CHAPTER X

THE ‘ORGANISM-AS-A-WHOLE’

> . . . in hypnotized children real colours and suggested colours are blended to form the complementary colour. (189) W. HORSLEY GANTT

Section A. Illustrations from biology.

Because of the semantic importance of the structural non-elementalistic principle, and the weighty, yet in the beginning odd, consequences which follow the consistent application of this principle in practice, we will give a short account of some other experimental structural facts taken from widely separated fields.

A worm, a marine planarian, called a *Thysanozoon (Brochii)*, is common in the bay of Naples. If we put a normal *Thysanozoon* on its back, it soon will right itself. When the brain of the worm has been removed, under similar conditions of the experiment, the worm will right itself, but *more slowly*. In this case, we see a general tendency of the organism-as-a-whole; the nervous system only facilitated a quicker action. If we cut the worm partly in two, so that the longitudinal nerves are severed, but a thin piece of tissue keeps the two parts together, the two parts move in a co-ordinated way, as if not cut. The organism still works as-a-whole, although the conditions seem not favourable.[1]

If we cut a fresh-water planarian *(Planaria torva)* in two, transversely, the posterior part, which has no brain, moves about as well as the anterior part, which has the brain. If we try to find the effect of light on the part devoid of brain and eyes, we see that the effect of light is not changed, and that the posterior part crawls away from light into dark corners as a normal animal would, except that the action takes place at a slower rate. In normal animals, the reaction usually begins in about one minute after the exposure; in the brainless part, it takes nearly five minutes of exposure.[2]

How chemical conditions affect the activities of the organism-as-a-whole can be well illustrated by the following examples. In a jellyfish, we can increase or decrease the locomotor activities by simply changing the chemical constitution of the water. If we increase the number of Na ions in the sea-water, the rhythmical contractions increase and the animal becomes restless. If we increase the number of Ca ions, the contractions decrease. In a similar way, we can change the orientation toward light in a number of marine animals by changing the constitution

of the medium. The larvae of *Polygordius*, which usually go away from light into dark corners, can be compelled to go toward light by two methods: either by lowering the temperature of the sea-water, or else by increasing the concentration of the salts in the sea-water. This behaviour can be reversed by raising the temperature or lowering the concentration of the salts.[3]

An extremely instructive group of experiments has been performed in artificial fertilization of the eggs of a large number of marine animals, such as starfish, molluscs, and others.

Under usual conditions, these eggs cannot develop unless a spermatozoon enters the egg, which results in a thickening of the membrane called the 'fertilization membrane'. Experiments show that such a transformation can be produced artificially in an unfertilized egg, with resulting 'fertilization', by several artificial means, as, for instance, by the treatment of the eggs with special chemicals, and, in some instances, by merely puncturing the egg with a needle. The late Jacques Loeb succeeded in producing in this way parthenogenetic frogs, which lived a normal life.[4]

Under normal conditions, the eggs of different sea animals can be fertilized only by their proper sperm. But, if we raise the alkalinity of the sea-water slightly, we find that the eggs can be fertilized by different sperms, often of widely separated kinds of animals.[5] If we put unfertilized eggs of a sea-urchin into sea-water which contains a trace of saponin, we find that the eggs acquire the characteristic 'membrane of fertilization'. If the eggs are taken out, washed carefully and put back into sea-water, they develop into larvae.[6] The change in the chemical constitution of sea-water will also often produce twins from one egg. Change in temperature may change the colour of butterflies, .[7]

A very large class of such organism-as-a-whole reactions is given in the works of Professor C. M. Child on regeneration. I suggest these works, not only because they are particularly interesting, even to the layman, but mainly because Professor Child has formulated a $\overline{A}$ biological system, the importance of which is becoming paramount, and is beginning to be applied even in psychiatry by Dr. Wm. A. White and others.

We find the characteristic of profiting by past experiences and acquiring negative reactions very low in the scale of life. Thus, even infusoria, which ingest a grain of carmine, soon learn to refuse it.[8] Most interesting experiments were performed on worms by Yerkes in 1912 and verified repeatedly. Yerkes built a T-shaped maze. In one arm (C) he placed a piece of sand-paper (S), beyond which there was an elec-

trical device (E) which could give an electrical shock. The animal used for experimenting was an earthworm. The worm was admitted through the entrance (A). If he selected his way through (B), he got out without disagreeable consequences. If he selected (C), he received, first, a fair warning through the sand-paper (S) and, if this was not enough, he received an electrical shock at (E). After a number of experiences, the worm learned his lesson and avoided the path (C). After this habit was acquired the five anterior segments of the worm were cut off. The beheaded worm retained the habit, although it reacted more slowly. During the following two months, the worm grew a new brain and the habit disappeared. When trained again, he partially reacquired the above habit. Further experiments established that normal worms acquire the avoiding habit in approximately two hundred trials; and when the electrical device was put in the other arm, the worm learned how to reverse his habit in about sixty-five trials. Once the habit was acquired, the removal of the brain did not alter it. Worms with removed brains were also able to acquire a similar habit. Since the brain of an earthworm is a very small part of his whole nervous system, it has only a small dominance, and the neuro-muscular habits are acquired by the whole system and not simply by the brain. But, when a new brain began to operate, its dominance was seemingly sufficient to eliminate the habit.[9]

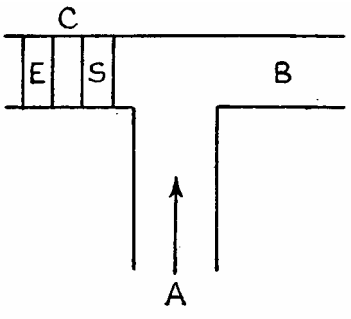

FIG. 1

Experiments of McCracken with silkworm moths have shown that a beheaded moth can live as long as a normal one. It can be mated and will lay the normal number of fertile eggs arranged in the usual way. But it will not lay eggs spontaneously, and cannot select the proper kind of leaves on which to deposit them. If the head and the thorax were cut off, the females were unable to mate and their life was shortened to about five days. If mated before the operation, they would still lay eggs when stimulated.

In these more complicated cases, the brain is necessary for the more complicated behaviour, as, for instance, the selection of a mulberry leaf.[10] Although the organism works as-a-whole, the differentiation and relative importance (domination) of different organs becomes more accentuated, the higher we go in the scale of life.

Section B. Illustrations from nutrition experiments.

We find striking illustrations of the *non-el* principle in the study of ‘vitamins’. A few years ago it was discovered that certain widely spread and pernicious diseases were due to deficiencies of some factors in diet. These factors, which normally are present in very minute amounts, were called ‘vitamins’ by the Polish biologist, Funk. The most important vitamin-deficiency diseases are called Rickets, Scurvy, Beri-Beri, and Pellagra. In all these cases, it is important to notice that the lack of a minute amount of some factor may have the most varied, pronounced, and seemingly unrelated consequences. The symptoms can now be produced deliberately on experimental animals, by diets free from the particular ‘vitamins’ and can also be cured at will by feeding them with the proper ‘vitamins’.[11]

Rickets appears essentially as a disease of infancy or childhood. In mild cases, the disease may only be discovered after the death of the adult. In these cases, the lesions have not become pronounced enough during life to attract attention.

The diagnosis usually depends on manifestations in the bones, but rickets affects the whole organism and not merely the skeleton. The children are nervous and irritable, but apathetic. They sleep poorly and perspire excessively. The muscles become wasted and weak. Often a secondary anaemia occurs. The children sit, stand, and walk later than usual; the teeth appear later in life and decay sooner. The bones usually become much affected. Areas of softening appear in the long bones, which become bent. In more severe cases, the bones may even become fractured and the head of the bone may separate from the shaft. The general resistance of the children to other diseases is lowered and mortality increases.

Cod liver oil or sunshine usually effects a cure. We should notice the little word ‘or’, for quite different ‘causes’ produce similar ‘effects’—an example illustrating that in life ‘cause’ and ‘effect’ do not correspond in a one-to-one relation, but in a many-to-one relation.

Experiments have shown that not less than three primary dietary factors are concerned with the development of skeletal tissue. These are phosphorus, calcium, and at least one organic compound which is known as antirachitic vitamin. The work of Professor E. V. McCollum and his co-workers seems to show an interesting point; namely, that the ratio between the concentrations of calcium and of phosphorus in the food may be more important than the absolute amounts of these substances.

Scurvy develops gradually. The patient loses weight, appears anaemic, pale, weak, and short of breath. The gums become swollen, bleed easily, and often develop ulcers. The teeth loosen and may fall out. Hemorrhages between the mucous membranes and the skin often occur. Blue-black spots in the skin are very easily produced, or even occur spontaneously. The ankles become swollen, and, in severe cases, the skin becomes hard. Nervous symptoms of a varied character appear, some of which are due to the rupture of blood vessels. In later stages of the disease, delirium and convulsions may occur. Autopsy reveals significant data; namely, hemorrhages and fragility of the bones. Scurvy appears also as a deficiency disease, produced mainly by the lack in food of the so-called 'anti-scorbutic vitamin'.

Beri-Beri labels a form of inflammation of the peripheral nerves, the nerves of motion and sensation being equally affected. In the beginning of the disease, the patient feels fatigue, depression, and stiffness of the legs. We distinguish two forms, the wet and the dry. In the dry form, wasting, anaesthesia and paralysis are the chief manifestations. The most marked manifestation in the wet form is the accumulation of serum in the cellular tissue affecting the trunks, limbs and extremities. Usually, in both forms, there appear tenderness of the calf muscles and a tingling or burning in the feet, legs, and arms. The mortality is high.

Pellagra involves the nervous system, the digestive tract, and skin. Normally, one of the first symptoms to appear is soreness and inflammation of the mouth. Symmetrical redness of the skin occurs on parts of the body. The nervous symptoms become more pronounced as the disease advances. The spinal cord is particularly involved, but the central nervous system is also often affected.

Speaking about 'vitamins' and how their absence affects the organism-as-a-whole, we should mention that sterility in females may be connected with lack of vitamins. Astonishing experiments by Professor McCollum showed that such diverse phenomena as loss of weight, premature old age, high infant mortality. , are largely due to diet, and that even such fundamental instincts as the motherly instinct are also affected. The normally nourished rat very seldom destroys its young and, as a rule**,** rats are good mothers. If we put such a mother rat on an abundant diet that is deficient in some vitamins, the mother reacts quite differently toward her young and destroys them soon after their birth. This characteristic has been controlled experimentally, and reversed at will by proper diets. Nervousness and irritability in rats can also be controlled experimentally by means of the vitamins they receive, or lack in food.

Section C. Illustrations from 'mental' and nervous diseases.

Simple and striking examples of what the *non-el* principle means can also be given from psychiatry.

White quotes the report of Prince that a patient was subject to severe attacks of hay fever when exposed to roses. On one occasion, a bunch of roses was unexpectedly produced from behind a screen. The patient started a severe attack with all the usual symptoms, lachrymation, congestion of the mucosa. , although the roses were made of *paper*. This interesting case shows clearly how 'mental' factors (the belief that the roses were genuine) produce a series of reactions involving sensory, motor, vasomotor disturbances, and secretory disturbances of a definitely 'physical' character.[12]

Migraine labels a disturbance in the tension of blood vessels (vasomotor), which is due to a great variety of possible stimuli acting on the vegetative nervous system. In some instances, the stimuli may be purely physical, as severe blows, falls, fast movements, sudden alteration in temperature, of pressure. ; or they may be chemical, and due to nicotine, alcohol, morphine, or to some endocrinal disturbances (adrenals, thyroid), toxins, . They may be of a purely somatic reflex character, due to fatigue, tumour formations , . They may also be of a semantic character, due to anger, fear, disappointment, worry, and other semantic states, which may act by disturbing the metabolism.

Migraine appears usually as a periodical abnormal state, in which the patient suffers from an oppressive pain in the head which gradually passes from heaviness and dullness to splitting intensity. Often characteristic visual signs also appear. The patient sees dark spots in the visual field, flying specks, and may become even partially blind. Chilliness, depression, sensory disturbances, particularly in the stomach, with vomiting, are often present. An attack may last a few hours or even several days.[13]

Cretinism labels a physical and 'mental' disturbance due mainly to the loss or diminution of the function of the thyroid gland. The patient (child) falls behind in his physical development, which often results in dwarfism, except for the skull, which grows larger in proportion to the rest of the body. The bone defects give rise to widely separated eyes, pug nose, . The bony tissue becomes unusually hard, and there is also a marked dental deficiency. The neck is usually thick and short, the abdomen puffy, the navel sunken. The hair line begins low on the forehead, the nose is sunken, the eyelids swollen, the face puffy, the tongue protruding. The liver is usually enlarged, respiration is slow, and

changes in the blood can be detected. The nervous system is affected: we also find defects in sensory and motor nerve structure. On the 'mentaI' level, we find different degrees of stupidity, 'mental' weakness (morons), imbecility, and even idiocy. Smell, eyesight, and hearing are often poor, speech disturbed, so that we often find the patients deaf and dumb. The patients have an unsteady gait, with wobbling of the head. Over-activity of the thyroid gland results in the well-known goitre.

Hyperpituitarism results in acromegaly, characterized by the gradual enlargement of the bones of the nose, jaw, hands and feet, gigantism, often connected with profound disturbances. Hypopituitarism, or deficiency of the pituitary hormones, gives rise to a group of diseases characterized by a progressive accumulation of fat, and is connected with other abnormalities and disturbances.

From the field of the psychoneuroses, I shall mention only hysteria. It is very interesting to note that the many and various physical and somatic symptoms are of a purely semantic origin. The symptoms of hysteria are many and very complex, but they group themselves mainly in disturbances of motion and 'sensation'. We find every kind of paralysis and anaesthesia. Paralysis of the limbs is frequent; anaesthesia may be distributed in many ways, involving the superficies or the various 'sense-organs'. It is interesting to note that the distribution of these symptoms does not follow the anatomical areas of nerve distribution, but shows a symbolic (psycho-logical) grouping. The disturbances of motility are usually in the form of paralysis. Tremors, muscular debility, fatigability, involuntary muscular twitching, tics and spasms are often hysterical in origin. Speech is often involved; sometimes patients can only whisper, although their vocal organs are healthy. Stuttering is often hysterical, and analysis shows that the words which give difficulties usually have special semantic significance for the patient. Respiratory disturbances of an asthmatic character and disturbances of the gastro-intestinal tract are also often hysterical.

It should be emphasized that since non-elementalism has a physico-chemical structural base in colloidal behaviour, all life and all organisms give ample material for illustration. We have given here only a very few examples, selected mainly because of their simple and spectacular empirical character, but not generally too well known. Empirical data show clearly that the most diversified factors, acting as partial stimuli, ultimately affect or result in the response of the whole.

The handling of such empirical, structural, fundamental problems involves serious structural, linguistic and semantic difficulties which have to be solved *entirely* by adjusting the structure of the language used. But

such adjustment requires a full understanding of the structural issues at hand and a fundamental structural departure from *A* methods and *means*. These structural issues and means of departures from *A* methods are explained in the following chapters.

To sum up: The *non-el* principle formulates a structural character inherently found in the structure of the world, ourselves, and our nervous system on all levels; the knowledge and application of which is unconditionally necessary for adjustment on all levels, and, therefore, in humans, for *sanity*.

As 'knowledge', 'understanding', and such functions are *solely* relational, and, therefore, structural, the unconditional and inherent condition for adjustment on all human levels depends on building languages of similar structure to the experimental facts. Once this is accomplished, all the former desirable semantic consequences follow *automatically*.

For simplicity, we have considered only examples of the 'organism-as-a-whole', but, as a matter of fact, such a detached consideration cannot be considered entirely satisfactory, as, *structurally*, every organism depends on its environment; and, therefore, in building our languages, we ought to coin terms which also involve the latter by implication. Fortunately, this condition does not involve us in serious difficulties, when once identity is eliminated and the fundamental problems of structure are grasped. Indeed, the terms which we have already used, or which will be used as we proceed, are all of such a *non-el* structure as to involve the environment by implication.

In dealing with 'Smith', the difficulties are particularly serious because his nervous system is the most complex known. It is stratified four-dimensionally (in space-time), and the dominance of some centres introduces prodigious and manifold interrelations non-existent in nervous systems of simpler structure; and we still have to learn how to handle the former. Fortunately, mathematical methods and psychiatry explain a good deal about this question, and give us the desired means to apply what we have learned.

Obviously, to 'know' something is quite different from the *habitual* application of what we have learned. This semantic difference is particularly acute in the case of language, as it involves *structural* implications which work *unconsciously*. It is not enough to 'understand' and 'know' the content of the present work; one must *train* oneself in *the use* of the new terms. Then only can he expect the maximum semantic results.