.l. capre qui) primo generat est melior et grossior post generatis.*

^a Bekker's text of this passage would give the following sense: [first part as above], "for the males become better [or, the males produced are better] than in the year after, when they are ageing." Various attempts have been made at emendation; A.-W.'s and Dittmeyer's would give the following sense: "but the offspring of the two-year-olds [of

So then, as we said, in general the voice of the male differs from that of the female in having a deeper note: this applies to animals whose voice can be prolonged, but not to all animals: in some the reverse occurs, e.g., in oxen: here the cow has a deeper note than the bull, and calves than adults. This also explains why gelded animals show a change of voice in opposite directions: they really change over into the female state.

I now give the ages at which animals begin to breed. Ewes and she-goats breed in their first year (the goat more definitely so), and the males are capable of intercourse at the same age, but the offspring, so far as the males are responsible for them, are different in the case of these from other animals, for the offspring produced by the yearling males are better and larger than those engendered afterwards.^a Sexual inter-

the excessively young, Dt.] differ in the case of these from other animals, for the males become better the year after, when they have a horn [when they are coming to maturity, Dt.]. I have recast the passage on the assumption (implicit in A.-W.'s and Dt.'s emendations) that annotations have ousted part of the original text, an important trace of which survives in the singular verb *γίνεται* of the ms. A (its subject being τὰ ἔκγονα). The word *γηράσκωσιν*, which has caused much trouble to editors, must certainly be an intrusion. A simpler version of the concluding phrase might (and probably should) be ἢ τὰ ὕστερον γεννώμενα. It had occurred to me that the word *ἄρρενες* might possibly conceal *ἀρρες* (lambs), but this seems unlikely, since *γίνεται* suggests that the subject is still τὰ ἔκγονα, and besides, Aristotle appears to be speaking of sheep and goats together, as he does elsewhere (e.g., 573 b 17 ff.). His point seems to be that, unlike what occurs in other animals, in the case of these the young produced by males while only a year old are better than those produced by them later, and the difference here (at least in the case of sheep: see 546 a 5) is particularly marked, because it is the older ewes which produce the better offspring.

545 a

30 ὀχεύεται πρῶτον ὀκτάμηνος, τίκτει δ' ἢ θήλεια
 μὲν ἑνιαυσία (οὕτω γὰρ συμβαίνει ὁ χρόνος τῆς
 κυήσεως), ὁ δ' ἄρρην γεννᾶ μὲν ὀκτάμηνος, φαῦλα
 μέντοι πρὶν γενέσθαι ἑνιαύσιος. οὐ πανταχοῦ δέ,
 ὡς περ εἴρηται, ὁμοίως συμβαίνουσιν αἱ ἡλικίαι·
 545 b ἑνιαχοῦ μὲν γὰρ αἱ ὕες ὀχεύονται μὲν καὶ ὀχεύουσι
 τετράμηνιοι, ὥστε δὲ γεννᾶν καὶ ἐκτρέφειν, ἐξάμηνιοι,
 ἑνιαχοῦ δ' οἱ κάπροι δεκάμηνιοι ἄρχονται ὀχεύειν.
 ἀγαθοὶ δὲ μέχρι ἐπὶ τριετές. κύων δ' ὡς ἐπὶ τὸ
 πολὺ μὲν ὀχεύεται ἑνιαυσία καὶ ὀχεύει ἑνιαύσιος,
 5 ἐνίοτε δὲ συμβαίνει ταῦτα καὶ ὀκταμήνιοις· μᾶλλον
 δὲ τοῦτο γίνεταί ἐπὶ τῶν ἀρρένων ἢ τῶν θηλειῶν.
 κύει δ' ἐξήκοντα καὶ μίαν ἢ δύο ἢ τρεῖς ἡμέρας τὸ
 μακρότατον· ἑλαττον δ' οὐ φέρει τῶν ἐξήκονθ' ἡμε-
 ρῶν, ἀλλ' ἂν τι καὶ γένηται, οὐκ ἐκτρέφεται εἰς
 τέλος. τεκοῦσα δὲ πάλιν ὀχεύεται ἕκτω μηνί, καὶ
 10 οὐ πρότερον. ἵππος δ' ὀχεύειν ἄρχεται διετῆς καὶ
 ὀχεύεσθαι, ὥστε καὶ γεννᾶν· τὰ μέντοι ἔκγονα τὰ
 κατὰ τούτους τοὺς χρόνους ἐλάττω καὶ ἀσθενικώ-
 τερα. ὡς δ' ἐπὶ τὸ πλείστον τριετῆς ὀχεύει καὶ
 ὀχεύεται. καὶ ἐπιδίδωσι δ' αἰεὶ ἐπὶ τὸ βελτίω τὰ
 15 ἔκγονα γεννᾶν μέχρι ἐτῶν εἴκοσιν. ὀχεύει δ' ὁ ἵππος
 ὁ ἄρρην μέχρι ἐτῶν τριάκοντα καὶ τριῶν, ἢ δὲ θήλεια
 ὀχεύεται μέχρι τετταράκοντα ἐτῶν, ὥστε συμβαίνει
 σχεδὸν διὰ βίου γίνεσθαι τὴν ὀχέλιαν· ζῆ γὰρ ὡς ἐπὶ
 τὸ πολὺ ὁ μὲν ἄρρην περὶ πέντε καὶ τριάκοντα ἔτη
 ἢ δὲ θήλεια πλείω τῶν τετταράκοντα· ἤδη δέ τις
 20 ἐβίωσεν ἵππος ἔτη ἐβδομήκοντα καὶ πέντε. ὄνος
 δὲ τριακοντάμηνος ὀχεύει καὶ ὀχεύεται. οὐ μέντοι
 γεννώσκει γ' ὡς ἐπὶ τὸ πολὺ ἀλλ' ἢ τριετείς ἢ τριετείς
 καὶ ἐξάμηνιοι.¹ ἤδη δὲ καὶ ἑνιαυσία ἐκύησεν ὥστε

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course first occurs with pigs at eight months ; the sow
 litters at a year (this fits in with her period of gesta-
 tion). The boar can generate at eight months, but the
 litter is poor until he is a year old. But, as I have said,
 the ages do not turn out thus in all instances : some-
 times boars and sows have intercourse at four months,
 and at six months can produce and rear a litter ;
 sometimes boars begin intercourse at ten months.
 They remain capable of it until about three years old.
 With dogs and bitches sexual intercourse generally
 begins at the end of their first year, sometimes at the
 end of eight months, but this occurs more commonly
 with the dog than with the bitch. The gestation
 period is sixty-one, sixty-two, or sixty-three days
 at the most ; it is never less than sixty ; and if
 it is, and if any offspring is produced, it is not reared
 to maturity. After her delivery the bitch will resume
 intercourse in the sixth month but not sooner. Horse
 and mare begin intercourse at two years with effective
 result, though the offspring at this stage tend to be
 small and weak ; generally they begin at three years,
 and they produce better and better offspring up to
 the age of twenty years. The stallion is sexually
 active up to the age of thirty-three, the mare up to
 forty, so that in fact they are both sexually active
 almost throughout their lives : the stallion normally
 lives to about thirty-five, the mare to beyond forty,
 though a case has been known of a horse that lived to
 be seventy-five. The ass, both sexes, is capable of
 intercourse at thirty months, but normally they do
 not produce offspring until three or three-and-a-half
 years ; though, here again, an instance has been

¹ sic Sn. (docente Cs.), A.-W., Dt. : ἀλλὰ διετείς ἢ καὶ τριετείς
 καὶ ἐξάμηνιοι PD : ἀλλ' ἢ τριετῆς ἢ διετῆς καὶ ἐξάμηνος AC, vulg.

545 b

καὶ ἐκτραφήναι. καὶ βοῦς ἐνιαυσία ἔτεκεν ὥστε καὶ ἐκτραφήναι· καὶ τὸ μέγεθος ἠϋξήθη ὅσον ἔμελλε, 25 καὶ οὐκέτι.

Αἱ μὲν οὖν ἀρχαὶ τοῖς ζώοις τούτοις τῆς γεννήσεως τοῦτον ἔχουσι τὸν τρόπον.

Γενᾶ δ' ἄνθρωπος μὲν τὸ ἔσχατον μέχρι ἑβδομή-
κοντα ἐτῶν ὁ ἄρρην, γυνή δὲ μέχρι πενήτηκοντα.
ἀλλὰ τοῦτο μὲν σπάνιον· ὀλίγοις γὰρ γεννᾶται ἐν
ταύταις ταῖς ἡλικίαις τέκνα· ὡς δ' ἐπὶ τὸ πολὺ τοῖς 30
μὲν πέντε καὶ ἐξήκοντα ὄρος, ταῖς δὲ πέντε καὶ
τετταράκοντα.

Πρόβατον δὲ τίκτει μέχρι ἐτῶν ὀκτώ, ἐὰν δὲ θερα-
πεύηται καλῶς, καὶ μέχρι ἑνδεκα· σχεδὸν δὲ διὰ βίου
546 a συμβαίνει ὀχεύειν καὶ ὀχεύεσθαι ἀμφοτέροις. οἱ δὲ
τράγοι πίονες ὄντες ἦττον γόνιμοὶ εἰσιν (ἀφ' ὧν καὶ
τὰς ἀμπέλους, ὅταν μὴ φέρωσι, τραγᾶν καλοῦσιν),
ἀλλὰ παρῖσχναινόμενοι δύνανται ὀχεύοντες γεννᾶν.
ὀχεύουσι δ' οἱ κριοὶ τὰς πρεσβυτάτας¹ πρῶτον, τὰς
5 δὲ νέας οὐ διώκουσιν. τίκτουσι δ', ὥσπερ εἴρηται
ἐν τοῖς πρότερον, αἱ νέαι ἐλάττω τὰ ἔκγονα τῶν
πρεσβυτέρων.

Κάπρος δ' ἀγαθὸς μὲν ὀχεύειν μέχρι ἐπὶ τριετές,
τῶν δὲ πρεσβυτέρων χεῖρω τὰ ἔκγονα· οὐ γὰρ ἔτι
γίγνεται αὐτῷ ἐπίδοσις οὐδὲ ῥώμη. ὀχεύειν δ'
10 εἴωθε χορτασθεῖς καὶ μὴ προβιβάσας ἄλλην· εἰ δὲ
μὴ, ὀλίγω χρονιωτέρα² ἢ ὀχεία γίγνεται καὶ μικρό-
τερα τὰ ἔκγονα. τίκτει δ' ἐλάχιστα μὲν ὄσ, ὅταν
ἦ πρωτοτόκος· δευτεροτόκος δ' οὐσα ἀκμάζει· γη-

¹ τὰς πρεσβυτέρας A : ταῖς πρεσβυτάταις PD.

² sic conl. Dt. (conferas vv. 24 seqq.): ὀλίγον χρ. P et v.l. A¹ :

known of a she-ass only a year old conceiving and successfully rearing a foal. A cow too has been known to calve at one year, and successfully reared its calf, which grew to the size one might expect, though not beyond that.

Such, then, are the ages at which these animals begin their reproduction.

Among human beings, a man can, at the longest, generate up to the age of seventy, a woman up to fifty; but both occur infrequently. Few people at these ages produce children. Generally the limit for men is sixty-five, for women forty-five.

The ewe bears up to eight years, and if well looked after up to eleven: both ram and ewe are sexually active throughout practically the whole of their lives. He-goats are less fertile if they are fat (that is why they say that vines "are getting" "goaty" if they bear no fruit); but if they get well thinned down they can copulate and produce offspring. Rams copulate with the oldest ewes first, and do not run after the young ones. And, as has been said previously, the offspring of the young ones are smaller than those of the older.

The boar is good for breeding up to three years old, but the offspring of older ones is poorer, because their strength is no longer increasing. Normally, the boar will copulate after a feed and not immediately following a previous copulation: otherwise, the act takes slightly longer^b and the offspring are smaller. The sow produces fewest when it is her first litter: at her second litter she is in her prime. As age increases

^a Cf. G.A. 725 b 34.

^b An alternative reading is "takes less time."

ράσκουσα δὲ τίκει μὲν ὁμοίως, ὀχεύεται δὲ βρα-
 δύτερον· ὅταν δὲ πεντεκαίδεκαετείς ὦσιν, οὐκέτι
 γεννώσιν ἀλλὰ γραῖαι γίνονται.¹ ἔαν δ' εὐτραφῆς
 15 ἦ, θᾶπτον ὄρμᾳ πρὸς τὰς ὀχείας καὶ νέα καὶ γη-
 ράσκουσα· ἔγκυος δ' οὖσα ἔαν παινῆται σφόδρα,
 ἔλαττον ἴσχει τὸ γάλα μετὰ τὸν τόκον. τὰ δ' ἔκγονα
 κατὰ μὲν τὴν ἡλικίαν βέλτιστα (ὄσα)² ἐν ἀκμῇ, κατὰ
 δὲ τὰς ὥρας, ὅσα τοῦ χειμῶνος ἀρχομένου γίνονται·
 20 χεῖριστα δὲ τὰ θερινά· καὶ γὰρ μικρὰ καὶ λεπτὰ καὶ
 ὑγρά. ὁ δ' ἄρρη, ἔαν μὲν εὐτραφῆς ἦ, πᾶσαν ὥραν
 ὀχεύει δύναται, καὶ μεθ' ἡμέραν καὶ νύκτωρ· εἰ δὲ
 μῆ, μάλιστα τὸ γ' ἔωθεν· καὶ γηράσκων ἦττον αἰεί,
 ὥσπερ εἴρηται καὶ πρότερον. πολλάκις δ' οἱ ἀδύ-
 νατοι ἢ διὰ τὴν ἡλικίαν ἢ δι' ἀσθένειαν, οὐ δυνάμενοι
 25 ταχέως ὀχεύειν, κατακλινομένης τῆς θηλείας διὰ τὸ
 κάμνειν τῇ στάσει συγκατακλιθέντες πλησιάζουσιν.
 κῦσκεται δὲ μάλιστα ἢ ὕς, ἐπειδὴν θυῶσα κατα-
 βάλλη τὰ ὦτα· εἰ δὲ μῆ, οὐκ, ἀλλ'³ ἀναθυᾶ πάλιν.
 Αἰ δὲ κύνες ὀχεύονται οὐ διὰ βίου ἀλλὰ μέχρι τινὸς
 ἀκμῆς⁴· ὡς μὲν οὖν⁵ ἐπὶ τὸ πολὺ μέχρι ἑτῶν δώδεκα
 30 αἰ τ' ὀχείαι συμβαίνουσι καὶ αἰ κηῖσεις αὐτῶν. οὐ
 μὴν ἀλλ' ἤδη τισὶ καὶ ὀκτωκαίδεκα ἔτη γεγονόσι
 καὶ εἴκοσι συνέβη καὶ θηλείαις ὀχευθῆναι καὶ ἄρρεσι
 γεννηῆσαι. ἀφαιρεῖται δὲ [καὶ]⁶ τὸ γῆρας ὥστε μῆ
 γεννᾶν μηδὲ τίκειν, καθάπερ καὶ ἐπὶ τῶν ἄλλων.

¹ γραῖα γ. C: ἀγριαίνονται PD, Cs., Sn., Pi.: ἄγοι γ. tent. A.-W.: fort. στείραι γ. Dt.: non pariet nisi fuerit multum pinguis [et] in deliciis Σ, unde credas ἀλλ' ἢ πειραι γίνονται (vel παινῆται) olim scriptum fuisse.

² ὄσα supplevi, ἄ Dt.

³ μῆ, οὐκ, ἀλλ' Dt.: μῆ οὐ ἀλλ' D, Cs., μῆ οὐ, ἀλλ' A.-W.: μῆ οὐ P: μῆ ὅταν AC: μῆ, vulg., Pi.

⁴ τ. ἄ. AC: ἄ. τ. PD, vulg.

she continues to breed, but she is slower at inter-
 course. When they get to fifteen years, they no
 longer produce but are growing ancient.^a If a sow is
 well fed it is more ready for intercourse, both in
 youth and age; but if while pregnant it gets unduly
 fat, its yield of milk after parturition is smaller. As
 for the offspring, so far as the age of their parents is
 concerned, the best are those produced from parents
 in their prime; so far as seasons of the year are con-
 cerned, those produced at the beginning of winter.
 The poorest are those produced in summer: these
 are small, thin, and flabby. The boar, if well fed, can
 copulate at any time of day or night, but otherwise
 prefers the early morning. As age advances, his
 activity grows progressively less, as has been stated
 already. Very often when boars that are impotent
 through age or weakness are unable to copulate with
 speed, the sow will get tired of standing up and will
 lie down, and thus they will have intercourse lying
 side by side. The sow is most certain to conceive if
 it drops its ears at rutting time^b; otherwise it fails
 to do so, and a second rutting occurs.

Bitches take part in intercourse not throughout
 their lives^c but up to a certain point of maturity. In
 general, intercourse and conception occur until they
 are twelve years old; nevertheless cases have been
 known both of dogs and of bitches generating re-
 spectively and conceiving up to the age of eighteen
 or twenty. But age tends to decrease both sexes'
 capacity, as in other animals.

^a Probably the text should be emended to read "unless they grow fat."

^b Cf. 573 b 7 f.

^c But cf. 574 b 27.

⁵ οὖν C: om. APD, vulg.

⁶ καὶ del. A.-W., Dt.

546 b Ἡ δὲ κάμηλός ἐστι μὲν ὀπισθοθηρτικὸν καὶ ὀχεύεται ὡσπερ εἴρηται πρότερον· τῆς δ' ὀχείας ὁ χρόνος ἐν τῇ Ἀραβίᾳ κατὰ τὸν Μαιμακτηριῶνα μῆνα. κύει δὲ δώδεκα μῆνας, τίκτει δ' ἐν ἔστι γὰρ μονοτόκον. ἄρχεται δὲ τῆς ὀχείας ἢ θήλεια
 5 τριετῆς οὔσα καὶ ὁ ἄρρην τριετῆς ὦν· μετὰ δὲ τὸν τόκον ἐν ἔτος διαλιποῦσα ὀχεύεται ἢ θήλεια.

Ὁ δ' ἐλέφας ἄρχεται μὲν βαίνεισθαι ὁ μὲν νεώτατος δέκ' ἐτῶν, ὁ δὲ πρεσβύτατος πεντεκαίδεκα· ὁ δ' ἄρρην βαίνει πεντέτης ὦν ἢ ἐξέτης. χρόνος δὲ τῆς ὀχείας τὸ ἔαρ. πάλιν δὲ βαίνει μετὰ τὴν ὀχείαν
 10 διὰ τρίτου ἔτους· ὃν δ' ἂν ἐγκύμονα ποιήσῃ, τούτου πάλιν οὐχ ἄπτεται. κύει δ' ἔτη δύο, τίκτει δ' ἐν ἔστι γὰρ μονοτόκον· τὸ δ' ἔμβρυον γίγνεται ὅσον μόσχος δίμηνος ἢ τρίμηνος.

Περὶ μὲν οὖν τῆς ὀχείας τῶν ζώων τῶν ὀχευομένων τούτων ἔχει τὸν τρόπον.

XV 15 Περὶ δὲ τῆς γενέσεως καὶ τῶν ὀχευομένων καὶ τῶν ἀνοχεύτων λεκτέον, καὶ πρῶτον περὶ τῶν ὀστρακοδέρμων· τοῦτο γάρ ἐστιν ἀνόχευτον μόνον ὡς εἰπεῖν ὅλον τὸ γένος.

Αἱ μὲν οὖν πορφύραι τοῦ ἔαρος συναθροιζόμεναι εἰς ταῦτό ποιοῦσι τὴν καλουμένην μελίκηραν. τοῦτο
 20 δ' ἐστὶν οἶον κηρίον, πλὴν οὐχ οὔτω γλαφυρόν, ἀλλ' ὡσπερ ἂν εἰ ἐκ λεπυρίων ἐρεβίνθων λευκῶν πολλὰ συμπαγείη. οὐκ ἔχει δ' ἀνεωγμένον πόρον οὐδὲν τούτων, οὐδὲ γίνονται ἐκ τούτων αἱ πορφύραι, ἀλλὰ φύονται καὶ αὐταὶ καὶ τὰλλα τὰ ὀστρακοδέρμα

The female camel is retromingent and submits to the male as has been already described ^a: the season for intercourse, in Arabia, is about the month of Maimakterion. Its gestation period is twelve months, and it produces one offspring at a time; it is uniparous. Both sexes enter upon intercourse at the age of three years. The female will not resume intercourse after parturition in less than a year.

The female elephant begins to submit to the male at ten years of age at the youngest, and never later than fifteen; the male copulates when five or six years old. The season for it is the spring. The male will not have intercourse a second time until three years have passed, and never touches again a female it has once impregnated. The period of gestation is two years; the number of young produced at a time, one—another instance of a uniparous animal. The embryo reaches the size of a calf two or three months old.

This completes our account of the manner of copulation in those animals where it occurs.

We must now go on to speak of the generation both XV of them and of the non-copulating animals. First, 4. Reproduction: then, the Testacea, for the Testacea are practically (1) Bloodless animals: the only group which in its totality is non-copulating. (a) Testacea.

The purpuras gather together in large numbers in spring into some one place and produce the so-called honeycomb. This is similar to the bee's honeycomb, except that it is not so neat: it rather resembles a large number of small white chickpea husks compacted together. None of these objects, however, has any open passage, and the purpuras do not come into being out of them: these, and all other Testacea

^a At 540 a 13.

ἐξ ἰλύος καὶ συσσήψεως. τοῦτο δὲ συμβαίνει ὡσπερ
 25 ἀποκάθαρμα καὶ ταύταις καὶ τοῖς κήρυξιν· κηριά-
 ζουσι γὰρ καὶ οἱ κήρυκες. γίνονται μὲν οὖν καὶ τὰ
 κηριάζοντα τῶν ὀστρακοδέρμων τὸν αὐτὸν τρόπον
 τοῖς ἄλλοις ὀστρακοδέρμοις, οὐ μὴν ἀλλὰ μᾶλλον
 ὅταν προὔπαρξη τὰ ὁμοιογενῆ. ἀφιάσι γὰρ ἀρχό-
 30 ριῶδη συνίσταται. ταῦτα μὲν οὖν ἅπαντα διαχεῖται,
 ἐφήσει δ' ὃ εἶχεν¹ εἰς τὴν γῆν· καὶ ἐν τούτῳ τῷ
 τόπῳ γίνονται ἐν τῇ γῆ συστάνα πορφύρια μικρά,
 ἃ ἔχουσαι ἀλίσκονται αἱ πορφύραι ἐφ' αὐτῶν,² ἔνια
 547 a δ' οὐπω διηκριβωμένα τὴν μορφήν. εἰάν δὲ πρὶν
 ἐκτεκεῖν ἀλώσιν, ἐνίστε ἐν ταῖς φορμίσι οὐχ ὅπου
 ἔτυχεν³ ἐκτίκτουσιν, ἀλλ' εἰς ταῦτο ἰοῦσαι, ὡσπερ
 καὶ ἐν τῇ θαλάττῃ, καὶ διὰ τὴν στενοχωρίαν γίνε-
 ται⁴ οἰοεὶ βότρυς.

Εἰσι δὲ τῶν πορφυρῶν γένη πλείω, καὶ ἔνια μὲν
 5 μεγάλοι, ὅσον αἶ⁵ περὶ τὸ Σίγειον καὶ Λεκτόν, αἱ δὲ
 μικραί, ὅσον ἐν τῷ Εὐρίπῳ καὶ περὶ τὴν Καρίαν.
 καὶ αἱ μὲν ἐν τοῖς κόλποις μεγάλοι καὶ τραχεῖαι,
 καὶ τὸ ἄνθος αὐτῶν αἱ μὲν πλείστα μέλαν ἔχουσιν,
 ἔνια δ' ἐρυθρόν καὶ μικρόν· γίνονται δ' ἔνια τῶν
 10 μεγάλων καὶ μνάται· αἱ δ' ἐν τοῖς αἰγιαλοῖς καὶ περὶ
 τὰς ἀκτὰς τὸ μὲν μέγεθος γίνονται μικραί, τὸ δ'

¹ ὃ εἶχεν] ἰχώρα ex Athen. Sn., Buss.: εἶον ἰχώρα Pi.

² ἐφ' αὐτῶν Pi., Dt.: ἐπ' αὐτῶν vulg. (ἐπ' om. P).

³ ἔτυχεν ACD, edd.: ἔτυχον P, vulg., A.-W.

⁴ γίνεται A: γίνονται CPD, vulg.

⁵ αἱ PD, vulg.: om. AC.

^a See the qualification of this statement at *G.A.* 762 a 10 ff.,
 quoted in n. on 539 a 23.

^b i.e., spontaneously; but at *G.A.* 762 a 8 ff. "all which

too, grow out of mud and putrefying matter.^a This
 "honeycomb" is in fact a sort of refuse in the case
 both of the purpuras and the trumpet-shells—the
 latter produce it as well. Now although it is true that
 these honeycombing Testacea come into being in the
 same way as other Testacea,^b yet they are produced
 in greater numbers where those of the same kind have
 been before. When they begin honeycombing, they
 emit a sticky mucous substance, which sets into the
 husk-like formations. The latter all dissolve, but they
 deposit their contents on the ground; and that is the
 place where the tiny purpuras which have taken form
 in the earth come into existence; and grown ones
 are caught with these small ones upon them, some of
 them so small that they have not yet assumed any
 articulate shape. If they are caught before producing
 this deposit, sometimes they produce it in the fish-
 baskets, not in any random place, but after they have
 collected together into one place, just as they do when
 in the sea, and owing to the cramped space available
 the result is like a bunch of grapes.

There are quite a number of kinds of purpuras:
 some are large, like those found near Sigeion and Lek-
 ton; others are small, like those found in the Euripus
 and on the Carian coast. Those found in bays are large
 and rough, and in most of these the bloom^c is dark-
 coloured, though in some it is red and small. Some
 of the large ones attain a weight of one mina. Those
 found on beaches and along rocky coasts are small in

neither produce side-shoots nor make 'honeycombs' repro-
 duce by spontaneous generation."

^c Which yields the dye. For an account of the industry
 see D'Arcy Thompson, *G.G.F.*, s.v. πορφύρα. See also
 Lloyd B. Jensen, "Royal Purple of Tyre," in *Journal of*
Near Eastern Studies, XXII (1963), pp. 104-118.

ἄνθος ἐρυθρὸν ἔχουσιν. ἔτι δ' ἐν μὲν τοῖς προσβο-
 ρεῖοις μέλαιναι, ἐν δὲ τοῖς νοτίοις ἐρυθραὶ ὡς ἐπὶ τὸ
 πλείστον εἰπεῖν. ἀλίσκονται δὲ τοῦ ἔαρος, ὅταν
 κηριάζωσιν· ὑπὸ κύνα δ' οὐχ ἀλίσκονται· οὐ γὰρ
 15 νέμονται, ἀλλὰ κρύπτουσι ἑαυτὰς καὶ φωλεύουσιν.
 τὸ δ' ἄνθος ἔχουσιν ἀνὰ μέσον τῆς μήκωνος καὶ τοῦ
 τραχήλου· τούτων δ' ἐστὶν ἡ σύμφυσις πυκνή, τὸ δὲ
 χρῶμα ἰδεῖν ὡσπερ ὑμῆν λευκός, ὃν ἀφαιροῦσιν·
 θλιβόμενος δὲ βάπτει καὶ ἀνθίζει τὴν χεῖρα. δια-
 τείνει δ' αὐτὴν οἶον φλέψ· τοῦτο δὲ δοκεῖ εἶναι τὸ
 20 ἄνθος. ἡ δ' ἄλλη φύσις οἶον στυπτηρία.¹ ὅταν δὲ
 κηριάσωσιν² αἱ πορφύραι, τότε χεῖριστον ἔχουσι τὸ
 ἄνθος. τὰς μὲν οὖν μικρὰς μετὰ τῶν ὄστράκων
 κόπτουσιν· οὐ γὰρ ῥάδιον ἀφελεῖν· τῶν δὲ μειζόνων
 περιελόντες τὸ ὄστρακον ἀφαιροῦσι τὸ ἄνθος. διὸ
 καὶ χωρίζεται ὁ τράχηλος καὶ ἡ μήκων· μεταξὺ γὰρ
 25 τούτων τὸ ἄνθος, ἐπάνω τῆς καλουμένης κοιλίας·
 ἀφαιρεθέντος οὖν ἀνάγκη διηρηθῆναι. σπουδάζουσι
 δὲ ζώσας κόπτειν· ἐὰν γὰρ πρότερον ἀποθάνῃ, συν-
 εξεμεί τὸ ἄνθος· διὸ καὶ φυλάττουσιν ἐν τοῖς κύρ-
 τοις, ἕως ἂν ἀθροίσωσι καὶ σχολάσωσιν. οἱ μὲν οὖν
 ἀρχαῖοι πρὸς τοῖς δελείωσιν οὐ καθίεσαν οὐδὲ προσ-
 30 ἦπτον τοὺς κύρτους, ὥστε συνέβαινεν ἀνεσπασμένην
 ἤδη πολλάκις ἀποπίπτειν· οἱ δὲ νῦν προσάπτουσιν,
 ὅπως ἐὰν ἀποπέσῃ, μὴ ἀπολλύηται. μάλιστα δ'

¹ τὸ δ' ἄνθος v. 16 hucusque secl. Dt.

size, and their bloom is red. Again, those found in
 northern districts are dark-coloured, in southern dis-
 tricts red, for the most part. They are caught in
 spring-time, when they are honeycombing, but they
 are not caught during the dog-days, because then
 they do not feed but hide themselves away in holes.
 The bloom is situated between the *mecon* and the
 neck: these are firmly attached to each other. In
 colour it looks like a white membrane, and this mem-
 brane is the part people take out: when squeezed it
 stains and dyes your hand. Extending through the
 animal is a sort of blood-vessel; and this, so it would
 seem, is the actual bloom. The rest of the substance
 is a sort of astringent. When the purpuras have
 honeycombed, their bloom is at its worst. The small
 ones people break up, shell and all, because it is not
 easy to extract <the bloom>; in the case of the larger
 ones they remove the shell and take out the bloom.
 To do this, the neck and the *mecon* are separated,
 because the bloom lies between them, above the so-
 called stomach, and therefore it cannot be got out
 unless they have been separated. They make every
 effort to break them up while they are alive, because
 if they die before this is done, they vomit the bloom
 out, and that is why they keep them in weels until
 they have collected a fair number of them and have
 leisure to deal with them. In former times they did
 not let down weels with the bait nor fasten them on,
 with the result that the animal frequently dropped
 off after being pulled up; but present-day fishermen
 do fasten them on, so that if the animal falls off it is
 not lost. It has the greatest tendency to drop off if

² κηριάσωσιν Sn., Dt.: κηριάζωσιν APD, vulg.: ἀκηριάζω-
 σιν C.

547 a

ἀποπίπτει, ἔαν πλήρης ἦ· κενῆς δ' οὔσης καὶ ἀπο-
σπάσαι χαλεπόν. ταῦτα μὲν οὖν τὰ συμβαίνοντα

547 b ἴδια περὶ τὰς πορφύρας ἐστίν.

Τὸν αὐτὸν δὲ τροπὸν γίνονται ταῖς πορφύραις καὶ
οἱ κήρυκες καὶ τὴν αὐτὴν ὥραν. ἔχουσι δὲ καὶ τὰ
ἐπικαλύμματα καὶ ταῦτα¹ ἀμφοτέρω καὶ τὰλλα τὰ
στρομβιώδη, ἐκ γενετῆς ἅπαντα· νέμονται δ' ἐξεί-
5 ροντα² τὴν καλουμένην γλώτταν ὑπὸ τὸ κάλυμμα.
τὸ δὲ μέγεθος τῆς γλώττης ἔχει ἢ πορφύρα μείζον
δακτύλου, ὧ νέμεται καὶ διατρυπᾶ τὰ κογχύλια καὶ
τὸ αὐτῆς³ ὄστρακον.⁴ ἔστι δὲ καὶ ἡ πορφύρα καὶ ὁ
κῆρυξ ἀμφοτέρω μακρόβια· ζῆ γὰρ ἡ πορφύρα περὶ
ἔτη ἕξ, καὶ καθ' ἕκαστον ἐνιαυτὸν φανερά ἐστὶν ἢ
10 αὔξησις τοῖς διαστήμασι τοῖς ἐν τῷ ὄστράκῳ τῆς
ἑλικος. κηριάζουσι δὲ καὶ οἱ μύες.⁵

Τὰ δὲ λιμνόστρεα καλούμενα, ὅπου ἂν βόρβορος
ἦ, ἐνταῦθα συνίσταται πρῶτον αὐτῶν ἢ ἀρχή. αἱ δὲ
κόγχαι καὶ αἱ χῆμαι καὶ οἱ σωλήνες καὶ οἱ κτένες ἐν
τοῖς ἀμμώδεσι λαμβάνουσι τὴν σύστασιν. αἱ δὲ
15 πίνναι ὄρθαι φύονται ἐκ τῆς βύσσου⁶ ἐν τοῖς ἀμμώ-
δεσι καὶ βορβορώδεσι. ἔχουσι δ' ἐν αὐταῖς πιννο-
φύλακα, αἱ μὲν καρδίον αἱ δὲ καρκίνιον· οὐ στερι-
σκόμεναι διαφθείρονται θάπτον.⁷

¹ καὶ ταῦτα conl. A.-W.: κατὰ ταῦτα codd.

² ἐξείροντα Sn. ex Athen., edd.: ἐξείροντα A C, vulg.: ἐξ-
εγείροντα PD.

³ αὐτῆς Buss., Pi., A.-W. (ἐαυτῆς Athen.): αὐτῆς codd., vulg.

⁴ ἔχουσι v. 3 hucusque secl. A.-W.

⁵ haec verba secl. A.-W., quia G.A. 761 b 30 repugnant.

⁶ τῆς βύσσου Th.: τοῦ βύσσου codd., edd.: τοῦ βυθοῦ A.-W.
ex Athen.

⁷ ἔχουσι hucusque secl. Dt.

^a Cf. P.A. 661 a 21.

^b Cf. G.A. 763 a 21 f.

^c Cf. G.A. 763 a 29 ff.

it is full; if it is empty, then even to pull it off is difficult. Very well, then: these are the phenomena peculiar to the purpuras.

The trumpet-shells come into existence in the same way as the purpuras and at the same season. In addition, both of these creatures, and the rest of the spiral shells, have the opercula; they all have them from birth, and they feed by extending the so-called tongue under the operculum. As for size, the tongue of the purpura is larger than a man's finger: with it the animal feeds, and bores through other creatures' shells^a and those of its own kind. Both the purpura and the trumpet-shell are long-lived: the purpura lives about six years, and every year its growth is clearly observable from the intervals in the shell of the spiral.^b Mussels also produce "honeycomb."

With regard to the so-called lagoon-oysters: wherever there is mud,^c there the "principle"^d of them first takes shape.^e Cockles^f and clams and razor-fishes and scallops take their rise^g in sandy places. Pinnae grow up erect out of their *byssos*^h in sandy and muddy places. They have inside them a "pinna-guard"; some of them have a small carid,ⁱ some a small crab^j; and if they are deprived of it they quickly perish.

^a See Notes, § 12.

^c See Notes, § 27.

^f This term seems to be used generally for cockles, mussels, and similar shellfish.

^g See Notes, § 27.

^h I have adopted the reading suggested by Th. The *byssos* is the tuft of silky fibres by which the animal is anchored. The traditional reading would give "from the bottom of the water."

ⁱ *Pontonia pinnophylax*.

^j *Pinnotheres* [sic] *pinnotheres*.

Ὅλως δὲ πάντα τὰ ὄστρακώδη γίγνεται μὲν¹
 αὐτόματα ἐν τῇ ἰλύϊ, κατὰ δὲ² τὴν διαφορὰν τῆς
 20 ἰλύος ἕτερα, ἐν μὲν τῇ βορβορώδει τὰ ὄστρεα, ἐν δὲ
 τῇ ἀμμώδει κόγχαι καὶ τὰ εἰρημένα, περὶ δὲ τὰς
 σήραγγας τῶν πετριδίων τήθυα καὶ βάλανοι καὶ τὰ
 ἐπιπολάζοντα, οἷον αἱ λεπάδες καὶ οἱ νηρέται.
 ἅπαντα μὲν οὖν τὰ τοιαῦτα τὴν αὐξῆσιν ἔχει ταχείαν,
 μάλιστα δ' αἶ τε πορφύραι καὶ οἱ κτένες· ταῦτα γὰρ
 25 ἐν ἐνιαυτῷ γίγνεται τέλεια. ἐμφύονται δ' ἐν ἐνίοις
 τῶν ὄστρακοδέρμων καρκῖνοι λευκοί, τὸ μέγεθος
 μικροὶ πάνπαν, πλείστοι μὲν ἐν τοῖς μυσὶ τοῖς
 πυελώδεσιν,³ ἔπειτα καὶ ἐν ταῖς πίνναις οἱ καλού-
 μενοι πιννοτήραι. γίνονται δὲ καὶ ἐν τοῖς κτεσὶ
 καὶ ἐν τοῖς λιμνοστρέοις· αὐξῆσιν δ' οὐδεμίαν οὗτοι
 30 ἐπίδηλον λαμβάνουσιν. φασὶ δ' αὐτοὺς οἱ ἀλιεῖς
 ἅμα συγγίγνεσθαι γιγνομένοις. ἀφανίζονται δὲ τινα
 χρόνον ἐν τῇ ἄμμῳ καὶ οἱ κτένες, ὥσπερ καὶ αἱ
 πορφύραι.⁴

Φύεται μὲν οὖν τὰ ὄστρεα καθάπερ εἴρηται,
 548 a φύεται δ' αὐτῶν τὰ μὲν ἐν τοῖς τενάγεσι,⁵ τὰ δ' ἐν
 τοῖς αἰγιαλοῖς, τὰ δ' ἐν τοῖς πηλώδεσι⁶ τόποις, ἕνια
 δ' ἐν τοῖς σκληροῖς καὶ τραχέσι,⁷ τὰ δ' ἐν τοῖς
 ἀμμώδεσιν. καὶ τὰ μὲν μεταβάλλει τοὺς τόπους,

¹ μὲν conl. Dt.: καὶ codd.: delent A.-W.

² δὲ hic Dt., post ἕτερα PD: om. AC, vulg.

³ πυλώδεσι AC: πηλώδεσιν Sn., Buss. ex Gul.

⁴ ἀφανίζονται . . . πορφύραι secl. A.-W.

⁵ στεναγέσι AC: πελάγεσι mavult Dt.: μοx τὰ δ' ἐν τοῖς
 αἰγιαλοῖς om. PD, A.-W.: et quidam eius in pelago, quidam
 in rira, et quidam in luto Σ.

⁶ sic Dt.: σπηλώδεσι C: πυελώδεσι P: σπιλώδεσι A, vulg.,
 A.-W.: σπλαδάδεσι D. ⁷ ἕνια . . . τραχέσι secl. A.-W.

Speaking generally, all the Testacea arise by spontaneous generation^a in mud, though they exhibit differences according as the mud differs^b: in slimy mud oysters grow, in sandy mud cockles and the others I mentioned; on the eroded hollows of rocks the *tethya*, barnacles, and the commoner kinds,^c such as limpets and *nerites*. Now all of these display swift growth, and especially the purpuras and the scallops, which reach their complete development within a year. Inside some Testacea white crabs^d grow, very small in size, and they are most plentiful in the trough-shaped mussels. Also in the pinnas are found the pinna-guards^e as they are called. They exist in scallops and in lagoon-oysters as well, and they never appear to grow any larger. Fishermen allege that they come into being simultaneously with their hosts. Further, for a time, scallops, just like purpuras, disappear in the sand.

Very well, then: shell-fish grow as I have described. Some of them grow in shallow^f water, some on the shore, some in muddy places, some on hard rough ground, and some in sandy positions. Some move about from place to place, others do not. Of the latter,

^a The belief in spontaneous generation persisted until the 17th century. The Italian naturalists Francesco Redi (1626-1698) and Lazzaro Spallanzani (1729-1799) showed that no insects, maggots, or infusoria could arise spontaneously; Pasteur in 1864 demonstrated the same about bacteria. (Balss.)

^b On the influence of the material upon the form of an animal or plant cf. *G.A.* 738 b 35, 762 a 25.

^c Sometimes translated "kinds that remain on the surface."

^d *Pinnotheres* [sic] *pisum*.

^e See above, 547 b 16. Only the female enters the shell; the male does not enter except for breeding. (Balss.)

^f An alternative proposal would read "out at sea."

τὰ δ' οὖν. τῶν δὲ μὴ μεταβαλλόντων αἱ μὲν πίνναι
 5 ἔρριζώνται, οἱ δὲ σωλήνες καὶ αἱ κόγχαι ἀρρίζωτοι
 διαμένουσιν· ὅταν δ' ἀνασπασθῶσιν, οὐκέτι δύναν-
 ται ζῆν.

[Ὁ δὲ καλούμενος ἀστὴρ οὕτω θερμὸς ἐστὶ τὴν
 φύσιν, ὥσθ' ὅ τι ἂν λάβῃ, παραχρῆμα ἐξαιρούμενον
 διέφθον εἶναι. φασὶ δὲ καὶ σίνος μέγιστον εἶναι
 τοῦτο ἐν τῷ εὐρίπῳ τῷ τῶν Πυρραίων. τὴν δὲ μορφήν
 10 ὁμοίον ἐστὶ τοῖς γραφομένοις. γίνονται δὲ καὶ οἱ
 καλούμενοι πνεύμονες αὐτόματοι. ᾧ δ' οἱ γραφεῖς
 ὀστρέω χρώνται, πάχει τε πολὺ ὑπερβάλλει, καὶ
 ἐξῶθεν τοῦ ὀστράκου τὸ ἄνθος ἐπιγίγνεται· εἰσὶ δὲ
 τὰ τοιαῦτα μάλιστα περὶ τοὺς τόπους τοὺς περὶ
 Καρίαν.]¹

15 Τὸ δὲ καρκίνιον γίγνεται μὲν τὴν ἀρχὴν ἐκ τῆς
 γῆς καὶ ἰλύος, εἴτ' εἰς τὰ κενὰ τῶν ὀστράκων εἰσ-
 δύεται, καὶ αὐξανόμενον μετεισδύνει πάλιν εἰς ἄλλο
 μείζον ὀστρακον, οἷον εἰς τε τὸ τοῦ νηρείτου καὶ τὸ
 τοῦ στρόμβου καὶ τὸ² τῶν ἄλλων τῶν τοιούτων,
 πολλάκις δὲ καὶ³ εἰς τοὺς κήρυκας τοὺς μικροῦς.
 20 ὅταν δ' εἰσδύσῃ, συμπεριφέρει τοῦτο καὶ ἐν τούτῳ
 τρέφεται⁴ [πάλιν· καὶ αὐξανόμενον πάλιν εἰς ἄλλο
 μετεισδύνει μείζον].⁵

XVI Τὸν αὐτὸν δὲ τρόπον γίνονται τοῖς ὀστρακοδέρ-
 μοις καὶ τὰ μὴ ἔχοντα ὀστρακον,⁶ οἷον αἶ τε κνίδαι
 καὶ οἱ σπόγγοι ἐν ταῖς σήραξι τῶν πετρῶν. ἔστι
 25 δὲ τῶν κνιδῶν δύο γένη· αἱ μὲν γὰρ⁷ ἐν τοῖς κοίλοις
 οὐκ ἀπολλύονται τῶν πετρῶν, αἱ δ' ἐπὶ τοῖς λείοις

¹ secl. A.-W., Dt., Th.² τὸ ACP: om. vulg.

the pinnae are fast-anchored, whereas the razor-fish
 and cockles stay where they are unrooted, though
 when they are taken away,^a they cannot go on living.

[The starfish is so warm naturally that any object
 it has taken hold of, when suddenly pulled away is
 thoroughly scorched. They say it is a very great pest
 in the strait of Pyrrha. In shape it resembles the
 stars seen in drawings. Another animal which arises
 spontaneously is the sea-lung^b as it is called. The
 shells that painters use are extremely thick, and the
 bloom is on the outside surface of the shell. These
 are found chiefly in and around Caria.]

The hermit-crab^c comes into being to begin with
 out of earth and mud, and later on enters empty
 shells: as it grows it moves on into another shell
 which is larger, e.g., the shell of the *nerites*, or of the
 whelk and of other similar creatures; and often it
 goes even into small trumpet-shells: when it has
 gone in, it carries the shell about with it, and begins
 to feed inside it [again; and as it grows it moves on
 again into a larger one.]

In addition to the Testacea, the animals which have XVI
 no shells are produced in the same way, e.g., sea-
 anemones and sponges in the eroded hollows of rocks. (b) Sea-
 Of sea-anemones there are two kinds: one kind, anemones
 which lives in hollows, never breaks loose from the and
 rocks; the others live on smooth flat ledges, relax sponges.

^a Cf. 588 b 15.^b The jelly-fish; cf. P.A. 681 a 18.^c Cf. 529 b 20 f.³ καὶ PD: om. AC, vulg.⁴ στρέφεται ACP.⁵ secl. Dt., plura (ab ὅταν) A.-W.⁶ ὀστρακον AC: ὄστρακα PD, vulg.⁷ γὰρ Sn.: οὖν codd., vulg.

καὶ πλαταμώδεσιν ἀπολυόμεναι μεταχωροῦσιν. [καὶ αἱ λεπάδες δ' ἀπολύονται καὶ μεταχωροῦσιν.]¹

Τῶν δὲ σπόγγων ἐν ταῖς θαλάμαις γίνονται πινυοφύλακες. ἔπεστι δ' οἶον ἀράχμιον ἐπὶ τῶν θαλαμῶν, ὃ διοίγοντες καὶ συνάγοντες θηρεύουσι τὰ ἰχθύδια τὰ μικρά, πρὸς μὲν τὸ εἰσελθεῖν αὐτά, διοίγοντες,² ὅταν δ' εἰσέλθῃ, συνάγοντες.

Ἔστι δὲ τῶν σπόγγων τρία γένη, ὃ μὲν μανός, ὃ δὲ πυκνός, τρίτος δ' ὃν καλοῦσιν Ἀχιλλεῖον λεπτότατος καὶ πυκνότατος καὶ ἰσχυρότατος· ὃν ὑπὸ τὰ κράνη καὶ τὰς κνημίδας ὑποτιθέασιν, καὶ ἦττον ἢ πληγὴ ψοφεῖ. σπανιώτατος δὲ γίνεταί οὗτος. τῶν δὲ πυκνῶν οἱ σκληροὶ σφόδρα καὶ τραχεῖς τράγοι 5 καλοῦνται.

Φύονται δ' ἢ πρὸς πέτρα πάντες ἢ ἐν ταῖς θισί, τρέφονται δ' ἐν τῇ ἰλύϊ. σημεῖον δέ· ὅταν γὰρ ληφθῶσι, φαίνονται μεστοὶ ἰλύος, ὅπερ συμβαίνει καὶ τοῖς ἄλλοις τοῖς φυομένοις, (οἷς) ἀπὸ τῆς προσφύσεως ἔστιν ἢ τροφή. ἀσθενέστεροι δ' εἰσὶν οἱ πυκνοὶ τῶν μανῶν διὰ τὸ τὴν πρόσφυσιν εἶναι κατ' 10 ἔλαττον.

Ἔχει δὲ καὶ αἴσθησιν, ὡς φασίν. σημεῖον δέ· εἰάν γὰρ μέλλοντος ἀποσπᾶν αἰσθηταί, συνάγει ἑαυτὸν καὶ χαλεπὸν ἀφελεῖν ἔστιν. ταῦτό δὲ τοῦτο ποιεῖ καὶ ὅταν ἦ πνεῦμα πολὺ καὶ κλύδων, πρὸς τὸ μὴ ἀποπίπτειν. εἰσὶ δὲ τινες οἱ περὶ τοῦτου ἀμφισβη- 15 τοῦσιν, ὥσπερ οἱ ἐν Τορώνῃ.

Τρέφει δ' ἐν ἑαυτῷ ζῶα, ἔλμινθας τε καὶ ἕτερά

¹ om. Cs., secl. Sn., Pi., A.-W., Dt.

² διοίγ. αὐτά codd., vulg.: transp. Dt.

their hold, and move about. [Limpets too relax their hold and move about.]

In the chambers of sponges pinna-guards^a are produced. Over the chambers there is a sort of spider's web, and by opening and closing this they hunt and catch tiny fishes, opening the web to let them come in, and closing it once they are inside.

Of sponges there are three kinds: the first, loose-textured, the second, close-textured, and the third, which is named after Achilles, is the finest, most closely-textured and strongest of all: it is used for lining helmets and greaves; this deadens the noise of a blow on them. This kind is very infrequent. Those close-textured sponges which are specially hard and rough are called "goats."

Sponges all grow either attached to rocks or on beaches, and they get their nourishment in the mud. This is shown by the fact that when they are gathered they are seen to be full of mud. The same occurs in other growing things whose nourishment is derived from their adherence to some surface. The close-textured sponges are not as strong as the porous ones because the area of their attachment is less extensive.

Sponges have sensation, so it is said. This is shown allegedly by the fact that if the sponge becomes aware that someone is intending to pull it off, it contracts itself and is then difficult to detach. It does the same when there is a high wind or a rough sea, to prevent itself being torn away. There are some people, for instance those at Torone, who dispute this.

The sponge provides a home for animals inside it-

^a A crab, *Typton spongicola*.

³ ita Sn. in curis posterioribus, Dt.: οἷς om., mox οὔσα loco ἔστιν codd., vulg.

ἄττα, ἃ κατεσθίει,¹ ὅταν ἀποσπασθῆ, τὰ ἰχθύδια τὰ πετραῖα καὶ τὰς ρίζας τὰς ὑπολοίπους· ἐὰν δ' ἀπορραγῆ, φύεται πάλιν ἐκ τοῦ καταλοίπου καὶ ἀναπληροῦται.

Μέγιστοι μὲν οὖν γίνονται οἱ μανοί, καὶ πλείστοι
 20 περὶ τὴν Λυκίαν, μαλακώτατοι δ' οἱ πυκνοί· οἱ γὰρ Ἀχιλλεῖοι στιφρότεροι τούτων εἰσίν. ὅλως δ' οἱ ἐν τοῖς βαθέσι καὶ εὐδιευοῖς μαλακώτατοί εἰσιν· τὸ γὰρ πνεῦμα καὶ ὁ χειμῶν σκληρύνει, καθάπερ καὶ τὰλλα τὰ φυόμενα, καὶ ἀφαιρεῖται τὴν αὔξησιν· διὸ καὶ οἱ ἐν Ἑλλησπόντῳ τραχεῖς εἰσι καὶ πυκνοί, καὶ
 25 ὅλως οἱ τ' ἐπέκεινα Μαλέας² καὶ οἱ ἐντὸς³ διαφέρουσι μαλακότητι καὶ σκληρότητι. δεῖ δὲ μὴδ' ἄλλαν εἶναι σφόδρα· σήπεται γάρ, ὥσπερ τὰ φυόμενα. διὸ οἱ πρὸς ταῖς ἀκταῖς εἰσι κάλλιστοι, ἂν ὦσιν ἀγχιβαθεῖς· εὖ γὰρ κέκρανται πρὸς ἄμφω διὰ τὸ βάθος.
 30 Ἄπλυτοι δ' ὄντες καὶ ζῶντες ἰδεῖν μὲν εἰσι μέλανες. ἢ δὲ πρόσφυσις ἐστὶν οὔτε καθ' ἐν οὔτε κατὰ πᾶν· μεταξὺ γάρ εἰσι πόροι κενοί. περιτέταται δ' ὥσπερ ὑμῖν περὶ τὰ κάτω· κατὰ πλείω δ' ἐστὶν
 549 a ἢ πρόσφυσις.⁴ ἄνωθεν δ' οἱ μὲν ἄλλοι πόροι συγκεκλεισμένοι, φανεροὶ δ' εἰσι τέτταρες ἢ πέντε· διὸ φασὶν ἔνιοι τούτους εἶναι καθ' οὓς δέχεται τὴν τροφήν.

¹ κ. hic AC, post πετραῖα PD, vulg.: ἄττα, κατεσθίει δ', ὄτα, A.-W.

² Μαλέας (sc. Lesb.) prop. Th.

³ ἐντὸς edd.: ἐν τοῖς codd. ⁴ κατὰ . . . πρόσφυσις secl. Dt.

^a Lit., "helminths"; see 551 a 8. Sponges harbour so many different creatures that they have been described as "biological hotels."

self, worms^a and other creatures, which, when it gets detached, are devoured by small rock-fishes: so are the remnants of the sponge's roots. If the sponge gets broken off, a new one grows up again from the remaining portion and takes the place of the old one.

The loose-textured ones reach the largest size, and these are most plentiful around Lycia, whereas the close-textured ones are the softest: the Achilles sponges are firmer than these. In general, those which grow in deep calm waters are softest, because the effect of winds and storms is to harden them—as indeed it is to harden all other things that grow,—and inhibits their growth. That is why sponges in the Hellespont are rough and close-textured, and in general those which are found beyond, or this side of, Cape Malea, differ, respectively, in softness and hardness. On the other hand, however, their situation ought not to be too sunny, for then they putrefy, as plants do. Hence those near the shore are the best, provided they are at a good depth; for then the depth supplies them with a well-tempered situation against both adverse conditions.

Before they have been washed and cleaned, and while they are still alive, they are dark in appearance. Their attachment is not confined to one part of them, nor is it over their whole area, because in between there are passages, and these are unoccupied. There is a sort of membrane stretched over their underparts; and the attachment is spread over numerous places. On top, most of the passages are closed, but four or five are plain to see; hence some people say that these are the ones through which they take in their food.

"Ἔστι δ' ἄλλο γένος ὃ καλοῦσιν ἀπλυσίας διὰ τὸ
 5 μὴ δύνασθαι πλύνεσθαι· τοῦτο δὲ τοὺς μὲν μεγάλους
 πόρους ἔχει, τὸ δ' ἄλλο πυκνὸν ἔστι πάν· διατμηθὲν
 δὲ πυκνότερόν ἐστι καὶ γλισχρότερον τοῦ σπόγγου,
 καὶ τὸ σύνολον πνευμονώδες. ὁμολογεῖται δὲ μά-
 λιστα παρὰ πάντων τοῦτο τὸ γένος αἰσθησὶν ἔχειν
 καὶ πολυχρόνιον εἶναι. διάδηλοι δ' εἰσὶν ἐν τῇ
 10 θαλάττῃ πρὸς τοὺς σπόγγους τῶ τοὺς σπόγγους μὲν
 εἶναι λευκοὺς ὑφίζούσης¹ τῆς ἰλύος, τούτους δ' αἰεὶ
 μέλανας.

Τὰ μὲν οὖν περὶ τοὺς σπόγγους καὶ τὴν τῶν
 ὀστρακοδέρμων γένεσιν τοῦτον ἔχει τὸν τρόπον.

XVII Τῶν δὲ μαλακοστράκων οἱ κάραβοι μετὰ τὴν
 15 ὀχείαν κύουσι καὶ ἰσχοῦσι τὰ ψὰ περὶ τρεῖς μῆνας,
 Σκιρροφοριῶνα καὶ Ἑκατομβαιῶνα καὶ Μεταγειτ-
 νιῶνα· μετὰ δὲ ταῦτα προεκτίκτουσιν² ὑπὸ τὴν
 κοιλίαν εἰς τὰς πτύχας, καὶ αὐξάνεται αὐτῶν τὰ ψὰ
 ὡσπερ οἱ σκώληκες. τὸ δ' αὐτὸ τοῦτο καὶ ἐπὶ τῶν
 μαλακίων ἔστι καὶ τῶν ἰχθύων, ὅσοι ὠστοκοῦσιν·
 20 αὐξάνεται γὰρ πάντων τὸ ὠόν.

Τὸ μὲν οὖν ὠόν γίγνεται ψαθυρὸν τῶν καράβων,
 διηρημένον εἰς ὀκτῶ μοίρας· καθ' ἕκαστον γὰρ τῶν
 ἐπικαλυμμάτων τῶν ἐκ τοῦ πλαγίου πεφυκότων ἔστι
 χονδρῶδες τι πρὸς ὃ περιφύεται, καὶ τὸ ὄλον γίγνε-

¹ ὑφίζούσης Ald., Cs., A.-W.: ἐφίζούσης codd., Σ, vulg.:
 <μη> ἐφίζούσης Dt.: fortasse ἐξικμαζούσης.

² προεκτ- C, Cs., Pi., A.-W., Dt.: προστ- APD, vulg.

^a See Appendix B, p. 409.

^b In the *G.A.* Aristotle frequently remarks on the fact that the eggs of many animals "grow" after deposition; and this fact, though unappreciated for many centuries, is the basis of the modern distinction between cleidoic and non-cleidoic eggs. The walls of a cleidoic egg are permeable to

There is another kind of sponge, known as the *aplysia* (unwashable), because it cannot be washed and cleaned. It has the large passages, though the whole of the remainder is close-textured; and when dissected it is closer-knit and stickier than the ordinary sponge; in fact, the whole thing is similar to a lung. It is generally agreed that this kind has the faculty of sense-perception and is long-lived. They can be clearly distinguished in the sea from ordinary sponges because the latter are white when the mud has settled down, whereas these are always dark in colour.

This completes our description of sponges and the way in which Testacea come into being.

We go on now to the Crustacea. The female cray-
 fish after copulation conceives and retains its eggs
 for about three months, during Skirrophorion, Heka-
 tombaion and Metageitnion^a; after that they lay the
 eggs into the folds under the belly, and the eggs grow
 like larvae. The same occurs in Cephalopods and in
 the oviparous fishes: the eggs of all of them grow.^b

The egg of the crayfish is crumbly, and is divided
 into eight portions. Corresponding to each of the
 flaps placed along the side there is a cartilaginous
 formation to which the egg gets attached, and the

matter in the gaseous state only (*e.g.*, a hen's egg). Most aquatic animals, however, lay non-cleidoic eggs, *i.e.*, eggs which, though they have sufficient organic material (proteins, fats, carbohydrates, etc.) to make each an embryo, have insufficient water and inorganic materials, and these they have to absorb from their environment. Hence their "growth." Most of their increase is accounted for by water, but not all; *e.g.*, the greater part of the copper which is present in the respiratory blood-pigment of the octopus at the time of hatching is derived not from the egg as laid but from the sea-water.

549 a

ται ὡσπερ βότρυς· σχίζεται γὰρ ἕκαστον εἰς πλείω
 25 τῶν χονδρωδῶν. ταῦτα δὲ διαστέλλοντι μὲν γίννε-
 ται φανερά, προσβλέποντι δὲ συνεστηκός τι φαίνεται.
 καὶ γίννεται δὲ μέγιστα οὐ τὰ πρὸς τῷ πόρῳ ἀλλὰ
 τὰ κατὰ μέσον, ἐλάχιστα δὲ τὰ ἔσχατα. τὸ δὲ μέγε-
 θος τῶν ὤων τῶν μικρῶν ἐστὶν ἡλικὸν κεγχραμῖς.
 οὐκ εὐθύς δ' ἐστὶν ἐχόμενα τοῦ πόρου, ἀλλὰ κατὰ
 30 μέσον· ἐκατέρωθεν γὰρ ἀπὸ τῆς κέρκου καὶ ἀπὸ τοῦ
 θώρακος δύο διαστήματ' ἐπέχει μάλιστα¹. οὕτω γὰρ
 καὶ τὰ ἐπικαλύμματα πέφυκεν. αὐτὰ μὲν οὖν τὰ
 ἐκ τοῦ πλαγίου οὐ δύναται συμπεριλαμβάνειν, τοῦ
 δ' ἄκρου προσεπιτεθέντος καλύπτει πάντα, καὶ γί-
 ννεται τοῦτ' αὐτοῖς οἶον πᾶμα.

549 b

"Ἔοικε δὲ τὰ ὡὰ τίκτουσα προσάγειν πρὸς τὰ
 χονδρώδη τῷ πλάτει τῆς κέρκου προσαναπτυττο-
 μένης, καὶ προσπίεσασα εὐθύς καὶ κεκαμμένη ἀπο-
 τίκτειν. τὰ δὲ χονδρώδη κατὰ τοὺς καιροὺς τούτους
 αὐξάνεται καὶ δεκτικὰ γίννεται τῶν ὤων· πρὸς τὰ
 5 χονδρώδη γὰρ ἀποτίκτουσι, καθάπερ αἱ σηπῖαι πρὸς
 τὰ κλήματα καὶ τὸν φορυτόν.

Ἀποτίκτει μὲν οὖν τοῦτον τὸν τρόπον, συμπέφασα
 δ' ἐνταῦθα μάλιστα ἐν εἴκοσιν ἡμέραις ἀποβάλλει
 συνεστηκός καὶ ἄθρόον, ὡσπερ φαίνεται καὶ ἐκτός·
 εἰτ' ἐκ τούτων γίννονται οἱ κάραβοι ἐν ἡμέραις
 10 μάλιστα πεντεκαίδεκα, καὶ λαμβάνονται πολλάκις
 ἐλάττους ἢ δακτυλιαῖοι. προεκτίκτει μὲν οὖν πρὸ
 ἄρκτουρου, μετὰ δ' ἄρκτουρον ἀποβάλλει τὰ ὡὰ.
 τῶν δὲ κυφῶν καρίδων ἢ κήσις ἐστὶ περὶ τέτταρας
 μῆνας.

¹ ἐπ. μ. AC: μ. ἐπ. PD, vulg.

whole comes to resemble a bunch of grapes, each of the cartilaginous formations being split into several parts. These become plain if you pull them apart, though at first sight the whole appears to be a single compact object. The largest are not those near the passage but those in the middle, and the end ones are smallest. The small eggs are in size about as big as a fig-seed. They are not immediately up against the passage, but placed centrally: in both directions, tail side and trunk side, there are two intervals in between <with no eggs>, corresponding to the way in which the flaps grow. Now the side-flaps cannot close; but when the end-flap has been placed on top of them the animal covers them all, and this one acts as a sort of lid for them.

Apparently, when laying its eggs it brings them towards the cartilaginous formations, while the flat part of its tail is folded back over them; then it at once exerts pressure upon them, and in a bent posture releases the eggs. The cartilaginous formations at these seasons increase in size and become capable of accommodating the eggs, for it is on to them that the animal actually lays the eggs, just as the cuttlefish lays its eggs into twigs and wooden débris.^a

Such then is the manner in which the crayfish lays its eggs. After maturing them there for about twenty days, it sheds them in a compact mass, as can be seen quite clearly from outside; then in about fifteen days' time the small crayfish are produced out of them. These are quite often caught less than a finger's breadth in size. The crayfish, then, lays its eggs before <the morning rising of> Arcturus,^b and sheds them after that date. In the hunch-back carids the gestation period is about four months.

^a See below, 550 b 8.

^b See Appendix A, p. 399.

Γίνονται δ' οἱ μὲν κάραβοι ἐν τοῖς τραχέσι καὶ
 πετρώδεσιν, οἱ δ' ἀστακοὶ ἐν τοῖς λείοις· ἐν δὲ τοῖς
 15 πηλώδεσιν οὐδέτεροι· διὸ καὶ ἐν Ἑλλησπόντῳ μὲν
 καὶ περὶ Θάσον ἀστακοὶ γίνονται, περὶ δὲ τὸ
 Σίγειον καὶ τὸν Ἄθων κάραβοι. διασημαίνονται
 δὲ τοὺς τόπους αἱ ἄλιεῖς τοὺς τε τραχεῖς καὶ τοὺς
 πηλώδεις ταῖς τ' ἀκταῖς καὶ τοῖς ἄλλοις τοῖς τοι-
 οὔτοις σημείοις, ὅταν βούλωνται ἐν τῷ πελάγει
 20 ποιεῖσθαι τὴν θήραν. γίνονται δ' ἐν μὲν τῷ χει-
 μῶνι καὶ τῷ ἔαρι πρὸς τῇ γῆ μάλλον, τοῦ δὲ θέρους
 ἐν τῷ πελάγει, διώκοντα ὅτε μὲν τὴν ἀλέαν ὅτε δὲ
 τὸ ψῦχος.

Τοῖς δὲ χρόνοις παραπλησίως καὶ αἱ καλούμεναι
 ἄρκτοι τίκτουσι τοῖς καράβοις· διὸ καὶ τοῦ χειμῶνος
 καὶ πρὶν ἐκτεκεῖν τοῦ ἔαρος ἄριστα εἰσιν, ὅταν δ'
 25 ἐκτέκωσι, χεῖρισταί. ἐκδύνουσι δὲ τὸ κέλυφος τοῦ
 ἔαρος, ὥσπερ οἱ ὄφεις τὸ καλούμενον γῆρας, καὶ
 εὐθὺς γενόμενοι¹ καὶ ὕστερον καὶ οἱ καρκῖνοι καὶ οἱ
 κάραβοι.² εἰσὶ δ' οἱ κάραβοι μακρόβιοι πάντες.

XVIII Τὰ δὲ μαλάκια ἐκ τοῦ συνδυασμοῦ καὶ τῆς ὀχείας
 30 ὧν ἴσχει λευκόν· τοῦτο δὲ γίνεταί τῳ χρόνῳ,
 ὥσπερ τὰ τῶν σκληροδέρμων, ψαθυρόν. καὶ ἀπο-
 τίκτει ὁ μὲν πολύπους εἰς τὰς θαλάμας ἢ εἰς κερά-
 μιον ἢ τι ἄλλο κοῖλον ὅμοιον βοστρυχίους οἰνάνθης
 ἢ³ λεύκης καρπῷ, καθάπερ εἴρηται πρότερον. ἐκ-
 κρεμάννυνται δὲ περὶ τὴν θαλάμην τὰ ῥά, ὅταν
 550 a ἐκτέκη. τὸ δὲ πλῆθος ἔχει τοσαῦτα ῥά ὥστ'

¹ γενόμενοι AC : γυγνόμενοι PD, vulg.

² sic AC : καραβ. καὶ οἱ καρκ. PD, vulg.

Crayfish occur in rough and rocky places, lobsters
 in level ones ; in muddy places neither occur. Hence
 lobsters are found in the Hellespont, and crayfish in the
 neighbourhood of Sigeion and Athos. Fishermen get
 their indications about rough and muddy situations
 from the coastline and other clues of that sort, when
 they want to go after these animals out at sea. In
 winter and spring they occur nearer the shore, in
 summer out at sea, making for warmth or coolness as
 the case may be.

With regard to the season when they lay their eggs,
 the so-called bear-crabs^a practically coincide with the
 crayfish ; hence in winter and in spring before they
 lay their eggs they are at their best ; after laying
 they are at their worst. They cast their shells in
 spring, just as serpents cast their slough^b as it is
 called ; they do this as soon as they are hatched and
 later too : both crabs and crayfish do this. All cray-
 fish are long-lived.

Cephalopods after pairing and copulation produce XVIII
 a white egg, which in the course of time becomes (d) Cepha-
 crumbly (compare the eggs of the hard-skinned ani-
 mals).^c The octopus discharges its eggs into its
 lurking-place, or into some old pot or other hollow
 object ; they resemble the twisted inflorescence of a
 grape-vine, or the fruit of the white poplar, as I men-
 tioned earlier.^d Once the parent has laid them, they
 cling on all round the receptacle. It has such a
 multitude of eggs that when they have been taken

^a Probably *Scyllarus arctus* (*Arctos ursus*).

^b Lit., "their old age."

^c Cf. also 549 a 20.

^d At 541 a 9.

³ ἢ Pi., A.-W., Dt. : καὶ codd., vulg.

ἐξαιρεθέντων ἐμπίπλονται ἀγγεῖον πολλῶ μείζον τῆς κεφαλῆς [ἐν ᾧ¹ ἔχει τὰ ὠά].²

Τὰ μὲν οὖν τῶν πολυπόδων μεθ' ἡμέρας μάλιστα πενήκοντα γίνονται, <καὶ> ἐκ τῶν <ᾧων>³ ἀπορραγέντων⁴ πολυπόδια [καὶ]⁵ ἐξέρπει, ὡσπερ τὰ φαλάγγια, πολλὰ τὸ πλῆθος· ὧν ἡ μὲν καθ' ἕκαστα φύσις τῶν μελῶν οὕτω διάδηλος, ἡ δ' ὅλη μορφή φανερά. διὰ δὲ τὴν μικρότητα καὶ τὴν ἀσθένειαν φθείρεται τὸ πλῆθος αὐτῶν.⁶ ἤδη δ' ὠπται καὶ οὕτω πάντων μικρὰ ὡστ' ἀδιάρθρωτα μὲν εἶναι, ἀπτο-
10 μένων δὲ κινεῖσθαι. ἃ δ' αἱ σηπία ἀποτίκτουσι, γίνονται⁷ ὅμοια μύρτοις μεγάλοις καὶ μέλασιν· καὶ ἀλλήλων ἐχόμενά ἐστιν, ὅλον βότρυσ τὸ πᾶν, περιπελεγμένα τινὶ ἐνί,⁸ καὶ οὐκ εὐαπόσπαστα ἀλλήλων. ἐπαφήσει γὰρ ὁ ἄρρην ὑγρότητα τινὰ μυξώδη· ὁ τὴν γλισχρότητα παρέχει. καὶ αὐξάνεται δὲ ταῦτα⁹
15 τὰ ὠά, καὶ εὐθύς μὲν ἐστὶ λευκά, ὅταν δ' ἀφῆ τὸν θορόν,¹⁰ καὶ μείζω καὶ μέλανα. ὅταν δὲ σηπίδιον γένηται, ὅλον ἐκ τοῦ λευκοῦ γενόμενον ἔσω, τοῦ ᾧου¹¹ περιρραγέντος ἐξέρχεται. γίνονται δὲ ἔσω ὅταν τὸ πρῶτον¹² ἀπορράνη ἢ θήλεια, οἶονε¹³ χάλαζα· ἐκ

¹ ὁ codd. : ἡ edd.

² seclusi : *maius capite femine impregnate ab eis* Σ. *videas et quae p. 372 scripta sunt.*

³ <καὶ> et <ᾧων> supplevi : ἐκάστων loco ἐκ τῶν Pi.

⁴ περιρραγέντων Pi., Dt.

⁵ καὶ seclusi : πολυπόδων C : πολύποια D : πολύπεια P : om. Gul.

⁶ hic in Σ explicit quintus tractatus ; reliqua pars libri deest.

⁷ correx. Pi., ita et A.-W., Dt. : αἱ δὲ σ. ἀπτο., καὶ γιν. codd., vulg.

⁸ τινὶ ἐνί AC : ἐνί τινι PD, vulg.

⁹ ταῦτα A : ταῦτη PD, vulg.

¹⁰ θορόν AC : θόρον PD : θολόν vulg.

out they fill a vessel much bigger than the "head" ^a [while it has the eggs].^b

Now the eggs of the octopus take about fifty days to form,^c and when <the eggs> have broken away small octopuses crawl out of them, just like the venom-spiders, in large numbers. The form of their limbs is not yet visible in detail, though their shape as a whole is clear enough. Owing to their smallness and weakness the great majority of them come to grief. Some have actually been observed so extremely small as to be unarticulated, yet they moved when touched. The eggs produced by cuttlefish, on the other hand, are similar to large black myrtle-berries : they adhere to each other, so that the whole looks like a bunch of grapes, twined round a central core, and cannot easily be pulled apart. The reason is that the male discharges a mucous fluid over them, and this provides the stickiness. These eggs increase in size : to begin with they are white, but when the male has discharged the milt, they are larger and dark in colour. Once the young cuttlefish has been formed (the whole of it is formed within out of the white part), the egg bursts, and it comes out. Now as soon as the female has laid the egg, there is formed inside a sort of hailstone,^d for it is out of this

^a See 523 b 24, 525 a 5.

^b These words have probably supplanted some such phrase as "of the parent animal" ; cf 525 a 5. See p. 372.

^c Cf. 544 a 7 f.

^d A similar formation in birds' eggs is mentioned at 560 a 28.

¹¹ τοῦ ᾧου scripsi cum Th., Dt. docente : τούτου vulg. : τότε PD.

¹² ita scripsi : δὲ τὸ ἔσω πρῶτον ὅταν PD, Dt., A.-W. : δ' ἂν (δ' ἐὰν C) τὸ πρῶτον AC, vulg., Sn. : δ' ὅ ἂν τὸ πρῶτον Pi.

¹³ οἶονε Pi. : ὅλον ἢ AC : ὅλον P, vulg.

γὰρ τούτου τὸ σηπίδιον φύεται ἐπὶ κεφαλῆν, ὡσπερ
 20 οἱ ὄρνιθες κατὰ τὴν κοιλίαν προσηρτημένοι. ποία
 δέ τις ἐστὶν ἢ πρόσφυσις ἢ ὀμφαλώδης, οὐπω
 ὤπται, πλὴν ὅτι αὐξανόμενον τοῦ σηπιδίου ἀεὶ
 ἔλαττον γίγνεται τὸ λευκόν, καὶ τέλος, ὡσπερ τὸ
 ὠχρὸν τοῖς ὄρνοι, τούτοις τὸ λευκὸν ἀφανίζεται.
 μέγιστοι δὲ φαίνονται πρῶτον, ὡσπερ καὶ ἐν τοῖς
 25 ἄλλοις, καὶ ἐν τούτοις οἱ ὀφθαλμοὶ [οἶον ὦν¹ ἐφ' οὐ
 τὸ Α, ὀφθαλμοὶ ἐφ' ὦν τὸ ΒΓ, τὸ σηπίδιον αὐτὸ ἐφ'
 οὐ Δ]. κύνει δὲ τοῦ ἔαρος, ἀποτίκει δ' ἐν ἡμέραις
 πεντεκαίδεκα· ὅταν δ' ἀποτέκη τὰ ὦα, γίγνεται ἐν
 ἄλλαις πεντεκαίδεκα ἡμέραις οἶον ῥάγες βότρυος,
 ἐν περιρραγόντων ἐκδύεται ἔσωθεν τὰ σηπίδια. ἐὰν
 30 δέ τις περισχίση πρότερον ἢδη τετελειωμένων,
 προῖενται κόπρον τὰ σηπίδια, καὶ τὸ χρῶμα μετα-
 βάλλει ἐρυθρότερον γιγνόμενον ἐκ λευκοῦ διὰ τὸν
 φόβον.

550 b Τὰ μὲν οὖν μαλακόστρακα αὐτὰ ὑφ' αὐτὰ θέμενα
 τὰ ὦα ἐπῳάζει, ὁ δὲ πολὺπους καὶ ἡ σηπία καὶ τᾶλλα
 τὰ τοιαῦτα ἐκτεκόντα,² οὐ ἂν τὰ κυήματα αὐτῶν ἦ,
 μάλιστα μὲν ἡ σηπία· πολλάκις γὰρ ὑπερφαίνεται

¹ οἶον ὦν scripsi: ὦν vulg.: οἶον D: text. vulg. ut videtur
 codici C consentit: codd. edd. alii alia exhibent: totum sine
 dubio aut corruptum aut alieno loco positum.

² ἐκτεκόντα <νέμονται> Gohlke.

^a It is difficult to see how a diagram such as these refer-
 ences imply could usefully illuminate Aristotle's account.
 One important feature, as he himself remarks, had not yet
 been observed; and a diagram is hardly necessary to empha-
 size the size of the eyes, a phenomenon which (again as
 Aristotle points out) occurs in other embryos. Thompson
 finds it necessary to provide two diagrams. There seems,
 however, to be at *G.A.* 758 a 24 a reference to a diagram in
H.A. showing "how the cuttlefish is situated during the

that the young cuttlefish grows, fastened by its head,
 just as birds are fastened by the belly. The nature
 of this umbilical attachment has not so far been ob-
 served; all we know is that as the young cuttlefish
 grows, the white portion continually diminishes, and
 ultimately disappears, just as the yolk does in birds'
 eggs. As with other animals, the eyes of the young
 cuttlefish are enormous to begin with. [*E.g.*, the egg
 is marked by A, the eyes by B and Γ, the young
 cuttlefish itself by Δ.]^a The cuttlefish becomes preg-
 nant in spring, and lays its eggs after fifteen days.
 When they have been laid, after another fifteen days
 something like a bunch of grapes develops, and when
 these have burst open the small cuttlefish emerge.
 But if anyone cuts the covering open too soon once
 their formation is completed, they discharge excre-
 ment and their colour, which was white, changes: they
 redden up through fright.

Now Crustacea place their eggs underneath them-
 selves and so incubate them; not so the octopus, the
 cuttlefish, and other such creatures: these place
 their eggs somewhere away from themselves, and
 incubation proceeds wherever the fetations^b happen
 to be. This applies particularly to the cuttlefish: the
 sac of the animal can often be seen just showing

process of formation"; and in the *G.A.* passage the point
 mentioned is the fact that the young cuttlefish is fastened to
 the egg by its front part (*cf.* in the present passage 550 a 19
 above), which is unusual, but unavoidable, because this
 animal's front and rear parts face in the same direction.
 There can be little doubt that this is what the original
 diagram illustrated. The text of the passage as given in
 the mss. and edd. is confused and in some cases unintelligible
 (see Schneider's commentary and Bekker's *apparatus*), and
 its introduction here is curiously abrupt.

^b See Notes, § 16.

πρὸς τῇ γῇ τὸ κύτος αὐτῆς. ὁ δὲ πολύπους ὁ θήλυς
 5 ὅτε μὲν ἐπὶ τοῖς ψοῖς ὅτε δ' ἐπὶ τῷ στόματι προ-
 κάθηται τῆς θαλάμης, τὴν πλεκτάνην ἐπέχων. ἡ δὲ
 σηπία πρὸς τὴν γῆν ἐκτίκει περὶ τὰ φυκία καὶ τὰ
 καλαμώδη, κἄν τι ἢ τοιοῦτον ἐκβεβλημένον, ὅλον
 ὕλη ^(ἢ)¹ κλήματα ἢ λίθοι· καὶ οἱ ἀλιεῖς δὲ κλήματα²
 τιθέασιν ἐπίτηδες· καὶ πρὸς ταῦτα ἐκτίκει μακρὸν
 10 καὶ συνεχές ἐκτὸς ψόν,³ ὅλον τὸ τῶν βατράχων.⁴
 ἀποτίκει δὲ καὶ ἀπορραίνει ἐξ ἀναγωγῆς, ὡς μετὰ
 πόνου γιγνομένης τῆς προέσεως. αἱ δὲ τευθίδες
 πελάγαι ἀποτίκτουσιν τὸ δ' ψόν, ὡσπερ ἡ σηπία,
 ἀποτίκει συνεχές. ἔστι δὲ καὶ ὁ τεύθος καὶ ἡ σηπία
 βραχύβιον· οὐ γὰρ διετίζουσιν, εἰ μὴ τινες ὀλίγαι
 15 αὐτῶν· ὁμοίως δὲ καὶ οἱ πολύποδες. γίγνεται δ' ἐξ
 ἑνὸς ψοῦ ἓν σηπίδιον· ὁμοίως δὲ καὶ ἐπὶ τῶν τευθί-
 δων ἔχει. [διαφέρει δ' ἡ ἄρρη τευθὶς τῆς θηλείας·
 ἔχει γὰρ ἡ θήλεια, εἰάν τις διαστείλας θεωρήσῃ τὴν
 κόμην⁵ εἴσω, ἐρυθρὰ δύο ὅλον μαστοῦς, ὁ δ' ἄρρη
 οὐκ ἔχει. ἡ δὲ σηπία τοῦτό τ' ἔχει διάφορον, καὶ
 20 ὅτι⁶ ποικιλώτερός ἐστιν ὁ ἄρρη τῆς θηλείας, καθ-
 ἄπερ εἴρηται πρότερον.]⁷

XIX Τὰ δ' ἔντομα τῶν ζώων ὅτι μὲν ἐλάττω ἐστὶ τὰ
 ἄρρενα τῶν θηλειῶν καὶ ἐπιβαίνει ἄνωθεν, καὶ πῶς
 ποιεῖται τὴν ὀχείαν, καὶ ὅτι διαλύεται μόλις, εἴρηται

¹ ἢ suppl. Dt.

² κλήματα C, A.-W., Dt.: κλήματα A: κληματίδας PD, vulg.

³ ἐκτὸς ψόν A.-W.: ἐκ τῶν ψόν codd.: num ἐκτεταμένον?

⁴ βατράχων scripsi, coll. 568 a 23 sqq.: βοστρύχων codd.: ὅλον

τι βοστρύχιον A.-W. (ὅλον τὸ φυτῶν βοστρύχιον Pi.)

⁵ κόμην] κεφαλὴν (= κύτος) conl. A.-W.: κοιλίαν Scal., Cs.

(alio disiecta Gaza); sed cf. 524 b 21.

close in to the shore. The female octopus sits some-
 times on the eggs, sometimes in front of her hole,
 with her tentacle spread out. The cuttlefish deposits
 its eggs near the shore round seaweed and reeds and
 anything of the sort which may have been cast up,
 such as brushwood or twigs or stones; in fact, fisher-
 men put twigs down on purpose. The animal deposits
 its egg into this stuff as a long and externally con-
 tinuous mass, resembling the spawn of frogs.^a It
 lays, or rather spurts, it out with a retching effort, as
 though its emission were a painful process. The
teuthides lay out at sea: like that of the cuttlefish,
 their egg is a continuous mass. Both the *teuthos* and
 the cuttlefish are short-lived: only in a very few
 instances do they reach their second year. The same
 is true of the octopus. From one egg comes one small
 cuttlefish: the same is true of the egg of the *teuthis*.
 [The male *teuthis* differs from the female: the latter,
 as can be seen if one pulls open the hairy region^b and
 looks inside, has two red objects resembling breasts;
 these are not present in the male. In the cuttlefish
 the same difference is found; in addition, the male is
 less uniform in colour than the female, as has been
 stated already.]

With regard to Insects, we have already described XIX
 how the males are smaller than the females, that they^(c) Insects.
 mount on top of them, how they perform their copu-
 lation and are loth to separate. But once they have

^a I have substituted "frogs" (cf. 568 a 23 ff.) for "curls." A.-W., following Piccolos, read "like some vine-tendril," which, as Th. points out, is inappropriate.

^b This apparently refers to the gills: see 524 b 21, and 529 a 32.

^c melius ἔτι. ⁷ secl. A.-W., ut e 524 b 30 sqq. iterata.

550 b

25 πρότερον· ὅταν δ' ὀχευθῆ, ταχέως ποιεῖται τὰ πλεῖ-
στα τὸν τόκον· τίκτει δὲ πάντα, ὅσα ὀχεύεται,¹
σκώληκας πλὴν γένος τι ψυχῶν, αὐται δὲ σκληρόν,
ὅμοιον κνήκου σπέρματι, ἔσω δ' ἔχον² χύμα. ἐκ
δὲ τῶν σκωλήκων οὐκ ἐκ μέρους τινὸς γίννεται τὸ
ζῶον, ὡσπερ ἐκ τῶν ὤων, ἀλλ' ὅλον αὐξάνεται καὶ
30 διαρθρούμενον γίννεται τὸ ζῶον.

Γίννεται δ' αὐτῶν τὰ μὲν ἐκ ζῶων τῶν συγγενῶν,
οἶον φαλάγγια τε καὶ ἀράχνια ἐκ φαλαγγίων καὶ
ἀραχνίων, καὶ ἀπτέλαβοι καὶ ἀκρίδες καὶ τέττιγες·
551 a τὰ δ' οὐκ ἐκ ζῶων ἀλλ' αὐτόματα, τὰ μὲν ἐκ τῆς
δρόσου τῆς ἐπὶ τοῖς φύλλοις πιπτούσης, κατὰ φύσιν
μὲν ἐν τῷ ἔαρι, πολλάκις δὲ καὶ τοῦ χειμῶνος, ὅταν
εὐδία καὶ νότια³ γένηται πλείω χρόνον· τὰ δ' ἐν βορ-
5 βόρῳ καὶ κόπρῳ σηπομένοις, τὰ δ' ἐν ξύλοις, τὰ μὲν
φυτῶν, τὰ δ' ἐν αὐοῖς⁴ ἤδη, τὰ δ' ἐν θριξί ζῶων, τὰ
δ' ἐν σαρκὶ τῶν ζῶων, τὰ δ' ἐν τοῖς περιπτώμασι,
καὶ τούτων τὰ μὲν ἐκ κεχωρισμένων,⁵ τὰ δ' ἐπι
ὄντων ἐν τοῖς ζῶοις, οἷον αἱ καλούμεναι ἔλμινθες.
ἔστι δ' αὐτῶν γένη τρία, ἢ τ' ὀνομαζομένη πλατεῖα,
10 καὶ αἱ στρογγύλαι, καὶ τρίται αἱ ἀκαρίδες.⁶ ἐκ μὲν
οὖν τούτων ἕτερον οὐδὲν γίννεται· ἡ δὲ πλατεῖα

¹ ὅσα ὀχεύεται post τόκον (supra) codd., edd. : huc translit Dt.

² ἔχον suppl. Dt. : χύμα A, vulg. : ἔγχυμα PD : ἔγχυμον Sn. ex m.

³ νότια scripsi (coll. 542 b 29) : νοτία edd.

⁴ ἐν αὐοῖς ed. Basil. : ἐν αὐτοῖς AC : ἐαυτοῖς PD.

⁵ ἐκ κεχωρισμένων Dt. : ἐγκεχωρ. A : ἐκκεχωρισμένων P : ἐκκεχεσμένων A v.l.

⁶ ἀκαρίδες AC, A.-W. : ἀσκαρίδες PD, vulg.

^a A thistle, *Carthamus tinctorius*, safflower.

^b See *G.A.* 732 a 29. The distinction is between the utilization of yolk as the raw material for the embryo, and the utilization of tissue-disintegration products in metamorphosis.

copulated, in most cases parturition quickly follows. All that copulate produce larvae, except one sort of butterfly, which produces a hard object, resembling a *knekos*-seed,^a which contains a fluid. In reproduction from larvae, the young animal is not formed out of some *part* of the larva (contrast reproduction from eggs, where the young is formed out of part of the egg^b), but the *whole* grows and becomes articulated and so the creature is produced.

Some insects are produced from animals of the same kind as themselves, e.g., venom-spiders are produced from venom-spiders, ordinary spiders from ordinary spiders; so too are locusts, grasshoppers and cicadas. Some, however, are not produced from animals at all, but spontaneously: some are produced out of the dew which falls on foliage, during spring in the natural course of events, but quite often in winter too, when there has been a considerable spell of good weather with southerly winds; others are produced in putrefying mud and dung,^c others in wood, green or dry, others in the hair of animals, others in their flesh; others in residues,^d whether voided residues or residues still within the living animal—an example is the so-called *helminths* (intestinal worms), of which there are three kinds, one named the flat-worm, another the round-worm, and a third, the *akarids*.^e Out of these nothing further is produced; though, to this extent exceptionally, the flat-worm clings tightly

The embryo feeds upon its yolk, but the pupa feeds upon itself. ^a See note on 539 a 23. ^d See Notes, §§ 22 ff.

^e The best mss. read *akarids*; some read *askarids*: in any case they are not to be confused with the *askarids* mentioned at 487 b 5 and 551 b 27. The modern name is ascarid. The three kinds of helminth are the flat-worm (trematodes), the round-worm (nematodes), and the tape-worm (cestodes).

551 a

προσπέφυκὲ τε μόνῃ τῷ ἐντέρῳ καὶ ἀποτίκει τι¹
 οἶον σικύου σπέρμα, ᾧ γινώσκουσι σημεῖω οἱ
 ἰατροὶ τοὺς ἔχοντας αὐτήν. γίνονται δ' αἱ μὲν
 καλούμεναι ψυχαὶ ἐκ τῶν καμπῶν, αἱ γίνονται ἐπὶ
 15 τῶν φύλλων τῶν χλωρῶν, καὶ μάλιστα ἐπὶ τῆς
 ῥαφάνου, ἣν καλοῦσιν τινες κράμβην, πρῶτον μὲν
 ἔλαττον κέγχρου, εἶτα μικροὶ σκώληκες αὐξανόμε-
 ναι,² ἔπειτα ἐν τρισὶν³ ἡμέραις κάμψαι μικραὶ·
 μετὰ δὲ ταῦτα αὐξηθεῖσαι ἀκινήτιζουσι, καὶ μετα-
 βάλλουσι τὴν μορφήν, καὶ καλοῦνται χρυσαλλίδες,
 20 καὶ σκληρὸν ἔχουσι τὸ κέλυφος, ἀπτομένου δὲ κι-
 νοῦνται. προσέχονται δὲ πόροις ἀραχνιώδεσιν οὔτε
 στόμα ἔχουσαι οὔτ' ἄλλο τῶν μορίων διάδηλον
 οὐδέν. χρόνου δ' οὐ πολλοῦ διελθόντος περιρρήνυ-
 ται τὸ κέλυφος, καὶ ἐκπέτεται ἐξ αὐτῶν περωτὰ
 ζῶα, ἃς καλοῦμεν ψυχάς. τὸ μὲν οὖν πρῶτον, ὅταν
 25 ὄσιν κάμψαι, τρέφονται καὶ περίττωμα ἀφιδῶσιν· ὅταν
 δὲ γένωνται χρυσαλλίδες, οὐδενὸς οὔτε γεύονται οὔτε
 προῖενται περίττωμα.

Τὸν αὐτὸν δὲ τρόπον καὶ τὰλλα ὅσα γίνονται ἐκ
 σκωλήκων, καὶ ὅσοι ἐκ συνδυασμοῦ γίνονται ζῶων
 σκώληκες, καὶ ὅσοι ἀνευ ὀχείας. καὶ γὰρ οἱ τῶν
 30 μελιττῶν καὶ ἀνθρηῶν καὶ σφηκῶν ὅταν μὲν νέοι
 551 b σκώληκες ὄσιν, τρέφονται τε καὶ κόπρον ἔχοντες
 φαίνονται· ὅταν δ' ἐκ τῶν σκωλήκων εἰς τὴν δια-
 τύπωσιν ἔλθωσι, καλοῦνται μὲν νύμφαι τότε, οὐ

¹ τι PD: om. AC, vulg.

² αὐξανόμεναι Dt.: αὐξανόμενοι codd.

³ τρισὶν] τισι suspic. A.-W.

^a This is known as the "proglottis," which is a segment

to the intestine and produces something like a melon-
 seed,^a which gives the doctor an indication that his
 patient is infested by the worm. Butterflies as they
 are called^b take their rise from caterpillars, which live
 on green-leaved plants, chiefly on the *rhapmanos*,
 which some people call *krambē*^c (cabbage): at first
 the creatures are smaller than a grain of millet, then
 they grow into small larvae, then in three days they
 are small caterpillars; after that, having grown still
 more, they remain stationary and change their shape;
chrysalis is the name then applied to them. They
 have a hard envelope, and move if this is touched.
 They adhere by means of cobweb-like connexions;
 they have no mouth and no other articulated part
 visible. After a short while the covering bursts open
 and out fly the winged creatures we call butterflies.
 To begin with, while they are at the caterpillar stage,
 they take nourishment and emit residue; but once
 they have reached the chrysalis stage they taste no
 food and emit no residue.

The same sequence of development is followed by
 other insects which arise out of larvae, both those lar-
 vae which arise as the result of the copulation of liv-
 ing animals and those which arise without copulation.
 Thus: the larvae of bees, anthrenas,^d and wasps, while
 they are young, take nourishment and are clearly seen
 to have excrement; but when they have passed
 from the larva stage to their clearly-defined stage—
 being then called *pypae*^e—they take no nourishment

of the worm, although the helminths are not truly segmented
 as are annelids (earth-worms).

^b "As they are called," because the same word in Greek
 is also used for "soul." *Ψυχαι* includes moths.

^c *Rhapmanos* is the Attic name for cabbage.

^d See 531 b 22.

^e Gk. *nymphai*, lit., "brides."

λαμβάνουσι δὲ τροφήν οὐδὲ κόπρον ἔτ' ἔχουσιν, ἀλλὰ
 περιεργόμενοι ἀκινήτίζουσιν ἕως ἂν ἀξήθωσιν· τότε
 5 δ' ἐξέρχονται διακόψαντες ὧ καταλήλειπται ὁ κύτ-
 τανος. γίνονται δὲ καὶ τὰ ὑπερα καὶ τὰ πηνία ἔκ-
 τινων καμπῶν τοιούτων,¹ αἱ κυμαίνουσι τῇ πορείᾳ
 καὶ προβάσαι τῷ ἐτέρῳ κάμψασαι ἐπιβαίνουσιν·
 ἕκαστον δὲ τῶν γιγνομένων τὸ οἰκείον χρῶμα λαμ-
 βάνει ἀπὸ τῆς κάμψης.

10 Ἐκ δὲ τινος σκώληκος μεγάλου, ὃς ἔχει οἶον
 κέρατα καὶ διαφέρει τῶν ἄλλων, γίνονται πρῶτον
 μὲν μεταβάλλοντος² τοῦ σκώληκος κάμψης, ἔπειτα
 βομβυλῆς,³ ἐκ δὲ τούτου νεκύδαλος· ἐν ἑξὶ δὲ μηνῶν
 μεταβάλλει ταύτας τὰς μορφὰς πάσας. ἐκ δὲ τού-
 του τοῦ ζώου καὶ τὰ βομβύκια ἀναλύουσι τῶν γυ-
 15 ναικῶν τινες ἀναπνηζόμεναι κάπειτα ὑφαίνουσιν·
 πρώτη δὲ λέγεται ὑφήναι ἐν Κῶ Παμφίλῃ Πλάτew
 θυγάτηρ. ἐκ δὲ τῶν σκωλήκων τῶν ἐν τοῖς ξύλοις
 τοῖς αἰοῖς οἱ καράμβιοι⁴ γίνονται τὸν αὐτὸν τρόπον·
 πρῶτον μὲν ἀκινήτισαντων τῶν σκωλήκων, εἶτα
 περιπραγέντος τοῦ κελύφους ἐξέρχονται οἱ καράμ-

¹ καμπῶν τοιούτων PD; τοιούτων ἄλλων AC, vulg.

² μεταβάλλοντος AC; μεταβαλόντος PD, vulg.

³ βομβυλῆς AC, Aristoph. epit. i. 36; βομβύλιος PD, vulg.

⁴ καράμβιοι C; καράβιοι A; κάραβοι PD, vulg.; κράμβιοι
 Aristoph. epit. i. 36.

^a Lit., pestle.

^b Lit., bobbin. Perhaps larvae of the currant-moth.

^c The word is derived from *nekys*, a corpse or ghost. Forbes (see next note) thinks the *nekydalos* is the moth itself, comparing *ψυχή* ("soul") = butterfly.

^d This cannot be a reference to the silkworm, *Bombyx mori*, since it is thought that this, and its food-plant the white mulberry, did not come to Greece until the middle of the sixth century A.D. Thompson suggests that the description may refer to one of the large *Saturniæ*. See further, W. T. M.

and have no excrement: they remain stationary, shut up inside, until their growth is complete, and then they break the covering with which the cell is sealed and make their way out. The *hyperon*,^a too, and the *penion*^b come from similar caterpillars, which walk with an undulating gait: they go forward with one part of their body, then bend themselves, and so advance. Each of the resulting animals derives its own proper colour from its caterpillar.

Out of a certain large larva, which has as it might be horns, and is different from the rest, there arises first of all a caterpillar (produced when the larva metamorphoses), then a *bombylis* (cocoon), then out of this a *nekydalos*^c: it goes through all these transformations in six months. Some of the women actually unwind the cocoons from these creatures, by reeling the thread off, and then weave a fabric from it; the first to do this weaving is said to have been a woman of Cos named Pamphile, daughter of Plates.^d The stag-beetles^e are produced in the same way out of larvae that live in dry wood: first the larvae become stationary, then the envelope bursts open and the

Forbes, "The Silkworm of Aristotle," *Classical Philology*, XXV (1930), pp. 22 ff., who is definite that the reference is not to the Chinese silkworm; there are, he says, two silkworms in eastern Europe which could have been used in this way, *Saturnia pyri* and *Pachypasa otus*: the latter produces finer and paler-coloured silk. According to Balss *ad loc.* the fabric obtained from the latter is still used as lint by the peasants of the Basilicata (part of the ancient Lucania) in South Italy. See also Gisela M. A. Richter, "Silk in Greece," in *American J. of Archaeology*, 33 (1929), pp. 27-33.

^e Reading *karambioi*, a horned or cerambycid beetle, similar to, though perhaps not identical with, *Lucanus cervus*. Cf. 531 b 25, *karabos*, which in fact is the reading of two mss. in the present passage.

20 βιοι.¹ ἐκ δὲ τῶν συνιδῶν² γίνονται αἱ πρασοκου-
 ρίδες· ἴσχυοσι δὲ πτερὰ καὶ αὐται.³ ἐκ δὲ τῶν ἐν
 τοῖς ποταμοῖς πλατέων ζωδαρίων τῶν ἐπιθεόντων
 οἱ οἰστροί· διὸ καὶ οἱ πλείστοι περὶ τὰ ὕδατα γίνον-
 ται οὗ τὰ τοιαῦτά ἐστι ζῶα. ἐκ δὲ μελαινῶν τινων
 καὶ δασειῶν οὐ μεγάλων καμπῶν πρῶτον γίνονται
 25 πυγολαμπίδες, οὐχ αἱ πετόμεναι· αὐται δὲ πάλιν
 μεταβάλλουσι, καὶ γίνονται πτερωτὰ ζῶα ἐξ αὐτῶν,
 οἱ καλούμενοι βόστρυχοι.

Αἱ δ' ἐμπίδες γίνονται ἐκ τῶν ἀσκαρίδων. αἱ δ'
 ἀσκαρίδες γίνονται ἐν τε τῇ ἰλύϊ τῶν φρεάτων καὶ
 ὅπου ἂν σύρρευσις γένηται ὕδατος γεώδη ἔχουσα
 30 ὑπόστασιν. τὸ μὲν οὖν πρῶτον αὐτῆ⁴ ἡ ἰλὺς σηπο-
 μένη χρῶμα λαμβάνει λευκόν, εἶτα μέλαν, τελευτώσα
 552 a δ' αἱματώδες· ὅταν δὲ τοιαύτη γένηται, φύεται ἐξ
 αὐτῆς ὥσπερ σταφύλια⁵ μικρὰ σφόδρα καὶ ἐρυθρά·
 ταῦτα δὲ χρόνον μὲν τινα κινεῖται προσπεφυκότα,⁶
 ἔπειτ' ἀπορραγέντα φέρεται κατὰ τὸ ὕδωρ, αἱ καλού-
 5 μенаι ἀσκαρίδες. μεθ' ἡμέρας δ' ὀλίγας ἴστανται
 ὄρθαι ἐπὶ τοῦ ὕδατος ἀκινήτιζουσαι καὶ σκληραί,
 κάπειτα περιρραγέντος τοῦ κελύφους ἡ ἐμπὶς ἄνω
 ἐπικάθηται, ἕως ἂν ἥλιος ἢ πνεῦμα κινήσῃ· τότε
 ἦδη⁷ πέτεται. πᾶσι δὲ καὶ τοῖς ἄλλοις σκωλήξι καὶ
 τοῖς ζῴοις τοῖς ἐκ τῶν σκωλήκων περιρρηγνυμένοις

¹ καράμβιοι C: καράβιοι A: κάραβοι PD, vulg.: κράμβιοι Aristoph. epit. i. 36.

² συνιδῶν scripsi: σίδων (δ corr.) C: σίμβλων A: συμβόλων Aristoph. epit. i. 36 cod. P: καράβων PD, vulg.: κραμβῶν Scal., Casaub.: ἐκ δὲ τῶν ἐπὶ τῶν σεύτων Dt. (σεύτων propos. Lambros in Arist. epit. edit.): alii alia.

³ αὐται Post: αὐταὶ vulg.

⁴ αὐτῆ AC: αὐτῆ vulg.
⁵ σταφύλια scripsi: σκωλήκια velint A.-W.: τὰ φυκία codd., edd.: τινὰ loco τὰ tent. Dt.

⁶ ita Sn. ex Gul., edd.: πεφυκότα codd.

stag-beetles emerge. Out of the "ravagers" ^a are produced the "leekslashers" ^b; these too have wings. From the small flat creatures that run about on the water of rivers comes the gadfly ^c; that is why gadflies are most abundant near waters where these creatures are. From certain small, dark-coloured hairy caterpillars come, at first, glowworms (not the flying ones); these in turn undergo a transformation, and give rise to winged creatures called *bostrychoi* ("curls").

Gnats are produced out of bloodworms ^d: these are produced in the mud of wells and wherever water collects which contains an earthy sediment. To begin with, this mud putrefies and takes on a white colour, then it turns black, and finally blood-red; at this point there grow out of it as it were tiny bunches of grapes, ^e red in colour; these for a time keep moving, still attached, then they break off and travel about in the water: these are the so-called bloodworms. After a few days they stand straight up on the water, motionless and hard; then when the envelope has burst open the gnat is seen sitting on top, waiting for the sun or a puff of wind to set it moving; then straight away off it flies. For all other larvae too and for all animals which break out from larvae, the first

^a I have conjectured *σινιδων*, "ravagers," a very slight alteration (NI for M) of the (meaningless) *σίδων* of the best ms. Other readings and conjectures are unconvincing.

^b A fifty-footed creature of this name is mentioned by Strattis, quoted by Athen. ii. 69.

^c Not the true gadfly, but a species of *Syrphus* or *Stratiomys* (Th.).

^d *Askarids*, larva of *Chironomus*. See also 487 b 5.

^e The received text reads τὰ φυκία, "the seaweeds"; σταφύλια seems a likely correction. A.-W. suggest σκωλήκια, "small larvae."

⁷ δ' ἦδη C, vulg.: ἦδη A: δῆ PD, Dt.

- 10 ἡ ἀρχὴ γίνεταί τῆς κινήσεως¹ ὑφ' ἡλίου ἢ ὑπὸ πνεύματος. μᾶλλον δὲ καὶ θάττον γίνονται αἱ ἀσκαρίδες ἐν τοῖς ἔχουσι παντοδαπὴν ὑπόστασιν, οἷον Μεγαροὶ γίνεταί ἐν ταῖς ὀργάσι². σήπεται γὰρ τὰ τοιαῦτα θάττον. καὶ μετοπώρου δὲ γίνονται μᾶλλον· τότε γὰρ τὸ ὑγρὸν συμβαίνει εἶναι ἕλαττον.³
- 15 Οἱ δὲ κροτῶνες γίνονται ἐκ τῆς ἀγρώστεως, αἱ δὲ μηλολόμβαι ἐκ τῶν σκωλήκων τῶν ἐν τοῖς βολίτοις καὶ ταῖς ὄνισιν.⁴ οἱ δὲ κάνθαροι ἦν κυλίουσι κόπρον, ἐν ταύτῃ φωλεύουσί τε τὸν χειμῶνα καὶ ἐντίκτουσι σκωλήκια, ἐξ ὧν γίνονται κάνθαροι. γίνονται δὲ καὶ ἐκ τῶν σκωλήκων τῶν ἐν τοῖς
- 20 ὀσπρίοις πτερωτὰ ζῶα ὁμοίως τοῖς εἰρημένοις. αἱ δὲ μυῖαι ἐκ τῶν σκωλήκων τῶν ἐν τῇ κόπρῳ τῇ χωριζομένῃ κατὰ μέρος· διὸ καὶ οἱ περὶ ταύτην τὴν ἐργασίαν ὄντες μηχανῶνται⁵ χωρίζουν τὴν ἄλλην τὴν

¹ κινήσεως Sylb., Pi., A.-W., Dt.: γενέσεως codd., vulg.

² ἐν ταῖς ὀργάσι scripsi: Μεγαροὶ τε γίνεταί καὶ ἐν τοῖς ἐργοῖς vulg.: Μεγαροὶ τε καὶ ἐν τοῖς Ἄργοις Scal.: Μεγαροὶ γίνεταί ἐν τοῖς ἐργοῖς Cs.: ἐν γυροῖς γίνν. τοῖς ἐν τοῖς ἐργοῖς (sive ἀργοῖς) vel ἐν μαγειρείοις τε γίνν. καὶ ἐν τοῖς ἐργοῖς coni. A.-W., alterum probat Dt.

³ ἕλαττον] cf. G.A. 763 a 29: μᾶλλον εἶναι ἕλαττον A.

⁴ βολίτοις καὶ τῶν ὄνιδων vulg.: βολίτοις <τοῖς τῶν βοῶν> καὶ τῶν ὄνων Dt. in textu, sed et ταῖς ὄνισιν coniecit, quod secutus sum.

⁵ μηχανῶνται Dt.: μάχονται codd., edd.; sed de quo hic agatur non satis liquet.

^a The traditional reading is "at Megara and in the works," which no one has been able satisfactorily to explain. A.-W. conjecture "in kitchens and in the works." I have replaced ἐν τοῖς ἐργοῖς by ἐν ταῖς ὀργάσι. An ὀργάς is a well-watered tract of land; and "the sacred ὀργάς," between Megara and Athens, dedicated to Demeter and Persephone, was a well-known area, partly because one of Pericles' accusations against the Megarians was that they had appropriated some

beginning of their movement comes from the sun or the wind. These bloodworms grow more plentifully and more quickly in places where there is sediment with a miscellaneous content, as for instance occurs at Megara in the water-meadows,^a because such places putrefy more quickly. In autumn too they tend to be more plentiful, because then there is less fluid about.^b

Ticks^c are produced out of dog's-tooth grass,^d cockchafers out of larvae found in the dung of oxen and asses. The dung-beetle^e rolls dung into a ball, lies hid in it during the winter, produces small larvae in it, and out of these come more dung-beetles. In a similar way to those just mentioned, winged animals also come out of the larvae found in pulse. Flies come out of the larvae found in dung which is being separated out in portions: that is why those who are occupied with this business contrive to separate out the remain-

of it (see Plut. *Pericles*, § 30. 330. 14 ff. S., Demosth. xiii. 32, Pausan. iii. 4. 2, Sud. iii. 552. 7 ff. Adler, etc.) The nature of such a tract, as well as its location, is exactly suited to the present passage. Cf. L. Chandler, *J.H.S.* XLVI (1926), p. 12: "It seems quite possible that the small stretch of land between the Iapis torrent and the Kerata mountain was the neutral Sacred Plain," i.e., the ὀργάς.

^b Dittmeyer says we should expect "more," not "less": but cf. G.A. 763 a 27 ff.: "Testacea form on the sides of boats when the frothy slime putrefies; and also, in many places where nothing of the kind has been present previously, after a time when the place has become muddy owing to lack of water, lagoon-oysters have been formed." Aristotle goes on to point out that where there is a strong current no Testacea are formed because no mud can be deposited. Cf. also H.A. 569 a 14, where the drying up of a pond is a preliminary stage in the production of certain fishes: and 556 a 10 f.

^d *Isodes ricinus*; cf. 557 a 16.

^e *Cynodon Dactylon*; cf. 598 a 6.

^f *Scarabaeus pilularius*.

μεμιγμένην, καὶ λέγουσι τότε κατειργάσθαι τὴν
κόπρον. ἢ δ' ἀρχὴ τῶν σκωληκίων μικρά· πρῶτον
25 μὲν γὰρ καὶ ἐνταῦθα ἐρυθραίνεται, καὶ ἐξ ἀκινήσιας
λαμβάνει κίνησιν, οἷον πεφυκωμένα¹. εἶτα σκωληκίον
ἀποβαίνει ἀκίνητον· εἶτα κινήθην ὕστερον γίνεταί
ἀκίνητον πάλιν· ἐκ δὲ τούτου μύια ἀποτελεῖται, καὶ
κινεῖται πνεύματος ἢ ἡλίου γενομένου. οἱ δὲ μύω-
30 [τῶν]² σκωληκίων μεταβαλλόντων· τὰ δὲ σκωλήκια
ταῦτα γίνεταί ἐν τοῖς καυλοῖς τῆς κράμβης. αἱ δὲ
552 b καθαρίδες ἐκ τῶν πρὸς ταῖς συκαῖς καμπῶν καὶ
ταῖς ἀπίοις καὶ ταῖς πεύκαις (πρὸς πᾶσι γὰρ τούτοις
γίνονται σκώληκες) καὶ ἐκ τῶν ἐν τῇ κυνακάνθῃ·
[ὄρμῳσι δὲ καὶ πρὸς τὰ δυσώδη διὰ τὸ ἐκ τοιαύτης
5 γεγονέναι ὕλης].³ οἱ δὲ κώνωπες ἐκ σκωλήκων οἱ
γίνονται ἐκ τῆς περὶ τὸ ὄξος ἰλύος.

⁴ Καὶ γὰρ ἐν τοῖς δοκοῦσιν ἀσηπτοτάτοις εἶναι
ἐγγίγονται ζῶα, οἷον ἐν χιόνι τῇ παλαιᾷ. γίνεταί
δ' ἡ παλαιὰ ἐρυθροτέρα, διὸ καὶ οἱ σκώληκες τοι-
οῦτοι καὶ δασεῖς· οἱ δ' ἐκ τῆς ἐν Μηδία χιόνος μεγά-
10 λοι καὶ λευκοί· δυσκίνητοι δὲ πάντες. ἐν δὲ Κύπρῳ,
οὗ ἡ χαλκίτις λίθος καλεῖται, ἐπὶ πολλὰς ἡμέρας

¹ πεφυκωμένα scripsi: πεφυκότα codd., quod sensu caret; προπεφυκότα Sn., Pi. ² τῶν seclusi: τινῶν tent. A.-W.

³ haec ad cantharos (supra, 552 a 17) pertinere, non ad cantharides, recte monet Janssens.

⁴ hinc usque ad v. 23 ἐφήμερον secl. A.-W., ad v. 25 πρῶτον secl. Dt.

^a No satisfactory explanation of this passage has been given.

^b Curculionid beetles, perhaps *Haltica oleracea* (Th.).

^c These words, as is pointed out by E. Janssens, refer not to the *kantharis* but to the *kantharos* (see 552 a 17 ff. above), and have been inserted here in error.

der of the dung, which has been mixed together, and then, they say, the manure has been worked up.^a The beginning of these larvae is small: at first, even at this early stage, they take on a red colour and from a motionless state acquire motion, looking as though they had been coloured with orchil; after that there results a small motionless larva; then after a period of motion it later again becomes motionless; and from this the fly comes out in its perfected state, and moves off when the breeze comes or the sun shines. Horseflies are produced out of timber; bud-eaters^b out of small larvae which undergo metamorphosis: these are produced in the stalks of cabbage. Blister-beetles come out of the caterpillars which infest fig-, pear-, and fir-trees (larvae are found on all these trees), and out of those which infest the dog-thorn: [they also make for evil-scented things because they were produced out of evil-smelling stuff].^c The vinegar-fly comes out of small larvae which are engendered from the slime of vinegar.

In addition, animals come into existence in substances which are considered to be most resistant to putrefaction, e.g., in long-fallen snow. After lying for some time, snow turns slightly red, hence the larvae it produces are red too, and hairy.^d Those which arise out of the snow in Media are large and white; all are sluggish. In Cyprus, where copper ore is smelted, and the ore is piled on the furnace for many

^a The redness is due not to larvae but to algae, such as *Sphaerella nivalis*; the only insects found in snow are black. The phenomenon was not again described until 1778 by the Swiss naturalist Horace-Bénédict de Saussure (1740-1799), professor of experimental philosophy at Geneva at the age of twenty-two, who did much botanical and geological work on the Alps. (Balss.)

ἐμβαλλόντων, ἐνταῦθα γίγνεται θηρία ἐν τῷ πυρί, τῶν μεγάλων μυιῶν μικρόν τι μείζονα, ὑπόπτερα, ἃ διὰ τοῦ πυρός πηδᾶ καὶ βαδίζει. ἀποθνήσκουσι δὲ καὶ οἱ σκώληκες καὶ ταῦτα χωριζόμενα τὰ μὲν
 15 τοῦ πυρός, οἱ δὲ τῆς χιόνος. ὅτι δ' ἐνδέχεται καὶ μὴ καίεσθαι¹ συστάσεις τινὰς ζῶων, ἢ σαλαμάνδρα ποιεῖ φανερόν· αὕτη γάρ, ὡς φασί, διὰ τοῦ² πυρός βαδίζουσα κατασβέννυσι τὸ πῦρ. περὶ δὲ τὸν Ὑπανιν ποταμὸν τὸν περὶ Βόσπορον τὸν Κιμμέριον ὑπὸ τροπᾶς θερινᾶς καταφέρονται ὑπὸ τοῦ ποταμοῦ
 20 οἶον θύλακοι μείζους ῥαγῶν, ἐξ ὧν ῥήγνυμένων ἐξέρχεται ζῶον πτερωτὸν τετράπουν· ζῆ δὲ καὶ πέτεται μέχρι δειλῆς, καταφερομένου δὲ τοῦ ἡλίου ἀπομαραίνεται, καὶ ἅμα δυομένου ἀποθνήσκει βιώσαν ἡμέραν μίαν, διὸ καὶ καλεῖται ἐφήμερον. τὰ πλείστα δὲ τῶν γιγνομένων ἐκ τε καμπῶν καὶ
 25 σκωλήκων ὑπὸ ἀραχνίων κατέχεται⁴ τὸ πρῶτον.

Ταῦτα μὲν οὖν γίγνεται τοῦτον τὸν τρόπον.

XX Οἱ δὲ σφήκες οἱ ἰχνεύμονες καλούμενοι (εἰσὶ δ' ἐλάττους τῶν ἐτέρων) τὰ φαλάγγια ἀποκτείναντες φέρουσι πρὸς τειχίον ἢ τι τοιοῦτον τρώγλην ἔχον, καὶ πηλῷ προσκαταλείψαντες ἐντίκτουσιν ἐνταῦθα,
 30 καὶ γίνονται ἐξ αὐτῶν οἱ σφήκες οἱ ἰχνεύμονες.

¹ καὶ AC: om. PD, vulg.

² καίεσθαι ACP: κάεσθαι D, vulg.

³ τοῦ APD: om. C, vulg.

⁴ κατέχεται vulg., edd.: περιέχεται PD.

^a But contrast *G.A.* 737 a 1, "fire generates no animal," and *Meteor.* 382 a 6 f., "there are animals in earth and water only, and not in air and fire." At *G.A.* 761 b 13 ff. Aristotle says that as plants belong to the earth, aquatic

successive days, certain creatures are engendered in the fire,^a slightly larger than large flies, and winged: these jump and crawl through the fire. And they die when kept away from fire, just as the larvae previously mentioned die when kept away from snow. The fact that certain animal structures exist which really cannot be burnt is evident from the salamander, which, so they say, puts the fire out by crawling through it. On the river Hypanis in the Kimmerian Bosphoros, round the time of the summer solstice, certain objects like wallets, larger than grapes, are brought down by the current: when these break open a winged four-footed animal emerges: it lives and flies about until evening, and as the sun drops it pines away and dies at sunset, having lived precisely one day, whence its name, the day-fly.^b Most of the creatures which develop out of caterpillars and larvae are at first held in by cobweb strands.

I have now described how these creatures are produced.

The wasps called ichneumons^c ("trackers")—they XX are smaller than the others—kill venom-spiders and carry them off to a wall or some such place which has a hole in it: this they smear over with mud and there they lay their eggs, out of which come the tracker-

creatures to the water, and footed animals to the air, so we should expect to find a class corresponding to fire; but this class must be looked for on the moon. See note *ad loc.* in *G.A.* (Loeb ed.), and Notes, § 59 (*H.A.*, vol. i). For a long discussion of this subject, see William Lameere, in *L'Antiquité classique*, 18 (1949), pp. 279-324.

^b Probably the may-fly, *Ephemera longicauda*; cf. 490 a 34. The whole of this paragraph down to this point is considered spurious by A.-W.; Dittmeyer in addition brackets the following sentence.

^c Probably *Pelopaeus spirifer*; cf. 609 a 5.

ἐνια δὲ τῶν κολεοπτέρων καὶ μικρῶν καὶ ἀνωμένων
ζώων τοῦ πηλοῦ τρώγλας ποιοῦνται μικρὰς ἢ πρὸς
553 a τάφοις ἢ τειχίοις, καὶ ἐνταῦθα τὰ σκωλήκια ἐντί-
κτουσιν.¹

² [Ὁ δὲ χρόνος τῆς γενέσεως ἀπὸ μὲν τῆς ἀρχῆς
μέχρι τοῦ τέλους σχεδὸν τοῖς πλείστοις ἐπτάσι με-
τρέϊται τριοῖν ἢ τέτταρσιν. τοῖς μὲν οὖν σκώληξι³
5 καὶ τοῖς σκωληκοειδέσι τοῖς πλείστοις τρεῖς γίννον-
ται ἐπτάδες, τοῖς δ' ὤτοκοῦσι⁴ τέτταρες ὡς ἐπὶ τὸ
πολύ. τούτων δ' ἀπὸ μὲν τῆς ὀχέας ἐν ταῖς ἐπτά
ἢ σύστασις γίννεται, ἐν δὲ ταῖς λοιπαῖς τρισὶν
ἐπιάζουσι καὶ ἐκλέπουσιν ὅσα γόνω τίκτεται, οἷον
ὑπ' ἀράχνου ἢ ἄλλου τινὸς τοιούτου. αἱ δὲ μετα-
10 βολαὶ γίννονται τοῖς πλείστοις κατὰ τριήμερον ἢ
τετραήμερον, ὥσπερ καὶ αἱ τῶν νόσων συμβαίνουσι
κρίσεις.]

⁵ Τῶν μὲν οὖν ἐντόμων οὗτος ὁ τρόπος ἐστὶ τῆς
γενέσεως· φθείρονται δ' ἐρρικνωμένων τῶν μορίων,
ὥσπερ γῆρα τὰ μείζω τῶν ζώων· ὅσα δὲ πτερωτά,
15 καὶ τῶν πτερῶν συσπυμένων περὶ τὸ μετόπωρον·
οἱ δὲ μύωπες καὶ τῶν ὀμμάτων ἐξυδρωπιώντων.]
XXI Περὶ δὲ τὴν γένεσιν τὴν τῶν μελιττῶν οὐ τὸν
αὐτὸν τρόπον πάντες ὑπολαμβάνουσιν. οἱ μὲν γάρ
φασιν οὐ τίκτειν οὐδ' ὀχεύεσθαι τὰς μελίττας, ἀλλὰ
20 φέρειν τὸν γόνον, καὶ φέρειν οἱ μὲν ἀπὸ τοῦ ἄνθους
τοῦ καλλύντρον, οἱ δ' ἀπὸ τοῦ ἄνθους τοῦ καλάμου,
ἄλλοι δ' ἀπὸ τοῦ ἄνθους τῆς ἐλαίας· καὶ σημείων

¹ ἐντίκτουσιν edd.: ἐκτίκτουσιν codd.

² hinc usque ad v. 16 ἐξυδρωπιώντων ut spuria secl. A.-W.

³ σκώληξι Cs. ex Ambros., edd.: σκόλωφι P: κίνωφι ACD.

⁴ ὤτοκοῦσι Gaza, vulg.: ζωτοκοῦσι codd. (ζωτοῦσι secun-
dum Bk.): ὤσειδέσι conl. A.-W., probat Dt.

wasps. Some of the sheath-winged insects (coleo-
ptera),^a certain small and unnamed animals,^b make
small holes out of mud either on gravestones or walls
and there deposit their larvae.

[The time taken for development from start to
finish is, for most of them, three or four weeks; for
most larvae and larva-like creatures it is three weeks,
for the oviparous ones usually four. In the last-
named, the eggs are constituted in the seven <days>
after copulation, and in the remaining three weeks
the parent broods over them and hatches them—this
applies to those which are produced by means of
copulation, such as spiders and other such creatures.
For most of them, the transformations take place after
three or four days: compare the occurrence of crises
in diseases.^c

Such then is the manner of generation of insects.
They perish when their parts shrivel up, just as larger
animals perish through old age. Winged insects too
die in autumn when their wings shrink up. The
horse-fly^d dies when its eyes become dropsical.]

On the subject of the generation of bees there is XXI
by no means unanimity of opinion.^e Some maintain Bees.
that bees neither copulate nor bring forth young:
they fetch them in, so it is alleged, some say from the
flower of the *kallyntron*,^f others say from the flower of
the reed, others from that of the olive: in favour of

^a See 490 a 14.

^b Such as *Trichodes alvearius*. (Sn.)

^c e.g., in intermittent fevers.

^d Its name *myops* means "screwing up the eyes."

^e See also Bk. IX, ch. 40 and *G.A.* Bk. III, ch. 10.

^f The name actually means "broom" or "brush."

^g hic secundum Bk. caput xx denuo incipit.

553 a

λέγουσιν ὅτι, ἂν ἐλαιῶν φορὰ γένηται, τότε καὶ ἔσμοι ἀφίενται πλείστοι. οἱ δὲ φασὶ τὸν μὲν τῶν κηφήνων γόνον αὐτὰς φέρειν ἀπὸ τινος ὕλης τῶν
25 προειρημένων, τὸν δὲ τῶν μελιττῶν τίττειν τοὺς ἡγεμόνας.

Τῶν δ' ἡγεμόνων ἐστὶ γένη δύο, ὁ μὲν βελτίων πυρρός, ὁ δ' ἕτερος μέλας καὶ ποικιλώτερος, τὸ δὲ μέγεθος διπλάσιος τῆς χρηστῆς μελίττης· τὸ δὲ¹ κάτω τοῦ διαζώματος ἔχουσιν ἡμιόλιον μάλιστα τῷ μήκει, καὶ καλοῦνται ὑπὸ τινων μητέρες ὡς γεννῶν-
30 τες. σημεῖον δὲ λέγουσιν ὅτι ὁ μὲν τῶν κηφήνων ἐγγίγνεται γόνος κἂν μὴ ἐνῆ ἡγεμών, ὁ δὲ τῶν μελιττῶν οὐκ ἐγγίγνεται. οἱ δὲ φασὶν ὀχεύεσθαι,
553 b καὶ εἶναι ἄρρενας μὲν τοὺς κηφήνας, θηλείας δὲ τὰς μελίττας.

"Ἔστι δὲ τῶν μὲν ἄλλων ἢ γένεσις ἐν τοῖς κοίλοις τοῦ κηρίου, οἱ δὲ γ' ἡγεμόνες γίνονται κάτω πρὸς τῷ κηρίῳ, ἀποκρεμάμενοι χωρὶς, ἐξ ἧ ἑπτά, ἐναντίως τῷ ἄλλῳ γόνῳ πεφυκότες.

5 Κέντρον δ' αἱ μὲν μελιτταὶ ἔχουσιν, οἱ δὲ κηφήνες οὐκ ἔχουσιν· οἱ δὲ βασιλεῖς καὶ ἡγεμόνες ἔχουσι μὲν κέντρον, ἀλλ' οὐ τύπτουσι, διὸ ἐνιοὶ οὐκ οἴονται ἔχειν αὐτούς.

XXII Εἰσὶ δὲ γένη τῶν μελιττῶν, ἡ μὲν ἀρίστη μικρὰ καὶ στρογγύλη καὶ ποικίλη, ἄλλη δὲ μακρὰ, ὅμοια τῇ ἀνθρήνῃ, τρίτος δ' ὁ φῶρ καλούμενος (οὗτος δ'

¹ τὸ δὲ AC : καὶ τὸ PD, vulg.

* A heavy crop of olives figures in the well-known story about Thales (see *Politics*, 1259 a 7 ff.), whose foreknowledge, during the previous winter, of its occurrence enabled him to make a corner in olive-presses; his information, according to Aristotle, was derived from his skill in astronomy.

the olive it is urged that when there is a heavy crop^a then it is that the greatest number of swarms come off.^b Others maintain that the "bees"^c fetch in the brood of drones from one of the plants mentioned above, while the brood of "bees" is generated from the "leaders."

There are two sorts of "leaders": the better kind is red, the other dark and somewhat mottled. Their size is double that of the worker-bee, and the part below the *diazoma* is half as long again. Some people call them "mothers," implying that they produce the young,^d and urge in favour of this view that the brood of drones comes into existence even if no "leader" is in the hive, whereas the brood of "bees" does not. Others maintain that copulation occurs among these insects, and that the drones are male and the "bees" female.

All except the "leaders" are formed in the cells of the comb; the "leaders" are formed down below, attached to the comb, suspended separately from it, six or seven of them: their manner of growth is quite different from the rest of the brood.^e

"Bees" have a sting, but drones have not. The kings or "rulers" have a sting, but never use it; hence some people suppose they do not possess one.

There are the following kinds of bees: The best XXII kind is small, roundish, and mottled; a second is long, similar to the anthrena; a third is the so-called

^b See below, 553 b 23.

^c *i.e.*, worker-bees, called "useful bees" at line 27 below.

^d The sex of the "leaders" was established by the Dutch zoologist Jan Swammerdam (1637-1680), who was a pioneer of microscopy and was the first to describe the red corpuscles of the blood (1658). (Balss.)

^e See 554 a 27.

10 ἐστὶ μέλας καὶ πλατυγαστῶρ), τέταρτος δ' ὁ κηφήν,
 μέγεθαι μὲν μέγιστος ἀπάντων,¹ ἄκεντρος δὲ καὶ
 νωθρός· διὸ καὶ πλέκουσί τινες περὶ τὰ σμήνη ὥστε
 τὰς μὲν μελίττας εἰσδύεσθαι, τοὺς δὲ κηφήνας μὴ
 διὰ τὸ εἶναι αὐτοὺς μείζους.

Ἡγεμόνων δὲ γένη δύο ἐστίν, ὥσπερ εἴρηται καὶ
 15 πρότερον. εἰσὶ δὲ πλείους ἐν ἐκάστῳ σμήνει ἡγε-
 μόνες, καὶ οὐχ εἷς μόνος· ἀπόλλυται δὲ τὸ σμήνος,
 ἂν τε ἡγεμόνες μὴ ἱκανοὶ ἐνώσιν (οὐχ οὕτω διὰ τὸ
 ἀναρχον² εἶναι, ἀλλ' ὡς φασίν, ὅτι συμβάλλονται εἰς
 τὴν γένεσιν τὴν τῶν μελιτῶν) ἂν τε πολλοὶ ὦσιν
 οἱ ἡγεμόνες· διασπῶσι γάρ.

20 Ὅταν μὲν οὖν ἔαρ ὄψιον γένηται, καὶ ὅταν αὐχμοὶ
 καὶ ἐρυσίβη, ἐλάττων γίγνεται ὁ γόνος· ἀλλ' αὐχμοῦ
 μὲν ὄντος μέλι ἐργάζονται μᾶλλον, ἐπομβρίας δὲ γό-
 νου, διὸ καὶ ἅμα συμβαίνει ἐλαιῶν φορὰ καὶ ἐσμῶν.
 ἐργάζονται δὲ πρῶτον μὲν τὸ κηρίον, εἶτα τὸν γόνον
 ἐναφιάσιν, ὡς μὲν ἔνιοι λέγουσιν, ἐκ τοῦ στόματος,
 25 ὅσοι φέρειν φασὶν ἄλλοθεν,³ εἶθ' οὕτω τὸ μέλι τροφήν
 τὴν μὲν τοῦ θέρους τὴν δὲ τοῦ μετοπώρου· ἄμεινον
 δ' ἐστὶ τὸ μετοπωρινὸν μέλι.

Γίγνεται δὲ κηρίον μὲν ἐξ ἀνθέων, κήρωσιν δὲ
 φέρουσιν ἀπὸ τοῦ δακρύου τῶν δένδρων, μέλι δὲ
 τὸ πίπτον ἐκ τοῦ ἀέρος, καὶ μάλιστα ἐν ταῖς τῶν

¹ ἀπάντων AC: πάντων vulg.

² ἀναρχον conl. A.-W.: ἀναρχοὶ AC, edd., vulg.: ἀναρχα D:
 ἀναρχαὶ P.

³ post ἄλλοθεν lac. stat. Dt., qui e.g. ὡς δ' ἄλλοι λέγουσι,

robber, which is dark-coloured and flat-bellied; a fourth is the drone, largest of all in size, but stingless and inactive. The size of the drones has led some beekeepers to put netting round the hives so as to let the "bees" enter and keep out the drones which are larger.

There are two kinds of "leaders," as I have already said. In each hive there are several "leaders," not one merely; a hive comes to grief unless it has enough "leaders" in it: this is not because of any resulting lack of leadership, but (so we are told) because they contribute towards the generation of the "bees." A hive will also fail if the "leaders" are too numerous: they produce factions in the hive.^a

When the spring is late in coming, and when there are droughts or mildew, the brood is less numerous: during a drought they give more attention to the honey, during rainy weather to the brood; thus we find heavy crops of olives^b and frequent swarmings coincide. They work first at the comb, then they put the brood into it—out of their mouths (so those allege who maintain they fetch it from elsewhere); after that they put in honey for nourishment, part of it in summer and part in autumn (autumn honey is the better).

The comb is made from flowers; the material for sealing they fetch in from the gum^c of trees; the honey is what falls from the air, especially at the risings

^a René-Antoine Ferchault de Réaumur (1683-1757) was the first (1740) to show that normally there is only one queen in a hive. (Balss.)

^b Cf. above, 553 a 22.

^c Lit., the "tear-drop."

τεκοῦσαι excidisse putat; ὡς μὲν ἔνιοι λέγουσιν <ἐξ ὀχίας, ὡς δ' ἄλλοι λέγ.> ἐκ Gohlke.

553^b

30 ἄστρον ἐπιτολαῖς, καὶ ὅταν κατασκήψῃ ἡ Ἴρις¹·
ὄλως δ' οὐ γίννεται μέλι πρὸ Πλειάδος ἐπιτολῆς.

[τὸ μὲν οὖν κηρίον² ποιεῖ, ὡσπερ εἴρηται, ἐκ τῶν
554 a ἀνθῶν· τὸ δὲ μέλι ὅτι οὐ ποιεῖ, ἀλλὰ φέρει τὸ πίπ-
τον,³ σημεῖον· ἐν μιᾷ γὰρ ἢ δυσὶν ἡμέραις πλήρη εὐ-
ρίσκουσι τὰ σμήνη οἱ μελιττουργοὶ μέλιτος. ἔτι δὲ
τοῦ μετοπώρου ἀνθῆ μὲν γίννεται, μέλι δ' οὐ, ὅταν
ἀφαιρεθῇ. ἀφηρημένου οὖν ἤδη τοῦ γενομένου
5 μέλιτος, καὶ τροφῆς ἢ οὐκ ἐνούσης ἔτι ἢ σπανίας,
ἐνεγίννετο ἄν, εἴπερ ἐποίουν ἐκ τῶν ἀνθῶν.]⁴

Συνίσταται δὲ τὸ μέλι πεττόμενον· ἐξ ἀρχῆς γὰρ
οἶον ὕδωρ γίννεται, καὶ ἐφ' ἡμέρας μὲν τινας ὑγρόν
ἔστι (διὸ καὶ ἀφαιρεθῆ ἔν ταύταις ταῖς ἡμέραις,

¹ ἡ Ἴρις | Iris A : σίριος D (cf. Plin. *N.H.* xi. 12. 30) : e contra cf. *Probl.* 906 a 37 ἂν ἡ Ἴρις κατασκήψῃ.

² sic AC : τὸν μὲν οὖν κηρὸν PD, vulg. : ποιεῖ ὡσπερ εἴρηται om. AC : hinc usque ad 554 a 6 ἀνθῶν secl. Dt., sequentibus enim contra dicunt.

³ τὸ πίπτον | πλείστον μέρος P (μόνον D).

⁴ secl. Dt. ut sequentibus repugnancia.

^a The "risings of the stars": cf. the phrase at 600 a 3 "that fishes go into hiding in summer too seems to be shown by the fact that they are caught ἐπὶ τοῖς ἀστροῖς, and especially ἐπὶ κυβλ." What is intended by τὰ ἄστρα is not clear: it no doubt referred to certain particular stars, and was well understood at the time without further qualification. Cf. too 568 a 18 "the *kyrrinos* breeds five or six times a year, and most of all ἐπὶ τοῖς ἀστροῖς," where Th. says it means "the rising of the greater constellations," e.g., the Pleiades, Arcturus, and the Dogstar, on the authority of Pliny xi. 14 f., and there seems some warrant for this in Aristotle's usage elsewhere. Further support is afforded by Hippocr. *Airs Waters Places*, ch. 11 (ii. 52. 4 ff. L.): "One must also be on one's guard against the risings of the stars, and especially of the Dogstar, next that of Arcturus, and also the setting of the Pleiades, for it is especially during these days that diseases come to a crisis."

of the stars^a and when the rainbow descends^b; on the whole there is no honey before the <morning> rising of the Pleiad.^c [The bee makes the comb, then, from flowers, as has been said, but honey it does not make; it fetches in what falls <from the air>, as is proved by the fact that beekeepers find the hives full of honey within one or two days. Again, flowers appear in autumn, but honey does not once what is in the hive has been taken off: if the bees made the honey out of flowers, we should find more honey appearing in the hives after the original supply had been taken off and no nourishment (or very little) remained there.]^d

Honey becomes firmer as it matures^e: to start with it is like water and stays liquid for several days; hence, if it is taken off during that time it is thin: it

^b "When the rainbow descends." The verb *κατασκήπτειν*, which normally means to strike or rush down upon, hardly seems appropriate to the rainbow, but it is used again in the same connexion at *Prob.* 906 a 37 (at 906 b 24 *ἐπισκήπτειν* is used), and for what it is worth this evidence favours the reading *Ἴρις* (rainbow) in preference to *σίριος* (Sirius, the Dogstar); it may also offer some elucidation of the present statement. The question dealt with in the *Problems* is whether trees upon which the rainbow has "descended" become sweet-scented: As the rainbow is not an actual object, but an effect produced on the eye by refraction, it can be a cause only *per accidens*; the real cause is the rains which accompany the rainbow; and these are not heavy rains: normally when rainbows appear the showers are frequent and light. A heavy shower would extinguish the heat in the newly-burnt wood, and that is where the effect is most noticeable. The dewfall mentioned in our present passage seems to be comparable with the slight showers mentioned in the *Problems*.

^c Early in May; see App. A, p. 399.

^d Some of the statements in this paragraph are at variance with those in the next.

^e *Lit.*, "as it gets concocted"; see Notes, §§ 19 ff.

οὐκ ἔχει πάχος), ἐν εἴκοσι δὲ μάλιστα συνίσταται.
 10 δῆλον δ' ἐστὶν εὐθέως τὸ ἀπὸ τοῦ θύμου¹. διαφέρει
 γὰρ τῇ γλυκύτητι καὶ τῷ πάχει. φέρει δ' ἀπὸ πάν-
 των ἢ μέλιττα ὅσα ἐν κάλυκι ἀνθεῖ, καὶ ἀπὸ τῶν
 ἄλλων δ' ὅσα ἀν γλυκύτητα ἔχῃ, οὐδένα βλάπτουσα
 15 ἀναλαμβάνουσα κομίζει. βλίσσεται δὲ τὰ σμήνη,
 ὅταν ἐρινεὸν σῦκον φανῇ· σχάδονας δ' ἀρίστας ποι-
 οῦσιν, ὅταν μέλι ἐργάζωνται. φέρει δὲ κηρὸν μὲν
 καὶ ἐριθάκην περὶ τοῖς σκέλεσι, τὸ δὲ μέλι ἐμὲ εἰς
 τὸν κύτταρον. τὸν δὲ γόνον ὅταν ἀφῆ, ἐπιάζει
 ὡσπερ ὄρνις. ἐν δὲ τῷ κηρίῳ τὸ σκωλήκιον μικρὸν
 20 μὲν ὄν κείται πλάγιον, ὕστερον δ' ἀνίσταται αὐτὸ
 ὑφ' αὐτοῦ καὶ τρέφεται, πρὸς δὲ τῷ κηρίῳ ἔχεται²
 ὡστε καὶ ἀντειληφθῆναι. ὁ δὲ γόνος ἐστὶ τῶν μελιτ-
 τῶν καὶ τῶν κηφήνων λευκός, ἐξ οὗ τὰ σκωλήκια
 γίνονται· αὐξανόμενα δὲ γίνονται μέλιττα καὶ κη-
 φήνες. ὁ δὲ τῶν βασιλέων γόνος τὴν χροάν γίνονται
 25 ὑπόπυρρος, τὴν δὲ λεπτότητα ἐστὶν ὅλον μέλι παχύ-
 τὸν δ' ὄγκον εὐθέως ἔχει παραπλήσιον τῷ γιγνομένῳ
 ἐξ αὐτοῦ.³ σκώληξ δ' οὐ γίνονται πρότερον ἐκ τοῦ-
 του, ἀλλ' εὐθέως ἢ μέλιττα, ὡς φασίν. ὅταν δὲ τέκη
 ἐν τῷ κηρίῳ, μέλι ἐκ τοῦ ἀπαντικρὺ γίνονται. φύει
 δ' ἢ σχάδων πόδας καὶ πτερά, ὅταν καταλειφθῇ·

¹ θύμου Pi., A.-W., Dt.: χυμοῦ codd., vulg.: Ὑμήττου loco χυμοῦ prop. A.-W.

² ἔχεται PD, vulg., edd.: οὐ προσέρχεται AC: οὐ προσέχεται Buss., Pi.

³ αὐτοῦ scripsi: αὐτοῦ codd.

^a "Thyme-honey" is an emendation accepted by several

takes about twenty days to thicken. Thyme-honey^a can be distinguished immediately: it is outstanding for its sweetness and consistency. The bees fetch it in from all flowers whose blossoms are in a calyx and from all others which contain sweetness, without injuring any of the fruit: they pick up the juices from them with their tongue-like organ and carry them home. The time for taking honey off the hives is when the wild-fig appears. They produce the best grubs^b when they are working at the honey. The bee carries wax and bee-bread round its legs: the honey it vomits into the cells. When it has deposited the brood, it incubates like a bird. In the comb, the larva, while it is small, lies obliquely^c; later on it rises upright by its own efforts and takes nourishment, and it clings so fast to the comb as actually to be squeezed up against it.^d The brood of bees and drones is white, and from it are formed the larvae, which grow up into bees and drones. The brood of the "kings" is somewhat red in colour, and its thinness is about the same as thick honey. From the first its bulk is comparable to that which is produced out of it. No larva is produced out of it by way of preliminary, but (so they say) the bee is formed straightway. Whenever a bee lays brood in the comb, there is always some honey over against it. The grub grows feet and wings as soon as it has been sealed up; and when it has editors; the mss. give "honey that comes from juice." A.-W. suggest "Hymettus honey."

^b Aristotle uses the proper word *σχάδων* for the larvae of bees and wasps four times in these chapters, and I have marked this by translating it "grubs," to distinguish it from *σκώληξ* and *σκωλήκιον*.

^c Cf. 555 a 1, 11.

^d I take the verb used here to be a compound of *εἰλέω*, pf. pass. *εἰλημαι*.

554 a

30 ὅταν δὲ λάβῃ τέλος, τὸν ὑμένα περιρρήξασ¹ ἐκπέ-
 554 b ται. κόπρον δὲ προίεται, ἕως ἂν ἡ σκωλήκιον,
 ὕστερον δ' οὐκέτι, πλὴν ἐὰν δῆ² ἐξέλθῃ, ὥσπερ
 ἐλέχθη πρότερον. ἐὰν δὲ τις ἀφέλῃ τὰς κεφαλὰς
 τῶν σχαδόνων³ πρὶν πτερὰ ἔχειν, ἐξεσθίουσιν αὐτὰς⁴
 αἱ μέλιτται· καὶ κηφήνος πτερόν ἂν ἀποκνίσας ἀφῆ
 5 τις, τῶν λοιπῶν αὐταὶ τὰ πτερὰ ἀπεσθίουσιν. βίος
 δὲ τῶν μελιττῶν ἔτη ἕξ· ἔνια δ' ἑπτὰ ζῶσιν. σμήνος
 δ' ἂν διαμείνῃ ἔτη ἑννέα ἢ δέκα, εἰ δοκεῖ διαγε-
 γενῆσθαι.

Ἐν δὲ τῷ Πόντῳ εἰσὶ τινες μέλιτται λευκαὶ σφό-
 δρα, αἱ τὸ μέλι ποιοῦσι δις⁵ τοῦ μηνός.⁶ (αἱ δ' ἐν
 10 Θεμισκύρα περὶ τὸν Θερμῶδοντα ποταμὸν ἐν τῇ γῆ
 καὶ ἐν τοῖς σμήνεσι ποιοῦνται κηρία οὐκ ἔχοντα
 κηρὸν πολὺν ἀλλὰ πάνυ σμικρὸν, μέλι δὲ παχὺ· τὸ δὲ
 κηρίον λεῖον καὶ ὀμαλὸν ἐστίν.) οὐκ αἰεὶ δὲ τοῦτο
 ποιοῦσιν, ἀλλὰ τοῦ χειμῶνος· ὁ γὰρ κιττός πολὺς ἐν
 τῷ Πόντῳ⁷ ἐστίν, ἀνθεὶ δὲ ταύτην τὴν ὥραν, ἀφ' οὗ
 15 φέρουσι τὸ μέλι. κατάγεται δὲ καὶ εἰς Ἀμισὸν μέλι
 ἄνωθεν λευκὸν καὶ παχὺ σφόδρα, ὃ ποιοῦσιν αἱ μέ-
 λιτται ἄνευ κηρίων πρὸς τοῖς δένδρεσιν· γίγνεται δὲ
 καὶ ἄλλοθι τοιοῦτον ἐν τῷ Πόντῳ. εἰσὶ δὲ καὶ
 μέλιτται αἱ ποιοῦσι κηρία τριπλά ἐν τῇ γῆ· ταῦτα
 20 δὲ μέλι μὲν ἔχει,⁸ σκώληκας δ' οὐκ ἔχει.⁹ ἐστὶ δ'
 οὔτε τὰ κηρία πάντα τοιαῦτα, οὔτε πᾶσαι αἱ μέλιτται
 τοιαῦτα ποιοῦσιν.

¹ περιρρήξασ' Dt. (περιρρήξασα Pi.): περιρρήξας CPD, vulg.: περιρρήξαν A.

² δῆ A.-W.: μῆ codd., vulg.: ἐν ἀκμῇ conii. Pi.

³ τῶν σχαδόνων Dt.: τῆς σχάδονος ACP, vulg.

⁴ αὐτὰς A.-W.: αὐτὰ AC: αὐτὰ PD, vulg.

⁵ δις] διὰ A. ⁶ δι' ἐκάστου μηνός vel λυσσομανές tent. Dt.

reached its complete development it breaks the membrane and flies out. It discharges excrement while still a larva, but none later on, until of course it has made its way out, as already described. If one removes the heads of the grubs before they get their wings, the bees eat them up; if one nips off a drone's wings and then lets it go, the bees eat off the wings of the remaining drones. The life of a bee is six years; some live for seven. If a hive lasts for nine or ten years, it is considered to have done very well.

In Pontus there are certain exceptionally white bees, which produce honey twice a month.^a (The bees in Themiskyra, in the neighbourhood of the river Thermodon, build combs in the earth and in hives: these combs contain very little wax indeed but quite thick honey: the comb itself is smooth and uniform.) They do not do this throughout the year, but only in winter, because in Pontus there is an abundance of ivy, which flowers at that season, and from it they collect the honey. A white and exceptionally thick honey is brought down to Amisos from the higher country: the bees make this without any combs up against the trees. This kind of honey is made in other regions of Pontus too. There are also bees which make triple combs in the earth; these contain honey, but no larvae. Not all the combs are of this type, nor do all the bees make such combs.

^a Dittmeyer makes two alternative suggestions instead of "twice a month," one of which is λυσσομανές, "raving mad." Pontic honey was reputed to cause madness; cf. Xen. *Anab.* iv, end, etc. Beckmann on [Arist.], *De mirab. ausc.* 831 b 22 (pp. 44 ff.), has a long note on the subject.

⁷ πόντῳ C: τόπῳ APD, vulg.

⁸ ἔχει restitui, monente Dt.: ἰσχεῖ codd., vulg.

⁹ ἔχει AC: ἰσχεῖ vulg.

554 b

- XXIII Αἱ δ' ἀνθρήναι καὶ οἱ σφήκες ποιοῦσι κηρία τῷ γόνῳ, ὅταν μὲν μὴ ἔχωσιν ἡγεμόνα ἀλλ' ἀποπλανηθῶσι καὶ μὴ εὐρίσκωσιν, αἱ μὲν ἀνθρήναι ἐπὶ με-
 25 τεώρου τινός, οἱ δὲ σφήκες ἐν τρώγλαις, ὅταν δ' ἔχωσιν ἡγεμόνα, ὑπὸ γῆν. ἐξάγωνα μὲν οὖν ἐστὶ πάντα¹ τὰ κηρία αὐτῶν, ὡσπερ καὶ τὰ τῶν μελιττῶν, σύγκειται δ' οὐκ ἐκ κηροῦ ἀλλ' ἐκ φλοιώδους καὶ ἀραχνιώδους² ὕλης τὸ κηρίον· γλαφυρώτερον δὲ πολλῶ τὸ τῶν ἀνθρηνῶν ἐστὶν ἢ τὸ τῶν σφήκων
 30 κηρίον. ἐναφιάσι δὲ γόνον, ὡσπερ αἱ μέλιτται, ὅσον
 555 a σταλαγμὸν εἰς τὸ πλάγιον τοῦ κυττάρου, καὶ ἔχεται πρὸς³ τῷ τοίχῳ. οὐχ ἅμα δὲ πᾶσι τοῖς κυττάροις ἐνεστι γόνος, ἀλλ' ἐνίοις μὲν ἤδη μεγάλα ἐνεστιν ὡστε καὶ πέτεσθαι, ἐνίοις δὲ νύμφαι, ἐν τοῖς δὲ σκώληκες ἐτι. κόπρος δὲ μόνον περὶ τοῖς σκώληξι,
 5 ὡσπερ καὶ ταῖς μελίτταις. καὶ ἔστ' ἂν νύμφαι ὦσιν, ἀκωνητίζουσι καὶ ἐπαλήθιπται ὁ κύτταρος, κατα-
 τικρῷ δ' ἐν τῷ κυττάρῳ τοῦ γόνου ὅσον σταλαγμὸς ἐγγίγνεται μέλιτος ἐν τοῖς τῆς ἀνθρήνης κηρίοις. γίνονται δ' αἱ σχάδονες οὐκ ἐν τῷ ἔαρι τούτων, ἀλλ' ἐν τῷ μετοπώρῳ· τὴν δ' αὔξησιν ἐπίδηλον λαμ-
 10 βάνουσι μάλιστ' ἐν ταῖς πανσελήνοις. ἔχεται δὲ καὶ ὁ γόνος καὶ οἱ σκώληκες οὐ κάτωθεν τοῦ κυττάρου, ἀλλ' ἐκ τοῦ πλαγίου.⁴
- XXIV Ἔνια δὲ τῶν βομβυκίων πρὸς λίθῳ ἢ τοιοῦτῳ τινὶ ποιοῦσι πῆλινον δξύ, ὡσπερ σιάλω⁵ καταλεί-
 15 φοντα⁶. τοῦτο δὲ σφόδρα παχὺ καὶ σκληρόν· λόγῃ

¹ ἐστὶ πάντα AC : πάντα ἐστὶ PD, vulg.² ἀραχνιώδους A.-W. : ἀραχνώδους PD : ἀμμώδους AC.³ ἔχεται πρὸς Pi. : ἔρχονται πρὸς AC : προσέχεται PDA².⁴ τοῦ πλαγίου AC : τῶν πλαγιῶν PD, vulg.⁵ σιάλω A.-W. : οἱ ἄλες APD : ἐν ἄλλοις οἱ ἄλες C : ὑάλω Sn., ὡσπερὶ ἀλὶ Sn. in cur. post. : ὡσπερὶ ἀλὸς στίλβη Pi.

Anthrenas and wasps make combs for their brood. XXIII
 When they have no "leader" and are wandering ^{Wasps.}
 about without finding one, the anthrenas make their
 comb on some high situation, the wasps in holes ;
 when they have a "leader," below ground. All their
 combs are hexagonal, like those of bees, but they
 consist not of wax but of some bark-like netted
 material, and the comb of the anthrenas is much
 neater than the wasps'. As bees do, they deposit in
 it the brood, each no bigger than a drop of liquid,
 on to the side of the cell, and it adheres to the cell-
 wall. Brood does not appear in all the cells simul-
 taneously : in some there are creatures already big
 enough to fly, in some pupae, in some mere larvae.
 Excrement occurs only with the larvae, as with bees.
 While they are at the pupa-stage they are motion-
 less, and the cell is sealed over. In the combs of the
 anthrenas, over against the brood in the cell there is
 just a drop of honey. The grubs of bees and anthrenas
 appear not in spring but in autumn, and they make
 noticeable growth especially at the times of full
 moon.^a The brood and the larvae do not adhere to
 the bottom of the cell, but to the side.^b

Some of the mason-bees^c make a pointed nest of XXIV
 clay against a stone or some such object, and smear
 it with some sort of spittle. This nest is very thick
 and hard : it is only just possible to break it with a

^a Cf. 544 a 20.^b Cf. 554 a 20.^c This description tallies with *Chalicodoma muraria*, except that this makes a rounded and not a pointed nest. The *Eumenes coarctata*, which is a solitary wasp, builds a small conical one-celled nest of clay and spittle, but it contains no comb. (Th.)⁶ καταλείφοντα Sn., Pi., A.-W., Dt. : καταλείφονται vulg.

555 a

γὰρ μόλις διαιρούσιν. ἐνταῦθα δὲ τίκτουσι, καὶ γίγνεται σκωλήκια λευκὰ ἐν ὑμένι μέλανι. χωρὶς δὲ τοῦ ὑμένος ἐν τῷ πηλῷ ἐγγίγνεται κηρός· οὗτος δ' ὁ κηρός πολὺ ἐστὶν ὠχρότερος τοῦ τῶν μελιττῶν.

XXV Ὀχεύονται δὲ καὶ οἱ μύρμηκες καὶ τίκτουσι σκω-
20 λήκια,¹ ἃ οὐ προσπέφυκεν οὐδενί, ἀξανάμενα δὲ ταῦτα ἐκ μικρῶν καὶ στρογγύλων τὸ πρῶτον μακρὰ γίγνεται καὶ διαρθροῦται· ἢ δὲ γένεσις ἐστὶ τούτοις τοῦ ἕαρος.

XXVI Τίκτουσι δὲ καὶ οἱ σκορπίοι οἱ χερσαῖοι σκωλήκια
ψοειδῆ πολλά καὶ ἐπιάζουσιν. ὅταν δὲ τελειωθῆ,
ἐκβάλλονται, ὥσπερ οἱ ἀράχναι, καὶ ἀπόλλυνται ὑπὸ
25 τῶν τέκνων· πολλάκις γὰρ γίνονται περὶ ἕνδεκα τὸν ἀριθμὸν.

XXVII Τὰ δ' ἀράχνια ὀχεύεται μὲν πάντα τὸν εἰρημένον
τρόπον, γεννᾷ δὲ σκωλήκια μικρὰ πρῶτον· ὅλα γὰρ
μεταβάλλοντα γίγνεται ἀράχνια, καὶ οὐκ ἐκ μέρους,
30 ἐπεὶ στρογγύλα ἐστὶ κατ' ἀρχάς· ὅταν δὲ τέκη,
555 b ἐπιάζει τε καὶ ἐν τρισὶν ἡμέραις διαρθροῦται. τίκτει
δὲ πάντα μὲν ἐν ἀραχνίῳ, ἀλλὰ τὰ μὲν ἐν λεπτῷ καὶ
μικρῷ, τὰ δ' ἐν παχεί, καὶ τὰ μὲν ὅλως ἐν κύτει
στρογγύλῳ, τὰ δὲ μέχρι τινὸς περιέχεται ὑπὸ τοῦ
ἀραχνίου. οὐχ ἅμα δὲ πάντα <τὰ>² ἀράχνια γίγνε-
5 ται· πηδᾷ δ' εὐθὺς καὶ ἀφήσιν ἀράχνιον. ὁ δὲ χυμὸς
ὁμοῖος ἐν τοῖς σκώληξι θλιβομένοις καὶ ἐν αὐτοῖς
νέοις οὔσι, παχὺς καὶ λευκός.

¹ post σκ. ψοειδῆ olim scriptum fuisse credunt A.-W.

² τὰ suppl. Dt.

^a Actually, a mixture of stored-up honey and pollen.

^b Cf. 550 b 28 ff. and note.

^c And therefore might have been expected to develop as

crowbar. Here they lay their brood, and small white larvae are produced, in a black membrane. Separate from the membrane there is wax^a in the clay-and-spittle construction: this wax is much yellower in colour than beeswax.

Ants, too, copulate and engender small larvae, which XXV
do not attach themselves to anything, but begin as Ants.
small round objects and get longer as they grow, and become articulated: they are found in spring.

Land-scorpions also engender large numbers of XXVI
small egglike larvae and incubate them. When their Land-
development is completed, the parents are thrown scorpions.
out (as happens too with spiders) and destroyed by the young ones, for these often number about eleven.

Spiders all copulate in the way already described XXVII
and generate small larvae at first: that is to say, the Spiders.
young spiders are produced by the metamorphosis of the larva as an entirety, and not out of part of it^b—although the larva is round in shape at the beginning.^c When the spider produces its brood, it incubates them, and in three days they take articulated shape. All spiders lay them in a web, some in a small fine web, others in a thick one; and some are completely enveloped in a round container, some are only partially surrounded by the web. The young spiders do not all hatch out at the same time; but they immediately begin to jump and to spin web. The juice in the larvae when squeezed is the same as in the young spiders—thick and white.

though it had been an egg; see note on 550 b 28 ff. Aristotle points out at *G.A.* 758 b 10 ff. that we must not suppose all round-shaped fetations are eggs: our decision between egg and larva must depend on what sort of development goes on inside; whether the embryo develops out of the whole or out of part of the contents. Cf. *Intro.*, vol. i, p. xviii.

Αἱ δὲ λειμώναι ἀράχαι προαποτίκτουσιν εἰς ἀράχιον, οὗ τὸ μὲν ἡμῖσιν πρὸς αὐταῖς ἔστι, τὸ δ' ἡμῖσιν ἕξω· καὶ ἐν τούτῳ ἐπμάζουσαι ζωοποιοῦσιν.
 10 τὰ δὲ φαλάγγια τίκτει εἰς γυργαθὸν πλεξάμενα παχύν, ἐφ' ᾧ ἐπμάζουσιν. τίκτουσι δ' αἱ μὲν γλαφυραὶ ἐλάττω τὸ πλήθος, τὰ δὲ φαλάγγια πολὺ τὸ¹ πλήθος· καὶ αὐξηθέντα περιέχει κύκλω τὸ φαλάγγιον καὶ ἀποκτείνει τὴν τεκοῦσαν ἐκβάλλοντα, πολλάκις δὲ καὶ τὸν ἄρρην, ἐὰν λάβωσιν· συνεπμάζει γὰρ τῇ
 15 θηλείᾳ. ἐνίοτε δὲ τὸ πλήθος γίνονται καὶ τριακόσια περὶ ἐν φαλάγγιον. ἐκ δὲ μικρῶν τέλειοι οἱ ἀράχαι γίνονται περὶ τὰς ἐπάδας τὰς τέτταρας.
 XXVIII Αἱ δ' ἀκρίδες ὀχεύονται μὲν τὸν αὐτὸν τρόπον τοῖς ἄλλοις ἐντόμοις, ἐπιβαίνοντος τοῦ ἐλάττονος ἐπὶ τὸ
 20 μείζον (τὸ γὰρ ἄρρην ἐλαττόν ἔστι), τίκτουσι δ' εἰς τὴν γῆν καταπήξασαι τὸν πρὸς τῇ κέρκῳ καυλόν,² ὃν οἱ ἄρρηνες οὐκ ἔχουσιν. ἀθρόα³ δὲ τίκτουσι καὶ κατὰ τὸν αὐτὸν τόπον, ὥστε εἶναι καθαπερὶ κηρίον. εἴθ' ὅταν τέκωσιν, ἐνταῦθα γίνονται σκώληκες ὡσειδεῖς, οἱ περιλαμβάνονται ὑπὸ τινος γῆς λεπτῆς
 25 ὡς περὶ ὑμένος· ἐν ταύτῃ⁴ δ' ἐκπέττονται. γίνεταί δὲ μαλακὰ τὰ κνήματα οὕτως ὡστ' ἂν τις ἀψῆται συνθλίβεσθαι. ταῦτα δ' οὐκ ἐπιπολῆς ἀλλὰ μικρὸν ὑπὸ γῆς ἔστιν. ὅταν δ' ἐκπεφθῶσιν,⁵ ἐκδύνουσιν ἐκ

¹ τὰ AC: om. PD, vulg.² αὐλόν PD.³ ἀθρόα A.-W.: ἀθροαὶ AC, vulg.: ἀθρόως PD.⁴ ἐν ταύτῃ PD: ἐκ ταύτης AC, vulg.⁵ ἐκπεφθῶσιν m Ambr., Cs., Buss., Pi., A.-W., Dt.: ἐκπευθῶσιν P: πεφθῶσιν AC, vulg.: ἐκτέκωσιν D.

^a This sentence appears to apply to all spiders, since the word ἀράχαι, not φαλάγγια, is used.

The field-spiders at the outset lay their brood into a web, of which one half is attached to the parent and the other half is external: on this web the spider incubates and so produces the young. The venom-spiders lay into a sort of thick basket, woven by them for this purpose, and on this they incubate. The smooth spider lays a comparatively small number, but the venom-spider is prolific, and its young, when they have grown, surround the mother-spider, eject it and kill it, and quite often they do the same to the male parent if they can get hold of it—for the male shares the incubation with the female. Sometimes there are as many as 300 of them round one parent venom-spider. Spiders^a complete their growth in about four weeks.

Grasshoppers^b copulate in the same way as other XXVIII insects: the smaller (*viz.*, the male) mounts the larger. The females lay their brood by fixing into the ground the tube^c which they have at their tail-end: the males do not have this tube. They lay them all together simultaneously in one place, and the effect is that of a honeycomb. This having been done, there are formed egglike larvae, which are enveloped in a sort of thin clay, as in a membrane; and in this they undergo the process of maturing.^d These fetations^e become so soft that they collapse if touched. They are not on the surface of the ground, but a little way below. When their maturing is complete, there

^b Ἀκρίς sometimes seems to include locusts, but I have kept "locust" as a translation of ἀρτέλαβος (see next chapter).

^c καυλός or αὐλός: either reading is possible. This ovipositor is present in species such as *Locusta viridissima*, but not in ordinary grasshoppers and locusts. (Th.)

^d Lit., "concoction"; see Notes, §§ 19 ff.

^e See Notes, § 16.

555 b

τοῦ γεοειδοῦς τοῦ περιέχοντος ἀκρίδες μικραὶ καὶ μέλαιναι· εἴτα περιρρήγνυται αὐταῖς τὸ δέριμα, καὶ γίνονται εὐθύς μείζους. τίκτουσι δὲ λήγοντος τοῦ θέρους καὶ τεκοῦσαι ἀποθνήσκουσιν· ἅμα γὰρ τικτούσαις σκώληκες ἐγγίγνονται περὶ τὸν τράχηλον. καὶ οἱ ἄρρενες δ' ἀποθνήσκουσι περὶ τὸν αὐτὸν χρόνον. ἐκδύνουσι δ' ἐκ τῆς γῆς τοῦ ἔαρος. οὐ γίνονται δ' ἀκρίδες οὐτ' ἐν τῇ ὄρεινῃ οὐτ' ἐν τῇ λυπρᾷ, ἀλλ' ἐν τῇ πεδιάδι καὶ κατερρωγνίᾳ· ἐν ταῖς ῥωγμαῖς γὰρ ἐκτίκτουσιν. διαμένει δὲ τὰ ψὰ τὸν χειμῶνα ἐν τῇ γῇ· ἅμα δὲ τῷ θέρει γίνονται ἐκ τῶν περυσίων κνημάτων ἀκρίδες.¹

XXIX Ὅμοίως δὲ τίκτουσι καὶ οἱ ἀπτέλαβοι, καὶ τεκόντες ἀποθνήσκουσιν. φθείρεται δ' αὐτῶν τὰ ψὰ ὑπὸ τῶν μετοπωρινῶν ὑδάτων, ὅταν πολλὰ γένηται· ἂν δ' αὐχμὸς συμβῆ, τότε γίνονται μᾶλλον πολλοὶ οἱ ἀπτέλαβοι διὰ τὸ μὴ φθείρεσθαι ὁμοίως, ἐπεὶ ἀτακτὸς γε δοκεῖ εἶναι ἢ φθορὰ αὐτῶν καὶ γίνεσθαι ὅπως ἂν τύχη.

XXX Τῶν δὲ τεττίγων γένη μὲν ἐστὶ δύο, οἱ μὲν μικροί, οἱ πρῶτοι φαίνονται καὶ τελευταῖοι ἀπόλλυνται, οἱ δὲ μεγάλοι, [οἱ ἄδοντες]² οἱ καὶ ὕστερον γίνονται καὶ πρότερον ἀπόλλυνται. ὁμοίως δ' ἐν τε τοῖς μικροῖς καὶ τοῖς μεγάλοις οἱ μὲν διηρημένοι εἰσὶ τὸ ὑπόζωμα, οἱ ἄδοντες, οἱ δ' ἀδιαίρετοι, οἱ οὐκ ἄδοντες. καλοῦσι δὲ τινες³ τοὺς μὲν μεγάλους καὶ ἄδοντας ἀχέτας, τοὺς δὲ μικροὺς τεττιγόνια· ἄδουσι δὲ μικρὸν καὶ τούτων οἱ διηρημένοι. οὐ γίνονται

¹ hucusque a v. 1 ἅμα secl. A.-W., a v. 3 ἐκδύνουσι usque ad ἐκτίκτουσιν Dt.

² secl. Dt.

³ τινες PD, vulg.: om. AC.

^a These words are rightly cut out by Dt. Aristotle says

emerge from the claylike envelope small black grasshoppers; then their skin bursts open, and they immediately become bigger. Grasshoppers lay at the end of summer, and having done so die. The reason is that at the time they lay their brood, larvae appear round the females' necks; and the males die about the same time. They emerge from the ground in spring. Grasshoppers do not occur in mountainous or on poor soil, only level and broken down—for they lay in cracks in the ground. During winter the eggs stay in the earth; but as soon as summer comes grasshoppers develop out of the previous year's fetations.

Locusts lay in the same manner, and having done so die. Their eggs get destroyed by autumn rains, when these are abundant; but if a drought occurs locusts are far more numerous, since they have not been subjected to destruction to the same extent: their destruction seems to be quite irregular and determined entirely by chance. XXIX
Locusts.

There are two kinds of cicada: the small ones, which are the first to appear and the last to die off, and the large ones [those which sing],^a which appear later than the others and die off earlier. In both kinds alike, large and small, there are some which are divided at the *hypozoma*^b—these are the singing ones—and others which are undivided, and these do not sing. The large ones which sing some call "chirpers"; the small kind they call cicadelles, though such of these as are divided sing a little. Cicadas do not occur where XXX
Cicadas.

there are two kinds, large and small; some of both kinds are divided at the *hypozoma* (in fact these are the males), and these sing. The divided ones (*i.e.*, the males) of the large kind are called "chirpers"; the divided ones of the small kind are not called "chirpers," though they sing a little.

^b Cf. 532 b 16, and note on 535 b 7 ff.

556 a

δὲ τέττιγες ὅπου μὴ δένδρα ἐστίν· διὸ καὶ ἐν Κυρήνῃ οὐ γίνονται ἐν τῷ πεδίῳ, περὶ δὲ τὴν πόλιν πολλοί, μάλιστα δ' οὐ ἐλαίαι· οὐ γὰρ γίνονται παλίνσκοιοι. ἐν γὰρ τοῖς ψυχροῖς οὐ γίνονται τέττιγες, διὸ οὐδ' ἐν τοῖς συσκίοις ἄλσεσιν. ὀχεύονται δ' ὁμοίως οἱ μεγάλοι ἀλλήλοις καὶ οἱ μικροί, ὕπτιοι συνδυαζόμενοι πρὸς ἀλλήλους· ἐναφίησι δ' ὁ ἄρρην εἰς τὴν θήλειαν, οὐχ ἢ θήλεια εἰς τὸν ἄρρην ὥσπερ τᾶλλα ἔντομα. ἔχει δ' ἡ θήλεια αἰδοῖον ἐσχισμένον εἰς ὁ¹ ἀφίησω ὁ ἄρρην. τίκτουσι δ' ἐν τοῖς ἀργοῖς, τρυ-
 30 πῶντες ᾧ ἔχουσι ὀπισθεν ὀξεῖ, καθάπερ καὶ οἱ
 556 b ἀπτέλαβοι· καὶ γὰρ οἱ ἀπτέλαβοι τίκτουσιν ἐν τοῖς ἀργοῖς, διὸ πολλοὶ ἐν τῇ Κυρηναίᾳ γίνονται. ἐν-
 τίκτουσι δὲ καὶ ἐν τοῖς καλάμοις ἐν οἷς ἰσῆσι τὰς ἀμπέλους, διατρυπῶντες τοὺς καλάμους, καὶ ἐν τοῖς τῆς σκίλλης καυλοῖς. ταῦτα δὲ τὰ κυήματα καταρ-
 5 ρεῖ εἰς τὴν γῆν. γίνονται δὲ πολλοὶ ὅταν ἐπομβρία γένηται. ὁ δὲ σκώληξ αὐξηθεὶς ἐν τῇ γῇ γίνεταί τεττιγομήτρα· καὶ εἰσὶ τότε ἡδιστοί, πρὶν περιρρα-
 γῆναι τὸ κέλυφος. ὅταν δ' ἡ ὥρα ἔλθῃ περὶ τροπᾶς, ἐξέρχονται νύκτωρ, καὶ εὐθὺς ῥήγγυται τε τὸ κέλυ-
 10 φος καὶ γίνονται τέττιγες ἐκ τῆς τεττιγομήτρας, καὶ γίνονται μέλανες καὶ σκληρότεροι εὐθὺς καὶ μείζους, καὶ ἄδουσιν. εἰσὶ δ' ἄρρενες μὲν οἱ ἄδοντες ἐν ἀμφοτέροις τοῖς γένεσι, θήλεις δ' οἱ ἕτεροι. καὶ τὸ μὲν πρῶτον ἡδίοις οἱ ἄρρενες, μετὰ δὲ τὴν ὀχλείαν αἱ θήλεια· ἔχουσι γὰρ ὡς λευκά· ἀναπετόμενοι²

¹ ita corrigere volebant A.-W. (qui τὸ ἄρρην; τὸν ἄρρην Dt.): ἐναφ. δ' ὁ ἄρρην εἰς τὴν θ., ὥσπερ καὶ τᾶλλα ἔντομα. ἔχει δὲ καὶ (καὶ om. PD) ἡ θήλεια αἰδοῖον ἐσχισμένον· θήλεια δ' ἐστὶν εἰς ἡν vulg. (ἡ δὲ θήλειά ἐστὶν ἐν ἡ PD).

² ἀναπετόμενοι Pi.: -μεναί D, vulg.: -πετόμεναί P: -πεπα-
 μέναί AC.

there are no trees: this explains why in the region of Cyrene they do not occur in the flat country, but are plentiful about the city, and especially where there are olive-trees,^a because these trees do not produce deep shade: cicadas do not occur in cold places, hence not in thickly-shaded groves either. The large ones and the small copulate in the same manner, with their undersides together. The male inserts a part into the female, not vice versa as with the other insects.^b The female has a cleft generative organ, into which the male inserts its own. They lay their brood in uncultivated land, boring into the ground with the sharp organ they have at their rear, just as locusts do: locusts too lay in uncultivated land, which explains why they are plentiful in the district of Cyrene. Cicadas also lay in the stakes which are used for supporting vines, and bore through them; they also lay in the stalks of the squill.^c These fetations seep down into the ground, and they are numerous in rainy weather. The larva, when it has increased in size in the ground, becomes a "mother-of-cicada"^d; and that is the time when they are pleasantest to eat, before the integument bursts open. When the time of the solstice approaches, the creature comes out under cover of night, the integument immediately breaks open, and there you have cicadas instead of "mothers": they turn black at once, and harder, and larger, and begin singing. In both kinds it is the singing ones that are males; the others are females. To begin with, the males are tastier to eat, but after copulation the females, because they then contain white eggs. As they fly up after you have startled

^a Cf. 601 a 7.

^b Cf. G.A. 721 a 13 ff.

• *Urginea* (or *Scilla*) *maritima*.

^d i.e., a pupa.

556 b

15 δ' ὅταν σοβήσῃ τις, ἀφίῳσιν ὑγρὸν οἶον ὕδωρ, ὃ λέγουσιν οἱ γεωργοὶ ὡς κατοουρούντων καὶ ἐχόντων περίττωμα καὶ τρεφομένων τῇ δρόσῳ. εἰάν δέ τις κινῶν τὸν δάκτυλον προσίῃ ἀπ' ἄκρου ἐπικάμπτων τε καὶ ἐκτείνων πάλιν, μᾶλλον ὑπομένουσιν ἢ εἰάν εὐθὺς ἐκτείνῃ, καὶ ἀναβαίνουσιν ἐπὶ τὸν δάκτυλον.
20 διὰ τὸ ἀμυδρῶς γὰρ ὄραν ὡς ἐπὶ φύλλον ἀναβαίνουσι κινούμενον.

XXXI Τῶν δ' ἐντόμων ὅσα σαρκοφάγα μὲν μὴ ἐστὶ, ζῆ δὲ χυμοῖς σαρκὸς ζώσης, οἶον οἱ τε φθειρές καὶ αἱ ψύλλαι καὶ κόρεις, ἐκ μὲν τῆς ὀχείας πάντα γεννᾶταις καλουμένας κονίδας, ἐκ δὲ τούτων ἕτερον οὐδὲν
25 γίγνεται πάλιν. αὐτῶν δὲ γίνονται τούτων αἱ μὲν ψύλλαι ἐξ ἐλαχίστης σηπεδόνος (ὅπου γὰρ ἂν κόπρος ξηρὰ γένηται, ἐνταῦθα συνίστανται), οἱ¹ δὲ κόρεις ἐκ τῆς ἱκμάδος τῆς ἀπὸ τῶν ζώων συνισταμένης ἐκτός, οἱ δὲ φθειρές ἐκ τῶν σαρκῶν. γίνονται δ' ὅταν μέλλωσιν οἶον ἰοῦνθαι μικροί, οὐκ ἔχοντες πύον.
30 τούτους εἰάν τις κεντήσῃ, ἐξέρχονται φθειρές. ἐνίοις δὲ τοῦτο συμβαίνει τῶν ἀνθρώπων νόσημα, ὅταν
557 a ὑγρασία πολλὴ ἐν τῷ σώματι ᾗ· καὶ διεφθάρσάν τινες ἤδη τοῦτον τὸν τρόπον, ὡσπερ Ἀλκμάνά τέ φασι τὸν ποιητὴν καὶ Φερεκύδην τὸν Σύριον. καὶ ἐν νόσοις δὲ τισὶ γίγνεται πλῆθος φθειρῶν.

¹ οἱ C: αἱ PD, vulg.

^a That is, not to fly off.

^b The story about M. Boyer is related by A.-W. and Th. (see Add. Note, p. 373): by whistling he induced one of these creatures to climb up his walking-stick, and "il est parvenu ainsi à en faire placer une sur son nez." Cf. E. 208

them, they discharge a liquid like water: countrymen will tell you this is urine—that is, that they have residue, and feed on dew. If you approach them, moving your finger, bending the tip of it back and then stretching it out again, they are more likely to stay^a than if you simply held it stretched straight out, and they begin to climb on to your finger.^b The reason is that they have poor sight, and think they are climbing on to a moving leaf.

We go on now to insects which though not carnivorous live on the juices of living flesh—insects such as lice, fleas,^c and bugs. All these as the result of copulation generate what are called nits, and from these nothing further is produced. The slightest quantity of putrefying matter gives rise to fleas (they are found taking shape^d where there is any dry excrement); bugs are produced out of the moisture from living animals as it congeals^e outside them; lice are produced out of flesh. When lice are going to be produced, as it were small eruptions form, but without any purulent matter in them; and if these are pricked, lice emerge.^f Some people get this disease^g when there is a great deal of moisture in the body; some indeed have been killed by it, as Alkman the poet is said to have been, and Pherekydes the Syrian. Further, in certain diseases large numbers of lice appear.

Lear, *My Aged Uncle Arly*, " 'Twas a first-class railway ticket; / But, on stooping down to pick it / Off the ground, a pea-green cricket / Settled on my uncle's nose."

^c Cf. 539 b 12.

^d The same word is used in both places in the Greek; cf. Notes, § 27.

^e The itch-mite, *Sarcoptes scabiei*, rediscovered by Avenzoar, a Moorish physician of Seville, in the 12th century (Th.).

^f Caused by *Phthirus inguinalis*.

XXXI
Other
insects.

Ἔστι δὲ γένος φθειρῶν οἱ καλοῦνται ἄγριοι
 5 καὶ σκληρότεροι τῶν ἐν τοῖς πολλοῖς γιγνομένων
 (εἰσίν)¹. εἰσὶ δ' οὗτοι καὶ δυσαφαίρετοι ἀπὸ τοῦ
 χρωτός. παισὶ μὲν οὖν οὖσιν αἱ κεφαλαὶ γίνονται
 φθειρώδεις, τοῖς δ' ἀνδράσιν ἦττον. γίνονται δὲ
 καὶ αἱ γυναῖκες τῶν ἀνδρῶν μᾶλλον φθειρώδεις.
 ὅσοις δ' ἂν ἐγγίγνωνται ἐν τῇ κεφαλῇ, ἦττον πονοῦσι
 10 τὰς κεφαλὰς. ἐγγίγνωνται δὲ καὶ τῶν ἄλλων ζώων
 ἐν πολλοῖς φθεῖρες. καὶ γὰρ οἱ ὄρνιθες ἔχουσι, καὶ
 οἱ καλούμενοι φασιανοὶ ἕαν μὴ κονίωνται,² διαφθεί-
 ρονται ὑπὸ τῶν φθειρῶν. καὶ τῶν ἄλλων δ' ὅσα
 πτερὰ ἔχει ἔχοντα³ καυλόν, καὶ τῶν ἐχόντων τρίχας.
 15 πλὴν ὄνος οὐκ ἔχει οὔτε φθειρας οὔτε κρότωνα. οἱ
 δὲ βόες ἔχουσιν ἄμφω· τὰ δὲ πρόβατα καὶ (αἰ)⁴
 αἴγες κρότωνα, φθειρας δ' οὐκ ἔχουσιν· καὶ αἱ ἕες
 φθειρας μεγάλους καὶ σκληροῦς. ἐν δὲ τοῖς κυσὶν
 οἱ καλούμενοι γίνονται κυνοραῖσται.⁵ πάντες δ' οἱ
 φθεῖρες ἐν τοῖς ἔχουσιν ἐξ αὐτῶν γίνονται τῶν
 ζώων. γίνονται δ' οἱ φθεῖρες μᾶλλον ὅταν μετα-
 20 βάλλωσι τὰ ὕδατα οἷς λούονται, ὅσα ἔχει τῶν λουο-
 μένων φθειρας. ἐν δὲ τῇ θαλάττῃ γίνονται μὲν ἐν
 τοῖς ἰχθύσι φθεῖρες, οὗτοι δ' οὐκ ἐξ αὐτῶν τῶν
 ἰχθύων ἀλλ' ἐκ τῆς ἰλύος· εἰσὶ δὲ τὰς ὄψεις ὅμοιοι
 τοῖς ὄνοις τοῖς πολύποσι, πλὴν τὴν οὐρὰν ἔχουσι
 πλατεῖαν. ἐν δ' εἰδός ἐστι τῶν φθειρῶν τῶν θαλατ-
 25 τίων, καὶ γίνονται πανταχοῦ, μάλιστα δὲ περὶ τὰς

¹ post γιγνομένων add. <εἰσίν> Dt.: contra suadet Radermacher (sed melius <οἱ> καὶ) nihil abesse ratus: fortasse σκληρότεροι <εἰσίν> scribendum.

² κονίωνται Sn., monente Sylb.: κονίονται codd., vulg.

³ ἔχοντα Dt.: τὸ ἔχον codd.: ἔχει, τῶν ἐχόντων A.-W., qui

There is also a kind of lice called wild-lice, which are harder than the common sort, and it is very difficult to rid the skin of them. Children's heads are infested with lice, men's not so much. Women are more troubled by them than men. On the other hand, people with lousy heads get fewer headaches. Many other animals too are infested with lice. Birds have them; pheasants, unless they take frequent dust-baths,^a are killed by them. They are found in many other animals too, those which have wings with^b a quill, and many hairy-coated animals. An exception is the ass, which has neither lice nor ticks. Cattle have both. Sheep and goats have ticks, but no lice. Pigs have lice, large hard ones. The "dog-wreckers"^c as they are called are found on dogs. Lice, on all animals that have them, take their rise out of the animals themselves. Some animals which bathe have lice, and on these the lice are more abundant when they make a change of the waters they bathe in. In the sea, lice are found on fishes, but these lice are derived from the mud, not from the fishes themselves: to look at, they resemble the many-footed woodlice, except that they have a flat tail. There is only one kind of sea-louse; they are ubiquitous, and they

^a Cf. 633 a 29 ff.

^b There is some error in the text here. One proposal is to substitute "without" for "with." The objection to this (*vide* Dt.) is that apparently Ar. does not elsewhere speak of lice on insects.

^c The common tick, *Ixodes ricinus*, or *Ricinus communis*.

lac. post τρίχας indicant: <οὐκ> ἔχοντα Karsch, idem Venmans coll. 504 a 30, 532 a 25.

⁴ αἰ suppl. Dt.

⁵ κυνοραῖσται D, Dt.: κυνοραῖσται C: κυνοραῖσται A: κυνορέσται P.

557 a

τριγλας.¹ πάντα δὲ πολύποδα ταῦτ' ἐστὶ καὶ ἄναιμα τὰ² ἔντομα. ὁ δὲ τῶν θύνων ἰστρός γίνεται μὲν περὶ τὰ πτερύγια, ἔστι δ' ὁμοίος τοῖς σκορπίοις, καὶ τὸ μέγεθος ἡλικὸς ἀράχνης. ἐν δὲ τῇ θαλάττῃ τῇ
30 ἀπὸ Κυρήνης πρὸς Αἴγυπτον ἔστι περὶ τὸν δελφίνα ἰχθύς ὃν καλοῦσι φθειρά· ὅς γίνεται πάντων πιότατος διὰ τὸ ἀπολαύειν τροφῆς ἀφθόνου θηρεύοντος τοῦ δελφίνου.

557 b
XXXII Γίνεται δὲ καὶ ἄλλα ζωάρια, ὡς περ ἐλέχθη καὶ πρότερον, τὰ μὲν ἐν ἐρίοις καὶ ὅσα ἐξ ἐρίων ἐστίν, οἷον οἱ σῆπτες, οἱ ἐμφύονται μᾶλλον ὅταν κονιορτώδη ἦ τὰ ἔρια, μάλιστα δὲ γίνονται ἀν ἀράχνης συγκ-
5 κατακλεισθῆ· ἐκπίνων γάρ, ἂν τι ἐνῆ ὑγρὸν, ξηραίνει. γίνεται δὲ καὶ ἐν χιτῶνι³ ὁ σκώληξ οὗτος. καὶ ἐν πικερίῳ⁴ δὲ γίνεται παλαιουμένῳ, ὡς περ ἐν ξύλῳ ζῶον, ὃ δὴ δοκεῖ ἐλάχιστον εἶναι τῶν ζῶων πάντων καὶ καλεῖται ἀκαρί, λευκὸν καὶ μικρόν.⁵

¹ τριγλας codd., vulg.: τρώγλας Ald., Cs., A.-W.: πτέρυγας ("= πτερύγια") Dt.: βράγχα mallet Th., coll. 602 b 29.

² τὰ D, vulg.: καὶ AC: κτὰ P: ὡς Dt.: πάντα . . . ἔντομα secl. A.-W.

³ χιόνι C.

⁴ ἐν πικερίῳ scripsi: ἐπὶ AC, ἐν PD: κηρῷ codd.: ἐν κηρῷ vulg.: τυρῷ prop. Sylb., A.-W., probat Dt.: κηρίῳ Rhen., ἐν κηρίῳ Sn., ἐπὶ κηρίῳ Dt. in textu.

⁵ μικρόν suspic. edd.

^a Dt. conjectures "infest the fins"; some edd. read "infest the holes."

^b A parasitic copepod, perhaps *Brachiella thynni*, or *Cecrops Latreillii*; cf. 599 b 26, 602 a 27.

^c The sucking-fish, *Echeneis remora*, or *E. naucrates*. The name *echeneis* is applied by Aristotle himself to a different fish; see 505 b 19, and note there, where references will be found to comments in later literature on the sucking-fish, to which the name *echeneis* or *remora* came to be applied.

infest the red mullet^a in particular. All these insects are many-footed and bloodless. The "gadfly"^b which infests the tunny is found round its fins; it is like a scorpion, and about the size of a spider. In the sea between Cyrene and Egypt there is a fish called "louse,"^c which dogs the dolphin; this fish gets extremely fat owing to the bountiful supplies of food available for its benefit when the dolphin is out hunting.

As I have already mentioned, other tiny animals XXXII are engendered, some in wool and woollen articles, such as the clothes-moth: these occur more abundantly if the woollen things are dusty, and particularly if a spider is shut up inside them, for this drinks up any moisture they may contain and dries them. This larva is found also in men's tunics. Also an animal is produced in cream cheese^d which is getting ancient, as in wood, and this is considered to be the smallest of all living creatures; it is known as *akari*, and is white

E. W. Gudger, "Some Old Time Figures of the Shipholder, Echeneis or Remora, Holding the Ship," in Sarton's *Isis*, XIII (1929/30), pp. 340-352, gives several woodcut illustrations and a photograph of the fish: cf. also the same author's "The Myth of the Shipholder," in *Annals and Magazine of Natural History*, 9 ser., vol. 2 (1918), pp. 271-307.

^d I have substituted ἐν πικερίῳ for the mss. ἐπὶ κηρῷ. Animals are not found in ancient wax, but they are found in ancient cream cheese. The word *πικέριον* (= *βούτυρον*, butter, lit., "cow-cheese") is found in *Aristot. frag.* 636 and elsewhere; it is said by Erotian (73. 13 ff. Nach.) to be Phrygian. It is possible that this is the Phrygian cheese, to make which horses' and asses' milk was mixed, mentioned at *H.A.* 522 a 29. *πικέριον* is recommended as a remedy in *Hippocr. Mul.* i. 63 (viii. 130. 2 L.) and in *Aret.* v. 1 and 10 (95. 17 and 117. 22 Hude), in the last-named passage "mixed with honey to a consistency." Sylb. and A.-W. suggest ἐν τυρῷ, "in cheese"; Schneider "in the honeycomb."

557 b

καὶ ἐν τοῖς βιβλίοις ἄλλα γίνεταί, τὰ μὲν ὅμοια τοῖς
 10 ἐν τοῖς ἱματίοις, τὰ δὲ τοῖς σκορπίοις ἀνευ τῆς οὐράς,
 μικρὰ πάνπαν· καὶ ὄλως ἐν πᾶσιν ὡς εἶπεῖν, ἐν τε
 τοῖς ξηροῖς ὑγραυομένοις καὶ ἐν τοῖς ὑγροῖς ξηραι-
 νομένοις, ὅσα ἔχει αὐτῶν ζωὴν. ἔστι δὲ τι σκωλή-
 κιον ὃ καλεῖται ξυλοφόρον,¹ οὐδενὸς ἦττον ἄτοπον
 τούτων τῶν² ζώων. ἡ μὲν γὰρ κεφαλὴ ἔξω τοῦ κε-
 15 λύφους προέρχεται ποικίλη, καὶ οἱ πόδες ἐπ' ἄκρον,
 ὡσπερ τοῖς ἄλλοις σκώληξιν, ἐν χιτῶνι δὲ τὸ ἄλλο
 σῶμα ἀραχνιώδει, καὶ περὶ αὐτὸ κάρφη, ὥστε δοκεῖν
 προσέχεσθαι βαδίζοντι· ταῦτα δὲ σύμφυτα τῷ χι-
 τῶνι ἔστιν—ὡς γὰρ³ κοχλίᾳ τὸ ὄστρακον, οὕτω τὸ
 ἄπαν τῷ σκώληκι—καὶ οὐκ ἀποπίπτει ἀλλ' ἀπο-
 20 σπᾶται ὡσπερ προσπεφυκότα· καὶ ἂν τις τὸν χιτῶνα
 περιέλη, ἀποθνήσκει καὶ γίνεταί ὁμοίως ἀχρεῖος
 ὡσπερ ὁ κοχλίας περιαιρεθέντος τοῦ ὄστράκου. χρό-
 νου δὲ προϊόντος γίνεταί καὶ οὗτος ὁ σκώληξ χρυ-
 σαλλίς ὡσπερ αἱ κάμπαι, καὶ ζῆ ἀκινήτιζων· ὃ τι
 δ' ἐξ αὐτοῦ γίνεταί τῶν πτερωτῶν ζώων, οὕτω
 συνῶπται.
 25 Τὰ δ' ἔρινεά τὰ⁴ ἐν τοῖς ἔρινεοῖς⁵ ἔχουσι τοὺς
 καλουμένους ψήγας. γίνεταί δὲ τοῦτο πρῶτον σκω-

¹ ξυλοφόρον suaserat Sn. e Gul., accep. A.-W., Dt.: ξυλο-
 φθόρον codd., vulg.

² ἄτοπον τούτων τῶν Ald., Cs., Sn., A.-W., Dt.: ἀπὸ τούτων
 τῶν PD: ἄτοπον τῶν AC.

³ ὡς γὰρ A.-W., Dt.: ὡσπερ codd., vulg.

⁴ τὰ δ' ἔρινεά τὰ Dt.: (τὰ δ' ἔρινα voluit Sn., sed οἱ δ' ἔρινεοὶ
 in textu): οἱ δ' ἔρινεοὶ AC: οἱ δ' ἔρινεοὶ οἱ vulg., A.-W.:
 οἱ δὲ ῥίνες οἱ PD. ⁵ ἔρινοῖς D: ἔρινοῖς P: ἔρινοῖς Cs., Pi.

^a *Chelifer cancroides*; cf. 532 a 18.

^b The basket-worm, caterpillar of a species of *Psychē*, a
 moth common in S. Europe. W. Capelle, "Zur Entomologie
 des Aristoteles," in *Rheinisches Museum*, CV (1962), pp. 56 ff.,

and small. Others are found in books, some of them
 similar to those found in clothes, others like tailless
 scorpions,^a very small indeed; and generally speaking
 small creatures are found in almost anything, both in
 dry things which are turning moist and moist ones
 which are turning dry, anything which contains life.
 There is also a small larva which is known as the
 faggot-bearer,^b as queer a creature as any of them:
 its head, which is mottled, projects outside its integu-
 ment: its feet are at the tip, as in other larvae, but
 the remainder of its body is enclosed in a cobweb-like
 tunic, and round it are dry twigs, which look as though
 they had stuck on to it as it walked along. In fact,
 however, they are an integral part of its tunic—just
 as the shell is an integral part of the snail, so is the
 whole integument with this larva—they do not drop
 off, but have to be torn off, as though they were
 organically attached to it; and if anyone removes the
 tunic the creature begins to die and becomes as help-
 less as a snail once its shell has been removed. As
 time goes on, this larva too, like the caterpillars,
 turns into a chrysalis, and lives an immobile life;
 but what winged creature develops out of it has not
 yet been observed.

The fruits of the wild-fig contain the so-called *psēn*
 (gall-wasp)^c: this creature begins as a larva; then

gives an identification of the creature as a species of *Psychē*,
 but strangely describes the passage as one which has never
 been explained. The identification, however, is at least as
 old as A.-W., and probably goes back to Réaumur.

^c This wasp (*Blastophaga grossorum*) plays an essential
 part in the fertilization of the fig. Aristotle mentions the
 process of "caprification" in the present passage, and clearly
 alludes to it at *G.A.* 715 b 22 ff., though he does not there
 mention the wasp. The fig-tree commonly cultivated in S.
 Europe is *Ficus carica*. This species includes two kinds of

557 b

λήκιον, εἶτα περιρραγέντος τοῦ δέρματος ἐκπέτεται
τοῦτο ἐγκαταλιπὼν ὁ ψῆν,¹ καὶ εἰσδύεται εἰς τὰ
τῶν συκῶν ἐρινεά² διὰ στομάτων, καὶ³ ποιεῖ μὴ
ἀποπίπτειν τὰ ἐρινεά· διὸ περιάπτουσί τε τὰ ἐρινεά
30 πρὸς τὰς συκάς οἱ γεωργοί, καὶ φυτεύουσι πλησίον
ταῖς συκαῖς ἐρινεούς.

XXXIII Τῶν δὲ τετραπόδων καὶ ἐναίμων καὶ ὠσότων αἱ
558 a μὲν γενέσεις εἰσὶ τοῦ ἔαρος, ὀχεύεται δ' οὐ πάντα
τὴν αὐτὴν ὥραν, ἀλλὰ τὰ μὲν ἔαρος τὰ δὲ θέρους τὰ
δὲ περὶ τὸ μετόπωρον, ὡς ἐκάστοις πρὸς τὴν γένεσιν
τῶν ἐκγόνων ἢ ἐπιούσα⁴ ὥρα συμφέρει. ἢ μὲν οὖν
χελώνη τίκτει ὡὰ σκληρόδερμα καὶ δίχροα ὥσπερ
5 τὰ τῶν ὀρνίθων, τεκοῦσα δὲ κατορύττει καὶ τὸ ἄνω
ποιεῖ ἐπίκροτον· ὅταν δὲ τοῦτο ποιήσῃ, φοιτῶσα
ἐπιάζει ἄνωθεν· ἐκλέπεται δὲ τὰ ὡὰ τῷ ὑστέρω
ἔτει. ἢ δ' ἐμὺς ἐξιούσα ἐκ τοῦ ὕδατος τίκτει, ὀρύ-
ξασα βόθνον πιθώδη, καὶ ἐντεκοῦσα καταλείπει·
ἑάσασα δ' ἡμέρας ἐλάττους ἢ τριάκοντα ἀνορύττει
10 καὶ ἐκλέπει ταχύ, καὶ ἀπάγει τοὺς νεοττοὺς εὐθύς
εἰς τὸ ὕδωρ. τίκτουσι δὲ καὶ αἱ θαλάττιαι χελῶναι

¹ ὁ ψῆν Sylb., edd.: ὄψιν codd.

² ἐρινεά A¹C (ter): ἐρινά PD: ἐρινά vulg.

³ διὰ στ. καὶ Th.: καὶ διὰ στομάτων CPD, vulg.: (στόματος A):
καὶ διαστομῶν Sylb., Cs., Sn., Buss., Pi., A.-W.: καὶ διὰ στυ-
μάτων conl. Dt.

⁴ fort. ἀπαρτίζουσα: cf. 542 a 31.

individual trees: (1) those whose inflorescences contain fully-developed female flowers only: (2) those whose inflorescences contain male flowers near the opening, and lower down aborted female flowers known as "gall-flowers" owing to their being adapted to receive the eggs of the *psæni*, which turns the ovary of the flower into a "gall." The latter trees are known as *Caprificus*. The former are Aristotle's *συκῆ* (here translated "domesticated fig-tree"), the latter his *ἐρινεός*

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its skin bursts open and the gall-wasp flies out leaving it behind, and enters the fruits of the domesticated fig by their orifices and prevents the fruit from falling off; this explains why countrymen hang wild-figs on domesticated fig-trees, and plant wild trees near them.

Blooded oviparous quadrupeds. The generation of XXXIII these takes place in spring, though copulation does 4. (ii) not occur at the same season in all cases. Some Blooded animals: copulate in spring, others in summer, others in autumn, (a) Oviparous quadrupeds. depending upon how the approaching season favours the generation of their offspring. The tortoise lays eggs which have hard shells and are bicoloured (inside), like those of birds, and after laying them buries them and treads the ground well down on top; having done this it comes back from time to time to incubate them on the surface and hatches them out the following year. The freshwater tortoise comes ashore to lay its eggs, digs a cask-like hole, lays them in it, and leaves them; it then lets rather less than thirty days elapse, digs them out, hatches them quite quickly, and takes its young straight off to the water. Sea-turtles too lay their eggs on

(here translated "wild fig-tree"). The female wasps, after impregnation by the male wasps within the gall, emerge from it and get dusted with pollen from the male flowers as they leave the inflorescence, and then pollinate female flowers elsewhere. Caprification is the name given to the artificial assistance of this process by hanging inflorescences of the caprifig on to trees of class (1). The growers believe that the fruit of the *Ficus* is improved by the wasps; but in fact excellent fruit is produced by these trees without pollination, though of course *no fertile seeds*. Hence caprification must be a traditional usage dating from the time when fertile seeds were required for propagation, which is now done by means of cuttings. See Kerner and Oliver, *Natural History of Plants*, ii. 160-162; H. Müller, *Fertilization of Flowers*, tr. p. 521 and bibliography.

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558 a

ἐν τῇ γῇ ὡς ὅμοια τοῖς ὄρνισι τοῖς ἡμέροις, καὶ
κατορύξασαι ἐπωάζουσι τὰς νύκτας. τίκτουσι δὲ
πολὺ πλῆθος ὧν· καὶ γὰρ εἰς ἑκατὸν τίκτουσιν ὡς.
τίκτουσι δὲ καὶ σαῦροι καὶ κροκόδειλοι οἱ χερσαῖοι
15 καὶ οἱ ποτάμιοι εἰς τὴν γῆν. ἐκλέπεται δὲ τὰ τῶν
σαύρων αὐτόματα ἐν τῇ γῇ· οὐ γὰρ διεισίδει ὁ σαῦρος·
λέγεται γὰρ ἕκμηρος εἶναι βίος σαύρου.¹ ὁ δὲ πο-
τάμιος κροκόδειλος τίκτει μὲν ὡς πολλά, τὰ πλείστα
περὶ ἑξήκοντα, λευκὰ τὴν χροίαν, καὶ ἐπικάθηται δ'
20 ἡμέρας ἑξήκοντα (καὶ γὰρ καὶ βιοῖ χρόνον πολύν),
ἐξ ἑλαχίστων δ' ὧν ζῶν μέγιστον γίννεται τοῦτο².
τὸ μὲν γὰρ ὧν οὐ μείζον ἔστι χηνεῖου, καὶ ὁ νεοττός
τούτου κατὰ λόγον, ἀξανάμενος δὲ γίννεται καὶ
ἐπτακαίδεκα πήχεων. λέγουσι δὲ τινες ὅτι καὶ
ἀξάνεται ἕως ἂν ζῇ.

XXXIV Τῶν δ' ὄφειν ὁ μὲν ἔχισ ζωοτοκεῖ ἔξω, ἐν αὐτῷ
28 πρῶτον ὠτοκῆσας· τὸ δ' ὧν, ὡς περ τῶν ἰχθύων,
μονόχρουν ἔστι καὶ μαλακόδερμον. ὁ δὲ νεοττός
ἄνω ἐπιγίννεται, καὶ οὐ περιέχει φλοιὸς ὄστρακώ-
δης, ὡς περ οὐδὲ τὰ τῶν ἰχθύων. τίκτει δὲ (τὰ)³
μικρὰ ἐχίδια ἐν ὑμέσιν, οἱ περιρρήγνυνται τριταῖοι·
30 ἐνίστε δὲ καὶ ἔσωθεν⁴ διαφαγόντα αὐτὰ ἐξέρχεται.
τίκτει δ' ἐν μιᾷ ἡμέρᾳ καθ' ἓν, τίκτει δὲ πλείω ἢ
558 b εἴκοσιν. οἱ δ' ἄλλοι ὄφεις ὠτοκοῦσιν ἔξω, τὰ δ'
ὡς ἀλλήλοισι συνεχῆ ἔστιν ὡς περ αἱ τῶν γυναικῶν
ὑποδερίδες· ὅταν δὲ τέκῃ εἰς τὴν γῆν, ἐπωάζει.
ἐκλέπεται δὲ καὶ ταῦτα τῷ ὑστέρω ἔτει.

¹ ita (σαύρας loco σαύρου) AC, vulg.: ὁ σαύρας βίος A.-W.:
βίος ὁ σαύρας Sn., Pl.: ἑξάμηρος Sn.: ἑξαμηνοβίος εἶναι ὁ σαύρος
PD, Cs., Dt.

land—their eggs are similar to those of domesti-
cated birds—bury them, and incubate during the
night. They lay a large quantity of eggs; indeed,
they lay up to one hundred. Lizards and crocodiles,
both land- and river-crocodiles, lay on land. Lizards'
eggs hatch spontaneously in the ground, for the
lizard does not live through into a second year: they
say it lives only six months. The river-crocodile lays
a large number of eggs, sixty at the most, white in
colour, and sits on them for sixty days (appropriately,
for it is a long-lived animal); and compared with the
size of its egg no other animal is so enormous when
fully grown: its egg is no bigger than a goose's egg,
and the young crocodile correspondingly small, but
it grows up to reach a length of seventeen cubits.
Some say it goes on growing throughout its life.

Serpents. The viper is externally viviparous, hav-
ing first produced an egg internally. Its egg, like
that of fishes, is of one colour and has a soft skin. The
young one is formed on the surface of it; and (again
as in fishes) no shelly integument envelops it. The
parent viper produces the young ones in membranes,
which burst open in three days; sometimes the young
themselves eat through the membrane from inside
and so get out. It produces them all at once on the
same day, more than twenty in number. The other
serpents are externally oviparous, and their eggs are
a continuous string like a woman's necklace. Having
laid the eggs in the ground, the mother incubates
them and hatches them out the following year.

XXXIV
(b) Vipers
and
serpents.

² τοῦτο Sn., A.-W.: ἐκ τούτων codd., vulg.

³ τὰ suppl. A.-W.: δὲ καὶ A.

⁴ ἔσωθεν AC: ἔσω PD, vulg.

- I Αἱ μὲν οὖν τῶν ὄφειων καὶ τῶν ἐντόμων γενέσεις, ἔτι δὲ τῶν τετραπόδων καὶ ὑποτόκων, τοῦτον ἔχουσι τὸν τρόπον.
- 10 Οἱ δ' ὄρνιθες ὑποτοκοῦσι μὲν ἅπαντες, ἡ δ' ὄρα τῆς ὀχείας καὶ οἱ τόκοι οὐ πᾶσιν ὁμοίως ἔχουσιν. τὰ μὲν γὰρ καὶ ὀχεύεται καὶ τίκτει κατὰ πάντα τὸν χρόνον ὡς εἰπεῖν, ὄλον ἀλεκτορὶς καὶ περιστερὰ, ἡ μὲν ἀλεκτορὶς ὄλον τὸν ἐνιαυτὸν ἔξω δύο μηνῶν τῶν ἐν τῷ χειμῶνι τροπικῶν. πλήθος δὲ τίκτουσιν ἔνιαι
- 15 καὶ τῶν γενναίων πρὸ ἐπίψασμοῦ καὶ ἐξήκοντα· καί-
τοι ἦττον πολυτόκοι αἱ γενναῖαι τῶν ἀγεννῶν εἰσιν. αἱ δ' Ἀδριανικαὶ¹ ἀλεκτορίδες εἰσὶ μὲν μικραὶ τὸ μέγεθος, τίκτουσι δ' ἀν' ἐκάστην ἡμέραν· εἰσὶ δὲ χαλεπαὶ καὶ κτείνουσι τοὺς νεοττοὺς πολλακίς· χρώ-
ματα δὲ παντοδαπὰ ἔχουσιν. τίκτουσι δὲ καὶ οἰκο-
20 γενεῖς ἔνιαι δις τῆς ἡμέρας· ἤδη δέ τινες λίαν πολυτοκήσασαι ἀπέθανον διὰ ταχέων. αἱ μὲν οὖν ἀλεκτορίδες τίκτουσιν, ὥσπερ εἴρηται, συνεχῶς· περιστερὰ δὲ καὶ φάττα καὶ τρυγῶν καὶ οἰνὰς διτο-
κοῦσι μὲν, ἀλλ' αἱ περιστερὰ καὶ δεκάκις τοῦ ἐνιαυτοῦ τίκτουσιν. οἱ δὲ πλείστοι τῶν ὄρνιθων
25 τίκτουσι τὴν ἑαρινὴν ὥραν, καὶ εἰσιν οἱ μὲν πολύ-
γονοι αὐτῶν, πολύγονοι δὲ διχῶς, οἱ μὲν τῷ πολλά-

¹ Ἀδριανικαὶ PD, cf. *G.A.* 749 b 29; Ἀδριαναὶ AC, vulg.

I HAVE described the manner of generation of serpents I and insects, and also of the oviparous quadrupeds, and we go on now to birds.

Birds lay eggs, one and all, but the seasons of pair- (c) Birds. ing and breeding are not the same for all of them. Some birds pair and breed practically the whole year round, *e.g.*, the domestic fowl and the pigeon: the former pairs and breeds throughout the year, except during the two solstitial months in winter.^a Some hens, even some of the thoroughbred strains,^b lay a large number of eggs before incubating—up to sixty, though the thoroughbred ones are less prolific than the nondescripts. The Adrianic hens^c are small in size, but they lay every day; they are bad-tempered and often kill their chicks; they are of all colours. Some of those which are bred domestically actually lay twice a day, and instances have been known of hens which have laid excessively dying suddenly. Domestic hens, then, lay continuously as I have said. The pigeon, the ring-dove, the turtle-dove and the *oinas*^d lay twice a year, though the pigeon may in fact lay ten times a year. The majority of birds lay in the season of spring. Some birds are prolific—prolific in either of two senses: some lay often, as pigeons do,

^a See Appendix B, p. 409.

^b See 488 b 18.

^c See *G.A.* 749 b 28. Thompson (*G.G.B.*² p. 39, *s.v.* ἀλεκτρούαν) considers them to have been a kind of bantam.

^d See n. on 544 b 8.

κίς, ὡς περ αἱ περιστεραι, οἱ δὲ τῷ πολλά, ὡς περ αἱ ἀλεκτορίδες. τὰ δὲ γαμφιώνυχα πάντα ὀλιγόγονά ἐστιν ἔξω κεγχρίδος· αὕτη δὲ πλείστα τίκτει τῶν γαμφωνύχων. ὥπται μὲν οὖν καὶ τέτταρα ἤδη,
30 τίκτει δὲ καὶ πλείω.

Τίκτουσι δὲ τὰ μὲν ἄλλα ἐν νεοττιαῖς, τὰ δὲ μὴ πτητικὰ ἐν νεοττιαῖς οὐδαμῶς, οἷον οἱ¹ τε πέρδικες
559 a καὶ οἱ ὄρτυγες, ἀλλ' ἐν τῇ γῇ, ἐπηλυγαζόμενα ὕλην. ὡσαύτως δὲ καὶ κόρυδος καὶ τέτριξ. ταῦτα μὲν οὖν ὑψηλέμενος ποιεῖται τὰς νεοττεύσεις· ὃν δ' οἱ Βοιωτοὶ καλοῦσιν μέροπα,² εἰς τὰς ὅπας ἐν τῇ γῇ καταδυόμενος νεοττεύει μόνος. αἱ δὲ κίχλαι νεοττιᾶν μὲν ποιοῦνται ὡς περ αἱ χελιδόνες ἐκ πηλοῦ ἐπὶ τοῖς ὑψηλοῖς τῶν δένδρων, ἐφεξῆς δὲ ποιοῦσιν³ ἀλλήλαις καὶ ἔχομένας, ὡστ' εἶναι διὰ τὴν συνέχειαν ὡς περ ὄρμαθὸν νεοττιῶν. ὁ δ' ἔποψ μόνος οὐ ποιεῖται νεοττιᾶν τῶν καθ' ἑαυτὰ⁴ νεοττευόντων, ἀλλ' εἰς-
10 δυόμενος εἰς τὰ στελέχη ἐν τοῖς κοίλοις αὐτῶν τίκτει, οὐδὲν συμφορούμενος. ὁ δὲ κίρκος⁵ καὶ ἐν οἰκίᾳ νεοττεύει καὶ ἐν πέτραις. ἡ δὲ τέτριξ, ἣν καλοῦσιν Ἀθηναῖοι οὐραγα, οὐτ' ἐπὶ τῆς γῆς νεοττεύει οὐτ' ἐπὶ τοῖς δένδρεσιν, ἀλλ' ἐπὶ τοῖς χαμαιζήλοις φυτοῖς.

¹ sic AC; οὐκ ἐν νεοττιαῖς οἷον αἱ PD, vulg.

² μέροπα PD; εἶροπα AC; ἀέροπα Sn., Pi.; cf. 615 b 25, 626 a 13.

³ ut verba rebus respondeant, αὐται hic inserendum est.

⁴ ἑαυτὰ Ambr., vulg.; ἐαυτὸν ACD; αὐτὸν P.

⁵ κίρκος D, Th.; κόκκυξ ACP, vulg.; κύβελος conl. Dt.: ὁ δὲ κόκκυξ [lacun.], <χελιδὼν δὲ> καὶ ἐν Pi.: *cignus autem et est albescens* Σ. fortasse κίγκλος scribendum.

^a See also *G.A.* 749 b 2 ff.

^b See *P.A.* 694 a 6 ff. and *G.A.* 749 b 10 ff.; some heavy, bulky birds are "fliers," e.g., pigeons; some are "non-fliers," e.g., domestic fowls and partridges. See also Table of Birds, *G.A.* (Loeb ed.), p. 368.

others lay a large number of eggs, as the domestic fowl does. All the crook-taloned birds^a are unprolific except the kestrel, which is the most productive of all birds of this sort: as many as four eggs have been seen, but it lays even more.

All birds lay in nests except the non-fliers,^b which do nothing of the sort, e.g., partridges and quails: these lay in the ground, and cover them over with twigs; similarly the lark^c and the *tetrix*.^d These birds nest in sheltered places, but the bird which the Boeotians call the *merops*^e is the only one that goes into holes it has dug in the ground and nests there. Thrushes, like swallows, build nests out of clay, on tall trees^f: they^g make a series of them, one close after another, so that the result is a sort of bead-necklace of nests, they are so close together. Of birds which hatch their broods on their own,^h the hoopoe is the only one which makes no nest for itself: instead, it goes into tree-trunks and lays its eggs in the hollows of them, without collecting any material for a nest. The *kirkos*ⁱ builds in houses and on rocky cliffs. The *tetrix*, known as *ourax* to Athenians, builds neither on the ground nor in trees, but on low-growing plants.

^a Lit., "crested bird"; cf. 617 b 20.

^b Perhaps a pipit (Thompson): but cf. the *tetrix-ourax* a few lines below.

^c Another reading is *eirops*. Identified by Thompson with the bee-eater. Cf. 615 b 24.

^d This is true only of the missel-thrush.

^e This must refer to the swallows; in fact, the statement is true of the house-martin.

^f This appears to mean: as contrasted with the cuckoo, which leaves the hatching and rearing of its young to other birds. See also 616 a 35.

^g Three of the best mss. read "cuckoo"; Dt. reads *kypselos* (cliff-martin); Piccolos supposes a lacuna in the text.

II Τὸ δ' ὦν ἀπάντων ὁμοίως τῶν ὀρνίθων σκληρό-
 16 δερμόν¹ ἐστίν, ἐὰν γόνῳ γένηται καὶ μὴ διαφθαρῆ
 (ἕνια γὰρ μαλακὰ τίκτουσιν αἱ ἀλεκτορίδες), καὶ
 δίχροα τὰ ὦά² τῶν ὀρνίθων, ἐκτὸς μὲν τὸ λευκόν,
 ἐντὸς δὲ τὸ ὠχρόν. διαφέρουσι δὲ³ τὰ τῶν περὶ
 ποταμοῦς καὶ λίμνας γιγνομένων ὀρνέων πρὸς τὰ
 20 τῶν ξηροβατικῶν· πολλαπλάσιον γὰρ ἔχει τὰ τῶν
 ἐνύδρων κατὰ λόγον τὸ ὠχρόν πρὸς τὸ λευκόν. καὶ
 τὰ χρώματα δὲ τῶν ὦων διαφέρει κατὰ τὰ γένη τῶν
 ὀρνίθων· τῶν μὲν γὰρ λευκά ἐστί τὰ ὦά, οἷον περι-
 στεράς καὶ πέρδικος, τῶν δ' ὠχρά, οἷον τῶν περὶ
 25 τὰς λίμνας, τῶν δὲ κατεστιγμένα, οἷον τὰ τῶν με-
 λεαγρίδων καὶ φασιανῶν· τὰ δὲ τῆς κεγχρίδος ἐρυθρά
 ἐστίν ὡσπερ μίλτος. ἔχει δὲ τὸ ὦν διαφορὰν· τῇ
 μὲν γὰρ ὀξύ τῇ δὲ πλατύτερόν ἐστιν· ἐξιόντος δ'
 ἡγείται τὸ πλατύ. ἔστι δὲ τὰ μὲν μακρὰ καὶ ὀξέα
 τῶν ὦων θήλεα, τὰ δὲ στρογγύλα καὶ περιφέρειαν
 30 ἔχοντα κατὰ τὸ ὀξύ ἄρρενα.⁴ ἐκλέπεται⁵ μὲν οὖν
 559 b ἐπιωάζοντων τῶν ὀρνίθων, οὐ μὴν ἀλλὰ καὶ αὐτό-
 ματα ἐν τῇ γῇ ὡσπερ ἐν Αἰγύπτῳ, κατορυπτόντων
 εἰς τὴν κόπρον· καὶ ἐν Συρακούσαις δὲ φιλοπότης τις
 ὑποτιθέμενος ὑπὸ τὴν ψίαθον εἰς τὴν γῆν τοσοῦτον
 ἔπινεν, ὡς φασί, χρόνον συνεχῶς, ἕως ἐκλέποι τὰ

¹ τ' add. PD, vulg., om. AC.

² τὰ add. PE, vulg., om. ACD.

³ καὶ add. PD, vulg., om. AC.

⁴ θήλεα . . . ἄρρενα] ἄρρενα . . . θήλεα Sn., Plinius et alios secutus.

⁵ ἐκλέπεται AC; ἐκπέττειται E; ἐκπέττειται P; ἐκπέμπεται D.

The egg of all birds alike has a hard shell, provided II
 it is formed by way of copulation and has not been ^{Eggs.}
 damaged (some domestic hens lay soft eggs). Further,
 <the contents of> birds' eggs are of two colours:
 outside is the white, and inside the yellow. However,
 there is a difference between the eggs of birds that
 live by rivers and marshes and the eggs of those that
 live on dry land: the eggs of aquatic birds have many
 times more yolk in proportion than they have white.
 Also, eggs differ in <external> colour according to
 the various kinds of birds: some eggs are white, e.g.,
 pigeons' and partridges' eggs; some are yellow, e.g.,
 those of marsh-birds: some are spotted, e.g., those
 of the guinea-fowl and the pheasant; while those of
 the kestrel are red, like vermilion. Further, an egg
 is unsymmetrical: it is pointed at one end and blunt
 at the other: the blunt end comes out first when it is
 being laid. Long, pointed eggs are female; round
 ones, and ones that have a gentler curve at the pointed
 end, are male.^a They are hatched by being incubated
 by the parent-bird, though they can also be hatched
 spontaneously in the ground, as occurs in Egypt,
 where they are buried in dung-heaps; and there is a
 story of a drink-addict at Syracuse who used to put
 eggs in the ground under his sleeping-mat, and went
 on drinking continuously for a long enough time to

^a Scot's translation states the reverse (*ova vero longa acuti capitis producunt mares, rotunda vero et habencia in loco acuminis rotundum producunt feminas*), agreeing with writers such as Horace and Pliny, and this view was current in the Middle Ages. Albertus Magnus (using Scot's translation) remarked that this was wrong, and that the correct statement, tallying with his own experience, was to be found in Avicenna. Rudberg (*Eranos*, 49 (1951), pp. 31 f.) suggests that the reversal may have been due to Strato, but it is not easy to see how this could have happened.

5 ψά. ἤδη δὲ καὶ κείμενα ἐν ἀγγείοις ἀλεεινοῖς ἐξ-
επέφθη καὶ ἐξῆλθεν αὐτόματα.

Ἡ μὲν οὖν γονὴ πάντων τῶν ὀρνίθων λευκῆ,
ὡσπερ καὶ τῶν ἄλλων ζώων· ὅταν δ' ὀχευθῆ, ἄνω
πρὸς τὸ ὑπόζωμα λαμβάνει ἢ θήλεια. καὶ τὸ μὲν
πρῶτον λευκὸν καὶ μικρὸν¹ φαίνεται, ἔπειτα ἐρυθρὸν
10 καὶ αἱματώδες, αὐξανόμενον δ' ὤχρον καὶ ξανθὸν
ἅπαν· ὅταν δ' ἤδη γένηται² ἀδρότερον, διακρίνεται,
καὶ ἔσω μὲν τὸ ὤχρον ἔξω δὲ τὸ λευκὸν περιστάται.
ὅταν δὲ τελειωθῆ, ἀπολύεται τε καὶ ἐξέρχεται οὕτω
τῷ καιρῷ ἐκ τοῦ μαλακὸν εἶναι μεταβάλλον ἐπὶ τὸ
σκληρόν, ὡστ' ἐξέρχεται μὲν οὕτω πεπηγός, ἐξ-
15 ελθὸν δ' εὐθέως πήγνυται καὶ γίγνεται σκληρόν, ἐὰν
μὴ ἐξίη νεοσηκός. ἐφάνη δ' ἤδη, οἷον ἐν τινι καιρῷ
γίγνεται τὸ ὠόν (ἅπαν γὰρ ὤχρον ὁμοίως ἐστίν,
ὡσπερ ὕστερον ὁ νεοττός), τοιαῦτα καὶ ἐν ἀλεκ-
τρῶνι διαιρουμένῳ ὑπὸ τὸ ὑπόζωμα, ὅσπερ αἱ θή-
λειαι ἔχουσι τὰ ψά, τὸ μὲν εἶδος ὠχρά ἅλα, τὸ δὲ
20 μέγεθος ἡλικία ψά· ἃ ἐν τέρατος λόγῳ τιθέασιν.

Οἱ δὲ λέγοντες ὅτι ὑπολείμματά ἐστι τὰ ὑπηνέμια
τῶν ἔμπροσθεν ἐξ ὀχείας γενομένων,³ οὐκ ἀληθῆ
λέγουσιν· ὥπται γὰρ ἰκανῶς ἤδη ἀνόχεντοι νεοττίδες
ἀλεκτορίδων καὶ χηνῶν τίκτουσαι ὑπηνέμια. τὰ δ'
ὠά τὰ ὑπηνέμια ἐλάττω μὲν τῷ μεγέθει γίγνεται
25 καὶ ἥττον ἡδέα καὶ ὑγρότερα τῶν γονίμων, πλήθει
δὲ πλείω· ὑποτιθεμένων δὲ τῇ ὀρνίθι οὐδὲν παχύνεται

¹ λ. καὶ μ. AC: μ. καὶ λ. PD.

² γένηται AC: γίγνεται PD, vulg.

³ γενομένων Dt.: γιγνομένων codd., vulg.

^a See Notes, §§ 19 f.

^b Cf. G.A. 739 b 6 ff.

^c On this subject cf. G.A. 750 b 2 ff. (and other reff. in Loeb G.A. index), and note on 541 a 30 above.

hatch them. Also, it has been known for eggs placed in warm vessels to get thoroughly concocted^a and to hatch out spontaneously.

Now the semen of all birds, as of all other animals, is white; and the hen bird, after having submitted to the cock, draws the semen up towards the *hypozoma*.^b At first it looks white and small, then it shows as red and blood-like, and as it grows it becomes yellow or orange-coloured all over. When it has become more fully developed, it differentiates, and the yolk settles in the middle with the white surrounding it. When its development is completed, the egg comes away and makes its way out; and the timing is such that whereas it has up to now been soft, at this moment it becomes hard: in other words, at the moment of laying it has not yet hardened, but as soon as it emerges it hardens immediately—unless some disease has overtaken it before reaching this stage. It has also occurred that, when a cock bird has been cut open, objects have been seen under its *hypozoma* (i.e., where hens have their eggs), resembling the egg at a certain stage of its development, viz., when it is yellow all over, just as the yolk is later on: these objects are completely yellow in appearance and identical with eggs in size. These occurrences are regarded as monstrosities.

Some people allege that wind-eggs^c are the remains of eggs previously produced by copulation. They are wrong, because we have sufficient observations to establish that chickens of the domestic fowl and of geese lay wind-eggs though they have never copulated. Wind-eggs are smaller in size than fertile ones, less tasty, and more fluid, and they are more numerous. If they are put under a hen, their fluid part does

τὸ ὑγρόν, ἀλλὰ τὸ τ' ὠχρόν διαμένει καὶ τὸ λευκὸν ὁμοία ὄντα. γίγνεται δ' ὑψηνέμια πολλῶν, οἷον ἀλεκτορίδος, πέρδικος, περιστερᾶς, ταῶνος, χηνός, 30 χηναλώπεκος. ἐκλέπεται δ' ἐπωαζουσῶν ἐν τῷ θέρει θάττον ἢ ἐν τῷ χειμῶνι· ἐν ὀκτωκαίδεκα γὰρ 560 α ἡμέραις αἱ ἀλεκτορίδες ἐν τῷ θέρει ἐκλέπουσιν, ἐν δὲ τῷ χειμῶνι ἐνίот' ἐν πέντε καὶ εἴκοσιν. διαφέρουσι μέντοι καὶ ὄρνιθες ὄρνιθων τῷ ἐπωαστικώτεροι εἶναι ἕτεροι ἑτέρων. εἰάν δὲ βροντήσῃ ἐπωαζούσης, 5 διαφθείρεται τὰ ὠά. τὰ δὲ καλούμενα ὑπὸ τινων κυνόσουρα καὶ οὔρια γίγνεται τοῦ θέρους μᾶλλον. ζεφύρια δὲ καλεῖται τὰ ὑψηνέμια ὑπὸ τινων, ὅτι ὑπὸ τὴν ἑαρινὴν ὥραν φαίνονται δεχόμενοι τὰ πνεύματα αἱ ὄρνιθες· τοιοῦτον δὲ ποιούσι καὶ τῇ χειρὶ πως ψηλαφώμεναι. γίγνεται δὲ τὰ ὑψηνέμια γόνιμα καὶ 10 τὰ ἐξ ὀχείας ἐνυπάρχοντα ἤδη μεταβάλλει τὸ γένος εἰς ἄλλο γένος, εἰάν πρὶν μεταβάλλειν ἐκ τοῦ ὠχροῦ εἰς τὸ λευκὸν ὀχεύηται ἢ τὰ ὑψηνέμια ἔχουσα ἢ τὰ γόνω εἰλημμένα ἐξ ἑτέρου ὄρνιθος· καὶ γίγνεται τὰ μὲν ὑψηνέμια γόνιμα, τὰ δὲ προϋπάρχοντα κατὰ τὸν ὕστερον ὀχεύοντα ὄρνιθα. εἰάν δ' ἤδη μεταβαλ- 15 λόντων εἰς τὸ λευκόν, οὐδὲν μεταβάλλει οὔτε τὰ ὑψηνέμια ὥστε γίνεσθαι γόνιμα, οὔτε τὰ γόνω κούμενα ὥστε μεταβαλεῖν εἰς τὸ τοῦ ὀχεύοντος γένος. καὶ εἰάν ὑπαρχόντων γε¹ μικρῶν διαλείπη ἢ ὀχεία, οὐδὲν ἐπαυξάνεται τὰ προϋπάρχοντα· εἰάν δὲ 20 πάλιν ὀχεύηται, ταχεῖα γίγνεται ἢ ἐπίδοσις εἰς τὸ μέγεθος.

¹ Ἐχει δὲ φύσιν τοῦ ὠοῦ τὸ ὠχρόν καὶ τὸ λευκόν

¹ γε Pi. : δὲ codd.

not thicken, but both yolk and white remain unchanged. Wind-eggs are produced by many kinds of birds, e.g., domestic hens, partridges, pigeons, peahen, geese, vulpanders.^a Eggs are hatched by incubating hens more quickly in summer than in winter; thus, domestic fowls take eighteen days to hatch them out in summer, but sometimes twenty-five in winter. Besides, one hen-bird will differ from another: some are better sitters than others. If thunder occurs while a bird is sitting, the eggs are ruined. What some people call *kynosoura* and *ouria*^b tend to be produced more in summer. Wind-eggs are called *zephyria* by some, because hen-birds can be seen in spring-time inhaling the breezes: they do a similar thing if stroked by the hand in a particular way. Wind-eggs become fertile, and eggs already impregnated can change their breed, if before they change from yellow to white the hen-bird which has the wind eggs or the impregnated eggs is trodden by another cock: when this happens, the wind-eggs become fertile and the previously impregnated eggs take after the breed of the second cock.^c But if the second impregnation occurs while the change from yellow to white is in progress, then neither alteration is effected: the wind-eggs do not become fertile, nor do the fertile eggs change over to the breed of the second cock. Further, if copulation be intermitted while the existing eggs are small, the previously existing ones do not increase in size; but if copulation is repeated, their growth is rapid.^d

Yolk and white are opposed not only in colour but

^a The Egyptian goose, lit. "goose-fox." Cf. 593 b 22.

^b i.e., "windy." ^c Cf. G.A. 730 a 8, 757 b 1.

^d Cf. G.A. 787 b 5.

560 a

ἐναντίαν οὐ μόνον τῷ χρώματι ἀλλὰ καὶ τῇ δυνάμει·
 τὸ μὲν γὰρ ὠχρὸν ὑπὸ τοῦ ψύχους πήγνυται, τὸ δὲ
 λευκὸν οὐ πήγνυται ἀλλ' ὑγραινεται μᾶλλον· ὑπὸ δὲ
 τοῦ πυρὸς τὸ μὲν λευκὸν πήγνυται, τὸ δ' ὠχρὸν οὐ
 25 πήγνυται ἀλλὰ μαλακὸν διατελεῖ, ἂν μὴ κατακαυθῆ,
 καὶ μᾶλλον ἐψομένου ἢ πυρουμένου συνίσταται καὶ
 ξηραίνεται. ἐκάτερον δὲ χωρὶς ὑμένι διείληπται ἀπ'
 ἀλλήλων. αἱ δὲ πρὸς τῇ ἀρχῇ τοῦ ὠχροῦ χάλαζαι
 οὐδὲν συμβάλλονται πρὸς τὴν γένεσιν, ὥσπερ τινὲς
 30 ὑπολαμβάνουσιν· εἰσὶ δὲ δύο, ἡ μὲν κάτωθεν ἡ δ'
 ἄνωθεν. συμβαίνει δὲ περὶ τὸ ὠχρὸν καὶ τὸ λευκὸν
 καὶ <τόδε>.¹ ὅταν ἐξαιρεθέντα συνεράσῃ τις πλείω
 560 b τοιαῦτα εἰς κύστιν καὶ ἔψη μαλακῶς καὶ μὴ συντόνω
 τῷ πυρὶ, τὸ ὠχρὸν εἰς τὸ μέσον συνέρχεται πᾶν,
 κύκλω δὲ τὸ λευκὸν περιίσταται.

Τῶν δ' ἀλεκτορίδων αἱ νεοττίδες πρῶτον τίκτου-
 σιν εὐθὺς ἀρχομένου τοῦ ἔαρος, καὶ πλείω τίκτουσιν
 5 ἢ αἱ πρεσβύτεραι· ἐλάττω δὲ τῷ μεγέθει τὰ ἐκ τῶν
 νεωτέρων. ὅλως δ' εἰ μὴ ἐπώαζωσιν αἱ ὄρνιθες,
 διαφθεύρονται καὶ κάμνουσιν. ὀχευθεῖσαι δ' αἱ μὲν
 ὄρνιθες φρίπτουσί τε καὶ ἀποσειόνται καὶ πολλάκις
 κάρφος περιβάλλονται (ποιοῦσι δὲ τὸ αὐτὸ τοῦτο
 10 καὶ τεκοῦσαι ἐνίοτε), αἱ δὲ περισσότεραι ἐφέλκουσι τὸ
 ὄρροπύγιον, οἱ δὲ χήνες κατακολυμβῶσιν. αἱ δὲ
 κηῖσαι καὶ αἱ τῶν ὑπηγεμίων ὠῶν συλλήψεις τα-
 χεῖαι γίνονται ταῖς πλείω τῶν ὄρνιθων οἷον καὶ
 τῇ πέρδικι, ὅταν ὀργᾶ πρὸς τὴν ὀχείαν· εἰ γὰρ
 κατὰ πνεῦμα στῆ τοῦ ἄρρενος, κυῖσκειται καὶ εὐθὺς

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also in their physical character^a; the yolk sets fast under the effect of cold, whereas the white does not, but tends to liquefy; again, the white sets fast under the effect of fire, whereas the yolk does not: it remains soft (unless it is thoroughly burnt), and it is by boiling the egg rather than by roasting it that the yolk sets and solidifies. The two components are kept separate and apart from each other by a membrane. The "hailstones" which are situated at the "principle" of the yolk do not contribute anything towards the generation of the embryo, as some suppose: there are two of them, one above and one below. The following also occurs with regard to the yolk and white: if you take these out of a number of eggs, pour them together into a receptacle, and boil them up gently—not over a roaring fire—all the yolk will come together into the middle, and the white will set round it.

Young domestic hens lay first at the beginning of spring, and they lay more eggs than the older birds, though the eggs of the younger ones are smaller in size. In general, hens, unless they sit on eggs, deteriorate and fall ill. After they have been trodden hens shiver and shake themselves, and often they scatter bits of dry straw etc. all round them (they do this sometimes after laying, too). Pigeons trail their rump on the ground, geese dive down under water. The conception of fertile eggs and the originating of wind-eggs take place quickly in most birds, e.g., in the partridge when it is in heat: when the hen partridge stands to windward of the cock, she conceives

^a *Dynamis*, i.e., physical character. The word used in a similar statement at *G.A.* 753 a 35 is *physis*, nature. See *G.A.* (Loeb ed.), *Intro.* §§ 23 ff.

¹ τόδε suppl. Dt.

15 ἄχρηστος γίνεταί πρὸς τὰς θήρας· ὄσφρησιν γὰρ δοκεῖ ἔχειν ἐπίδηλον ὁ πέρδιξ.

Ἡ δὲ τοῦ ψοῦ γένεσις μετὰ τὴν ὀχείαν καὶ ἐκ τοῦ ψοῦ πάλιν συμπετομένου ἢ τοῦ νεοττοῦ γένεσις οὐκ ἐν ἴσοις χρόνοις συμβαίνει πᾶσιν, ἀλλὰ διαφέρει κατὰ τὰ μεγέθη τῶν γεννώντων. συνίσταται δὲ τὸ
20 τῆς ἀλεκτορίδος ὦν μετὰ τὴν ὀχείαν καὶ τελειοῦται ἐν δέχ' ἡμέραις ὡς ἐπὶ τὸ πολὺ· καὶ τῆς περιστερᾶς δ' ἐν μικρῷ ἐλάττονι. δύνανται δ' αἱ περιστερᾶι καὶ ἤδη τοῦ ψοῦ ἐν ὠδίνι ὄντος κατέχειν· ἐὰν γάρ τι ἐνοχληθῆ ὑπὸ τινος ἢ περὶ τὴν νεοττείαν ἢ πτερόν ἐκτιλθῆ ἢ ἄλλο τι πονήσῃ καὶ δυσαρασθήσῃ, κατέχει καὶ οὐ τίκτει μελλήσασα.

25 Ἴδια δὲ περὶ τὰς περιστερὰς συμβαίνει καὶ τάδε περὶ τὴν ὀχείαν. κυνοῦσί τε γὰρ ἀλλήλας, ὅταν μέλλῃ ἀναβαίνειν ὁ ἄρρην, ἢ οὐκ ἂν ὀχεύσειεν—ὁ μὲν πρεσβύτερος² ἐὰν μὴ κύσῃ τὸ³ πρῶτον, ὕστερον μέντοι ἀναβαίνει καὶ μὴ κύσας· οἱ δὲ νεώτεροι αἰεὶ τοῦτο ποιήσαντες ὀχεύουσιν. τοῦτο [τε]⁴ δὴ ἴδιον

30 ποιοῦσι. καὶ ἔτι αἱ θήλειαι ἀλλήλας⁵ ἀναβαίνουσιν, ὅταν ἄρρην μὴ παρῆ, κύσασαί ὡσπερ οἱ ἄρρηνες· καὶ
561 a οὐδὲν προΐεμεναι εἰς ἀλλήλας τίκτουςιν ᾧ πλείω ἢ τὰ γόνω γιγνόμενα, ἐξ ὧν οὐ γίνεταί νεοττὸς οὐδείς, ἀλλ' ὑπηνέμια πάντα τὰ τοιαῦτά ἐστιν.

III Ἡ δὲ γένεσις ἐκ τοῦ ψοῦ τοῖς ὄρνεσι συμβαίνει
5 μὲν τὸν αὐτὸν τρόπον πᾶσιν, οἱ δὲ χρόνοι διαφέρουσι

¹ καὶ AC, om. P, vulg.

² ἢ οὐκ ἀνέχονται. διὸ οὐκ ἂν ὀχ. ὁ μὲν πρεσβ. Dt.: ἀνέχονται [sc. αἱ θηλείαι] suppleverat Sn. ex Athenaeo ix. 394 d: ipse ut supra interpuncti.

³ ἐὰν μὴ κύσῃ AC: ἐὰν μὴ κύσῃ τὸ <γε> Dt.: ἂν μὴ τὸ D: τὸ vulg. ⁴ τε secl. Dt.: δὴ om. PDE.

⁵ ἀλλήλας Pi.: ἀλλήλαις codd.

and at once becomes useless as a decoy—for the partridge appears to have a very distinct sense of smell.

The formation of the egg after copulation and the formation of the chick as the egg in its turn gets concocted^a do not take the same length of time for all birds; they vary according to the size of the parents. The domestic hen's egg is constituted^b and completely formed in ten days after copulation for the most part; a pigeon's egg in a somewhat shorter time. Pigeons are able to hold the egg back even when they are just on the point of laying it: if the bird is worried by anyone—e.g., by being disturbed on its nest, or by having a feather pulled out, or if it is bothered or annoyed in any other way, it will hold the egg back and refuse to lay, though it was on the point of doing so.

Peculiar features of behaviour occur in pigeons in connexion with pairing. (a) They kiss one another just when the cock is about to mount the hen, or the male would not copulate—an older male would not do so without the kissing, to begin with; though later he mounts without it; younger males however always kiss before copulation. This then is a singular peculiarity of pigeons' behaviour. Furthermore, (b) female pigeons mount one another if no male is present, having first kissed as the males do; and although nothing passes between them, they lay more eggs than if they had been impregnated. These eggs, of course, produce no chicks; all such are wind-eggs.

Generation from the egg occurs in an identical III manner in all birds, though the time taken to com-

^a See Notes, §§ 19 f.

^b See Notes, § 27.

τῆς τελειώσεως, καθάπερ εἶρηται. ταῖς μὲν οὖν ἀλεκτορίσι τριῶν ἡμερῶν καὶ νυκτῶν παρελθουσῶν ἐπισημαίνει τὸ πρῶτον, ταῖς δὲ μείζουσιν αὐτῶν ὄρνισιν ἐν πλείονι χρόνῳ, ταῖς δ' ἐλάττωσιν ἐν ἐλάττωσι. γίγνεται δ' ἐν τούτῳ τῷ χρόνῳ ἤδη τό τ' ὠχρὸν 10 ἄνω¹ προσεληλυθὸς πρὸς τὸ ὄξύ, ἥπερ ἐστὶν ἡ ἀρχή τε τοῦ ψοῦ καὶ ἐκλέπεται τὸ ψόν, καὶ ὅσον στιγμῆ αἱματίνῃ ἐν τῷ λευκῷ ἢ καρδία. τοῦτο δὲ τὸ σημεῖον πηδᾶ καὶ κινεῖται ὡσπερ ἔμψυχον, καὶ ἀπ' αὐτοῦ δύο πόροι φλεβικοὶ ἔναιμοι ἐλισσόμενοι φέρουσι αὐξανομένου εἰς ἐκάτερον τῶν χιτώνων τῶν 15 περιεχόντων.² καὶ ὑμῆν δ' αἱματικὰς ἴνας ἔχων ἡδη περιέχει τὸ λευκόν³ κατὰ τὸν χρόνον τοῦτον ἀπὸ τῶν πόρων τῶν φλεβικῶν. ὀλίγον δ' ὕστερον καὶ τὸ σῶμα ἡδη ἀποκρίνεται, μικρὸν τὸ πρῶτον πάμπαν καὶ λευκόν. δηλῆ δ' ἡ κεφαλὴ, καὶ ταύτης οἱ ὀφθαλμοὶ μάλιστ' ἐμπεφυσημένοι· καὶ τοῦτο μέχρι πόρρω 20 διατελεῖ· ὅψε γὰρ ποτε μικροὶ γίνονται καὶ συμπύπτουσι. τοῦ δὲ σώματος τὸ κάτω μέρος οὐδὲν φαίνεται μῦριον πρὸς τὸ ἄνω τὸ πρῶτον. τῶν δὲ πόρων τῶν ἐκ τῆς καρδίας τεινόντων ὁ μὲν φέρει εἰς τὸ κύκλω περιέχον,⁴ ὁ δ' εἰς τὸ ὠχρὸν ὡσπερ ὀμ-

¹ τό τε ὠχρὸν ἄνω A : ἄνω τὸ ὠχρὸν vulg. : τό τε ἄνω ὠχρὸν C ἄνω tantum PDE : *ascendit citrinum versus acumen* Σ.

² αὐξαν. . . περιεχόντων secl. Th.

³ λέκιθον coni. Th.

⁴ hic <χόριον> suppl. Dt.

^a See Notes, § 12. Aristotle's belief that the ἀρχή of the egg is at the pointed end seems to suggest, as Platt remarks on *G.A.* 752 a 10 ff., that he was a "little-endian" and always opened his eggs at that end, for in fact the germ always floats up to the top whichever way the egg is placed. The *G.A.* passage, however, indicates that theoretical considerations also were involved, for there two reasons are adduced: (1) the

plete the whole process varies, as has been said. In the case of the domestic hen, the first signs of the embryo are seen after three days and three nights; in the case of larger birds than these, the time is longer; of smaller birds, shorter. During this time the yolk has worked its way up towards the pointed end, where the "principle"^a of the egg is situated and where the egg hatches; and the heart is no bigger than just a small blood-spot in the white. This spot beats and moves as though it were alive; and from it, as it grows, two vein-like passages with blood in them lead on a twisted course to each of the two surrounding envelopes. A membrane containing blood-coloured fibres at this stage envelops the white, leading off from the vein-like passages. Soon after this, the body of the embryo becomes distinct: it is very small at first, and white. The head is clearly visible, and in it the eyes, very much swollen up. This state of affairs persists quite a long time: it is late in the development that the eyes become small and contract. The lower part of the body is as nothing compared with the upper part at first. Of the two passages which extend from the heart, one leads to the surrounding envelope, the other to the yolk, like a sort of umbilical cord. The "principle"

Develop-
ment of the
embryo.

pointed end comes out last; this is because that is where the egg was fastened before being laid, and that (on the analogy of seeds of plants) is the end where the ἀρχή must be; and (2) the pointed end of the shell is harder than the other; this is in order to give more protection to the ἀρχή. Later in the same passage (*G.A.* 752 b 2 ff.) Aristotle mentions a third consideration: early in the egg's development there is something like an umbilical cord at the pointed end, which sticks out like a pipe, and this can be seen in small aborted eggs (actually this is a reference to the *chalazae*, the function of which is not known).

φαλός ὤν. ἡ μὲν οὖν ἀρχὴ τοῦ νεοττοῦ ἐστὶν ἐκ τοῦ
25 λευκοῦ, ἡ δὲ τροφή διὰ τοῦ ὀμφαλοῦ ἐκ τοῦ ὠχροῦ.

Δεκαταίου δ' ἤδη ὄντος ὁ νεοττός ὅλος διάδηλος
καὶ τὰ μέρη πάντα. ἔχει δ' ἔτι τὴν κεφαλὴν μείζω
τοῦ ἄλλου σώματος, καὶ τοὺς ὀφθαλμοὺς τῆς κεφα-
λῆς, οὐκ ἔχοντάς πω ὄψιν. γίνονται δ' οἱ ὀφθαλμοὶ
30 περὶ τὸν χρόνον τοῦτον ἐξαιρούμενοι, μείζους κυάμων,
καὶ μέλανες· ἀφαιρουμένου δὲ τοῦ δέρματος ὑγρὸν
ἐνεσσι λευκὸν καὶ ψυχρὸν, σφόδρα στίλβον πρὸς τὴν
αὐγὴν, στερεὸν δ' οὐδέν. τὰ μὲν οὖν περὶ τὰ ὄμματα
561 b καὶ τὴν κεφαλὴν τοῦτον διάκειται τὸν τρόπον, ἔχει
δ' ἐν τῷ χρόνῳ τούτῳ καὶ τὰ σπλάγχνα ἤδη φανερά
καὶ τὰ περὶ τὴν κοιλίαν καὶ τὴν τῶν ἐντέρων φύσιν,
καὶ αἱ φλέβες αἱ ἀπὸ τῆς καρδίας φαινόμεναι τείνειν
5 πρὸς τῷ ὀμφαλῷ ἤδη γίνονται. ἀπὸ δὲ τοῦ ὀμφα-
λοῦ τέταται φλέψ ἡ μὲν πρὸς τὸν ὑμένα τὸν περι-
έχοντα τὸ ὠχρὸν (τὸ δ' ὠχρὸν ἐν τῷ χρόνῳ τούτῳ
ὑγρὸν ἐστὶν ἤδη καὶ πλεῖον ἢ τὸ κατὰ φύσιν), ἡ δ'
ἑτέρα εἰς τὸν ὑμένα τὸν περιέχοντα ὄλον τὸν θ' ὑμένα
ἐν ᾧ ὁ νεοττός, καὶ τὸν τοῦ ὠχροῦ ὑμένα καὶ τὸ
10 μεταξὺ τούτων ὑγρὸν. [αὐξανόμενου γὰρ τοῦ νεο-
τοῦ κατὰ μικρὸν τοῦ ὠχροῦ τὸ μὲν ἄνω γίνεταί
τὸ δὲ κάτω, ἐν μέσῳ δὲ τὸ λευκὸν ὑγρὸν· τοῦ δὲ
κάτω ὠχροῦ τὸ λευκὸν κάτωθεν, ὥσπερ τὸ πρῶτον
ὑπήρχεν.] δεκαταίου δ' ὄντος τὸ λευκὸν ἔσχατον
γίνεταί, ὀλίγον ἤδη ὄν καὶ γλίσχρον καὶ παχὺ καὶ
15 ὑπωχρον.¹

Τέτακται γὰρ τῇ θέσει ἕκαστα τόνδε τὸν τρόπον.
πρῶτος μὲν καὶ ἔσχατος πρὸς τὸ ὄστρακον ὁ τοῦ

¹ ab αὐξανόμενου hucusque secl. Dt. : usque ad ὑπήρχεν Th.

^a See Notes, § 21, and cf. 489 b 8.

of the chick is derived from the white; its nourishment comes through the umbilical cord from the yolk.^a

At ten days the whole chick and all its parts are clearly distinguishable. Its head is still bigger than the rest of the body, and the eyes bigger than the head, but so far they are devoid of sight. At about this time the eyes become projecting, larger than beans, and black; when the skin is taken off them, they have inside them a white, cold fluid, which glitters brightly in the light, but they contain no solid substance. Such then is the disposition of the head and the eyes. The internal organs are also clearly distinguishable by this time—both those pertaining to the stomach and those pertaining to the viscera; and the blood-vessels which are to be seen extending from the heart are now near the navel. Two blood-vessels extend from the navel: one leads to the membrane which surrounds the yolk (and at this stage the yolk is by now fluid, and bulkier than is natural); the other leads to the membrane which surrounds (a) the membrane in which the chick is situated, (b) the membrane round the yolk, and (c) the fluid between them. [For as the chick grows, gradually part of the yolk goes upwards and part downwards, and in the middle is the white fluid; the white of the egg is below the lower part of the yolk, as was the case at first.] On the tenth day the white is at the outer surface, small in amount by now, glutinous, firm and rather yellow in colour.^b

The several components are arranged as follows. First and outermost, next the shell, is the membrane

^b A diagram showing the membranes of the chick embryo at ten days will be found in *G.A.* (Loeb ed.), p. 369.

ὡοῦ ὑμῆν, οὐχ ὁ τοῦ ὀστράκου, ἀλλ' ὑπ' ἐκείνον.
 ἐν δὲ τούτῳ λευκὸν ἔνεστιν ὑγρόν, εἶτα ὁ νεοττός,
 καὶ περὶ αὐτὸν ὑμῆν χωρίζων, ὅπως μὴ ἦ ἐν ὑγρῷ
 20 ὁ νεοττός· ὑπὸ δὲ τὸν νεοττὸν τὸ ὠχρόν [εἰς ὃ τῶν
 φλεβῶν ἔφερον ἢ ἑτέρα, ἢ δ' ἑτέρα εἰς τὸ περιέχον
 λευκόν. τὸ δὲ πᾶν περιέχει ὑμῆν μεθ' ὑγρότητος
 ἰχωροειδοῦς. εἴτ' ἄλλος ὑμῆν περὶ αὐτὸ ἤδη τὸ
 ἔμβρυον, ὡσπερ εἴρηται, χωρίζων πρὸς τὸ ὑγρόν.
 ὑποκάτω δὲ τούτου τὸ ὠχρόν ἐν ἑτέρῳ ὑμένι περι-
 25 ειλημμένον, εἰς ὃ τείνει ὀμφαλὸς ὁ ἀπὸ τῆς καρδίας
 καὶ τῆς μεγάλης φλεβὸς φέρων, ὥστε μὴ εἶναι τὸ
 ἔμβρυον ἐν μηδετέρῳ τῶν ὑγροτήτων.]¹

Περὶ δὲ τὴν εἰκοστὴν ἤδη φθέγγεται τε κινου-
 μενος ἔσωθεν, εἰάν τις θίγῃ² διελὼν, καὶ ἤδη δασὺς
 γίνεταί ὅταν ὑπὲρ τὰς εἰκοσιν ἢ ἐκκόλαψις γίνηται
 30 τῶν ὠῶν. ἔχει δὲ τὴν κεφαλὴν ὑπὲρ τοῦ δεξιῶ
 σκέλους ἐπὶ τῇ λαγόνι, τὴν δὲ πτέρυγα ὑπὲρ τῆς
 κεφαλῆς· καὶ φανερὸς κατὰ τοῦτον τὸν χρόνον ὁ τε
 χοριοειδὴς ὑμῆν ὁ μετὰ τὸν τοῦ ὀστράκου ὑμένα τὸν
 562 a ἔσχατον, εἰς ὃν ἔτεινεν ὁ ἕτερος τῶν ὀμφαλῶν (καὶ
 ὁ νεοττός ἐν τούτῳ ἤδη³ γίνεταί τότε ὅλος), καὶ
 ὁ ἕτερος ὑμῆν χοριοειδὴς ὢν, ὁ περὶ τὸ ὠχρόν εἰς
 ὃ ἔτεινεν ὁ ἕτερος ὀμφαλός· ἄμφω δ' ἦσθη ἀπὸ τε
 5 τῆς καρδίας καὶ τῆς φλεβὸς τῆς μεγάλης. ἐν δὲ
 τούτῳ τῷ χρόνῳ ὁ μὲν πρὸς τὸ ἔξω χόριον ὀμφαλός
 τείνων ἀπολύεται τοῦ ζώου συμπεπτωκώς, ὁ δ' εἰς
 τὸ ὠχρόν φέρων συνήρτηται τοῦ νεοττοῦ πρὸς τὸ
 ἔντερον τὸ λεπτόν, καὶ ἔσω τοῦ ὠχροῦ πολὺ ἤδη

¹ secl. Dt.² θίγη conl. A.-W.: κινῆ AC (D), vulg.: ἀντικινεῖ PE.: *si movetur ovum* Σ.

of the egg—not the membrane of the shell, but under it. Within this is a white fluid; next is the chick, and round the chick a membrane which keeps it separate, so that the chick is not immersed in fluid; under the chick is the yolk [into which one of the two blood-vessels I mentioned leads, while the other leads to the surrounding white substance. The whole thing is surrounded by a membrane with an ichor-like fluid. Then there is another membrane, which envelops the embryo itself, as has been stated, separating it off from the fluid. Under this, enveloped in another membrane is the yolk, into which extends the umbilical cord which leads from the heart and the great blood-vessel—to prevent the embryo from being in either of the fluids.]

About the twentieth day, if you open the egg and touch the chick, it moves inside and squeaks, and it is already getting downy when beyond the twenty days the eggs begin to hatch out. The chick has its head over its right leg close to the flank, and its wing over its head. At this time one can clearly see the chorion-like membrane which is situated next after the outermost membrane of the shell, to which (as we said) one of the umbilical cords extended (and by this stage the chick is wholly within it), and one can see the other membrane, also chorion-like, *i.e.*, the one surrounding the yolk into which the second umbilical cord led (as described above); both, as we said, originated from the heart and the great blood-vessel. At this time the umbilical cord which leads to the outer chorion collapses and gets detached from the chick, while the one that leads to the yolk is attached to the chick by its thin gut; and by now much of the yolk is inside

³ ἤδη A: δὴ PD, vulg.

562 a

γίνεται ἐν τῷ νεοττῷ, καὶ ὑπόστημα ἐν τῇ κοιλίᾳ
 10 ὠχρόν. καὶ περίττωμα δ' ἀφήσει περὶ τὸν χρόνον
 τοῦτον πρὸς τὸ ἔξω χόριον, καὶ ἐν τῇ κοιλίᾳ ἔχει
 λευκὸν δὲ καὶ τὸ ἔξω περίττωμα [καὶ ἔσω τι ἐγγί-
 γνεται λευκόν].¹ τέλος δὲ τὸ ὠχρόν αἰεὶ ἔλαττον
 γιγνόμενον καὶ προῖον ἀναλίσκεται πάμπαν καὶ ἐμ-
 περιλαμβάνεται ἐν τῷ νεοττῷ (ὥστ' ἤδη ἐκκεκολαμ-
 15 μένου δεκαταίου, ἂν τις ἀνασχίση, ἔτι πρὸς τῷ
 ἐντέρῳ μικρόν τι τοῦ ὠχροῦ λείπεται) ἀπὸ δὲ τοῦ
 ὀμφαλοῦ ἀπολέλυται, καὶ οὐδὲν γίνεται μεταξύ ἀλλ'
 ἀνήλωται πᾶν. περὶ δὲ τὸν χρόνον τὸν πρότερον
 ῥηθέντα καθεύδει μὲν ὁ νεοττός, ἐγείρεται δὲ καὶ
 ἀναβλέπει κινούμενος καὶ φθέγγεται· καὶ ἡ καρδιά
 20 ἅμα τῷ ὀμφαλῷ ἀναφυσᾷ ὡς ἀναπνέοντος. ἡ μὲν
 οὖν γένεσις ἐκ τοῦ ψοῦ τοῖς ὄρνεσι τοῦτον ἔχει τὸν
 τρόπον.

Τίκτουσι δ' αἱ ὄρνιθες ἔνια ἄγονα τῶν ψῶν καὶ τὰ
 ἐξ ὀχείας γιγνόμενα, καὶ ἐπωζουσῶν οὐδὲν γίνεται
 ἔκγονον· τεθεώρηται δὲ τοῦτο μάλιστα ἐπὶ τῶν
 περιστερῶν.

25 Τὰ δὲ δίδυμα τῶν ψῶν δὴ ἔχει λεκίθους, ὧν τὰ
 μὲν διείργει τοῦ μὴ εἰς ἀλληλα συγκεχύσθαι τὰ ὠχρά
 τοῦ λευκοῦ λεπτή διάφυσις, τὰ δ' οὐκ ἔχει ταύτην
 τὴν διάφυσιν, ἀλλὰ συμβαίνουσιν. εἰσὶ δ' ἔνια ἀλε-
 κτορίδες αἱ πάντα δίδυμα τίκτουσιν, καὶ ἤδη² ἐπὶ
 τούτων ὤπται [τὸ περὶ τὴν λέκιθον]³ συμβαίνον·
 30 ὀκτωκαίδεκα⁴ γάρ τις τεκοῦσα ἐξέλεψε δίδυμα, πλήν

¹ suspic. est Scal., secl. Th.; om. Gaza.

² καὶ ἤδη] ὡς PD, Aldus.

³ clausi; fortasse τὸδε scribendum; cf. 560 a 31.

the chick, and there is yellow sediment in the stomach. About this time, too, it discharges residue^a towards the outer chorion, and has residue in its stomach; the outer residue also is white [and some white matter forms inside]. Finally, the yolk, gradually diminishing all the time, in due course gets completely used up and enclosed within the chick (so that, ten days after hatching, if you cut the chick open, there will be a small piece of the yolk still remaining attached to the gut), but it has become detached from the umbilical cord, and there is nothing in between: all has been used up. During the time above mentioned, the chick sleeps, but when stirred, wakes, looks up, and squeaks, and its heart together with the umbilical cord palpitates, as though the animal were breathing. Such then is the process of generation of birds from the egg.

Some eggs laid by birds are infertile, even eggs produced by copulation, and no offspring comes from them when incubated. This has been observed especially in the case of pigeons.

Twin-eggs have two yolks. In some twin-eggs the yolks are prevented from running together by a thin partition of white; in others this partition is absent, and the yolks are in contact. Some hens lay twin-eggs and nothing else, and in their case this phenomenon [with the yolk] has been observed to occur: thus, a hen has laid and hatched out eighteen twin-eggs,^b

Double-
yolked
eggs.

^a See Notes, § 25.

^b The text should perhaps be emended to read "hatched out on the eighteenth day all twin-eggs"; cf. critical note.

⁴ et quedam gallina cubat super ova et finduntur teste in xviii. diebus Σ, unde fortasse ὀκτωκαίδεκαταία vel ὀκτωκαίδεκαταία scribendum (cf. 560 a 1), et mox <πάντα> δίδυμα.

562 a

ὄσα οὖρια ἐγένετο. τὰ μὲν οὖν δίδυμα¹ γόνιμα,

562 b πλὴν ὄσων² τὸ μὲν μείζον τὸ δ' ἔλαττον γίγνεται τῶν διδύμων, τὸ³ ἔλαττον ἐνίοτε⁴ τερατώδες.

IV Τίκτουσι δὲ πάντα μὲν τὰ περιστεροειδῆ δύο, οἷον φάττα καὶ τρυγῶν, ὡς ἐπὶ τὸ πολὺ, τὰ δὲ πλείστα
5 τρία [τρυγῶν καὶ φάττα].⁵ τίκτει δ' ἡ μὲν περιστέρα, ὡσπερ εἴρηται, πᾶσαν ὥραν, τρυγῶν δὲ καὶ φάττα ἐν τῷ ἔαρι, οὐ πλεονάκεις ἢ δὶς· τίκτει δὲ τὰ δεύτερα, ὅταν τὰ πρότερον γεννηθέντα διαφθαρῇ·
πολλὰ γὰρ διαφθεύουσιν αὐτὰ τῶν ὀρνίθων. τίκτει μὲν οὖν, ὡσπερ εἴρηται, καὶ τρία ποτέ· ἀλλ' ἐξάγει
10 οὐδέποτε δυοῖν πλέον νεοττοῖν, ἐνίοτε δὲ καὶ ἓνα μόνον· τὸ δ' ὑπολειπόμενον τῶν ὤων ἀεὶ οὐρίον ἐστίν.

Τῶν δὲ πλείστων ὀρνέων οὐδὲν αὐτοετὲς γεννᾷ. ἅπαντες δ' οἱ ὀρνίθες, ἐπειδὴν ἅπαξ ἄρξωνται τίκτειν, διὰ τέλους ὡς εἰπεῖν ἔχουσιν ὤα, ἀλλ' ἐν ἐνίοις διὰ μικρότητα οὐ ῥάδιον ἰδεῖν.

15 Ἡ δὲ περιστέρα ὡς ἐπὶ τὸ πολὺ ἄρρεν καὶ θῆλυ, καὶ τούτων ὡς ἐπὶ τὸ πολὺ πρότερον τὸ ἄρρεν τίκτει· καὶ τεκοῦσα μίαν ἡμέραν διαλείπει,⁶ εἶτα πάλιν τίκτει θάτερον. ἐπωάζει δὲ καὶ ὁ ἄρρην ἐν τῷ μέρει τῆς ἡμέρας, τὴν δὲ νύκτα ἡ θήλεια. ἐκπέττεται τε καὶ ἐκλέπεται ἐντὸς εἴκοσιν ἡμερῶν τὸ γενόμενον
20 πρότερον τῶν ὤων· τιτρώσκει δὲ τὸ ὤον τῇ προτεραίᾳ ἢ ἐκλέπει. καὶ συνθερμαίνουσι τοὺς νεοττοὺς

¹ δίδυμα scripsi, quod propos. Dt. : ἀλλα codd., edd.

² ὄσων scripsi : ὄσα codd. (quod fort. stare possit) : ὄσι Gesner, vulg., edd. : aliter scriberes πλὴν ὄσων . . . διδύμων, τὸ δ' ἔλαττον (vide et infra).

³ τὸ vulg. : ὅτε PE.

⁴ ἔλαττον ἐνίοτε scripsi : δὲ τελευταῖον codd., edd. ; fortasse

except those which turned "windy" (*ouria*).^a Twin-eggs therefore are fertile, except that in cases where one of the twins is larger and the other smaller, the smaller one is sometimes a monstrosity.

All birds of the pigeon class, e.g., the ring-dove and the turtle-dove, generally lay two eggs, at the most
IV Pigeons. three. The pigeon, as has been stated, lays at all seasons ; the turtle-dove and the ring-dove in spring, not more than twice. The second batch is laid when the first has been produced and destroyed—many birds do in fact destroy them. As I have said, the pigeon sometimes lays three eggs, but it never brings up more than two chicks, sometimes only one : the remaining egg is always "windy."

Most birds do not reproduce at all in their first year ; but all birds, once they have begun laying, have eggs continuously, one might say, though it is not easy to see them in the case of some birds owing to their smallness.

The pigeon generally lays one male egg and one female, and generally the male one first ; after laying it, the bird misses a day and then lays the other. The cock bird takes its turn to sit on the eggs in the daytime ; the female sits at night. The egg which was laid first gets fully concocted^b and hatches out within twenty days ; the mother bird pierces the egg the day before hatching it. Both parent birds keep the

^a See 560 a 5.

^b See Notes, §§ 19 f.

malle πλὴν ὅτε μὲν τὸ μὲν μείζον . . . ὅτε δὲ τὸ ἔλαττον τερατώδες : τὰ δὲ ἀδιόριστα (vel συγκεκριμένα) τερατώδη ex G.A. 770 a 15 sqq. conī. A.-W. : et unus gemellorum parvus est et alter magnus, et multociens est parvus monstruosus Σ ; videas et quae p. 374 scripta sunt.

⁵ secl. Dt.

⁶ τὰ πολλὰ add. PD, vulg. : om. AC.

ἀμφοτέροι ἐπὶ χρόνον τινά, τὸν αὐτὸν δὲ τρόπον¹
 ὄνπερ καὶ τὰ ὄα. χαλεπωτέρα δ' ἢ θήλειά ἐστι περὶ
 τὴν τεκνοτροφίαν τοῦ ἄρρενος, ὥσπερ καὶ τὰ ἄλλα
 ζῶα μετὰ τὸν τόκον. τίκτουσι δὲ τοῦ ἐνιαυτοῦ καὶ
 25 δεκάκις, ἤδη δέ τινες καὶ ἑνδεκάκις, αἱ δ' ἐν Αἰγύπτῳ
 καὶ δωδεκάκις. ὀχεύει δὲ καὶ ὀχεύεται ἢ περιστερὰ
 ἐντὸς ἐνιαυτοῦ· καὶ γὰρ ἔκμηνος ὀχεύει καὶ ὀχεύεται.
 τὰς δὲ φάττας καὶ τὰς τρυγόνας ἐνιοὶ φασι ὀχεύ-
 εσθαι καὶ γεννᾶν καὶ τρίμηνα ὄντα, σημεῖον ποιού-
 μενοι τὴν πολυπλήθειαν αὐτῶν. ἔγκυα δὲ γίγνεται
 30 δέκα καὶ τέτταρας ἡμέρας, καὶ ἐπιβάζει ἄλλας τος-
 αὔτας· ἐν ἑτέραις δὲ δέκα καὶ τέτταρσι πτεροῦνται
 563 a οὕτως ὥστε μὴ ῥαδίως καταλαμβάνεσθαι. [βιοὶ δὲ
 φάττα, ὡς φασί, καὶ τετταράκοντα ἔτη· καὶ αἱ πέρ-
 δικες δὲ πλείω ἢ ἔτη ἑκκαίδεκα. τίκτει δ' ἢ περι-
 στερὰ ἀπονεοττεύουσα πάλιν ἐν τριάκονθ' ἡμέραις.]²
 V 5 Ὁ δὲ γυψ νεοττεύει μὲν ἐπὶ πέτραις ἀπροσβάτοις·
 διὸ σπάνιον ἰδεῖν νεοττιὰν γυψὸς καὶ νεοττούς. καὶ
 διὰ τοῦτο καὶ Ἡρόδωρος ὁ Βρύσωνος τοῦ σοφιστοῦ
 πατὴρ φησιν εἶναι τοὺς γυψας ἀφ' ἑτέρας γῆς, ἀδή-
 λου³ ἡμῖν, τοῦτό τε λέγων τὸ σημεῖον, ὅτι οὐδεὶς
 10 εἴωρακε γυψὸς νεοττιὰν, καὶ ὅτι πολλοὶ ἐξαίφνης
 φαίνονται ἀκολουθοῦντες τοῖς στρατεύμασιν. τὸ δ'
 ἐστὶ χαλεπὸν μὲν ἰδεῖν, ὠπταὶ δ' ὅμως. τίκτουσι
 δὲ δύο ὄα οἱ γυψες.

Τὰ μὲν οὖν ἄλλα ὅσα σαρκοφάγα οὐκ ὠπταὶ πλεο-
 νάκις ἢ ἅπαξ τίκτοντα, ἢ δὲ χελιδῶν δις νεοττεύει
 μόνον τῶν σαρκοφάγων· τῶν δὲ νεοττῶν ἂν τις ἔτι

¹ sic Buss., Pi.: τινὰ χρόνον Dt.: γε loco δὲ A.-W., Dt.:
 χρόνον τινὰ τὸν αὐτὸν δὲ τρόπον (αὐτὸν χρόνον A) AC: χρόνον
 τὸν αὐτὸν tantum PD, vulg.

² totum secl. Dt., Th.: βιοὶ . . . ἑκκαίδεκα secl. A.-W.

³ ἀδήλους PD, Aldus.

chicks warm for a while in the same way that they
 did the eggs. The hen-bird is worse-tempered than
 the cock while rearing the young; the same applies
 to other animals after parturition. They lay as often
 as ten times a year; indeed, some have been known
 to lay eleven times, and in Egypt up to twelve.
 Pigeons of both sexes copulate within their first year;
 indeed, they do so at six months. Some people allege
 that ring-doves and turtle-doves copulate and repro-
 duce even at three months, citing as evidence their
 enormous numbers. The hen-birds are in lay for
 fourteen days, and incubate for another fourteen;
 in fourteen more the young are so sure on the wing
 that they cannot easily be caught up with. [The
 ring-dove, so it is said, lives as long as forty years;
 partridges over sixteen. The pigeon begins laying
 again for another brood in thirty days.]

The vulture builds on inaccessible rocky cliffs; V
 hence one seldom sees either its nest or its young. Vultures.
 And hence Herodorus,^a father of Bryson the sophist,
 says that vultures come from some other country
 unknown to us, citing as evidence that no one has ever
 seen a vulture's nest, and that vultures suddenly appear
 in large numbers in the wake of armies. It is certainly
 difficult to get a sight <of the nest>, but still it has
 been seen. Vultures lay two eggs.

Practically all carnivorous birds, so far as has been
 observed, do not lay more than once <a year>; the
 swallow is the only carnivorous bird that builds twice.

^a Herodorus of Heraclea Pontica (see *G.A.* 757 a 4), a
 colony of Megara, on the south shore of the Black Sea, about
 100 miles east of the Bosphorus. Herodorus (fl. c. 400 B.C.)
 wrote a *History of Heracles*, which seems to have contained
 a great variety of matter. Aristotle mentions him three times
 (here, 615 a 9, and *G.A. loc. cit.*) to disagree with him.

563 a

15 νέων ὄντων τῆς χελιδόνος τὰ ὄμματα ἐκκεντήσῃ,
γίγνονται ὑγίεις καὶ βλέπουσιν ὕστερον.¹

VI Ὁ δ' ἀετὸς ᾧ μὲν τίκτει τρία, ἐκλέπει δὲ τοῦτων
τὰ δύο, ὡς περ ἐστὶ καὶ ἐν τοῖς Μουσαίου λεγομένοις
ἔπεισιν,

ὅς τρία μὲν τίκτει, δύο δ' ἐκλέπει, ἐν δ' ἀλεγίζει.

20 ὡς μὲν οὖν τὰ πολλὰ οὕτω συμβαίνει, ἤδη δὲ καὶ
τρεῖς νεοττοὶ ὠμμένοι εἰσίν. ἐκβάλλει δ' αὐξανο-
μένων τὸν ἕτερον τῶν νεοττῶν ἀχθόμενος τῇ ἐδωδῇ.
ἄμα δὲ καὶ λέγεται ἐν τῷ χρόνῳ τῷ αὐτῷ² ἀπτήν
ὁ ἀετὸς³ γίνεσθαι, ὅπως μὴ ἀρπάξῃ τοὺς τῶν θηρίων
σκύμνους· οἱ γ' οὖν ὄνυχες αὐτοῦ διαστρέφονται

25 ὀλίγας ἡμέρας, καὶ τὰ πτερὰ λευκαίνεται, ὥστε καὶ
τοῖς τέκνοις τότε γίγνονται χαλεποί.⁴ τὸν δ' ἐκ-
βληθέντα δέχεται καὶ ἐκτρέφει ἡ φήνη. ἐπιμάζει δὲ
περὶ τριάκονθ' ἡμέρας. καὶ τῶν ἄλλων δὲ τοῖς με-
γάλοις ὁ χρόνος τοσοῦτός ἐστι τῆς ἐπιμάσεως, οἷον
χηνὶ καὶ ᾠτίδι· τοῖς δὲ μέσοις περὶ εἴκοσιν, οἷον
30 ἰκτίνῳ καὶ ἰέρακι. τίκτει δ' ὁ ἰκτίνος τὰ μὲν πλεί-

¹ haec ut alieno loco posita secl. A.-W.

² τῷ αὐτῷ A¹C: τοῦτω PDA², vulg.

³ ἀπτήν ὁ ἀετὸς scripsi (fort. ἀπτερος ὁ ἀ. malle): ἐπτάετος A: ἐπάετος C: ἀπατος PD, Sylb., vulg., edd.: ἀπάετος Junt., Camot. (ex Gul. extra genus aquilae fieri): ἀπασὸς Ald.: ἀπαγος (= ἀτυχῆς περὶ τὰς ἀγγας, Hesych.) mavult Sn.: tantum debilitatur Σ.

⁴ ἄμα δὲ . . . χαλεποί secl. A.-W., Dt. ut alieno loco posita.

^a See n. on 508 b 5, and cf. *G.A.* 774 b 31 ff.

^b Probably the lämmergeier; see 592 b 5, 619 a 12.

^c Aristotle's figures for incubation periods were quoted unaltered by all the main writers on ornithology from Pliny downwards to Aldrovandi (1599-1603), and again 170 years later by Buffon (1770-1786): see Margaret Morse Nice,

If you prick out the eyes of swallows while they are still young, the birds will heal and later on be able to see.^a

The eagle lays three eggs, and hatches out two of VI them, as we read in the poem ascribed to Musaeus: *Eagles, etc.*

Three it lays, two it hatches, one it cares for.

It is true that this is what most often occurs, though three chicks have actually been observed. The mother ejects one of the two chicks from the nest as they get bigger, because she finds feeding them too much trouble. It is also said that at the same time the eagle becomes "unwinged," so that it may not carry off the cubs of wild animals: thus its talons get distorted for a few days, and its feathers turn white: the result is that eagles then are bad-tempered towards their young. The chick that has been ejected is taken and brought up by the *phēnē*.^b The eagle sits on the eggs for about thirty days. The period of sitting is the same length for the other large birds, e.g., the goose and the bustard; for medium-sized birds, e.g., the kite and the hawk, it is about twenty days.^c The kite, in general, lays two eggs, but some-

"Incubation periods throughout the ages," in *Centaurus*, III (1953/4), pp. 311 ff. The errors with regard to the eagle and bustard have persisted well into the present century, and according to Nice, so far as the smaller hawks were concerned the errors had persisted in North America and in popular books in Germany up to the time of writing. The first period based on observation for any of the hawks (*viz.*, the peregrine falcon) was published in 1841 by W. Macgillivray, who quoted the observations of a gamekeeper, George Craven. The basic error has been that of taking the size of the bird (or of the egg) as the determining factor. The figures should be: for the eagle, forty-five days; for the bustard, twenty-five days; and for the hawks and kites, twenty-eight to thirty-five days. The figure given for the raven is correct.

563 a

στα δύο, ἐνίστε δὲ καὶ τρεῖς ἐξάγει νεοττούς· ὁ δ' αἰγώλιος¹ καλούμενος ἔστιν ὅτε καὶ τέτταρας. τίκτει

563 b

δὲ καὶ ὁ κόραξ οὐ μόνον δύο, ὡσπερ φασι τινες, ἀλλὰ καὶ πλείω· ἐπιάζει δὲ περὶ εἴκοσιν ἡμέρας καὶ ἐκβάλλει τοὺς νεοττούς ὁ κόραξ. ποιεῖ δὲ καὶ ἄλλα τῶν ὀρνέων τὸ αὐτὸ τοῦτο· πολλάκις γάρ, ὅσα πλείω τίκτει, ἓνα ἐκβάλλουσιν.

5 Οὐ πάντα δὲ τὰ τῶν αἰτῶν γένη ὅμοια περὶ τὰ τέκνα, ἀλλ' ὁ πύγαργος χαλεπός, οἱ δὲ μέλανες εὐτεκνοὶ περὶ τὴν τροφήν εἰσιν, ἐπεὶ πάντες γ' ὡς εἰπεῖν οἱ γαμφώνυχες, ὅταν² θάπτον οἱ νεοττοὶ δύνωνται³ πέτεσθαι, ἐκβάλλουσι τύπτοντες ἐκ τῆς νεοττίας. καὶ τῶν ἄλλων δέ, ὡσπερ εἴρηται, σχεδὸν

10 οἱ πλείστοι τοῦτο δρῶσι καὶ θρέψαντες οὐδεμίαν ἐπιμέλειαν ποιοῦνται τὸ λοιπόν, πλὴν κορώνης· αὐτῇ δ' ἐπὶ τινα χρόνον ἐπιμελεῖται· καὶ γὰρ ἤδη πετομένων σιτίζει παραπετομένη.

VII [Ὁ δὲ κόκκυξ λέγεται μὲν ὑπὸ τιῶν ὡς μετα-
15 βάλλει ἐξ ἰέρακος, διὰ τὸ ἀφανίζεσθαι τὸν ἰέρακα περὶ τοῦτον τὸν χρόνον. ὅμοιος δ' ἔστιν⁴ . . . σχεδὸν δὲ καὶ τοὺς ἄλλους ἰέρακας οὐκ ἔστιν ἰδεῖν, ὅταν θάπτον φθέγγηται⁵ ὁ κόκκυξ, πλὴν ὀλίγας ἡμέρας. ὁ δὲ κόκκυξ φαίνεται ἐπ' ὀλίγον χρόνον τοῦ θέρους, τὸν δὲ χειμῶνα ἀφανίζεται. ἔστι δ' ὁ μὲν ἰέραξ
20 γαμφώνυχος, ὁ δὲ κόκκυξ οὐ γαμφώνυχος. ἔτι δ' οὐδὲ τὰ περὶ τὴν κεφαλὴν ἔοικεν ἰέρακι, ἀλλ' ἄμφω

¹ αἰγώλιος Buss., Pi., Dt.: αἰγώλιος A.-W.: αἰγώλιος ACD vulg., edd. plerique: δὲ γώλιος P.

² ὅταν PD: ὅτι C: ὅτε A.

³ δύνωνται CPD: δύνανται A.

⁴ sic AC: ᾧ ὁμοίος ἔστιν· PD, vulg.; lacunam statuit Dt.:

times it brings up as many as three chicks. The *aigolios*^a as it is called sometimes brings up four. The raven, also, does not (as some allege) lay only two, but more; it sits on them for about twenty days and then ejects the chicks. Other birds too do the same: very often birds that lay several eggs eject one chick.

Not all kinds of eagles behave in the same way towards their young. The white-tail^b is fierce to them, but the black eagle treats them well in the matter of feeding, though practically all the crook-taloned birds beat their young and eject them from the nest as soon as they are able to fly; and, as already stated, most other birds do the same: after raising them they take no more interest in them afterwards—with the exception of the crow: this bird looks after her chicks for quite a while, and even after they can fly she flies alongside and feeds them.

[According to some people the cuckoo is a meta-
morphosed hawk: this is because the hawk disappears
around that time. It is similar . . .^c The other
Cuckoos. hawks, too, are hardly to be seen once the cuckoo has begun to call, except for a few days. The cuckoo appears for a short time in summer, and disappears in winter. But the hawk is a crook-taloned bird, whereas the cuckoo is not; nor does it resemble the hawk about the head. In both these respects it

^a Probably a kind of owl; see also 592 b 11 (where it is described as rapacious), and 616 b 25 (as nocturnal).

^b Cf. 618 b 19.

^c On the text of this paragraph see Additional Note, p. 375.—The transformation of the cuckoo into a hawk was discussed by Goethe and Eckermann (*Gespräch vom 8. Okt. 1827*).

ὅμοιος usque ad ἡμέρας om. Σ. vide et quae p. 375 scripta sunt. ^d ὅταν θ. φθέγγηται CPD: ὅτε θ. φθέγγεται A, vulg.

ταῦτα περισσότερῃ μᾶλλον· ἀλλ' ἢ κατὰ¹ τὸ χρῶμα μόνον προσέοικεν ἰέρακι, πλὴν τοῦ μὲν ἰέρακος τὰ ποικίλα οἷον γραμμαῖ εἰσι, τοῦ δὲ κόκκυγος οἷον στιγμαί. τὸ μέντοι μέγεθος καὶ ἡ πτῆσις παρα-
 25 πλησία τῷ ἐλαχίστῳ τῶν ἰεράκων, ὃς κατὰ τὸν χρόνον τοῦτον ἀφανής ἐστίν ὡς ἐπὶ τὸ πολὺ ὄν φαίνεται ὁ κόκκυξ, ἐπεὶ ἤδη γ' ὠμμένοι εἰσὶν ἄμφω. καὶ κατεσθιόμενος δ' ὠπταί κόκκυξ ὑπὸ ἰέρακος· καίτοι οὐδὲν ποιεῖ τοῦτο τῶν ὁμογενῶν ὀρνέων.]²

Νεοττοὺς δὲ κόκκυγος λέγουσιν ὡς οὐδεὶς ἑώρα-
 30 κεν· ὁ δὲ τίκτει μὲν, ἀλλ' οὐ ποιησάμενος νεοττιάν, ἀλλ' ἐνόστε μὲν ἐν τῇ τῶν ἐλαττόνων ὀρνίθων ἐν-τίκτει καταφαγὼν τὰ ψὰ τὰ ἐκείνων, μάλιστα δ' ἐν ταῖς τῶν φαβῶν νεοττιαῖς, καταφαγὼν καὶ τὰ τού-
 564 a τῶν ψά. τίκτει δ' ὀλιγάκις μὲν δύο, τὰ δὲ πλείεστα ἐν. ἐντίκτει δὲ καὶ τῇ τῆς ὑπολαΐδος νεοττιᾶ· ἡ δ' ἐκπέττει καὶ ἐκτρέφει. γίγνεται δὲ πίων καὶ ἡδύ-κρεως κατὰ τοῦτον τὸν καιρὸν μάλιστα. [γίγνονται
 5 δὲ καὶ τῶν ἰεράκων οἱ νεοττοὶ ἡδύκρεω σφόδρα καὶ πιονες. νεοττεύει δὲ γένος τι αὐτῶν πόρρω καὶ ἐν ἀποτόμοις πέτραις.]³

VIII Ἐπῳάζει δὲ τὰ πολλὰ τῶν ὀρνέων, ὥσπερ εἴρηται περὶ τῶν περισσότερων, διαδεχόμενα τὰ ἄρρενα τοῖς θήλεσι,⁴ τὰ δὲ τοσοῦτον χρόνον ὅσον ἀπολείπει τὸ
 10 θήλυ τροφήν αὐτῷ ποριζόμενον. τῶν δὲ χηνῶν αἰ θήλειαι ἐπῳάζουσι μόναι, καὶ διαμένουσι διὰ παντός ἐφεδρεύουσαι, ὅταν περ ἄρξωνται τοῦτο ποιεῖν. πρὸς

¹ τὰ αὐτὰ π. μᾶλλον ἢ ἰέρακι ἀλλὰ κατὰ AC.

² ab initio cap. hucusque secl. A.-W. ut alieno loco posita.

³ γίγνεται δὲ πίων . . . πιονες secl. A.-W., γίγνονται δὲ καὶ . . . πέτραις secl. Th. docente Dt.

⁴ hic verba τὰ μὲν μέρος τι τῆς ἡμέρας vel similia intercidisse monet Dt.

rather resembles the pigeon. It is only in colour that it resembles the hawk, and even here there is a difference: the hawk's markings are like stripes, while the cuckoo's are like dots. However, its size and its flight are comparable with the smallest of the hawks; and this is a bird which, generally speaking, disappears from view at the time the cuckoo appears, though both have been seen together. Also, a cuckoo has been observed being devoured by a hawk, whereas no birds of one and the same race do this.]

They say that no one has ever seen cuckoo-chicks. The bird lays eggs, but without previously building a nest. Sometimes it lays its eggs in the nest of smaller birds, after devouring these birds' eggs: it lays first and foremost in the nests of the wild pigeon, having first devoured this bird's eggs. It seldom lays two, most frequently one. It also lays in the nest of the *hypolaïs*,^a which brings the egg's concoction^b to completion and rears the chick. At this season particularly the bird becomes fat and tasty for the table. [The chicks of hawks also become especially tasty and fat. One sort of them builds in remote places and on precipitous rocky cliffs.]^c

I mentioned when speaking of pigeons that the VIII male and female take it in turns to sit on the eggs. Incubation habits. Most other birds do the same, but the males of some kinds sit only long enough to give the female time to get herself some food. As for geese, only the females sit on the eggs, and once they have begun they continue sitting right through until they hatch. The

^a Perhaps one of the warblers; see also 618 a 10: it makes its nest on the ground.

^b See Notes, §§ 19 f.

^c These two sentences appear to be out of place.

564 a

δὲ τόποις ἐλώδεσσι τε καὶ πόαν ἔχουσι πάντων τῶν λιμναίων ὀρνίθων αἱ νεοττιαὶ γίνονται· διόπερ καὶ ἡσυχίαν ἔχοντες ἐπὶ τῶν ὤων δύνανται τροφήν τινα¹
 15 αὐτοῖς πορίζεσθαι καὶ μὴ παντάπασιν ἄσιτοι εἶναι. ἐπιβάλλουσι δὲ καὶ τῶν κορωνῶν αἱ θήλειαι μόναι, καὶ διατελοῦσιν ἐπ' αὐτῶν οὐσαι διὰ παντός· τρέφουσι δ' αὐτὰς οἱ ἄρρενες κομίζοντες τὴν τροφήν αὐταῖς καὶ σιτίζοντες. τῶν δὲ φαβῶν ἡ μὲν θήλεια ἀπὸ δειλῆς ἀρξαμένη τὴν τε νύχθ' ὅλην ἐπιβάλλει καὶ
 20 ἔως ἀκρατίσματος ὥρας, ὁ δ' ἄρρην τὸ λοιπὸν τοῦ χρόνου. οἱ δὲ πέρδικες δύο ποιοῦνται τῶν ὤων σηκούς, καὶ ἐφ' ᾧ μὲν ἡ θήλεια ἐπὶ θατέρῳ δ'² ὁ ἄρρην ἐπιβάλλει, καὶ ἐκλέψας ἐκτρέφει³ ἑκάτερος ἑκάτερα· καὶ τοὺς νεοττοὺς ὅταν πρῶτον ἐξάγῃ, ὀχεύει αὐτούς.

IX 25 Ὁ δὲ ταῶς ζῆ μὲν περὶ πέντε καὶ εἴκοσιν ἔτη, γεννᾷ δὲ τριετῆς⁴ μάλιστα, ἐν οἷς καὶ τὴν ποικιλίαν τῶν πτερῶν ἀπολαμβάνει· ἐκλέπει δ' ἐν τριάκονθ' ἡμέραις ἢ μικρῶ πλείουσιν. ἀπαξ δὲ τοῦ ἔτους μόνον τίκτει· τίκτει δ' ὡς δώδεκα ἢ μικρῶ ἐλάττω· τίκτει δὲ διαλείπων δύο ἢ τρεῖς ἡμέρας καὶ οὐκ
 30 ἐφεξῆς· αἱ δὲ πρωτοτόκοι μάλιστα περὶ ὀκτῶ ὡς τίκτουσι δ' οἱ ταῶ καὶ⁵ ὑπηνέμια. ὀχεύονται δὲ περὶ τὸ ἔαρ· γίνονται δὲ καὶ ὁ τόκος εὐθέως μετὰ
 564 b τὴν ὀχείαν, πτερορρνυεῖ δ' ἅμα τοῖς πρώτοις τῶν δένδρων καὶ ἄρχεται αὐθις ἀπολαμβάνειν τὴν πτέρωσιν ἅμα τῇ τούτων βλασθήσει. ἀλεκτοριδί δ' ὑποτιθέασιν αὐτῶν τὰ ὡς ἐπιβάλλειν οἱ τρέφοντες διὰ τὸ τὸν ἄρρην τῆς θηλείας τοῦτο δρώσης ἐπιπετό-
 5 μνον συντρίβειν· διὰ ταύτην δὲ τὴν αἰτίαν καὶ τῶν

¹ τινα om. PD, vulg.

nests of all marsh-birds are built near swampy and grassy places, and as a result of this the birds can remain sitting quietly on the eggs and get some food for themselves and so not go without eating altogether. Among crows, too, the females only sit on the eggs, and remain on them from start to finish; the males fetch food for them and feed them. The female wild pigeon begins to sit in the afternoon and stays on the eggs all night until breakfast-time; the male sits for the remainder of the day. Partridges put their eggs into two compartments; the female sits on one and the male on the other; and when the chicks come off each rears its own. The male treads his chicks when he first takes them out of the nest.

Peafowl live about twenty-five years, and repro- IX
 Peafowl. duce at about three years; then too they assume their spangled plumage. Hatching occurs in thirty days or slightly more. The peahen lays only once a year, laying twelve eggs or slightly fewer. She does not lay them all straight off, but misses two or three days in between. A bird laying for the first time will normally lay only about eight. Peahens also lay wind-eggs. Peafowl pair in spring, and the eggs are laid immediately after copulation. They moult just as the first trees are shedding their leaves, and grow their new feathers when the trees break into leaf. Peafowl-breeders put their eggs under a domestic hen, because when the peahen is sitting the peacock flies at her and crushes them. For the same reason some wild birds

² θατέρω δὲ P: δὲ θατέρω A, vulg.: δὲ θατέρω δ' C: θατέρου δὲ D.³ ἐκτρέφει C (teste Cs., sed silet Bk.), Sn., Buss., Pi., Dt.: ἐκπέμπει vulg.⁴ τριετῆς D: τριετῆς ACP, vulg.⁵ ταῶ καὶ Pi., A.-W., Dt.: καὶ om. AC, vulg.: ταῶ τὰ ὡς καὶ τὰ PD: δὲ καὶ οἱ ταῶ Sn., Buss.

ἀγρίων ἔνιοι ὀρνίθων ἀποδιδράσκοντες τοὺς ἄρρενας
τίκτουσι καὶ ἐπιάζουσιν. ὑποτίθεται δὲ τῇ ὀρνιθί¹
μάλιστα δύο ὡά· τοσαῦτα γὰρ μόνα δύναται² ἐπιά-
ζουσα³ ἐξάγειν. ἐπιμελοῦνται δ' ὅπως μὴ καταβαί-
νουσα διαλίπη τὸν ἐπώασμόν, παρατιθέντες τροφήν.

10 Οἱ δ' ὀρνίθες περὶ τὴν ὀχείαν τοὺς ὄρχεις μείζους
ἴσχουσιν [ἐπιδήλως],⁴ οἱ μὲν μᾶλλον ὀχεντικοὶ καὶ
ἀεὶ μᾶλλον⁵ ἐπιδήλως,⁶ ὅλον ἀλεκτρούνες καὶ πέρ-
δικες, οἱ δὲ μὴ συνεχῶς, ἦττον.

Περὶ μὲν οὖν τῆς τῶν ὀρνίθων κνήσεως καὶ γενέ-
X σεως τοῦτον ἔχει τὸν τρόπον. οἱ δ' ἰχθύες ὅτι μὲν
15 οὐ πάντες ὤστοκοῦσιν, εἴρηται πρότερον. τὰ μὲν
γὰρ σελάχη ζωστοκεῖ, τὸ δὲ τῶν ἄλλων γένος ἰχθύων
ὤστοκεῖ. ζωστοκεῖ δὲ τὰ σελάχη πρότερον ὤστο-
κήσαντα ἐν αὐτοῖς, καὶ ἐκτρέφουσιν ἐν αὐτοῖς, πλήν
βατράχου.

Ἐχουσι δὲ καὶ τὰς ὑστέρας, ὥσπερ ἐν τοῖς ἄνω
ἐλέχθη, διαφόρους οἱ ἰχθύες· τὰ μὲν γὰρ ὤστοκοῦντα
20 δικρούας ἔχει καὶ κάτω, τὰ δὲ σελάχη ὀρνιθωδε-
στέρας. διαφέρει δὲ τῆς τῶν ὀρνίθων ὑστέρας, ὅτι
οὐ πρὸς τῷ ὑποζώματι ἐνίοις συνίσταται τὰ ὡά,
ἀλλὰ μεταξὺ κατὰ τὴν ράχιν, ἐκείθεν δ' αὐξανόμενα
μεταβαίνει.

Τὸ δ' ὡὸν γίγνεται πάντων τῶν ἰχθύων οὐ δίχρων
ἀλλὰ μονόχρων, λευκότερον δ' ἢ ὠχρότερον, καὶ
25 πρότερον καὶ ὅταν ἐνῆ ὁ νεοττός.

¹ τῇ ὀρνιθί Dt.: τοῖς ὀρνοι codd.: ταῖς ὀρν. Sn., Pi., A.-W.

² δύναται CP, vulg.: δύναται AD: post δύν. add. καὶ AC.

³ ἐπιάζουσα C, vulg.: ἐπιάζουσαι AD.

⁴ secl. Sn., Dt., non secl. vulg., Buss., A.-W.

⁵ loco καὶ ἀεὶ μᾶλλον habet καὶ ἀεὶ C, καὶ αἱ δὲ A¹: ἀεὶ om. vulg.

⁶ ἐπιδήλως A¹. locum ut supra (nisi ἔχουσιν (PD) loco ἴσχουσιν) exhibet Sn., idem vulg. ἀεὶ omisso, edd. alii alia:

run away from the males to lay and incubate their eggs. Only two eggs are put under the hen: that is as many as she can incubate and bring off. They take great care to prevent her coming off the eggs and abandoning the incubation, by placing food beside her.

The testicles of male birds are [noticeably] larger at the season of pairing; in those birds which are more prone to pairing and do so at all times, they are more noticeably so—instances are the domestic cock and the partridge; in birds which pair intermittently this is not so noticeable.^a

I have now described the manner of conception and generation of birds. Next, fishes. I have already X said that not all fishes are oviparous. Thus, the (d) Marine animals: Selachia are viviparous; the remaining class of fishes: Fishes. is oviparous. The Selachia are viviparous, but at an earlier stage are oviparous: they rear the young internally. (The fishing-frog is an exception.)

Fish have a uterus,^b as was stated above; and this exhibits differences of formation. The oviparous fishes have a bifurcated uterus, and it is low down; that of the Selachia rather resembles a bird's, but differs from a bird's in this respect: in some Selachia the eggs are constituted^c not near the *hyozoma* but in between along the backbone; and as they grow they move away from that position.

All fishes' eggs <internally> are of one colour only, not two; and they are white rather than yellow, both at their early stage and also when the young is inside.

^a Cf. 510 a 2.

^b It should be noted that for Aristotle this term includes what are now known as oviducts. ^c See Notes, § 27.

οἱ μὲν μᾶλλον ὀχ. καὶ ἀεὶ ἐπιδήλως Buss.; ἴσχουσιν· ἐπὶ τέλους δὲ οἱ μὲν μᾶλλον ὀχ., καὶ ἀεὶ ἐπιδήλως Pi.

Διαφέρει δ' ἡ γένεσις ἢ ἐκ τοῦ ὤου τοῦ τῶν ἰχθύων καὶ τῶν ὀρνίθων, ἢ οὐκ ἔχει τὸν ἕτερον ὀμφαλὸν <τὸν>¹ τείνοντα πρὸς τὸν ὑμένα τὸν ὑπὸ τὸ ὄστρακον· τὸν δ' εἰς τὸ ὠχρὸν τοῖς ὀρμισι τείνοντα πόρον, τοῦτον ἔχει τοῖν δυοῖν μόνον. ἢ δ' ἄλλη
 30 γένεσις ἤδη πᾶσα ἢ αὐτῇ ἢ ἐκ τοῦ ὤου τῶν τ' ὀρνίθων καὶ τῶν ἰχθύων· ἐπ' ἄκρῳ τε γὰρ τούτου γίνεταί, καὶ αἱ φλέβες ὁμοίως τείνουσιν ἐκ τῆς καρδίας πρῶτον, καὶ ἡ κεφαλὴ καὶ τὰ ὄμματα καὶ
 565 α τὰ ἄνω μέγιστα γίνεταί τὸ πρῶτον· ὁμοίως δ' αὐξανομένου ἀεὶ² ἔλαττον γίνεταί τὸ ὦν, καὶ τέλος ἀφανίζεται καὶ εἰσδύεται ἔσω, καθάπερ καὶ³ τοῖς ὀρμισιν ὁ νεοττός καλούμενος.

Προσπέφυκε δὲ καὶ ὁ ὀμφαλὸς μικρὸν κατώτερον τοῦ στόματος⁴ <ἐπὶ>⁵ τῆς γαστροῦ. ἔστι δὲ νέοις
 5 μὲν οὖσιν ὁ ὀμφαλὸς μακρὸς, αὐξανομένοις δ' ἐλάττων, καὶ τέλος μικρὸς, ἕως ἂν εἰσέλθῃ, καθάπερ ἐλέχθη ἐπὶ τῶν ὀρνίθων. περιέχεται δὲ τὸ ἔμβρυον καὶ τὸ ὦν ὑμένι κοινῶ· ὑπὸ δὲ τοῦτον ἄλλος ἐστὶν ὑμῆν, ὃς περιέχει ἰδίᾳ τὸ ἔμβρυον· μεταξὺ δὲ τῶν
 10 ὑμένων ἔνεστιν ὑγρότης. καὶ ἡ τροφή δ' ὁμοία γίνεταί τοῖς ἰχθυοῖς ἐν τῇ κοιλίᾳ ὡςπερ τοῖς τῶν ὀρνίθων νεοττοῖς, ἢ μὲν λευκῇ ἢ δ' ὠχρᾷ.

Τὸ μὲν οὖν σχῆμα τῆς ὑστέρας ὡς ἔχει, ἐκ τῶν ἀνατομῶν θεωρεῖσθω· διαφορὰ δ' ἐστὶν αὐτοῖς πρὸς αὐτοὺς, οἷον τοῖς γαλεώδεσι καὶ πρὸς αὐτοὺς καὶ

¹ τὸν suppl. Sn., coll. G.A. 754 b 5, probant Buss., Pl., Dt., Th.

The process of generation out of fishes' eggs differs from that out of birds' eggs : the former do not have that one of the two umbilical cords which extends to the membrane under the shell, though they do have the passage which in birds' eggs extends to the yolk.^a The whole of the rest of the process of development is identical in birds' eggs and in fishes' : it takes place at the tip of the egg, and the blood-vessels extend in a similar way from the heart to begin with, and at first the head and eyes and the upper parts are the largest. In a similar way, too, as the embryo grows the egg continually diminishes, and finally disappears and goes inside it, just as the so-called *neottos* (yolk) does in birds' eggs.

The umbilical cord is attached a short distance below the mouth, to the belly. While the embryos are still quite young, the umbilical cord is long, but as they grow it shortens, and finally it is quite small, until it goes inside, as we described above when dealing with birds. The embryo and the egg are surrounded by one common membrane ; beneath this is another membrane, which surrounds the embryo just by itself ; between the two membranes there is fluid. Nourishment is present inside the small fishes' stomachs similar to that in the stomachs of chicks ; some of it is white and some yellow.

For the conformation of the uterus, the *Dissections* should be consulted. Fishes, however, differ from one another ; thus, the dogfishes differ among themselves,

^a Cf. G.A. 754 b 5.

² sic A, A.-W., Dt. : μεγ. ὁμοίως τὸ πρῶτον· αὐξαν. δ' εἰ vulg. : μεγ. ὁμοίως πρῶτον PD : αὐξ. δὲ CPD.

³ καὶ ACP : ἐν D, vulg.

⁴ σώματος AC.

⁵ ἐπὶ suppl. Dt. : τῇ γαστρὶ propos. Karsch, A.-W.

15 πρὸς τὰ πλατέα. ἐνίοις μὲν γὰρ ἐν τῷ μέσῳ τῆς ὑστέρας περὶ τὴν ράχιν προσπέφυκε τὰ ῥά, ὥσπερ εἴρηται, ὅσον τοῖς σκυλίοις· αὐξανόμενα δὲ περιέρχεται. οὐσῆς δὲ δικρόας τῆς ὑστέρας καὶ προσπεφυκυίας πρὸς τῷ ὑποζώματι, ὥσπερ καὶ τῶν ἄλλων τῶν τοιούτων, περιέρχεται εἰς ἑκάτερον τὸ
20 μέρος. ἔχει δ' ἡ ὑστέρα καὶ αὐτὴ καὶ ἡ τῶν ἄλλων τῶν γαλεοειδῶν μικρὸν προελθόντι ἀπὸ τοῦ ὑποζώματος ὅσον μαστοὺς λευκοὺς, οἱ κυημάτων μὴ ἐνότων οὐκ ἐγγίγγονται.

Τὰ μὲν σκύλια καὶ αἱ βατίδες ἴσχυοσι τὰ ὄστρακώδη, ἐν οἷς ἐγγίγνεται ῥώδης ὑγρότης· τὸ δὲ σχῆμα τοῦ ὄστράκου ὅμοιον ταῖς τῶν αὐλῶν γλώτταις, καὶ
25 πόροι τριχῶδεις προσγίγγονται¹ τοῖς ὄστράκοις. τοῖς μὲν οὖν σκυλίοις, οὓς καλοῦσί τινας νεβρίας γαλεοῦς, ὅταν περιρραγῇ καὶ ἐκπέσῃ τὸ ὄστρακον, γίνονται οἱ νεοττοί· ταῖς δὲ βατίσιν, ὅταν ἐκτέκωσι, τοῦ ὄστράκου περιρραγέντος, ἐξέρχεται ὁ νεοττός. ὁ δ' ἀκανθίας γαλεός πρὸς τῷ ὑποζώματι ἔχει τὰ ῥά
30 ἄνωθεν τῶν μαστῶν· ὅταν δὲ καταβῇ τὸ ῥόν, ἐπὶ τούτῳ ἀπολελυμένῳ γίγνεται ὁ νεοττός. τὸν αὐτὸν
565 b δὲ τρόπον συμβαίνει ἡ γένεσις καὶ ἐπὶ τῶν ἀλωπέκων.

Οἱ δὲ καλούμενοι λείοι τῶν γαλεῶν τὰ μὲν ῥά ἴσχυοσι μεταξύ τῶν ὑστερῶν ὁμοίως τοῖς σκυλίοις, περιμόντα² δὲ ταῦτα εἰς ἑκατέραν τὴν δικρόαν τῆς ὑστέρας³ καταβαίνει, καὶ τὰ ζῶα γίγνεται τὸν ὁμ-

¹ προσγίγ. C : προσεγγίγ. A : ἐγγίγ. PD, vulg.

² περιμόντα Buss. : περιμόντα AC : περιμόντα PD, vulg.

³ τῆς ὑστέρας secl. Dt.

^a The contrast is between the dogfishes, which are elong-

and also as compared with the broad ones^a: in some *Selachia*, dogfish the eggs adhere in the middle of the uterus round the backbone, as has been stated, e.g., in the "puppy"^b; and as they grow they move around. Since the uterus is bifurcated, and is attached to the *hypozoma* as in other such animals, they move along into one or the other of its compartments. The uterus in this fish, and in the other dogfishes, contains, a little way on from the *hypozoma*, objects like white breasts: these do not appear if there are no fetations in the uterus.

The "puppy" and the ray have objects like eggshells, in which an egg-like fluid appears. The shape of this shell is similar to the tongues^c of a bagpipe, and there are hair-like passages attached to the shell. In the case of the "puppy," which some call the dappled dogfish, the young are produced when the shell breaks open and falls out; in the case of the ray, when it has laid the egg and the shell has broken open, then the young emerge. The spiny dogfish has its eggs up against the *hypozoma*, above the "breasts,"^d and when the egg comes down, as this becomes detached, the young is produced. Generation takes place in the same way in the fox-sharks as well.

The so-called smooth dogfish have their eggs between (the parts of) the uterus, in a similar way to the "puppy," and they move along into each of the two "horns"^e of the uterus: the young are produced

ated, and the "broad" ones such as the torpedo-fish and the ray; cf. 505 a 3 ff., and 566 a 31.

^b *Scyllium canicoula* or *So. stellare*.

^c The split reed of the bagpipe (Thompson).

^d Johannes Müller's explanation of this is given by Th., *G.G.F.*, p. 6.

^e Cf. 510 b 19.

5 φαλὸν ἔχοντα πρὸς τῇ ὑστέρα, ὥστε ἀναλίσκομένων
 τῶν ὠῶν ὁμοίως δοκεῖν ἔχειν τὸ ἔμβρυον τοῖς τετρά-
 ποσιν. προσπέφυκε δὲ μακρὸς ὦν ὁ ὀμφαλὸς τῆς
 μὲν ὑστέρας πρὸς τῷ κάτω μέρει, ὥσπερ ἐκ κοτυ-
 ληδόνης ἕκαστος ἠρτημένος, τοῦ δ' ἔμβρύου κατὰ
 τὸ μέσον, ἢ τὸ ἦπαρ. ἢ δὲ τροφή ἀνατεμνομένου,
 10 κἂν μηκέτ' ἔχη τὸ ὠόν, ὠώδης. χόριον δὲ καὶ
 ὑμένες ἴδιοι περὶ ἕκαστον γίνονται τῶν ἐμβρύων,
 καθάπερ ἐπὶ τῶν τετραπόδων. ἔχει δὲ τὰ ἔμβρυα
 τὴν κεφαλὴν νέα μὲν ὄντα ἄνω, ἀδρυνόμενα δὲ καὶ
 τέλεα ὄντα κάτω. ἐγγίγνεται δὲ καὶ ἐν τῇ ἀριστερᾷ
 ἄρρενα καὶ ἐν τῇ δεξιᾷ θήλεα, καὶ ἐν τῇ αὐτῇ ἅμα
 15 θήλεα καὶ ἄρρενα. καὶ τὰ ἔμβρυα διαιρούμενα,
 ὁμοίως ὥσπερ ἐπὶ τῶν τετραπόδων, ἔχει τῶν σπλάγ-
 χνων ὅσα ἔχει μεγάλα, οἷον τὸ ἦπαρ, καὶ αἱματώδη.

Πάντα δὲ τὰ σελαχώδη ἅμα ἔχουσιν ἄνω μὲν πρὸς
 τῷ ὑποζώματι ὠά, τὰ μὲν μείζω τὰ δ' ἐλάττω,
 20 πολλά,¹ κάτω δ' ἔμβρυα ἤδη.² διὸ πολλοὶ κατὰ μῆνα
 τίκτειν καὶ ὀχεύεσθαι οἰοῦνται τοὺς τοιοῦτους τῶν
 ἰχθύων, ὅτι οὐχ ἅμα πάντα προΐενται, ἀλλὰ πολλάκις

¹ πολλά del. A.-W.

² διὸ usque ad 567 b 26 πάλιν om. A.

^a This is the famous description of the placentoid structure in the embryo of the *Mustelus laevis*. The structure is similar both in form and function to the placenta of a mammal, although its origin is not the same. The observation was not again described until modern times, by Nicolaus Steno (1638-1686), in his book *Ova viviparorum spectantes observationes*, 1675, and the facts were not widely known until the work of Johannes Müller in the 19th century (*Über den glatten Hai des Aristoteles*, Berlin, 1842; paper read April 1839 and 260

with the umbilical cord attached to the uterus, so that as the substance of the egg gets used up the embryo's condition appears to be similar to what is found in quadrupeds.^a The umbilical cord, which is long, is attached to the lower part of the uterus: each one is, as it were, fastened to a cotyledon, and is attached to the embryo by the middle, where the liver is situated. If you cut the embryo open, even if it no longer contains the egg, the nourishment in it is egg-like in substance.^b Each embryo has a chorion and membranes of its own round it, just as in quadrupeds. While in their early stages, the embryos have their head upwards, but as they mature and reach perfection it is downwards. Males are produced in the left-hand side and females in the right, and males and females together in the same side. If the embryos are cut open, an exactly similar situation is disclosed as in quadrupeds: what internal organs they have are large (e.g., the liver) and are supplied with blood.

All Selachia have, at one and the same time, in their upper part near the *hypozoma*, eggs, many of them, some large, some small; and lower down, embryos already formed: hence, many people suppose that fish of this kind reproduce and pair every month, because they do not bring forth all their young at once, but in batches over a considerable length of

August 1840). An account of the discovery, with Müller's letters, is given by W. Haberling, in *Archiv für Geschichte der Mathem., der Naturw. und der Technik*, X (1927), pp. 166-184. Bernhard Peyer, in *Gesnerus*, III (1946), pp. 58-71, in the course of his sketch of Aristotle's biological works, reproduces the diagram from Steno's book (re-edited) and also Müller's drawing. Cf. *G.A.* 754 b 27 ff.

^b According to Johannes Müller (*vide Th.*, *G.G.F.* p. 12), this applies to *Acanthias* and *Alopes* (the spiny dogfish and the fox-shark), i.e., the viviparous but acotyledonous dogfish.

καὶ πολλὸν χρόνον. τὰ δὲ κάτω ἐν τῇ ὑστέρα ἅμα πέττεται καὶ τελεσιουργεῖται.

Οἱ μὲν οὖν ἄλλοι γαλεοὶ καὶ ἑξαφιαῖσι καὶ δέχονται
 25 εἰς ἑαυτοὺς τοὺς νεοττοὺς, καὶ αἱ ῥῖναι καὶ αἱ νάρκαι
 (ἤδη δ' ὠφθη νάρκη μεγάλη περὶ ὀγδοήκοντα ἔχουσα
 ἐν ἑαυτῇ ἔμβρυα), ὁ δ' ἀκανθίας οὐκ εἰσδέχεται
 μόνος τῶν γαλεῶν διὰ τὴν ἀκανθαν. τῶν δὲ πλα-
 τέων τρυγῶν καὶ βάτος οὐ δέχονται διὰ τὴν τραχύ-
 τητα τῆς κέρκου. οὐκ εἰσδέχεται δ' οὐδὲ βάτραχος
 30 τοὺς νεοττοὺς διὰ τὸ μέγεθος τῆς κεφαλῆς καὶ τὰς
 ἀκάνθας· οὐδὲ γὰρ ζωτοκεῖ μόνος τούτων, ὥσπερ
 εἴρηται πρότερον.

566 a Αἱ μὲν οὖν πρὸς ἄλληλα διαφοραὶ τοῦτον ἔχουσι
 τὸν τρόπον αὐτῶν, καὶ ἡ γένεσις ἢ ἐκ τῶν ὤων.

XI Οἱ δ' ἄρρενες περὶ τὸν χρόνον τῆς ὀχείας τοὺς
 πόρους ἔχουσι θοροῦ πλήρεις οὕτως ὥστε θλιβομένων
 ἔξω ρεῖν τὸ σπέρμα λευκόν. εἰσι δ' οἱ πόροι δίκροισι,
 5 ἀπὸ τοῦ ὑποζώματος καὶ τῆς μεγάλης φλεβὸς ἔχον-
 τες τὴν ἀρχήν. περὶ μὲν οὖν τὸν χρόνον τοῦτον ἤδη
 διάδηλοι [πρὸς τὴν τῶν θηλειῶν ὑστέραν]¹ εἰσὶν οἱ
 πόροι τῶν ἀρρένων, ὅταν δὲ μὴ αὐτῆ² ἢ ὠρα (<ῆ>),³
 ἦττον διάδηλοι τῶ μὴ συνήθει· πάμπαν γὰρ ἐν ἐνίοις
 καὶ ἐνίοτε ἀδηλοὶ γίνονται, ὥσπερ ἐλέχθη περὶ τῶν
 10 ὄρχεων ἐν τοῖς ὄρνεσι.

Ἐχουσι δὲ διαφορὰς καὶ ἄλλας [μὲν]⁴ πρὸς ἄλληλα
 οἱ τε θορικοὶ πόροι καὶ οἱ ὑστερικοί, καὶ ὅτι οἱ μὲν
 προσπεφύκασι τῇ ὀσφύϊ, οἱ δὲ τῶν θηλειῶν πόροι
 εὐκίνητοι εἰσι καὶ λεπτῶ ὑμένι προσειλημμένοι.

¹ secl. Th., om. Gaza: *et vie magne et matrices in isto tempore sunt manifeste. et similiter vie masculorum Σ.*

² αὐτῆ Sylb., Sn.: αὐτῆ codd., vulg.

³ <ῆ> suppl. Dt., sed in textu μὴ παρῆ ἢ ὠρα: ὅταν παρέλθῃ αὐτῆ ἢ ὠρα propros. Sn., ὅταν δὲ παρέλθῃ ἢ ὠρα propros. A.-W.

time. However, those which are down below in the uterus are concocted^a and brought to completion simultaneously.

With one exception dogfish can both release and take in again their young: the angel-fish and the torpedo-fish can do it (a large torpedo-fish has been recorded with about eighty embryos inside it): the exception is the spiny dogfish; this is the only dogfish which cannot take them in, and this is because of the spine. Of the broad Selachia, the sting-ray and the *batos* (ray) cannot take them in owing to the roughness of their tails. Nor can the fishing-frog do it, owing to the size of their heads, and their spines; furthermore, it is the only one of the Selachia which is not viviparous, as has been already stated.

Such then are the differences between the various Selachia, and such their generation from the egg.

At the time of pairing the males have their passages XI so full of milt that when they are squeezed the semen flows out as a white fluid. The passages are bifurcated, and have their origin at the *hypozoma* and the great blood-vessel. About this time the passages of the male are quite evident [compared with the uterus of the females]; but otherwise than at this season they are not so evident to anyone who is unfamiliar with them. Actually at certain times in certain fishes these passages cannot be made out at all: compare what was said about the testicles of birds.^b

There are other differences between the spermatie passages and those of the uterus. Thus, the former are attached to the loin, whereas the passages in the female are mobile and attached merely by a thin

^a See Notes, §§ 19 f.

^b Cf. 510 a 2 ff., 564 b 10 ff.

⁴ μὲν om. Ald., Cs., Sn., secl. Dt.

θεωρείσθωσαν δὲ καὶ οἱ τῶν ἀρρένων πόροι, ὡς
15 ἔχουσιν, ἐκ τῶν ἐν ταῖς ἀνατομαῖς διαγεγραμμένων.

Ἐπικυύσεται δὲ τὰ σελάχη, καὶ κύει τοὺς πλεί-
στους μῆνας ἕξ. πλειστάκις δ' ἀποτίκτει ὁ καλού-
μενος τῶν γαλεῶν ἀστερίας· ἀποτίκτει γὰρ δις τοῦ
μηνός. ἄρχονται δ' ὀχεύεσθαι μηνός Μαιμακτη-
ριῶνος. οἱ δ' ἄλλοι γαλεοὶ δις τίκτουσι, πλὴν τοῦ
20 σκυλίου· οὗτος δ' ἅπαξ τοῦ ἐνιαυτοῦ. τίκτουσι δὲ
τὰ μὲν τοῦ ἔαρος αὐτῶν, ῥίνη δὲ καὶ τοῦ μετοπάρου
πρὸς δύσιν Πλειάδος χειμερινὴν τὸ ὕστερον, τὸ δὲ
πρῶτον τοῦ ἔαρος· εὐθενεῖ¹ δ' αὐτῆς μᾶλλον² ὁ γόνος
ὁ ὕστερος· αἱ δὲ νάρκαι περὶ τὸ φθινόπωρον.

Ἐκτίκτει δὲ τὰ σελάχη πρὸς τὴν γῆν ἐκ τοῦ
25 πελάγους καὶ τῶν βαθέων ἐπανιόντα διὰ τε τὴν
ἀλέαν καὶ διὰ τὸ φοβεῖσθαι περὶ τῶν τέκνων.

Τῶν μὲν οὖν ἄλλων ἰχθύων παρὰ τὰς συγγενείας
οὐδὲν ὥπται συνδυαζόμενον, ῥίνη δὲ δοκεῖ μόνη
τοῦτο ποιεῖν καὶ βάτος· ἔστι γὰρ τις ἰχθύς ὃς καλεῖ-
ται ῥινόβατος· ἔχει γὰρ τὴν μὲν κεφαλὴν καὶ τὰ
30 ἔμπροσθεν βάτου, τὰ δ' ὀπισθεν ῥίνης, ὡς γιγνόμενος
ἕξ ἀμφοτέρων τούτων.

Οἱ μὲν οὖν γαλεοὶ καὶ οἱ γαλεοειδεῖς, οἷον ἀλώπηξ
καὶ κύων, καὶ οἱ πλατεῖς ἰχθύες, νάρκη καὶ βάτος
566 b καὶ λειόβατος καὶ τρυγῶν, τὸν εἰρημένον τρόπον
ζωοτοκοῦσιν ὡσοκῆσαντες.

XII Δελφίς δὲ καὶ φάλαινα καὶ τὰ ἄλλα κήτη, ὅσα μὴ

¹ εὐθηνεῖ vulg.: ἀσθενεῖ C.

² μᾶλλον Sn. ex Gul.: μάλιστα μὲν codd., vulg.

^a See Appendix B, p. 409.

^b Early in November; see Appendix A, p. 399. See also n.
on 543 a 15.

membrane. For the arrangement of the passages in
the male, the diagrams in the *Dissections* should be
consulted.

Superfetation occurs in the Selachia; and the
period of gestation is six months at the most. The
so-called starry dogfish is the one that breeds most
frequently—twice a month; they begin to copulate
in the month of Maimakterion.^a The other dog-
fishes breed twice, with the exception of the “puppy,”
which breeds once a year. Some of them breed in
spring; the angel-fish also breeds in late autumn
towards the time of the winter setting of the Pleiad^b
—this is its second breeding; the first is in spring.
Its second brood thrives better than the first. Tor-
pedo-fish breed in the late autumn.

The Selachia come in from the high seas and out
of deep water towards land and produce their young
there; this is for the sake of the warmth and because
they are concerned for the safety of their young.

No instance has been observed of fishes uniting
outside their own kind except for the angel-fish (*rhinē*)
only, which appears to mate with the *batos*, for there
is a fish known as the *rhinobatos*,^c which has the head
and foreparts of a *batos*, and the rear parts of a *rhinē*,
as though it were composed of these two fishes.

Dogfish then and their allied kinds, such as the
fox-shark and the hound, and the broad fishes such as
the torpedo-fish and the *batos* and the smooth *batos*
and the sting-ray, reproduce as I have described:
i.e., they are oviparous at the first stage and then
viviparous.

The dolphin, the whale, and the other Cetacea, as XII

^c Identified by Thompson with the modern genus of that
name (*Rhinobatus*); cf. *G.A.* 746 b 5 ff.

ἔχει βράγχια ἀλλὰ φυσητήρα, ζωτοκοῦσιν, ἔτι δὲ
 5 πρίστis καὶ βοῦs¹. οὐδὲν γὰρ τούτων φαίνεται ἔχον
 ῥά, ἀλλ' εὐθέως κῆμα, ἐξ οὗ διαρθρουμένου γίννε-
 ται τὸ ζῶον, καθάπερ ἄνθρωπος καὶ τῶν τετραπόδων
 τὰ ζωτόκα. τίκτει δ' ὁ μὲν δελφίς τὰ μὲν πολλὰ
 ἔν, ἐνίοτε δὲ καὶ δύο· ἡ δὲ φάλαινα ἢ δύο τὰ πλεῖστα
 καὶ πλεονάκις, ἢ ἔν. ὁμοίως δὲ τῷ δελφῖνι καὶ
 10 γίννεται δ' ἐν τῷ Πόντῳ. διαφέρει δὲ φάλαινα
 δελφίνος· ἔστι γὰρ τὸ μέγεθος ἑλαττον, εὐρύτερον
 δ' ἐκ τοῦ νώτου· τὸ χρῶμα ἔχει κυανοῦν. πολλοὶ δὲ
 δελφίνων τι γένος εἶναι φασι τὴν φάλαιναν.

² Ἀναπνεῖ δὲ πάντα ὅσα ἔχει φυσητήρα, καὶ δέ-
 χεται τὸν ἀέρα· πνεύμονα γὰρ ἔχουσιν. καὶ ὁ γε
 15 δελφίς ὠπται, ὅταν καθεύδῃ, ὑπερέχων τὸ ῥύγχος,
 καὶ ῥέγγει καθεύδων.³ ἔχει δ' ὁ δελφίς καὶ ἡ φά-
 λαινα γάλα, καὶ θηλάζονται· καὶ εἰσδέχονται τὰ
 τέκνα μικρὰ ὄντα. τὴν δ' αὐξῆσιν τὰ τέκνα τῶν
 δελφίνων ποιοῦνται ταχεῖαν· ἐν ἔτεσι γὰρ δέκα⁴ μέ-
 γεθος λαμβάνουσι τέλειον. κύει δὲ δέκα μῆνας.
 20 τίκτει δ' ὁ δελφίς ἐν τῷ θέρει, ἐν ἄλλῃ δ' ὥρα
 οὐδεμιᾷ· συμβαίνει δὲ καὶ ἀφανίζεσθαι αὐτὸν ὑπὸ
 κύνα περι τριάκονθ' ἡμέρας.⁵ παρακολουθεῖ δὲ τὰ
 τέκνα πολὺν χρόνον, καὶ ἔστι τὸ ζῶον φιλότεκνον.
 ζῆ δ' ἔτη πολλά· δῆλοι γὰρ ἔνιοι γεγόνασι βιοῦντες
 οἱ μὲν πλείω ἔτη ἢ⁵ πέντε καὶ εἴκοσιν, οἱ δὲ τριά-

¹ ἔτι δὲ πρίστis καὶ βοῦs post ζωτοκῆσαντες ad fin. cap. praeced. ponenda censet Dt.

² ἀναπνεῖ . . . καθεύδων ut ex 537 a 31 sqq. desumpta secl. A.-W. ³ δ' (= τέτταρα) suspic. A.-W.

⁴ συμβαίνει . . . ἡμέρας secl. Th.

⁵ πλείω ἔτη ἢ C, om. vulg.: ἔτη post εἴκοσιν PD, vulg.

^a *Pristis*, lit., sawyer. Sometimes spelt *πρήστis* (= spou-

many as have no gills but a blowhole instead, are vivi- Cetacea.
 parous; so too are the *pristis*^a and the ox-fish. None
 of these is to be seen carrying eggs; they omit this
 stage, and begin with the actual fctation, which be-
 comes articulated and gives rise to the young animal,
 exactly as occurs with the human species and the
 viviparous quadrupeds. For the most part, the dol-
 phin produces one offspring, occasionally two; the
 whale either two (not more, generally two), or one.
 The porpoise does as the dolphin. It resembles a
 small dolphin, and occurs in the Black Sea, though it
 differs from the dolphin by being smaller in size and
 broader across the back; it is bluish-grey in colour.
 Many people believe that the porpoise is a kind of
 dolphin.^b

All animals which have a blowhole breathe in and
 out, as they possess lungs. A dolphin has been ob-
 served, while asleep, with its snout above water,
 and snoring in its sleep. Both dolphin and porpoise
 have milk and suckle their young; and they take
 their young, while still small, inside them. The young
 dolphins grow quickly: they are grown to full size
 in ten^c years. The dolphin's gestation period is ten
 months. It bears its young in summer, and at no
 other season; furthermore, it actually disappears at
 the time of the Dogstar for about thirty days. Its
 offspring accompany it for a considerable time; in
 fact, it is an animal that dotes on its children. It lives
 many years; some are definitely known to have lived
 for over twenty-five years, others for thirty—by the

ter). The identification is uncertain. The words "so too . . .
 ox-fish" are moved by Dt. and Th. to the end of the preceding
 chapter.

^b Cf. 598 b 1.

^c A.-W. suggest δ' ("four") instead of δέκα.

566 b

25 κοντα· ἀποκόπτοντες γὰρ ἐνίων τὸ οὐραῖον οἱ ἀλιεῖς ἀφιάσων, ὥστε τούτῳ γνωρίζουσι¹ τοὺς χρόνους αὐτῶν.

Ἡ δὲ φώκη ἐστὶ τῶν ἐπαμφοτεριζόντων ζώων· οὐ δέχεται μὲν γὰρ τὸ ὕδωρ, ἀλλ' ἀναπνεῖ καὶ καθεύδει καὶ τίκτει ἐν τῇ γῆ μὲν, πρὸς αἰγιαλοῖς δέ,
30 ὡς οὐσα τῶν πεζῶν, διατρίβει δὲ τοῦ χρόνου τὸν πολὺν καὶ τρέφεται ἐκ τῆς θαλάττης, διὸ μετὰ τῶν ἐνὺδρων περὶ αὐτῆς λεκτέον. ζωοτοκεῖ μὲν οὖν εὐθύς ἐν αὐτῇ, καὶ τίκτει ζῶα, καὶ χόριον καὶ τάλλα
567 a προἴεται ὡσπερ πρόβατον. τίκτει δ' ἐν ἡ δύο, τὰ δὲ πλείστα τρία. καὶ μαστοὺς δ' ἔχει δύο, καὶ θηλάζεται ὑπὸ τῶν τέκνων καθάπερ τὰ τετράποδα. τίκτει δ' ὡσπερ ἄνθρωπος πᾶσαν ὥραν τοῦ ἔτους, μάλιστα
5 δ' ἅμα ταῖς πρώταις αἰξίν. ἄγει δὲ περὶ δωδεκαταῖα ὄντα τὰ τέκνα εἰς τὴν θάλατταν πολλάκις τῆς ἡμέρας, συνθείζουσα κατὰ μικρόν· τὰ δὲ κατάντη φέρεται, ἀλλ' οὐ βαδίζει, διὰ τὸ μὴ δύνασθαι ἀπερείδεσθαι τοῖς ποσίν. συνάγει δὲ καὶ συστέλλει ἑαυτήν· σαρκῶδες γὰρ ἐστὶ καὶ μαλακόν, καὶ ὅσα χονδρῶδη
10 ἔχει. ἀποκτεῖναι δὲ φώκην χαλεπὸν βιαίως, εἰ μὴ τις πατάξῃ παρὰ τὸν κρόταφον· τὸ γὰρ σῶμα σαρκῶδες αὐτῆς ἐστίν.² ἀφίησι δὲ φωνὴν ὁμοίαν βοῦ. ἔχει δὲ καὶ τὸ αἰδοῖον ἢ θήλεια ὁμοίον βατίδι,³ πάντα δὲ τάλλα γυναικί.

¹ γνωρίζουσι PC : γνωρίζεσθαι D, vulg.

² ἐστίν C : om. PD, vulg.

³ βατίδι codd. : βοῦ A.-W. : βοιδίω Dt. : et in eius femina invenitur virga sicut [in mare] in nativ. et invenitur residuum in sua femina sicut in muliere Σ.

following method : fishermen dock the tails of some of them and then let them go again : this enables them to discover how long they live.

The seal comes under the heading of " animals that dualize " ^a : it does not take in seawater : it breathes and sleeps and brings forth its young on dry land (near the shore, though, it is true) as belonging to the land-animals ; on the other hand, it spends most of its time in the sea and gets its food from the sea, and therefore we must discuss it along with the aquatic animals. ^b It is internally viviparous (there is no oviparous stage) and brings forth its young alive, and produces a chorion and all the rest, just like a ewe. It produces one, or two, young ; at the most three. It has two teats and gives suck to its young as quadrupeds do. Like human beings, it bears at every season of the year, but especially at the time when the first goats are kidding. When the young are about twelve days old, it takes them down to the sea many times a day to accustom them to it gradually. To get down steep places it just lets itself go without attempting to walk, because it is unable to get a grip with its feet. It can contract and compress its own bulk, because it is soft and fleshy and its bones are cartilaginous. It is difficult to kill a seal by using force, unless you strike it on the temple, because its body is fleshy. It lows like a cow. In respect of its genital organ also the female resembles a ray ^c ; in all other respects, (< i.e., in its sexual parts >), it resembles the human female.

^a See n. on 488 a 2, and Notes, §§ 28 ff. Cf. 502 a 16, 589 a 21, etc.

^b On the implications of πεζόν and ἐνυδρον see Notes, §§ 39 ff.

^c The word βατίδι (" ray ") is probably corrupt, and should no doubt be replaced by " cow."

567 a

15 Περὶ μὲν οὖν τῶν ἐνύδρων καὶ ζωοτοκούντων ἢ ἐν αὐτοῖς ἢ ἔξω ἢ γένεσις καὶ τὰ περὶ τὸν τόκον τοῦτον ἔχει τὸν τρόπον·

XIII Οἱ δ' ὠτοκοῦντες τῶν ἰχθύων τὴν μὲν ὑστέραν δικροάν ἔχουσι καὶ κάτω, καθάπερ ἐλέχθη πρότερον (ὠτοκοῦσι δὲ πάντες οἱ τε λεπιδωτοί, οἷον λάβραξ 20 κεστρεὺς κέφαλος ἐτελὶς, καὶ οἱ λευκοὶ καλούμενοι πάντες, καὶ οἱ λεῖοι πλὴν ἐγχέλυος), ὧν δ' ἴσχουσι ψαθυρόν. τοῦτο δ' ἐν¹ φαίνεται διὰ τὸ τὴν ὑστέραν εἶναι πλήρη πᾶσαν ὥσθ' ἐν γε τοῖς μικροῖς τῶν ἰχθύων δοκεῖν ὡς μόνον εἶναι δύο· διὰ τὴν μικρότητα γὰρ καὶ τὴν λεπτότητα ἄδηλος ἐν αὐτοῖς 25 ἢ ὑστέρα. περὶ μὲν οὖν τῆς ὀχείας πάντων τῶν ἰχθύων εἴρηται πρότερον.

Εἰσι δὲ τῶν ἰχθύων οἱ μὲν πλείστοι ἄρρενες καὶ θήλεις, περὶ δ' ἐρυθρίνου καὶ χάννης ἀπορεῖται· πάντες γὰρ ἀλίσκονται κυήματα ἔχοντες.

Συνίσταται μὲν οὖν καὶ ὀχευμένων ὡς τοῖς συνδουλομένοις τῶν ἰχθύων, ἴσχουσι δὲ καὶ ἀνευ ὀχείας. 30 δηλοῦσι δ' ἐνιοὶ τῶν ποταμίων· εὐθύς γὰρ γεννώμενοι ὡς εἶπεν καὶ μικροὶ ὄντες οἱ φοξίνοι κυήματ' ἔχουσιν. ἀπορραίνουσι δὲ τὰ ὡς, καὶ καθάπερ λέγεται, τὰ μὲν πολλὰ² οἱ ἄρρενες ἀνακάπτουσι, τὰ δ' ἀπόλλυται ἐν τῷ ὑγρῷ· ὅσα δ' ἂν ἐκτέκωσιν εἰς 567 b τοὺς τόπους οἰκείους ἐκτίκτειν,³ ταῦτα σώζεται· εἰ γὰρ πάντα ἐσώζετο, παμπληθὲς ἂν τὸ γένος ἦν ἐκάστων. καὶ τούτων δ' οὐ γίγνεται τὰ πολλὰ

¹ δ' ἐν Sn., Pi. : δὲ codd. ² ὡς add. PD, vulg. : om. C.

³ οἰκείους ἐκτίκτειν Dt., coll. 598 b 4 : εἰς οὓς ἐκτίκτουσι codd. (εἰς om. PD) : εἰς οὓς ἐδ πίπτουσι Pi.

^a Identified by Hesychius with the gilthead.

^b *Erythrinus* and *channa*, species of *Serranus* (sea-perch),

We have now described the manner of generation and parturition in aquatic animals which are either internally or externally viviparous.

Oviparous aquatic animals. Those fishes which are oviparous have a bifurcated uterus, placed low down, as was stated earlier. All scaly fishes are oviparous : examples are the basse, the grey mullet, the *kephalos*, the *etelis*,^a and all the so-called white fish, and all the smooth ones except the eel. Their egg is friable ; and it appears to be a single mass, because the whole uterus is absolutely full of eggs. The result is that in the small fishes there appear to be two eggs only, for owing to its being so small and delicate their uterus is indistinguishable. Of the copulation of all kinds of fishes I have already spoken.

XIII
Oviparous
fishes.

In most kinds of fishes male and female exist ; but the *erythrinus* and *channa*^b present a puzzle, for all of these when caught contain fetations.^c

The eggs of those fishes which copulate are constituted^d not only as a result of their doing this, but also without previous copulation. This is clearly so in certain freshwater fishes : thus, one might say that minnows,^e as soon as they are born, or at any rate when very small, carry fetations. These fishes shed their eggs, and (as is said) the males swallow most of them, while others get lost in the water, but those which they deposit in places which are suitable for the purpose come through safely : if they all survived, the multitude of each kind of fish would be enormous. The great majority of these eggs are not fertile, only

many of which are hermaphrodite, as was rediscovered by Cavolini (*La generazione dei pesci spinosi*, 1787). Cf. 538 a 21, *G.A.* 741 a 36, 755 b 22.

^c See Notes, § 16.

^d See Notes, § 27.

^e The identification is uncertain.

γόνιμα, ἀλλ' ὅσα ἂν ἐπιρράνη ὁ ἄρρη τῷ θορῶ·
 5 ὅταν γὰρ ἐκτέκη, παρεπόμενος ὁ ἄρρη ἐπιρραίνει
 ἐπὶ τὰ ψὰ τὸν θορόν, καὶ ὅσα μὲν ἂν ἐπιρρανθῆ, ἐκ
 πάντων γίγνεται ἰχθύδια, ἐκ δὲ τῶν ἄλλων ὅπως ἂν
 τύχη.

Ταῦτό δὲ συμβαίνει τοῦτο καὶ ἐπὶ τῶν μαλακίων·
 ὁ γὰρ ἄρρη τῶν σηπιῶν, ὅταν ἐκτέκη ἢ θήλεια,
 ἐπιρραίνει τὰ ψά. ὅπερ εὐλογον συμβαίνειν καὶ ἐπὶ
 10 τῶν ἄλλων μαλακίων, ἀλλ' ἐπὶ τῶν σηπιῶν ὥπται
 ἐν τῷ παρόντι μόνον.

Ἐκτίκτουσι δὲ πρὸς τῇ γῆ, οἱ μὲν κωβιοὶ πρὸς
 τοῖς λίθοις, πλὴν πλατὺ καὶ ψαθυρὸν τὸ ἀποικτιό-
 μενόν ἐστιν. ὁμοίως δὲ καὶ οἱ ἄλλοι ἀλεινά τε
 γὰρ ἐστὶ τὰ περὶ τὴν γῆν, καὶ τροφήν ἔχει μᾶλλον,
 15 καὶ πρὸς τὸ μὴ κατεσθίεσθαι ὑπὸ τῶν μειζόνων τὰ
 κνήματα. διὸ καὶ ἐν τῷ Πόντῳ περὶ τὸν Θερμώ-
 δοντα ποταμὸν οἱ πλείστοι τίκτουσιν· νήνεμος γὰρ
 ὁ τόπος καὶ ἀλεινὸς καὶ ἔχων ὕδατα γλυκέα.

Τίκτουσι δ' οἱ μὲν ἄλλοι τῶν ψοτόκων ἰχθύων
 ἀπαξ τοῦ ἐνιαυτοῦ, πλὴν τῶν μικρῶν φυκίδων· αὐταὶ
 20 δὲ δις. διαφέρει δ' ὁ ἄρρη φύκης τῆς θηλείας τῷ
 μελάντερος εἶναι καὶ μείζους ἔχειν τὰς λεπίδας.¹

Οἱ μὲν οὖν ἄλλοι ἰχθύες γόνω² τίκτουσι καὶ τὰ
 ψὰ ἀφιασιν· ἦν δὲ καλοῦσί τινες βελόνην, ὅταν ἦδη
 ὥρα ἦ τοῦ τίκτειν, διαρρήγνυται, καὶ οὕτω τὰ ψὰ
 ἐξέρχεται. ἔχει γὰρ τινα ὁ ἰχθύς οὖτος διάφνουσι
 25 ὑπὸ τὴν γαστέρα καὶ τὸ ἦτρον, ὥσπερ οἱ τυφλίνοι
 ὄφεις· ὅταν δ' ἐκτέκη, συμφύεται ταῦτα³ πάλιν.

¹ ταῦτόν v. 8 A.-W., ἐκτίκτουσι v. 12 Dt., hucusque secludunt.

² ἐν γόνω PD, vulg.

³ ταῦτα] τὸ τραύμα conī. Sn. ex Plinio ix. 76.

those which the male sprinkles with his milt; when
 the eggs have been laid the male follows and sheds
 his milt over them. Those which get sprinkled in this
 way all give rise to tiny fishes; the remainder have to
 take their chance.

The same process occurs with the Cephalopods:
 thus, the male cuttlefish, when the female has laid
 her eggs, sprinkles them. It is reasonable to suppose
 that the same thing takes place with the other
 Cephalopods, but up to the present it has been ob-
 served only with cuttlefish.

Fish deposit their eggs near land, the goby near
 stones, though (in contrast with the cuttlefish's) its
 spawn is broad and friable. The others behave in a
 similar way, for places near the shore are warmer and
 provide more food, as well as (protection) to prevent
 the fetations being devoured by larger fishes. This,
 too, is why in the Black Sea most fishes deposit their
 eggs near the mouth of the Thermodon, because this
 is a spot which is sheltered from the winds, warm, and
 with a good supply of fresh water.

With one exception (*viz.*, the small *phykis*,^a which
 spawns twice) oviparous fishes spawn once a year.
 The male *phykes* differs from the female in being
 blacker and having larger scales.

Almost without exception, then, fishes breed by
 copulation and lay their eggs: but the fish some call
belonē,^b when the time for parturition has arrived,
 bursts asunder, and in that way the eggs emerge.
 The explanation is that this fish has a cleavage under
 the belly and the abdomen, just as the blind snakes
 have, and once it has got rid of its eggs the sides of
 this cleavage grow together again.

^a A wrasse (Th.)

^b The pipe-fish.

Ἡ δὲ γένεσις ἐκ τοῦ ὤου ὁμοίως συμβαίνει ἐπὶ τε τῶν ἔσω φωτοκούντων καὶ ἐπὶ τῶν ἔξω· ἐπ' ἄκρου τε γὰρ γίνεσθαι καὶ ὑμένι περιέχεται, καὶ πρῶτον 30 διαδήλοισι οἱ ὀφθαλμοὶ μεγάλοι καὶ σφαιροειδεῖς ὄντες. ἢ καὶ δῆλον ὅτι οὐχ ὡσπερ τινὲς φασι, ὁμοίως γίνονται τοῖς ἐκ τῶν σκωλήκων γιγνομένοις· τούτων γὰρ συμβαίνει ἐπ' ἐκείνων, τὰ κάτω μείζω πρῶτον, οἱ δ' ὀφθαλμοὶ καὶ ἡ κεφαλὴ ὕστερον.

568 a "Ὅταν δ' ἀναλωθῇ τὸ ὤον, γίνονται γυρινώδη,¹ καὶ τὸ μὲν πρῶτον οὐδὲμίαν τροφήν λαμβάνοντα αὐξάνονται ἐκ τῆς ἀπὸ τοῦ ὤου ἐγγιγνομένης ὑγρότητος, ὕστερον δὲ τρέφονται ἕως ἂν αὐξήθωσι τοῖς ποταμίοις ὕδασι.

Τοῦ δὲ Πόντου καθαιρομένου ἐπιφέρεται τι κατὰ 5 τὸν Ἑλλησποντον ὃ καλοῦσι φύκος· ἔστι δ' ὠχρὸν τοῦτο· οἱ δὲ² φασι τοῦτο ἄνθος εἶναι τοῦ φύκου, ἀφ' οὗ τὸ φυκίον εἶναι.³ ἀρχομένου δὲ γίνεσθαι τοῦ θέρους. τούτῳ τρέφεται καὶ τὰ ὄστρεα καὶ τὰ ἰχθυῖδια τὰ ἐν τοῖς τόποις τούτοις. φασι δὲ τινας τῶν θαλαττίων καὶ τὴν πορφύραν ἴσχειν ἀπὸ τούτου 10 τὸ ἄνθος.⁴

XIV Οἱ δὲ λιμναῖοι καὶ οἱ ποτάμιοι τῶν ἰχθύων κνή-

¹ γυρινώδη Dt.: γυρινώδεις vulg.: πυρινώδεις PD.

² οἱ δὲ τινὲς PD, vulg.

³ εἶναι τοῦ φύκου, ἀφ' οὗ τὸ φυκίον εἶναι PD: εἶναι τι φυσικόν τοῦ φύκου C, vulg.

⁴ τοῦ δὲ Π. v. 4 hucusque secl. A.-W., Dt.

^a Theophrastus (*H.P.* iv. 6. 4) speaks of a seaweed (φύκος), called πράσον, of enormous size (probably *Laminaria saccharina*), which is carried by the current into the Mediterranean from the Atlantic, and is at its best in summer. In the next section (5) he speaks of another, which grows in Crete on

Generation from the egg follows a similar course both with internally and with externally oviparous fishes, *viz.*, the embryo is formed at the tip of the egg and is surrounded by a membrane, and the eyes are the first organs to be distinguishable, being large and spherical. This circumstance shows that, contrary to what some maintain, fish embryos do not develop like the creatures that are produced out of larvae. There, the process is quite the reverse: the lower parts are the larger to begin with, and the eyes and the head develop later.

When the egg has been used up, the young fishes are like tadpoles to look at, and at first, in spite of their taking no nourishment, they grow—by making use of the fluid produced out of the egg; later they are nourished by the river waters until they reach their full growth.

When the Black Sea is being "cleansed," a substance which they call *phykos*^a is brought down through the Hellespont; it is pale yellow in colour. Some persons say this is the bloom of the *phykos*, from which *phykion* (rouge) comes; it appears at the beginning of summer. On this the oysters^b and small fishes of those regions feed. Some of the seaboard inhabitants actually maintain that the purpura gets its bloom (dye) from this substance.

Marsh-fishes and river-fishes have fetations^c at the XIV rocks near the shore, from which a dye finer than purple is obtained: this is no doubt *Roccella tinctoria*, litmus or orchella-weed, from which orchil is produced. Cf. Lloyd B. Jensen, "Royal Purple of Tyre," *Journal of Near Eastern Studies*, XXII (1963), pp. 110 f., and W. F. Leggett, *Ancient and Medieval Dyes*, pp. 56-60.—On the "cleansing" of the Black Sea see Add. Note, p. 375.

^b Or, "shellfish."

^c See Notes, § 16.

ματα μὲν ἰσχοῦσι πεντάμηνοι τὴν ἡλικίαν ὄντες ὡς ἐπὶ τὸ πολὺ, τίκτουσι δὲ τοῦ ἐνιαυτοῦ περιμόντος ἅπαντες· ὡσπερ δὲ καὶ οἱ θαλάττιοι, καὶ οὗτοι οὐκ
 15 ἕξαφιάσιν οὐδέποτε ἅμα πᾶν, οὐθ' αἱ θήλειαι τὸ ὦδον οὐθ' οἱ ἄρρενες τὸν θορόν, ἀλλ' ἔχουσιν αἰεὶ πλείω ἢ ἐλάττονα αἱ μὲν ὡς αἱ δὲ θορόν. τίκτουσι δ' ἐν τῇ καθηκούσῃ ὥρᾳ κυπρίνος μὲν πεντάκις ἢ ἑξάκις· ποιεῖται δὲ τὸν τόκον μάλιστα ἐπὶ τοῖς ἄστροις· χαλκίς δὲ τίκτει τρίς, οἱ δ' ἄλλοι ἅπαξ ἐν τῷ ἐνι-
 20 αὐτῷ.¹ τίκτουσι δὲ πάντες ἐν ταῖς προλιμνάσι τῶν ποταμῶν καὶ τῶν λιμνῶν πρὸς τὰ καλαμῶδη, οἷον οἱ τε φοξῖνοι καὶ αἱ πέρκαί.

Οἱ δὲ γλάνεις καὶ αἱ πέρκαί συνεχῆς ἀφιάσι τὸ κῆμα, ὡσπερ οἱ βάτραχοι· οὕτω δὲ συνεχῆς ἐστὶ τὸ κῆμα περιελιγμένον, ὥστε τό γε τῆς πέρκης διὰ
 25 πλατύτητα ἀναπηνίζονται ἐν ταῖς λίμναις οἱ ἀλιεῖς ἐκ τῶν καλάμων. οἱ μὲν οὖν μείζους τῶν γλανίων ἐν τοῖς βαθέσιν ἐκτίκτουσιν, ἐνιοὶ καὶ κατ' ὀργυιάς τὸ βάθος, οἱ δ' ἐλάττους αὐτῶν ἐν τοῖς βραχυτέροις, μάλιστα πρὸς ρίζαις ἰτέας ἢ ἄλλου τιὸς δένδρου, καὶ πρὸς τῷ καλάμῳ δὲ καὶ πρὸς τῷ βρύῳ. συμ-
 30 πλέκονται δὲ πρὸς ἀλλήλους ἐνίοτε καὶ πάνυ μέγας πρὸς μικρόν· καὶ προσαγαγόντες τοὺς πόρους πρὸς ἀλλήλους, οὓς καλοῦσιν τινες ὀμφαλοῦς, ἢ τὸν γόνον
 568 b ἀφιάσιν, ὁ μὲν τὸ ὦδον ὁ δὲ τὸν θορόν ἐξίησιν. ὅσα δ' ἂν τῷ θορῷ μιχθῇ τῶν ὦδων, εὐθύς τε λευκότερα φαίνεται καὶ μείζω ἐν ἡμέρᾳ ὡς εἰπεῖν. ὕστερον δ'

¹ ἐν τῷ ἐν. AC : τοῦ ἐνιαυτοῦ Ald., Cs., A.-W., Dt.

^a This phrase must obviously have borne a definite meaning for Aristotle and his contemporaries. Thompson suggests
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age of five months in general, and all of them deposit their eggs at the turn of the year. These fishes also behave in the same way as seagoing fish, *viz.*, the females do not produce all their eggs at one time, nor the males all their milt; females have eggs, more or less, and males milt, the whole time. The carp spawns, at the appropriate season, five or six times: it does this mostly at (the risings and settings of) the stars^a; the *chalkis*^b spawns three times; the remainder once a year. They all spawn in stagnant pools left behind by river-floods, and near the reedy parts of marshes; examples are the minnow and the perch.

The *glanis*^c and the perch deposit their fetation in a continuous string, as frogs do; so continuous is this twisted fetation—at any rate, the perch's is—and so even, that fishermen in the marshes can unwind it off the reeds like thread. The large specimens of the *glanis* spawn in deep waters, some of them in water a fathom deep: the smaller ones in shallower places, especially near the roots of the willow or some other tree, and also near reeds and sea-moss.^d Sometimes these fishes intertwine with one another, quite a large one with a small one: they bring their passages up against each other, the passages which some call their navels, through which the generative substance is emitted, the eggs by the female and the milt by the male. Such eggs as get mixed with milt, at once—in a day or so—appear whiter and larger. Soon after,

that the stars concerned are the Pleiades, Arcturus, and the Dogstar. See n. on 553 b 29.

^b At 543 a 2 the *chalkis* appears to be a sardine, a small fish of the herring family; but here it is mentioned among freshwater fishes, and may be the shad (Th.). Cf. 568 b 24.

^c See n. on 490 a 5, and on 568 b 13 below.

^d Sea-moss, or oyster-green; cf. 591 b 12.

ἐν ὀλίγῳ χρόνῳ δῆλὰ ἐστὶ τὰ ὄμματα τοῦ ἰχθύος·
 5 τοῦτο γὰρ ἐν πάσι τοῖς ἰχθύσιν, ὡσπερ καὶ ἐν τοῖς
 ἄλλοις ζώοις, ἐπιδηλότατόν ἐστιν εὐθὺς καὶ φαίνεται
 μέγιστον. ὅσων δ' ἂν ὤων ὁ θορός μὴ θίγη, καθά-
 περ καὶ ἐπὶ τῶν θαλαττίων, ἀχρεῖον τὸ ὤον τοῦτο
 καὶ ἄγονόν ἐστιν. ἀπὸ δὲ τῶν γονίμων ὤων, αὐξά-
 νομένων τῶν ἰχθυδίων, ἀποκαθαίρεται οἶον κέλυφος·
 10 τοῦτο δ' ἐστὶν ὑμῆν ὁ περιέχων τὸ ὤον καὶ τὸ
 ἰχθυδίων. ὅταν δὲ μιγῇ τῷ ὤῳ ὁ θορός, σφόδρα
 γίνεταί κολλῶδες τὸ συνεστηκός ἐξ αὐτῶν πρὸς
 ταῖς ρίζαις ἢ ὅπου ἂν ἐκτέκωσιν. οὐ δ' ἂν πλεῖστον
 τέκωσιν, ψοφυλακεῖ ὁ ἄρρην, ἢ δὲ θήλεια ἀπέρχεται
 τεκοῦσα. ἐστὶ δὲ βραδυτάτη μὲν ἐκ τῶν ὤων ἢ
 15 τῶν γλάνιων αὐξήσις, διὸ προσεδρεύει ὁ ἄρρην καὶ
 τετταράκοντα καὶ πεντήκοντα ἡμέρας, ὅπως μὴ
 κατεσθῆται ὁ γόνος ὑπὸ τῶν παρατυχόντων ἰχθυ-
 δίων· δευτέρα δὲ βραδυτήτι ἢ τοῦ κυπρίνου γένεσις,
 ὅμως δὲ [ταχέως]¹ καὶ τούτων ὁ σωζόμενος δια-
 φεύγει γόνος. τῶν δ' (ὤων)² ἐλαττόνων ἐνίων καὶ
 20 τριταίων ὄντων ἤδη ἰχθυῖδά ἐστιν. λαμβάνει δ'
 αὐξήσιν τὰ ὤα, ὧν ἂν ἐπιψαύσῃ ὁ θορός, καὶ αὐθη-
 μερόν καὶ ὑστερον ἔτι. τὸ μὲν οὖν τοῦ γλάνιος

¹ ὅμως PD, vulg.: ὁμοίως AC; ταχέως seclusi.

² ὤων credit hic intercidisse Dt.; supplevi.

^a See Notes, § 27.

^b For a further description see 621 a 21 ff. The fish was recognized by the distinguished Swiss-born biologist Jean Louis Rodolphe Agassiz (1807–1873), professor of zoology at Harvard from 1848, to whom specimens were sent from the river Achelouß (where it still bears the name *glanos*) and was named *Parasilurus Aristotelis* by him in 1857. Fishes of this type are variously known as *Silurus*, catfish, Wels, or sheatfish. The male's habit of staying on guard over the eggs and young has apparently not been attested in modern times for

the fish's eyes become distinctly visible—this occurs
 in all fishes, as in all other animals: the eye is from
 the start the most conspicuous part, and appears
 largest. Such eggs as the milt fails to touch (again,
 as with sea-going fish) are useless and infertile. From
 the fertile eggs, as the small fishes grow, a sort of
 sheath is thrown off: this is a membrane which en-
 velops the egg and the tiny fish. When the milt
 mixes with the egg, the combined product^a becomes
 very sticky and sticks to the roots or whatever there
 is where the eggs were laid. Wherever the bulk of
 the eggs were laid, the male stays on guard^b; the
 female having laid goes away. Growth from the egg
 is slowest with the *glanis*; that is why the male keeps The catfish.
 watch for as much as forty or fifty days, to prevent
 the brood being devoured by any small fishes that
 may happen to come by. Second in slowness is the
 development of the carp; but the brood even of
 these which is safeguarded manages to escape. The
 eggs of some of the smaller ones are only three days
 old when there are already tiny fishes. Eggs which
 have been touched by the milt begin to grow the same
 day, and later too. The egg of the *glanis* is the size

this or for any other European species; but Agassiz knew
 there were catfish in America which did this. Aristotle's
 record, considered even by Cuvier and Valenciennes a trifle
 far-fetched ("Ce qu'Aristote rapporte . . . tient un peu du
 merveilleux," *Histoire naturelle des poissons*, vol. XIV
 (1839), p. 260; cf. A.-W., I. 126) has therefore been vindic-
 ated after many centuries. Illustrations of the *Parasilurus*,
 and of the American catfish (*Ameiurus*) on guard, taken
 from Theodore Gill, *Annual Report of Regents of the Smith-
 sonian Institute for 1905*, are given by Charles Singer, *A
 History of Biology* (rev. ed., 1950), p. 19, figs. 7 and 8. It
 was not until 1906 that Aristotle's fish became properly
 known to biologists.

γίγνεται ὄσον ὄροβος, τὰ δὲ τῶν κυπρίνων καὶ τῶν τοιούτων ὄσον κέγχρος.

Ταῦτα μὲν οὖν τοῦτον τὸν τρόπον τίκτει καὶ γεννᾷ, χαλκίς δὲ τίκτει ἐν τοῖς βαθέσιν ἀθρόα ὡς¹ ἀγελαία,²

25 ὃν δὲ καλοῦσι τίλωνα, πρὸς τοῖς αἰγιαλοῖς ἐν ὑπὴ-
νέμοις· ἀγελαῖος δὲ καὶ οὗτος. κυπρίνος δὲ καὶ
βάλερος καὶ οἱ ἄλλοι πάντες ὡς εἰπεῖν ὠθοῦνται
μὲν εἰς τὰ βραχέα πρὸς τὸν τόκον, μιᾷ δὲ θηλείᾳ

30 τεσσαρεσκαίδεκα· τῆς θηλείας δ' ἀφείσης τὸ ῥὼν
καὶ ὑποχωροῦσιν ἄρρενες καὶ τρισκαίδεκα καὶ
θορόν. ἀπόλλυται δὲ τὰ πλεῖστ' αὐτῶν· διὰ³ γὰρ τὸ

569 α ὑποχωροῦσαν τίκτειν τὴν θήλειαν σκεδάννυται τὸ
ῥὼν, ὃ τι ἂν ὑπὸ ρεύματος ληφθῆ καὶ μὴ προσπέσῃ
πρὸς ὕλην· καὶ γὰρ οὐδ' ὠφουλακεῖ τῶν ἄλλων ἕξω
γλάνιος οὐδεὶς· πλὴν ἐὰν ἀθρόω γόνω ἑαυτοῦ περι-
5 τύχη ὁ κυπρίνος, τοῦτόν⁴ φασιν ὠφουλακεῖν.

Θορόν δὲ πάντες ἔχουσιν οἱ ἄρρενες πλὴν ἐγγέ-
λως· αὕτη δ' οὐδέτερον οὐτ' ῥὼν οὔτε θορόν. οἱ μὲν
οὖν κεστρεῖς ἐκ τῆς θαλάττης ἀναβαίνουσιν εἰς⁵ τὰς
λίμνας καὶ τοὺς ποταμούς, αἱ δ' ἐγγέλως τοῦναντίον
ἐκ τούτων εἰς τὴν θάλατταν.

XV 10 Οἱ μὲν οὖν πλεῖστοι, ὡς περ εἴρηται, τῶν ἰχθύων
γίγνονται ἐξ ῥῶν. ὁ μὴν ἄλλ' ἔνιοι καὶ ἐκ τῆς
λίγος καὶ ἐκ τῆς ἄμμου γίγνονται, καὶ τῶν τοιούτων

¹ ὡς Dt.: καὶ codd., vulg.

² ἀγελαία A.-W., Dt.: ἀγελαία D, vulg.: ἀγελαῖος P: ἀγε-
λαῖος AC.

³ διὰ τε codd., vulg.: τε om. Ald., A.-W., Dt.

⁴ δέ add. codd., vulg.: om. Sn., A.-W., Dt.: τότε δέ Scal.

⁵ εἰς τε Ald., vulg.: τε om. PCO.

⁶ totum hoc caput damnant St-Hilaire, Dt.

of a vetch seed; that of the carp and similar fishes, the size of a grain of millet.

Such then is the manner in which these fishes spawn and reproduce. The *chalkis*, on the other hand, spawns in deep water, massed together, as being a shoal-fish; the fish they call *tilon*^a spawns near beaches in sheltered spots; it too is a shoal-fish. The carp, the *baleros*,^b and practically all other fishes throng forward into the shallows in order to spawn; and often one female is followed by maybe thirteen or fourteen males. When she deposits her egg and as she retires, they follow and sprinkle their milt. Most of the eggs come to grief: since the female spawns while she is on the move, the egg gets scattered—that is, as much of it as is carried away by the current and does not get caught up in the undergrowth; for, apart from the *glanis*, no fish mounts guard over the eggs, except that if it finds a mass of its own spawn the carp will do so—or so it is alleged.

All male fishes have milt, except the eel: the eel has neither egg nor milt. Grey mullets go up from the sea into the marshes and rivers; eels do the reverse: they go down from the marshes and rivers to the sea.^c

As has been stated, the great majority of fishes are XV
formed out of eggs. Nevertheless, there are some Spontane-
ously
generated
fishes.
which are formed out of mud and out of sand, even of

another name for the *glanis*; it is not certainly identifiable. It is mentioned by Herodotus (v. 16) in his account of the lake-dwellers in the Paeonian lake Prasias, later L. Takino, on the river Strymon, just inland from Amphipolis, on the Thracian border, and not far from Stagira.

^b A kind of carp.

^c This is true: they go to the Sargasso Sea. Cf. note on 517 b 8.

^a Cf. 602 b 26, where Th. suggests that *tilon* may be 280

- γενῶν ἃ γίνεταί ἐκ συνδυασμοῦ καὶ ῥῶν, ἐν τέλμασιν ἄλλοις τε, καὶ οἶον περὶ Κνίδον φασὶν εἶναι ποτε, ὃ ἐξηραίνετο μὲν ὑπὸ κύμα καὶ ἡ ἰλὺς ἅπασα
- 15 ἐξηρεῖτο, ὕδωρ δ' ἤρχετο ἐγγίγνεσθαι ἅμα τοῖς πρώτοις γιγνομένοις <ὄμβροις>.¹ ἐν τούτῳ δὴ² ἰχθύδια ἐνεγίνετο ἀρχομένου τοῦ ὕδατος. ἦν δὲ κεστρέων τι γένος τοῦτο, ὃ οὐ³ γίνεταί ἐξ ὀχείας, μέγεθος ἡλίκα μαινίδια μικρά· ῥῶν δὲ τούτων εἶχεν οὐδὲν οὐδὲ θορόν. γίνεταί δὲ καὶ ἐν ποταμοῖς ἐν τῇ
- 20 Ἀσίᾳ, ὅπου⁴ διαρρέουσιν εἰς τὴν θάλατταν, ἰχθύδια μικρά, ἡλίκοι ἐψητοί, ἕτερα τὸν αὐτὸν τρόπον τούτοις. ἐνιοὶ δὲ καὶ οὕτως⁵ φασὶ τοὺς κεστρεῖς φύεσθαι πάντας,⁶ οὐκ ὀρθῶς λέγοντες· ἔχουσαι γὰρ φαίνονται καὶ ῥὰ αἱ θήλειαι αὐτῶν καὶ θορόν οἱ ἄρρενες. ἀλλὰ γένος τί ἐστὶν αὐτῶν τοιούτου, ὃ φύεται ἐκ τῆς ἰλῦος καὶ τῆς ἄμμου.
- 25 "Ὅτι μὲν οὖν γίνεταί αὐτόματα ἔνια οὐτ' ἐξ ῥῶν⁷ οὐτ' ἐξ ὀχείας, φανερόν ἐκ τούτων. ὅσα δὲ μήτ' ὦτοκεῖ μήτε ζωτοκεῖ, πάντα γίνεταί τὰ μὲν ἐκ τῆς ἰλῦος τὰ δ' ἐκ τῆς ἄμμου καὶ τῆς ἐπιπολαζούσης σήψεως, οἶον καὶ τῆς ἀφύης ὃ καλούμενος ἀφρός γίνεταί ἐκ τῆς ἀμμώδους γῆς· καὶ ἐστὶν αὕτη ἡ
- 30 ἀφύη ἀναυξῆς καὶ ἄγονος, καὶ ὅταν πλείων γένηται χρόνος, ἀπόλλυται, ἄλλη δὲ πάλιν ἐπιγίγνεταί, διὸ
- 569 b ἐξῶ χρόνου τινὸς ὀλίγου πᾶσαν ὡς εἰπεῖν τὴν ἄλλην γίνεταί ὥραν· διαμένει γὰρ ἀρξάμενος⁸ ἀπ' ἀρκτού-
- ¹ ὄμβροις suppl. Dt., νετοῖς Camot., Sylb., Cs., Sn.: πρώτοις <ἐκ Σειρίου> γιγνομένοις Pi. ² δὴ Dt.: δὲ PD, om. AC, vulg.
- ³ οὐ A: οὐδὲ C, vulg.
- ⁴ ὅπου PD: οὐ vulg. (fort. οὐ scribendum).
- ⁵ οὕτως Camot., Cs., Sn.: ὅλως vulg. ⁶ ταύτη Pi.
- ⁷ οὐτ' ἐξ ῥῶν A² (ζῶων supra versum), C²: οὐτε ζῶων A¹C¹: οὐτ' ἐκ ζῶων PD, vulg.
- ⁸ ἀρξάμενος ACPD, A.-W., Dt.: ἀρξάμενη vulg., edd.

those kinds which are formed out of eggs and as a result of copulation. This occurs in ponds, especially one near Knidos, which, so it is said, on one occasion dried up at the time of the Dogstar and all the mud was taken out; water began to collect in it as the first <rains> came, and at that point tiny fishes appeared, as soon as the water began.^a This fish was a kind of grey mullet which is not produced as the result of copulation, and its size was about that of a small sprat: none of them had either egg or milt. In Asia <Minor>, too, in rivers, where they flow out into the sea, tiny fishes occur, about the size of cooking-fish, different <from the ones mentioned above, but produced> in the same way. Some people say that all grey mullets are formed in this way, but they are wrong, because the females are observed carrying eggs and the males milt. There is, however, a kind of grey mullet which grows out of mud and sand.

This evidence shows that certain fishes are produced spontaneously, and do not come out of eggs or from copulation. Those which are neither oviparous nor viviparous are all formed either out of mud or out of sand and the putrefying matter on the surface: e.g., the so-called "froth" of the small fry^b is formed out of sandy soil. This fry never grows or propagates, and as time goes on it disintegrates, to be followed by a fresh growth, so that apart from a short interval there is some of it almost all the rest of the time: it persists from the autumn <rising of> Arcturus^c until the

^a Cf. below, 570 a 8 ff.

^b The Greek word is ἀφύη, which means (or has been taken to mean) "not born"; the name, as Th. remarks, is perpetuated in the *nonnati* of the Mediterranean fish-markets. They are mostly small sand-smelts (*atherinæ*) or gobies (*Aphya*).

^c See Appendix A, p. 399.

ρου μετοπωρινου μέχρι του εαρος. σημειον δ' οτι
5 ενιστ' εκ της γης ανερχεται· αλιενομενων γαρ, εαν
μεν η ψυχρος, ουχ αλίσκεται, εαν δ' η ευδια, αλίσκε-
ται, ως εκ της γης ανιουσα προς την αλεαν. και
ελκόντων και αναξνομενης της γης πλεονακίς πλειων
γιγνεται και βελτιων. αι δ' αλλαι αφυαι χειρους
δια το ταχυ λαμβανειν αυξησιν.

10 Γίγνονται δ' εν τοις επισκίοις και ελώδεσι¹ τό-
ποις, όταν εημερίας γενομένης αναθερμαίνηται η
γη, ολον περι Αθήνας εν Σαλαμίνι και προς τω
Θεμιστοκλειω και εν Μαραθώνι· εν γαρ τούτοις τοις
τόποις γίγνεται ο αφρός. φαίνεται δ' εν μεν τόποις
15 τοιούτοις και εημερίαις τοιαύταις, γίγνεται δ' ενια-
χου και οποταν υδωρ πολυ εξ ουρανου γένηται, εν
τω αφρω τω γιγνομενω υπο του ομβριου υδατος,
διο και καλειται αφρός· και επιφερεται ενιστε επι-
πολης της θαλάττης, όταν εημερία η [εν ω συστρέ-
φεται, ολον² εν τη κόπρω τα σκωλήκια, ούτως εν
τούτω ο αφρός, όπου αν συστη επιπολης· διο πολ-
20 λαχου προσφερεται εκ του πελάγους η αφυη αυτη.
και ευθενει³ δε και αλίσκεται πλειστη, οποταν εν-
υγρον και ευδιενον γένηται το ετος.]⁴

Η δ' αλλη αφυη γονος ιχθυων εστιν. η μεν κα-
λουμένη κωβίτις⁵ κωβιων των μικρων και φαυλων,
οι καταδύνουσι εις την γην· εκ δε της Φαληρικης
25 γίγνονται μεμβράδες, εκ δε τούτων τριχίδες, εκ δε

¹ αλεινοίς D : εν ευέλοις P.

² εν ω (sc. χρόνω) συσ., ζκαι> ολον Gohlke.

³ ευθηνει ACP, vulg.: ευσθενει D. ⁴ secl. A.-W., Th.

⁵ η μεν καλουμένη κωβίτις conl. Syll., secuti sunt vulg., alii :
ο μεν καλούμενος κωβίτης codd.

spring. Here is a proof that sometimes this fry comes
up out of the ground : when fishing is in progress, if
the weather is cold, they are not caught, but they are
caught in warm weather, which suggests that they
come up out of the ground, making for the warmth.
Again, when the bottom is being dragged or scraped,
very often they appear in larger quantities and of
better quality. Other sorts of fry are of inferior
quality because of their rapid growth.

The fry are formed in shaded and marshy places,
when fine weather has set in, and the ground is
warming up, e.g., in the neighbourhood of Athens at
Salamis, and near the tomb of Themistocles, and at
Marathon : in these regions the "froth" occurs. It
appears, then, in places of this sort and during fine
weather such as I have mentioned, but it also appears
in some places when there has been heavy rain : it is
found in the froth produced by the falling of rain—
which is why it is itself called "froth." It is some-
times brought in on the surface of the sea when the
weather is fine. [In which it collects ; just as larvae
collect in dung, so the "froth" collects in this,
wherever it has taken form on the surface : hence this
fry is often brought in from the open sea. It is at its
best and is caught most plentifully in a calm, wet
year.]

Other fry is the offspring of fishes : the gudgeon-fry
(*kobitis*, as it is called) is produced by the small worth-
less gudgeon which burrows underground ; the
Phaleric^a fry gives rise to the *membras*, this to the
trichis, and this to the *trichias*^b ; and one sort of fry,

^a Phalerum is the eastern harbour of Athens ; the verb
φαληριω means "to be white with foam."

^b These all seem to be sardine-like fishes.

569 b

τῶν τριχίδων τριχίαι, ἐκ δὲ μιᾶς ἀφύης, οἷον τῆς ἐν τῷ Ἀθηναίων λιμένι, οἱ ἐγκρασίχολοι καλούμενοι. ἔστι δὲ καὶ ἄλλη ἀφύη, ἣ γόνος ἐστὶ μαινίδων καὶ κεστρέων.

30 Ὁ δ' ἀφρὸς ὁ ἄγονος ὑγρὸς ἐστὶ καὶ διαμένει
 570 a ὀλίγον χρόνον, καθάπερ εἴρηται πρότερον· τέλος γὰρ
 λείπεται κεφαλὴ καὶ ὀφθαλμοί. πλὴν νῦν εὔρηται
 τοῖς ἀλιεῦσι πρὸς τὸ διακομίζειν· ἀλιζομένη γὰρ
 πλείω μένει χρόνον.

XVI Αἱ δ' ἐγγέλους οὐτ' ἐξ ὀχείας γίνονται οὐτ' ὠτο-
 5 κούσιν, οὐδ' ἐλήφθη πώποτε οὔτε θορὸν ἔχουσα
 οὐδεμίαν οὐτ' ὠά, οὐτ' ἀνασχοθεῖσαι ἐντὸς θορικοῦς
 πόρους οὐθ' ὑστερικοῦς ἔχουσιν· ἀλλὰ τοῦτο ὄλοντ'
 τὸ γένος τῶν ἐναίμων οὐ γίνονται οὐτ' ἐξ ὀχείας
 οὐτ' ἐξ ὠῶν. φανερόν δ' ἐστὶν ὅτι οὕτως ἔχει· ἐν
 ἐνίαις γὰρ τελματώδεσι λίμναις τοῦ θ' ὕδατος παντὸς
 ἐξαυθιγθέντος καὶ τοῦ πηλοῦ ξυσθέντος γίνονται
 10 πάλιν, ὅταν ὕδωρ γένηται ὄμβριον· ἐν δὲ τοῖς αὐχ-
 μοῖς οὐ γίνονται, οὐδ' ἐν ταῖς διαμενούσαις λίμναις·
 καὶ γὰρ ζῶσι καὶ τρέφονται ὄμβριῷ ὕδατι.

Ἐπιμένει οὖν οὐτ' ἐξ ὀχείας οὐτ' ἐξ ὠῶν γίνονται,
 φανερόν ἐστιν· δοκοῦσι δὲ τισὶ γεννᾶν, ὅτι ἐν ἐνίαις
 τῶν ἐγγελύων ἐλμίνθια ἐγγίνεσθαι· ἐκ τούτων γὰρ
 15 οἰοῦνται γίνεσθαι ἐγγέλους. τοῦτο δ' ἐστὶν οὐκ ἀλη-
 θές, ἀλλὰ γίνονται ἐκ τῶν καλουμένων γῆς ἐντέρων,
 ἃ αὐτόματα συνίσταται ἐν τῷ πηλῷ καὶ ἐν τῇ γῆ τῇ
 ἐνίκμῳ. καὶ ἤδη εἰσὶν ὠμμένοι αἱ μὲν ἐκλυόμεναι²
 ἐκ τούτων, αἱ δ' ἐν διακνιζομένοις καὶ διαιρουμένοις

¹ μόνον Sn. ἐ Gul. (ἐναίμων <μόνον> Pi. e Gaza): totum Σ.

² ἐκλυόμεναι C: ἐκδύνοσαι PD, vulg.

^a The anchovy.

^b Cf. 569 a 14 ff. above.

such as that in the harbour of Athens, gives rise to the *encrasicholos*^a as it is called. There is another sort of fry which is the offspring of sprats and of grey mullets.

The non-reproductive "froth" is flabby and keeps only a short time, as I said before. Ultimately only the head and eyes are left. However, fishermen have discovered a way of transporting it: when salted down it will keep longer.

Eels are not produced by copulation, nor are they ^{XVI} oviparous. No eel has ever been caught which had ^{Eols.} either milt or eggs; nor when cut open are they found to possess passages for milt or uterine passages. In fact, this whole tribe of blooded animals is produced neither by copulation nor out of eggs. That this is so is made absolutely clear by the following: in certain marshy pools, after the water has been completely drawn off and the mud scraped out, they reappear when there has been a shower of rain^b: they do not appear in times of drought, even in stagnant pools, for the obvious reason that they live on rainwater and derive their nourishment from it.

It is absolutely clear then that they are not formed by copulation nor out of eggs. Yet some people believe they generate, because in some eels small worms are found; and they suppose eels are formed out of these. This is a mistake. They are formed out of the so-called "earth's-guts,"^c which take shape^d spontaneously in mud and soggy soil. In fact, eels (a) have been observed working themselves free out of these creatures, and (b) come to view when these

^a Cf. *G.A.* 762 b 27 ff., "the 'earth's-guts' as they are called have the nature of a larva: the body of the eel forms within them." For the breeding habits of eels see *G.A.* (Loeb ed.), p. 565, and note on *H.A.* 517 b 8 above.

^d See Notes, § 27.

570 a

γίνονται φανεραί. καὶ ἐν τῇ θαλάττῃ δέ¹ καὶ ἐν
 20 τοῖς ποταμοῖς γίνονται² τὰ τοιαῦτα, ὅταν ᾗ μάλιστα
 σῆψις, τῆς μὲν θαλάττης πρὸς τοῖς τοιούτοις τόποις
 οὐδ' ἂν ᾗ φύκιος, τῶν δὲ ποταμῶν καὶ λιμνῶν περὶ τὰ
 χεῖλη· ἐνταῦθα γὰρ ἡ ἀλέα ἰσχύουσα σῆπει.

Περὶ μὲν οὖν τῆς τῶν ἐγγελύων γενέσεως τοῦτον
 ἔχει τὸν τρόπον.

XVII

25 Τοὺς δὲ τόκους οὔτε πάντες οἱ ἰχθύες ποιοῦνται
 τὴν αὐτὴν ὥραν οὐθ' ὁμοίως, οὔτε κύουσι τὸν ἴσον
 χρόνον. πρὸ μὲν οὖν τῆς ὀχέας ἀγέλαι γίνονται
 ἀρρένων καὶ θηλειῶν· ὅταν δὲ περὶ τὴν ὀχέαν καὶ
 τοὺς τόκους ὦσι, συνδυάζονται. κύουσι δὲ τούτων
 ἔνιοι μὲν οὐ πλείους τριάκονθ' ἡμερῶν, οἱ δ' ἐλάττω
 30 χρόνον, πάντες δ' ἐν χρόνοις διαιρουμένοις εἰς τὸν
 τῶν ἑβδομάδων ἀριθμὸν. κύουσι δὲ πλείστον χρό-
 νον οὓς καλοῦσιν τινες μαρίνους. σαργὸς³ δὲ κυῖσκε-
 570 b ται μὲν περὶ τὸν Ποσειδεῶνα μῆνα, κύει δ' ἡμέρας
 τριάκοντα· καὶ ὃν καλοῦσιν⁴ τινες χελῶνα τῶν κε-
 στρέων, καὶ ὁ μύξων τὴν αὐτὴν ὥραν καὶ ἴσον
 χρόνον κύουσι τῷ σαργῷ.⁵

Πονοῦσι δὲ τῇ κινήσει πάντες, διὸ μάλιστα τὴν
 5 ὥραν ταύτην ἐκπίπτουσιν· φέρονται γὰρ οἰστρῶντες
 πρὸς τὴν γῆν. καὶ ὅλως ἐν κινήσει περὶ τὸν χρόνον
 τοῦτον διατελοῦσιν ὄντες, ἕως ἂν ἐκτέκωσιν· καὶ
 μάλιστα ὁ κεστρεὺς τοῦτο ποιεῖ τῶν ἰχθύων· ὅταν
 δ' ἐκτέκωσιν, ἡσυχάζουσιν. πολλοῖς δὲ τῶν ἰχθύων
 πέρας ἐστὶ τοῦ τίκτειν, ὅταν ἐγγένηται σκωλήκια ἐν

¹ δὲ om. PC.² γίνονται C: γίνονται PD, vulg.

are pulled apart or cut open. Creatures of this sort
 are produced in the sea and in rivers, when there is a
 good deal of putrefying matter about—in the sea near
 places where there is seaweed, in rivers and marshes
 near their edges, for that is where the heat of the sun
 is strong and causes putrefaction.

Such then is the manner in which eels are generated.

Fishes do not all breed at the same season of the XVII
 year, nor in the same manner, nor are their periods ^{Spawning}
 of gestation identical. Before pairing, shoals of males ^{seasons.}
 and females assemble, and when the time comes for
 copulation and breeding, they pair off. Some fishes'
 period of gestation is not more than thirty days, that
 of others, less; but for all of them the period is a
 multiple of seven days. The longest is that of the
 fish some call the *marinos*.^a The sargue becomes
 pregnant about the month Poseideon,^b and carries its
 spawn for thirty days; the mullet which some call
chelon, and the *myxon*,^c are pregnant at the same
 season, and for the same length of time as the sargue.

All fishes suffer in pregnancy, which is why they
 get thrown up on shore especially at that season:
 they are maddened with pain and this drives them
 towards land. In any case, they are continuously on
 the move at this time, until they have deposited their
 eggs (this applies particularly to the grey mullet);
 once they have done this, they remain quiet. For
 many fishes a limit is put on their breeding when

^a Not identified; it is mentioned again at 602 a 1.^b See Appendix B, p. 409.^c *Chelon* and *myxon* are kinds of grey mullet.³ σαργός AC: σάργος PD, vulg.⁴ καλοῦσιν δὲ PD, vulg.: δὲ om. AC.⁵ σαργῷ ACD: σάργω P, vulg.

10 τῆ γαστρὶ· ἐγγίγνεται γὰρ μικρὰ καὶ ἔμφυχα,¹ ἃ ἐξελαύνει² τὰ κνήματα.

Οἱ δὲ τόκοι γίνονται τοῖς μὲν ρύασι τοῦ ἔαρος, καὶ τοῖς πλείστοις δὲ περὶ τὴν ἔαριν ἰσημερινῶν τοῖς δ' ἄλλοις οὐχ ἡ αὐτῆ ὥρα τοῦ ἔτους, ἀλλὰ τοῖς μὲν τοῦ θέρους, τοῖς δὲ περὶ τὴν φθινοπωρινὴν ἰσημερινῶν. τίκει δὲ πρῶτον τῶν τοιούτων ἀθερίνη
 15 (τίκει δὲ πρὸς τῆ γῆ), κέφαλος δ' ὕστατος· δῆλον δ' ἐκ τοῦ πρῶτον ταύτης φαίνεσθαι τὸν γόνον, τοῦ δ' ὕστατον. τίκει δὲ καὶ κεστρεὺς ἐν τοῖς πρώτοις, καὶ σάλπη τοῦ θέρους ἀρχομένου ἐν τοῖς πλείστοις, ἐνιαχοῦ δὲ μετοπώρου. τίκει δὲ καὶ ὁ αὐλωπίας, ὃν καλοῦσιν τινες ἀνθίαν, τοῦ θέρους. μετὰ δὲ τού-
 20 τος χρύσοφρυς καὶ λάβραξ καὶ μόρμυρος³ καὶ ὄλως οἱ καλούμενοι δρομάδες. ὕστατοι δὲ τῶν ἀγελαίων τρίγλη καὶ κορακίνος· τίκτουσι δ' οἷοι περὶ τὸ μετοπώρον. τίκει δ' ἡ τρίγλη ἐπὶ τῷ πηλῷ, διὸ ὅψις τίκει· πολὺν γὰρ χρόνον ὁ πηλὸς ψυχρὸς ἐστίν.
 25 ὁ δὲ κορακίνος ὕστερον τῆς τρίγλης ἐπὶ τῶν φυκίων ἐκπορευόμενος, διὰ τὸ βιωτεύειν ἐν τοῖς πετραίοις χωρίοις. κύει δὲ πολὺν χρόνον. αἱ δὲ μαινίδες τίκτουσι μετὰ τροπὰς χειμερινάς. τῶν δ' ἄλλων ὅσοι πελάγιοι, οἱ πολλοὶ θέρους τίκτουσιν· σημεῖον δ' ὅτι οὐχ ἀλίσκονται τὸν χρόνον τοῦτον. πολυ-
 30 γονώτατον δ' ἐστὶ τῶν ἰχθύων μαινίς, τῶν δὲ σελα-

¹ ἔμφυχα displicet A.-W., Dt.: *habent vermes parvos alatos* Σ, *alata* Gul., *innascuntur enim minuta quaedam animalia vermi specie* Gaza: *tentavit* Dt. ἔμφυτα, παμφάγα, πάμπολλα.

² ἐξεσθίει malunt A.-W., Dt., Th.: *destruunt* Σ.

³ δσμύλος AC.

^a The sand-smelt.

^b A kind of grey mullet.

larvae are produced in their belly: certain small living things get formed there which drive the fetations out.

Shoal-fishes breed in the spring, and indeed most fishes breed about the time of the spring equinox; those which do not breed then have various seasons of the year for it: some breed in summer, others about the time of the autumn equinox. The first of such fishes to breed is the *atherinē*,^a which spawns close to land; the last is the *kephalos*.^b This is clear from the fact that the *atherinē*'s brood appears first and the *kephalos*' last. The grey mullet is one of the first to breed; the *salpē*^c breeds mostly at the beginning of summer, in some places in autumn. The *aulopias*,^d which some call the *anthias*, is another that breeds in summer. After these come the gilthead, the basse, the *mormyros*,^e and in general those which are called "runners."^f Last of the shoal-fish come the red mullet and the *korakinos*: these breed towards autumn. The red mullet lays its eggs in mud; therefore it breeds late, because the mud remains cold for a long time. The *korakinos* spawns later than the red mullet, and goes off to a distance for this purpose on to seaweed banks, because its normal habitat is in rocky places; it carries its fetations for a long while. The *mainis*^g spawns after the winter solstice. Of the remainder, those which are seagoing breed mostly in summer: a proof of this is that they are not caught at that season. The *mainis* is the most prolific of ordinary fishes, the fishing-frog the most

^c The saupe, *Box salpa*.

^d The identification is uncertain; perhaps a tunny.

^e A sea-bream, *Pagellus mormyrus* (Cuvier).

^f "Runners": apparently migrants.

^g The Mediterranean equivalent of the sprat.

χῶν βάτραχος· ἀλλὰ σπάνιοί εἰσι διὰ τὸ ἀπόλλυσθαι
 ῥαδίως· τίκτει γὰρ ἄθροα καὶ πρὸς τῇ γῆ. ὅλως δ'
 ὀλιγογονώτερα μὲν ἐστὶ τὰ σελάχη διὰ τὸ ζωοτο-
 571 a κεῖν, σώζεται δὲ μάλιστα ταῦτα διὰ τὸ μέγεθος.

Ἐψίγονον δ' ἐστὶ καὶ ἡ καλουμένη βελόνη, καὶ
 αἱ πολλαὶ αὐτῶν πρὸ τοῦ τίκτειν διαρρήγνυνται ὑπὸ
 τῶν ὤων· ἴσχει δ' οὐχ οὕτω πολλὰ ὡς μεγάλα. καὶ
 5 ὥσπερ τὰ φαλάγγια δέ, περικέχυνται καὶ περὶ τὴν
 βελόνην· ἐκτίκτει γὰρ πρὸς αὐτῇ, καὶ τις θίγη,
 φεύγουσιν. ἡ δ' ἀθερίνη τίκτει τρίβουσα τὴν κοι-
 λίαν πρὸς τὴν ἄμμον.

[Διαρρήγνυνται δὲ καὶ οἱ θύννοι ὑπὸ τῆς πιμελῆς,
 ζῶσι δ' ἔτη δύο. σημεῖον δὲ τούτου ποιοῦνται οἱ
 ἀλιεῖς· ἐκλιπουσῶν γάρ ποτε τῶν θυννίδων ἐνιαυτόν,
 10 τῷ ἐχομένῳ ἔτει καὶ οἱ θύννοι ἐξέλιπον. δοκοῦσι
 δ' ἐνιαυτῷ εἶναι πρεσβύτεροι τῶν πηλαμύδων.]¹

Ἐοχεύονται δ' οἱ θύννοι καὶ οἱ σκόμβροι περὶ τὸν
 Ἐλαφεβολῶνα φθίνοντα, τίκτουσι δὲ περὶ τὸν Ἐκα-
 τομβαιῶνα ἀρχόμενον· τίκτουσι δ' οἶον ἐν θυλάκῳ
 τὰ ὡά. ἡ δ' αὐξήσις ἐστὶ τῶν θυννιδίων ταχεῖα·
 15 ὅταν γὰρ τέκωσιν οἱ ἰχθύες ἐν τῷ Πόντῳ, γίνονται
 ἐκ τοῦ ὡοῦ ἄς καλοῦσιν οἱ μὲν σκορδύλας, οἱ δὲ
 Βυζάντιοι² αὐξίδας διὰ τὸ ἐν ὀλίγαις αὐξάνεσθαι
 ἡμέραις, καὶ ἐξέρχονται μὲν τοῦ φθινοπώρου ἅμα
 ταῖς θυννίσιν, εἰσπλέουσι δὲ τοῦ ἔαρος ἤδη οἶσαι
 20 πηλαμύδες. σχεδὸν δὲ καὶ οἱ ἄλλοι πάντες ἰχθύες
 ταχεῖαν λαμβάνουσι τὴν αὐξήσιν, πάντες δ' ἐν τῷ

¹ secl. A.-W., Dt. ut alieno loco posita.

² οἱ δὲ B. A : B. δ' CPD, vulg.

prolific of the Selachia ; the latter however are scarce
 because the young easily get destroyed ; the eggs
 are deposited in a mass near land. On the whole, the
 Selachia are less prolific than other fishes because they
 are viviparous ; on the other hand, the size of their
 young means that they have a high survival rate.

Another late breeder is the so-called *belonē* : the
 majority of these are burst asunder before spawning
 by their eggs, which are great not so much in number
 as in size. The young ones crowd round the parent
 fish like so many venom-spiders,^a since the fish de-
 posits the spawn on to itself ; and if you touch them,
 off they go. The *atherinē* spawns by rubbing its belly
 against the sand.

[Tunnies also are burst asunder—by their fat. They
 live for two years ; the fishermen consider this to be
 proved by the fact that once there was a failure of
 young tunnies for a year, and the next year there was
 a failure of the adult ones. Tunnies are considered to
 be a fish a year older than the *pelamys*.]

The tunny and the mackerel pair about the end
 of Elaphebolion and spawn about the beginning of
 Hekatombaion^b ; the eggs are deposited in a sort of
 wallet.^c Young tunnies grow rapidly. After the
 fishes have spawned in the Pontus, there are formed
 out of the egg what some call *skordylai* : the Byzantine
 name for them is *auxidai* (" growers "), because they
 grow up within a few days ; they come out in the
 autumn together with the young tunnies, and swim
 back in again in the spring, by which time they are
 pelamys. In fact, practically all fishes grow rapidly,
 but all those in Pontus grow more rapidly than the

^a Cf. 555 b 12.

^b See Appendix B, p. 409.

^c Cf. 543 b 13.

571 a

Πόντω θάπτον· παρ' ἡμέραν γὰρ καὶ αἱ ἄμια πολὺ ἐπιδήλως αὐξάνονται.¹

Ὅλως δὲ δεῖ νομίζειν τοῖς αὐτοῖς ἰχθύσι μὴ ἐν τοῖς αὐτοῖς τόποις μήτε τῆς ὀχείας καὶ τῆς κυήσεως εἶναι τὴν αὐτὴν ὥραν μήτε τοῦ τόκου καὶ τῆς εὐ-
25 ημερίας, ἐπεὶ καὶ οἱ καλούμενοι κορακίνοι ἐνιαχοῦ τίκτουσι περὶ τὸν πυραμητόν· ἀλλὰ τοῦ ὡς ἐπὶ τὸ πολὺ γιγνομένου ἐστόχασται τὰ εἰρημένα.

Ἴσχυοσι δὲ καὶ οἱ γόγγροι κυήματα· ἀλλ' οὐκ ἐν πᾶσι τοῖς τόποις ὁμοίως τοῦτο ἐπίδηλον, οὐδὲ τὸ κύημα σφόδρα φανερόν διὰ τὴν πιμελήν· ἴσχει γὰρ
30 μακρόν, ὥσπερ καὶ οἱ ὄφεις. ἀλλ' ἐπὶ τὸ πῦρ τιθέμενον διάδηλον ποιεῖ· ἢ μὲν γὰρ πιμελὴ θυμιάται καὶ τήκεται, τὰ δὲ πηδᾶ καὶ ψοφεῖ ἐκθλιβόμενα. ἔτι δ' ἂν τις ψηλαφᾶ καὶ τρίβῃ τοῖς δακτύλοις, τὸ μὲν στέαρ λεῖον φαίνεται, τὸ δ' ὠδὸν τραχύ. ἔνιοι
571 b μὲν οὖν γόγγροι στέαρ μὲν ἔχουσιν ὠδὸν δ' οὐδέν, οἱ δὲ τοῦναντίον στέαρ μὲν οὐδέν, ὠδὸν δὲ τοιοῦτον οἶον εἴρηται νῦν.

XVIII Περὶ μὲν οὖν τῶν ἄλλων ζώων καὶ πτηνῶν καὶ πλωτῶν,² καὶ περὶ τῶν πεζῶν ὅσα ὥσοκεῖ, σχεδὸν
5 εἴρηται περὶ πάντων, περὶ τ' ὀχείας καὶ κυήσεως καὶ τῶν ἄλλων τῶν ὁμοιοτρόπων τούτοις· περὶ δὲ τῶν πεζῶν ὅσα ζωοτοκεῖ καὶ περὶ ἀνθρώπου λεκτέον τὰ συμβαίνοντα τὸν αὐτὸν τρόπον.

Περὶ μὲν οὖν ὀχείας εἴρηται καὶ ἰδίᾳ καὶ κοινῇ

¹ αὐξάνονται PD : αὔξονται C, vulg.

² πτ. καὶ πλ. AC : πλ. καὶ πτ. PD, vulg.

^a The word πεζόν is difficult to translate adequately and consistently (see Notes, §§ 39 ff.). Here its primary conno-
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rest : as for the bonito, you can see how much it grows from one day to another.

To sum up, we should bear in mind that even the same fishes, if they are not in the same places, will not have the same season for copulation, for pregnancy, for parturition, or for peaks of physical fitness. For example, the fish known as *korakinoi* spawn in some localities about the time of wheat-harvest. The statements made in these chapters aim at describing what happens *for the most part*.

Conger-eels, like other fishes, have fetations, but this is not equally plain in all localities, and in any case the fetation is not very clearly visible owing to the fat in the animal. The fetation is elongated, as in serpents. However, if you put it on the fire, it becomes plain enough : the fat goes up in smoke and melts, while the fetations jump about and crackle as they explode ; and in addition, if you handle the stuff and rub it in your fingers, the fat feels smooth and the egg rough. Some conger-eels have fat in them but no eggs ; others, conversely, have no fat, but they have the egg as I have just described it.

So far, then, as the animals that fly and swim are
concerned, and also those walking^a ones that are oviparous, we have described how practically all of them copulate and conceive and their other activities of that sort. We must now go on to those walking animals which are viviparous, and man, and describe their activities in the same way. XVIII

What I have already said about copulation contains (e) Viviparous quadrupeds : statements which apply to particular animals and to tation is animals which have feet and walk on land, as contrasted with animals that fly in the air or swim in the water. In fact the remaining πεζά considered in this Book are the land-dwelling viviparous quadrupeds.

κατὰ πάντων. πάντων δὲ κοινὸν τῶν ζώων τὸ περι-
 10 τὴν ἐπιθυμίαν καὶ τὴν ἡδονὴν ἐπτοῆσθαι τὴν ἀπὸ
 τῆς ὀχείας μάλιστα. τὰ μὲν οὖν θήλεα χαλεπώτατα,
 ὅταν ἐκτέκωσι πρῶτον, οἱ δ' ἄρρενες περὶ τὴν ὀχείαν.
 οἱ τε γὰρ ἵπποι δάκνουσι τοὺς ἵππους καὶ κατα-
 βάλλουσι καὶ διώκουσι τοὺς ἵππείας καὶ οἱ ὕες οἱ
 ἄγριοι χαλεπώτατοι, καίπερ ἀσθενέστεροι¹ περὶ τὸν
 15 καιρὸν τοῦτον ὄντες διὰ τὴν ὀχείαν, καὶ πρὸς ἀλλή-
 λους δὲ² ποιοῦνται μάχας θαυμαστάς, θωρακίζοντες
 ἑαυτοὺς καὶ ποιοῦντες τὸ δέρμα ὡς παχύτατον ἐκ
 παρασκευῆς, πρὸς τὰ δένδρα τρίβοντες καὶ τῷ πηλῷ
 μολύνοντες πολλάκις καὶ ξηραίνοντες ἑαυτοὺς· μά-
 χονται δὲ πρὸς ἀλλήλους, ἐξελαύνοντες ἐκ τῶν
 20 συοφορβίων, οὕτω σφοδρῶς ὥστε πολλάκις ἀμφό-
 τεροι ἀποθνήσκουσιν. ὡσαύτως δὲ καὶ οἱ ταῦροι
 καὶ οἱ κριοὶ καὶ οἱ τράγοι· πρότερον γὰρ ὄντες
 σύννομοι ἕκαστοι περὶ τοὺς καιροὺς τῆς ὀχείας μά-
 χονται διωστάμενοι πρὸς ἀλλήλους. χαλεπὸς δὲ καὶ
 ὁ κάμηλος περὶ τὴν ὀχείαν ὁ ἄρρηγ, ἐάν τ' ἀνθρωπος
 25 ἐάν τε κάμηλος πλησιάζῃ· ἵππῳ μὲν γὰρ ὄλως αἰεὶ
 πολεμεῖ.³ τὸν αὐτὸν δὲ τρόπον καὶ ἐπὶ τῶν ἀγρίων·
 καὶ γὰρ ἄρκτοι καὶ λύκοι καὶ λέοντες χαλεποὶ τοῖς
 πλησιάζουσι γίνονται περὶ τὸν καιρὸν τοῦτον. πρὸς
 ἀλλήλους δ' ἤττον μάχονται διὰ τὸ μὴ ἀγελαῖον
 εἶναι μηδὲν τῶν τοιούτων ζώων. χαλεπαὶ δὲ καὶ
 30 αἱ θήλειαι ἄρκτοι ἀπὸ τῶν σκύμνων, ὡσπερ καὶ αἱ
 κύνες ἀπὸ τῶν σκυλακίων. ἐξαγριαίνονται δὲ καὶ
 οἱ ἐλέφαντες περὶ τὴν ὀχείαν, διόπερ φασὶν οὐκ εἶναι
 αὐτοὺς ὀχεύειν τὰς θηλείας τοὺς τρέφοντας ἐν τοῖς
 Ἰνδοῖς· ἐμμανεῖς γὰρ γιγνομένους ἐν τοῖς χρόνοις

572 a τούτοις ἀνατρέπειν τὰς οἰκῆσεις αὐτῶν ἅτε φαύλως
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all animals in common. Common to all is the excite- General.
 ment connected with sexual appetite and especially
 with the pleasure derived from sexual intercourse.
 Female animals are most fierce just after parturition,
 males at the time of pairing : thus stallions will bite
 one another, throw their riders and chase them about ;
 wild boars, although less powerful than usual at this
 time owing to copulation, are extremely fierce, and
 fight one another in an amazing manner : they put
 on their defensive armour, viz., they deliberately
 thicken their hide as much as they possibly can by
 rubbing against trees, and by repeatedly wallowing
 in the mud and then letting themselves dry off. They
 start the fight by driving each other away from their
 feeding-places, and the duels are so furious that often
 both combatants are killed. The same is true of bulls,
 rams, and he-goats : before the pairing season they
 herd and feed together, but when this arrives they
 fight and draw apart. The male camel too is fierce at
 pairing-time if a human being or another camel comes
 near him. (As for a horse, the camel always treats
 him altogether as an enemy.) The same applies
 to wild animals. Bears, wolves, and lions are fierce
 at this time to any outsiders who come near, though
 they fight less with each other because none of these
 animals is gregarious. The she-bear too is fierce after
 cubbing, as in fact bitches are after their puppies are
 born. Male elephants also become savage at pairing-
 time, and that is why people say that in India
 elephant-raisers will not allow them to mount the
 females, the reason being that they get so frantic at
 this time that they wreck their keepers' houses (jerry-

¹ ἀσθενέστεροι C : -ατοι APD, vulg.

² δὲ A : μὲν P, om. D.

³ ἵππῳ . . . πολεμεῖ secl. Dt.

ἠκοδομημένας, καὶ ἄλλα πολλὰ ἐργάζεσθαι. φασὶ δὲ καὶ τὴν τῆς τροφῆς δαψίλειαν πραοτέρους αὐτοὺς παρέχειν· καὶ προσάγοντες δ' αὐτοῖς ἑτέρους κολάζουσι καὶ δουλοῦνται προστάττοντες τύπτει τοῖς
 5 προσαγομένοις. τὰ δὲ πολλάκις ποιούμενα τὰς ὀχείας καὶ μὴ κατὰ μίαν ὥραν, οἷον τὰ συνανθρωπεύόμενα, ὕες τε καὶ κύνες, ἦττον τοιαῦτα ποιοῦντα φαίνεται διὰ τὴν ἀφθονίαν τῆς ὀμιλίας.

Τῶν δὲ θηλειῶν ὀρητικῶς ἔχουσι πρὸς τὸν συνδρασμὸν μάλιστα μὲν ἵππος, ἔπειτα βοῦς. αἱ μὲν
 10 ὄν ἵπποι αἱ θήλειαι ἵππομανοῦσιν· ὅθεν καὶ ἐπὶ τὴν βλασφημίαν τὸ ὄνομα αὐτῶν ἐπιφέρουσιν ἀπὸ μόνου τῶν ζώων τούτου¹ ἐπὶ τῶν ἀκολάστων περὶ τὸ ἀφροδισιάζεσθαι. λέγονται δὲ καὶ ἐξανεμοῦσθαι περὶ τὸν καιρὸν τοῦτον· διὸ ἐν Κρήτῃ οὐκ ἐξαιροῦσι τὰ ὀχεία ἐκ τῶν θηλειῶν. ὅταν δὲ τοῦτο πάθωσι, θέουσι ἐκ
 15 τῶν ἄλλων ἵππων. (ἔστι δὲ τὸ πάθος ὅπερ ἐπὶ τῶν ὑῶν λέγεται τὸ καπρίζειν.)² θέουσι δ' οὔτε πρὸς ἑω οὔτε πρὸς δυσμάς, ἀλλὰ πρὸς ἄρκτον ἢ νότον. ὅταν δ' ἐμπέσῃ τὸ πάθος, οὐδένα ἐῶσι πλησιάζειν, ἕως ἂν ἢ ἀπέπωσι διὰ τὸν πόνον ἢ πρὸς θάλατταν ἔλθωσιν· τότε δ' ἐκβάλλουσί τι. καλοῦσι δὲ καὶ
 20 τοῦτο, ὡσπερ <τὸ> ἐπὶ τοῦ τικτομένου <πώλου>,³ ἵππομανές· ἔστι δ' οἷον ἢ καπρία, καὶ ζητοῦσι τοῦτο μάλιστα πάντων αἱ περὶ τὰς φαρμακείας. περὶ δὲ τὴν ὥραν τῆς ὀχείας συγκύπτουσι τε πρὸς ἀλλήλας μᾶλλον ἢ πρότερον, καὶ τὴν κέρκον κινοῦσι πυκνά,
 25 καὶ τὴν φωνὴν ἀφιάσιν ἀλλοιοτέραν ἢ κατὰ τὸν

¹ τούτου] τούτου τὴν AC: τὴν D, vulg., om. P.

² haec post ἀφροδ. v. 13 transfert Th., delet Pi.

³ τὸ et πώλου suppl. Sn.

^a See note on 541 a 30.

built constructions) and do much other damage. It is also alleged that a lavish supply of food keeps them calmer. In addition, they bring in other elephants to be with them, and chastise and subdue them by setting these others on to belabour them. Animals which pair frequently and not at one season only, such as domesticated animals, swine and dogs, do not exhibit this kind of behaviour to such an extent owing to the frequency of their coition.

In eagerness for sexual intercourse, of all female animals the mare comes first; next, the cow. Mares become horse-mad (hippomaniac), and the term derived from this one animal is applied by way of abuse to women who are inordinate in their sexual desires. Mares are also said to get impregnated by the wind at this season^a; and that is why in Crete they never take the stallions away from the mares, for when they get into that state they run away from all other horses. (This is the condition which in sows is known as being boar-mad.) They run off neither to the east nor to the west, but either to the north or the south. When this condition overtakes them, they allow no one to come near until they are either exhausted by the effort or have got to the sea; at that stage they discharge a certain substance which is known by the same name as that which appears on the offspring mares produce, viz., *hippomanes*^b: it is similar to the sow-virus, and is the chief thing sought after by women who deal in philtres and drugs. About pairing-time mares huddle together more than they have done previously, they keep their tails continuously moving, and their neigh sounds quite different

^b See also 577 a 8, 605 a 2, and cf. Verg. *Aen.* iv. 515 f., *Georg.* iii. 280 ff., Juv. vi. 133, 616.

572 a

ἄλλον χρόνον· ρεῖ δ' αὐταῖς ἐκ τοῦ αἰδοίου ὅμοιον
γονῆ, λεπτότερον δὲ πολὺ ἢ τὸ τοῦ ἄρρενος· καὶ
καλοῦσι τοῦτό τινας ἵππομανές, ἀλλ' οὐ τὸ ἐπὶ τοῖς
πώλοις ἐπιφνόμενον· ἐργῶδες δ' εἶναι φασι λαβεῖν·
κατὰ μικρὸν γὰρ ρεῖν· καὶ οὐροῦσι δὲ πολλάκις,
30 ὅταν σκυζῶσι, καὶ πρὸς αὐτὰς παίξουσιν.

Τὰ μὲν οὖν περὶ τὰς¹ ἵππους τοῦτον ἔχει τὸν
τρόπον, αἱ δὲ βόες ταυρῶσιν· οὕτω δὲ σφόδρα κατα-
κώχονται τῷ πάθει γίνονται, ὥστε μὴ δύνασθαι
αὐτῶν κρατεῖν μηδὲ λαμβάνεσθαι τοὺς βουκόλους.

572 b δῆλαι δ' εἰσὶ καὶ αἱ ἵπποι καὶ αἱ βόες, ὅταν ὀργῶσι
πρὸς τὴν ὀχείαν, καὶ τῇ ἐπάρσει τῶν αἰδοίων καὶ τῷ
πυκνὰ οὐρεῖν αἱ βόες ὥσπερ αἱ ἵπποι· ἔτι δ' αἱ γε
βόες ἐπὶ τοὺς ταύρους ἀναβαίνουνσι, καὶ παρακολου-
5 θοῦσιν αἰεὶ, καὶ παρεστᾶσιν· πρότερα δὲ τὰ νεώτερα
ὀργᾶ πρὸς τὴν ὀχείαν καὶ ἐν ταῖς² ἵπποις καὶ ἐν
ταῖς³ βουσίν· καὶ ὅταν εὐημερίαί γίνωνται καὶ τὰ
σώματα εὖ ἔχωσι, μᾶλλον ὀργῶσιν· αἱ μὲν οὖν
ἵπποι ὅταν ἀποκείρωνται, ἀποπαύονται τῆς ὀρμῆς
μᾶλλον καὶ γίνονται κατηφέστεραι· οἱ δ' ἄρρενες
10 ἵπποι διαγιγνώσκουσι τὰς θηλείας τὰς συννόμους
ταῖς ὁσμαῖς, κἂν ὀλίγας ἡμέρας ἅμα γένωνται πρὸ
τῆς ὀχείας· κἂν ἀναμιχθῶσιν ἄλλαι,³ ἐξελαύνουσι
δάκνοντες, καὶ νέμονται χωρὶς, ἕκαστοι τὰς ἑαυτῶν
ἔχοντες· διδόασι δ' ἐκάστω περὶ τριάκοντα ἢ μικρῷ
πλείους· ὅταν δὲ προσήη τις ἄρρην, συστρέψας εἰς
15 ταῦτό καὶ περιδραμῶν κύκλω, προσελθῶν μάχεται·

¹ τὰς D: τοὺς ACP, vulg.

² ταῖς bis D: τοῖς ACP, vulg.

³ καὶ (ἐάν suprascr. A², κἂν P) ἀναμιχθῶσιν codd.: ἀλλήλοις

from what it does at other times. A fluid also flows out of their sexual organs, similar to semen, but much thinner than the male's; and some people apply the name *hippomanés* to this instead of to the substance that grows on foals. They say it is difficult to procure because it flows out in such small quantities. Further, mares discharge urine frequently when they are in heat, and frisk about with each other. Such then is the behaviour of mares.

Cows get bull-struck, and this condition drives them so frantic that the herdsmen cannot control them or even get hold of them. Both mares and cows, when they are eager for intercourse, show it plainly by raising their genital organs and by frequently discharging urine. In addition, cows mount the bulls, follow them about the whole time, and stand beside them. The young ones, both mares and cows, are the first to want intercourse; and the warmer the weather and the better their physical condition, the more they want it. When mares have their manes shorn, their eagerness tends to slacken off and they take on a somewhat hangdog appearance. The stallions recognize the mares of their companies by their scent, even if they have been together for only a few days before breeding-time; and if others get mixed up with them, they bite them and drive them off. They feed apart, each with his own company of mares. Each stallion is given about thirty mares, or slightly more. When another stallion approaches, he will round his mares into a compact group, run round them, and then go forward to fight the intruder; and

PA²: ἀλλήλαις A¹C: τὰς ἄλλας D: καὶ (καὶ <αἱ> Dt.) ἐν μιχθῶσιν ἄλλοις Sn.: κἂν ἀναμιχ. ἀλλήλαις vulg.: ipse ἄλλαι scripsi.

καὶν τις κινήται, δάκνει καὶ κωλύει. ὁ δὲ ταῦρος, ὅταν ὦρα τῆς ὀχείας ᾗ, τότε γίνεταί συννομος καὶ μάχεται τοῖς ἄλλοις, τὸν δὲ πρότερον χρόνον μετ' ἀλλήλων εἰσίν, ὃ καλεῖται ἀτιμαγελεῖν¹· πολλάκις
 20 γὰρ οἱ γ' ἐν τῇ Ἡπείρῳ οὐ φαίνονται τριῶν μηνῶν. ὅλως δὲ τῶν ἀγρίων τὰ ἄρρενα¹ πάντα ἢ τὰ πλείστα οὐ συννέμονται τοῖς θήλεσι πρὸ τῆς ὥρας τοῦ ὀχεύειν, ἀλλ' ἐκκρίνονται, ὅταν εἰς ἡλικίαν ἔλθωσι, καὶ χωρὶς βόσκονται τὰ ἄρρενα τῶν θηλειῶν. καὶ αἱ
 25 ὕες δ' ὅταν ἔχωσι πρὸς τὴν ὀχείαν ὀρμητικῶς, ὃ καλεῖται καπρᾶν, ὠθοῦνται καὶ πρὸς τοὺς ἀνθρώπους. περὶ δὲ τὰς κύνας τὸ τοιοῦτον πάθος καλεῖται σκυζᾶν. ἔπαρσις μὲν οὖν τοῖς θήλεσι γίνεταί² τῶν αἰδοίων, ὅταν πρὸς τὴν ὀχείαν ὀργῶσι, καὶ ὑγρασία περὶ τὸν τόπον· αἱ δ' ἵπποι καὶ ἀπορραίνουσι λευκὴν ὑγρότητα περὶ τὸν καιρὸν τοῦτον.
 30 Καθάρσεις δὲ γίνονται μὲν καταμνηνίων, οὐ μὴν ὅσαι γε ταῖς γυναιξίν οὐδενὶ τῶν ἄλλων ζώων. τοῖς μὲν οὖν προβάτοις καὶ αἰξίν, ἐπειδὴν ὦρα ἢ ὀχεύεσθαι, ἐπισημαίνει πρὸ τοῦ ὀχεύεσθαι· καὶ ἐπειδὴν ὀχευθῶσι, γίνεταί τὰ σημεῖα, εἶτα διαλείπει, μέχρι
 573 a οὐδ' ἂν μέλλωσι τίκτειν. τότε δ' ἐπισημαίνει, καὶ οὕτω γινώσκουσιν ὅτι ἐπίτοκά εἰσιν³ οἱ ποιμένες. ἐπειδὴν δὲ τέκη, καθάρσις γίνεταί πολλή, τὸ μὲν πρῶτον οὐ σφόδρα αἱματώδης, ὕστερον μέντοι σφόδρα. βοῖ δὲ καὶ ὄνω καὶ ἵππῳ πλείων⁴ μὲν τούτων
 5 διὰ τὸ μέγεθος, ἐλάττων⁵ δὲ κατὰ λόγον πολλῶ.

¹ τῶν ἀγρίων τὰ ἄρρενα scripsi: τὰ ἄρρενα conl. A.-W.: τὰ ἀγρία PD, vulg.: τὰ ἀγριώτερα AC: omnes illi mares aut plures non pascuntur cum feminis ante tempus coitus, et praecipue silvestria quadrupedum Σ. fortasse ita scribendum: ὅλως δὲ τὰ ἄρρενα πάντα . . . ὀχεύειν, <καὶ μάλιστα τὰ ἀγριώτερα <τῶν τετραπόδων>, ἀλλ'.

if one (of the mares) makes a move, he will bite her and stop her. The bull at pairing-time begins grazing with the cows and fights other bulls; during the preceding period the bulls are together, and this is called "herd-shunning": thus, very often in Epirus bulls will not be seen for three months at a time. And generally, we may say that all, or most, wild male animals do not graze with the females before the season for pairing, but go off on their own once they have reached maturity, and the males and females feed apart. Sows, too, when they are eager for copulation (a condition which is described as being "boar-mad"), will thrust themselves even against human beings. In bitches this condition is known as being in heat. The sexual organ rises at this time, when they are eager for sexual intercourse, and there is moisture around that region. Mares discharge a white fluid at this time.

Menstruation occurs in female animals, but in none of them on so great a scale as in women. In ewes and she-goats, when the breeding season has arrived, it appears before they copulate; after copulation it is still present, then it ceases, until they are on the point of giving birth. Then it comes on again, and that is how the shepherds know the ewes are on the point of parturition. After the young are born, there is copious menstruation, which at first shows little sign of blood, but there are very strong signs of blood later. In cows, she-asses and mares, owing to their greater size, it is more copious than in ewes, but much less in

² γίνεταί C: ἐγγίνεταί PD, vulg.: γίνονται A.

³ ἐπίτοκά εἰσιν D: ἐπίτοκοι ACP, vulg.

⁴ πλείων Dt.: πλείω codd., edd.

⁵ ἐλάττων Dt.: ἐλάττω AC, vulg.: ἐλαττων PD.

ἡ μὲν οὖν βοῦς, ὅταν ὀργᾶ πρὸς τὴν ὀχείαν ἢ θήλεια, καθαίρεται κάθαρσιν βραχείαν ὅσον ἡμικοτύλιον ἢ μικρῶ πλέον· καιρὸς δὲ γίννεται τῆς ὀχείας μάλιστα περὶ τὴν κάθαρσιν. ἵππος δὲ τῶν τετραπόδων ἀπάντων εὐτοκώτατον καὶ λοχίων καθαρώτατον, καὶ
 10 ἐλαχίστην προίεται αἵματος ῥύσιν, ὡς κατὰ τὸ τοῦ σώματος μέγεθος. μάλιστα δὲ καὶ ταῖς βουσί καὶ ταῖς ἵπποις τὰ καταμήνια ἐπισημαίνει διαλείποντα δίμηνον καὶ τετράμηνον καὶ ἐξάμηνον· ἀλλ' οὐ ῥάδιον γινῶναι μὴ παρεπομένῳ μηδὲ συνήθει σφόδρα,
 15 διὸ ἔνιοι οὐκ οἴονται γίννεσθαι αὐτοῖς. τοῖς δ' ὀρεῦσι τοῖς θήλεσιν οὐδὲν γίννεται καταμήνιον, ἀλλὰ τὸ οὖρον παχύτερον τὸ τῆς θηλείας. ὅλως μὲν οὖν τὸ τῆς κύστεως περίττωμα τοῖς τετράποσι παχύτερον ἢ τὸ τῶν ἀνθρώπων, τὸ δὲ τῶν προβάτων καὶ τῶν αἰγῶν τῶν θηλειῶν παχύτερον ἔτι ἢ τὸ τῶν ἀρρένων· ὄνου δὲ λεπτότερον τὸ τῶν θηλειῶν, βοῦς δὲ δριμύτερον τὸ τῆς θηλείας. μετὰ δὲ τοὺς τόκους ἀπάντων τῶν τετραπόδων παχύτερον τὸ οὖρον γίννεται, καὶ μᾶλλον τῶν ἐλάττω προἰεμένων κάθαρσιν. τὸ δὲ γάλα γίννεται, ὅταν ὀχεύεσθαι ἀρχωνται, πυσειδές· χρήσιμον δὲ γίννεται, ἐπειδὰν τέκωσιν
 20 ὕστερον. κύντα δὲ καὶ πρόβατα καὶ αἰγες πιότερα γίννονται καὶ ἐσθίουσι μᾶλλον· καὶ βόες δ' ὡσαύτως καὶ τᾶλλα¹ τετράποδα πάντα. ὀρμητικώτατα μὲν οὖν ὡς ἐπὶ τὸ πᾶν εἰπεῖν πρὸς τὴν ὀχείαν τὴν ἔαριν ἦσαν ἐστίν· οὐ μὴν ἅπαντά² γε ποιεῖται τὸν
 30 αὐτὸν καιρὸν τὰς³ ὀχείας, ἀλλὰ πρὸς τὴν ἐκτροφὴν τῶν τέκνων ἐν τοῖς καθήκουσι καιροῖς.

Αἱ μὲν οὖν ἡμέροι ὕες κύουσι τέτταρας μῆνας, τίκτουσι δὲ τὰ πλείστα εἴκοσιν· πλην ἂν πολλὰ
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proportion. Thus the cow, when in heat, produces a scanty discharge, about a quarter of a pint or a little less; the best time for copulation is when this is occurring. Of all quadrupeds the mare is the most easily delivered of its young, produces least discharge at birth, and the least flow of blood, in proportion to its size. In cows and mares menstruation appears mostly at intervals of two, four, and six months; but it is not easy to detect it without close attention and thorough familiarity, and in consequence some people suppose it does not occur in these animals. In female mules it does not occur at all, but the female's urine is thicker. In general, the residue^a from the bladder in quadrupeds is thicker than in human beings; in sheep and goats the females' is thicker than the males'; on the other hand, in asses the females' is thinner, and the cow's is more pungent than the bull's. After parturition all quadrupeds' urine becomes thicker, and even more so in the case of those whose menstrual discharge is less. When they begin copulation, the milk becomes purulent,^b but later, after parturition, it can be used. During pregnancy ewes and she-goats get fatter and eat more; so do cows and all the other quadrupeds. Generally speaking, animals are most eager for sexual intercourse during spring; however, they do not all pair at the same season, but time it so as to ensure a suitable time for the rearing of their young.

Now domesticated sows carry their young for four months, and bring forth twenty at the most; though

^a See Notes, § 25.

^b Beestings; cf. 522 a 3.

¹ τὰ add. vulg., om. CPD.

² ἅπαντά Pi., Sn. docente: τὰ πάντα PD, vulg.: πάντα AC.

³ τὰς Pi., Sn. docente: τῆς codd.

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τέκωσω, οὐ δύνανται ἐκτρέφειν πάντα. γηράσκουσαι δὲ τίκτουσι μὲν ὁμοίως, ὀχεύονται δὲ βραδύτερον· κυῖσκονται δ' ἐκ μιᾶς ὀχείας, ἀλλὰ πολλάκις

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ἐπιβιάσκουσι διὰ τὸ ἐκβάλλειν μετὰ τὴν ὀχείαν τὴν καλουμένην ὑπὸ τινων καπρίαν. τοῦτο μὲν οὖν συμβαίνει πάσαις, ἔναι δ' ἅμα τούτῳ καὶ τὸ σπέρμα προίενται. ἐν δὲ τῇ κηῖσει ὃ ἂν βλαφθῇ τῶν τέκνων

5 καὶ τῷ μεγέθει πηρωθῇ, καλεῖται μεταχοῖρον· τοῦτο δὲ γίνεταί ὅπου ἂν τύχη τῆς ὑτέρας. ὅταν δὲ γεννήσῃ, τῷ πρώτῳ τὸν πρῶτον παρέχει μαστόν. θυῶσαν δ' οὐ δεῖ εὐθὺς βιβιάζειν, πρὶν ἂν μὴ τὰ ὦτα καταβάλῃ· εἰ δὲ μὴ, ἀναθῶα πάλιν. ἔαν δ' ὀργῶσαν βιβιάσῃ, μία ὀχεία, ὡσπερ εἴρηται, ἀρκεῖ. συμφέρει

10 δ' ὀχεύοντι μὲν τῷ κάπρῳ παρέχειν κριθᾶς, τετοκυῖα δὲ τῇ ὑῖ κριθᾶς ἐφθᾶς. εἰσι δὲ τῶν ὑῶν αἱ μὲν εὐθὺς καλλίχοιροι μόνον, αἱ δ' ἐπαυξανόμεναι [τὰ τέκνα καὶ τὰς δέλφakas χρηστὰς γεννώσιν.]¹ φασὶ δὲ τινες, ἔαν τὸν ἕτερον ὀφθαλμὸν ἐκκοπῇ ἢ ὑς, ἀπο-
15 θνήσκειν διὰ ταχέων ὡς ἐπὶ τὸ πολὺ. ζῶσι δ' αἱ πλείστα μὲν περὶ ἕτη πεντεκαίδεκα, ἔναι δὲ καὶ τῶν εἴκοσιν ὀλίγον ἀπολείπουσιν.²

XIX Τὰ δὲ πρόβατα κυῖσκειται μὲν ἐν τρισὶν ἢ τέτταρ-
σιν ὀχείαις, ἔαν δ' ὕδωρ ἐπιγένηται μετὰ τὴν ὀχείαν, ἀμβλίσκει.³ ὁμοίως δὲ καὶ αἱ αἰγες. τίκτουσι δὲ
20 τὰ μὲν πλείστα δύο, ἐνίστε δὲ καὶ τρία ἢ τέτταρα. κύει δὲ πέντε μῆνας καὶ πρόβατον καὶ αἶξ· διὸ ἐν ἐνίοις τόποις, ὅσοι ἀλεινοὶ εἰσι καὶ ἐν οἷς εὐημεροῦσι

¹ seclusi.² θυῶσαν v. 7 hucusque secl. A.-W., Dt. ut partim ex 546 a 26 repetita.

if the litter is very large they cannot rear them all. As sows grow old they continue bearing, but are less eager for intercourse. A single copulation is sufficient to produce conception, but they put the boar to the sow many times over because after intercourse she drops the *kapria* (sow-virus) as some call it. This happens with all sows; but some of them eject the semen as well. Any one of the litter which gets injured during pregnancy and stunted in size is called a *metachoiron*; this may happen in any part of the uterus. Once the young are born, the sow offers her first teat to the first of them. When the sow is in heat, she ought not to be put to the boar immediately—not until she has dropped her ears^a; otherwise she will get in heat again; but if the boar mounts her while in heat, a single copulation, as I have said, is sufficient. It is advisable to provide barley for the boar that serves the sow, and boiled barley for the sow when she has littered. Some sows produce fine litters straight away, and only then; others as they grow bigger [produce good offspring which do well]. Some allege that if a sow has one eye knocked out she is almost certain to die soon after. Most sows live about fifteen years, some almost reach the age of twenty.

Ewes become pregnant after three or four copulations, but if rain ensues, miscarriage occurs; the same happens with she-goats. The ewe normally produces two lambs, sometimes three or four. Both ewe and she-goat are pregnant for five months; hence in districts that are sunny, where they can thrive and get

XIX
Sheep and
goats.^a Cf. 546 a 26.³ ἀμβλίσκει propos. A.-W.: ἐκτινρώσκει mavult Dt.: ἀνακυῖσκει codd., edd.: conferas 610 b 35, G.A. 752 b 4.

καὶ τροφήν ἀφθονον ἔχουσι, δις τίκτουσιν. ζῆ δ' αἶξ μὲν περὶ ἔτη ὀκτώ, πρόβατον δὲ δέκα, τὰ δὲ πλεῖστα ἐλάττω, πλὴν οἱ ἡγεμόνες τῶν προβάτων·
 25 οὗτοι δὲ καὶ πεντεκαίδεκα. (ἐν ἐκάστη γὰρ¹ ποίμνη κατασκευάζουσιν ἡγεμόνα ἓνα²) τῶν ἀρρένων, ὅς ὅταν ὀνόματι κληθῆ ὑπὸ τοῦ ποιμένου προηγείται· συνελίζουσι δὲ τοῦτο δρᾶν ἐκ νέων.) τὰ δὲ περὶ τὴν Αἰθιοπίαν πρόβατα ζῆ καὶ δώδεκα καὶ τριακαίδεκα ἔτη, καὶ αἶγες δὲ καὶ δέκα καὶ ἕνδεκα. ὀχεύει δὲ
 30 καὶ ὀχεύεται, ἕως ἂν ζῆ, καὶ πρόβατον καὶ αἶξ.

Διδυμοτοκοῦσι δὲ καὶ πρόβατα καὶ αἶγες διὰ τ' εὐβοσίαν, καὶ ἐὰν ὁ κριὸς ἢ ὁ τράγος ἢ διδυμοτόκος ἢ ἡ μήτηρ. θηλυγόνα δέ, τὰ δ' ἀρρενογόνα γίνονται διὰ τε τὰ ὕδατα (ἔστι γὰρ τὰ μὲν θηλυγόνα τὰ δ' ἀρρενογόνα) καὶ διὰ τὰ ὀχεῖα³ ὡσαύτως· καὶ⁴ βο-
 574 a ρείοις μὲν ὀχεύομενα ἀρρενοτοκεῖ μᾶλλον, νοτίοις δὲ θηλυτοκεῖ. μεταβάλλει δὲ καὶ τὰ θηλυτοκοῦντα καὶ ἀρρενοτοκεῖ· δεῖ δ' ὄραν ὀχεύομενα πρὸς βορέαν. τὰ δ' εἰωθότα πρῶτ' ὀχεύεσθαι, ἐὰν ὀψέ ὀχεύηται,⁵
 5 οὐχ ὑπομένουσι τοὺς κριούς. λευκὰ δὲ τὰ ἔκγονα γίνονται καὶ μέλανα, ἐὰν ὑπὸ τῆ τοῦ κριοῦ γλώττη λευκαὶ φλέβες ὦσιν ἢ μέλαιναί, λευκὰ μὲν ἐὰν λευκαί, ἐὰν δὲ μέλαιναί, μέλανα⁶. ἐὰν δ' ἀμφότεραι, ἀμφω⁷. πυρρά δ' ἐὰν πυρραί· τὰ δὲ τὸ ἀλυκὸν ὕδωρ πίνοντα πρότερον ὀχεύεται· δεῖ δ' ἀλίξειν πρὶν τε-
 10 κείν καὶ ἐπειδὰν τέκη, καὶ ἕαρος αὐθις· αἰγῶν δ' ἡγεμόνα οὐ καθιστᾶσιν οἱ νομεῖς διὰ τὸ μὴ μόνιμον

¹ γὰρ P, A.-W., Dt.: δὲ ACD, vulg.

² ἓνα (vel ἐκ) suppl. A.-W.: *aristotem unum rectorem* Σ.

³ τὰ ὀχεῖα AC: τὰς ὀχείας PD, vulg.: τὰς χώρας voluit Karsch.

⁴ ὡσαύτως· καὶ] ταῦτα γὰρ A.-W.

⁵ ὀχεύηται Dt.: ὀχευθῆ A.-W.: ὀχεύη τις ACD, vulg.: ὀχευθῆ τις P.

⁶ sic AC: μέλανα δ' ἐὰν μελ. PD, vulg.

plenty to eat, they bear twice a year. A goat lives eight years, a sheep ten, though most of them do not live so long, except that bell-wethers (flock-leaders) may live to fifteen. (In every flock they train one of the rams to be bell-wether. When the shepherd calls him by name, he takes the lead. Rams are trained to this from their earliest days.) In Ethiopia sheep live for as long as twelve or thirteen years, goats for ten or eleven. Sheep and goats, both sexes, have intercourse throughout their lives.

The production of twin lambs and goats may occur because of good pasturage or because the ram or he-goat, or the dam, is a twin-producer. Some give birth to females, others to males, and the difference is due to the waters they drink (some waters are productive of females, some of males) and to the sires in the same way. If copulation takes place while north winds are blowing, they tend to produce males; if south winds, females.^a Female-bearing animals may change over to become male-bearing: they must face north during their intercourse. Ewes which are accustomed to early copulation will not submit to having it late. The colour of the lambs, white or black, depends upon whether the blood-vessels under the ram's tongue are white or black: if the blood-vessels are white, the lambs are white; if black, black; if both, both; if red, then red. Those which drink brackish water are the first to be mounted: salt must be supplied before and after lambing, and again in spring. Herdsmen do not appoint any leader of the flock for goats, because they are not sufficiently stationary in their

^a Cf. G.A. 766 b 35, 767 a 9 ff.

⁷ ἀμφω AC: ἀμφότερα PD, vulg.

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εἶναι τὴν φύσιν αὐτῶν, ἀλλ' ὀξεῖαν καὶ εὐκίνητον. τῶν δὲ προβάτων ἐὰν μὲν τὰ πρεσβύτερα ὀρμᾶ πρὸς τὴν ὀχείαν κατὰ τὴν τεταγμένην ὥραν, φασὶν οἱ ποιμένες σημεῖον εὐετηρίας εἶναι τοῖς προβάτοις,

15 ἐὰν δὲ τὰ νεώτερα, κακοθηνεῖν¹ τὰ πρόβατα.

XX Τῶν δὲ κυνῶν ἔστι μὲν γένη πλείω. ὀχεύει δὲ κύων ἢ Λακωνικῆ² ὀκτάμηρος καὶ³ ὀχεύεται· καὶ τὸ σκέλος δ' αἵροντες οὐροῦσιν ἤδη ἔνιοι περὶ τὸν χρόνον τοῦτον. κυῖσκειται δὲ κύων ἐκ μιᾶς ὀχείας·

20 δῆλον δὲ τοῦτο γίνεταί μάλιστα δὴ⁴ τοῖς κλέπτουσι τὰς ὀχείας· ἀπαξ γὰρ ἐπιβάντες πληροῦσιν. κύει δ' ἢ μὲν Λακωνικῆ ἕκτον μέρος τοῦ ἐνιαυτοῦ (τοῦτο δ' ἔστιν ἡμέραι ἐξήκοντα), κᾶν ἄρα μιᾶ ἢ δυοῖν ἢ τρισὶ πλείονας ἡμέρας ἢ καὶ⁵ ἐλάττους μιᾶ. τυφλά δὲ γίνεταί αὐτῇ τὰ σκυλάκια, ὅταν τέκη, δώδεκα ἡμέρας. τεκοῦσα δὲ πάλιν ὀχεύεται ἕκτω μηνί, καὶ

25 οὐ πρότερον. ἔνιοι δὲ κύουσι τῶν κυνῶν⁶ πέμπτου μέρος τοῦ ἐνιαυτοῦ (τοῦτο δ' ἔστιν ἡμέραι ἐβδομήκοντα καὶ δύο), τυφλά δὲ γίνεταί τὰ σκυλάκια τούτων τῶν κυνῶν ἡμέρας δεκατέτταρας. ἔνιοι δὲ κύουσι μὲν τέταρτον μέρος τοῦ ἐνιαυτοῦ (τοῦτο δ' ἔστι τρεῖς μῆνες ὅλοι), τυφλά δὲ τὰ σκυλάκια τού-

30 των γίνεταί ἐπτακαίδεχ' ἡμέρας.⁷ δοκεῖ δὲ σκυζᾶν τὸν ἴσον χρόνον κύων. τὰ δὲ καταμήνια ταῖς κυσὶν ἐπτά ἡμέρας⁸ γίνεταί· συμβαίνει δ' ἅμα καὶ ἔπαρσις αἰδοίου. ἐν δὲ τῷ χρόνῳ τούτῳ οὐ προσίενται

574 b ὀχείαν, ἀλλ' ἐν ταῖς μετὰ ταῦτα⁹ ἐπτά ἡμέραις· τὰς γὰρ πάσας δοκεῖ σκυζᾶν ἡμέρας τέτταρας καὶ δέκα ὡς ἐπὶ τὸ πολὺ, οὐ μὴν ἀλλὰ τισι καὶ περὶ ἑκκαίδεχ'

¹ κακοθηνεῖν PD, vulg. ² μὲν add. PD, vulg., om. AC.

³ ἢ θήλεια δ' ὡσαύτως add. AC, om. PD, vulg.

nature : they are easily excited and unsettled. If the older sheep are eager for intercourse at the appointed season, the shepherds say it is a sign that the flock will thrive ; if the younger ones, that the flock will be in poor shape.

There are several breeds of dog. Laconian hounds **XX** of both sexes copulate at the age of eight months ; **Dogs.** at about this time some kinds of dog raise the leg for voiding urine. The bitch conceives at one copulation ; this is plainly shown in cases where a dog covers a bitch by stealth : impregnation is effected by one mounting. The Laconian bitch is pregnant for a sixth of a year (*i.e.*, sixty days)—perhaps one, two, or three days more than this, or even one day less ; the puppies are born blind and remain so for twelve days. After giving birth the bitch will be mounted again in six months, but not sooner. Some bitches are pregnant for a fifth of a year (*i.e.*, seventy-two days), and the puppies of these are blind for fourteen days. Others are pregnant for a quarter of a year (*i.e.*, three whole months) ; their puppies are blind for seventeen days. The bitch, so it appears, is in heat for an equal length of time. Menstruation in bitches lasts for seven days ; simultaneously the generative organ rises. During this time the bitch does not permit the dog to have sexual intercourse, but in the seven days following : in fact it appears to be a general rule for all bitches that they are in heat for fourteen days ; never-

⁴ δὴ AC : ἐν PD, vulg.

⁵ ἢ καὶ scripsi : ἢ AC, A.-W., Dt. : καὶ PD, vulg. : κᾶν Pi.

⁶ τὸ add. D, vulg., om. ACF.

⁷ ἡμέρας A, Sn. : ἡμέραις CPD, vulg.

⁸ ἡμέρας P : ἡμέραις ACD, vulg.

⁹ ταῦτα AC : ταύτας PD, vulg.

ἡμέρας γεγένηται τοῦτο τὸ πάθος. ἢ δ' ἐν τοῖς
 τόκοις κάθαρσις γίνεταί ἅμα τοῖς σκυλακίοις τι-
 5 κτομένοις, ἔστι δ' αὕτη παχέα καὶ φλεγματοῦδης·
 καὶ τὸ¹ πλήθος δ', ὅταν ἐκτέκωσιν,² ἀπισχναίνεται
 ἔλαττον ἢ³ κατὰ τὸ⁴ σῶμα.⁵ τὸ δὲ γάλα αἰ κύνες
 ἰσχυοῦσι πρὸ τοῦ τεκεῖν ὡς ἐπὶ τὸ πολὺ ἡμέραις⁶
 πέντε· οὐ μὴν ἀλλ' ἐνιαῖς καὶ ἐπτὰ γίνεταί πρό-
 10 γάλα, ὅταν τέκωσιν. ἢ δὲ Λακωνικὴ μετὰ τὴν
 ὀχείαν τριάκονθ' ἡμέραις ὕστερον. τὸ μὲν οὖν πρῶ-
 τον παχὺ ἔστι, χροινιζόμενον δὲ γίνεταί λεπτότερον.
 διαφέρει δὲ παχύτητι τὸ κύνειον⁷ τῶν ἄλλων ζώων
 μετὰ τὸ ὕειν καὶ δασυπόδειον. γίνεταί δὲ σημεῖον
 καὶ ὅταν ἡλικίαν ἔχωσι τοῦ ὀχέεσθαι· ὡσπερ γὰρ
 15 τοῖς ἀνθρώποις, ἐπὶ ταῖς θηλαῖς τῶν μαστῶν ἐπι-
 γίνεταί ἀνοίδησίς τις καὶ χόνδρον ἰσχυοῦσι· οὐ μὴν
 ἀλλ' ἔργον μὴ συνήθει ὄντι ταῦτα καταμαθεῖν· οὐ
 γὰρ ἔχει μέγεθος οὐδὲν τὸ σημεῖον. τῇ μὲν οὖν
 θηλείᾳ τοῦτο συμβαίνει, τῷ δ' ἄρρενι οὐδὲν τούτων.
 20 ἐπὶ τὸ πολὺ ὅταν ἐξάμηνοι ὦσιν· ποιοῦσι δὲ τινες
 τοῦτο καὶ ὕστερον, ἤδη ὀκτάμηνοι ὄντες, καὶ πρό-
 τερον ἢ ἐξάμηνοι· ὡς γὰρ ἀπλῶς εἰπεῖν, ὅταν ἰσχύ-
 εω⁸ ἄρξωνται, αὐτὸ ποιοῦσιν. αἱ δὲ θήλειαι πᾶσαι
 καθεζόμεναι οὐροῦσιν· ἤδη δὲ τινες καὶ τούτων
 25 λάκια τὰ πλείστα δώδεκα, ὡς δ' ἐπὶ τὸ πολὺ πέντε
 ἢ ἕξ· ἤδη δὲ καὶ ἐν ἕτεκε τις· αἱ δὲ Λακωνικαὶ ὡς

¹ καὶ τὸ] καὶ κατὰ Sn.: κατὰ τε Pi.: κατὰ τὸ A.-W.

² sic AC, vulg.: πλήθος ὅταν τέκωσιν PD, Dt.

³ ἔλαττον ἢ] καὶ ἔλαττον AC. ⁴ τὸ om. Ald., Cs. (Sn.), Pi.

⁵ locus corruptus; καὶ . . . σῶμα secl. Th., quae ita vertit Σ:
et propter hoc macrescit (v.l. *marcescit*) corpus.

theless, this condition lasts for sixteen days in some. The birth-discharge takes place simultaneously with the delivery of the young: it is thick and phlegm-like, and the quantity, once they have whelped, thins off less than in proportion to the body.^a Bitches usually have milk five days before parturition; some however seven days before, some four only. The milk is fit for use immediately after their delivery. The Laconian bitch has milk thirty days after copulation. The milk at first is thick, but gets thinner as time proceeds. A bitch's milk is thicker than that of any other animal apart from the sow and the hare. When bitches are of an age for sexual intercourse, an indication of it shows itself, as in women: a swelling occurs in the teats on the breasts and cartilage develops. It is, however, difficult for anyone who is not thoroughly acquainted with the subject to detect this, because the indication is quite small. This occurs in the female; none of these things occurs in the male. The males normally lift the leg for passing urine at the age of six months, though some do it later, at eight months, others before six months: as a general statement, we may say they do it when entering on the period of exercising their full powers. Bitches all pass urine in a sitting position, though some have been known to raise the leg. The bitch produces twelve puppies at the most, but usually five or six; a case is known of a single puppy being born. Laconian

^a The text of this part of the sentence is confused and the meaning uncertain. Scot's translation reads ". . . phlegm-like, and on this account the body becomes thin."

⁶ ἡμέραις Dt.: ἡμέρας codd., edd.

⁷ πρὸς τὸ add. D: πρὸς τὰ P., om. AC, vulg.

⁸ ὀχεῖν PD.

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ἐπὶ τὸ πολὺ ὀκτώ. ὀχεύονται δ' αἱ θήλειαι καὶ ὀχεύουσιν οἱ ἄρρενες ἕως ἂν ζῶσιν. ἴδιον δ' ἐπὶ τῶν Λακωνικῶν συμβαίνει πάθος· πονήσαντες γὰρ μᾶλλον δύνανται ὀχεύειν ἢ ἀργοῦντες. ζῆ δ' ἢ μὲν

30 Λακωνικῆ κύων ὁ μὲν ἄρρην περὶ ἔτη δέκα, ἢ δὲ θήλεια περὶ ἔτη δώδεκα, τῶν δ' ἄλλων κυνῶν αἱ μὲν πλείστα περὶ ἔτη τετταρακαίδεκα ἢ πεντεκαίδεκα, ἔναι δὲ καὶ εἴκοσιν· διὸ καὶ Ὅμηρον οἴονται τινες

575 a ὀρθῶς ποιῆσαι τῷ εἰκοστῷ ἔτει ἀποθανόντα τὸν κύνα τοῦ Ὀδυσσεύς. ἐπὶ μὲν οὖν τῶν Λακωνικῶν διὰ τὸ πονεῖν τοὺς ἄρρενας μᾶλλον μακροβιώτεροι αἱ θήλειαι τῶν ἀρρένων· ἐπὶ δὲ τῶν ἄλλων λίαν μὲν οὐκ ἐπίδηλον, μακροβιώτεροι δ' ὅμως οἱ ἄρρενες
5 τῶν θηλειῶν εἰσιν.

Ὀδόντας δὲ κύων οὐ βάλλει πλὴν τοὺς καλουμένους κυνόδοντας· τούτους δ' ὅταν ὦσι τετράμηνοι, ὁμοίως αἱ τε θήλειαι καὶ οἱ ἄρρενες. διὰ δὲ τὸ τούτους μόνους βάλλειν ἀμφισβητοῦσι τινες· οἱ μὲν γὰρ διὰ τὸ δύο μόνους βάλλειν ὅλως οὐ φασι (χαλεπὸν γὰρ ἐπιτυχεῖν τούτοις), οἱ δ' ὅταν ἴδωσι τού-

10 τους, ὅλως οἴονται βάλλειν καὶ τοὺς ἄλλους. τὰς δ' ἡλικίας ἐκ τῶν ὀδόντων σκοποῦσιν· οἱ μὲν γὰρ νεοὶ λευκοὺς καὶ ὀξεῖς ἔχουσιν, οἱ δὲ πρεσβύτεροι μέλανας καὶ ἀμβλεῖς.

XXI Βοῦς δὲ πληροὶ μὲν ὁ ἄρρην ἐκ μιᾶς ὀχείας, βαίνει δὲ σφοδρῶς ὥστε συγκάμπτεσθαι τὴν βοῦν· ἔαν δ'

15 ἀμάρτη τῆς ὀρμῆς, εἴκοσιν ἡμέρας διαλείπουσα προσίεται πάλιν ἢ θήλεια τὴν ὀχείαν. οἱ μὲν οὖν πρεσβύτεροι τῶν ταύρων οὐδ' ἀναβαίνουσι πλεονάκεις ἐπὶ τὴν αὐτὴν τῆς αὐτῆς ἡμέρας, ἔαν μὴ ἄρα διαλιπόντες· οἱ δὲ νεώτεροι καὶ τὴν αὐτὴν βιάζονται

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bitches usually produce eight. Both sexes have intercourse throughout their lives.^a An unusual thing occurs in the case of the Laconian hounds: they are more vigorous in mounting the bitch after hard work than if they stay idle. The dog of this breed lives about ten years, the bitch about twelve; bitches of other breeds for the most part live about fourteen or fifteen years, some as many as twenty, which is why some people think Homer was correct in his statement that Odysseus' dog died in its twentieth year.^b As for the Laconian hounds, the females tend to live longer than the males, because the latter are worked harder. In other breeds this difference is not very noticeable, though males nevertheless tend to be longer-lived than females.

A dog sheds no teeth other than the "canines" as they are called; these are shed by both sexes at the age of four months. As these are the only teeth dogs shed, some people are in doubt about the facts. Since they shed only two, and as it is difficult to detect this, there are some who maintain that dogs shed none at all; others, when they see two shed, suppose that all the rest must be shed as well. A dog's age is told by inspecting its teeth: young dogs have sharp, white teeth, older dogs black blunt ones.

The bull impregnates the cow at a single copulation, ^{XXI} and his mounting is so vigorous that the cow is bowed ^{Cattle.} down with it. If his attempt fails, the cow waits for twenty days before submitting to another. The older bulls will not even mount the same cow several times in any one day, unless after considerable intervals. The younger ones, owing to their vigour, mount the

^a Not so at 546 a 28.

^b See *Odyssey* xvii. 326 f.

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πλεονάκις καὶ ἐπὶ πολλὰς ἀναβαίνουσι διὰ τὴν ἀκμὴν.
 20 ἥκιστα δὲ τῶν ἀρρένων λάγνον¹ ἐστὶ βοῦς. . . .²
 ὀχεύει δ' ὁ νικῶν τῶν ταύρων· ὅταν δ' ἐξάδυνατῆση
 διὰ τὴν λαγνείαν, ἐπιτίθεται ὁ ἠττώμενος, καὶ κρα-
 τεῖ πολλάκις. ὀχεύει δὲ τὰ ἄρρενα καὶ ὀχεύεται τὰ
 θήλεα ἐνιαύσια ὄντα πρῶτον, ὥστε καὶ γεννᾶν· οὐ
 μὴν ἀλλὰ τό γ' ὡς ἐπὶ τὸ πολὺ ἐνιαύσιοι καὶ ὀκτά-
 25 μηνιοί, τὸ δὲ μάλισθ' ὁμολογούμενον διετεῖς. κύει
 δ' ἐννέα μῆνας, δεκάτῳ δὲ τίκτει· ἔνιοι δὲ δυσχυρί-
 ζονται δέκα μῆνας κύειν ἡμερολογδόν. ὅ τι δ' ἂν
 ἔμπροσθεν ἐξενεχθῆ τῶν εἰρημένων χρόνων, ἐκβόλι-
 μόν ἐστὶ καὶ οὐ θέλει ζῆν³. μαλακαὶ⁴ γὰρ καὶ ἀτελεῖς
 γίνονται αἱ ὄπλα· τίκτει δ' ἐν τὰ πλείοστα, ὀλιγάκις
 30 δὲ δύο· καὶ τίκτει καὶ ὀχεύει ἕως ἂν ζῆ.

Ζῶσι δ' ὡς ἐπὶ τὸ πολὺ περὶ πεντεκαίδεκα ἔτη αἱ
 θήλειαι· καὶ οἱ ἄρρενες δ', εἰς ἐκμηθῶσιν. ἔνιοι δὲ
 ζῶσι καὶ εἴκοσιν ἔτη καὶ ἔτι πλείω, εἰς εὐφορον
 575 b ἔχωσι τὸ σῶμα· καὶ γὰρ τῶν βοῶν τοὺς τομίας
 ἐθίζουσι καὶ καθιστᾶσι τῶν βοῶν ἡγεμόνας ὡσπερ
 τῶν προβάτων, καὶ ζῶσιν οὗτοι πλείω χρόνον τῶν
 ἄλλων διὰ τε τὸ (μῆ)⁵ πονεῖν καὶ διὰ τὸ νέμεσθαι
 ἀκέραιον νομῆν. ἀκμάζει δὲ μάλιστα πεντετητῆς⁶ ὢν,
 5 διὸ καὶ Ὀμηρὸν φασὶ πεποιηκέναι τινὲς ὀρθῶς ποιή-
 σαντα “ ἄρσενα πενταέτηρον ” καὶ τὸ “ βοὸς ἐν-
 νεώροιο ”· δύνασθαι γὰρ ταυτόν. τοὺς δ' ὀδόντας

¹ τῶν ἀρρ. λ. AC: λ. τῶν ἀρρ. D, vulg. (loco δὲ λ. τῶν habet δὲ λαυόν τῶν P¹, δ' ἐλαυόντων P corr.).

² post βοῦς lac. stat. A.-W. sic ἥκιστα δὲ λάγνον ἐστὶ βοῦς . . . τῶν ἀρρένων. Ioco διὰ τὴν ἀκμὴν κ.τ.λ., et aliquando ruginant tauri et qui vicerit salit feminam Σ: immo Dt. talia desideravit, e.g., ὅμως δὲ μάχεται σφόδρα τῷ ἀντιπάλῳ ὁ βοῦς.

³ οὐ θέλει ζῆν C, vulg.: οὐ ζῆν θ. A: οὐ ζῆ ἔτι κἂν μικρὸν προτερῆση τῷ τόκῳ οὔτε θ. PD.

⁴ μάλα ACPD.

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same cow several times, and indeed many cows. The bull is the least salacious of all male animals. . . .^a The bull that comes off the victor mounts the cows; but when he is exhausted by his efforts, the one that was beaten sets upon him and often gets the better of him. The earliest that bulls and cows can have intercourse so as to produce offspring is at a year old; however, mostly it is at the age of twenty months; all agree it is possible at two years. The cow is pregnant for nine months, and she calves in the tenth. Some maintain that cows are pregnant for ten months exactly to the day. A calf born earlier than the times stated is an abortion, and will not live, for its hoofs are weak and incompletely formed. The cow usually bears one calf, seldom two; she bears and has intercourse throughout her life.

Cows live normally for about fifteen years, and bulls too if they are castrated. Some bulls live twenty years or even more, if they are physically sound. Herdsmen train the castrated bulls and make them leaders of the flock (as is done with sheep): these live longer than the others because they are <not> hard-worked and have unspoiled pasturage to graze on. A bull is at its prime when five years old; whence Homer receives commendation in some quarters for his phrases “ a five-year bull ” and “ a nine seasons' bull ”—phrases identical in meaning.^b Oxen shed

^a Some words seem to have fallen out of the text at this point. Instead of the incomplete sentence Scot reads “ Sometimes the bulls fight, and the one that comes off the victor mounts the cow.”

^b See *Iliad* ii. 402 f., *Odyssey* x. 19, xix. 420.

⁵ μῆ add. Sn. monentibus Sylb. et Scal., probat vulg.: ἔλαττον add. Gohlke: propter pastum bonum tantum Σ.

⁶ πενταετής PD: πεντέτης vulg.

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575 b

- βάλλει βοῦς διετής, καὶ οὐκ ἀθρώους ἀλλ' ὡσπερ ἵππος· τὰς δ' ὀπλάς, ὅποταν ποδαγραῖ, οὐκ ἀποβάλλει, ἀλλ' οἶδεὶ μόνον σφόδρα τοὺς πόδας. τὸ δὲ γάλα, ὅταν τέκη, χρήσιμον γίννεται¹. ἔμπροσθεν δ' οὐκ ἔχει γάλα. τὸ δὲ πρῶτον γιγνόμενον γάλα ὅταν παγῆ, οὕτω γίννεται σκληρόν ὡσπερ λίθος· τοῦτο δὲ συμβαίνει, εἰ μὴ τις μίξη ὕδατι. νεώτεροι δ' ἐνιαυσίων οὐκ ὀχεύονται πλὴν εἰς τι τερατώδες ἢ ἤδη δέ τινες καὶ δεκάμηνοι² ὀχεύθησαν καὶ ὤχευσαν.
- 15 ἄρχονται δὲ τῆς ὀχείας περὶ τὸν Θαργηλιῶνα μῆνα καὶ τὸν Σκιρροφοριῶνα αἰ πλείσται· οὐ μὴν ἀλλ' ἐνιαὶ καὶ μέχρι τοῦ μετοπώρου κυῖσκονται. ὅταν δὲ πολλὰ³ κύωσι καὶ προσδέχωνται τὴν ὀχείαν, σφόδρα δοκεῖ σημεῖον εἶναι καὶ χειμῶνος καὶ ἐπομβρίας. αἱ δὲ συνήθειαι γίννονται μὲν ταῖς βοῦσιν
- 20 ὡσπερ ταῖς ἵπποις, ἦττον δέ.
- XXII Ἴππος δ' ἄρχεται ὀχεύειν ὁ μὲν ἄρρην διετής, καὶ ἡ θήλεια διετής⁴ ὀχεύεσθαι· ταῦτα μέντοι ὀλίγα ἐστί, καὶ τὰ ἔκγονα τούτων ἐλάττω καὶ ἀσθενικώτερα· ὡς δ' ἐπὶ τὸ πολὺ ἄρχονται ὀχεύειν τριετείς ὄντες,
- 25 καὶ αἱ ἵπποι ὀχεύεσθαι, καὶ ἐπιδιδόασιν δ' αἰεὶ πρὸς τὸ βελτίω τὰ ἔκγονα γίννεσθαι μέχρι ἐτῶν εἴκοσιν· κύει δ' ἑνδεκά μῆνας, δωδεκάτω δὲ τίκτει. πληροῖ δ' ὁ ἵππος οὐκ ἐν τεταγμέναις ἡμέραις, ἀλλ' ἐνίοτε μὲν ἐν μιᾷ ἢ δυσὶν ἢ τρισὶν, ἐνίοτε δ' ἐν πλείοσιν· θάπτον δὲ πληροῖ ἐπιβαίνων ὄνος ἢ ἵππος. ἡ δ'
- 30 ὀχεία οὐκ ἐπίπονος τῶν ἵππων, ὡσπερ ἡ τῶν βοῶν. λαγνίστατον δὲ καὶ τῶν θηλειῶν καὶ τῶν ἀρρένων μετ' ἀνθρώπων ἵππος ἐστίν. ἡ δὲ τῶν νεωτέρων
- ¹ εὐθὺς add. post γάλα Scal., post χρήσιμον Pl., post γίννεται Dt.
² δεκάμηνοι Pl.: *due vacce decem mensium* Σ: τετράμηνοι codd.
³ πολλὰ

their teeth at two years, not all simultaneously, but as the horse does; the hoofs they do not shed when affected by podagra, but suffer a painful swelling in the feet.^a The milk, once a cow has calved, becomes fit for use; there is none before calving. The first milk, once it has set, becomes as hard as stone: this happens unless it is mixed with water. Cows younger than a year old do not copulate, or if they do there is some monstrous factor involved: instances are known of both sexes copulating at the age of ten months. Most cows begin their copulation about the month of Thargelion or Skirrophorion,^b though some become pregnant as late as the autumn. When large numbers of cows are pregnant and submit to copulation, it is held to be a sure sign of stormy and rainy weather. Cows herd together as mares do, but to a less extent.

Horses. Both stallion and mare begin copulation XXII HORSES. at two years; but few actually do this, and their offspring are smaller and weaker than the normal. In general, they begin at three years, and their offspring continue to improve until the parents are twenty years old. The mare's pregnancy lasts eleven months, and she bears in the twelfth. There is no fixed length of time in which the stallion impregnates; it may take one day, two days, three, or sometimes more. An ass will achieve it more quickly than a stallion. Copulation is not a toilsome business for horses, as it is for oxen. After human beings, the horse, both sexes, is the most salacious of all animals. Younger

^a Cf. 604 a 14.^b See Appendix B, p. 409.³ πολλὰ Syll. e Gaza (*plurimae* Albertus), vulg.: *πολλὰ codd.*: *et quando vacce multociens impregnantur et faciunt multos filios* Σ.⁴ διετής (bis) codd., vulg.

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ὀχεία γίνεται παρὰ τὴν ἡλικίαν, ὅταν εὐβοσία καὶ ἀφθονία γένηται τροφῆς. ἔστι μὲν οὖν ὡς ἐπὶ τὸ

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πολὺ μονοτόκον,¹ τίκτει μέντοι ποτὲ καὶ δύο τὰ πλείστα. καὶ ἡμίονους δ' ἤδη ἔτεκε τις δύο². ἃ κρινοῦσιν ἐν τέρασιν.

Ὅχευει μὲν οὖν ἵππος καὶ τριακοντάμηνος· ὥστε δὲ καὶ γεννᾶν ἀξίως, ὅταν παύσῃται βάλλων (ἤδη δὲ τινες καὶ βάλλοντες ἐπλήρωσαν, ὡς φασίν), εἰ μὴ φύσει ἄγονοι τυγχάνωσιν ὄντες. ἔχει μὲν οὖν ὀδόντας τετταράκοντα, βάλλει δὲ τοὺς μὲν πρώτους τέτταρας τριακοντάμηνος, τοὺς μὲν δύο ἄνωθεν τοὺς δὲ δύο κάτωθεν· ἐπειδὴν δὲ γένηται ἐνιαυτός, βάλλει τὸν αὐτὸν τρόπον τέτταρας, δύο μὲν ἄνωθεν δύο δὲ

10 κάτωθεν, καὶ πάλιν ὅταν ἄλλος ἐνιαυτὸς γένηται, ἐτέρους τέτταρας τὸν αὐτὸν τρόπον· τεττάρων δ' ἐτῶν παρελθόντων καὶ ἐξ μηνῶν οὐκέτι βάλλει οὐδένα. ἤδη δὲ τις τὸ πρῶτον εὐθύς ἅμα πάντας ἐξέβαλε, καὶ ἄλλος ἅμα τοῖς τελευταίοις ἅπαντας·

15 συμβαίνει, ὅταν τεττάρων ἐτῶν ἢ καὶ ἐξ μηνῶν, χρήσιμον εἶναι πρὸς τὴν γέννησιν μάλιστα.

Εἰσὶ δ' οἱ πρεσβύτεροι τῶν ἵππων γονιμώτεροι, καὶ οἱ ἄρρενες τῶν ἀρρένων καὶ αἱ θήλειαι τῶν θηλειῶν. ἀναβαίνουνσι δὲ καὶ ἐπὶ τὰς μητέρας οἱ ἵπποι καὶ ἐπὶ τὰς θυγατέρας· καὶ τότε δοκεῖ τέλειον

20 εἶναι τὸ ἵπποφόρβιον, ὅταν ὀχεύωσι τὰ ἑαυτῶν ἔκγονα. οἱ δὲ Σκύθαι ἵππεύουσι ταῖς κνούσαις ἵπποις, ὅταν θᾶπτον στραφῆ τὸ ἔμβρυον, καὶ φασι γίνεσθαι αὐτὰς εὐτοκωτέρας. τὰ μὲν οὖν ἄλλα τετράποδα κατακείμενα τίκτει, διὸ καὶ πλάγια προέρχεται τὰ

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ones may come on to breed earlier than the normal age if they have good pasture and plenty of it. For the most part, the mare produces one foal only; two is the maximum. A mare has been known to produce two mules; such a thing is reckoned a monstrosity.

The stallion, then, can breed at thirty months; but if he is to produce satisfactory offspring, breeding should occur when he has ceased shedding his teeth (some have been known to impregnate while the teeth were actually being shed, so it is alleged)—unless they are naturally sterile. A horse has forty teeth; it sheds the first four at thirty months, two from the top jaw and two from the lower; after a year has passed it sheds four more in the same way, two from the top and two from the bottom; and yet again, after another year, four more. At the age of four and a half years it sheds no more teeth. A horse has been known to shed all its teeth straight away at the start, and another to shed them all with the last four, but such occurrences are rare. Hence in general it comes about that after four and a half years a horse is in the best condition for breeding.

Older horses of both sexes are better for breeding purposes. Horses will mount the mare that bore them and mares they have begotten; in fact, an establishment is not considered perfect unless horses mount their own progeny. Scythians ride their pregnant mares, as soon as the embryo has turned, and allege that this gives them easier delivery. With one exception quadrupeds lie down to bring forth their young; hence the embryos of all of them emerge

¹ μονοτόκον vel μονότοκον ACP: μονοτόκος D, vulg.

² hic in Σ explicit sextus tractatus; reliqua pars libri deest.

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ἔμβρυα πάντων· ἢ δ' ἵππος ἢ θήλεια ὅταν ἦδη
25 πλησίον ἢ τῆς ἀφέσεως, ὀρθῆ στασα προίεται τὸ
ἔκγονον.

Ζῶσι δὲ τῶν ἵππων οἱ μὲν πλείστοι περὶ ὀκτω-
καίδεκα ἔτη καὶ εἴκοσι, ἔνιοι δὲ πέντε καὶ εἴκοσι
καὶ τριάκοντα· ἐὰν δέ τις ἐπιμελῶς θεραπεύῃ, ἐκτεί-
νει καὶ πρὸς τὰ πενήκοντα. ὁ δὲ μακρότατος βίος
30 τῶν πλείστων ἐστὶν ὡς ἐπὶ τὸ πολὺ τριακοντετῆς¹.
ἢ δὲ θήλεια ὡς ἐπὶ τὸ πολὺ μὲν πέντε καὶ εἴκοσι
576 b ἔτη, ἦδη δὲ τινες καὶ τετταράκοντα ἔτη βεβιώκασιν.²
ἐλάττω δὲ χρόνον βιοῦσιν οἱ ἄρρενες τῶν θηλειῶν
διὰ τὰς ὀχείας, καὶ οἱ ἰδία τρεφόμενοι τῶν ἐν τοῖς
ἵπποφορβίσις. ἢ μὲν οὖν θήλεια πέντ' ἐτῶν τέλος
5 λαμβάνει μήκους καὶ ὕψους, ὁ δ' ἄρρην ἐξ ἐτῶν
μετὰ δὲ ταῦτα ἐν ἄλλοις ἐξ ἔτεσι τὸ πλήθος λαμ-
βάνει τοῦ σώματος, καὶ ἐπιδίδωσι μέχρι ἐτῶν εἴκο-
σιν. ἀποτελειοῦται δὴ³ τὰ θήλεια τῶν ἀρρένων ἔμ-
προσθεν, ἐν δὲ τῇ γαστρὶ τὰ ἄρρενα τῶν θηλειῶν,
καθάπερ⁴ καὶ ἐπὶ τῶν ἀνθρώπων· ταυτὸ δὲ ταῦτο
10 συμβαίνει καὶ ἐπὶ τῶν ἄλλων ζῴων ὅσα⁵ πλείω τίκτει.

Θηλάζειν δὲ φασι τὸν μὲν ἡμίονον ἐξάμηνον, εἰτ'
οὐκέτι προσίσθαι διὰ τὸ σπᾶσθαι⁶ καὶ πονεῖν· τὸν
δ' ἵππον πλείω χρόνον.

Ἀκμάζει δὲ καὶ ἵππος καὶ ἡμίονος μετὰ τοὺς
βόλους· ὅταν δὲ πάντας ὦσι βεβληκότες, οὐ ράδιον
γνώναι τὴν ἡλικίαν. διὸ καὶ λέγεται⁷ γνώμα⁸ ἔχειν,
15 ὅταν ἄβολος ἦ· ὅταν δὲ βεβληκώς, οὐκ ἔχειν. ὁμως

¹ τριακοντετῆς vulg.

² ὁ δὲ μακρότατος . . . βεβιώκασιν secl. Dt.

³ δὴ Dt. : δὲ codd., edd.

⁴ ἀποτελ. δὲ τὰ θ. τῶν ἀρρ. ἔμπρ. ἐν (hic add. δὲ A : ras. in C)
τῇ γαστρὶ, τὰ δ' ἄρρ. τῶν θηλειῶν ὑστερον καθάπερ A¹C.

⁵ ὅσα <μη> Karsch, Dt.

towards one side : the mare alone, when the time for parturition approaches, stands upright and so produces her offspring.

Most stallions live for eighteen or twenty years, some for twenty-five or thirty ; and if you look after him carefully, a stallion may live to be fifty. However, the maximum age for most is thirty years. The mare lives generally about twenty-five years, though some have reached the age of forty. The males live less long than the females, because of their sexual activities ; and those which are reared privately live longer than those in large establishments. The mare reaches her full length and height in five years, the stallion in six ; after that, during the next six years they attain their full physical bulk, and go on improving until they are twenty. So the females reach their complete development before the males, though while in the uterus the males are ahead of the females, as in human beings^a ; and the same is true of the other animals which produce many young.

It is said that a mare will suckle a mule for six months ; beyond that it will not let it come near because of its excessive tugging and the pain it causes ; a horse-foal it will suckle longer.

Horse and mule are at their prime after they have shed their teeth ; when they have all been shed it is difficult to tell their age ; hence, until they shed their teeth, they are said to carry their " token," but after doing so they have it no longer. Nevertheless,

^a Cf. G.A. 775 a 4 ff., where the reason is given.

⁶ ἀποσπᾶσθαι AC : ἄγαν σπᾶσθαι A.-W. : σπᾶσθαι vulg.

⁷ λέγεται AC : λέγουσι PD, vulg.

⁸ γνώμα Dt., coll. 577 a 31, b 3 : γνώριμα A²C : γνώριμα A¹ ; γνώμη PD, vulg.

576 b

δὲ μάλιστα γνωρίζεται ἡ ἡλικία μετὰ τοὺς βόλους τῷ κυνόδοντι· τῶν μὲν γὰρ ἵππαστῶν γίγνεται μικρὸς διὰ τὴν τριψῶν (κατὰ τοῦτον γὰρ ἐμβάλλεται ὁ χαλινός), τῶν δὲ μὴ ἵππαστῶν μέγας μὲν ἀλλ' ἀπηρητισμένος,¹ τῶν δὲ νέων ὄξυς καὶ μικρός.

20 Ὄχευει δ' ὁ μὲν ἄρρην πᾶσάν τε ὦραν καὶ ἕως ζῆ· καὶ ἡ θήλεια δ' ὀχεύεται ἕως ἂν ζῆ, ὄργα² δὲ πᾶσαν ὦραν, εἰ μὴ τις δεσμὸν ἢ ἄλλην τινὰ προσενέγκῃ ἀνάγκην. ὦρα δ' οὐκ ἀφώρισται³ οὐδεμία τεταγμένη τοῦ ὀχεύεσθαι καὶ ὀχεύειν, οὐ μέντοι γ' ὅτ' ἔτυχε γενομένης τῆς ὀχείας δύναται ὅτι ἂν⁴ γεννη-
25 σωσιν ἐκτρέφειν. ἐν Ὀποῦντι δ' ἐν ἵπποφορβίῳ ἵππος ἐγένετο ὃς ὤχευεν ἑτῶν ὦν τετταράκοντα· ἔδει δὲ τὰ πρόσθια σκέλη συνεπαίρειν.

Ἄρχονται δ' ὀχεύεσθαι αἱ ἵπποι τοῦ ἔαρος. ὅταν δὲ τέκῃ ἡ ἵππος, οὐκ εὐθὺς μετὰ τοῦτο ἰμπλάται ἀλλὰ διαλείπει χρόνον, καὶ τίκτει ἄμεινον⁵ τετάρτῳ
30 ἢ πέμπτῳ ἔτει μετὰ τὸν τόκον. ἕνα δ' ἐνιαυτὸν καὶ
577 a πάμπαν ἀνάγκη διαλείπειν καὶ ποιεῖν ὥσπερ νεῖον. ἵππος μὲν οὖν διαλείπουσα τίκτει, ὥσπερ εἶρηται, ὄνος⁶ δὲ συνεχῶς. γίγνονται δὲ τῶν ἵππων αἱ μὲν καὶ ἄτεκνοι ὄλως, αἱ δὲ συλλαμβάνουσι μὲν, οὐ δύ-
5 νανται δ' ἐκφέρειν· σημεῖον δὲ τῶν τοιούτων λέγουσιν εἶναι, τὸ ἐμβρυον ἀνασχιζόμενον ἔχειν ἄλλα νεφροειδῆ περὶ τοὺς νεφρούς, ὥστε δοκεῖν τέτταρας

¹ ἀπηρητισμένος scripsi : ἀπηρητημένος codd. : οὐκ ἀπηρητημένος Cs. (pas encore entièrement sortie) : ἀπαμβλυόμενος voluit Scal.

² ὄργα scripsi : οὐτῶ A¹C : οὐτῶ PDA², vulg. : οὐ πως coni. Dt. : αὐτῆ δ' οὐ A.-W.

³ ἀφώρισται Casaub. : ἀφαίρεται codd., edd.

⁴ ὅτι ἂν Dt. : ὅταν A¹C : ἂ ἂν PDA², vulg.

⁵ ἄμεινον AC : ἀμείνω PD, vulg.

even after the teeth are shed their age can be told from their canines, because in horses which have been ridden a great deal there is not much left of the canines owing to the friction caused by the bit, which is inserted at that place ; whereas in horses that have not been ridden these teeth are quite large though their sharpness has been smoothed down, while in young horses they are sharp and small.

The male horse will copulate at all seasons and throughout life ; the female too will copulate throughout life, and is eager for it at any season, unless a halter or some other form of constraint is used. There is no fixed season for either sex to have intercourse ; though it does not follow that when they have copulated at some chance time they will be able to rear their offspring. There was once a stallion in a large establishment at Opus which used to mount the mares at the age of forty ; his forelegs had to be raised and supported to enable him to do so.

Mares begin their copulation in the spring. Once a mare has foaled she does not receive another impregnation immediately but lets some time elapse, and she produces better foals if she waits four or five years after bearing. It is absolutely essential that she should wait for one year, so that she may as it were lie fallow. A mare, then, leaves intervals between her foalings, but a she-ass will breed without such intervals. Some mares are completely sterile ; some conceive, but cannot complete their pregnancy : a sign of this is said to be that when the embryo is cut open it has, round its kidneys, other kidney-shaped objects, giving the impression that it has four kidneys. After

⁶ ὄνος Scal. e Gaza, Rob. Constantinus, vulg., edd. : ἡμίονος ACPD.

577 a

ἔχειν νεφρούς. ὅταν δὲ τέκη ἢ ἵππος, τό τε χόριον
 εὐθὺς κατεσθίει, καὶ ἀπεσθίει τὸ πωλίον¹ ὃ ἐπι-
 φύεται ἐπὶ τοῦ μετώπου τῶν πώλων,² καλεῖται
 10 δ' ἵππομανές· ἔστι δὲ τὸ μέγεθος ἕλαττον μικρῶ
 ἰσχάδος, τὴν δ' ἰδέαν πλατὺν, περιφερές, μέλαν. τοῦτο
 δ' ἂν τις φθῆ³ λαβὼν καὶ ὄσφρηται ἢ ἵππος, ἐξί-
 σταται καὶ μαινεται πρὸς τὴν ὄσμήν· διὸ καὶ τοῦτο
 αἱ φαρμακίδες ζητοῦσι καὶ συλλέγουσιν. ἂν δ'
 ὠχευμένην ἵππον ὑφ' ἵππου ὄνος ὀχεύσῃ, διαφθείρει
 15 τὸ ἔμβρυον τὸ ἐνυπάρχον. [ἵππων δ' ἠγεμόνα οὐ
 καθιστᾶσιν οἱ ἵπποφορβοὶ ὥσπερ τῶν⁵ βοῶν, διὰ τὸ
 μὴ μόνιμον εἶναι τὴν φύσιν αὐτῶν ἀλλ' ὀξεῖαν καὶ
 εὐκίνητον.]⁶

XXIII "Ὀνος δ' ὀχεύει μὲν καὶ ὀχεύεται τριακοντάμηνος,
 καὶ βάλλει τοὺς πρώτους ὀδόντας· τοὺς δὲ δευτέρους
 20 ἕκτω μηνί, καὶ τοὺς τρίτους καὶ τοὺς τετάρτους
 ὡσαύτως· τούτους δὲ γνώμα⁷ καλοῦσι, τοὺς τετάρ-
 τους. ἤδη δὲ καὶ ἐνιαυσία ὄνος ἐκίνησεν ὥστε καὶ
 ἐκτραφῆναι. ἐξουρεῖ δ', ὅταν ὀχευθῆ, τὴν γονήν,
 ἂν μὴ κωλύηται· διὸ τύπτουσι μετὰ τὴν ὀχείαν
 εὐθὺς καὶ διώκουσιν. τίκει δὲ δωδεκάτῳ μηνί.
 25 τίκει δὲ τὰ μὲν πολλὰ ἐν μονοτόκῳ γάρ ἐστι φύσει.
 τίκει δ' ἐπίοτε καὶ δύο. ὃ μὲν οὖν ὄνος ἐπαναβὰς
 διαφθείρει τὸ τοῦ ἵππου ὀχευμα, ὥσπερ εἴρηται· ὃ δ'

¹ τὸ πωλίον scripsi (τοῦ πωλίου coniecerat Th., coll. 605 a 6):
 τοῦ πώλου codd., suspicati sunt edd.

² τῶν πώλων secl. Dt.: τῶν πολλῶν A¹, fortasse C¹; τούτων
 τῶν πωλίων PD.

³ δ' AC: om. PD, vulg.

⁴ ὀφθῆ AC.

⁵ τῶν AC: om. PD, vulg.

⁶ haec secluit Dt.: ἂν δ' . . . εὐκίνητον A.-W.

parturition a mare will at once swallow the *chorion*
 (afterbirth) and also eat off the growth on the foal's
 forehead known as *hippomanes*: the size of this is
 slightly smaller than a dried fig, and to look at it is flat
 and round, and black in colour. If anyone gets hold
 of it before <the mare does> and she gets scent of it,
 the scent drives her mad and frantic. That is why it
 is in demand by sorceresses, who collect it for their
 purposes. If an ass mounts a mare which has been
 mounted by a horse, it destroys the already existing
 embryo.^a [Horse-trainers do not appoint any leader
 of the troop for horses as is done for herds, because
 they are not sufficiently stationary in their nature:
 they are easily excited and unsettled.]^b

Asses of both sexes copulate at the age of thirty **XXIII**
 months, and shed their first teeth. An ass sheds its Asses.
 second teeth in the sixth month, its third and fourth
 at like intervals; these fourth teeth they call its
 "token." A she-ass has been known to conceive at
 one year and to produce a foal that survived. When
 it has had intercourse, a she-ass will discharge the
 sperm with its urine unless it is prevented; and that
 is why they beat them immediately after intercourse
 and chase them about.^c The she-ass produces its
 young in the twelfth month. Normally it bears a
 single foal, for that is its nature, but occasionally two.
 An ass, if it covers a mare, destroys an embryo that
 has been produced by a horse, as I have said: but a

^a Cf. G.A. 748 a 33, where the reason is given.

^b This passage is obviously an inappropriate repetition,
mutatis mutandis, from 574 a 10 ff.

^c Cf. G.A. 748 a 22.

⁷ γνώμα AC, Cs., A.-W., Dt.: γνώμας PD: γνώμονας vulg.,
 edd. plerique.

577 a

ἵππος τὸ τοῦ ὄνου οὐ διαφθείρει, ὅταν ἢ ὠχευμένη
 ἢ ἵππος ὑπὸ τοῦ ὄνου. ἴσχει δὲ γάλα κύουσα δεκά-
 μηνος οὔσα. τεκούσα δὲ βιβάζεται ἐβδόμη ἡμέρα,
 30 καὶ μάλιστα δέχεται τὸ πλῆσμα ταύτη βιβασθεῖσα
 τῇ ἡμέρᾳ, λαμβάνει δὲ καὶ ὕστερον. εἰ δὲ μὴ τέκη
 πρὶν τὸ γνῶμα λιπεῖν, οὐκέτι λαμβάνει πλῆσμα οὐδὲ
 577 b κυῖσκειται τοῦ λοιποῦ βίου παντός. τίκτειν οὐ θέλει
 οὔθ' ὄρωμένη ὑπ' ἀνθρώπου οὔτ' ἐν τῷ φωτί, ἀλλ'
 εἰς τὸ σκοτός ἀπάγουσιν, ὅταν μέλλῃ τίκτειν. τίκτει
 δὲ διὰ βίου, εἰ δὲ τέκη πρὶν τὸ γνῶμα λιπεῖν. βιοῖ
 δ' ὄνος πλείω τριάκοντ' ἐτών, καὶ ἡ θήλεια τοῦ
 ἄρρενος πλείω ἔτη.

5 "Ὅταν δ' ἵππος ὀχεύσῃ ὄνον ἢ ὄνος ἵππον, πολὺ
 μᾶλλον ἐξαμβλοῖ ἢ ὅταν τὰ ὁμογενῆ ἀλλήλοις μιχθῇ,
 οἷον ἵππος ἵππῳ ἢ ὄνος ὄνω. ἀποβαίνει δὲ καὶ ὁ
 τῆς κυήσεως χρόνος, ὅταν μιχθῇ ἵππος καὶ ὄνος,
 κατὰ τὸ ἄρρεν, λέγω δ' ἐν ὅσῳ χρόνῳ τοῦτο γίνεταί
 ἐξ ὁμογενῶν γιγνόμενον. τὸ δὲ μέγεθος τοῦ σώ-
 10 ματος καὶ τὸ εἶδος καὶ ἡ ἰσχὺς μᾶλλον τῷ θήλει
 ἀφομοιοῦται τοῦ γενομένου. εἰ δὲ συνεχῶς μίσηγ-
 ται καὶ μὴ διαλείπη χρόνον τινὰ οὕτως ὀχευόμενον,¹
 ταχέως ἄγονον τὸ θῆλυ γίνεταί διὸ συνεχῶς οὐ
 μίσηγουσιν οὕτως οἱ περὶ ταῦτα πραγματευόμενοι,
 15 ἀλλὰ διαλείπουσιν τινὰ χρόνον. οὐ προσδέχεται δ'
 οὔθ' ἢ ἵππος τὸν ὄνον οὔθ' ἢ ὄνος τὸν ἵππον, εἰ δὲ μὴ
 τύχη τεθηλακῶς ὁ ὄνος ἵππον· ὑποβάλλουσι γὰρ

horse does not destroy an ass's, if the mare has been covered by an ass." A pregnant she-ass will have milk at ten months. Seven days after bearing her foal, the she-ass accepts the male, and is almost certain to conceive if it occurs on this actual day, though she will do so later as well. If she has not foaled at all before shedding her "token," she never conceives or becomes pregnant for the whole of the rest of her life. She refuses to bring forth her foal if anyone is watching her or if she is in the light, so when she is going to give birth she has to be taken into some dark place. A she-ass will bear throughout her life, if she once foals before shedding her "token." The ass lives for over thirty years, and the female longer than the male.

When a horse covers a she-ass or an ass a mare, a miscarriage is more likely to occur than when two animals of the same kind have intercourse, horse with horse and ass with ass. The period of gestation when there is cross-breeding is that of the kind to which the male belongs; in other words, it is the same as it would have been if the male had copulated with a female of his own kind. So far as size, appearance, and vigour are concerned, the offspring tends to resemble its dam rather than its sire. If such intercourse goes on without intermission, the female soon becomes sterile; and that is why those who are engaged in this sort of business do not allow them to have intercourse continuously but space it out. No mare will allow an ass to copulate, nor will a she-ass allow a horse, unless the ass (or she-ass) has been suckled by a mare; and that is why breeders put

^a Cf. *G.A.* 748 a 33 ff., where the reason is given.

¹ ὀχευόμενον scripsi: ὀχευόμενα vulg.

577 b

ἐπίτηδες οὓς καλοῦσιν ἵπποθῆλας. οὗτοι δ' ὀχεύουσιν ἐν τῇ νομῇ βία κρατοῦντες, ὥσπερ οἱ ἵπποι.

XXIV 'Ο δ' ὄρεὺς ἀναβαίνει μὲν καὶ ὀχεύει μετὰ τὸν

20 πρῶτον βόλον, ἑπταετῆς δ' ὦν καὶ πληροῖ, καὶ ἤδη ἐγένετο γίννος¹ ὅταν ἀναβῆ ἔφ' ἵππον θήλειαν. ὕστερον δ' οὐκέτι ἀναβαίνει. καὶ ὁ θήλυς δ' ὄρεὺς ἤδη ἐπληρώθη, οὐ μέντοι γ' ὥστ' ἐξενεγκεῖν διὰ τέλους. αἱ δ' ἐν τῇ Συρία τῇ ὑπὲρ Φοινίκης ἡμίονοι καὶ ὀχεύονται καὶ τίκτουσιν· ἀλλ' ἔστι τὸ γένος ὁμοῖον

25 μὲν ἕτερον δέ. οἱ δὲ καλούμενοι γίννοι² γίννονται ἐξ ἵππου, ὅταν νοσήσῃ ἐν τῇ κυήσει, ὥσπερ ἐν μὲν τοῖς ἀνθρώποις οἱ νάνοι, ἐν δὲ τοῖς ὑπὸ τὰ μετὰ χοῖρα· καὶ ἴσχει δέ, ὥσπερ οἱ νάνοι, ὁ γίννος³ τὸ αἰδοῖον μέγα. ζῆ δ' ἡμίονος ἔτη πολλά· ἤδη γάρ τις βε-

30 βίωκεν ἔτη καὶ ὀγδοήκοντα, οἷον Ἀθήνησιν ὅτε τὸν νεῶν ᾠκοδόμουν· ὃς καὶ ἀφειμένος ἤδη διὰ τὸ γῆρας συναμπρεύων καὶ παραπορευόμενος παρώξυνε τὰ ζεύγη πρὸς τὸ ἔργον, ὥστ' ἐψηφίσαντο μὴ ἀπελαύ-

578 a νειν αὐτὸν τοὺς σιτοπώλας⁴ ἀπὸ τῶν τηλιῶν. γηράσκει δὲ βραδύτερον ὁ θήλυς ὄρεὺς τοῦ ἄρρενος. λέγουσι δ' ἔνιοι ὅτι ἡ μὲν καθαίρεται οὐροῦσα, ὁ δ' ἄρρην διὰ τὸ ὀσφραίνεσθαι τοῦ οὔρου γηράσκει θάπτον.

5 Τούτων μὲν οὖν τῶν ζώων αἱ γενέσεις τοῦτον ἔχουσι τὸν τρόπον.

XXV Τὰ δὲ νέα καὶ τὰ παλαιὰ τετράποδα διαγιγνώ-

¹ γίννος A¹C : γίννος vulg. ; ἴννος A² : ἴννος PD.

² γίννοι APD : γίννοι C, vulg.

³ γίννος D : γίννος AC : γίννος P, vulg.

⁴ σιτοπώλας PD : σιτοπώλους AC, vulg.

asses to be suckled by mares. These are known as "mare-suckled" asses. Such asses mount the mares by force in the grazing-grounds, as stallions do.

The mule mounts the female after shedding its first teeth, and at the age of seven years can impregnate ; a case is known of a *ginnos* being produced by a mule from a mare. After that time it will have no further intercourse. A female mule too has been known to conceive, though not to bring the pregnancy to completion. In Syrophoenicia she-mules ("half-asses") submit to the male and produce offspring : this animal, however, though similar to the mule, is really a different kind.^a *Ginnoi*, as they are called,^b are produced by mares when they have been ailing during pregnancy, just as in human beings dwarfs are produced, and *metachoirs* in pigs ; and *ginnoi*, like dwarfs, have a large sexual organ. The half-ass lives many years ; one has been known to live to the age of eighty. There was one such at Athens when they were building the temple there : this animal was given its discharge on account of age, but continued to help with the hauling and walked alongside urging on the teams of animals to their work. The result was that a decree was passed forbidding corn-merchants to drive it away from the corn on their display-trays. The female mule ages more slowly than the male. Some allege that she menstruates while voiding urine, and that the reason the male ages more quickly is that he smells at her urine.

Such then is the manner of generation of these animals.

Those whose business is with animals can distin- XXV

^a See 580 b 1 ff.

^b See Additional Note, vol. i, p. 237, and *G.A.* 748 b 34, n.

578 a

σκοουσιν οἱ περὶ τὰς θεραπειὰς ὄντες αὐτῶν· εἰ μὲν ἀπὸ τῆς γνάθου τὸ δέρμα ἀφελκόμενον¹ ταχὺ ἐπανήη,² νέον τὸ τετράπουν, εἰ μὲν πολὺν χρόνον μίση ἔρρυτιδωμένον, παλαιόν.

10 Ἡ δὲ κάμηλος κύει μὲν δέκα³ μῆνας, τίκει δ' XXVI αἰεὶ ἐν μόνον· μονοτόκον γὰρ ἔστιν. ἐκκρίνουσι δ' ἐκ τῶν καμήλων ἐνιαύσιον τὸ ἔκγονον. ζῆ δὲ χρόνον πολὺν, πλείω ἢ πεντήκοντα ἔτη. τίκει δὲ τοῦ ἔαρος, καὶ γάλα ἔχει μέχρι οὗ ἂν ἐν γαστρὶ λάβῃ. ἔχει δὲ καὶ τὰ κρέα⁴ καὶ τὸ γάλα ἡδιστα πάντων· 15 πίνουσι δὲ τὸ γάλα δύο καὶ ἐν ἢ τρία καὶ ἐν⁵ πρὸς ὕδωρ κεράσαντες.

XXVII Ὁ δ' ἐλέφας ὀχεύει καὶ ὀχεύεται πρὸ τῶν⁶ εἰκοσίων ἐτῶν. ὅταν δ' ὀχευθῆ ἢ θήλεια, φέρει ἐν γαστρὶ, ὡς μὲν τινὲς φασιν, ἐνιαυτὸν καὶ ἕξ μῆνας, ὡς δ' 20 ἕτεροι, τρεῖς ἔτη· τοῦ δὲ μὴ ὁμολογεῖσθαι τὸν χρόνον αἴτιον τὸ μὴ εὐθεώρητον εἶναι τὴν ὀχείαν. τίκει δ' ἢ θήλεια συγκαθίσασα ἐπὶ τὰ ὀπισθεν, καὶ ἀλγοῦσα δήλη ἔστιν. ὁ δὲ σκύμνος ὅταν γένηται, θηλάζει τῷ στόματι καὶ οὐ τῷ μυκτῆρι, καὶ βαδίζει καὶ βλέπει εὐθὺς γεννηθείς.

25 Αἰ δ' ὕες αἰ ἀγριαὶ τοῦ χειμῶνος ἀρχομένου ὀχεύονται, τίκτουσι δὲ τοῦ ἔαρος ἀποχωροῦσαι εἰς τοὺς 30 δυσβατωτάτους τόπους καὶ ἀποκρήμους μάλιστα καὶ φαραγγώδεις καὶ συσκίους. διατρίβει δ' ὁ ἄρρην ἐν ταῖς ὑσὶν ὡς ἐπὶ τὸ πολὺ ἡμέρας τριάκοντα. τὸ δὲ πλήθος τῶν τικτομένων καὶ ὁ χρόνος τῆς 30 κυήσεως ὁ αὐτὸς καὶ ἐπὶ τῶν ἡμέρων ὑσῶν ἔστιν.

¹ ἀφελκόμενον D: ἐφ- ACP, vulg.

² ἐπανήη Sn., Pi., Dt.: ἐπήη codd., vulg.

guish an old quadruped from a young one. They draw back the skin from the jaw: if it quickly slips back into place, the animal is young; if it stays wrinkled up for a long time, it is old.

The camel is pregnant for ten^a months, and pro- XXVI
duces one at a birth always; it is uniparous. The Camels.
offspring are taken away from the camels at the age of one year. The camel lives a long time, more than fifty years. It brings forth in spring, and has milk until it conceives again. Its flesh and milk are the most delicious of all. The milk is drunk mixed with water in the proportion of two, or three, parts to one.

The elephant, both sexes, copulates before the age XXVII
of twenty. After copulation the female carries her Elephants.
young, as some say, for eighteen months; others say for three years. The reason for the disagreement about the period is that it is by no means easy to witness their copulation. The female brings forth by sitting back on her rear parts, and is clearly in considerable pain. As soon as the cub is born it suckles itself by its mouth, not with its trunk. It can walk about and see as soon as it is born.

Wild sows copulate at the beginning of winter, and XXVIII
for parturition they withdraw in spring to inaccessible Wild swine.
places, where there are sheer precipices and ravines and plenty of shade. The boar remains with the sows normally for thirty days. The number of the young and the period of gestation are the same as for the

^a Twelve at 546 b 3.

³ δώδεκα Pi., coll. 546 b 3.

⁴ καὶ τὰ κρέα delenda censet Mercurialis.

⁵ ἐν (bis) m, Dt.: ἐνα (bis) ceteri, edd.

⁶ πρὸ τῶν PD, Rose, coll. 546 b 7: πρῶτων AC, vulg.

⁷ δύο Rose, coll. 546 b 11.

578 a

τὰς δὲ φωνὰς παραπλησίας¹ ἔχουσι ταῖς² ἡμέροις, πλὴν μᾶλλον ἢ θήλεια φωνεῖ, ὃ δ' ἄρρην σπανίως. τῶν δ' ἄρρένων οἱ τομῖαι μείζους γίνονται καὶ

578 b χαλεπώτεροι, ὥσπερ καὶ Ὅμηρος ἐποίησεν

θρέψεν ἐπι³ χλοῦνην σὺν ἄγριον· οὐδὲ ἐώκει
θηρί γε σιτοφάγῳ, ἀλλὰ ρίῳ ὑλήεντι.

γίνονται δὲ τομῖαι διὰ τὸ νέοις οὖσιν ἐμπίπτειν νόσημα κνησιμὸν εἰς τοὺς ὄρχεις· εἶτα ξυόμενοι πρὸς τὰ δένδρα ἐκθλίβουσι τοὺς ὄρχεις.

XXIX⁵ Ἡ δ' ἔλαφος τὴν μὲν ὀχείαν ποιεῖται, καθάπερ ἐλέχθη πρότερον, τὰ πλεῖστα μὲν ἐξ ὑπαγωγῆς (οὐ γὰρ ὑπομένει ἢ θήλεια τὸν ἄρρην πολλὰκις διὰ τὴν συντονίαν), οὐ μὴν ἀλλὰ καὶ ὑπομένουσαι ἐνίοτε ὀχεύονται, καθάπερ τὰ πρόβατα· καὶ ὅταν ὀργῶσι, 10 παρεκκλίνουσιν ἀλλήλας· μεταλλάττει δ' ὁ ἄρρην καὶ οὐ πρὸς μιᾷ διατρίβει, ἀλλὰ διαλιπῶν βραχὺν χρόνον πλησιάζει ἄλλαις· ἢ δ' ὀχεία γίνονται μετ' ἄρκτουρον περὶ τὸν Βοηδρομιῶνα καὶ Μαιμακτηριῶνα· κύει δ' ὀκτῶ μῆνας· κυῖσκειται δ' ἐν ὀλίγαις 15 ἡμέραις, καὶ ὑφ' ἑνὸς πολλαί· τίκτει δ' ὡς μὲν ἐπὶ τὸ πολὺ ἐν, ἤδη δὲ τινες ὠμμένα ἐσὶν ὀλίγα καὶ δύο· καὶ ποιεῖται τοὺς τόκους παρὰ τὰς ὁδοὺς διὰ τὸν πρὸς τὰ θηρία φόβον· ἢ δ' αὐξήσις ταχεῖα τῶν νεβρῶν· κάθαρσις δὲ κατ' ἄλλους μὲν χρόνους οὐ συμβαίνει ταῖς ἐλάφοις· ὅταν δὲ τέκωσι,⁴ γίνονται 20 φλεγματώδης αὐταῖς κάθαρσις· εἴθισται δ' ἄγειν

¹ παραπλησίας A: -ίους D, vulg.: -ίως P.

² ταῖς D: τοῖς ACP, vulg.

³ ἐπὶ vulg. ⁴ τέκωσι PD: τίκτωσι AC, vulg.

domesticated animals; their grunt too is similar to theirs, except that the female grunts more and the male seldom. Wild boars which have been castrated grow larger and fiercer, as Homer says^a:

He reared against him a wild castrated boar; nor was it like a corn-eating beast, but like a forest-covered peak.

They get castrated because when they are young they are attacked by an itching disease of the testicles; they then rub themselves against trees and squeeze the testicles out.

The hind copulates, as I have already said, mostly XXIX
under compulsion (the female often cannot endure the Deer.
male owing to the rigidity)^b; however, they do sometimes endure it and copulate, as the ewe does, and when they are in heat, the females avoid one another. The stag divides his attentions and does not spend all his time with one hind; after a while he will mate with others. Breeding occurs after <the morning rising of> Arcturus round about Boedromion and Maimakterion.^c Gestation lasts for eight months. It takes a hind only a few days to conceive, and many can be impregnated by one male. In general, the hind bears one only, but a few have been observed to bear two. Through fear of wild beasts the hind brings forth her young by the roadside. The fawns grow rapidly. No menstruation occurs in hinds at any other time; when they have borne, their menstrual substance is phlegm-like. The hind's custom is to

^a This is a curious conflation of two passages, *Iliad* ix. 539 and *Odyssey* ix. 190 f. Whether χλοῦνης really has the meaning here assigned to it by Aristotle is doubtful. His interpretation is misrepresented by Plutarch at *Q.N.* xxi, where see F. H. Sandbach's notes (Loeb ed.). ^b See 540 a.

^c See App. A, p. 399, and App. B, p. 409.

τοὺς νεβροὺς ἐπὶ τοὺς σταθμούς· ἔστι δὲ τοῦτο τὸ χωρίον αὐταῖς καταφυγή, πέτρα περιρραγεῖσα μίαν ἔχουσα εἴσοδον, οὗ καὶ ἀμύνεσθαι εἴωθε¹ τοὺς ἐπιτιθεμένους.

Περὶ δὲ τῆς ζωῆς μυθολογεῖται μὲν ὡς ὄν μακρόβιον, οὐ φαίνεται δ' οὔτε τῶν μυθολογουμένων οὐδὲν
 25 σαφές, ἢ τε κήσις καὶ ἢ αὔξις τῶν νεβρῶν συμβαίνει οὐχ ὡς μακροβίου τοῦ ζώου ὄντος. ἐν δὲ τῷ ὄρει τῷ Ἐλαφῶεντι καλουμένῳ, ὃ ἔστι τῆς Ἀσίας ἐν τῇ Ἀργινούσῃ, οὗ ἐτελεύτησεν Ἀλκιβιάδης, αἱ ἔλαφοι πᾶσαι τὸ² οὖς ἐσχισμένοι εἰσίν, ὥστε κἂν ἐκτοπίσῃσι γινώσκεισθαι τούτῳ· καὶ τὰ ἔμβρυα δ'
 30 ἐν τῇ γαστρὶ ὄντα εὐθύς ἔχει τοῦτο τὸ σημεῖον. θηλὰς δ' ἔχουσιν αἱ θήλειαι τέτταρας ὡσπερ αἱ βόες. ἐπειδὴν δὲ πλησθῶσιν αἱ θήλειαι, ἐκκρίνονται οἱ ἄρρενες καθ' ἑαυτοὺς, καὶ διὰ τὴν ὄρμην τὴν τῶν ἀφροδισίων ἕκαστος μονούμενος βόθρους ὀρύττει,
 579 a καὶ βρωμεῖ³ ὡσπερ οἱ τράγοι· καὶ τὰ πρόσωπα διὰ τὸ ραίνεσθαι μέλανα γίνεσθαι αὐτῶν [ὡσπερ τῶν τράγων].⁴ οὕτω δὲ διάγουσιν, ἕως ἂν ὕδωρ γένηται· μετὰ δὲ ταῦτα τρέπονται πρὸς τὴν νομὴν. ταῦτα δὲ
 5 ποιεῖ τὸ ζῶον διὰ τὸ φύσει λάνθον εἶναι καὶ διὰ τὴν παχύτητα· ὑπερβάλλουσα γὰρ γίνεσθαι τοῦ θέρους αὐτῶν, διὸ καὶ οὐ δύναται θεῖν, ἀλλ' ἀλίσκονται ὑπὸ τῶν πεζῆ διωκόντων ἐν τῷ δευτέρῳ δρόμῳ καὶ τρίτῳ, καὶ φεύγουσι διὰ τὸ καῦμα καὶ τὸ ἀσθμα εἰς τὸ ὕδωρ. καθ' ὃν δὲ χρόνον ὀχεύουσι, τὰ κρέα
 10 γίνεσθαι φαῦλα καὶ δυσώδη, καθάπερ καὶ τῶν τράγων. ἐν μὲν οὖν τῷ χειμῶνι γίνονται λεπτοὶ καὶ

¹ εἴωθεν ἤδη PD, vulg.: deinde τοῖς ἐπιτιθεμένοις AC: ἀμύν. οἶδε τοὺς ἐπ. propos. Pí.: ἐβίξει loco εἴωθε propos. Dt.

take the fawns to the lair, which is their place of refuge—a cave which has only one way in, and there she is wont to defend herself from would-be attackers.

Stories are told of its longevity, but none of them has been established as true; besides, the period of gestation and the swift growth of the fawns do not suggest that it is a long-lived animal. On the so-called Deer Mountain, which is at Arginusa in Asia <Minor>—the place where Alcibiades met his end—all the hinds have their ear split, so that even if they roam far afield they can be recognized by it: the embryos while still in the uterus also have this mark. The females have four teats, like the cow. After the females have become pregnant, the males separate off on their own, and on account of their sexual urge each one by himself digs out a hole in the ground; their smell is rank,^a as is that of he-goats. And owing to their getting spattered their foreheads become black [as do those of goats]. They pass the time in this way until the rain comes; after that they go to pasture. The animal does these things owing to its natural salacity and owing to its fatness, which is excessive in summer and makes them unable to run: they are in fact caught by huntsmen on foot in the second or third run. Also, the heat and their own shortness of breath makes them take flight towards water. At the breeding season their flesh is worthless and rank, as is he-goats' flesh. In winter they get thin and weak,

^a The traditional text reads "they bellow."

² <ἕτερον> add. Sn., Dt.

³ βρωμεῖ Dt.: βρωμεῖ AC: βρωμᾷ D: βρωμα P: βρωμάται γρ. A, vulg.

⁴ secl. A.-W., Dt.: πρόσωπα suspic. est Th., qui credit fort. ποσθία leg. esse.

ἀσθενεῖς, πρὸς δ' ἕαρ μάλιστ' ἀκμάζουσι πρὸς τὸ δραμεῖν. ἐν δὲ τῷ φεύγειν ἀνάπαυσιν ποιοῦνται τῶν δρόμων, καὶ ὑφιστάμενοι μένουσιν ἕως ἂν πλησίον ἔλθῃ ὁ διώκων· τότε δὲ πάλιν φεύγουσιν. τοῦτο δὲ 15 δοκοῦσι ποιεῖν διὰ τὸ πονεῖν τὰ ἐντός· τὸ γὰρ ἔντερον ἔχει λεπτόν καὶ ἀσθενές οὕτως ὥστ' εἰάν ἡρέμα τις πατάξῃ, διακόπτεται τοῦ δέρματος ὑγιούς ὄντος.

XXX Αἱ δ' ἄρκτοι τὴν μὲν ὀχείαν ποιοῦνται, ὥσπερ εἴρηται πρότερον, οὐκ ἀναβαδὸν ἀλλὰ κατακεκλι- 20 μέναι ἐπὶ τῆς γῆς. κύει δ' ἄρκτος τριάκονθ' ἡμέρας. τίκτει δὲ καὶ ἐν καὶ δύο, τὰ δὲ πλείστα πέντε. ἐλάχιστον δὲ τίκτει τὸ ἔμβρυον τῷ μεγέθει ὡς κατὰ τὸ σῶμα τὸ ἐαυτῆς· ἔλαττον μὲν γὰρ γαλῆς τίκτει, μείζον δὲ μύος, καὶ ψιλὸν καὶ τυφλόν, καὶ σχεδὸν ἀδιάρθρωτα τὰ σκέλη καὶ τὰ πλείστα τῶν μορίων.

25 τὴν δ' ὀχείαν ποιεῖται τοῦ μηνὸς τοῦ Ἐλαφηβολιῶνος,¹ τίκτει δὲ περὶ τὴν ὥραν τὴν τοῦ φωλεύειν. γίνονται μὲν οὖν περὶ τὸν χρόνον τοῦτον καὶ ἡ θήλεια καὶ ἡ ἄρρηγ πίοτατοι· ὅταν δ' ἐκθρέψῃ, τρίτῳ μηνί² ἐκφαίνεται ἤδη τοῦ ἕαρος. καὶ ἡ ὑστρίξ δὲ φωλεῖ τε³ καὶ κύει ἴσας ἡμέρας, καὶ τᾶλλα ὡσαύτως

30 τῇ ἄρκτῳ. κύουσαν δ' ἄρκτον ἔργον ἐστὶ λαβεῖν.
XXXI Λέων δ' ὅτι μὲν ὀχεύει ὀπισθεν καὶ ἔστιν ὀπισθου-

¹ τοῦ <Ποσειδεῶνος καὶ φωλεύει μέχρι τοῦ μηνὸς τοῦ> Ἐλαφ. Dt. (secutus Petavium, qui ποιεῖται τοῦ Ποσ. καὶ φωλεύει μέχρι τοῦ Ἐλαφ. proposit.) vel (Plinio praeunte, viii. 54, *estium coitus hiemis inibi*) ποιεῖται τοῦ χειμῶνος ἀρχομένου καὶ φ. μεχ. τοῦ Ἐλαφ. : Ποσειδεῶνος loco Ἐλαφ. Cs. ex Gul. (*mensis Decembris*): Ἐκατομβαιῶνος velint A.-W., ut et Cs. in commentario.

² ἐκθρέψῃ τρίτῳ μηνί, interp. vulg.; post μηνί intercidit. credit Dt. ἀπὸ (vel ἐκ) τροπῶν, coll. 600 b 2 : ἐκφαίνουσιν PD, vulg.; ἐκφαίνει mavult Sn. : ἐκφαίνεται A, Dt. ("post ἐκφαίνεται fort. intercidit ἀρχομένου"); ἐκφαίνει αὐτὰ Pl. : ἐκφέρεται C.

³ φωλεῖ τε Sn., Pl. : φωλεῖται A¹CPD : φωλεύει A².

but towards spring they are in their best condition for running. When being coursed they pause in their running, and stand still, waiting until the huntsman is almost on top of them, then off they go again. It seems that they do this because of some internal stress; at any rate, their gut is so slender and weak that if you give them a slight hit it breaks apart, although their skin remains whole.

Bears, as has been mentioned already, do not copu- late by mounting; the female lies on the ground. XXX The she-bear is pregnant for thirty days; and she Bears. brings forth sometimes one cub, sometimes two; the maximum is five. The new-born bear's-cub is the smallest of all compared with the size of its parent: it is smaller than a weasel, but bigger than a mouse, hairless and blind, and its legs and most of its limbs are practically unarticulated.^a They pair in the month of Elaphebolion,^b and the young are born about the season when they go into their winter lair. About this time both sexes become extremely fat. When the she-bear has reared her young, she comes out into view in the third month, by which time it is spring. The female porcupine also hides away for the winter, and is pregnant for the same length of time, and otherwise does as the she-bear. It is no easy business to catch a bear when pregnant.

Lions copulate rearwards, and are opisthuretic, as XXXI

^a See Additional Note, p. 376.

^b See Appendix B, p. 409. Various attempts at emendation have been made, in order to make the passage more consistent. Dt. (following the suggestion of Petavius) reads: "in the month of Poseideon, and go into hiding until Elaphebolion"; Pliny's version (viii. 54) seems to indicate "at the beginning of winter, and go into hiding until Elaphebolion"; Camus merely substitutes Poseideon for Elaphebolion (following Gul.), and A.-W. substitute Hekatombaion.

579 a

ρητικόν, εἶρηται πρότερον· ὀχεύει δὲ καὶ τίκτει οὐ
 πᾶσαν ὥραν, καθ' ἕκαστον μέντοι τὸν ἐνιαυτόν.
 τίκτει μὲν οὖν τοῦ ἔαρος, τίκτει δ' ὡς ἐπὶ τὸ πολὺ

579 b δύο, τὰ μέντοι πλεῖστα ἕξ· τίκτει δ' ἐνίοτε καὶ ἓν.

ὁ δὲ λεχθεὶς μῦθος περὶ τοῦ ἐκβάλλειν τὰς ὑστέρας
 τίκτοντα ληρώδης ἐστὶ, συνετέθη δ' ἐκ τοῦ σπανίους
 εἶναι τοὺς λέοντας, ἀποροῦντος τὴν αἰτίαν τοῦ τὸν

5 μῦθον συνθέντος· σπάνιον γὰρ τὸ γένος τὸ τῶν λεόν-
 των ἐστὶ καὶ οὐκ ἐν πολλῶ γίγνεται τόπῳ, ἀλλὰ τῆς
 Εὐρώπης ἀπάσης ἐν τῷ μεταξύ τοῦ Ἀχελώου καὶ
 τοῦ Νέσσου ποταμοῦ. τίκτει δὲ καὶ ὁ λέων πάνυ
 μικρὰ οὕτως ὥστε δίμηνα ὄντα μόλις βαδίζειν. οἱ
10 πέντε, εἴτ' αἰεὶ ἐνὶ ἐλάττονα· μετὰ δὲ ταῦτα οὐκέτι
 οὐδὲν τίκτουσιν, ἀλλ' ἄγονοι διατελοῦσιν. οὐκ ἔχει
 δ' ἡ λέαινα χαίτην, ἀλλ' ὁ ἄρρην λέων. βάλλει δ' ὁ
 λέων τῶν ὀδόντων τοὺς κυνόδοντας καλουμένους
 τέτταρας μόνους, δύο μὲν ἄνωθεν δύο δὲ κάτωθεν·
 βάλλει δ' ἐξάμηνος ὢν τὴν ἡλικίαν.

15 XXXII

Ἡ δ' ὕαινα τῷ μὲν χρώματι λυκώδης ἐστὶ, δαυ-
 τέρα δέ, καὶ λοφίαν ἔχει δι' ὅλης τῆς ράχεως· περὶ
 δὲ τῶν αἰδοίων ὁ λέγεται, ὡς ἔχει ἄρρενος καὶ θή-
 λείας, ψεῦδός ἐστιν. ἀλλ' ἔχει τὸ μὲν τοῦ ἄρρενος
 ὅμοιον τῷ τῶν λύκων καὶ τῶν κυνῶν, τὸ δὲ δοκοῦν
 θηλείας εἶναι ὑποκάτω μὲν ἔχει τῆς κέρκου, παρα-
 20 πλήσιον δ' ἐστὶ τῷ σχήματι τῷ τοῦ θήλεος, οὐκ
 ἔχει μέντοι οὐδένα πόρον· ὑποκάτω δ' ἐστὶν αὐτοῦ
 ὁ τῆς περιπτώσεως πόρος. ἡ δὲ θήλεια ὕαινα ἔχει

^a Cf. 606 b 15. The authority is Herodotus vii. 126: "The boundary of the lions' country is the river Nestos [*sic*] which flows through the territory of Abdera [in Thrace] and the river Achelōis which flows through Acarnania: neither to

has been already stated. They do not copulate and ^{Lions.}
 bear at every season, but once every year. Parturi-
 tion is in spring, and the lioness bears usually two
 cubs, at the most six, though sometimes only one.
 The story which is told about the lioness losing her
 uterus in parturition is nonsense, and was made up to
 account for the scarcity of lions by someone who was
 at a loss to explain it otherwise. It is a fact that the
 lion is a scarce animal, and is not found in many places
 —in the whole of Europe it occurs only in the tract of
 country between the rivers Achelōis and Nessos.^a
 The lioness' cubs are so small when born that at two
 months they can barely walk. Lions in Syria bear
 five times: five the first time, then one fewer each
 succeeding time; after that they bear no more, but
 continue without offspring.^b The lioness has no mane;
 only the lion has one. The lion sheds only the four
 so-called canine teeth, two from the upper jaw and
 two from the lower; this happens at the age of six
 months.

In colour the hyena is similar to the wolf, but it has ^{XXXII}
 a shaggier coat, and a mane the whole length of its ^{Hyenas.}
 spine. The statement is made that the hyena has
 both male and female sexual organs; but this is un-
 true. In fact the sex-organ of the male resembles
 that of the wolf and the dog; the organ which is
 thought to be like that of the female is under the tail,
 and in shape does resemble that of the female, but
 there is no passage connected with it, and the passage
 for the residue is situated underneath it. The female

the east of the Nestos in the whole of the fore part of Europe
 [sc., the part nearest to Asia Minor] would you see a lion, nor
 westward of the Achelōis in the rest of the mainland; but in
 between these two rivers they are to be found."

^b Repeated at *G.A.* 750 a 32 ff., where the reason is given.

579 b

μέν καὶ τὸ ὅμοιον τῷ τῆς θηλείας λεγομένῳ αἰδοίῳ, ἔχει δ' ὡσπερ ὁ ἄρρην αὐτὸ ὑποκάτω τῆς κέρκου, 25 πόρον δ' οὐδένα ἔχει· μετὰ δὲ τοῦτο ὁ τῆς περιττώσεως ἐστὶ πόρος, ὑποκάτω δὲ τούτου τὸ ἀληθινὸν αἰδοῖον. ἔχει δ' ἢ ὕαινα ἢ θήλεια καὶ ὑστέραν, ὡσπερ καὶ τὰ ἄλλα ζῶα τὰ θήλεια, ὅσα ἐστὶ τοιαῦτα. σπάνιον δ' ἐστὶ λαβεῖν θήλειαν ὕαιναν· ἐν ἔνδεκα γούν κυνηγὸς τις μίαν ἔφη λαβεῖν.

30 Οἱ δὲ δασύποδες ὀχεύονται μὲν συνιόντες ὀπισθεν, ὡσπερ εἴρηται πρότερον (ἐστὶ γὰρ ὀπισθορηητικόν), ὀχεύονται δὲ καὶ τίκτουσι πάσαν ὥραν, καὶ ἐπι- 30 XXXIII κύσκονται ὅταν κύωσι, καὶ τίκτουσι κατὰ μῆνα. τίκτουσι δ' οὐκ ἄθρόα, ἀλλὰ διαλείπουσιν ἡμέρας 580 a ὅσας ἂν τύχωσιν. ἴσχει δ' ἢ θήλεια γάλα πρότερον ἢ τεκεῖν, καὶ τεκοῦσα εὐθὺς ὀχεύεται, καὶ συλλαμβάνει ἔτι θηλαζομένη· τὸ δὲ γάλα παχύτητι ὁμοίον ἐστὶ τῷ ὑεῖω. τίκτει δὲ τυφλά, ὡσπερ τὰ πολλὰ τῶν πολυσχιδῶν.

5 Ἡ δ' ἀλώπηξ ὀχεύει μὲν ἀναβαίνουσα, τίκτει δ' 5 XXXIV ὡσπερ ἡ ἄρκτος, καὶ ἔτι μᾶλλον ἀδιάρθρωτον. ὅταν δὲ μέλλη τίκτειν, ἐκτοπίζει οὕτως ὥστε σπάνιον εἶναι τὸ ληφθῆναι κύουσαν. ὅταν δ' ἐκτέκη, τῇ γλώττῃ λείχουσα ἐκθερμαίνει καὶ συμπέττει. τίκτει

10 δὲ τέτταρα τὰ πλεῖστα.

XXXV Λύκος δὲ κύει μὲν καὶ τίκτει καθάπερ κύων τῷ 10 χρόνῳ καὶ τῷ πλήθει τῶν γιγνομένων, καὶ τυφλά τίκτει ὡσπερ κύων· ὀχεύει δὲ καὶ ὀχεύεται κατὰ μίαν

^a For a note on the anatomy of the hyena and the frequency of males, see *G.A.* (Loeb ed.), pp. 565 f. Cf. *G.A.* 757 a 2 ff.

^b See Notes, §§ 19 f., and note there. Cf. Additional Note on 579 a 24 (p. 376).

hyena indeed has the organ which is said to be similar to a female organ, but, as in the male, it is underneath the tail and has no passage connected with it; after that is placed the passage for the residue, and underneath this the true genital organ. The female hyena has a uterus as the other female animals have which are of that sort. It is a very rare thing to find a female hyena: a hunter told me that out of eleven hyenas he caught only one was a female.^a

Hares copulate in the rearward position, as I have XXXIII already stated, since they are retromingent animals: Hares. they pair and bring forth at all seasons. Superfetation occurs during pregnancy, and they bring forth every month. The young are not produced all together, but at intervals of as many days as it may happen to be. The female has milk before parturition, and after bearing will have intercourse immediately; she conceives while still suckling her young. In consistency the milk is similar to the sow's. The young are born blind, as are the young of most of the fissipede animals.

The fox mounts the vixen for intercourse, and she XXXIV brings forth as the bear does: the young are even Foxes. more unarticulated. When she is about to give birth the vixen withdraws to unfrequented places, so that it is a rare event to catch one while pregnant. When the young have been born, by licking them with her tongue she warms them thoroughly and brings their concoction to completion.^b Four is the maximum number at a birth.

The wolf coincides with the dog both in time of XXXV conception and parturition, and also in the number Wolves. of young produced; similarly too its young are born blind. Copulation takes place at one definite season,

580 a

ὄραν, καὶ τίκτει ἀρχομένου τοῦ θέρου. λέγεται δέ
 15 τις περὶ τοῦ τόκου λόγος πρὸς μῦθον συνάπτων·
 φαῖν γὰρ πάντας τοὺς λύκους ἐν δώδεξ' ἡμέραις τοῦ
 ἐνιαυτοῦ τίκτειν. τούτου δὲ τὴν αἰτίαν ἐν μύθῳ
 λέγουσιν, ὅτι ἐν τσσαύταις ἡμέραις τὴν Λητώ παρε-
 κόμισαν ἐξ Ἑπερβορέων εἰς Δῆλον, λύκαιναν φαινο-
 μένην διὰ τὸν τῆς Ἥρας φόβον. εἰ δ' ἐστὶν ὁ χρόνος
 20 οὗτος τῆς κυήσεως ἢ μή¹ ἐστίν, οὐδέν πω συνῶπται
 μέχρι γε τοῦ νῦν, ἀλλ' ἢ ὅτι λέγεται μόνον. οὐκ
 ἀληθές δὲ φαίνεται ὃν οὐδὲ τὸ λεγόμενον ὡς ἄπαξ ἐν
 τῷ βίῳ τίκτουσιν οἱ λύκοι.

Οἱ δ' αἰλουροὶ καὶ οἱ ἰχνεύμονες τίκτουσιν ὅσα περ
 καὶ οἱ κύνες, καὶ τρέφονται τοῖς αὐτοῖς· ζῶσι δέ
 25 περὶ ἔτη ἕξ. καὶ ὁ πανθῆρ δὲ τίκτει τυφλά ὡς περ
 λύκος, τίκτει δὲ τὰ πλεῖστα τέτταρα τὸν ἀριθμόν.²
 καὶ οἱ θῶες δ' ὁμοίως κυτσκοῦνται τοῖς κυσὶ, καὶ
 τίκτουσι τυφλά. τίκτουσι δὲ καὶ δύο καὶ τρία καὶ
 τέτταρα τὸν ἀριθμόν. ἐστὶ δὲ τὴν ἰδέαν ἐπ' οὐρανὸν
 μὲν μακρός, τὸ δ' ὕψος βραχύτερος.³ ὅμως⁴ δὲ
 30 ταχυτήτι διαφέρει, καίπερ τῶν σκελῶν ὄντων βρα-
 χέων, διὰ τὸ ὑγρὸς εἶναι καὶ πηδᾶν⁵ πόρρω.

580 b

XXXVI

Εἰσὶ δ' ἐν Συρίᾳ οἱ καλούμενοι ἡμίονοι, ἕτερον
 γένος τῶν ἐκ συνδυασμοῦ γιγνομένων ἵππου καὶ
 ὄνου, ὅμοιοι δὲ τὴν ὄψιν, ὡς περ καὶ οἱ ἄγριοι ὄνοι
 πρὸς τοὺς ἡμέρους, ἀπὸ τίνος ὁμοιότητος λεχθέντες.
 εἰσὶ δ' ὡς περ οἱ ὄνοι οἱ ἄγριοι καὶ οἱ⁶ ἡμίονοι τὴν

¹ μή PD, vulg.: αἰεί A.-W., Dt.: αἰεί AC.

² τὸν ἀριθμόν om. AC. ³ μακρότερος PD.

⁴ ὅμως A.-W.: ὁμοίως codd., vulg.

⁵ πηδᾶν A.-W.: πηδᾶ codd., vulg.

and the young are born at the beginning of summer. An account is given of the she-wolf's parturition which comes very near the fabulous, viz., that there are just twelve days in the year during which all wolves bring forth their young. The reason for this, they say, is found in a fable, which alleges that it took twelve days to bring Leto from the land of the Hyperboreans to Delos, during which time she had the appearance of a she-wolf because she was afraid of Hera.^a Whether this really is the time for their pregnancy or not, has not yet been definitely established by observation; that is merely what is asserted. The other assertion, that the she-wolf bears only once in her life, is patently untrue.

Cats and ichneumons ("trackers") bear the same Cats, etc. number of young as dogs, and live on the same diet; they live for about six years. The panther's cubs, like the wolf's, are born blind; the maximum number at a birth is four. Conception in the *thōs*^b is similar to that in the dog; the young are born blind, and two, three, or four are produced at a birth. To look at, the *thōs* is long from head to tail, but does not stand so high. However, in spite of its short legs, it is exceptionally swift, owing to its being so supple and because it can jump a long way.

In Syria there are the so-called half-asses,^c a differ- XXXVI
 ent animal from those which are the offspring of horse Half-asses.
 and ass, though similar in appearance, just as wild asses are, compared with domesticated ones, and this accounts for their name. Like the wild asses, these

^a Cf. Plutarch, *Q.N.* xxxviii (Loeb ed.).

^b See Additional Note, p. 377.

^c Mentioned also at 491 a 2, 577 b 23.

⁶ of Sn. (in cur. post.), Dt.: αἰ AC, vulg.: om. PD.

5 ταχυτήτα διαφέροντες. οὔτοι δ' οἱ¹ ἡμίονοι γεννώ-
 σιν ἐξ ἄλλήλων. σημείον δέ· ἦλθον γάρ τινες εἰς
 Φρυγίαν ἐπὶ Φαρνάκου τοῦ Φαρναβάζου πατρός, καὶ
 διαμένουσιν ἔτι. εἰσὶ δὲ νῦν μὲν τρεῖς, τὸ παλαιὸν
 δ' ἑννέα ἦσαν, ὡς φασίν.

10
 XXXVII

Ἡ δὲ τῶν μυῶν γένεσις θαυμασιωτάτη παρὰ
 τᾶλλα ζῶα ἐστὶ τῷ πλήθει καὶ τῷ τάχει. ἤδη γάρ
 ποτε ἐναποληφθείσης τῆς θηλείας κνούσης ἐν ἀγγεῖῳ
 κέγχρῳ, μετ' ὀλίγον ἀνοιχθέντος τοῦ ἀγγείου ἐφά-
 νησαν ἑκατὸν καὶ εἴκοσι μύες τὸν ἀριθμὸν. ἀπο-
 ρεῖται δὲ καὶ ἡ τῶν ἐπιπολαζόντων γένεσις μυῶν
 15 ἐν ταῖς χώραις καὶ ἡ φθορά². πολλαχοῦ γὰρ εἴωθε
 γίνεσθαι πλήθος³ ἀμύθητον τῶν ἀρουραίων, ὥστ'
 ὀλίγον λείπεσθαι τοῦ σίτου παντός. γίνεται δ'
 οὕτω ταχεῖα ἡ φθορά,⁴ ὥστ' ἔνιοι τῶν μὴ μεγάλας
 γεωργίας ἐργαζομένων, τῇ προτεραίᾳ ἰδόντες ὅτι
 20 θερρίζειν ὦρα, τῇ ὑστεραίᾳ ἔωθεν ἄγοντες τοὺς θερι-
 στὰς καταβεβρωμένα ἅπαντα καταλαμβάνουσιν. ὁ
 δ' ἀφανισμὸς οὐ κατὰ λόγον ἀποβαίνει· ἐν ὀλίγαις
 γὰρ ἡμέραις ἀφανεῖς πάμπαν γίνονται· καίτοι ἐν
 τοῖς ἐμπροσθεν χρόνοις οὐ κρατοῦσιν οἱ ἄνθρωποι
 ἀποθυμῶντες καὶ ἀνορύττοντες, ἔτι δὲ θηρεύοντες
 καὶ τὰς ὄσ ἐμβάλλοντες· αὐταὶ γὰρ ἀνορύττουσι τὰς
 25 μυωπίας. θηρεύουσι δὲ καὶ αἱ ἀλώπεκες αὐτούς,
 καὶ αἱ γαλαὶ αἱ ἄγρια μάλιστα ἀναιροῦσιν, [ὅταν
 ἐπιγένωνται]⁵ ἀλλ' οὐ κρατοῦσι τῆς πολυγονίας καὶ
 τῆς ταχυγονίας, οὐδ' ἀλλ' οὐδὲν πλην οἱ ὄμβροι,

¹ οὔτοι δ' οἱ Dt.: αὐταὶ δ' αἱ A.-W.: αὐταὶ αἱ PD, vulg.: αὐ-
 ται δὲ AC.

² φθορά P.

³ γ. π. CPD: π. γ. A, vulg.

⁴ φθορά D, vulg.

⁵ secl. Scal., edd.; om. Gaza.

half-asses are exceptionally swift of foot. They breed
 with their own kind, as is proved by the following
 incident: Some of them came to Phrygia in the time
 of Pharnakes the father of Pharnabazus,^a and some
 are there still. There are three of them there now,
 though in the old days there were nine, so it is said.

The reproduction of mice is a most astonishing
 thing when compared with other animals both for the
 number of young produced and the speed of it. There
 is the case of a female mouse having got shut up in a
 jar of millet seed while pregnant, and after a short
 while when the jar was opened 120 mice came to light.
 The way in which mice appear in enormous numbers
 in the countryside and disappear is also a puzzle. In
 many places an innumerable multitude of field mice
 appears regularly, with the result that very little of
 the corn crop is left. They get to work with such
 speed that those in charge of smallish farms will on
 one day see that it is time for reaping to start, and
 the next day early in the morning they will go out
 with their reapers and discover the whole crop has
 been devoured. Their disappearance too is un-
 accountable: in a few days they will have completely
 disappeared. Yet before that the farm hands would
 have been fumigating and digging them out, hunting
 them down and turning pigs on to them (pigs root
 their holes up), without making any headway against
 them. Foxes, too, hunt them, and wild ferrets are
 particularly good at getting rid of them; but even
 these creatures are no match for the speed and
 volume of their reproduction. Rain is the only thing

XXXVII
 Mice.

^a Pharnabazus, the celebrated Persian satrap, c. 450-370
 B.C. His father Pharnakes was apparently still alive in the
 spring of 414 B.C. (see Aristophanes, *Birds* 1028).

580 b

ὅταν ἐπιγένωνται τότε δ' ἀφανίζονται ταχέως. τῆς δὲ Περαικῆς ἐν τινι τόπῳ ἀνασχιζομένης τῆς θη-
30 λείας τῶν ἐμβρύων τὰ θήλεα κύντα φαίνεται. φασι δὲ τινες καὶ ἰσχυρίζονται καὶ ἐὰν¹ ἄλα λείχων²

581 a ἀνευ ὀχείας γίνεσθαι ἐγκύους.

Οἱ δ' ἐν Αἰγύπτῳ μύες σκληρὰν ἔχουσι τὴν τρίχα ὡσπερ οἱ χερσαῖοι ἐχίνοι. εἰσὶ δὲ καὶ ἕτεροι οἱ βαδίζουσιν ἐπὶ τοῖς δυοῖ ποσίν· τὰ γὰρ πρόσθια μικρὰ ἔχουσι, τὰ δ' ὀπίσθια μεγάλα· γίνονται δὲ 5 πλήθει πολλοί. ἔστι δὲ καὶ ἄλλα γένη μυῶν πολλὰ.³

¹ καὶ ἐὰν AC: ὅτι ἂν PD, vulg.

² ἄλλας λείχων C: ἀλλήλας λείχ. propos. A.-W.: ἀναλείχων D: ἀναλίχων P.

³ add. A init. octavi libri τὰ μὲν οὖν . . . τὸν τρόπον (588 a 16 sq.): hunc enim librum et A et CPD et alii hic subiungunt, edd. autem quem nonum habent codd.; vide et quae tom. i, pp. xxxv sq. scripsi.

^a Cf. a very similar passage in Photius, cod. 278 (528 a 23 ff. Bk.), paraphrasing Theophrastus on "Animals which appear in large numbers." Photius goes on to mention the "two-

which can control their attacks—and then they disappear with speed.^a There is a place in Persia where when a female mouse is cut open the female embryos are seen to be pregnant. Some people say, indeed stoutly maintain, that, if they merely lick salt, mice become pregnant, without any copulation.^b

The mice in Egypt have bristles^c like hedgehogs. There is another kind of mouse which walks on its hind legs^d: the front legs are short, and the hind ones long: these exist in great numbers. There are also many other kinds of mice.^e

legged" mice in Egypt (cf. the last paragraph of the present Book).

^b Cf. Plutarch, *Q.N.* iii, *ad fin.*, and above, 574 a 9.

^c An African genus.

^d The jerboa; cf. 606 b 6 ff.—Herodotus (iv. 192) mentions three kinds of mice in eastern Libya, adjoining Egypt: "two-legged," *zegeries* (a Libyan word meaning "hills"), and *echinees*, i.e., bristly, "hedgehog-mice."

^e It is possible that this may be intended to include rats. See W. P. MacArthur, "The occurrence of the Rat in early Europe," *Trans. Royal Soc. Trop. Med. and Hygiene*, XLVI (1952), pp. 209 ff.

ADDITIONAL NOTES

Additional Note for IV. 531 a 3 ff.

The sea-urchin's "lantern"

I have been unable to find any archaeological evidence about lanterns (*λαμπτήρες*) in Aristotle's time, although very many lamps (*λύχναι*) survive. Aristotle refers again to lanterns with skin at *G.A.* 780 a 26 ff., where he remarks that the skin on the pupil of the eye must be transparent: this requires that it should be thin, white (*λευκόν*), and even. It must be white, because what is black is not transparent, for that is precisely what black is—the non-transparent. Hence also, lanterns (*λαμπτήρες*) cannot shine if they consist of skin of that sort. It is perhaps worth pointing out that the diagram of a lantern which Thompson gives at *G.G.F.*, p. 71 for comparison with the oral skeleton of the sea-urchin is a product of the imagination, as is clear from his own words: "I seem to see the lantern itself, like a street-lamp, in the shape of an inverted cone, with its panes set in a frame all round" (the panes he assumes to be made of horn, *ibid.*, and in his translation of the present passage; but both here and at *G.A.* 780 a Aristotle speaks of skin).

The word *genus* in Scot's version (see *apparatus criticus*) is at first surprising, and appears to give no help towards deciding between *σῶμα* and *στόμα*. The Arabic words, however, for genus (*jins*) and body (*jism*) are graphically not dissimilar, whereas the word for mouth (*fam*) is far less similar, and it is therefore probable that *σῶμα* was the reading of the Arabic translator's Greek ms.; it is, of course, the only word which makes sense of Scot's statement. I have myself seen no adequate explanation of the phrase *κατὰ μὲν οὖν τὴν ἀρχὴν καὶ τελευτήν*, which must in some way be intended as a contrast with *κατὰ δὲ τὴν ἐπιφάνειαν*. Furthermore, it is remarkable that Scot's version has no reference whatever to the lantern, and none to "the beginning and end." Not only that; his statement "the sea-urchin's kind [*read* body] is continuous in its lower part, but in its upper part where the spines are it is discontinuous" can be readily understood as a correct description of the facts: the lower part of the sea-urchin, *i.e.*, the part round the mouth-aperture, is a continuous skin, whereas the upper part, to which the spines are fixed, consists of separate, though interlocking, plates.

No doubt some of the larger sea-urchins would make handsome lanterns, and it is interesting to note that Ethel Browne Harvey, in her excellent book *The American Arbacia and other sea-urchins* (Princeton U.P., 1956, plate 1: 6), gives an aboral view of *Arbacia punctulata* taken with a light-bulb illuminating the shell from inside; an enlarged coloured version of the same photograph is on the dust-cover. Thompson had remarked (*G.G.F.*, p. 71) that "a large urchin becomes translucent and makes a pretty lamp if a light be lit inside," and that this may favour the reading "body," but he goes on to say, "on the other hand, there is no lack of continuity in the shell."

The text of the Greek manuscripts therefore still awaits a satisfactory interpretation.^a

I append a transcript of William of Moerbeke's version. It will be seen that he gives a close translation of the Greek text, reading *σώμα*, not *στόμα*:

Secundum principium quidem igitur et finem continuum corpus ericii est, secundum superficiem autem non continuum sed simile radiationi non habenti que in circuitu pellem. spinis autem ericius utitur ut pedibus.

^a At the time of writing I have not been able to see a copy of Alfred Osborne, *Lychnos et lucerna*.

Additional Note for IV. 531 a 31 ff.

Sea-anemones

Bekker's text (1831)

- (A) ἔστι δὲ καὶ τὸ τῶν ἀκαληφῶν γένος ἴδιον· προσπέφυκε μὲν γὰρ¹ ταῖς πέτραις ὡς περ ἓνια τῶν ὀστρακοδέρμων,
 (B) ἀπολύεται² δ' ἐνίοτε.
 (C) οὐκ ἔχει δ' ὀστρακον, ἀλλὰ σαρκῶδες τὸ σῶμα πᾶν³ ἐστὶν αὐτῆς.
 (D) αἰσθάνεται δὲ καὶ συναρπάζει
 (E) προσφερομένης τῆς χειρὸς⁴
 (F) καὶ προσέχεται,⁵

¹ μὲν γὰρ] δὲ AC ² ἀπολύονται AC Gul. ³ σῶμα πᾶν] στόμα AC
⁴ σινυλῖ τὰρτὶ ὀβλάτα τὰνυ Gul. ⁵ προσδέχεται A: προέρχεται C Gul.

Even a casual reading of this passage is sufficient to show that the text has suffered considerable interference, and several editors have made attempts to correct it. In the absence of the Arabic version for Book IV our ms. authorities for the original state of the text are limited to the Greek mss. and Michael Scot's translation, and an editor must get whatever clues he can from these two sources, from what Aristotle himself has written elsewhere on this subject, and from the sort of structure one might expect an intelligible account to have. Neither the Greek text nor Scot's translation can be considered wholly satisfactory, but I believe it is possible to construct a reasonable text taking them both into account.

I give first the Greek text as presented by Bekker, with mss. variants, and the text of Michael Scot's version as given by the three Cambridge mss. and as incorporated in Albert's *de animalibus*. I have broken up each of these two texts into sections, keeping the original order of each, so as to show as far as possible the correspondences and discrepancies between them, and also for ease of reference in commenting. It is unnecessary to print Gaza's translation (1476), since this is a very slightly expanded version made from a Greek text indistinguishable from Bekker's. The ms. of Scot's version used by Albert did not differ substantially from the text as printed below. I include the continuation of Scot's version, where it will be seen to follow the Greek text closely.

Michael Scot's version

- (A) Et genus animalis quod dicitur grece akaleki¹ est unum genus per se, et applicatur lapidibus sicut animal cuius testa est aspera similis teste vasis.
 (B)
 (C) et non habet testam,² sed creatio sui corporis est similis creationi carnis.
 (D) Et hoc genus sentit et rapit³
 (E) quicquid appropinquat manibus
 (F) et applicatur

¹ akakelu I: et est genus quod dicitur akaloki D
 om. I ² et rapit et D

³ testam

ARISTOTLE

- (G) καθάπερ ὁ πολύπους ταῖς πλεκτάναις,
 (H) οὕτως⁶ ὥστε τὴν σάρκα ἐπανοιδεῖν.
 (L) ἔχει δὲ τὸ στόμα ἐν μέσῳ,
 (N) καὶ ζῆ ἀπὸ⁷
 (O) τῆς πέτρας ὡπερ ἀπ' ὄστρέου.⁸
 (P) κἂν⁹ τι προσέση τῶν μικρῶν ἰχθυδίων,¹⁰
 (Q) ἀντέχεται ὡπερ¹¹ τῆς χειρός·
 (R) οὕτω κἂν τι¹² προσέση αὐτῇ ἐδάδιμον,
 (S) κατεσθίει.¹³
 (T) καὶ ἀπολύεται δὲ
 (V) γένος τι αὐτῶν, ὃ
 (X) ἐάν¹⁴ τι προσέση
 (Y) κατεσθίει καὶ ἐχίνους καὶ κτένας.¹⁵

⁶ οὔτε A¹ ⁷ δ' ἀπὸ AC ⁸ ἀπὸ στεροῦ A¹C ⁹ καὶ ἂν PD
¹⁰ ἰχθυῶν D ¹¹ ὡπερ] γὰρ ὡπερ καὶ AC (retinet enim sicut manu
 Gul.) ¹² τι om. PD ¹³ om. AC ¹⁴ ἂν PD ¹⁵ κτένας καὶ ἐχίνους A
 praeter ea quae supra notavi, versio Gul. cum text. vulg. consentit.

Scot's version continues :

et non invenitur in suo corpore superfluitas omnino, et in hoc assimilatur arboribus,¹ et in isto genere sunt duo modi, et unus est parvi corporis et comeditur, et alius magni corporis et duri, sicut in regione que dicitur helfiz,² et caro eius in hyeme est dura et propter hoc venantur ipsum et comedunt.

¹ carbonibus D ² helfiz G, Albertus : belfiz D : efliz I (Χαλκίς)

D = Univ. Libr. Camb. Dd. 4. 30
 I = Univ. Libr. Camb. II. 3. 16
 G = Gonv. and Cal. Coll. Ms. 109
 Albertus = Albertus, *de animalibus*, ed. Stadler

Schneider (1811)

Schneider's text differs from the vulgate at the following points (I give the passage (N-S) as recast by him in his *Curae posteriores*, vol. iv, p. 379) :

- (A) μὲν γὰρ] δὲ
 (C) αὐτῆς] αὐτοῦ
 (E) χειρός· (punctuation)
 (N-S) καὶ χρῆται τῇ πέτρᾳ ὡπερὰν ὄστρέω· καὶ ἂν τι προσέση

HISTORIA ANIMALIUM

- (G) lapidibus
 (H) cum suis pedibus⁴ sicut animal multorum pedum,
 (K) et fortasse tumescet⁵ corpus eius
 (L) quando applicatur alicui rei.
 (M) et habet orificium⁶ in medio corporis eius,
 (N) et venatur
 (O)
 (P) quicquid transit per ipsum ex piscibus parvis.
 (Q)
 (R)
 (S)
 (T)
 (V) et quoddam genus ipsius
 (X)
 (Y) comedit hyricium et pecten.

⁴ cum suis pedibus DG : pedibus suis Albertus : om. I ⁵ tu-
 mescit I ⁶ orificia DG

αὐτῇ ἐδάδιμον ἢ τῶν μικρῶν ἰχθυδίων, ἀντέχεται, ὡπερ
 τῆς χειρός, καὶ κατεσθίει.

(V-Y) ὃ, ἐάν τι προσέση, κατεσθίει, καὶ κτένας καὶ ἐχίνους.

Piccolos (1863)

Piccolos' text differs from the vulgate as follows :

- (N-P) καὶ δὴ ἀπὸ τῆς πέτρας ὡπερ ἀπ' ὄστρέου, ἂν τι προσέση
 τῶν μικρῶν ἰχθυδίων,
 (X) [ἐάν τι προσέση] seclisit

Aubert and Wimmer (1868)

A.-W.'s text differs from the vulgate as follows (I include also their translation of sections N-O) :

- (N-O) und sie leben am Felsen wie die Schaltiere in der Schale.
 (Q-Y) ἀντέχεται· ὡπερ γὰρ τῆς χειρός, οὕτω κἂν τι προσέση αὐτῇ ἐδάδιμον. κατεσθίει δὲ καὶ ἐχίνους καὶ κτένας, καὶ ἀπολύεται δὲ γένος τι αὐτῶν.

Dittmeyer (1907)

Dittmeyer's text differs from the vulgate as follows :

- (M) no comma after μέσῳ

(P-Y) These sections are recast as follows :

ἀντέχεται γὰρ ὡσπερ καὶ τῆς χειρός, οὕτω τῶν μικρῶν ἰχθυ-
δίων κἄν τι προσπέσῃ αὐτῇ ἐδώδιμον· κατεσθίει δὲ καὶ
ἐχίνους καὶ κτένας. [καὶ ἀπολύεται δὲ γένος τι αὐτῶν.]

Louis (1964)

Louis gives A.-W.'s, Piccolos' and Dittmeyer's proposals in his *apparatus*, but he seems himself to be unaware of any difficulty in the text.

The points of difficulty may be enumerated as follows :

- (1) A statement about sea-anemones casting loose occurs twice: first at (B): ἀπολύεται δ' ἐνίοτε [sc. τὸ τῶν ἀκα-
ληφῶν γένος]; secondly at (T-V): ἀπολύεται δὲ γένος τι
αὐτῶν.

On the first occasion the statement appears to apply to
all sea-anemones. On the second occasion it applies
only to one kind of sea-anemone. The latter agrees with
what we find stated by Aristotle elsewhere :

At 487 b 11 ff. we read: τὰ δὲ [sc. τῶν ζώων] καὶ προσφύεται
καὶ ἀπολύεται, οἷόν ἐστι γένος τι τῆς καλουμένης ἀκαλήφης·
τούτων γὰρ τινες νύκτωρ ἀπολυόμεναι νέμονται.

At *P.A.* 681 b 2 ff. the sea-anemones are said to " dual-
ize " between animals and plants: τῷ μὲν γὰρ ἀπολύεσθαι
καὶ προσπίπτειν πρὸς τὴν τροφὴν ἐνίας αὐτῶν ζῳικόν ἐστι, καὶ
τῷ αἰσθάνεσθαι τῶν προσπιπτόντων . . . τῷ δ' ἀτελὲς εἶναι
καὶ προσφύεσθαι ταχέως ταῖς πέτραις τῷ γένει τῶν φυτῶν
παραλήσιον.

Cf. H.A. 548 a 24 (κνίδαι = ἀκαλήφαι) ἐστὶ δὲ τῶν κνιδῶν δύο
γένη· αἱ μὲν γὰρ ἐν τοῖς κοίλοις οὐκ ἀπολύονται τῶν πετρῶν,
αἱ δὲ ἐπὶ τοῖς λείοις καὶ πλαταμώδεσιν ἀπολυόμεναι μετα-
χωροῦσιν.

It would, therefore, appear that the statement at (T-V)
is more likely to be the genuine one, and the earlier
statement at (B) to be an interpolation. Thus the
excision of (T-V), as proposed by Dittmeyer on the
ground that it conflicts with (B), would seem to be
mistaken. Alternatively, (B) could be brought into

agreement with (T-V) by adopting the reading ἀπολύου-
ται of the two best mss. A and C, and by changing
ἐνίοτε to ἐνιαί. However, such an anticipation of (T-V)
seems unnecessary; and if the words of section (B) were
omitted, the sentence would run equally well, indeed
better, as the statement of the way in which the sea-
anemones differ from the Testacea would then follow
immediately after the statement of the way in which
they resemble them. Section (B) is not represented in
Scot, but nothing can be deduced from this, since the
similar words at (T) do not appear in his version either.

- (2) The statement at (N-O) καὶ ζῆ ἀπὸ τῆς πέτρας ὡσπερ ἀπ'
δοστρέου can mean only that the creature " lives off "
the rock in the sense of deriving its sustenance from the
rock. That this is the meaning of ζῆ ἀπὸ is shown, e.g.,
by *H.A.* 610 a 13 f. (πολέμοιο δὲ καὶ ὁ λέων καὶ ὁ θῶς
ἀλλήλοισ· ὠμοφάγοι γὰρ ὄντες ἀπὸ τῶν αὐτῶν ζώουσιν), Her-
odotus i. 216 (σπεῖρουσι δὲ οὐδὲν, ἀλλ' ἀπὸ κτηνῶν ζώουσι καὶ
ἰχθύων), *id.* ii. 36 (ἀπὸ τυρῶν καὶ κριθῶν ἄλλοι ζώουσι), *id.*
iv. 22 (ζῶσι δὲ ἀπὸ θήρης); and *cf.* Aristophanes, *Paav* 850,
and Thucydides i. 2 (νερόμενοι τε τὰ αὐτῶν ἕκαστοι ὅσον
ἀποζῆν καὶ περιουσίαν χρημάτων οὐκ ἔχοντες οὐδὲ γῆν φυτεύ-
οντες). The same meaning appears in the passage quoted
by Louis (Xenophon, *Mem.* i. 2. 14: ἤδεσαν Σωκράτη ἀπ'
ἐλασσόνων χρημάτων ἀταρκέστατα ζῶντα), though strangely
Louis cites it in support of the interpretation which he
(with others) adopts of the *H.A.* phrase as meaning " uses
the rock instead of a shell."

In fact, what the sea-anemone " lives off," according to
Aristotle, is not the rock but small fishes: αἱ δ' ἀκαλήφαι
τρέφονται ὁ τι ἂν προσπέσῃ ἰχθυδίων (590 a 27); and if the
words of section (O) are omitted, the present passage
gives us this self-same assertion. It would therefore
appear that the words at (O) are the relic of a statement,
perhaps originally in the margin, intended as a com-
ment on (A), and based upon the statement at 590 a 32,
that the sea-anemone " appears to make use of the rock
as a shell " (τῇ πέτρᾳ χρῆσθαι ὡς δοστρέω). Indeed Schneider,
feeling that the statement (N-O) was unsatisfactory,
boldly proposed in his *Curae posteriores* (see above)
to substitute for it καὶ χρῆται τῇ πέτρᾳ ὡσπερὰν δοστρέω,
taken almost verbatim from 590 a 32.

Quite apart from the fact that ζῆ ἀπὸ τῆς πέτρας ὡς ἀπ'

ὄστρέου cannot mean "makes use of the rock instead of a shell," any statement to this effect would be out of place at this point, for Aristotle has now gone on to speak of the creature's mouth and its food; adherence to the rock has already been mentioned at (A).

I conclude therefore that the words τῆς πέτρας ὡς ἀπ' ὄστρέου at (O) are intrusive. The word lapidibus at (G) in Scot may be a relic of this interpolation, which is not otherwise represented in his version.

- (3) This leads on to a consideration of the phrases at (H) and (E). It seems likely that in (H) the Greek text has preserved the correct arrangement, and I shall assume that this is so, *i.e.*, that *cum suis pedibus* represents ταῖς πλεκτάνας and refers to the octopus; the dislocation in Scot could well have been caused by the insertion of lapidibus at (G). At (E), προσφερομένης τῆς χειρὸς seems clearly to refer to the hand of a human disturber, whereas in Scot *manibus* just as clearly refers to the "hands" of the sea-anemone. Similarly, at (K), σάρκα seems clearly to refer to the flesh of the disturber's hand (and is so taken by editors and translators), whereas *corpus* in Scot refers to the creature's body.

If the phrase at (E) in the Greek were to be amended so as to refer to the sea-anemone's hands, we should have an opportunity of obtaining (a) an accusative for the verb συναρπάζει instead of the present genitive, and (b) an appropriate parallel between the sea-anemone's "hands" and the octopus' tentacles. I therefore propose that προσφερομένης τῆς χειρὸς be emended into τὰ προσφερόμενα ταῖς χερσὶ—which would also exactly correspond to *quicquid appropinquat manibus*.

The transformation, which I have thus assumed, of the Greek phrase at (E) into a reference to the hand of a human disturber may be responsible for the introduction of the second reference to the hand at (Q), which is not represented in Scot.

Similarly, σάρκα at (K) is just as likely to have been intended to refer to the sea-urchin's flesh (*cf.* Scot) as to the flesh of the hand; in fact, more likely, since the flesh mentioned earlier (at (C)) was the flesh of the sea-anemone.

Some support for this interpretation may be claimed from modern observations, *e.g.*, as recorded by Elaine A.

Robson, "Some observations on the swimming behaviour of the anemone *Stomphia coccinea*," in *J. of Experim. Biology*, 38 (1961), pp. 343-363; this article is also relevant in that it deals with an anemone which casts loose. This anemone ranges from Siberia through Scandinavia to the Pacific, and is infra-tidal in relatively cold waters. Apparently it needs the stimulus of contact with a particular starfish (*Dermasterias imbricata*) to make it cast loose; when this happens expansion (*cf.* Aristotle's "swelling up of the flesh") takes place; "After stimulation by *Dermasterias* the anemone expands much beyond its normal resting size. . . . The crown of the anemone . . . becomes expanded to the point of translucence" (p. 351). Miss Robson writes later on (p. 359), "There are few records of swimming in other actinians. Planktonic forms (*e.g.*, *Minyas*) float passively. . . . The only published description of rhythmic activity as rapid as in *Stomphia* seems to be Verrill's note (1928) on *Nectothela lilae*. This is a small Hawaiian anemone related to *Anemonia*, which possesses long and extremely numerous tentacles. It can swim actively, apparently by rhythmical contractions of the disk, during which time the column is markedly shortened. Here a temporary pacemaker is almost certainly present. Carlgren referred *Nectothela* to *Bolocerooides m. murricchi* and found a similar species in the Red Sea (articles dated 1899, 1927, 1949), and it is also recorded from Japan. *Gonactinia prolifera* can also swim, apparently in the same way." *cf.* O. Carlgren, "Report on the Actinaria and Ceriantharia," in "Zoological Results of the Cambridge Expedition to the Suez Canal, 1924," *Trans. Zool. Soc. of London*, 22 (1927), pp. 443-445: "From the Red Sea *Bolocerooides* has migrated all the way to the Great Bitter Lake. *Aiptasia diaphana* has migrated from the Mediterranean through the whole canal to Port Taufiq. The occurrence of *Diadumene luciae* makes it appear to have migrated from the Mediterranean as far as Lake Timsah. . . . *Bolocerooides* is a swimming form characterized by great mobility" (p. 445). The anemones mentioned by Carlgren belong to regions nearer Aristotle's, and may have been known to him.

- (4) The phrase ἐδν (or κᾶν) τι προσέσθη occurs three times

over, at (P), (R) and (X). That all three occurrences are a genuine part of the text seems improbable; and it may be noticed that two of them are not represented in Scot. The third occurrence (at (X)) was ejected by Piccolos, A.-W. and Dittmeyer; the second also (R) was ejected by Dittmeyer. Schneider conflated the two occurrences at (P) and (R). (It is possible that Scot's (L) may represent one of the *ἐάν τι προσπέση* phrases, perhaps in the form *ἐάν τι προσπέση*).

The phrase already quoted (in para. 2 above) from *H.A.*, 590 a 27 suggests that in the present passage too the connexion of *ἐάν τι προσπέση* is properly with *ἰχθύδια*. In any case the phrase (R) is superfluous, since presumably the purpose of the sea-anemone in fastening on to small fishes would be to eat them and not to make them swell up, but as the Greek text stands in the vulgate there seems to be a contrast between the "small fishes" and "anything eatable," suggesting that the small fishes are not eatable.

- (5) The word *κατεσθίει* occurs twice, at (S) and (Y). At (S) it is omitted by the two best mss. A and C, and also by Scot. Aubert and Wimmer and Dittmeyer eliminate one occurrence.
- (6) The most likely restoration of (N-S) is thus: *καὶ ζῆ ἀπὸ τῶν μικρῶν ἰχθυδίων, ἐάν τι προσπέση αὐτῆ [ἐδώδιμον]*. It is difficult to decide whether or not *ἐδώδιμον* should be regarded as an original part of the text.
- (7) My recommendations for this passage are therefore as follows:
- (B) should be excised or emended to *ἀπολύονται δ' ἔναι*
 (E) should be emended to *τὰ προσφερόμενα ταῖς χερσὶ*
 (N-R) should read *καὶ ζῆ ἀπὸ τῶν μικρῶν ἰχθυδίων, ἐάν τι προσπέση αὐτῆ*, perhaps adding the word *ἐδώδιμον*.
 (S) *κατεσθίει* should be omitted.
 (T) *καὶ ἀπολύεται δὲ* here should remain.
 (X) *ἐάν τι προσπέση* should be omitted.

Additional Note for IV. 536 a 4 ff.

There has clearly been some confusion in the text of this passage, though it is difficult to suggest a convincing restoration. It may be useful to have before us for com-

parison Scot's version, which elsewhere in the context corresponds closely with the Greek:

animal vero linguam habens et pulmonem et quattuor pedes habet vocem debilem, et quod est ex eis ovans sibilat ut serpens, et ex eis est quod habet vocem debilem ut tortuca.

Like the Greek text, the Latin version has the repetition of the phrase about "a weak voice," which can hardly be right, and serpents are still grammatically included under quadrupeds. (Schneider's supposition (III. 248) that serpents are cited merely for the sake of comparison, and not as actual examples of the first kind of weak voice specified (*συριγμός*), seems unconvincing, especially as tortoises must be intended as examples of the second kind of weak voice, whatever this may be; see below). If, however, the words *καὶ τετράποδα* were omitted, birds (which are dealt with in the next paragraph) would not be excluded, and if *φρόσκα* were omitted (or deferred, as in Scot), the description would be of even wider application, for it would then include Vivipara, and the first statement would be untrue, because many Vivipara certainly emit more than a weak voice. It seems that the real purpose of these two words is to exclude Vivipara and to exclude bipeds, but not necessarily to exclude footless animals, for although *τετράποδα* obviously cannot describe serpents, Aristotle frequently considers serpents together with the four-footed Ovipara, as being closely allied to them (*e.g.*, 508 a 8 ff., and *cf.* *G.A.* 732 b 4, *P.A.* 660 b 6, 676 a 24, 690 b 12 ff.) It seems that he is doing the same in the present passage, and it could therefore be maintained that the insertion of A.-W.'s *ἡ ἄποδα* is unnecessary.

With regard to the latter part of the sentence, it is doubtful whether *λεπτήν καὶ ἀσθενῆ φωνήν* (as in Scot) or *συριγμὸν μικρὸν* is more likely to have been the genuine reading (the ms. A^a gives *συριγμὸν* here also). Probably one of these phrases is a gloss on the other; A.-W. thought the former was a gloss on the latter, and it is true that if we take the former to be the original text, we are presented with the repetition already mentioned above.

I have followed A.-W. in excising the former phrase, though I do not feel convinced that the contrast of *συριγμὸν* and *συριγμὸν* is genuine (especially in view of the reading of A^a); and I have also adopted their insertion of *ἡ ἄποδα*, which is palaeographically reasonable.

In this passage William of Moerbeke's translation closely follows the Greek text as given by Bekker.

Additional Note for IV. 537 a 3 ff.

The difficulties presented by this passage have been recognized by previous editors and translators. For the reader's convenience I give first the vulgate text, with manuscript variants, and then Michael Scot's version. Both have been divided into sections, as before, so as to show correspondences and omissions, though in some instances it is

Bekker's text (1831)

- (A) σημείον δὲ κατὰ μὲν τὰ ὄμματα οὐκ ἔστι λαβεῖν (οὐδὲν γὰρ ἔχει βλέφαρα αὐτῶν),
 (B) ἀλλὰ ταῖς ἀτρεμίαις.
 (C) ἀλίσκονται γὰρ¹ οἱ ἰχθύες,
 (D) εἰ μὴ² διὰ τοὺς φθειράς καὶ τοὺς καλουμένους ψύλλους,³ καὶ
 (E) ὥστε τῇ χειρὶ λαμβάνειν⁴ βραδίως·
 (F) νῦν δ',
 (G) ἂν χρονίζωσιν,⁵
 (H)
 (K) οὗτοι τῆς νυκτὸς
 (L) κατεσθίουσι προσπίπτοντες,
 (M) πολλοὶ τὸ πλῆθος ὄντες.⁶
 (N)
 (O) γίνονται δ' ἐν τῷ βυθῷ τῆς θαλάττης, καὶ τοσοῦτοι τὸ πλῆθος
 (P) ὥστε καὶ τὸ δέλεαρ, ὃ τι ἂν ἰχθύος ᾖ, εἰάν⁷ χρονίση ἐπὶ τῆς γῆς, κατεσθίουσιν·
 (Q) καὶ ἀνέλκουσι⁸ πολλάκις οἱ ἀλιεῖς
 (R) περὶ⁹ τὸ δέλεαρ
 (S)
 (T) ὥσπερ σφαῖραν συνεχομένων¹⁰ αὐτῶν.
 (V) ἀλλ' ἐκ τῶν τοιῶνδε¹¹ μᾶλλον ἔστι τεκμήρωσθαι¹² ὅτι καθεύδουσιν·
 (X) πολλάκις γὰρ ἔστιν ἐπιπεσόντα¹³ τοῖς ἰχθύσι¹⁴ λαβεῖν

¹ μὲν γὰρ D ² εἰ μὲν μὴ PD ³ τοὺς καλουμένους ψύλλους A : τοὺς λεγομένους ψύλλους D : τὰς ψύλλας P ⁴ λαβεῖν D : λαμβάνη A¹
⁵ χρονίζωσιν D : χρονίσουσιν P ⁶ ὄντες om. A¹ ⁷ εἰάν ἰχθύος
⁸ ἀνέλκουσι in ras. A ⁹ παρὰ A¹ ¹⁰ συνεχομένην AP
¹¹ τοιῶν PD ¹² τεκμαίρωσθαι PD ¹³ ἐπιπεσόντες A¹ ¹⁴ τοὺς ἰχθύς D

difficult to be sure that there is nothing in Scot's version corresponding to something in the Greek, e.g., *propter ponderositatem eorum in casu* may perhaps represent ταῖς ἀτρεμίαις (B) and προσπίπτοντες (L); *dividet* (H²) may represent κατεσθίουσιν (L), and so on. The lacuna at (H) in the Greek is intended to indicate that there is no reference in the Greek text to the net. At (R) περὶ τὸ δέλεαρ is replaced in Scot's version by a reference to the net (S); and it is possible that throughout the Arabic translator understood bait in the sense of trap or net.

Michael Scot's version

- (A) et hoc non scitur per oculos eorum quoniam non habent palpebras.
 (B)
 (C) et multi pisces deprehenduntur
 (?B) propter ponderositatem eorum in casu.
 (D)
 (E) et propter hoc forte accipiuntur¹ manu.
 (F)
 (G¹) et si permaneat² piscis
 (H¹) in reti
 (G²) per aliquod tempus
 (H²) dividet rete.³
 (K) et faciet hoc plus de nocte
 (L)
 (M) cum fuerit multum implicatum⁴
 (N) in reti.
 (O) et multitudo piscium est in profundo maris.
 (P)
 (Q) et propter hoc venatores⁵ cum elevant
 (R)
 (S) rete
 (T) inveniunt⁶ in eo⁷ pisces rotundos factos sicut spera magna.
 (V)
 (X) et forte⁸ venabuntur⁹ et forte¹⁰ non sciunt¹¹ venatorem.

¹ add. eum I ² maneat G ³ dividet retia D : dividit rethe I
⁴ multum implicatum G (quamvis sint multum impliciti Albertus) : multum D : implicatum I ⁵ add. piscium D ⁶ inveniunt I
⁷ eo ex eos corr. D : eos G : eis I ⁸ fortiter I
⁹ add. pisces Dd ¹⁰ forte om. G ¹¹ sciunt I ; add. pisces G

- (Y) οὕτως ὥστε καὶ¹⁶ τῇ χειρὶ λαβεῖν ἢ πατάξαντα λαθεῖν.
 (Z) ὑπὸ δὲ τὸν καιρὸν τοῦτον ἡρεμοῦσι σφόδρα, καὶ κινουοῦν
 οὐθέν πλὴν ἡρέμα τὸ οὐραῖον.

¹⁶ καὶ om. AC

Schneider

Schneider's text, amended in accordance with his *Curae posteriores* (vol. iv, p. 384), is identical with the vulgate except at the three following points:

- (D-L) καλουμένους ψύλλους . . . <οὕτως ἀτρεμίζοντες>, ὥστε κἄν τῇ χειρὶ λαμβάνειν ῥαδίως· νῦν δ' ἂν χρονίσωσιν <ἐν τοῖς δικτύοις>, οὗτοι τῆς νυκτὸς κατεσθίονσι προσπεσόντες, (I have modernized his brackets. The dots after ψύλλους are his. In his text he had προσπίπτοντες, not προσπεσόντες.)

- (V) ἀλλ' ἐκ τῶν τοιούτων μᾶλλον ἐστι τεκμαίρεσθαι

- (X) ἐπιπεσόντα τοῖς ἰχθύσι λαθεῖν

The insertion of ἀτρεμίζοντες is based on William of Moerbeke's version, which Schneider quotes as follows: *capuntur enim pisces, nisi propter pediculos et vocatos pulices inquietentur, ita utique immobilitantes, ut in manu capere sit facile.* (In his note Schneider suggests ἀτρεμίζοντες or ἀκινήτιζοντες as alternatives.)

The insertion of ἐν τοῖς δικτύοις is based on William of Moerbeke's phrase, quoted by Schneider as *si moram faciant in reti, which corresponds closely with Scot's si maneat piscis in reti per aliquod tempus.* (I give a transcript of William's version of A-T below.)

Piccolos

Piccolos' text follows Schneider's closely. It is identical with the vulgate except in the following passage (the brackets have been modernized):

- (D-K) καλουμένους ψύλλους, <ἀτρεμίζοντες οὕτως> ὥστε κἄν τῇ χειρὶ λαμβάνειν ῥαδίως· νῦν δ', ἂν χρονίσωσιν <ἐν τοῖς δικτύοις>, οὗτοι τῆς νυκτὸς

(A.-W.'s report of Piccolos' text is incorrect; what they quote as his is really Schneider's: ψύλλους . . . οὕτως ἀτρεμίζοντες, ὥστε κἄν τῇ χειρὶ).

(Y)

- (Z) et in somno quiescit piscis et non movetur ex eo nisi cauda solum motu modico.¹²

¹² movetur ex eo nisi cauda motu solum modico D; movetur nisi ex cauda solum motu modico I

MSS. references as for the earlier passage above, p. 354.

Aubert and Wimmer

A.-W.'s text is identical with the vulgate except for the following:

- (A) οὐθέν γὰρ ἔχει βλέφαρα αὐτῶν is between commas and not between brackets.

- (C-T) ἀλλοκονταῖ down to συνεχόμενων αὐτῶν is marked for excision.

In their translation A.-W. indicate lacunae as follows:

- (C-E) Die Fische nämlich werden gefangen, . . . wenn nicht wegen der Läuse und sogenannten Flöhe . . ., so dass man sie mit der Hand u.s.w.

A.-W. quote Gaza's version as follows (it is clearly a somewhat expanded version of a text closely resembling the vulgate):

Pisces enim vel manu facile caperentur dum dormiunt, nisi pediculis et pulicibus sollicitarentur, nunc vero si somno dati immorentur, noctu ab innumera multitudine illarum bestiarum occupati absumuntur. gignuntur haec in profundo maris tanta fecunditate, ut etiam escam de pisce emolitam, si diu in uno (humo?) manserit, totam corrodant atque absumant: et quidem saepenumero piscator escam demissam glomeratis undique his bestiolis perinde ut pilam recipit.

The word *uno*, which A.-W. query as possibly a mistake for *humo*, is the reading of the 1498 edition, which I have consulted, but the true reading is no doubt *imo*, as given by Schneider in his quotation *ad loc.*

Dittmeyer

Dittmeyer's text is identical with the vulgate, except that: in (C-T) he brackets for excision the same passage as A.-W.; and

in (D-E) instead of *κᾶν ὥστε* he reads *<ἀτρεμίζοντες οὕτως>* ὥστε (following Schneider and Piccolos, but omitting *κᾶν*).

William of Moerbeke

The following is William of Moerbeke's version of the passage (A-T) as given in the Merton College mss. 270 and 271:

Signum autem secundum oculos quidem non est accipere, nullum enim habet palpebram ipsorum, sed immobilitibus. Capiuntur enim pisces nisi propter pediculos et vocatos pulices inquietentur ita utique immobilitantur ut et manu capere sit facile. Nunc autem si moram fecerant¹ in reti² isti nocte comedunt³ incidentes multi multitudine⁴ existentes. Fiunt autem in fundo maris et tot multitudine ut et esca quecumque piscis fuerit si moram fecerint in terram com(m)edunt et extrahunt frequenter piscatores circa escam⁵ sicut speram coherentem ipsorum.

¹ sic MSS. ² rethi 270 ³ comeduntur 270 ⁴ multitudinem 271 ⁵ terram 270

In view of the very literal character of William's translation in general, the appearance in it of the words *inquietentur ita utique immobilitantur*, which are not represented in our Greek text, and especially of the words *in reti* (see above), is the more remarkable.

It is clear that in this passage there has been considerable interpolation and confusion of the text. The whole passage 537 a 5 to a 12, (C) to (T) inclusive (*ἀλίσκονται . . . συνηχομένων αὐτῶν*) is, as I have said, excised by A.-W. and Dittmeyer, probably rightly, since (a) it is difficult to see how the remarks about sea-lice and fleas are relevant to the matter under discussion; (b) the passage interrupts the subject of *ἀτρεμῖαι* (B), which reappears at (X-Z); (c) it anticipates the mention of catching fishes with the hand; (F) anticipates (Y); (d) *νῦν δ'* at (F) seems completely pointless; (e) the verb *χρονίζεω* occurs twice, once with the fishes and once with the bait as subject; *κατεσθίουσιν* occurs twice, its subject being the lice on both occasions, but the first time its object is the fishes and the second time the bait; and it is

difficult not to believe that the two phrases in which these two verbs occur originally referred to one and the same phenomenon, *i.e.*, that they are really doublets of one original phrase. It is also remarkable that in Scot's version there is no mention of lice, fleas, or bait, but instead mention of the net. Mention of the net occurs also in William of Moerbeke's version; see the quotation given above.

It is not easy to account for the present state of the text; and the passage would read perfectly well if the whole of the passage 537 a 5 *ἀλίσκονται* (C) to 537 a 13 *ὅτι καθεύδουσιν* (V) were omitted. It seems possible that there was at this point a marginal note, perhaps by Aristotle himself, on the subject of lice and fleas, which has got incorporated into the text, the earlier part of it in a somewhat mutilated and repetitive form, and to some extent perhaps confused with portions of the original text. Thus it is possible that phrases such as *ἀλίσκονται γὰρ οἱ ἰχθύες* and *τῆς νυκτός* were such original portions; and the insertion of *τῆς νυκτός* after *πολλάκις γὰρ ἔστιν* at (X) would give more point to the phrase *ὑπὸ δὲ τὸν καιρὸν τοῦτον* at (Z). Or one could write *ἀλίσκονται γὰρ οἱ ἰχθύες τῆς νυκτός μάλλον* (taking *μάλλον* from V): *πολλάκις γὰρ ἔστιν ἐπιτεσσόντα αὐτοῖς λαθεῖν οὕτως κ.τ.λ.* The phrase *ἢ πατάξαντα λαθεῖν* (Y), with the awkward repetition of *λαθεῖν*, is also open to suspicion. Attempts at rewriting cannot, however, be other than futile, as was pointed out by A.-W. (*vergebliche Versuche*), and my own opinion is that it is best to treat the whole passage from *ἀλίσκονται* (C) down to *αὐτῶν* (T) as corrupt and interpolated. In that case, the sentence *ἀλλ' ἐκ τῶν τοιῶνδε . . . καθεύδουσιν* (V) will have been inserted to effect a return to the subject properly under discussion; it is, however, incorrect, since it is not a new or better (*μᾶλλον*) line of evidence which is to be adduced, but an illustration of *ἀτρεμῖαι*.

If this diagnosis is correct, the first two lines of evidence adduced by Aristotle to show that fishes sleep will be (1) the fact that they remain immobile; (2) that they suddenly cease to be immobile (*δῆλον δὲ γίνεται ὅτι καθεύδουσι καὶ ταῖς φораῖς* 537 a 17), as though startled out of sleep.

Whether the text originally contained a reference to fishes in the net, and if so, what the point of it was, and whether it had any connexion with the mention of sea-lice, it is impossible to say.

Additional Note for V. 542 b 4 ff.

The halcyon

Page 119, note a. On the halcyon see Thompson, *G.C.B.* (1936), pp. 46 ff. The halcyon was early identified, rightly or wrongly, with the kingfisher. Aristotle refers to it again at *H.A.* 593 b 8 ff., and 616 a 14 ff. Thompson remarks that the kingfisher is a winter migrant to Greece, and is not known to breed there; it does not in fact nest in winter, nor breed on the sea. It should, however, be noted that there is no statement in the present passage (542 b 4 ff.), nor in either of the other passages, that the halcyon's nest is *on* the sea. In the passage at 616 a 29 Thompson (see his translation and note *ad loc.*) takes the subject of the verb *ἀνατραπή* to be the nest (punctuating after that verb), and the meaning of the verb therefore to be "gets upset"; but at 600 a 4, where the same verb occurs again, there can be no doubt whatever that the subject of it is the sea: *καὶ μάλιστα ἐπὶ κυνί τριμυκάθρα γὰρ ἀνατρέπεσθαι τὴν θάλατταν.*^a In any case, it seems unlikely that if Aristotle supposed the halcyon to breed on the sea, in a floating nest, he would have failed to say so explicitly and to have drawn attention to so remarkable a phenomenon, especially as he describes the nest in great detail. There is no suggestion in Pliny (x. 89-91) that the nest is *on* the sea,^b nor in Ambrose, *Hexaemeron*, v. 40, where the halcyon is described as a sea-bird, which breeds on the shore (*in litoribus*), and deposits its eggs in the sand round about midwinter, when the sea is roughest and beats against the shore with unusual force; as soon as the eggs are laid, however, the waves and storms subside, while the bird incubates for seven days, and for a further seven days while she brings up her brood. This part of Ambrose's description is found copied almost verbatim in a 12th-century bestiary, published in facsimile by M. R. James for the Roxburghe Club in 1928 from the Cambridge Univ. Libr. ms. II. 4. 26; and in commenting on this passage, in a footnote to his translation, T. H. White suggests that the origin of the account may have been the neap tides at the time of the winter solstice. Ambrose draws attention to

^a Cf. the use of the same verb at 605 a 11.

^b It is not clear that Ovid (*Metam.* xi. 745 ff.) intends to say that the nest is *on* the water: *perque dies placidos hierno tempore septem / incubat Alcyone penitentibus aequore nidis. / tunc iacet unda maris, etc.* See the fuller quotation, p. 370 below.

the shortness of the periods of incubation and upbringing, and White observes that this is in fact true about birds of the tide-line. He also remarks that the numbers 7 and 14 have an evident connexion with lunar and tidal periods.

Thompson suggests that the stories have an astronomical origin: Alcyone is the name of the brightest star in the group known as the Pleiades; and, as he points out, about 2000 B.C., in the early and vigorous period of ancient astronomy, at the vernal equinox the sun rose in conjunction with the Pleiades. [In fact, about 2200 B.C. the star Alcyone was only 4° due north of the vernal equinox: see Baehr, *Tafeln*, p. 49; and the sun's position in the heavens at the equinox would therefore almost coincide with that of the Pleiades.] They would then be on the meridian at 6 p.m. at the date of the winter solstice, when, as Thompson remarks, the sun, being at the lowest, *i.e.*, most southerly, part of its annual course, might be said to brood on the sea for about a fortnight. Different numbers, however, ranging from seven to fifteen, are given by various authors for the "halcyon days"; and in the Calendar appended to Geminus' *Isagoge* the date said to have been assigned by Democritus to "changeable days called halcyonid days" is equivalent to February 20th in the modern calendar: the same date occurs elsewhere. The Pleiades were clearly an important feature in ancient times for marking points in the year: they, with the addition of Arcturus and Sirius, are used for this purpose by Aristotle in the *H.A.*, and (with Arcturus) by the author of the Hippocratic *περὶ διατρῆς*, iii. 68 (vi. 595 ff. L.). See also Appendix A, pp. 383 ff.

Thompson's translation of the verse of Simonides "when the deep / cradles the mother Halcyon and her brood," has no justification in the Greek text; in fact, there is no mention at all of the sea in the quotation given by Aristotle. At 593 b 8 ff., in the course of a discussion of water-birds, Aristotle says that the *γένος* of halcyons is *πάρυδρον*: they live beside the water. There are two kinds: one that sits on the reeds and sings, another, a larger kind, which is voiceless. Both the halcyon and the *kerylos* (not mentioned elsewhere by Aristotle) are *περὶ τὴν θάλατταν*. At 616 a 33, after describing the halcyon's nest, Aristotle remarks that the bird "also goes inland up rivers" (*ἀναβαίνει δὲ καὶ ἀπὸ τοῦ ποταμοῦ*). In these two passages there is no mention of midwinter breeding.

The only feature in any of Aristotle's accounts which could

properly be described as fabulous is the reference to Zeus calming the weather in the quotation from Simonides; for the description of the nest which Aristotle gives at 616 a 19 ff. reads like a first-hand account of something he had actually seen. What bird is in fact concerned is another matter: the kingfisher's nest, as is well known, is something quite different from what Aristotle describes as the nest of the halcyon. It seems clear that what Aristotle has in mind is a sea-bird, which also frequents rivers, feeds on fish, and nests on the shore very near the high-water mark—in fact, exactly as Ambrose alleges it to do. In his note on Theocritus vii. 57 Kynaston (*alias* Snow) says that the bird described by Aristotle in *H.A.* VIII was certainly not the kingfisher; the description corresponds with that species of tern or sea-swallow which is most common in the Mediterranean. In the ancient scholia on Theocritus (ed. Wendel) *ad loc.* there is no reference to a floating nest: the bird is said to have its habitat and to hatch its young by the shore, and its chicks get carried away by the waves. A derivation of the name is offered, from ἐν ἄλῃ κέου. There is a statement that ancient [or, alternatively, male] halcyons are called *keryloi*. Professor War-nington tells me that the name *kērytos*, however it is pronounced, is not unlike the call-note or alarm-note of the common tern and the arctic tern; that the little tern has a call-note which sounds like *kiv* or *kēyv*, the latter being another sea-bird name (*cf. kēv*, Homer, *Od.* xv. 479); that the black tern also has a disyllabic call; and that the Greeks must have known all these species except the arctic tern. At *N.H.* xxxii. 27, § 86, Pliny speaks of *nidi alcyonum et ceyxum*. As a proper name, Ceyx was that of a son of Lucifer, king of Trachis, husband of Alcyonē. The story of his decision to go to consult Apollo's oracle, his parting from his wife, and his shipwreck in the Aegean, is movingly told by Ovid, *Metam.* xi. 415-748; his body was washed ashore at the feet of his wife, and they were both transformed into birds. The concluding lines of Ovid's account are:

tunc quoque mansit amor nec coniugiale solutum
foedus in alitibus; coeunt fiuntque parentes,
perque dies placidos hiberno tempore septem
incubat Alcyone pendentibus aequore nidis.
tunc iacet unda maris; ventos custodit et arceit
Aeolus egressu praestatque nepotibus aequor.

Nevertheless, it is clear that in later times, and perhaps also in earlier times, there were fabulous beliefs connected with the halcyon, and it is probable, as Thompson suggests, that the bird was in some way symbolic of the sun. The myth of Delos, birthplace of Apollo and originally according to legend a floating island, may be part of the tradition. There is also the reference to Delos and Apollo at the end of Plutarch's elaborate description of the nest (*De soll. anim.* 983), which he says is "built like a ship," and although he does not explicitly say that it is launched, he seems to imply it. His concluding words are: "I suppose there is no one here present who has not had a sight of this nest. I have often seen it and touched it myself, and this suggests to me that I should say and sing, 'Once such a thing in Delos near Apollo's shrine . . .'" (*Odyssey* vi. 162). In the intentionally fantastic description in Lucian (*V.H.* ii. 40) we read that at midnight, when it was calm, they ran aground on an enormous halcyon's nest, 60 stadia in circumference, on which the hen-bird was sailing, sitting, as they discovered next day, on 500 eggs. The nest was like a great raft, built of great trees, etc. It may be relevant to remark that according to Peterson, Mountfort and Hollom, *A field guide to the birds of Britain and Europe*, the black tern (*Chlidonias niger*), and some other terns which breed in northern Greece, build a floating nest in shallows of marshes and lagoons.

Thompson points out (*G.G.B.*², pp. 96, 100, *s.v.* ἑρόψ) that birds such as the hoopoe, the crested lark and the woodpecker, were symbolic of the sun owing to their bright crests. Professor G. K. Gresseth remarks that such association of birds with the sun is not infrequent in the folk-lore of other lands also, and that if the identification of the halcyon with the kingfisher is accepted its bright colouring "would readily explain its association with the sun. His view is that it is difficult to explain the peculiar story of its nest otherwise than on the assumption that the story of the halcyon days was originally a myth of the birth of the sun. I am very grateful to Professor Gresseth for discussing this matter with me. His paper on the subject ("The myth of Alcyone"), read at Pittsburgh in December 1963, is summarized in *The Classical World*, 57, no. 3, December 1963, and printed in full in *Trans. Amer. Philol. Assoc.* XCV (1964), pp. 88-98.

* The brilliant blue of its upper plumage and the chestnut-red of its under-parts.

There are many references in ancient literature to the halcyon's melancholy note (see Thompson). The Scholiast on Apoll. Rhod. i. 1086 says that Apollonius took his statements about the halcyon from Pindar's *Paeans* (a passage not now extant): the word *ῥοσα*, which Apollonius uses twice in the passage mentioned, is, he says, appropriate, because Pindar said the bird was sent by Hera. (*Cf.* Pind. fr. 73 Turyn (62 S.)) The word *ῥοσα* is also in Homer and Hesiod and elsewhere in Pindar associated with voices or signs from the gods.

The ramifications of this subject are obviously extensive, and it is impossible here to go further into the problem.

Additional Note for V. 550 a 2 f.

The words *ἐν ᾧ ἔχει τὰ ῥά* appear to be corrupt.

Pliny has an account of the octopus' egg, which is obviously based upon three passages of the *H.A.*, one of them being the present passage. Pliny writes as follows (*N.H.* ix. 74 (163)):

Polypi hieme coeunt, pariunt vere ova tortili vibrata pampino, tanta fecunditate ut multitudinem ovorum occisi non recipiant cavo capitis quo praegnantem tulere.

The three Aristotelian passages are:

- (A) 544 a 6 ff. The octopus mates in winter and lays in spring . . . it lays an egg like the twisted inflorescence of a grape-vine. . . . It is a very prolific animal: an enormous multitude of progeny is produced from the spawn.
- (B) 549 b 32 ff. The egg is like the twisted inflorescence of a grape-vine. . . . The octopus has such a multitude of eggs that when they have been taken out they fill a vessel very much bigger than the head [here follow the words under discussion].
- (C) 525 a 5 f. The egg is so multitudinous that it fills a vessel bigger than the octopus' head.

Scot's translation of the end of passage (B) is *maius capite femine impregnate ab eis*; and the similarity of Pliny's corresponding phrase *capitis quo praegnantem tulere* suggests that the words *ἐν ᾧ ἔχει τὰ ῥά* may be a corruption of an original text in which some word like *ὠχρῆμένη* appeared. It will be remarked that Pliny seems to have understood

ἐξαπεθέντων in our present passage to mean "destroyed" (*occisi*).

Additional Note for V. 556 b 17 ff.

Cicadas

Aubert and Wimmer refer to Milde, *Die Sing-Cicaden*, Programm, Breslau, 1866, p. 25, Thompson to Charles Jean-Baptiste Amyot and Audinet Serville, *Histoire naturelle des insectes: Hémiptères*, Paris, 1843. The original account, from which both are derived, is given by M. Solier, Capitaine du Génie, of Marseille, in *Annales de la Société entomologique de France*, VI (1837), p. 214, as follows:

Il me reste à parler, avant de quitter ces insectes, d'une particularité très-remarquable de la Cigale commune. Je dois sa connaissance à mon ami M. Boyer, pharmacien à Aix [Bouches-du-Rhône], avec lequel je l'ai vérifiée. Lorsqu'on entend chanter une Cigale, on s'en approche en sifflant d'une manière un peu tremblotante, à peu près comme elle [Solier here adds a footnote: Ou peut-être bien de toute autre manière; nous pensons même M. Boyer et moi, qu'une serinette ferait le même effet et serait plus commode: car il faut siffler assez long-temps pour bien juger de l'effet produit sur cet insecte. J'engage donc l'entomologiste qui voudra tenter cette expérience à se servir de cet instrument.], mais de façon cependant à dominer son chant. L'on remarquera d'abord qu'elle descend à reculons un petit espace le long de la branche où elle se trouve, comme pour se rapprocher du siffleur, et qu'elle s'arrête ensuite. Si on lui présente doucement une canne, en continuant toujours de siffler, elle s'y pose et redescend lentement, encore à reculons; elle s'arrête de temps en temps, probablement pour écouter, et finit enfin, attirée par cette musique inaccoutumée, à arriver jusqu'à l'observateur. De cette manière, mon ami en a fait placer une sur son nez, où elle continuait à chanter en même temps qu'il sifflait à l'unisson. Cet animal paraissait charmé par cette musique et avait perdu sa timidité naturelle.

A. N. Brangham, *The Naturalist's Riviera* (1962), pp. 183 f., gives a similar account, though at second hand:

Not only do cicadas hear the song of their own species and

react accordingly, they respond also to sounds bearing some resemblance to their own, even if not to cannon-fire. Children in Provence, it is said, used to catch the otherwise shy and elusive cicadas by creeping up to the tree where they were singing. Then the boys would whistle or clap their hands rhythmically. The insects would stop singing, sidle towards the whistling or hand-clapping. They stop, apparently listening. Then they move farther towards the sound. It was part of the game to thrust a length of bamboo gently towards the branch where the insect was sitting. Gradually it moved towards the stick, sometimes even settling on the face of the whistler. In other cases it would fly from its perch on to the lapel. It has also been claimed that the rhythm of song could be changed to the one imposed by the human conductor near by.

On December 21st 1965, the British Broadcasting Corporation broadcast a television programme, with a commentary by Lt.-Commander Peter Scott, showing the response of grasshoppers and similar creatures to various musical sounds. Commander Scott has very kindly informed me that the pictures shown were extracted from a series of experiments undertaken at the Laboratoire de Physiologie Acoustique de l'Institut de la Recherche Agronomique. The animal concerned was an ephippiger (grasshopper), and the instrument used was a whistle. The experiment showed that it was the rhythm, and the length of the bursts of sound, and whether it was produced suddenly or in a gradual crescendo, upon which the effect depended, and not upon the pitch or quality.

Additional Note for VI. 562 a 27-b 2

The whole of Michael Scot's version of this passage reads as follows:

et sunt quedam galline que semper faciunt gemellos. et quedam gallina cubat super ova et finduntur teste in .xviii. diebus. et in quolibet inveniuntur gemelli. et unus gemellorum parvus est et alter magnus, et multociens est parvus monstruosus.

Scot therefore does not translate the words τὸ περὶ τὴν λέκθον, and he appears to have nothing corresponding to πλὴν ὅσα οὐρία . . . γόνιμα.

Additional Note for VI. 563 b 14-29

A.-W. are undoubtedly right in supposing this paragraph to be out of place. The subject currently under discussion is the nesting habits of birds. Those of the cuckoo are in fact described in the succeeding paragraph; the present paragraph has nothing to say on the subject. It could have originated as a marginal note, perhaps by Aristotle himself (though A.-W. doubt this), but in any case it is in an unsatisfactory condition. The reading ὁ ὁμοίος ἐστὶν of the *ms.* P1 in line 16, as Dt. points out, looks like a conjecture; and the reading of the generally better *ms.* AC, ὁμοίος δ' ἐστὶν, suggests that something is missing; Dt. marks a lacuna, supposing the name of the bird concerned to have fallen out (Pi. proposed to read τὸν <μικρὸν> ἰέρακα in the previous sentence). The words ὁμοίος δ' ἐστὶν could, however, be the abandoned opening of a statement in the sense of that made lower down (line 25) about the cuckoo's resemblance to the smallest of the hawks. (The passage ὁμοίος δ' ἐστὶν τοὺς ὀλίγας ἡμέρας is not represented in Scot's translation.) Furthermore, the phrase περὶ τοῦτον τὸν χρόνον in lines 15/16 has nothing to refer to; nor has the phrase τοὺς ἄλλους ἰέρακας. Whatever the status of the paragraph, its component parts have obviously become dislocated, and if a better arrangement is required the following may be suggested: ὁ δὲ κόκκυξ φαίνεται ἐπ' ὀλίγον χρόνον τοῦ θέρους, τὸν δὲ χειμῶνα ἀφανίζεται. καὶ λέγεται μὲν ὑπὸ τινῶν ὡς μεταβάλλει ἐξ ἰέρακος, διὰ τὸ ἀφανίζεσθαι τὸν ἰέρακα περὶ τοῦτον τὸν χρόνον. ἐστὶ δ' ὁ μὲν ἰέραξ continuing down to ὠμμένοι εἰσὶν ἄμφω. σχεδὸν δὲ καὶ τοὺς ἄλλους ἰέρακας οὐκ ἐστὶν ἰδεῖν ὅταν θάπτον φθέγγηται ὁ κόκκυξ, πλὴν ὀλίγας ἡμέρας. And the rest as in the text.

Possibly the last sentence (καὶ κατεσθόμενος κ.τ.λ.) would come better after στιγμαί in line 24.

A.-W. remark that Gaza translates the penultimate sentence of the paragraph as though ἅμα stood in the text; it could, of course, easily have fallen out before ἄμφω.

Additional Note for VI. 568 a 5

Schneider (iii. 459) *ad loc.* quotes Plutarch, *de ira cohibenda*, 456 c: "They describe the sea, when it has been thoroughly agitated by the winds and casts up lumps of sea-

moss [or oyster-green; cf. 568 a 29], and seaweed ($\phi\acute{\upsilon}\kappa\omicron\varsigma$), as 'being cleansed.'

Additional Note for VI. 579 a 24

Licking bear-cubs into shape

Page 339, note a. The bear is not the only animal which brings forth its young in an "almost unarticulated" state. At *G.A.* 774 b 15 ff. "the fox, the bear, the lion, and some others" [sc. of the fissipede animals which produce numerous young] are said to do so; and "practically all of them are born blind, e.g., those just mentioned, and in addition the dog, the wolf, and the $\theta\acute{\omega}\varsigma$ " (see p. 377). In the present passage, however, the phrase $\sigma\chi\epsilon\delta\acute{\omicron}\nu\ \acute{\alpha}\delta\iota\alpha\rho\theta\rho\omega\tau\alpha$, which occurs also in the *G.A.* passage, is elaborated to the extent of asserting that the legs and most of the limbs are unarticulated. Four chapters further on (at 580 a 6 ff.) it is said that the vixen "brings forth as the bear does," and that her cubs are even more unarticulated; having produced them, by licking them with her tongue she completes their warming and concocts them, matures them ($\acute{\epsilon}\kappa\theta\epsilon\rho\mu\alpha\acute{\iota}\nu\epsilon\iota\ \kappa\alpha\acute{\iota}\ \sigma\upsilon\mu\pi\acute{\epsilon}\tau\tau\epsilon\iota$). The notion of "concoction," which is of fundamental importance in Aristotle's biology (cf. Notes, § 19), is regularly associated with the bringing to completion, to the complete attainment of its form, of some developing fruit or animal by means of heat; in fact, at 580 a 10 Thompson actually translates $\sigma\upsilon\mu\pi\acute{\epsilon}\tau\tau\epsilon\iota$ by "gets them into shape." Thus although Aristotle does not expressly attribute the practice of licking her cubs to the she-bear, the stage is set for the belief that bear-cubs have to be licked into shape, and it is found explicitly stated in later literature: Vergil is said to have compared his first drafts to bear-cubs which needed to be licked into shape (e.g., Suetonius, *Vit. Verg.* 22 *carmen se more ursae parere dicens et lambendo demum effingere*; cf. Aulus Gellius xvii. 10, *parere se versus more atque ritu ursino; namque ut illa bestia fetum ederet ineffigiatum informemque, lambendoque . . . postea . . . conformaret et fingeret*, etc.). It is found also in Ovid, *Metam.* xv. 380 f., and Pliny viii. 54 (126), and although first contradicted by Albertus Magnus in the 13th century it persisted in literature as late as Gesner (1551) and Shakespeare (*Henry VI*, Pt. 3, Act 3, sc. 2: "Like to a chaos, or an unlick'd bear-whelp / That carries no impression like the dam");

and later still in popular tradition. Evidence to refute it was first adduced by Pierandrea (Pietro Andrea) Mattioli in ch. 37 of his commentary on Bk. 2 of Dioscorides (see text below); published in 1544, where he reported that a pregnant bear had been killed and cut open by huntsmen, and that cubs with their limbs distinctly formed had been found inside. For a discussion of the belief see Curt Elze, "Vom 'ungeleckten Bären,'" in *Archiv für die Gesch. der Naturwiss. und der Technik*, V (1915), pp. 36-48. (The German phrase can also mean "a rude fellow.")

The following is the text of Mattioli's remarks about bear-cubs from the 37th chapter of his commentary on the second Book of Dioscorides (Frankfort ed., 1598, p. 278):

Vana de Vrsae partu opinio

Quaquam illud silentio non dissimulandum, quòd scilicet Vrsarum partus non sit plurimis membris indiscretus, cruribus praesertim, & vndique rudis, ac informis: nec quòd parentis linctu formam tandem recipiat vrsinam, vt nonnulli scriptis commendarunt, & credit vulgus. Quandoquidem in valle Anania supra Tridentum vidimus nos praegrandem Vrsam praegnantem, ab ipsis venatoribus exenteratam, cuius catuli adhuc in vtero existentes, omnibus suis membris distinctis, ac formatis reperti sunt, non autem informes, vt plerique existimant, magis fortasse Aristotelis, & Plinij auctoritatibus freti, qui ita esse memoriae prodiderunt, quàm sensibus, et experientia.

Additional Note for VI. 580 a 26 ff.
and other passages $\theta\acute{\omega}\varsigma$

In volume I, at 507 b 17, I adopted Krumbiegel's identification of $\theta\acute{\omega}\varsigma$ as the stoat (*Mustela erminea*). Others have identified it with the jackal or the civet. In view of the uncertainty, it may be useful to bring together the passages in which Aristotle mentions this animal. Although many of the descriptions seem to fit the jackal, not all do, and it is possible that more than one animal may be involved.

H.A. 507 b 15 ff. Animals with teeth in both jaws have

one stomach only, *e.g.*, man, pig, dog, bear, lion, and wolf. The *thōs*, too, has all its internal parts similar to the wolf.

H.A. 580 a 24 ff. Cats and ichneumons bear the same number of young as dogs, and live on the same diet; they live for about six years. The panther's cubs, like the wolf's, are born blind; the maximum number at a birth is four. Conception in the *thōs* is similar to that in the dog; the young are born blind, and two, three, or four are produced at a birth. To look at (*τὴν ἰδέαν*), the *thōs* is long from head to tail, but is rather short ^a in height. However, it is exceptionally swift, in spite of its short legs, owing to its being so supple, and because it can jump a long way.

H.A. 610 a 13 f. The lion and the *thōs* are enemies, because they are both carnivorous and live on the same food.

H.A. 630 a 9 ff. *Thōes* too are fond of human company; they do man no harm, and are not much afraid of him, but they are enemies to dogs and lions, and consequently are not found in the same habitat with them. The small *thōes* are the best. Some say there are two kinds of them, and some say three. Probably there are not several kinds, but as is the case with certain fishes, birds, and quadrupeds, *thōes* change according to the seasons, and have a different colour in winter and in summer; and in summer they become smooth-haired, in winter they get a thick coat.

G.A. 742 a 8 ff. The polydactylous quadrupeds (such as the dog, the lion, the wolf, and the *thōs*) all bring forth their young blind, and the eyelid does not separate until some time after birth.

G.A. 746 a 30 ff. Animals which are closely allied in their nature, yet not identical in εἶδος (? kind, appearance) copulate, if they are comparable in size and if their periods of gestation are equal in length. Although such crossing is infrequent among the majority of animals, it occurs among dogs, foxes, wolves (and *thōes* ^b); the Indian dog also is produced from the union of a dog with some wild dog-like beast.

^a The word so translated is a comparative adjective, and may mean "shorter (than the dog)," (The MSS. P and D read μακρότερος, "rather long," or "longer.") At the beginning of the next sentence, "However" (ὅμως) is A.-W.'s emendation for the MSS. "similarly" (ὁμοίως); if the latter reading is adopted, the meaning will be "But like (the dog) it is exceptionally swift, in spite &c."

^b The words (and *thōes*) are inserted, no doubt rightly, by Bussemaker and Bitterauf, on the strength of the Latin versions of William of Moerbeke and Michael Scot.

G.A. 774 b 10 ff. Those polydactylous animals which produce their offspring in an imperfect state all produce numerous offspring . . . for indeed their young are practically unarticulated when born, *e.g.*, those of the fox, the bear, the lion, and similarly with some of the others; moreover, practically all of them are born blind, *e.g.*, the ones just mentioned, and in addition those of the dog, the wolf, and the *thōs*.

Note on the Manuscript Brit. Mus. Add. 7511

Since this appears to be the unique ms. of the Arabic version of *H.A.*, it may be useful to put on record what information I have about it. I examined it again with my late friend and colleague Professor R. Levy in December 1965, and to him I am greatly indebted. I am also greatly indebted to Dr. J. N. Mattock, of Glasgow University, who has told me the precise places in the Greek text corresponding to those where the Arabic version of *H.A.* breaks off and resumes, and has also informed me that the 14 folios (modern 40 to 53 inclusive) have been wrongly inserted and are from *P.A.* III. (He is not, however, responsible for the statement that this passage of *P.A.* begins at 668 b 32.)

- (1) The ms. now contains 232 folios, which have been numbered consecutively in recent times. The first 39 folios have also been numbered in Arabic script. Then follow 14 folios (mod. 40 to 53 inclusive), which are not numbered in Arabic script. The Arabic foliation (fol. 170) resumes at mod. fol. 54, but does not continue throughout the ms.
- (2) The text begins on fol. 1^v. There is a break in the text of *H.A.* at fol. 39, *viz.*, at *H.A.* III. 514 b 16, the last word in the Arabic being "aorta."
- (3) The 14 folios (mod. 40 to 53 inclusive) which follow here have been wrongly bound, and are from *P.A.* III (beginning probably at 668 b 32).
- (4) The text of *H.A.* is resumed at mod. fol. 54 (where the Arabic-script foliation is also resumed, *viz.* 170). This is at Book VII modern reckoning, 582 a 33 (Book IX according to the Arabic and original Greek reckoning), *περί τῆν ἡκλίαν ταύτην*.
- (5) Book X begins fol. 61^r (Arabic fol. 177^r).

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- (6) Book XI (*i.e.*, *P.A.* Book I) begins fol. 67^v (Arabic fol. 183^v).
- (7) The treatise ends at the end of Book XIX (*i.e.*, *G.A.* Book V) on mod. fol. 231^v.
- (8) There is some further writing on fol. 232^r.
- (9) The mss. must therefore have originally contained at least 362 folios, of which 130 are now missing (*viz.*, those which were numbered 40 to 169 inclusive in Arabic script). Since the text begins on fol. 1^v and ends on (mod.) fol. 231^v, it is probable that the total amount of text was $230\frac{1}{2} + 130 = 360\frac{1}{2}$ folios.

Thus the latter part of *H.A.* Book III, the whole of Books IV, V, VI, the present VIII and IX (original VII and VIII) and the beginning of the present Book VII (original IX), are missing.

In the Table which follows I have indicated the approximate amount of text in Greek and Arabic, measuring the former by Bekker's pages and the latter by folios of the ms. The figures are sufficiently accurate for the purpose, and it will be seen that the ratio factor (Greek : Arabic) is fairly constant throughout.

A. Portions preserved in the Arabic

	Bekker's pages	ms. folios	Factor
<i>H.A.</i> I, II, III to 514 b 16	28 $\frac{1}{2}$	38 $\frac{1}{2}$	$\times 1.4 -$
Orig. IX (now VII) from 582 a 33	5 $\frac{1}{2}$	14	$\times 1.3 -$
X	5 $\frac{1}{4}$		
<i>P.A.</i> and <i>G.A.</i>	132 $\frac{1}{2}$	178 ^a	$\times 1.3 -$
	172	230 $\frac{1}{2}$	$\times 1.3 +$

^a This figure includes the 14 folios of *P.A.* III which have been bound in the wrong place.

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B. Portions missing from the Arabic

<i>H.A.</i> III. 514 b 16—V. 550 a 8	35 $\frac{1}{2}$ ^a	} 130	
VI to 576 a 2	17 $\frac{1}{2}$ ^a		
Orig. VII (now VIII)	20		
Orig. VIII (now IX)	25 $\frac{1}{2}$		
Orig. IX (now VII) to 582 a 33	1 $\frac{3}{4}$		
	—	100	$\times 1.3$
	—	272	$\times 1.3 +$
		360 $\frac{1}{2}$	

^a The latter part of Book V (550 a 8 to the end; = 8 $\frac{1}{2}$ pages Bekker), and the latter part of Book VI (576 a 2 to the end; = 5 pages Bekker), are missing from Michael Scot's translation, and it seems probable that they were missing also from the Arabic. I have therefore not reckoned these pages in the figures given above. Their absence from the Arabic seems to be confirmed by the resultant ratio factor ($\times 1.3$).

The loss of over two-thirds of the Arabic version of *H.A.* is perhaps less serious than might have been thought. For his edition of *G.A.* in the *Oxford Classical Texts* (1965) H. J. Drossaert Lulofs made a thorough examination of the ms. Add. 7511, which (as indicated above) contains the whole of *G.A.*, and although the results are most valuable so far as elucidating the relationship of the Arabic version to the existing Greek mss. is concerned, the net result for the improvement of the Greek text is almost negligible. In fact, it is evident from Lulofs' work that there is hardly anything further of importance for the Greek text of *G.A.* to be obtained from the Arabic version beyond what had already been available and taken into account from the Greek mss. and from Michael Scot's version (see my review of Lulofs' edition in *C.R.* XVI (n.s.), 1966, pp. 171 ff.). There seems to be no reason to suppose that the situation would be substantially different for the *H.A.*

Mr R. Roolvink, of the Oriental Manuscripts Department at Leiden University Library, kindly informs me that the Arabic ms. Lugd. Bat. Golius 166 contains only the beginning and end of *P.A.* II, *P.A.* III and IV, and *G.A.* I (the last breaks off in the middle of a chapter).

ARISTOTLE

Since the foregoing account was written, it has been reported that a ms. has come to light in Tehran containing the whole of the Arabic translation of the *de animalibus*. Dr. Mattock tells me that he is to edit this ms. (Tehran, Majles, no. 1143 of the 'Fabāḥḩa'ī collection).

Acknowledgements

I am greatly indebted to Dr. Mattock, not only for his help recorded above, but also for applying his knowledge of the Arabic translations of Aristotle's zoological work to the textual problem in the passage about the sea-urchin's "lantern"; to Dr. Sydney Smith for much advice on zoological matters and for many references; and to Dr. D. L. Lee for information about the helminths. The excellent arrangements, already mentioned in the Introduction, at the Institute for Advanced Study, included admirable library facilities not only on the classical side, but also in connexion with my work on the astronomical appendix in this volume. It may also be of interest to record that among the volumes at my disposal there, were some which had belonged to Professor D'Arcy Thompson, including his copy of Aubert and Wimmer's edition of *H.A.*

While this volume was in the press, the Budé edition of *H.A.* v-vii was published: Aristote, *Histoire des Animaux*, tome II, livres V-VII. Texte établi et traduit par Pierre Louis. Paris, 1968.

APPENDIX A

THE RISINGS AND SETTINGS OF THE STARS

- (1) It is evident from Greek literature that it was a customary practice from early times to denote periods in the year by reference to the "risings" and "settings" of certain stars, and we find this method used several times by Aristotle in the *H.A.* The three stars mentioned by him are Arcturus (α Boötis), the Pleiades or the Pleiad (η Tauri), and the Dogstar (α Canis majoris): these stars are mentioned by other writers also in the same connexion. Since I am not aware of any conveniently accessible account in English of this somewhat complicated matter, and as I believe it is not generally understood what the terms mean or how the dates are arrived at, I have thought it worth while to attempt to provide some account of it here, in preference to merely copying without explanation or comment the equivalents for the dates given elsewhere.
- (2) The "risings" and "settings" of the stars are clearly explained by Geminus (*Isagoge* 13). Each star has two annual risings and two annual settings, which must be sharply distinguished from its daily rising and setting. A star's "early morning rising" (its $\acute{\epsilon}\omega\alpha$ or $\acute{\epsilon}\omega\theta\iota\nu\eta$ $\acute{\epsilon}\pi\iota\tau\omicron\lambda\eta$) is when it rises above the horizon at the same moment as the sun; its "evening rising" ($\acute{\epsilon}\sigma\pi\epsilon\rho\iota\alpha$ $\acute{\epsilon}\pi\iota\tau\omicron\lambda\eta$) is when it rises above the horizon at the moment when the sun is setting. The star's "early morning setting" ($\acute{\epsilon}\omega\alpha$ $\delta\upsilon\sigma\iota\varsigma$) is when it sets just as the sun is rising; its "evening setting" ($\acute{\epsilon}\sigma\pi\epsilon\rho\iota\alpha$ $\delta\upsilon\sigma\iota\varsigma$) is when it sets just as the sun is setting. There is one date every year when each of these events respectively occurs for any one star (at any rate, for any star in that region of the sky with which we are concerned; obviously it does not apply to circumpolar stars).
- (3) However, none of these "true" ($\acute{\alpha}\lambda\theta\iota\nu\alpha\iota$) risings and settings can actually be observed, for the simple reason that when the sun is rising or setting the sky is too bright for the star to be visible. We must therefore distinguish these "true" risings and settings as just described from the "visible" ($\phi\alpha\iota\nu\acute{\omicron}\mu\epsilon\nu\alpha\iota$) ones, *i.e.*, the ones which can

actually be observed. In the case of the evening phenomena, the "visible" ones occur some days before the "true" ones: the last time we can actually see a star setting in the evening is some days before it in fact sets simultaneously with the sun; and the same applies to its rising in the evening: here too its last observable rising occurs some days before the date on which it rises exactly at sunset. The reason is that the star rises (and sets) some 4 minutes earlier each successive day (the exact amount is slightly less than 4 minutes: it is 24 hours divided by 365½). Assume that on some particular day sunset is about 4.30 p.m., and that the star is setting on that day at 5.30: the sky is dark enough for the star to be visible when setting. In 15 days' time the star will set 15 × 4 minutes earlier, *i.e.*, an hour earlier, and the sky will not be dark enough for the star to be visible then. Again, assume sunset is at the same time, 4.30 p.m., and that a star is rising at 5.30 p.m.: its rising will be visible. In a month's time the star will be rising at 4.30 p.m., when it will still be daylight, and the star's rising will not be visible. The reverse applies in the case of the early morning phenomena: here we have to wait a few days until the star is rising or setting sufficiently early for the sky to be still dark enough for us to observe its rising or setting. Hence, in the case of the evening phenomena, the "visible" ones occur some days before the "true" ones: in the case of the morning phenomena, the "visible" occur some days after the "true." And, in the case of the evening phenomena, the visible rising or setting is the *last* of a series of occasions on which we can see the star rising or setting, whereas in the case of the morning phenomena the visible rising or setting is the *first* of a series of occasions on which we can see the star rising or setting.

- (4) For the reader's convenience I tabulate below these phenomena with their descriptions:

True

Morning rising :	the star rises at sunrise	(a)
Morning setting :	the star sets at sunrise	(a)
Evening rising :	the star rises at sunset	(b)
Evening setting :	the star sets at sunset	(b)

Visible

Morning rising : first visible rising in morning twilight
 Morning setting : first visible setting in morning twilight
 Evening rising : last visible rising in evening twilight
 Evening setting : last visible setting in evening twilight

- (a) true precedes visible
 (b) visible precedes true

- (5) In the foregoing account I have adhered to the terminology used by Geminus because it is simpler to follow than the terminology used in some later and in many modern works. In case any readers find the alternative terminology simpler, I append it here:

	<i>Geminus</i>	<i>true</i>	<i>visible</i>
Morning rising	= cosmic rising		heliacal rising
Morning setting	= cosmic setting		visible cosmic setting
Evening rising	= acronychal rising		visible acronychal rising
Evening setting	= acronychal setting		heliacal setting

- (6) The interval between the date of a "true" rising or setting and the date of an observable one depends upon several factors, including:

- (a) the brightness of the star concerned;
 (b) the season of the year, which affects
 (i) the interval by which the sun itself rises or sets earlier or later on successive days, and
 (ii) the time taken by the sun to sink far enough below the horizon for the sky to become dark enough in the evening for the star to be visible (and *mutatis mutandis* for the mornings):
 both of these are also affected by the latitude of the observer;
 (c) the climate—the state of the atmosphere;
 (d) the acuteness of the observer's vision.

- (7) Some of these factors can obviously be allowed for by calculation, but some are imponderables. In what follows I shall therefore be concerned at first with the dates of the *true* risings and settings only.

- (8) In discussing these phenomena it will be useful at the

outset to distinguish the various kinds of movements with which we are concerned. These are all in some way due to the behaviour of the earth itself. Some of them are *actual*, some *apparent*, the latter being a result of the former. No movements, whether actual or apparent, of the moon or planets concern us, and no *actual* movements of the sun or stars. For our purpose we can regard the stars as really "fixed," fixed to the inner surface of an imaginary "celestial sphere"; and any movements, whether short- or long-term, in which they appear to be involved will not be independent of the "celestial sphere" as a whole, *e.g.*, as we see them being carried round by it across the sky night after night; them and it we may consider as being all of a piece. Like them, the sun too is carried round by the celestial sphere across the sky day after day; but unlike them it has another apparent movement, an annual one, across the celestial sphere in the contrary direction to its apparent daily movement.

- (9) We are concerned, then, with

the *actual* movements of the earth; and, resulting from them,
the *apparent* movements of the sun, and
the *apparent* effects upon the celestial sphere as a whole.

Our ultimate concern is with *apparent* movements (*viz.*, with the rising and setting of the sun and stars), but these cannot be properly understood and certainly not ascertained apart from the *actual* movements which produce them; and for the sake of clarity of exposition it will be best sometimes to visualize the actual bodies themselves, the earth and the sun, as it were from outside, at other times to visualize the imaginary celestial sphere with the fixed stars on it, either as spinning round the earth or as a background for the movement of the sun across it.

- (10) It will also make for greater clarity if we classify movements into (a) daily, (b) annual, and (c) long-term.
(11) The movements with which we are concerned are these:
(1) [Daily] The *actual* daily spinning of the earth on its axis from west to east. This produces a corresponding *apparent* daily spin of the celestial sphere in the

contrary direction, *viz.*, from east to west, involving the rising and setting of the sun and of the stars.

(2) [Annual] The *actual* annual revolution (travel) of the earth along its orbit round the sun. This produces the *apparent* annual revolution (travel) of the sun round the celestial sphere from west to east.

The effect of (1) can be easily observed during the course of a few hours. More careful attention is required to observe the effect of (2), partly owing to the fact that it is slower, partly because when the sun is up no background of stars is visible to enable us to see how far the sun has moved. The apparent track described by the sun across the celestial sphere is known as the ecliptic: this also is the name for the plane of the orbit in which the earth travels round the sun, which is reasonable, since the sun's *apparent* track is merely the result of, and the counterpart of, the earth's *actual* track round the sun.

- (12) The other two movements are of a rather different kind, and are of long-term duration. They act respectively as modifying factors upon (1) and (2).
(13) (3) This is the very slow gyration, swivel or wobble performed by the earth. Compared with the plane in which the earth travels round the sun, the earth's axis is tilted $23\frac{1}{2}^{\circ}$ from the perpendicular. At present the north end of the axis points towards a spot on the celestial sphere (*viz.*, the celestial north pole) very near the chief star of the Lesser Bear (the "Pole Star"). It has not always pointed to this spot. The axis of the earth, while maintaining *the same inclination from the perpendicular*, is slowly swivelling; and if we imagine a penholder sticking straight up from the north pole as far as the celestial sphere, in the course of 26,000 years the pen-point would trace out on the celestial sphere a circle of $23\frac{1}{2}^{\circ}$ radius. It is obvious that such a change in the position of the celestial north pole will affect the times of rising and setting of the stars "fixed" to the celestial sphere, for (to take the case of the northern hemisphere) the nearer the celestial north pole is to a star the longer that star remains above the horizon.
(14) If we now dismiss the celestial sphere from mind and think of the earth actually travelling along its orbit, we shall find that every year it passes through two places

when its tilted axis is as it were broadside on to the sun : neither pole is tilted in towards the sun or away from it : neither hemisphere is having either summer or winter. These are the positions, and the times, known as the equinoxes : night and day are equal in length all over the world. Owing, however, to the swivelling of the earth's axis described above, in each successive year the moment when the earth's axis is broadside on to the sun comes a little sooner (just over 20 minutes, *i.e.*, one-26,000th of 365½ days) than the time required by the earth to make a complete circuit round the sun. This is the phenomenon known as the "precession of the equinoxes" : the equinox-point has advanced slightly round the orbit, as it were to meet the earth. (There is no essential reason why the term "equinox" should come into this title, since the precession is in progress throughout ; but it is convenient to take one particular point for reference, and the vernal equinox especially is an important and useful point of reference for other purposes too.)

- (15) If we now return, and consider the corresponding effect upon the celestial sphere, we shall see that, just as the celestial north pole has moved slightly during a year, so too the celestial vernal equinox (*i.e.*, the point where the sun appears to be at that time) has moved—in fact it has moved slightly westwards. And as stars are visible only after dark, in the course of years different stars will come to be visible at any given hour of the night on March 21st (or any other night), and identical stars will rise and set later, because *effectively* they have shifted further east : their retardation amounts to about 3·3 seconds per annum (*i.e.*, one-26,000th of 24 hours).
- (16) (4) The fourth factor is the eccentricity of the earth's orbit. This orbit is not a perfect circle, but an ellipse, with the sun at one focus of it. There are thus two points, roughly 180° (or, in time, 6 months) apart, at which the earth is respectively nearest the sun (perihelion) and furthest from it (aphelion). The nearer the earth is to the sun, the faster it travels, the further it is away, the slower : in consequence, the sun *apparently* does the same : its *apparent* speed along the ecliptic increases and decreases correspondingly.

(17) Here again for convenience we concentrate upon one

point in the orbit, as we did with the equinox, this time on the point of perihelion. The position of perihelion is not stationary, but is shifting very slowly along the earth's orbit, in the same direction as that in which the earth travels ; and although the shift is a very slow one—a complete circuit takes about 111,300 years—in the course of centuries it becomes noticeable. Hence the whole sequence of faster and slower travel of the earth is gradually shifting round the orbit, and correspondingly the sequence of the sun's *apparent* speeding up and slowing down is shifting round too—shifting gradually eastwards, *i.e.*, in a contrary direction to the shift of the equinox.

- (18) By taking these factors into consideration we can obtain the following essential data :
- a star's position on the celestial sphere at the epoch concerned ;
 - the adjustments which must be made to the times of sunrise and sunset on each day of the year at the epoch concerned.
- From these we can determine
- the times of rising and setting of the star on each day, and
 - the times of sunrise and sunset on each day, and this enables us to say on what days of the year the star's rising and setting coincide with those of the sun.
- For our present purpose I assume that the epoch is 350 B.C., and the locality Athens (latitude 38° N.).

- (19) The amount of time spent above the horizon by a star at any given locality during any 24 hours depends upon two factors : (1) the latitude of the locality and (2) the star's angular distance from the celestial pole (in our hemisphere, the north pole). This distance is usually expressed in degrees of "declination" north or south of the celestial equator.^a *At what part of the 24 hours* this time above the horizon is spent depends upon the star's angular distance east of an agreed celestial meridian, *viz.*, that of the vernal equinox : this distance is expressed in hours minutes and seconds of R(ight) A(scen-

^a Tables showing the length of time spent above the horizon by a star according to various latitudes and declinations are given, *e.g.*, by W. Valentiner, *Handwörterbuch der Astronomie*, i, pp. 434 f., and by F. K. Ginzel, *Handbuch der mathem. und techn. Chronologie*, i, p. 546.

sion) counting eastwards from that meridian." These two coordinates, declination and R.A., give the star's exact position on the celestial sphere, and they must be calculated, or ascertained from published tables, for the epoch concerned.^b

- (20) As an example of the extent of the change involved, we may take the star Alcyone (γ Tauri), the brightest star in the group known as the Pleiades, and one of the stars whose risings and settings were used by the Greeks, including Aristotle, to mark points in the year. At the present day the position of this star is given by R.A. 3 h. 45 m. 16 sec., declination $29^{\circ} 59' 32''$ N. It therefore crosses the meridian at midnight about November 18th, and at the latitude of Athens it remains above the horizon for 14 h. 50 m. at one stretch. In 350 b.c. its position was R.A. 1 h. 32 m., declination $14^{\circ} 12'$ N. At that epoch, therefore, it crossed the meridian at midnight about October 15th, and at the latitude of Athens it remained above the horizon for approximately 13 h. 38 m. only. Another, perhaps even more striking, example is the present Pole Star (α Ursae minoris), although being circumpolar this star never sets in northern latitudes. Its position now is R.A. 1 h. 57 m. 53 sec., declination $89^{\circ} 5' 33''$ N; *i.e.*, it is less than one degree from the pole. In 350 b.c. its position was R.A. 23 h. 4 m. 36 sec., declination $76^{\circ} 18'$ N; *i.e.*, it was over 13° from the pole, and could hardly have qualified as a pole star. These changes are due entirely to the continually changing direction of the earth's axis, resulting in, or otherwise known as, the precession of the equinoxes.

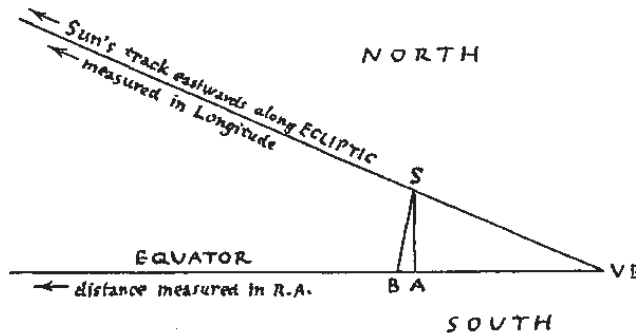
^a Since the meridians of Right Ascension pass through the pole, round which the celestial sphere spins, passage across the sky of these meridians corresponds exactly with the even passage of time, and hence it is appropriate and convenient to measure R.A. in hours, minutes and seconds. Right Ascension must be clearly distinguished from celestial "longitude" (see § 22), which is measured along the ecliptic: the ecliptic is for most of its course inclined to the equator (*cf.* § 24), and its centre is not the celestial pole; hence longitude cannot be used to measure the time taken by the celestial sphere to spin evenly round the pole. (The nomenclature is somewhat confusing, since it is R.A., and not celestial longitude, which is the counterpart of longitude on the terrestrial globe. "Declination" is the celestial counterpart of terrestrial latitude.)

^b Tables are given for the positions of over 300 stars from 4000 B.C. to A.D. 2000 by U. Baehr, *Tafeln zur Behandlung chronologischer Probleme*, 1955, pp. 48 ff.

- (21) The times also of sunrise and sunset for any locality depend upon the latitude of the locality and on the sun's declination north or south of the celestial equator according to the season of the year, and for any particular locality they do not vary substantially from one century to another; but they are subject to a certain advance and retardation owing to (a) the precession of the equinoxes combined with (b) the effect of the eccentricity of the earth's orbit as already described. These variations, though small, cannot be ignored in calculating the dates of the annual risings and settings of stars, since they may give rise to errors of considerable size. The two effects just mentioned can now be explained more fully.
- (22) The eccentricity of the earth's orbit, as we have seen, causes the sun to appear to travel at varying speeds along the ecliptic. Distances along the ecliptic are measured eastwards in degrees of "longitude" counting from the vernal equinox (the point at which the ecliptic intersects the celestial equator). The sun's progress in "longitude" therefore varies from one part of its track to another. When the earth is travelling more slowly, the sun makes less headway in longitude eastwards; hence, since the apparent daily spin of the celestial sphere is from *east to west*, the sun is brought round again to the observer's meridian (*i.e.*, due south) *sooner* than the average, *i.e.*, in less than 24 hours as measured by a steady-going clock. Compared with the clock, the sundial shows a later hour, compared with the sundial the clock shows an earlier hour. The reverse applies when the earth is travelling more quickly.
- (23) The other factor, the inclination of the earth's axis, has of itself no effect upon the actual speed of the earth and therefore none upon the apparent speed of the sun; nevertheless, it has an effect in respect of advancing and retarding the times of sunrise and sunset. This will be made clear by taking the example of the sun's progress along the ecliptic just after the time of the vernal equinox (March 21st). This is illustrated in diagram 1, which shows part of the celestial sphere as viewed from the earth. At this time of the year the sun is gaining rapidly in declination north of the equator; in other words, its track (the ecliptic) is fairly sharply inclined to the

celestial equator. Now, as we have seen, although the amount of time spent by the sun above the horizon during any 24 hours is controlled by the amount of declination N. or S., it is its angular distance in Right Ascension measured from the celestial vernal equinox-point which determines *at what part of the 24 hours* that period occurs; and R.A. is measured *not* along the ecliptic but along the celestial equator. Hence it is not the amount of the sun's progress along the ecliptic which determines how much earlier or later than the average the sun will rise, cross the meridian, and set the following day, but the amount of that progress *when projected on to the celestial equator*, in other words, the amount of corresponding progress in Right Ascension.

- (24) In the diagram, VE represents the point where the sun appears to be at the time of the vernal equinox, and S the point it has reached say 3 days after passing that point. The actual distance from VE to S is, as we have seen, controlled by the speed of the earth in its orbit; but whatever the distance from VE to S may be, *its projection on to the celestial equator*, that is, VE to A, is shorter.



1. Diagram showing part of the celestial sphere as viewed from the earth.

If the sun had been travelling along the celestial equator, in three days it would have got to B. So in fact it has

made *less progress in R.A.* than it has in longitude: its progress eastwards is less than it would have been, and it is therefore brought round again by the spinning of the celestial sphere on to the observer's meridian the following day *sooner*. The whole period spent by the sun above the horizon is shifted forward: it rises x minutes earlier and sets x minutes earlier, as well as crossing the meridian x minutes earlier. At the solstices, on the other hand, in contrast with the time around the equinox, the ecliptic is not sharply inclined to the equator, but approximately parallel to it; hence the sun makes as much progress in R.A. as it does in longitude—in fact, it makes more, because at the time of the solstices the sun is nearer one of the poles; and the nearer they get to the poles the closer together are the meridians of R.A. (*cf.* the way in which the meridians on terrestrial globes converge as they approach the poles). This greater progress in R.A. takes the sun further east than would otherwise happen, and therefore it comes back to the observer's meridian the following day *later*.

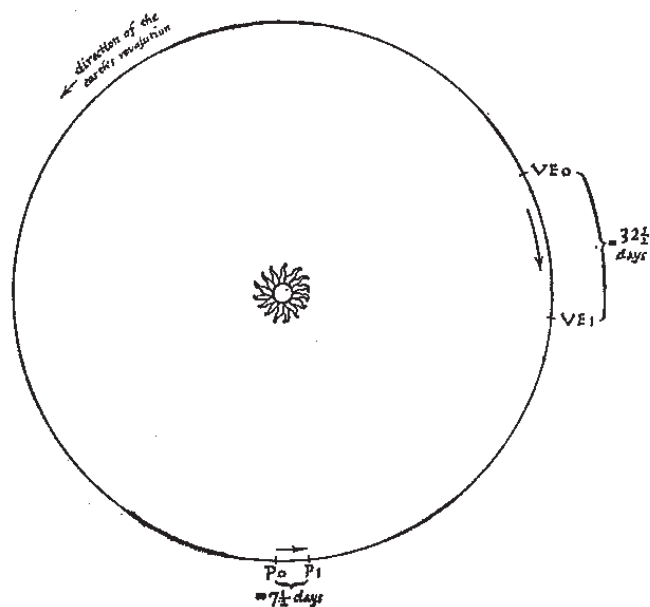
- (25) The maximum amount of earliness and of lateness in the sun's daily appearance caused by the eccentricity is about $7\frac{1}{2}$ minutes, and by the inclination of the axis nearly 10 minutes. But they are not permanently geared together: their operation *relatively to each other* does not remain constant. This is because, as we have seen, both the point of perihelion and the point of the vernal equinox are continually shifting round the earth's orbit. A pictorial illustration of this is given in the second diagram, which represents the earth's orbit round the sun as it might be seen from outside.

- (26) So far as the calendar date of the vernal equinox is concerned, it has long been generally agreed that the calendar must be so adjusted that the date is always March 21st or some adjoining date; but since both equinox and perihelion are continually shifting, it is obviously impossible to fix the date of perihelion *as well*; and therefore, even if the position of perihelion were not itself shifting, its *date* would be continually shifting, owing to the shift in position on the earth's orbit of the point through which the earth passes on the date we have agreed to call March 21st. To put this in terms of the

particular epoch with which we are concerned, the change in the date of perihelion caused simply by the shift in the position of the equinox since 350 B.C. amounts to $32\frac{1}{2}$ days,^a and the change caused by the shift in the position of perihelion itself amounts to $7\frac{1}{2}$ days: as these positions are moving in opposite directions (see diagram), and are in fact approaching each other, the result over the 2300 years involved has been that both factors have operated to shorten the interval between the two points. Thus, whereas the date of perihelion now is about January 3rd, in 350 B.C. it was $32\frac{1}{2} + 7\frac{1}{2}$ days earlier, *viz.*, about November 24th. As will be clear from what has already been said, at any given *longitude* (or number of days) after perihelion, the effect of the orbital eccentricity factor in modifying the times of sunrise and sunset remains the same from century to century; and at any given *longitude* after the vernal equinox the effect of the axis-inclination factor remains the same; and a fixed series of values for each factor can be tabulated and graphed. But the *combined* effect of the two factors in modifying the times of sunrise and sunset on every day of the year varies from one century to another according to the date of perihelion; and the sort of variation which results can be illustrated as follows. At the present day, the times of sunrise and sunset at any given latitude are advanced by as much as 16 minutes at the beginning of November and retarded by as much as 14 minutes for a fortnight in February. In 350 B.C., the amount of advance was greatest (nearly 13 minutes) at the end of October, and the retardation greatest (17 minutes) at the end of January. This phenomenon of advance and retardation is referred to as "the equation of time," *i.e.*, the length of time required to be added to or subtracted from the time shown by the sundial to equate it with the time shown by a well-regulated clock geared to mean local time.

(27) The "equation of time" must therefore be taken into account in computing the dates of the annual "risings" and "settings" of stars—not because it affects their daily risings and settings in any way, but because it affects the sun's daily risings and settings. This computation can be done either by means of formulae and

^a *i.e.*, (approx.) 2300×20 minutes; cf. § 14.



2. Diagram to show the earth's orbit round the sun a viewed from outside the solar system.

The Sun is approximately at the centre.

VE0 = Position of vernal equinox } at 350 B.C.

P0 = Position of perihelion

VE1 = Position of vernal equinox } at the present day

P1 = Position of perihelion

The arrows indicate the direction of the shifts.

The figures indicate the number of days taken by the earth to travel between the points marked.

Distance of the earth from the sun:

at perihelion, 91.4 million miles

at aphelion, 94.6 million miles

Orbital speed of the earth:

at perihelion, 67,700 m.p.h.

at aphelion, 65,500 m.p.h.

Average orbital speed of the earth:

$18\frac{1}{2}$ miles per second.

specially prepared tables, or by means of graphs. The latter is the more illuminating method, and I have myself constructed graphs for this purpose.

- (28) Two graphs are required. On the first graph (A) two curves are plotted. One (i) plots the contribution of the eccentricity of the earth's orbit to the equation of time, showing how much advance or retardation of the sun it produces compared with the normal or average, at stated intervals beginning from perihelion (10 days is a convenient interval; but these intervals will of course not be equal in length on the graph, since the sun's progress in longitude is not even); the other curve (ii) plots the contribution of the inclination of the earth's axis, taking care to synchronize the two curves, so that they both begin at the longitude of perihelion.^a From this graph it is possible to read off the simultaneous contributions of both factors and so to compute their *net* effect for any value of the sun's longitude. Actual dates for the year concerned are then assigned to the ten-day intervals; and it is most convenient to use the net values of the equation of time at these intervals for the second graph.
- (29) For the second graph (B), the times of sunset and sunrise for the latitude of Athens at stated intervals must first be listed, and then adjusted by applying the net values of the equation of time as ascertained by Graph A. These sunset and sunrise times are then plotted on Graph B, producing a curve on each side of the graph, midnight being represented by the perpendicular centre line of the paper. Across the paper are then drawn the lines representing the times of the daily rising and setting of the particular stars concerned (all these lines will be oblique, and parallel to each other); and where these lines intersect the curves representing sunset and sunrise times we can read off at the side of the graph the four dates of the particular star's annual "risings" and "settings."^b

^a The procedure may be clarified if we think of the second curve as being plotted on a separate sheet, beginning at longitude 0° (the vernal equinox); it will then be applied to the first graph so that it begins at the point where it refers to the longitude of perihelion (which is where the first curve begins). Both curves will then at every point throughout their length simultaneously refer to the same longitudes. See also § 32.

^b Cf. two such diagrams (one for Sirius, epoch 1929, lat. 50° N) in P. V. Neugebauer, *Astronomische Chronologie*, 1929, vol. i, pp. 151 f.

- (30) As a check on this method I have also computed the dates of the annual risings and settings of the three stars mentioned by Aristotle, according to the formulae and tables given by U. Baehr (*Tafeln zur Behandlung chronologischer Probleme*, 1955), but without applying the modifications offered by him for adjusting "true" risings and settings to "visible." It will be seen from the tabulation given below that the results obtained by the two methods agree to within a few days throughout. Together with these, for comparison, I have given the dates for the same phenomena as attributed to Eudoxus in the Calendar appended to Geminus' work, having reduced the dates given there to those of the present-day calendar, assuming the Calendar's "Month 1 Day 1" (which is there stated to be the day of the summer solstice) to be equivalent to our June 22nd.^c It is possible that Eudoxus' dates are intended to apply to a latitude other than that of Athens, since he worked in Egypt as well as at Athens, Cyzicus and Knidos. I assume that the dates stated by Eudoxus were those of the *visible* risings and settings.
- (31) The dates given in the table below for "Baehr" and "Graph" are those of the "true" phenomena; but I have suggested [in brackets] the approximate amount of adjustment required to convert them into those of the "visible" phenomena. The dates given for "Baehr" are as calculated by me from his formulae and tables

^c My dates do not agree with those given by Manitius in his edition of Geminus, since he has taken June 26th as the equivalent date for the summer solstice. The reason for this is that in works dealing with historical time-reckoning, where exact dating of historical events is involved, it has become customary to reduce dates to the system of the Julian calendar, extended where necessary backwards into the past. Such historical considerations do not operate in our present study. We are not concerned with continuous back-reckoning an exact number of days to any historical event in some particular year in the past, but with annually recurring phenomena such as the breeding of animals, and it is more relevant that a date should indicate immediately to a modern reader the season when these take place. Although it so happens that the difference between the Julian calendar as extended back into the 4th century B.C. and the 20th century Gregorian calendar is small, there appears to be no reason why for our present purpose we should hesitate to choose as the equivalent date for the summer solstice that which it occupies in the current calendar. For the same reason I have subtracted 4 days in giving below the dates obtained by means of Baehr's formulae and tables, since he also uses the Julian reckoning.

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(less 4 days in each case, see note on § 30), and any errors are attributable to me and not to him. Nor is he responsible for the suggested adjustments. It will be seen that when the adjustments are applied there is fairly close agreement with Eudoxus' dates.

(32) The dates given for "Graph" are those obtained from the graphs constructed by me as described above, and reproduced on folded sheets in this volume. It may be remarked in passing that if one of the curves of Graph A were plotted on transparent paper, it would be possible, by sliding the transparent sheet along across the other, to read off the two components of the equation of time for any day at any period in the earth's history, assuming that the inclination of its axis and the eccentricity of its orbit remain constant.

(33) See Table opposite.

(34) Unfortunately the Calendar attached to Geminus' work does not give the dates assigned by Callippus for the risings and settings of the three stars concerned here; the nearest we have are

Head of Taurus rises May 1
Head of Taurus sets October 30

This part of the constellation is about 5° south of the Pleiades, and considerably further east.

(35) Some interesting information on these matters is to be found in the Hippocratic treatise *περι διαίτης*, iii. 68 (vi. 595 ff. L.). The author divides the year into "the four parts which are most commonly and generally recognized," viz., winter, spring, summer and autumn (*φθινόπωρον*), for the purpose of prescribing regimen. Of the seasons he speaks as follows:

Winter lasts from the setting of the Pleiades until the spring equinox.
Spring lasts from the equinox until the rising of the Pleiades.
Summer lasts from the Pleiades until the rising of Arcturus.
Autumn lasts from Arcturus until the setting of the Pleiades.

Later in the chapter we find the following (to which I

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	Morning rising	Morning setting	Evening rising	Evening setting
(33) Eudoxus		<i>Arcturus</i> (α Βοώτις)		
Baehr	Sept. 10 [Some days after]	June 2 [14 days after]	Feb. 20 [12 days before]	Oct. 29 [14 days before]
Graph	Sept. 5 [Some days after]	May 17 [14 days after]	March 3 [12 days before]	Nov. 17 [14 days before]
	Sept. 5	May 20	March 2	Nov. 17
Eudoxus		<i>Alcyone</i> (γ Ταυρί)		
Baehr	May 10 [15-20 days after]	Nov. 9 [10 days after]	Sept. 29 [10-12 days before]	March 31 [10 days before]
Graph	April 10 [15-20 days after]	Oct. 22 [10 days after]	Oct. 12 [10-12 days before]	April 20 [10 days before]
	April 9/10	Oct. 22	Oct. 8	April 19
Eudoxus		<i>Sirius</i> (α Canis majoris)		
Baehr	July 18 [Some days after]	Dec. 2 [Some days after]	Dec. 6 [Some days before]	April 22 [Some days before]
Graph	July 10 [Some days after]	Nov. 12 [Some days after]	Jan. 1 [Some days before]	May 11 [Some days before]
	July 8/9	Nov. 17	Jan. 1	May 15

have added dates according to the notation of the modern calendar for ease of comparison):

From the setting of the Pleiades to the solstice, 44 days
[Assuming winter solstice = December 23rd, then morning setting of the Pleiades is November 9th]

From the rising of Arcturus to the equinox, 32 days
[Assuming vernal equinox = March 20th, then evening rising of Arcturus is February 16th]

From the equinox to the rising of the Pleiades, 48 days
[Morning rising of the Pleiades is therefore May 7th]

From the summer solstice to the rising of Arcturus and the equinox, 93 days

[Assuming summer solstice = June 21st, then equinox is September 22nd]

From the equinox to the setting of the Pleiades, 48 days
[Assuming equinox = September 22nd, then morning setting of Pleiades is November 9th]

From the setting of the Pleiades to the solstice, 44 days
[November 9th to December 23rd, as above]

- (36) It will be seen that the dates obtained from this chapter accord fairly closely with those in the table already given. At first sight there appears to be some discrepancy about the autumn (*i.e.*, the morning) rising of Arcturus: the Hippocratic author seems to equate this rising (which must be placed not much later than mid-September; see § 33) with the autumn equinox. It does not, however, necessarily follow that he really supposed these to coincide in date. In the *Calendar* appended to Geminus' *Isagoge*, Euktemon is stated to have put the beginning of autumn on the same day as the appearance (*εμφανής*) of Arcturus, for which his date is the equivalent of September 11th, although the date he assigned for the equinox was the equivalent of September 22nd. It seems likely that the Hippocratic author took a similar view.

- (37) The Hippocratic author thus reckons the "seasons" approximately as follows:

Spring	March 20th to May 7th
Summer	May 7th to mid-Sept. (or the equinox)
Autumn	mid-Sept. (or the equinox) to Nov. 9th
Winter	Nov. 9th to March 20th

In doing so he perhaps takes a more realistic view than

our modern almanacs, which reckon that the change-over from one "season" to another occurs at the solstices and equinoxes; thus spring does not change over to summer until about June 22nd, autumn to winter about Dec. 22nd, and so on. On the Hippocratic reckoning, too, our own "Midsummer Day" (June 24th) would be nearer the actual middle of summer than it is on our modern almanac reckoning. However, the latter is a convenient method of division for purposes of discussion, and I shall adopt it here.

- (38) The length of the "seasons" is a point of some relevance, since it is closely connected with what has been discussed in the foregoing paragraphs. It is no doubt commonly supposed that the four "seasons" or "quarters" of the year are equal in length; but in fact this is not so. This was well known to Callippus, Aristotle's contemporary. In the *Calendar* mentioned above (§ 36), the dates he is said to have assigned to the solstices and equinoxes result in the following lengths for the "seasons":

Summer	92 days
Autumn	89 days
Winter	89½ days
Spring*	95 days
	<hr/> 365½ days

I have added the ½ to winter to allow for leap-years. In the *Calendar* the total number of days is 365 only.

The dates attributed to Callippus may be converted as follows into dates of the modern calendar, equating "the first day of the first month" (the day of the summer solstice) with our June 22nd:

Summer solstice	June 22nd
Autumn equinox	Sept. 22nd
Winter solstice	Dec. 20th
Spring equinox	March 19th

* The *Calendar* is so arranged that the equinoxes and solstices fall always on the first day of a month. If one day were transferred from the first month of spring, which has 31 days, to the third of month winter, which has 30 days, the lengths of these two seasons would approximate more closely to the figures obtained by calculation (see below, § 40).

(39) This inequality in the length of the "seasons" may at first seem surprising; but Callippus' figures (though they are in round numbers, and in the absence of greater detail I have had to reckon the lengths from mid-day of each of the days mentioned) give a reasonably correct representation of the facts, as will be seen below.

(40) It will be clear from what has already been said (§§ 16, 17, 22, 26; see also diagram 2) that the "season" in which perihelion occurs will be the shortest, because then the earth is travelling fastest in its orbit; and in Callippus' time perihelion was in "autumn" (see above, § 26; its longitude was 243° , corresponding to the date November 24th), and "spring," therefore, in which aphelion occurred, was the longest, because then the earth is travelling at its slowest. At the present day, perihelion (at longitude 282.36°) comes in the northern hemisphere's "winter," about January 3rd; hence this "season" is now the shortest, and "summer" in the northern hemisphere is the longest. I give below the relevant figures: first, the lengths of the "seasons" in 350 B.C. for comparison with Callippus' as recorded in the *Calendar*, and then their lengths at the present day (both sets I have calculated from the formulae given by W. M. Smart, *Text-book on Spherical Astronomy*, pp. 153 f., assuming that the eccentricity of the earth's orbit, and the speed of advance of perihelion, are the same for both epochs); and in the third column the lengths for 1966/7 as worked out from the predictions in the current *Astronomical Ephemeris*, which no doubt takes into account certain other modifying factors.

	<i>(N. hemisphere) 350 B.C.</i>		1966/7		1966/7 (Astr. Ephem.)	
	d	h	d	h	d	h
Summer	92	3.84	93	14.99	93	15.16
Autumn	88	16.72	89	19.87	89	19.76
Winter	90	11.06	88	23.91	89	0.13
Spring	93	22.18	92	19.03	92	18.77
	<u>365</u>	<u>5.80</u>	<u>365</u>	<u>5.80</u>	<u>365</u>	<u>5.82</u>

(41) In the actual text of Geminus' work (i, §§ 10 ff.) a set
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of figures is given which differ from those attributed to Callippus in the *Calendar* (§ 38 above) and are identical with those attributed to Hipparchus (c. 150 B.C.) by Ptolemy (*Syntaxis*, iii, § 4). I append these figures, together with the figures for 150 B.C. as calculated from the formulae already mentioned, taking the longitude of perihelion at that epoch as 246.4° .

	<i>Hipparchus</i>	<i>By formula</i>
Summer	$92\frac{1}{2}$ days	92 d 7.52 h
Autumn	$88\frac{1}{2}$	88 18.01
Winter	$90\frac{1}{2}$	90 7.38
Spring	$94\frac{1}{2}$	93 20.89
	<u>$365\frac{1}{4}$ days</u>	<u>365 d 5.80 h</u>

THE GRAPHS

It should be remembered that, unlike the diagrams in Appendix A, the Graphs in no way attempt to represent *pictorially* any observed phenomena. They are intended simply to exhibit schematically and in a serviceable form certain facts relating to the observed phenomena.

Graph A

Key

Above the Graph are marked:

in the upper row, (1) the sun's longitude in degrees E. from the vernal equinox-point (this is relevant to Curve ii).

in the lower row, (2) the sun's longitude in degrees E. from the point of perihelion at 350 B.C. (this is relevant to Curve i).

The figures in the upper row exceed those in the lower row by 243, or are exceeded by them by 360 - 243, throughout.

Below the Graph are marked:

in the upper row, (3) the number of days after perihelion, at intervals (irregular in length) of 10 days.

in the lower row, (4) the actual dates corresponding to these intervals at 350 B.C.

At the side of the Graph are marked the minutes of time by which the sun is caused to be ahead of (+) or behind (-) a clock showing mean time.

- Curves:* (i) The curve which at the left-hand edge of the Graph is the lower of the two shows the number of minutes by which, at any given longitude east of the point of perihelion (or at any given number of days after perihelion), the sun is ahead of (+) or behind (-) the clock, owing to the effect of the *eccentricity of the earth's orbit*.
- (ii) The curve which at the left-hand edge of the Graph is the upper of the two shows the number of minutes of time by which, at any given longitude east of the vernal equinox-point, the sun is ahead of or behind the clock, owing to the effect of the *inclination of the earth's axis*.

(I will not attempt to explain how the data required for plotting the curves of Graph A are arrived at. A good deal of somewhat complicated calculation is involved, and an explanation would be unduly lengthy.)

Synchronization of the curves

As I explained above (App. A, § 26), the effect upon the "equation of time" (*i.e.*, upon the sun's earliness or lateness) caused by the eccentricity of the earth's orbit remains constant from century to century for any given quantity of the sun's longitude east from perihelion. Similarly, the effect caused by the inclination of the earth's axis remains constant for any given quantity of the sun's longitude east from the vernal equinox-point. It is therefore possible to plot the values of both effects upon one and the same graph; and in order to synchronize the two curves for any particular epoch (*e.g.*, 350 B.C.), all that is necessary is to ensure that the point on Curve ii which shows the axis-inclination effect at the longitude of perihelion (243° for 350 B.C.) is in the same perpendicular with the point on Curve i which shows the effect of the orbital eccentricity at perihelion. It will be seen that this has been done at the left-hand edge of the Graph. For 350 B.C., the sun's longitude when 0° east of

perihelion-point (*i.e.*, when coincident with it) is 243° east from the vernal-equinox-point, since the longitude of perihelion itself is 243° east of the vernal equinox-point. The two longitudes marked at the top of the Graph thus run *pari passu* throughout.

The *actual dates*, however, at which the sun is situated at the various longitudes have not so far come into view. In plotting Curve i, I used (except for the first interval), intervals of 10 days for convenience; and these intervals (8, 18, 28, etc. . . . days) appear below the Graph as already mentioned. These intervals, of course, are not evenly spaced, owing to the fact that the sun's apparent speed varies, as has been already explained. But the *sequence* of the intervals with regard to Curve i remains constant, and can be used for any epoch. In assigning actual dates to these intervals, we begin at the date of perihelion for the epoch concerned, and for 350 B.C. this date is November 24th.

To obtain synchronization of the two curves for any other epoch, all that needs to be done is to shift the figures on the upper row at the top of the Graph until the figure at the extreme left-hand edge is that of the longitude of perihelion for the epoch concerned (for 1966 it would have to be 282.3°); and to shift Curve ii, together with the dates in the lower row under the graph, accordingly. For 1966 the date Jan. 3rd would have to coincide with the left-hand edge. As stated in App. A, § 32, a perpetual graph, applicable to any epoch in the earth's history, could be produced by tracing the second curve (together with the upper longitude figures at the top of the graph, and the dates in the lower row below) on a transparent sheet, which could then be slid along over the first curve into whatever position was required by the epoch under consideration.

Use of the Graph

The use of the Graph is simple.

To find the value of the equation of time for any day in the year at epoch 350 B.C., the procedure is as follows:

* As given in the *Astronomical Ephemeris* (formerly the *Nautical Almanac*). The difference (39.3°) between this figure and 243° (in 350 B.C.) is made up of (a) approx. 32° due to the precession (westward) of the equinoxes and (b) approx. 7.1° due to the advance (eastward) of the point of perihelion. During the interval of 2316 years since 350 B.C., (a) amounts to $2316/26,000$ ths of 360° (*cf.* App. A, §§ 13 f.) and (b) to $2316/111,300$ ths of 360° (*cf.* App. A, § 17). See also Diagram 2, p. 395.

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Read off the value shown by each curve at the point directly above the date concerned, and add the two :

Example : For April 3rd, curve i shows -6 minutes
curve ii shows +4 minutes

net value -2 minutes

On April 3rd, therefore, *circa* 350 B.C., the sun was 2 minutes behind the clock, and crossed the meridian at 12.2 p.m.

Example :

For February 1st, curve i shows -7 minutes approx.
curve ii shows -10 minutes approx.

On that date, therefore, at the period concerned, the sun crossed the meridian at 12.17 p.m.

Application

The next requirement is to list the times of sunset and sunrise for latitude 38° N. (Athens) at convenient intervals throughout the year. The lengths of time spent above the horizon at various terrestrial latitudes by heavenly bodies according to their various "declinations" N. or S. of the celestial equator are given in published tables. In the case of the sun it cannot, as we have seen, be assumed that the time it spends above the horizon is divided into two equal halves on either side of 12 noon by-the-clock. The times of its rising and setting must therefore be adjusted by applying to them the amounts of the "equation of time," as ascertained from Graph A.

Graph B

The times of sunrise and sunset, having been calculated as just described, are now plotted on a second graph (Graph B). On this graph midnight is represented by the central perpendicular line, and the hours p.m. and a.m. by parallel lines on either side of it. The dates throughout the year at convenient intervals (*e.g.*, 15 days) are marked along the sides of the graph.

Next, the times of rising and setting of the stars concerned, *viz.*, Arcturus (α Boötis), Alcyone (η Tauri) and Sirius (α

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Canis majoris) must be worked out. First, their positions in the heavens at 350 B.C. must be determined from published tables (*e.g.*, those of Baehr), and their times of daily rising and setting at latitude 38° N. determined. These times throughout the year are then plotted on the graph, producing parallel straight lines running obliquely across the sheet. Where these lines intersect the curves of sunset and sunrise, we can read off at the sides of the graph the dates at which each of these stars rises, and sets, at the moment of sunrise and at the moment of sunset. These are the dates of its "morning rising," "morning setting," "evening rising" and "evening setting" respectively (see App. A, §§ 2 ff.). These are, of course, the dates of its "true" risings and settings. Inspection of the shapes of the sunrise and sunset curves, and of the angle at which they are intersected by the star-lines, makes it possible to gauge the interval which is likely to occur between the "true" rising or setting and the "visible" rising or setting (see App. A, §§ 3 ff.). These intervals have been indicated [in brackets] in the Table given in App. A, § 33. It may be remarked here that the very acute angle at which some of the star-lines intersect the sunrise and sunset curves shows the importance of applying the "equation of time" adjustments to the times of sunrise and sunset before plotting them.

Further remarks on Graph A

It will readily be seen from the Graph that both curves are completely regular.

In both cases the maximum *build-up* of the effect (shown by the steepness of the curve) is when the resulting earliness or lateness of the sun's meridian transit is nil : the maximum *cumulative* earliness or lateness of the sun's transit comes midway between these points. Curve i has one early (*plus*) maximum and one late (*minus*) maximum, amounting to about 7½ minutes either way ; Curve ii has two of each, amounting to nearly 10 minutes either way.

Curve i (effect of the orbital eccentricity).

The steepness of the curve is greatest at longitude 0° E. from perihelion (*i.e.*, at perihelion itself) and at 180° (aphelion). At 0° the earth is travelling at its fastest, being at its nearest to the sun ; hence the sun appears to be doing the

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same, and consequently the daily additional delay in the time at which it crosses the meridian is then greatest.

At 90° the earth's speed is average; the *cumulative* delaying effect of the eccentricity-factor upon the sun has reached its maximum (7½ minutes), and the effect now goes into reverse.

At 180° (aphelion) the earth is travelling at its slowest; hence the sun appears to be doing the same, hence the daily additional advance in the time at which it crosses the meridian is greatest.

At 270° the earth has regained its average speed, and begins to travel faster than average; hence the sun appears to do the same. The *cumulative* advancing effect of the eccentricity-factor has reached its maximum, and the sun's earliness begins to lessen.

At 0° (perihelion) the sun's earliness has been completely wiped out, so far as the eccentricity-factor is concerned, and it begins to cross the meridian late.

Curve ii (effect of the axial inclination).

At 0° and 180° longitude from the vernal equinox-point the build-up is at its greatest; hence the daily additional advance of the sun's transit-time is at its greatest.

At 90° and 270° (the solstices) the build-up is again at its greatest, but in the contrary sense—that of speeding the sun up—and hence the daily additional delay of the sun's transit-time is at its greatest.

The maximum *cumulative* times (10 minutes in either direction, early or late) occur midway between these points, *viz.*, at 45°, 135°, 225° and 315° E. of the vernal equinox-point.

APPENDIX B

THE ATTIC MONTHS

The names of the Attic months (of 29 or 30 days) are usually given as follows (the spelling of some varies slightly):

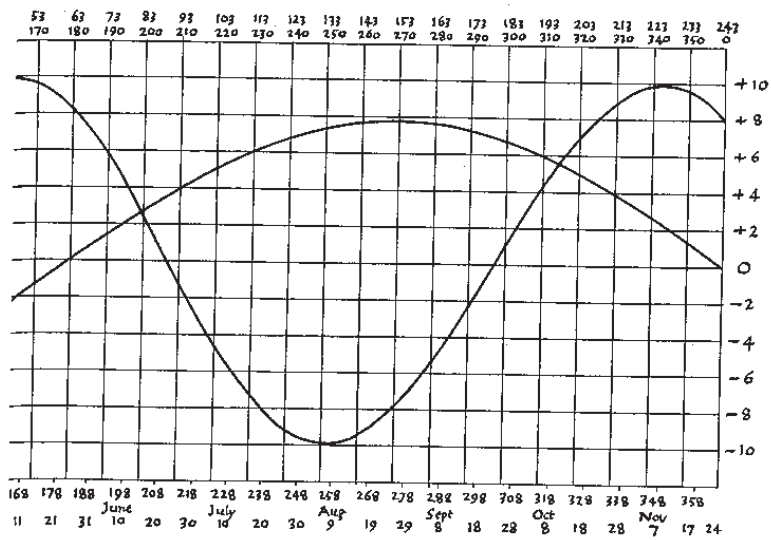
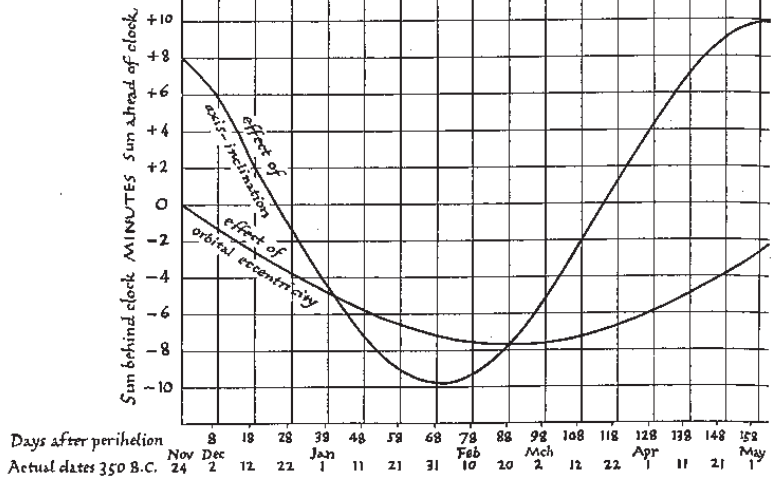
- | | |
|-----------------|------------------|
| 1. Hekatombaion | 7. Gamelion |
| 2. Metageitnion | 8. Anthesterion |
| 3. Boedromion | 9. Elaphebolion |
| 4. Pyanepsion | 10. Mounychion |
| 5. Maimakterion | 11. Thargelion |
| 6. Posideon | 12. Skirophorion |

Most of these are mentioned by Aristotle in the *H.A.* I have not attempted in the translation to represent them by modern month-names, since there is no exact correspondence. The Attic year began at the first new moon after the summer solstice, but owing to the practice of inserting an intercalary month (a second Posideon) in order to keep the calendar in step with the solar year, the first day of Hekatombaion could range over an area of about a month. The beginnings of the years from 337/6 to 318/7 B.C. as given by Prof. B. D. Meritt (*The Athenian Year*, pp. 132 ff.) range from June 30th to July 23th.^a Of these 20 years, 13 were "ordinary" years of 354 or 355 days, and 7 were intercalary years of 384 days.

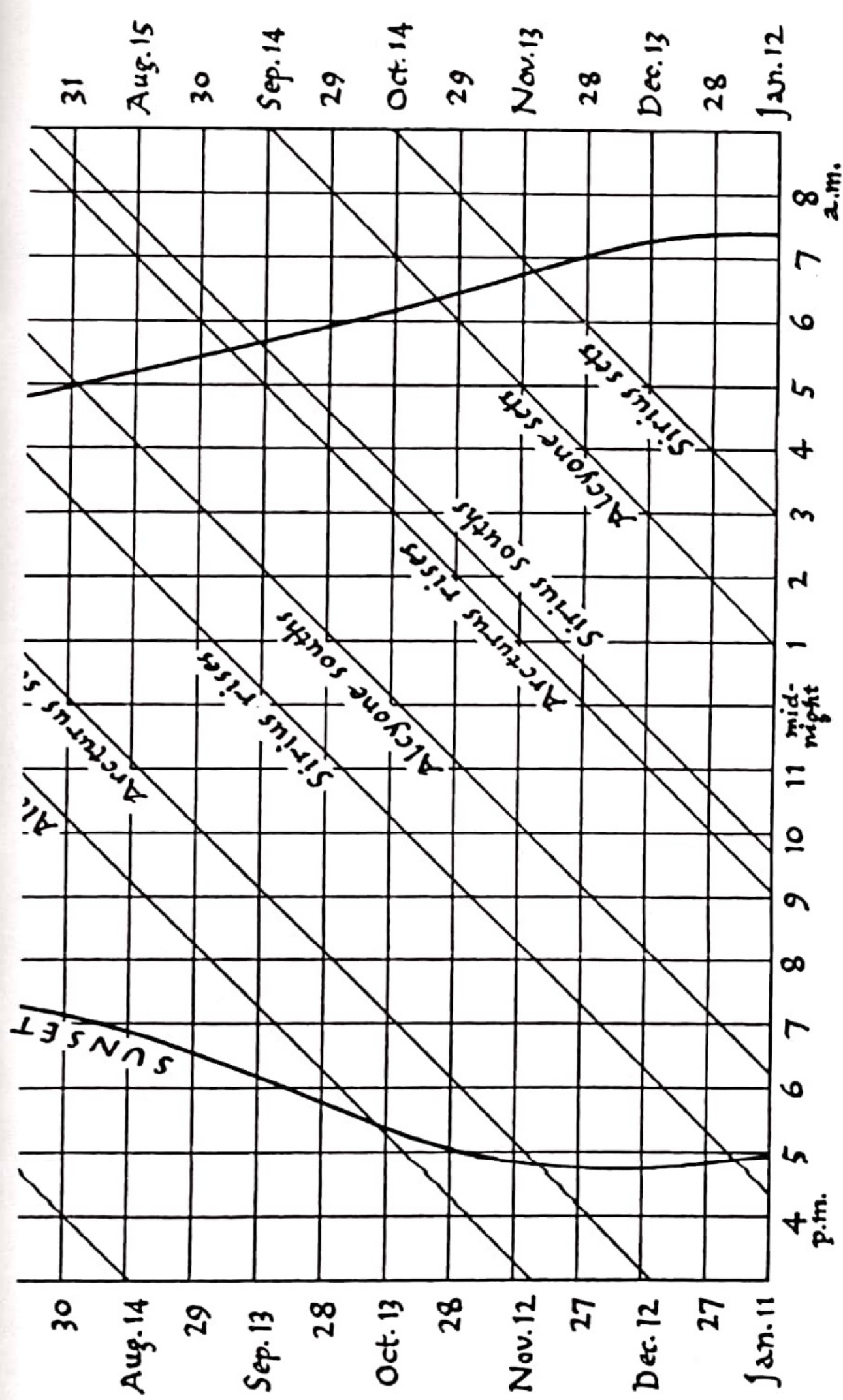
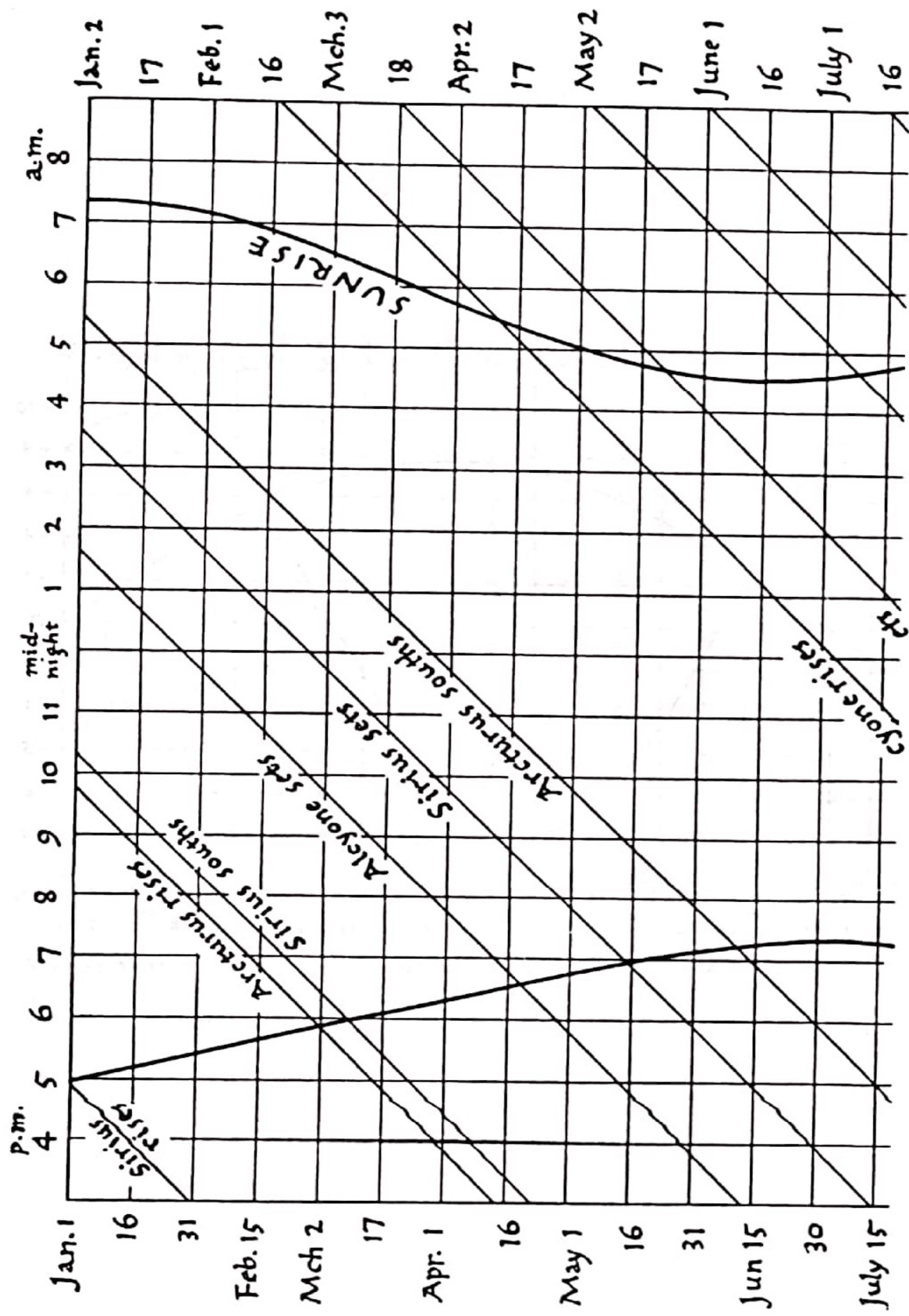
^a These dates are stated in terms of the Julian calendar, according to which the date of the solstice would be a few days later than it is in the present-day calendar. See note on page 397.

Sun's longitude
 ° E from V. Equinox
 ° E from perihelion

2.43 153 263 273 283 293 303 313 323 333 343 353 3 13 23 33 43
 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160



GRAPH A To show the components of the Equation of Time 350 B.C.



GRAPH B To show the dates of Risings & Settings of the Stars 350 B.C.