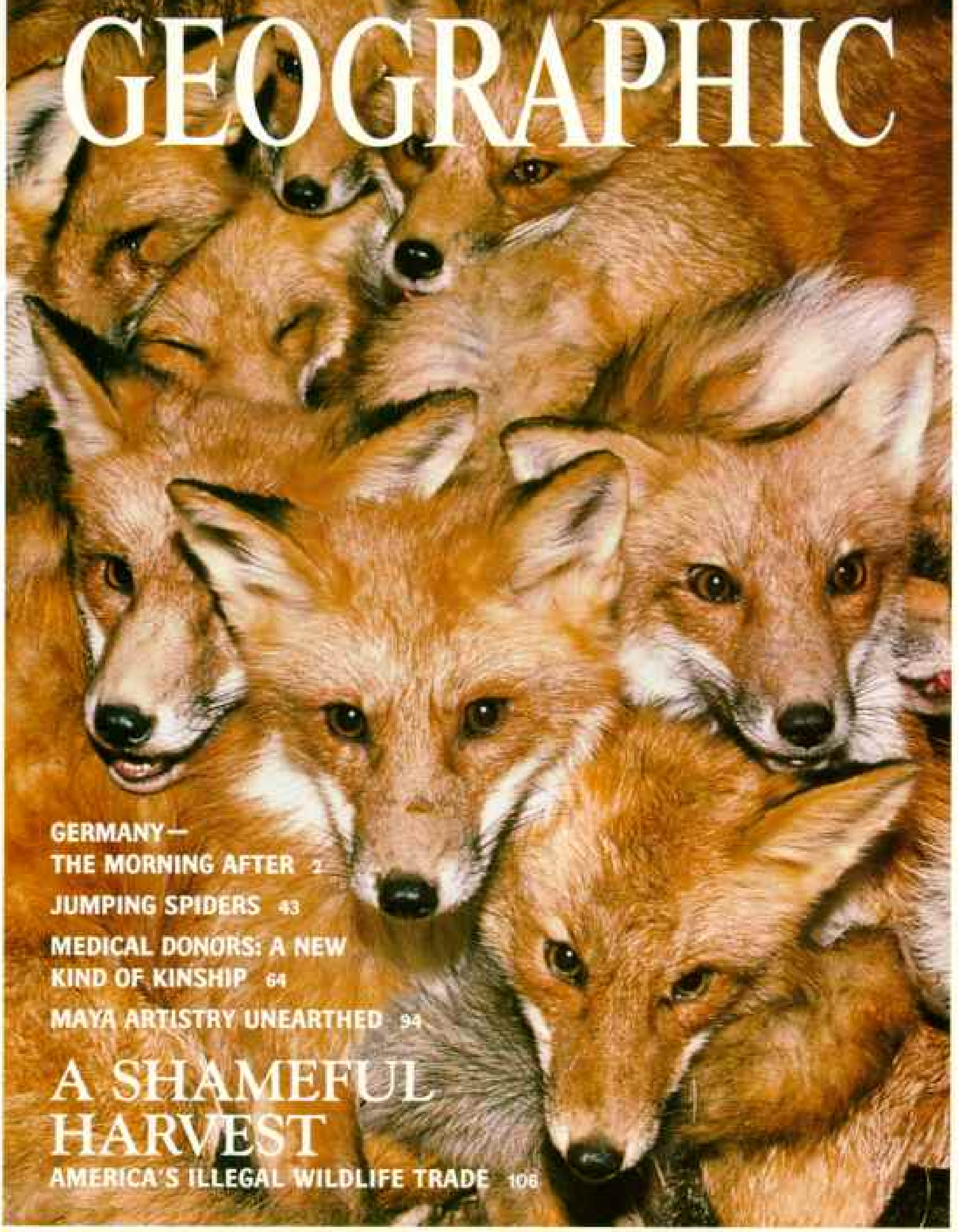
DOUBLE MAP SUPPLEMENT: GERMANY

VOL. 180, NO. 3 SEPTEMBER 1991

NATIONAL GEOGRAPHIC



OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

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SEPTEMBER 1991

COVER: Cooped up in South Carolina, a skulk of red foxes fell victim to the booming and bloody illegal commerce in American wildlife. Photograph by José Azel.

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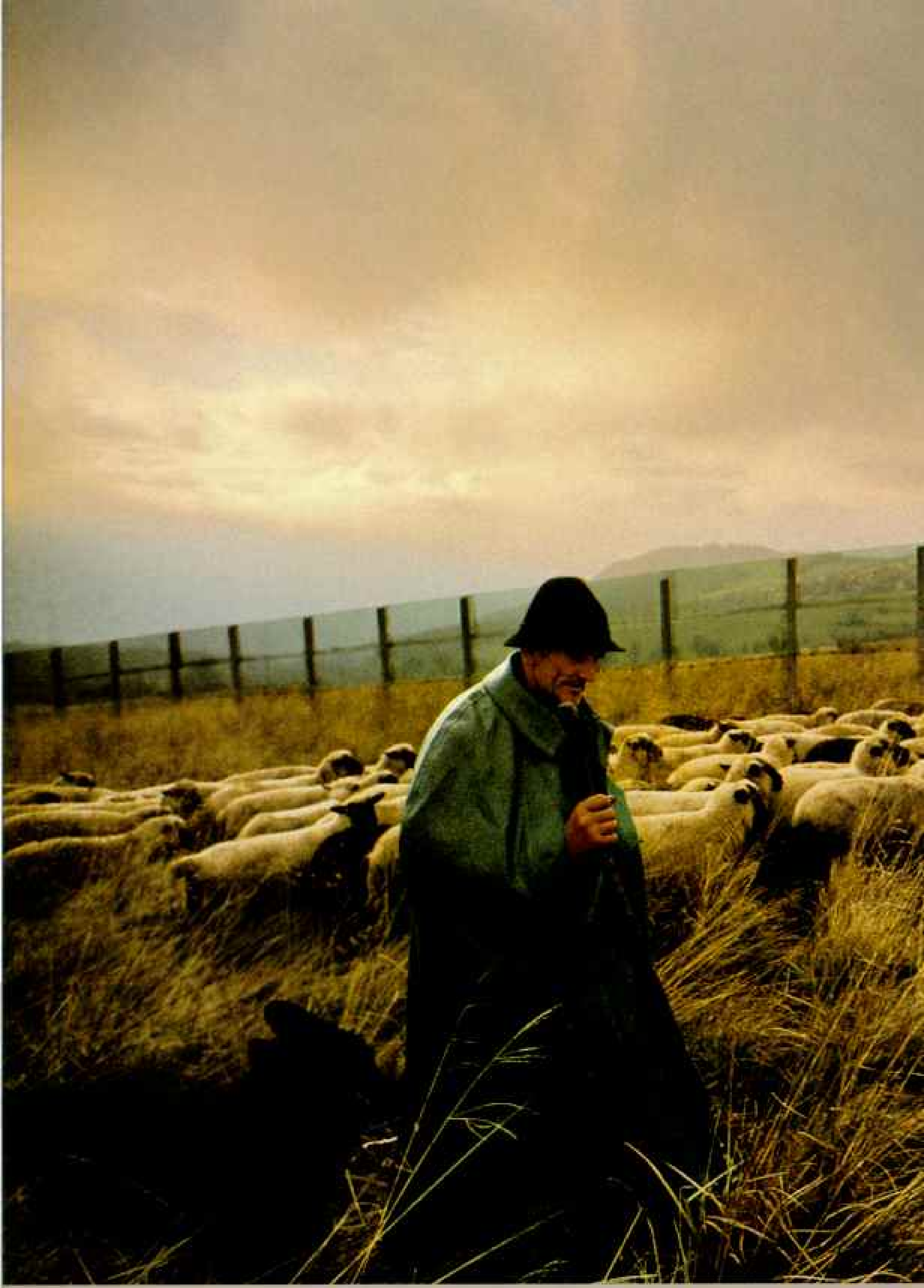
THE MORNING AFTER

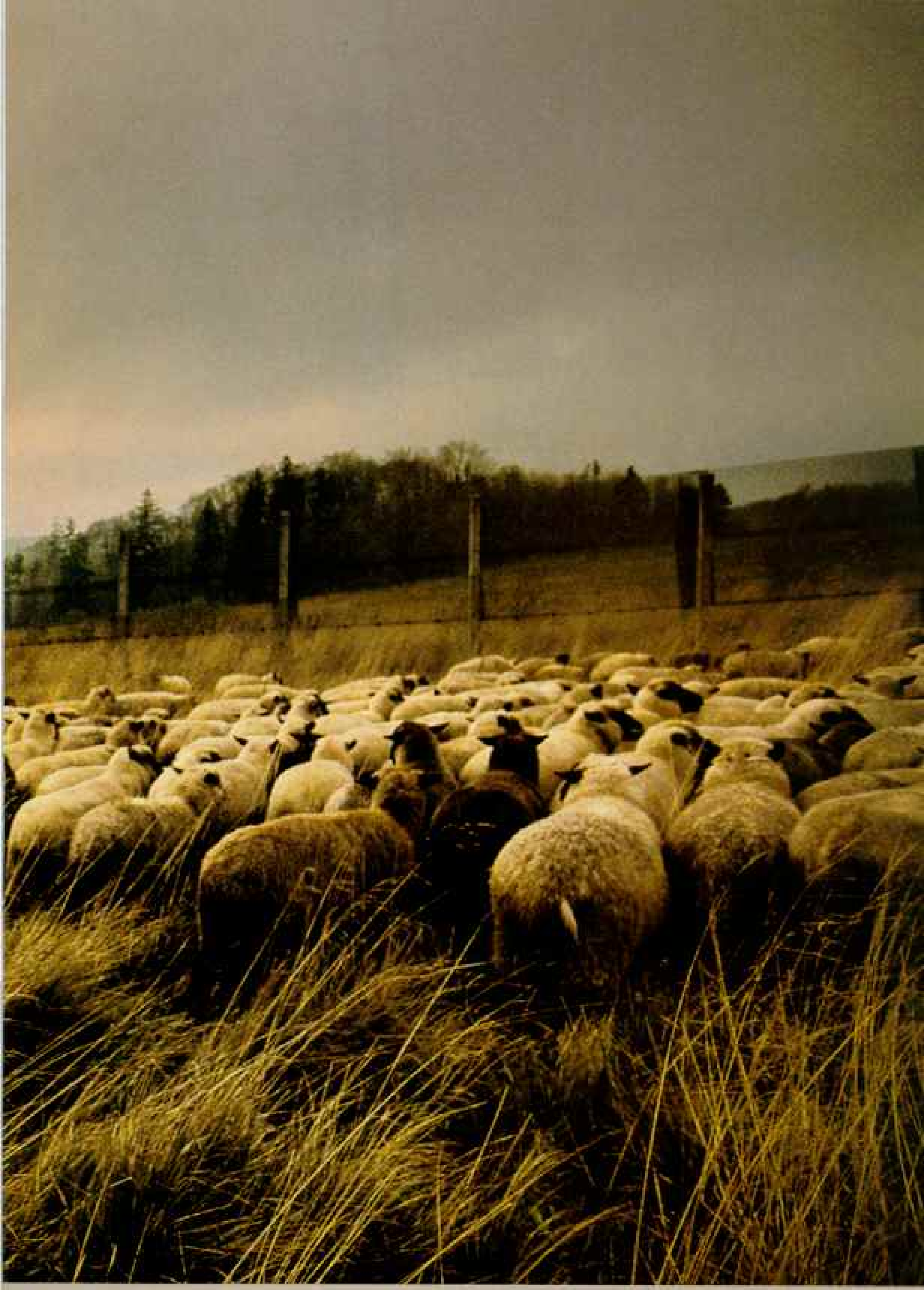
GERMANY REUNITED

Fireworks light the Berlin sky on the eve of a nation's reunification—46 years after defeat in World War II tore it apart. Amid the jubilation: uncertainty over where the new Germany will go from here.

By WILLIAM S. ELLIS ASSISTANT EDITOR
Photographs by GERD LUDWIG



OUTMODED BARRIER A fence whose days are numbered keeps Heinrich Staab, a villager in former West Germany, from herding his sheep into the East. On the old East German side shepherds once were escorted by border guards intent on preventing

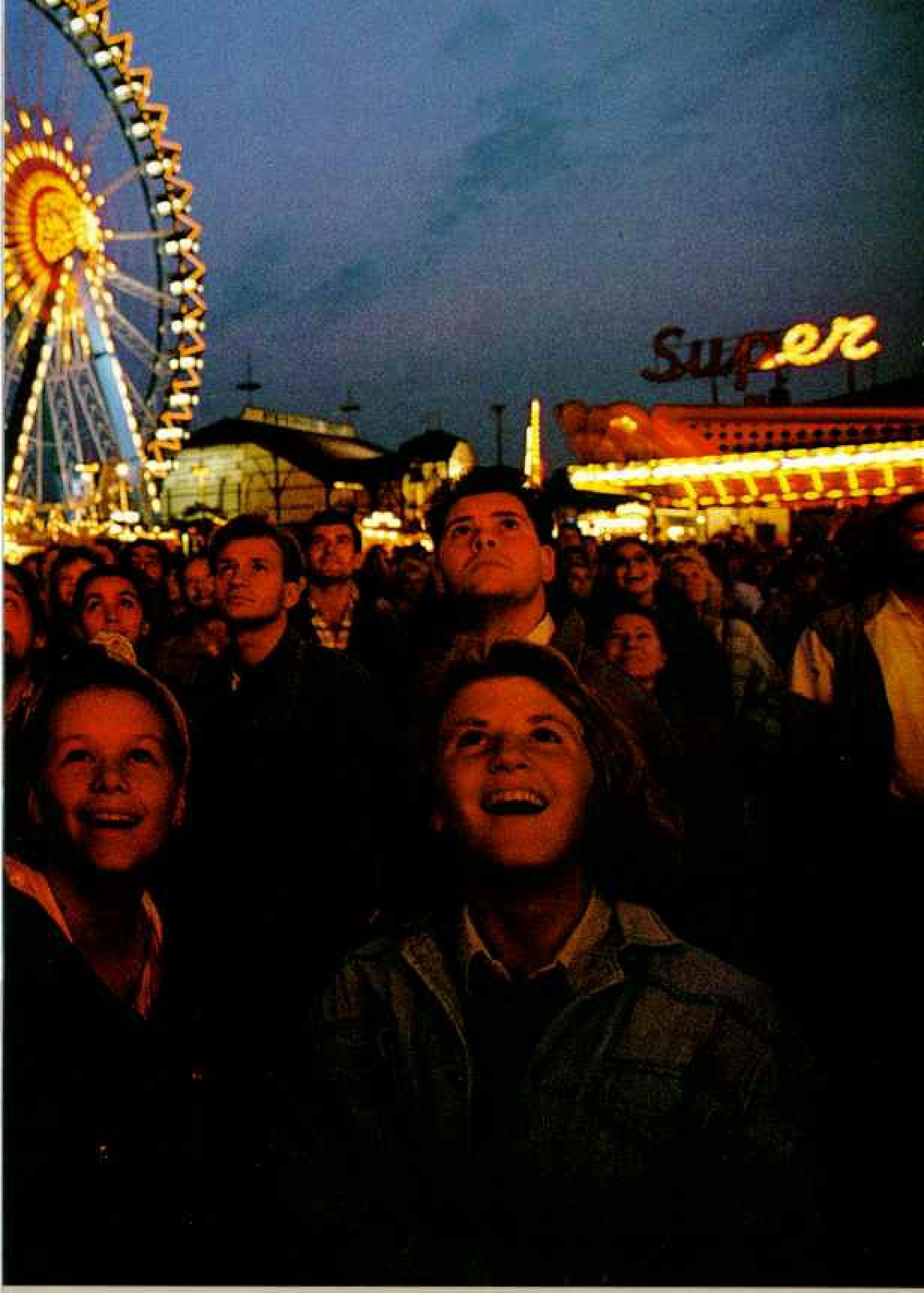


escapes. In a nearby valley known as Fulda Gap, a historic invasion route, American forces stood guard throughout the Cold War. They watched for a Soviet attack, possibly aimed at cutting West Germany in two—an invasion that never came.

INFANT ENTERPRISE Oranges and bananas—exotic goods in the eyes of an East German woman—are showcased in Kesselsdorf. In front of their home the entrepreneurs, a former truck driver and his wife, erected crude signs advertising parking.

beverages, and a rest area. Such initiatives are the training wheels of emerging capitalism in a land still burdened by the remnants of a stagnant communist economy. Forced to compete with their western counterparts, many East German businesses have closed.

UNITED BY DELIGHT Germans from East and West watch a hair-raising carnival ride at Munich's Oktoberfest. For many, reunification was a giddy ride: too fast for safety—followed by a letdown. Now that it's done, fellow citizens confront their differences. Some



West Germans view their new compatriots as backward and docile. East Germans see the "Wessies" as arrogant and greedy. Different words are used for even mundane items, leading to the publication of the first Pan-German dictionaries in more than 40 years.

IT WAS ALL SO GOOD in the beginning, as if they were the chosen to be touched by a fairy's wand, and while under the spell they challenged the rifles and breached the Wall. They were from the East and the West, the people of divided Germany, and by the end of 1990, a little more than a year after the uprising and the collapse of the Berlin Wall, they would stand together by the hundreds of thousands before the Reichstag, the old parliament building, in Berlin, counting down with the clock to midnight and the rebirth of a unified Germany.

Communist East Germany, or the German Democratic Republic (GDR), ceased to exist last October on a night awash in smoky moonlight. At twelve o'clock, the German flag, a banner of black, red, and gold, was raised, the pealing of bells began, and rockets traced dazzling patterns in the sky. After four decades it ended like that, tens of thousands celebrating while a country—once the showplace of the Eastern bloc—went out of business like some disreputable retailer with a lost lease.

Germany's western sector, the Federal Republic, absorbed it all, adding more than 16 million people to its 63 million and increasing its territory by 40 percent. At the same time, the boundary of Western Europe advanced some 200 miles, to the Polish border. But as usually happens with a night of bliss, there is also a troublesome morning after, and so it is now with a Germany beset with doubts and even some regrets.

For West Germans those regrets begin with the bill. The cost of reunification will be more than they ever imagined, perhaps a trillion dollars over the next decade. For the East Germans, suddenly merged with a powerful, modern economy, the cost is factory closings, lost jobs, insecurity.

It all came too quickly, many say—especially the decision to swap at parity the powerful deutsche mark of the West with the worthless money of East Germany.

In the city of Frankfurt I talked with Manfred J. Körber, an official of the Bundesbank, the German central bank. It was one of those days in autumn when much of Germany seems to be cast in pewter, when the margin between day and night is narrowed to a damp darkness that presses against the windows of the buildings.

Körber recalled that some had foreseen the dangers in a too quick unification. "Economic union occurred on July 1, 1990, and just three months later the two countries became fully united," he said. "We had proposed that there be a transition period of sufficient time to allow the East to raise its economic development closer to Western levels." That time was not allowed. The result, as Körber's boss, former Bundesbank President Karl Otto Pöhl, said: "A disaster, as you can see."

The Bundesbank is the most powerful central bank in Europe, its currency—the deutsche mark—the strongest. Such are the blessings of the *Wirtschaftswunder*, West Germany's postwar "economic miracle." This deep well of wealth is not likely to run dry, but Germans face new taxes and the government must borrow, an unaccustomed exercise.

Also now evident is the deterioration of property, infrastructure, the environment, housing, and general well-being during the four decades of the GDR. It can be seen in most cities and towns there—in Dresden, Leipzig, Weimar, all fountainheads of German culture. It is the same in Meissen, where, nevertheless, craftsmen continue to produce some of the finest porcelain pieces in the world, and in the port city of Rostock. Bitterfeld, chemical laden, is as toxic and unworldly a town as is to be found anywhere.

So the first flush of euphoria did not last. Rather a preoccupation with the problems prevails in both the West and East. The splicing together of two countries with such gapingly divergent ideological and economic systems was certain to be costly and stressful.

DURING OKTOBERFEST in Munich last year, when the earth there was atremble with the parading of Clydesdales and weighty brewmasters, several clubs from the East participated in the Costume and Marksmen's Parade for the first time in more than 40 years. The curbside crowds responded with applause loud enough to be heard a block away, in the bar where Rolf Wöllner was drinking one of the more than five million mugs of beer that would be sold in Munich during the 16 days of celebration.

Wöllner is a slim, elderly man, retired, who tends to blow sparks from his pipe and set small fires to things around him. But there was nothing careless in his analysis of Germany's emerging role in Europe. "What the United States is in the Americas," he told me, "Germany will become in Europe."

Much of the grunt work of removing the scar between past rivals fell to the East Germans. Near Stapelburg former border guards, trained to shoot countrymen trying to escape, now remove the barrier that once stretched uninterrupted from the Baltic Sea south to Czechoslovakia.

He served with the German Army in World War II, was captured by the Russians, and spent time in five detention camps. Thus he reacts with sensitivity to the question of whether, with a Germany made whole, there is a danger of the country once more becoming militaristic and aggressive.

"A strong Germany will pose no military danger, because the strength of the country will be embedded in European unity," Wöllner said. This vision is now widely held in Germany, especially among those born after the forties. For them unification is seen as merely a prelude to the future, when Europe is without trade barriers, when fatherlands become—if not forgotten—obsolete.

That is hardly enough to win over skeptics whose views have been hardened by history. The nation bears the stigma of Hitler's unspeakable Third Reich; for this, trust will likely be afforded to Germany in small offerings. But Germans are not reluctant to speak to that issue; they even have a word (a long one) to express the process of confronting and overcoming any guilt feelings about the past. It is *Vergangenheitsbewältigung*.

Karin Fassbender, an interpreter doing graduate work at a university in Saarbrücken, was not born at the time of World War II. She said: "You must understand that we Germans, even those of my age, have to live with the terrible burden of Germans having killed so many Jews. It's awful, and I think that is why there was so little show of rampant nationalism when unification occurred."

But whatever the problems with guilt, Germany has regained full sovereignty, and the four Allied powers that defeated Nazi Germany in 1945 have already begun to withdraw their military forces from the country.

It was agreed that by the end of 1994, the last of the 370,000 Soviet troops currently in the former GDR will be gone. The United States will make significant reductions in its 250,000-troop presence by the middle of this decade.

And finally an end will have been written to an extraordinary chapter of world history, wherein both Germanys sat balanced on the trip wire of confrontation between the Soviet Union and the United States. At no other place was the tension between the two superpowers more explosive than along the line of partition that ran down the length of the country, from the Baltic Sea to Czechoslovakia.

TWO NATIONS BECOME ONE

The new Germany represents the peaceful annexation of a decaying chunk of the old Eastern bloc by a Western democracy. Germany borders nine other nations and, despite the staggering costs of reunification, stands to prosper from increased trade with Eastern Europe and from a pivotal role in the European Community.

FEDERAL REPUBLIC OF GERMANY

AREA: 357,046 sq km (137,857 sq mi). **POPULATION:** 79,500,000. **CAPITAL:** Berlin. **RELIGION:** Protestant, Roman Catholic. **LITERACY:** 99%. **LIFE EXPECTANCY:** 74 years. **PER CAPITA INCOME:** $14,000. **INDUSTRY:** Iron and steel, transportation equipment, chemicals, machinery. **EXPORT CROPS:** Dairy products, beer, wine.

After centuries of factional warfare the rise of Prussian military might led to the establishment of the German Empire in 1871, under the leadership of the Iron Chancellor, Otto von Bismarck. Growing instability in Europe foreshadowed the outbreak of the First World War in 1914 and the empire's collapse.

Germany's attempts to rebuild after World War I were frustrated by territorial losses, war reparations, high inflation, and the post-1929 world depression. Public disenchantment paved the way for the rise of the National Socialist (Nazi) Party under Adolf Hitler, whose territorial ambitions sparked the Second World War.

Upon surrendering in 1945, Germany was stripped of its annexed territory. The Allied powers—the U. S., the United Kingdom, France, and the U.S.S.R.—set up occupation zones in Germany and divided Berlin into quadrants. In 1949 the Soviet zone became East Germany; the other three became West Germany.

FOR YEARS the Soviet Eighth Guards Army and the U. S. 11th Armored Cavalry faced each other across the Fulda Gap, a traditional invasion route about a hundred miles northeast of Frankfurt. In the city of Fulda there are still more than a thousand soldiers of the 11th Armored, but patrols along the former border have stopped. And the tall towers from which the opposing sides watched each other night and day stand empty among the birches and hemlocks.

One of the towers has been obtained by a businessman who intends to make it into a tourist attraction. Even now there is a refreshment stand at the site, and the aroma of sausages sizzling in grease carries across the hills. And so does the skeleton of the fence—the four-by-six, ten-foot-high concrete pillars to which was once affixed a grating of sharp steel mesh.

It was there I met Peter Haak, a former GDR soldier. He is out of work now except for the pickup jobs he occasionally comes across. He said he was not yet 30, but he seemed to carry the weight of ages in worry.

"You have to know," he said, "that there was no unemployment in the East, and now there are many who are out of work. Even if you have a job now, you're never sure it will be there the next morning. Basically I think unification is a good thing, but it all went too fast. The people were not prepared."

They were offered roses when they conquered the Wall, but now for many East Germans, like Peter Haak, only the thorns remain. Of a work force of between eight million and nine million, close to 50 percent are idle. The figure is startling when set against the fact that for four decades, up until the very last, there were jobs for all in the GDR.

The East Germans had their workers' holiday camps, low rents, the all but free medical and dental care, and other adornments that served to distract from the stifled life of a closed society. Most of all, there were the jobs. That is not to say, of course, that the work was usually of much quality or quantity, and certainly the salaries reflected that. In a way it was like the state pretending to pay, and the workers pretending to work, and in the end it all came out even.

The glitter of Kurfürstendamm, at upper left, West Berlin's premier commercial strip, leads to Breitscheid Platz and Kaiser-Wilhelm-Gedächtniskirche. Behind the church's sleek new tower the old church was left with its bomb damage unrepaired as a World War II memorial. The prewar center of cultural and commercial life, East Berlin languished after the city was divided.

Still, the GDR became an industrial giant, and for all of the problems there was always that bedrock of security; the people would never have much but always something.

For women, especially, there have been losses of benefits, such as a year's paid maternity leave, free day-care centers, and free abortion on demand. They hold protest rallies on weekends in many cities, and the speakers, filled with the spirit of sisterhood, rail against a life given over to what they call the three K's—*Kirche, Kinder,* and *Küche,* or church, children, and kitchen.

"The women in the East are used to working," said a Munich journalist. "Whether it's good or bad to dump a kid in a day-care center at six o'clock in the morning so momma can work isn't the issue. The women there feel it is their right to do so, one of their achievements. People are angry now; they are afraid."

Reunification hit industry in the East like wind shear. Overnight almost, with the abolition of the GDR, the state-controlled

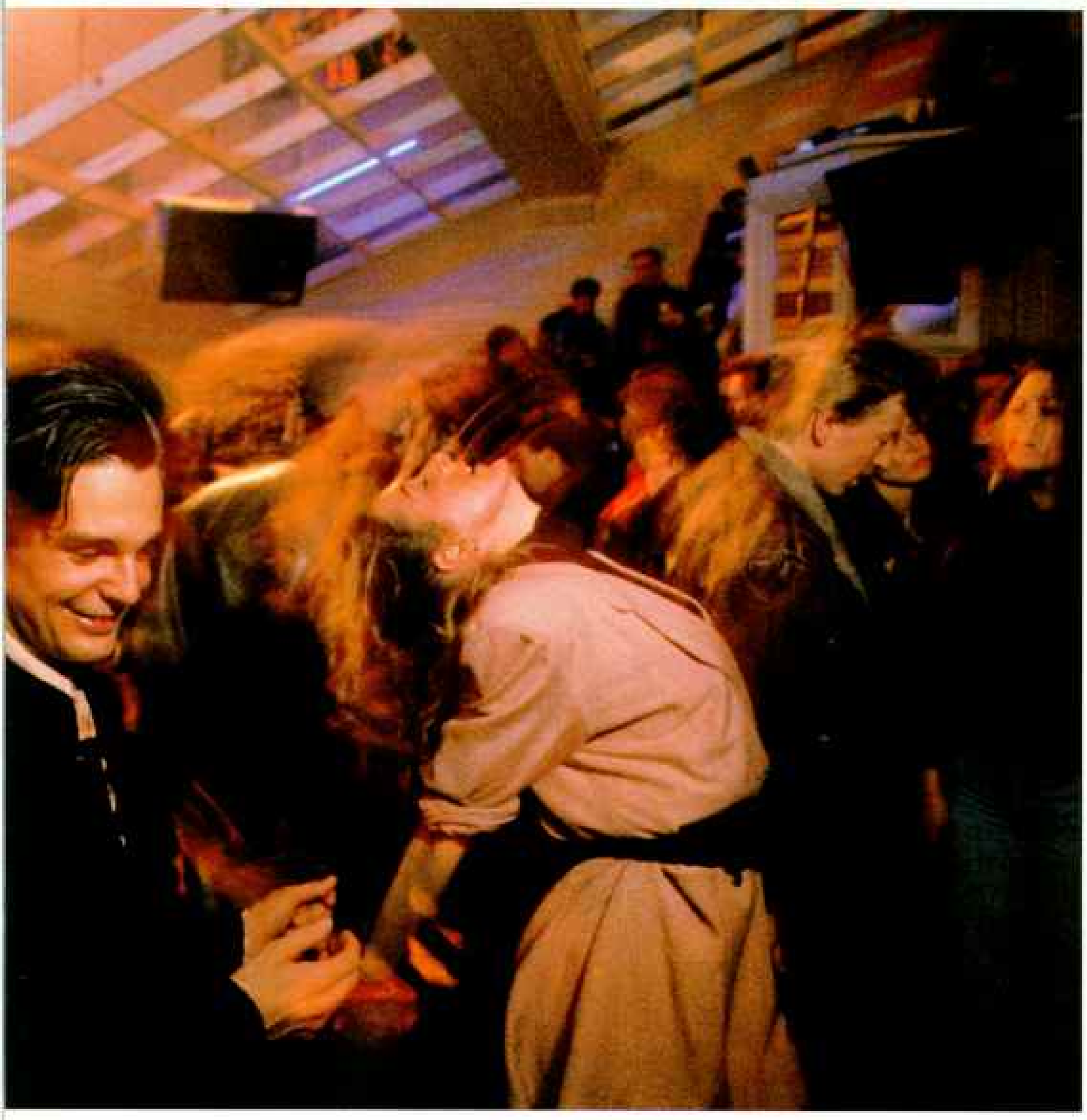
Dancers strut their stuff at Munich's P1 disco (right) where a young, affluent crowd keeps the place jumping until the wee hours. Models sporting high-crowned hats do their own strutting at a fashion show in Berlin. The event was truly European, attracting couturiers from eight nations, including three in Eastern Europe. A Latvian designer took the top award.

economy began to crumble. As many as 8,000 industries were declared eligible for private ownership. But not many were buying, not then and not now. For one thing, it is not clear who owns the industrial real estate, and, for another, it will take vast sums of money to bring the facilities up-to-date for competing in a world-market economy.

There was no state-owned company in the GDR more popular, or seemingly successful, than Pentacon. Based in Dresden, the firm manufactured the cheap but well-made Praktica camera, something of an article of faith for amateur photographers throughout Europe. And yet the government body charged with deciding the fate of companies in the East, the Treuhandanstalt, shut down Pentacon.

"The production cost of one camera was more than three times the selling price," said Gordon Rapp, a member of the caretaker management team. "The operation was heavily subsidized. Also, under the communists, they employed 6,000 workers here when they only needed a thousand. In a competitive situation this company would not have survived a year."

Pentacon, however, served a vital purpose for East Germany. With most of the 300,000 cameras manufactured each year going to Great Britain and the Netherlands, the sales



produced hard Western currency. Production stopped on the last day of 1990.

THE FORMER GDR may not have seen the opening of free enterprise on a grand scale, but the small fishers are there in large numbers. They have come like drummers to the frontier, eager to trade on the craving for Western wares and ways. For Bianka Zimmol of Halle, the dream was to become a model.

She was sitting in the lobby of a hotel in the city where she had lived all her life, the city of Handel's birth, and she told me of the people from the West who had just interviewed her. "They told me I could become a successful model," she said, "but they want me to pay them 300 marks first." She was young and pretty, and when I advised her not to give them the money, she seemed grateful.

"It's just that it's such a bad time to make a living," she said. "I was a waitress, and it was a respected thing in the GDR to be a waitress. I had to serve two years as an apprentice. It wasn't like being a servant. People would promise me a pair of jeans if I could get them a table in the restaurant. If my watch was broken, I could get it fixed right away because I could get the repairman a table. Otherwise, it would take weeks to get a watch fixed."

DETERMINED DRINKERS It takes thick skin to work the crowd at a Munich beer garden during Oktoberfest. Carrying hefty one-liter mugs—an experienced waitress can handle a dozen—makes it difficult to ward off pawing customers. Begun as a royal

Bavarian wedding celebration in 1810, the world's biggest beer bust now attracts eight million revelers annually. Acknowledging his countrymen's reputation for being phlegmatic, one German noted that even Bavarians "have to work hard to have fun."

Bianka remembered the years before unification: A person might have to wait hours to enter a restaurant. Then another wait for service in rooms where the steam from all the bowls of lentil soup would be enough to drive a train, you'd think (and the meat and dumplings heavy enough to stop it). The meals, however, were inexpensive. Now the old prices on the menus have been inked out and replaced by higher ones. Many restaurants have closed. Those that remain offer immediate seating.

HALLE IS A GRIMY, medieval place, and it sits in that part of eastern Germany where the chemical industries are clustered. The blackened stacks of the plants have been feeding poison into the air for at least 40 years, or as long as it takes to make the skies sunless, the birds seldom seen.*

Once, while in a village near Leipzig, I remarked to the postman that it was surprising to see trees with no leaves as early as September. "The leaves here are gone by midsummer," he replied, "and with the air we have, it sometimes happens overnight."

Whole sections of forest in the GDR died because of the more than five million tons of sulfur dioxide released into the air each year. Groundwater over a vast area is polluted with heavy metals and lethal chemicals. Even the Elbe River, for so long a queen of waterways in Germany, is now scummy and fouled with a stew of lead, mercury, nickel, and pesticides.

Some may view this residue of harmful materials as retribution of a sort for the times before unification when the *Länder*, or states, of the Federal Republic dumped toxic wastes in the GDR over a period of at least ten years. They paid a fee to do so, but not very much.

A leading culprit in the environmental crisis is lignite, the brown coal used for heating and for generating most of the electricity and other forms of energy in the East. When it burns, the sulfuric emissions can in time blister metal and wilt the lungs.

In nearby Bitterfeld the choking, blinding pollution comes from various sources, including a huge chemical complex. There are at least 50 separate factories involved, producing about 2,500 products, including plastics and pesticides. The furnaces at the complex were first fired up during the closing years of the last century. Eberhard Grahn, chairman of the Chemical Engineering Department of the complex, told me, "The problems here today represent an accumulation of one hundred years of problems."

Grahn said reforms are taking place: Emissions have been substantially reduced, and measures are being taken to control the discharge of heavy metals into streams and the nearby Mulde River.

"We will bring it up to Western standards," Grahn said. Perhaps, but first the ownership of the massive facility, employing some 17,500 workers before cutbacks in the past year, must be determined. *(Continued on page 24)*

*See "East Europe's Dark Dawn," by Jon Thompson, NATIONAL GEOGRAPHIC, June 1991.

Conspicuous piety ruled the day when members of Osho Multiversity, followers of an Indian guru, proselytized East and West Germans at a Berlin "love meditation," complete with taped music. Such displays had been forbidden in East Germany, forcing the sect to meet in secret.

Near a Berlin train station Polish nationals pack newly purchased electronic equipment to be resold at a modest profit in Poland.

A TALE OF TWO

Only 20 miles apart, they live in different worlds

WEST

With Christmas around the corner, Jens and Christa Haude and their daughters, Eva and Inge, go window-shopping in the city of Braunschweig.

A family man who enjoys gardening as a hobby, Jens sells press time for a printing company. His salary provides a modest but comfortable life in the town of Königslutter. In their finished basement, Eva, at right, celebrates her 11th birthday with friends.

Early on, Jens and Christa were enthusiastic about a reunited Germany, though they don't consider themselves nationalistic.

FAMILIES

Photographs by STEVE McCURRY MAGNUM

EAST For the Rabe family, life in the East has had few frills. At the old East-West border Günter and Rosemarie Rabe pose with Matthias, 18, at left, Alice, 11, and Andrea, 15, who leans against the family car, a utilitarian East German Trabant.

In July 1990 Günter, an engineer, jumped into the market economy with both feet by forming his own electrical business. In the basement of the Rabe home in the village of Flechtingen, Matthias helps his father cut kindling for the coal furnace that heats their house.

WEST

Evening at the Haudes' finds 16-year-old Inge in her bedroom studying vocabulary for her English class. Christa talks by telephone with her mother, as she does almost every day.

Christa's schedule allows time for sewing, batik, playing the guitar, and a class in jazz dancing. On Saturdays during the holiday season she earns extra money selling men's clothing at a department store. On one of those days Jens picks up chicken, butter, and milk before cooking lunch for the children.

Now that reunification is a reality, the Haudes are still enthusiastic but less optimistic. Said Jens: "The problems will be solved but not as quickly as we thought. It may take five or six years, but democracy will prevail."

EAST Home from school with the flu, Matthias passes the time.

While bathing, Alice visits with her mother. Besides keeping house, Rosemarie works in a clothing store. For this family, a vegetable garden is a necessity. They also raise pigs and chickens.

Reunification came too fast for the Rabes. West German ways were imposed with no alternatives. The paperwork for Günter's business is sometimes baffling. And when Alice needed dental work, the insurance carrier required documentation. Before, approval was automatic.

Under communism, says Rosemarie, "We had our jobs, a home, and food. What bothered us was being shut in and not being able to speak our minds freely."

(Continued from page 18) It now remains under the control of the Treuhandanstalt, pending possible sale to private ownership.

The deprivation imposed on the people of the GDR through the shameful mismanagement of the whole process of government was deep and all-embracing. What looked good—a new telephone set plugged into wiring installed in the early 1920s—was, more often than not, a sort of facade. It was still 1920s technology. So there were spiteful reactions not long after unification, when the people could journey freely to the West and see all the goods in the shops, and the fine automobiles, and the clipped poodles with shiny stones in their collars. They saw all of that, and some of them said to the West Germans, in effect, "You rushed us into unification, so we want our share now." The bitterness is palpable.

FOR GERTRAUD HELLWIG, unification means many things, small and large. It means she can go to the West and buy an ice-cream cone without having to ask her cousins there for the money, now that the deutsche mark is the currency for all of Germany. And she has plans to buy a Western-made car ("something small and cheap") when the economy improves.

She is a plump, sweet-smelling woman, and

A smoky *Kaffeeklatsch* helps pass the time in Chemnitz, an industrial city where at least a third of the work force has no job. Reunification restored the original name to the city, called Karl-Marx-Stadt after 1953. The window reflects a bust of Karl Marx, which the city kept as a reminder of the communist oppression that was spawned in part by the philosopher's theories.

the town where she lives is called Riesa, an hour or so northwest of Dresden by car. The best place to stay there is the former House of Steel Workers, and the best rooms have a view of the former Street of German-Soviet Friendship (once again called Bahnhofstrasse). It takes a few days, but it is possible in Riesa to wipe a window in the coal dust and reach in to touch the souls of the people and the place.

Hellwig lives in the house that was built by her parents more than half a century ago. It is comfortable and clean, and there is a large television set where she, like 80 percent of the people in the GDR, picked up transmissions from the West during the years of partition. And there is the green, rotary-dial telephone that has been out of service for two years. "I waited 20 years to get that phone, and then after eight years it was disconnected," she said. "They said someone else needed the connection more than I did." Then she was laughing. "The communists really gave it to us."

It was only human nature, of course, to want to pick up the receiver and see, if by some stroke of good fortune, the thing was back in service. I did, and it wasn't, and Gertraud Hellwig said she does that all the time.

Rehabilitating the telephone system in the East will be a major, expensive undertaking. Introducing more advanced systems of communications is even more challenging. It was once determined that there is more computer power in the offices of just one company in one city in the West than in all the East.

I walked with Hellwig through the yard behind her house where she showed me a small kennel with six puppies. She said they belonged to a friend, a waiter who had lost his job and was trying to make a living raising and selling cocker spaniels. Hellwig too had lost her job in a film-processing company.

On the street in front, children were playing, one of them with that simple and ageless toy—a small box—that is shaken until the metal balls in it drop into the eye sockets of the dragon/snake/tiger.

One of Hellwig's neighbors, Reinhard Polke, is a schoolteacher whose defiance of Marxist authority became something of a hallmark of his career. "Without unification—the big change—I think the end was near for my career as a teacher," he told me. "I would get angry and yell and scream at all the socialist nonsense." He is waiting now for updated textbooks to become available and replace those that tell of "only one side of America—the poor, dirty, ugly side."

Changes in education have occurred. No longer are teaching guidelines focused on glorification of the Communist Party and the system. English has become a required course in

Riesa's 11 public schools and all the others in the former GDR. Members of the Young Pioneers, a party youth group, have even stopped wearing their red scarfs to school on political holidays, as was the rule.

There are Soviet soldiers on the streets of Riesa, many of them with the look of Asia in their faces. A few smile, or frown, but most are expressionless, as if boredom had metastasized into stupor. It is not an easy life for them in Germany today, but they are apprehensive about reassignment back to the Soviet Union. The wives among them are particularly concerned about the move. Some have written to German Chancellor Helmut Kohl asking for his support in delaying their departure, citing fears of the possibility of having to live in tent cities near Chernobyl.

The Soviets are not leaving without a heavy cost to the treasury at Bonn. The German government agreed to pay the Soviet Union more than seven billion dollars to provide housing and other resettlement services for the returning troops.

For now though, they walk the streets of Riesa and other towns and cities in the East, sometimes selling their greatcoats and other pieces of their uniforms—sometimes, even, selling their Kalashnikov assault rifles. With the Wall gone, they have been exposed to the West. Discipline and morale have also been weakened.

The result: more desertions and crime. But mostly the soldiers have reacted with the syndrome of the child outside the candy store: staring, craving, tense with the stirrings of a devil in some cul-de-sac of the mind.

If there was a need for proof that the Cold War was at an end, I found it one afternoon near the village of Hillersleben, at a Soviet military base. The main gate was open, so I walked in, inspected a tank, and when I was finally approached by a sentry, asked if I could see the commandant. Only then was military procedure—or logic as practiced in the East—brought into play.

"See the commandant? Impossible. He's too busy."

"Is there an office where I can get official permission to speak with him?"

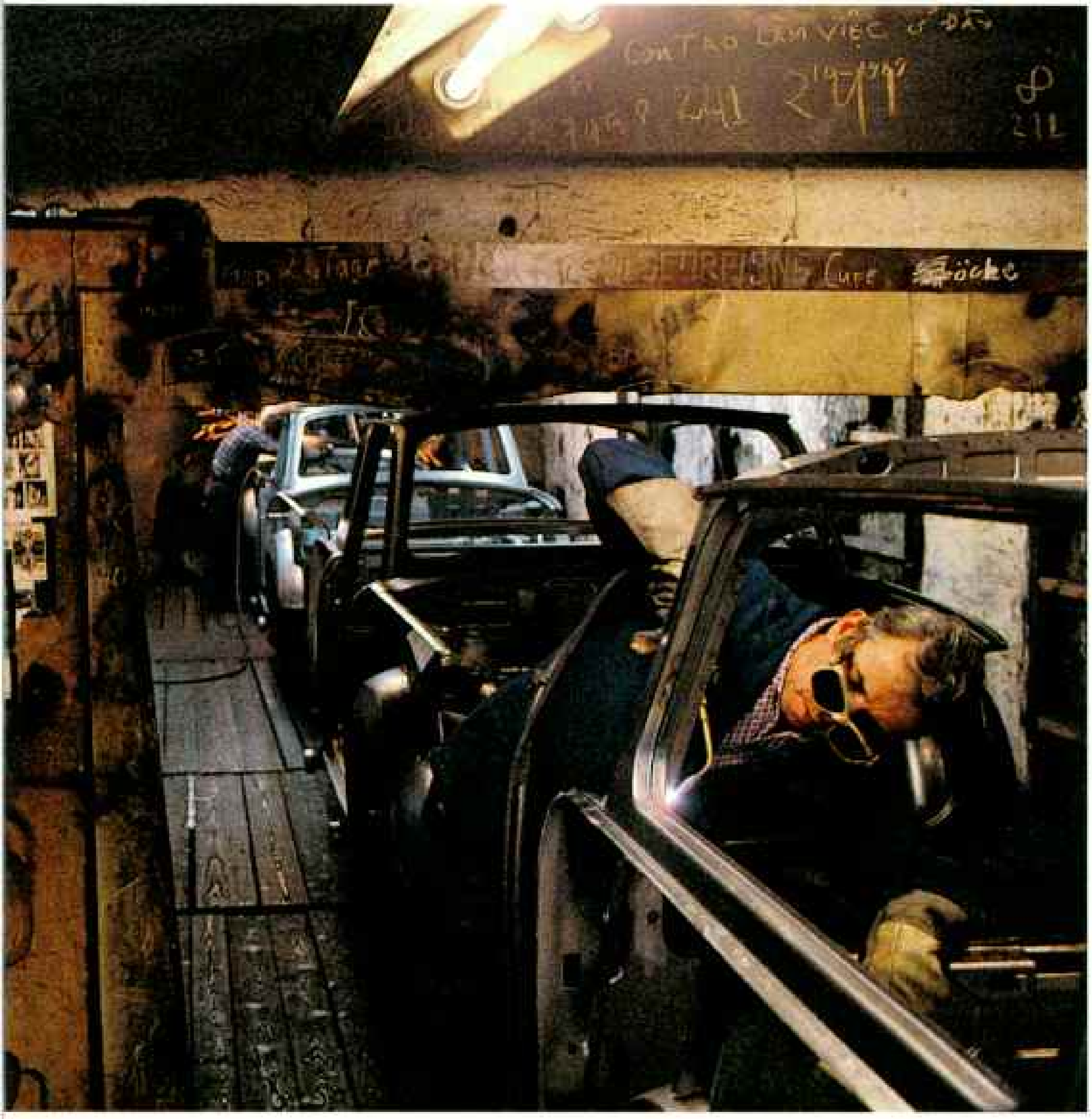
"There is, but it would serve no purpose for me to tell you how to get there."

"Why?"

"Because they are too busy to give you permission."

THE RUSSIANS ARE LEAVING, but others are arriving. In the past year some 2,000 Jews from the Soviet Union have immigrated to the eastern part of Germany. In addition, Eastern Europe may well be on the eve of one of the largest migrations in history, a massive movement westward, across borders.

The prospect has Germany on edge. As tensions mount in the Soviet Union, with the threat of civil and ethnic uprisings, the possibility of refugees reaching out for asylum becomes less remote each day. Coming on top of the social upheaval and the staggering blow to the economy brought on by unification, the



Bound for the autobahn, a Mercedes-Benz emerges from a plant near Stuttgart. The star emblem has become a symbol of West German manufacturing quality. In Zwickau workers churn out the last Trabants, the smoke-belching cars that East Germans regarded with frustrated affection. Once, it is said, a man ordered a Trabant and was told it would be delivered ten years later on a Friday. "Not then," he pleaded, "that's when the plumber's coming."

"Bunny suits" are mandatory for technicians in Siemens AG's immaculate semiconductor assembly room near Munich. In the East workers lunch on bread and sausage at Chemie AG's grimy graphite plant in Bitterfeld. The industrial city's environment is so foul that a doctor, when asked whether Bitterfeld had been bombed in World War II, replied: "Unfortunately, no."

consequence of such a movement would be one of incalculable difficulty.

So the German government is preparing to impose tighter controls on the influx of foreigners. The action makes some uneasy. Richard von Weizsäcker, the 71-year-old President of Germany, recalls that "racism and xenophobia were terrible traits of the Third Reich." But before that, he said, Germany and especially Prussia had a tradition of welcoming people of various national and religious backgrounds. Today, he said, "the new political culture again welcomes foreigners," and the immigration controls would be only of a prudent nature.

No newcomers are more perplexing to the Germans than the thousands of Gypsies from Romania who have moved into Berlin and other cities. Some of them beg on the streets, holding out sickly children as lures for compassion. Such behavior is repugnant to most Germans. Reaction is tempered, however, by the knowledge that Germans, under Hitler, sent as many as 500,000 Gypsies to their death.

"I reach for a coin whenever I see a Gypsy begging on the street," I was told by an elderly woman selling chocolates in a shop on the Kurfürstendamm, Berlin's tony street for shopping. "We owe them something."

Allowing foreigners to enter the country and handing out change to the needy is one thing, but granting permanent asylum is quite different. Of the nearly 150,000 applications for asylum considered last year, only about 4 percent were approved.

For the Vietnamese in Germany—mostly in the East—the year-long post-unification period has been a nightmarish ordeal. Many of the Asians have been subjected to harassment and physical attack by youth gangs. And now each Vietnamese has an invitation from the government to accept 3,000 deutsche marks and a free airplane ride back to Vietnam.

At one time there were as many as 60,000 Vietnamese in East Germany. They were asked to come to the country to work as laborers in the great storm of industrialization that swept through the GDR. Now that they are no longer needed for that, some have turned to selling on the streets, standing all day behind trestle tables freighted with cassettes and boomboxes, wristwatches, and, of course—the flagship product, as it were—cigarettes.

As much as 40 percent of the population in the East continues to smoke, buying 82 million cigarettes every day, a statistic not lost on Western tobacco companies as they rushed in to stage promotional extravaganzas.

MUCH OF THE HISTORY of Germany has been played out in Berlin, capital of the country from 1871 to 1945. But the city's role in German history dates back to the 13th century.

Now, with reunification, Berlin is once again the capital, although it may take ten years to transfer the administrative side of the government from Bonn.

The move could cost in excess of 40 billion dollars. Berlin may or may not be worth that as the home port for federal bureaucracy, but as a city with such a grip on the psyche of a nation, it is of a value beyond determination.

In time Berlin could become the hub of a unified Europe. It is there, more than anywhere else in Germany, that the people speak of a desire to diminish nationhood and bolster allegiance to Europe.

Every day, for ten days, I asked a different Berliner if she or he held pride in nationalism. Only one said yes. Of the others, one told me this: "I was watching television once and saw a group of Americans rise to their feet and place their hands over their hearts when the flag went by. I can't imagine people here doing that."

Another Berliner, a woman in a bookstore, said, "I'm not proud to be German, but I'm not ashamed of it. Becoming more European—that's what excites me."

It was in that time between wars, the 14 years of the Weimar Republic, that Berlin flourished as a city for the arts and for sultry decadence. Boleslaw Barlog was an important figure in the city's post-World War II cultural scene, serving as general director at many of Berlin's top legitimate theaters, such as the Schiller and the Schlosspark. He was a friend of the playwright Bertolt Brecht, and many of the acting greats of that era sat at his feet. Now he is an elderly man who remembers how good it was and hopes that it will be that way once again.

"I don't think that the dictatorship in the East managed to suppress the talent of the artists there," Barlog said. I was at his house on a quiet street in Berlin, sitting in a room filled with morning sunlight. "But now that unification is here and there is freedom in the East, I'm sure that the talent will develop faster."

In the Berlin undivided, there are three opera houses, 29 major theaters and numerous others, at least a dozen first-rate orchestras, a Philharmonic, and a couple hundred choirs. "The difficulty now," Barlog said, "is that with unification, you now find two or more of everything."

Berlin, like Frankfurt and Hamburg and Stuttgart and all the other urban colossi in the West, has problems with drugs and crime. There are prostitutes in the subway stations, leaning against the gum-ball machines, and bank tellers positioned behind glass thick enough to stop a bullet. But on a Sunday morning in fall, early enough so that the traffic signals are still flashing caution, there is a strong sense of righteousness that seems to sweep like a wind around me as I walk through

the Brandenburg Gate, from west to east.

Once, an unauthorized crossing in the opposite direction meant almost certain death, but now it's all right. The wide street ahead is Unter den Linden, and they are there, the lindens, lining the broad thoroughfare. It was on this side, along this way, that Berlin was at its best before the 1930s and the war.

The hotels and cafés are still there, although the glamour has been drained off. It does not quite sit under the lindens, but the headquarters building for the Stasi, the notorious secret police that kept files on two million persons in the West, is also there, a reminder that probably never have two countries spied on one

The future is murky for Igor Marfut, a Soviet Army officer billeted in a Dresden apartment with his wife and son. By the end of 1994 the army will be back in the Soviet Union, where housing for soldiers is critically scarce. Meanwhile, defections have increased, and some soldiers have sold their uniforms. The Soviet command is unloading white elephants, such as amphibious vehicles, which went on the block in East Berlin.

PINNACLE OF ESPIONAGE Dimly seen through the fog, a communications tower sits squatly atop the summit of the Brocken, where it once cocked an ear toward transmitters in the West. Elsewhere in the Harz Mountains other installations did similar

espionage for NATO allies, making East and West Germany among the most spied-upon of nations. A land of storybook villages, the mountains inspired the tales of the Brothers Grimm and now draw tourists to castles converted to restaurants and country inns.

another as heavily as did the two Germanys.

There are shop fronts with the windows broken out, a morning-after legacy of a demonstration against unemployment; also leftists are often out with banners and speeches, for they feel they were betrayed by the speed with which unification came about. They also fear the revival of Nazism.

Peter Scherfer is a teacher of music, a gentle man, but when I spoke with him at a rally in Berlin, his voice was impassioned. "This has been a bankruptcy sale of the GDR," he said. "We should have given them an opportunity to correct their mistakes. Unification without a referendum? It's not right."

AMONG THE UNCERTAINTIES facing Germans is this: Who owns the properties abandoned in the East by those who fled west to escape communism? Should these properties be returned to their original owners—or should they remain in the hands of the government agencies and families that have owned or occupied them for so long? The matter awaits a clear legal ruling.

In the meantime many West Germans return to the houses they knew before and, once there, often discover that the place is not as large as memory portrayed. That is not the case, however, with the property that Marietta and Jürgen Tiedt hope to recover. Theirs is not a row house in a section of Leipzig where cats leap out of garbage cans, scaring you half to death. Rather, it is her family's castle.

The Tiedts own a clothing shop in West Berlin. The goods they sell are fashionable, not inexpensive, and the retailing practiced there is one of gilt-edged decorum.

Today the castle, in the village of Liebenberg, is a hotel-restaurant, with the ownership tied to high officials of the Party of Democratic Socialism (PDS), the successor to the Communist Party, which dominated the government in the GDR for more than four decades. It has been revealed that the assets of the PDS amounted to billions of dollars and that attempts were made to spirit some of the funds out of the country.

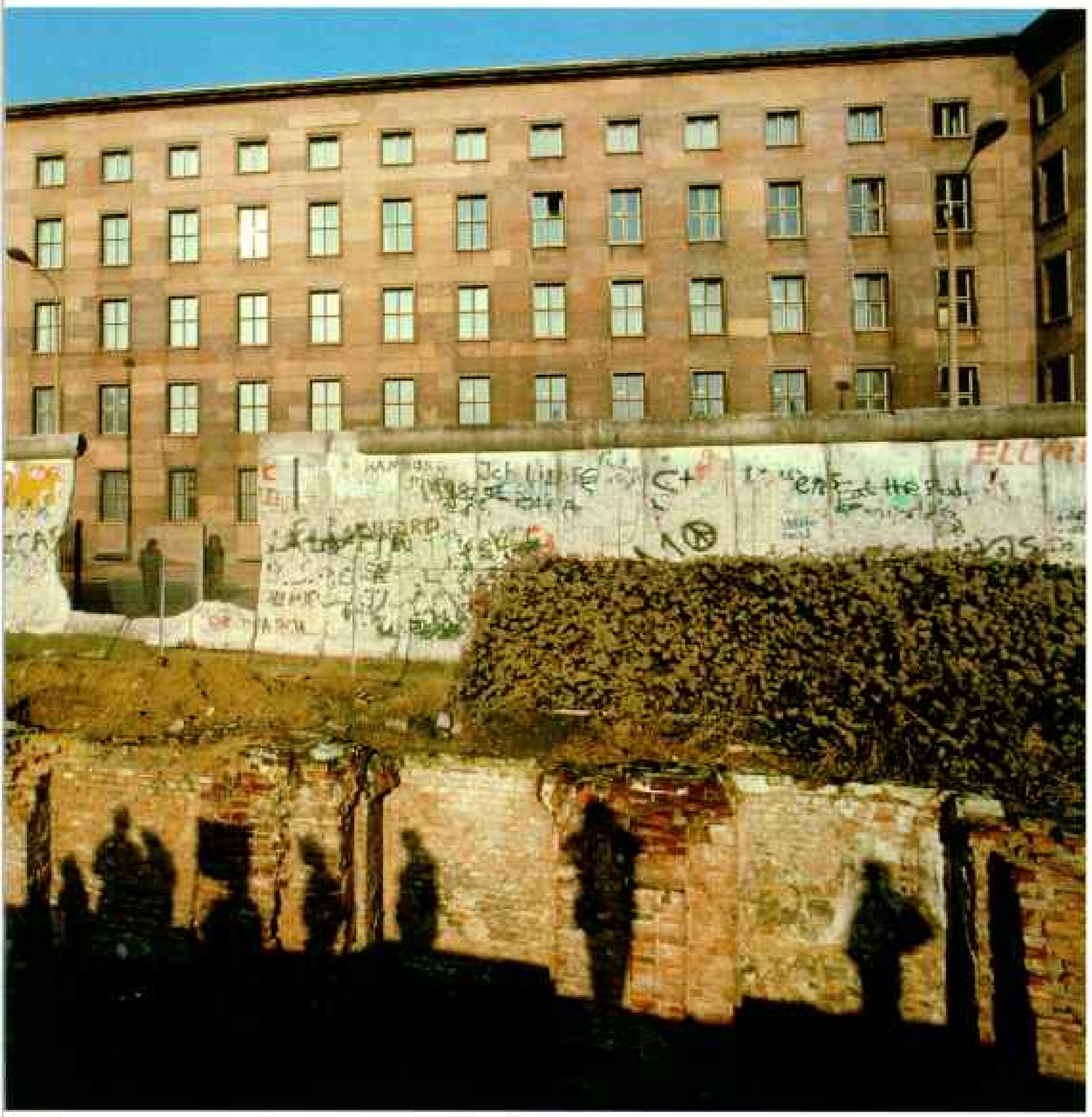
With 30 rooms, more or less, the castle was built in 1462 and purchased by Marietta Tiedt's ancestors two centuries later. It came with 21,000 acres.

"I was baptized in the castle," Mrs. Tiedt said. "My grandparents were the last of our family to live there. They had to give it up on

the eighth day of April 1945. The next day the Russians came in and ransacked it."

I went with Jürgen Tiedt to Liebenberg, 30 miles north of Berlin, to see the place. Viewed from the gatehouse entrance, the castle rose in heavy, many-windowed presence. There were auxiliary buildings all around. "That house over there," Jürgen said, pointing, "was where one brother lived. Now they breed pigs there."

Jürgen Tiedt was not allowed to visit the chapel or enter part of the castle grounds. He was told that the house his wife's family occupied for more than 325 years was open for lunch, but otherwise he'd have to return on a



Shadows of tourists play against the ruins of a building that once housed the Gestapo, Nazi Germany's dreaded secret police. Charged with eliminating "enemies of the state," the Gestapo sent countless arrestees to extermination camps where six million Jews died. So that the genocide won't be forgotten, a photograph at Dachau—site of one infamous camp—shows the prisoners' barracks that covered the fields.

Seeking sanctuary, Sorin-Daniel Ardelean brought his family to Hamburg in 1990. He feared persecution for his knowledge about ties between the old and new regimes in his native Romania. A Hamburg policeman has his hands full with immigrants clamoring for applications for asylum from Eastern European, Asian, and African nations. Though liberal in allowing foreigners in, Germany allows fewer than 5 percent to stay.

Sunday when visitors are allowed in. He took it in good humor and was made to feel better when an old woman employed in the kitchen greeted him warmly. "She was a servant when my wife's family was still here," he said.

There have been tens of thousands of claims for regaining property abandoned in the East. They have come not only from Germany but from around the world. There is Albert Prinz von Sachsen, the Prince of Saxony, seeking to recover 28 estates in the Dresden area, including a castle valued at 3.8 million deutsche marks (2.2 million dollars U. S.). A wealthy American writes officials to say that he is the owner of 69 holdings in Dresden.

"We need laundry tubs to hold all the claims we are receiving," said Günter Rühlemann, the official in charge of handling claims for property in the Dresden area. "Every claim will be examined individually, and if there is proof that they owned the property before, we will proceed from there. It may be that we will offer other land as compensation."

From Rühlemann's office window, it is possible to look out on part of the center of Dresden, the heart of certainly one of the most beautiful cities in the world before United States and British planes came with their bombs in February 1945 to kill 35,000 people and destroy forever the baroque grandeur of the place. The opera house and several palaces, museums, and churches have been rebuilt, but it's not the same, some longtime residents of the city assured me.

But as a city with promise of recovery from four decades of the GDR government's austere stewardship, Dresden is far ahead of most. There is a sense of renewal there, unlike in Leipzig where the despair and destruction by neglect have the feel of intractability.

TO GO DIRECTLY from Leipzig to Hamburg is to gauge with some accuracy the vastness of the gulf between East and West—between the Trabants and the Mercedes-Benzes.

The Trabant is known by all as the "Trabi." If there is to be an icon in remembrance of the folly of the GDR, it would be this car. Its body is made of a plastic, which, over the years, has contained among other things some of the discards from a cotton gin. Many models have a simple two-stroke engine, making the whole thing, in effect, an enclosed motorbike with four wheels. They can even run on a mixture of heating oil and kerosene.

You see them all over the East, thumping along the roads, shrouded in clouds of the vile smoke they blow (one Trabi, it has been calculated, puts out more polluted material than a hundred cars with catalytic converters). The people in the East do not like to hear cutting remarks or jokes about the Trabi. Most of the owners had to wait years before they could take delivery, and to them the machine was something grand.

So it is going to take some time before the hum of the Mercedes-Benz's sunroof sliding open and the popping of the Trabi's infernal workings strike a few chords of harmony.

FASCIST APPEAL A neo-Nazi speaker issues a diatribe against aliens, communists, and Jews at a rally in Munich. The 300 demonstrators and 120 counterdemonstrators were outnumbered by police. Seven persons were arrested for wearing Nazi insignia, an

Illegal act in Germany and an especially sensitive issue in Munich, where Adolf Hitler gained early notoriety. Many Germans worry about the growth of Nazism, particularly its appeal to young people in the East disheartened because of joblessness.

Voting with violence, radical leftists from West Berlin showed their disapproval of the triumph of capitalism by trashing an East Berlin display case on the night of reunification. Five months after the tumultuous night when the two Germanys again became one, a less ecstatic crowd took to the streets of Berlin (opposite), this time with a pressing demand: decent jobs.

Still, there is widespread confidence in Germany that East and West will eventually draw together.

ANXIETIES REMAIN, however, and come from many directions. I talked one morning with Axel von dem Bussche, a retired diplomat. The matter of the Polish border was on his mind. As a young German officer in World War II, he had served in Poland; that war had begun when Germany crossed into Poland.

As a 24-year-old captain, von dem Bussche faced the conflict between conscience and duty to the state. He chose the former and entered into a conspiracy to kill Hitler.

Recruited by Count Claus von Stauffenberg, he agreed to carry a bomb on his person when showing Hitler a new issue of winter uniforms. He would also die in the explosion. But when the uniforms failed to arrive (ironically the vehicle transporting the uniforms was attacked and destroyed by Allied aircraft), the assassination attempt was called off. Von dem Bussche went off to fight on the Russian front, where he lost a leg.

I asked if he had been resigned to die in order to kill Hitler. "Getting at Hitler was worth the risk of one man," he replied, grimacing with the phantom pain that has invaded the point of amputation. "I had ordered many young men—indirectly—to die. You don't tell your sergeant and six men to 'go and die.' You tell them, 'We have to take a prisoner alive from the other camp,' and you know only three of them will come back. So what one did to one's soldiers and sergeants, one could demand of himself."

His thoughts kept returning to the Polish border and the possibility of trouble.

The present border had been set after the war by the victors. Russia took a large slice of Poland; in return a large slice of Germany was awarded to Poland.

The German government, after some hesitation, recently reaffirmed the border. Yet some Germans, particularly those whose families once lived there, want the lands back. There's always been trouble along that border, von dem Bussche mused.

It was as if the past troubles of Germany were playing out in his mind—the wars, the uncertainties, the insecurities that have stood like ushers to the country's many weddings with history.

And so it is again: uncertainty. Maybe, as some say, Germany is about to enter a period of regionalism, where people will take pride in being a citizen of Saxony or Mecklenburg-Vorpommern or Baden-Württemberg. There is talk of that. In Germany today there is talk of so many things, of what was and what is and what will be.

Sometimes it's wise just to shut it all out and listen only, once more, to the four words that made a nation whole. Standing there together with the dust of the fallen Wall still swirling around their feet, the Germans had raised their voices on that chilly November night two years ago. *Wir sind ein Volk.*

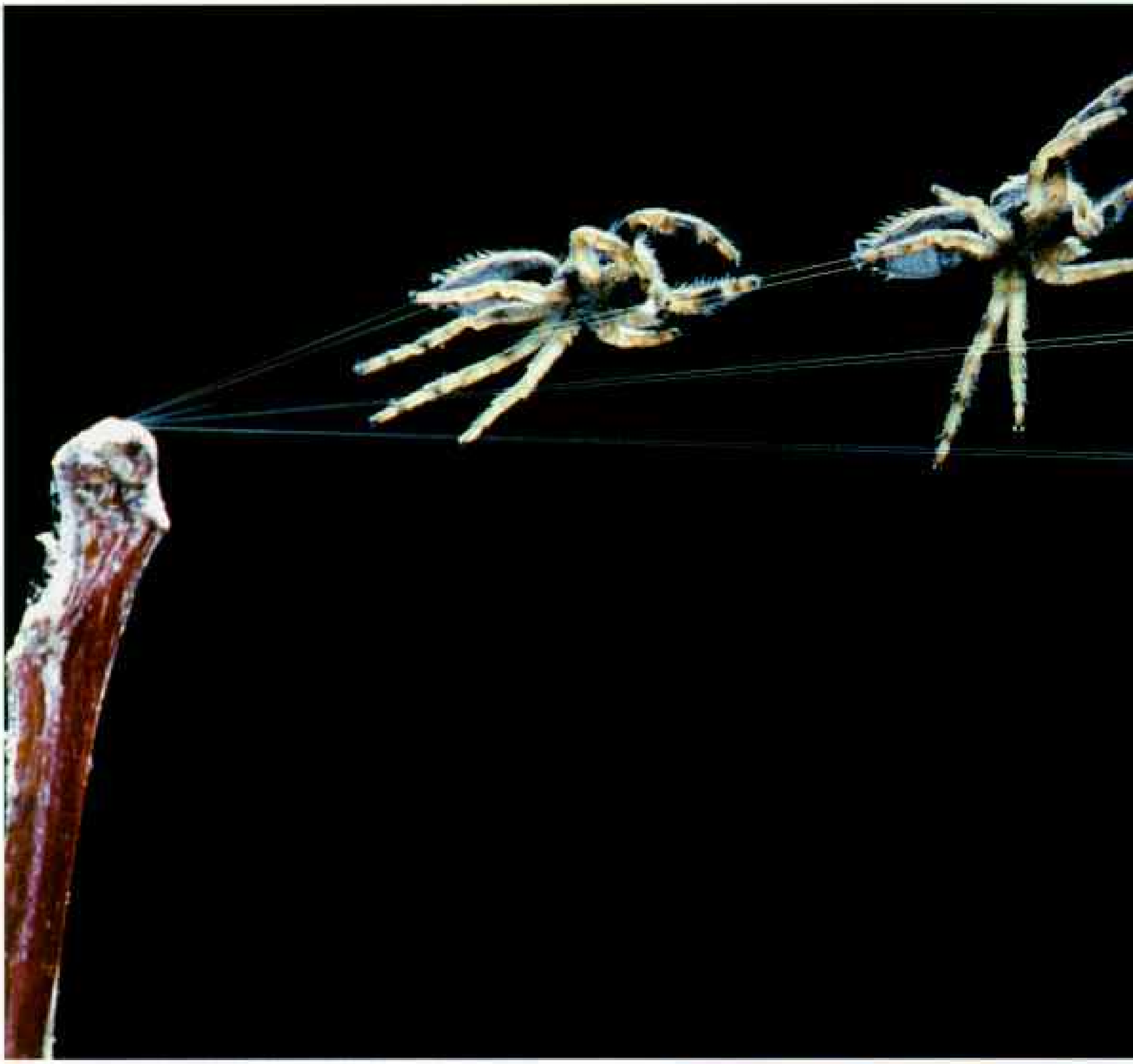
And then they repeated it and repeated it until it became a chant. *We are one people . . . We are one people . . . We are one people. . . .* □


ARBEITSLOS
heute wir

ALL EYES ON JUMPING SPIDERS

A parrot's colors, an eagle's eyes, a falcon's strike, a roadrunner's leap: The 4,000 or so species of jumping spiders are as diverse as birds and, like them, communicate by gesture, form, and sometimes sound. Many, such as this male *Chrysilla* from Sri Lanka, attract mates with vivid colors. With their acute vision, jumpers look raptly into my camera, even as I focus on them.

TEXT AND PHOTOGRAPHS BY
MARK W. MOFFETT



Powered aloft by an explosive release of internal hydraulic pressure, *Phidippus apacheanus* from Arizona pushes off with four back legs. As it blasts across an inch-wide gap between twigs, its motion is stopped by my high-speed strobe. By trailing silk safety lines, the spider can recover from a fall if it misses.

Phidippus regius walks along fingertips with a certain teddy bearish charm, for it, like virtually all jumper species, will not bite humans. Most jumpers come smaller, from three to eight millimeters. A young *Phyaces* from Sri Lanka (far right) struggles through rough terrain—the ridges of a single fingertip.

In North America you can often find jumpers with striped or mottled

pelts blending into sunlit walls. They stalk flies and mosquitoes, pouncing on them even when several centimeters away. Their chelicerae, or jaws (iridescent in *Phidippus* at left), open in mid-bound, fangs unfolding from their tips. Gripping tenaciously, the spiders kill prey by injecting venom. This also begins to liquefy the victims' tissues, which the jumping spiders later suck out.

Most of what jumpers do may be innate. Yet when I watch them sneak about—leaving sight of their quarry to follow complex routes through the vegetation in search of a better angle for attack—I am struck by flexible behavior that seems to reflect intelligence.

Many of the most impressive jumpers live in the tropics. I have investigated them with Robert Jackson, the world's leading authority

on jumper behavior, and his students at New Zealand's University of Canterbury.

COURT, KILL, AND HIDE

Dressed up to mate, attack, and defend, jumping spiders—found throughout the world—display an astonishing range of forms. Yet all can be readily identified as jumpers, or as scientists call them, Salticidae. They have big front eyes, they wander about without a web—and they jump.

Gaudy colors (A, from Kenya), tufts of hair (F, Kenya), and specialized mating rituals (E, Singapore) sort the sexes and species.

Predatory equipment comes in snout-like jaws hiding fangs (B, Sri Lanka) and in—for jumpers—huge size (C, Australia). This gorilla-like stare is

A

B

C

A PHINTELLA ARGUIPES
B NYMPHACHNE PLATALEOIDES
C MOPSUS MORMON
D PACHYBALLUS CORDIFORME
E VICIRIA PRAEMANDIBULARIS
F POSSIBLY OF THE GENUS HYLUS
G TRITE PLANICEPS
H PORTIA SCHULTZII

D

more than a bluff: *Mopsus* is a ferocious hunter.

A *Portia* (H, Kenya) spins two variations: One is a web, rare in jumpers. The second is a body so mottled and irregular that it looks like debris—even to the other jumping spiders it preys upon.

An elongate New Zealander (G) keeps a low profile in grass blades or curled leaves. A little Kenyan (D) mimics a beetle—good defense since to predators spiders taste fine, but most beetles are odious or toxic.

E

F

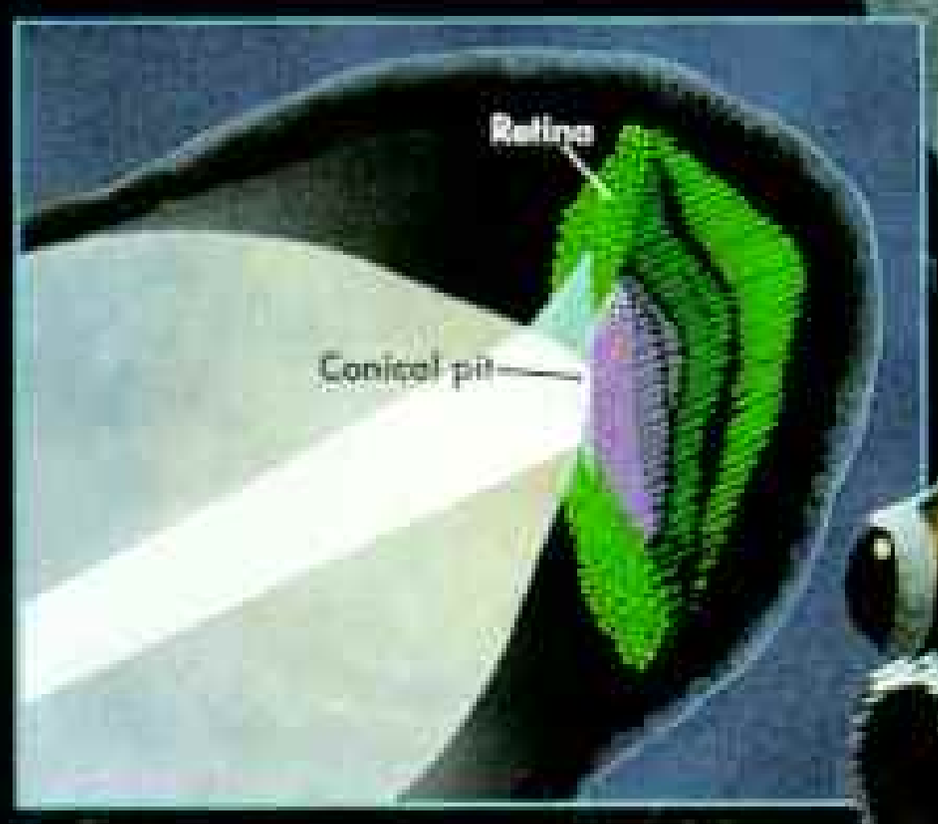
G

H

A Research Project Supported In Part By Your Society

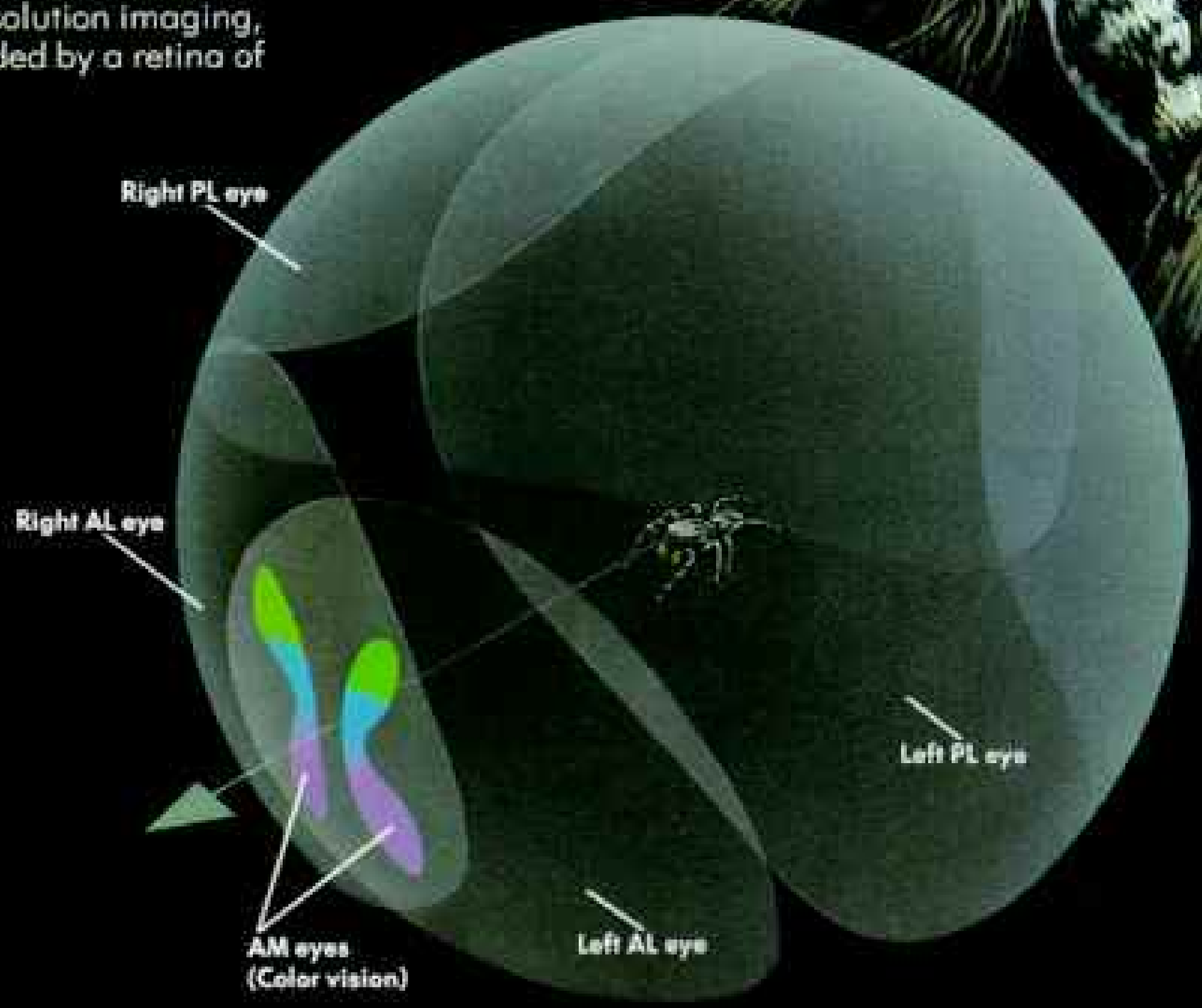
MISSION: Locate and lock on target

The two large AM eyes can move independently: When showing dark, the eye is looking straight into the camera; when light, it's looking elsewhere.



Swivel and magnify

Shaped like test tubes, the large anterior-median eyes are fixed in the front but swivel in the back to permit limited scanning. Their main function is high-resolution imaging, aided by a retina of four tiers sensitive to green and ultraviolet wavelengths. The conical pit bends light to magnify the image.



Panoramic vision

With four pairs of specialized eyes, a jumping spider is able to sense mate, food, or foe in any quadrant. The four lateral eyes have low resolution but detect motion.

ILLUSTRATION BY
GREG HARLIN, SRW INC.

For the kill or for courtship, the most singular asset in a jumper's repertoire is its remarkable vision. Armed with eight eyes, a jumper can detect motion virtually all around and distinguish detail as far away as 20 times its own body length (artwork, left).

The lateral eyes respond to motion, providing peripheral vision as in humans, though the coverage is far greater.

Once a moving object is detected, the spider swivels its body toward it and zeroes in on it with its anterior-median (AM) eyes.

The internal tubes of these large eyes can be moved independently or together, allowing the spider to scan the object rapidly. With the long focal lengths needed for high resolution, these AM eyes take up more space in the spider's body than does its brain.

Vision is so acute in jumpers that a male *Maevia* shown a female's image on TV will court it (top). But how does a female choose a mate—when males appear in two radically different forms and use different courting rituals, bobbing (left top) and shifting side to side (left bottom)?

At the University of Cincinnati, David Clark (above, at right) and George Uetz alter a computer image to make the tufted *Maevia* behave as if it were the other, shifting, male. They hope to learn whether females are swayed more by appearance or by behavior.

Normally the long "nose" on a Sri Lankan *Myrmarachne plataleoides* male (top, at right) makes him seem a benign character—like Cyrano de Bergerac the poet. When he confronts another male, however, he splits the "nose" and unfolds the halves into jaws with unsheathed fangs at each tip. If the challenge is accepted, the spiders duel Cyrano fashion, their fangs clashing like swords (above).

The winner rears up in triumph (left), while the other backs away and scuttles off, a loser with hide intact. These Sri Lankans, like most other jumpers, rarely fight to the death.

Since jumpers almost never catch prey in webs, they need other tactics. One hides in a leaf, leaps out, and spears flies in mid-air (facing page).

Another is sedentary but so blends into its bark habitat that a moth will

blunder into close range (right).

In turnabout defense, a fruit fly's hindquarters resemble a jumper (above). The real spider reacts cautiously to this decoy, but enough to give his position away.

In the big leagues of predation, *Mopsus mormon* plays rough. Stalking along plant leaves near water in Australia, it takes on other fierce predators. A female *Mopsus* strikes a damselfly in the insect's equivalent of the jugular (above), even as the victim attempts a takeoff.

Closely matched as top hunters, praying mantises and *Mopsus* usually treat each other with cautious respect, circling and going their separate ways. But, given a clear chance, they attack. *Mopsus* hits the weakest spot (right top), but sometimes the mantis prevails (right bottom).

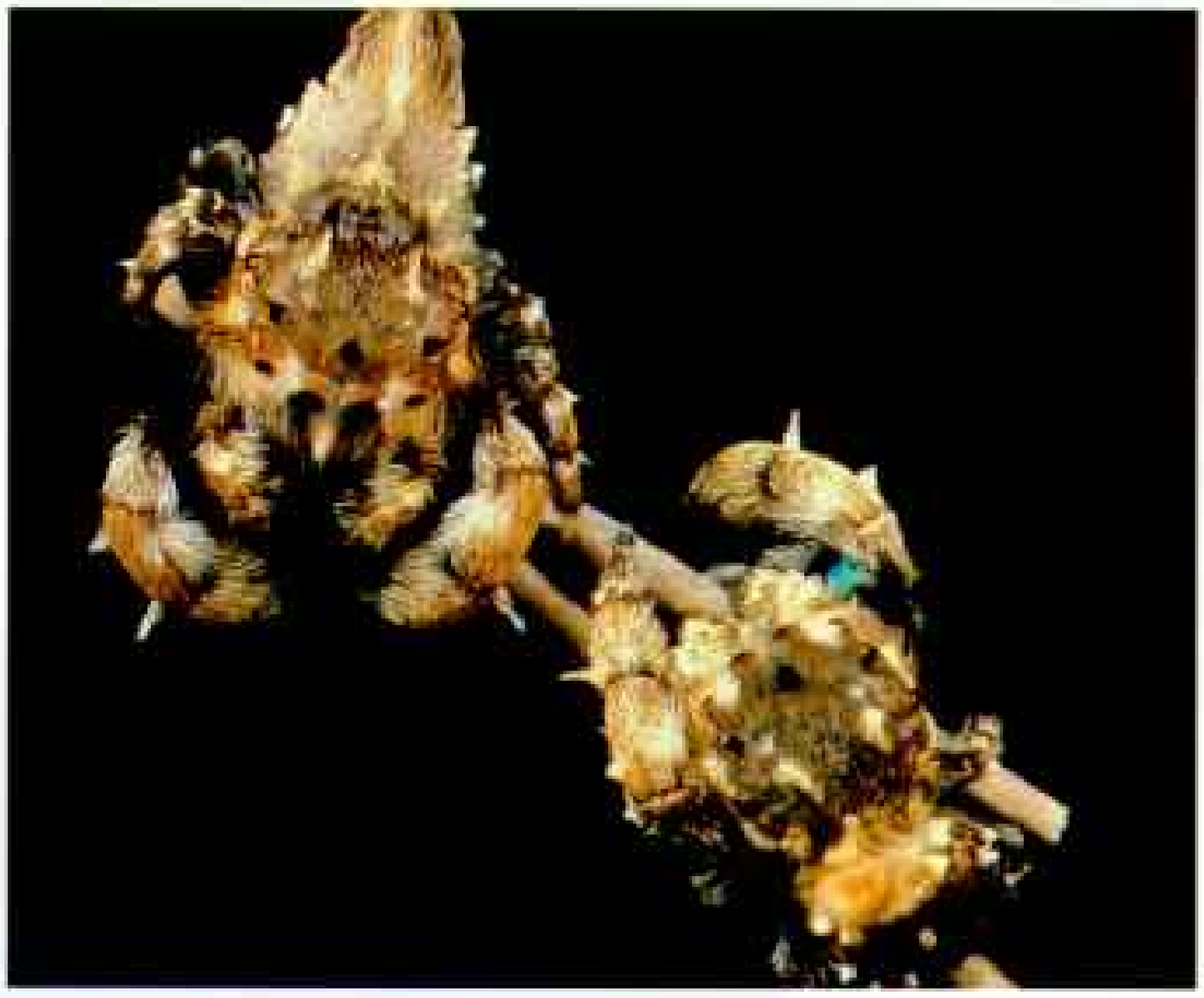
Yet set a prey-size frog before a *Mopsus* (right), and the spider makes no attempt to attack. It's as if this little vertebrate is not in the spider's data bank at all, as food or foe.

Camouflage takes *Phyaces comosus* on covert missions, infiltrating the nests of other jumpers to eat their young. About two millimeters in size, a *Phyaces* (above, at right) looks like a barely animated piece of dirt, even to the all-eyes mother *Epeus* guarding her nest. As *Phyaces* prepares to devour an egg, the female seems alert but confused, since even *Phyaces*' slow, irregular movements add to the guise of windblown dust. If pretense fails, *Phyaces*' great tufts of hair give a fallback defense. Fangs aimed at the little jumper pierce that hair, not flesh.

Its prey captured, a *Phyaces* (right top) appears to toy with a hatchling much the way a cat plays with a mouse.

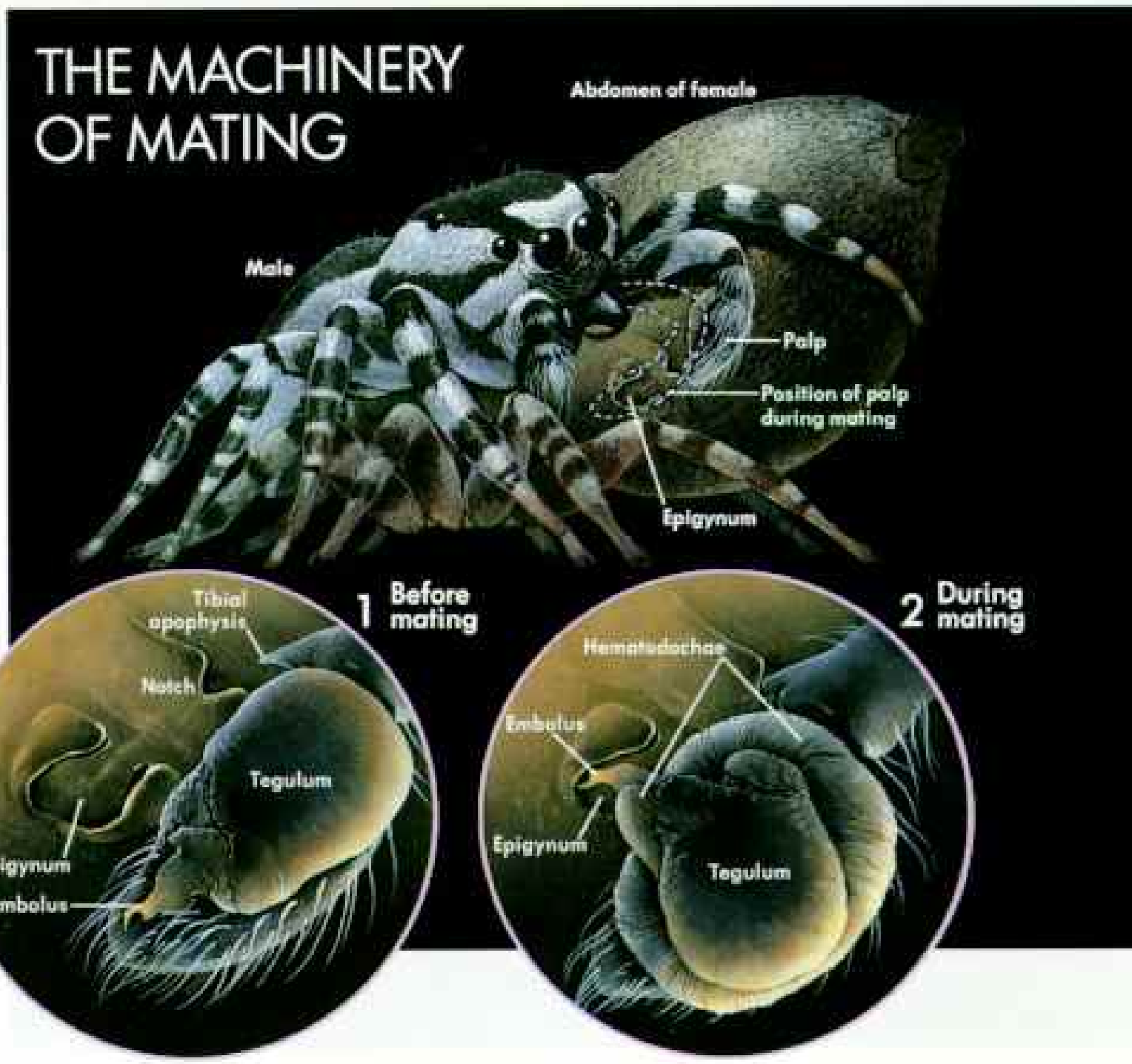
Resident of bamboo, individual *Phyaces* may dispute each other. When females meet on a stem (right middle), one flashes colorful underarm patches and drives the other spider off.

The lives of jumpers seem frantic, but *Ptocasius* of Singapore (right), like most jumpers, spins a nighttime shelter, here by securing leaves with bolts of silk.



Spider procreation requires exact orientation and fit of puzzle-like parts. The two male palps (right) first collect sperm from an abdominal opening. Each palp has two keys. One (tibial apophysis) fits securely into a notch in the female's abdomen. The other (embolus, at the end of the tegulum) moves into the female organ (epigynum) to deliver sperm, as balloon-like membranes (hematodochae) inflate.

ILLUSTRATION BY GREG HARLIN, SRW INC.



Jumper courtship is a complex business. Each species relies on its own suite of visual, tactile, and sometimes vibratory and olfactory signals. The male usually sets out to impress a reluctant female, which is typically larger and relatively drab.

A case in point: *Asemonea tenuipes* (far left, above). In the top panel a dark, narrow male resplendent in psychedelic colors is on the underside of the leaf. The pale, plump female has escaped to the top. The male looks for her, and, feeling her movements through the leaf, he vibrates it, perhaps to telegraph his impending arrival (bottom panel).

If she doesn't run away, he begins the mating dance, which seems submissive, as if he were groveling (above). Finally, the female permits approach. The male rotates his body into a less awkward position and calms her with caresses from his outstretched legs (left, above).

Looking under her abdomen, the male inserts his left palp (left, below) and discharges sperm. He can then mate again with his right palp.

Weaver ants swarm across the top of a leaf in Sri Lanka, while the mimic jumper *Myrmarachne* (with her fake ant-eye spot and fake ant-antennae forelegs) hides under it. She doesn't fool the ants; they operate on smell, not sight, and would eat her in a second if they could. She fools those predators who avoid toxic, nasty-tasting ants.

Another mimic (far left, at center) moves and looks antlike, until you count the legs.

Other jumping spiders, the wolves of their kind, hunt ants. This Singapore jumper (left, above) has just dispatched one. Yet even ant-eaters can be confused. A black jumper in Australia (left, below) mistakes an ant-mimic jumper for the real thing.

In Australia, which has some extraordinarily combative species, two female *Bavia aericeps* meet eye to eye (right). They then roll about in a close approximation of a wrestling match.

Charge! Like rams or goats, horned *Thorelliola ensifera* (above) butt heads for dominance. In this contest, "big horn" on the left rammed the smaller male and knocked him right off the leaf.

With *Mopsus* males (left) aggression is more than show. The one on top has flicked out a fang and fatally stabbed the other in the back.

Whether fighting or courting, jumpers display great color and complexity, often behaving like tiny, eight-legged birds. □

A New Kind

A life together ended when Paul Swerdlow, the author's older brother (at left in color photograph), died of leukemia in 1985. All efforts to find matching bone marrow—the tissue that manufactures blood cells—failed. Today with advances in transplant medicine and with increased awareness of the need to donate organs and tissues, the human family can better serve—and save—its members.

By JOEL L. SWERDLOW

Photographs by BILL LUSTER

MY BROTHER PAUL and I took only one walk together in the summer of 1984. He had leukemia. Doctors gave him a 20 percent chance of living more than a year.

The sun was shining. Our steps were strong. "Why are you so upbeat?" I asked.

He smiled. "We'll transplant bone marrow, and I'll be saved," he said. Paul was a doctor, on staff at one of America's best hospitals, and I listened carefully as he explained how marrow from our sister, Joby, or me might save him. Later that week, technicians took our blood. We tried to keep busy while waiting for test results. When the telephone rang, it was bad news. Neither of us matched Paul. In less than eight months, he was dead.

Several years later I read about a woman in Wisconsin who gave marrow—and life—to a six-year-old girl in North Carolina. A new donor registry brought them together. This prompted me to study what could be accomplished with registries. In America alone, as many as 13,000 strangers might have saved my brother—if society had established mechanisms to find them.

But the more I saw, the more I came to realize that the story is much larger than linking donor and recipient. It extends deeply into what binds us together. Donated organs and tissues give life and sight, teach researchers how the brain works, provide drugs for fighting cancer, and allow us to master the very genes that define us as human.

Even small gifts can become miracles. Transplantation of dopamine-producing cells into the brain can reduce symptoms in Parkinson's disease, and injection of immature muscle cells can give renewed strength to diseased muscles. Insulin-producing islet cells may cure diabetes, which kills tens of thousands of people each year.

If you save one life, the Talmud teaches, you save the world. By using donated material to harness commonality among all human cells and genes, medical technology has given this new meaning. Each of us, while we live and after we die, may now save the world many times over. We may also help future generations in ways the wisest among us cannot yet imagine.

This medical revolution affects everyone, yet it is emerging quietly, in a series of little-noticed struggles.

In 1983 three-year-old Eric Knapp of Clear Lake, Iowa, began to stumble. The eventual diagnosis: Duchenne muscular dystrophy, a disease, usually hereditary, that wastes children's muscles and allows few people to live past their early 20s.

To date no proven treatment is available, but researchers in 1986 identified the genetic defect that causes the absence of a key protein. Transplant of whole and minced muscles that carry healthy genes had no effect, so physicians have begun injecting

Courtesy Joel L. Swanson

# of Kinship

patients with donated myoblasts, immature muscle cells capable of proliferation. The goal is for transplanted cells to fuse with the patient's defective muscle cells and begin producing the missing protein.

At San Francisco's Children's Hospital I meet Lonnie and Nancy Knapp and their three children.

Eric, the oldest, is ten. Lonnie has a bandage on his arm. The day before, physicians had cut out a segment of Lonnie's muscle the size of a pencil eraser. It will take several weeks to grow this into about a hundred million cells for injection into his son. The cells will be stored in waist-high freezers at minus 170°C.

The technical skills needed—in this case, nurturing and purifying several myoblast cells to generate millions of exact copies—emphasize that donation is not an end in itself. Ingenuity and diligence must bridge the gap between theory and clinical application.

Although similar transplants have yielded promising results, experts advise caution. I ask Lonnie about the emotional letdown he may face if his cells prove ineffective.

"This is my chance not to feel helpless," he says. "If it does not help Eric, at least it will help others."

"I think it's neat," Eric tells his father. Eric risks more than raised hopes. There will be the pain of many muscle biopsies. He will often be out of school, away from friends.

The disease makes him slump, but his eyes are full of mischief.

"Are you scared?" I ask.

"No."

"Do you see yourself as brave?"

He does not hesitate, "Yes, I am."

After he's had the operation—an injection of less than one tablespoon of opaque fluid containing the cells—Eric says, "I'm starting to feel stronger already."

Surgeon David Scharp and pathologist Paul Lacy of Washington University in St. Louis are working on another form of transplant—that of insulin-producing islet cells from the pancreas. It promises to prolong millions of lives. But one islet transplant can require two to four donated pancreases. Commingling of

A father's love—and part of his liver—helped save 19-month-old Nicole Goykin (opposite) from a deadly liver disease. In a live-donor transplant at the University of Chicago Medical Center, Christoph Broelsch (top, at right) prepares a piece of liver removed from Rick Goykin. The fragment, which will replace the diseased liver in his daughter, will grow and function as a complete organ. At home a year later with her baby brother, Nicole exudes new-found health.

cells from many donors causes no problems—yet another sign of human commonality.

"So far, seven islet transplant patients have achieved insulin independence," says Scharp, "but work is slowed by lack of donor pancreases."

I watch surgeon Camillo Ricordi of the University of Pittsburgh Medical Center start the shaking of a thermos-shaped tube, the first stage in an automated process to extract clusters of islet cells from human pancreases (page 71). Ricordi then carries a plastic bag of a fluid that looks like pink grapefruit juice down the hospital corridor.

We tend to believe that what is important is dramatic—but as this moment demonstrates, it often is not. Ricordi connects the bag to a tube that runs into the patient's abdomen. Cells flow down. The patient reports warmth and no other sensation. In minutes he has received more than two billion islet cells.

Such transplants rearrange the body's inner geography. Islet cells normally exist only in the pancreas, yet they have been transplanted into the liver and spleen.

At 5 p.m., two hours after the transplant, Ricordi goes to the cafeteria for lunch but is paged. He returns with good news: The cells in his patient's liver are already producing insulin.

Lunch at five is typical. The professionals I meet work extremely long hours. Competition—with themselves, one another, and the unknown—dominates their lives. I ask Ricordi about his dreams. "My dreams can be nightmares," he says. "Recently I have dreamed of my children asking, 'Where were you when we were growing up?' "

Crusader for patients' rights, Joanne Raymond, founder of the Caitlin Raymond International Registry of Bone Marrow Donor Banks, plots lobbying strategy at a Washington, D. C., hotel with assistant Tom Wiegand. Their efforts on Capitol Hill led to a 1990 law requiring rival bone-marrow registries to cooperate on donor searches. Raymond came to the struggle the hard way. Her daughter Caitlin, stricken with leukemia, died of pneumonia following a marrow transplant from a donor in England.

FOR ISLETS—and most forms of transplantation—a paradox exists: The body claims transplanted objects as its own, giving them life, while attacking them as alien. At work is a complex process. Each individual inherits certain molecules on the surface of cells—in effect a password. If the immune system reads the correct password, it welcomes the object. If the password comes from an incompatible person, however, an often deadly assault begins.

Here the biological and the biblical seem to merge. The Bible

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During his early research on organ and tissue donation, JOEL L. SWERDLOW was a fellow in communications policy studies at Northwestern University's Annenberg Washington Program. A frequent contributor to NATIONAL GEOGRAPHIC, he wrote about the Erie Canal for the November 1990 issue. Photographer BILL LUSTER, a native of Kentucky, works at the *Louisville Courier-Journal*. This is his first assignment for the magazine.

says the best giving is anonymous, and the body agrees. Rejection comes only when biological information identifies the donor as foreign. Thus, if you receive an organ from anyone other than an identical twin, chances are overwhelming that you will take immunosuppressive drugs for the rest of your life. A transplanted heart could function well for decades, but if you stop taking these drugs, your body will reject it.

Organ recipients, therefore, have become living laboratories, teaching invaluable lessons about what happens when the immune system is suppressed; among other things, viruses have an opportunity to grow. A study of heart recipients, for example, shows a possible viral link to the clogging of arteries; recipients of other organs, too, are helping the fight against cancer.

Ronald Herberman, director of the Pittsburgh Cancer Institute, explains: "About 3 percent of organ recipients develop tumors. They're on immunosuppressants to prevent rejection, and this suppression of their immune defenses seems to allow tumors to begin. When immunosuppressants are lowered and immune defenses return to normal levels, many of the growths melt away. This indicates that the immune system helps repel some cancers and could lead to drugs to boost the body's defenses."

Hoping for a miracle, a mother comforts her critically ill son, confined to a germ-free room before a bone-marrow transplant. The only known cure for some forms of leukemia, a cancer of the blood, is an infusion of healthy blood-cell-producing marrow. An international search turned up a donor in England. Yet the still new field of transplantation is not fail-safe, and the boy died as a result of complications. The only solace is that with the knowledge gained a future life might be saved.

Rosemary Warmenhoven of Lexington, Kentucky, noticed lumps in her neck two years after a liver transplant. She was frantic until physicians reduced her immunosuppressants and gave her antiviral medication. The lumps disappeared within days. "It was strange," she tells me. "The growths were just gone." She is describing one of mankind's great fantasies.

It's not always that easy. Marva Cotton of Oak Ridge, Tennessee, describes her daughter Alicia: "She's now 13 and was diagnosed as having a fatal disease at five weeks. She's had two liver transplants. In May 1988 we noticed she had trouble breathing. Tests revealed a tumor near her jugular vein. Biopsy reports were just horrible—there was danger of its spreading."

As we talk, the Cotton family sits in a Pittsburgh motel. Alicia is undergoing more tests to see if lowering her immunosuppressants and other experimental treatment have eliminated the tumor. "If they learn something that helps cure cancer," Marva says, "it's been worth it." Until now her voice has been matter-of-fact. "When things get hard," she continues, "I think about the two families that donated livers to save my child."

A week later Marva Cotton calls. "Tests indicate that the tumor is almost gone and no new growths," she says.

"So they're telling Alicia to go out and have a nice life?"

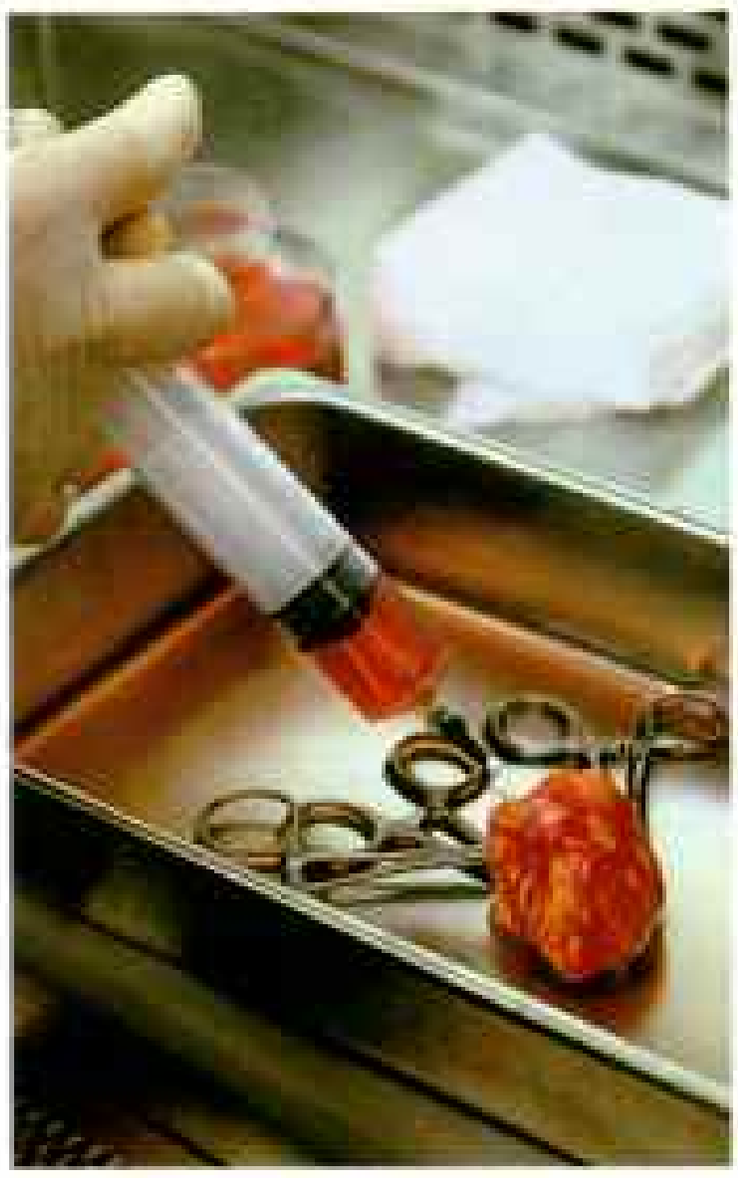
Her laugh has a southern accent. "You got that right."

Dreams of transplanting organs date back millennia. There is the story of a fourth-century B.C. heart transplant by Chinese surgeon Pien Ch'iao and of a third-century A.D. leg transplant by physicians Cosmas and Damian, brothers said to have come from Arabia. Patients in both mythical operations were up and walking within days.

Real success belongs to modern times. "The only organ not on-line is the brain," says Thomas Starzl, the Pittsburgh surgeon who is one of transplant surgery's leading pioneers. On his desk is a just completed article documenting the first successful small bowel transplant. "I can't think of anything," Starzl tells me, "that will necessarily be excluded." In the works: transplantation of ovaries, limbs, and nerves.

Starzl gives me a rough draft of his autobiography. He bought a cadaver while in medical school and "learned her body lovingly"; to Starzl she became the "noblest of beings." He chose transplantation because the professional literature was "uncompromisingly pessimistic." His first liver patient, a three-year-old named Bennie, bled to death on the operating table. Starzl sat for hours staring at the floor, until orderlies with mops urged him out.

F. Scott Fitzgerald warned that there are no second acts in American life, but Starzl keeps walking back on stage. In 1981, organ transplants—which had been conducted since the 1950s—were largely a medical oddity because recipient immune systems rejected transplants. Starzl demonstrated that cyclosporine, a drug derived from a fungus found in Norway, made success rates soar. In 1989 he reported an even better immunosuppressant, FK 506, obtained from a Japanese fungus. In both cases professionals had written off the drugs as dangerous to humans.



A new cell-transplant procedure now in clinical trials (artwork, opposite) isolates cell clusters called islets, critical to insulin production. The large syringe (above) injects collagenase, a digestive enzyme, to break down tissue in a donor pancreas. The enlarged pancreas is then gently macerated. The resulting cell "soup" is spun in a centrifuge to separate as much as 90 percent of the islets. After further purification, these are injected into the patient.

FK 506 may also turn out to be effective against such diseases as multiple sclerosis, diabetes, psoriasis, and rheumatoid arthritis in which the body's immune system attacks itself. "Transplantation," Starzl says, "may end up being just a footnote in the FK 506 story."

I attend a weekly meeting chaired by Starzl. About 30 physicians and researchers attend. The topic is whether FK 506 could prevent diabetes. Starzl wears a sweatshirt and is casual as he guides discussion. The meeting starts at 7 p.m. and continues for several hours. A few beepers go off, but no one leaves. Nothing seems to happen, but later, as I examine my notes, I realize I witnessed the creative process. Starzl pulled out ideas, suggested patterns, and wove tangential facts into major themes. Participants left the room armed with concepts and connections that had not existed before.

ONE ORGAN DONOR can save at least six lives, yet shortages steadily increase. Many of the 23,000 people on America's waiting lists will die before an organ becomes available. Every year waiting lists become longer, and every day brings death for people who could be saved.

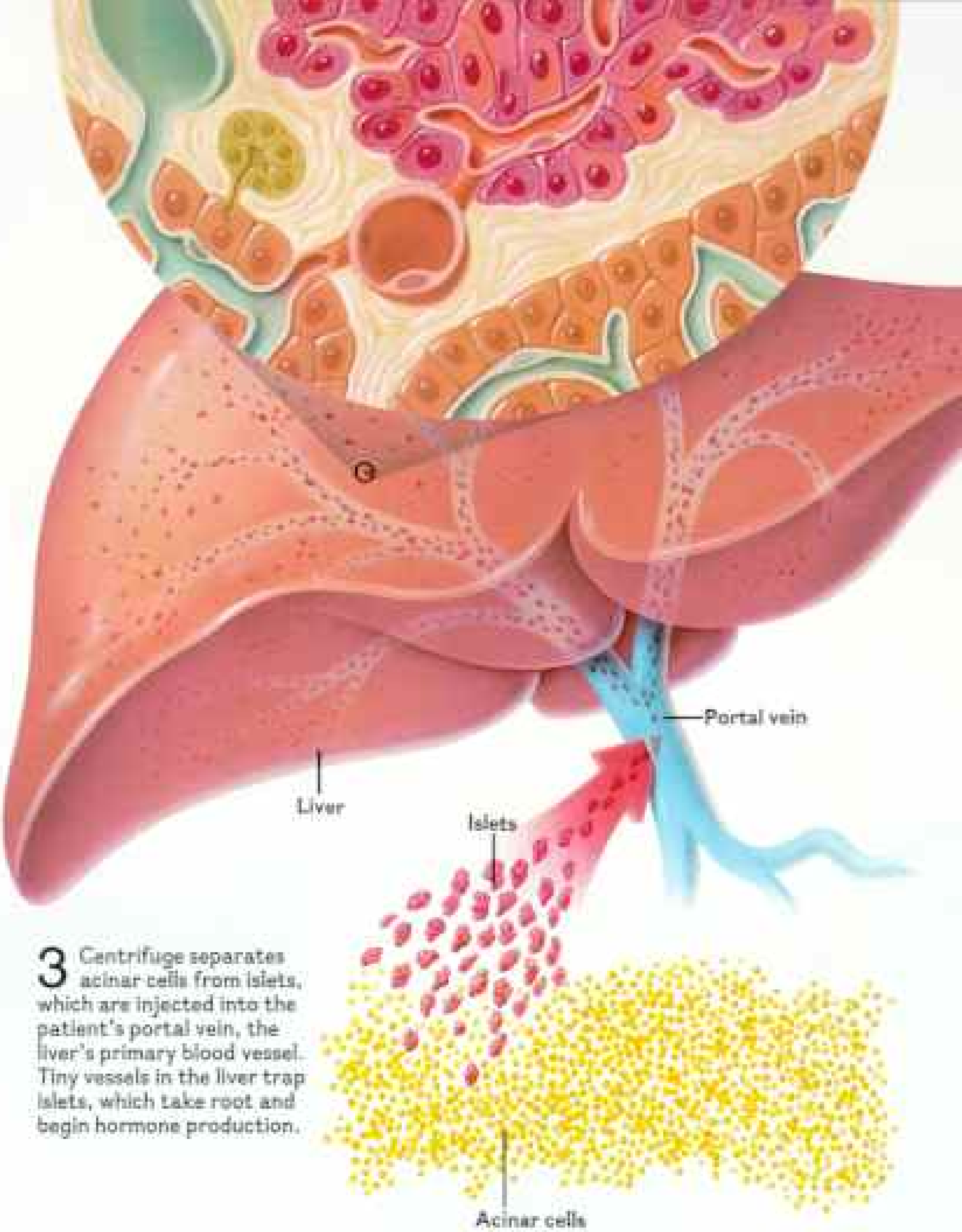
Desperation breeds courage. Although the medical community limits the risks donors can take for strangers, parents may donate pieces of lung, liver, *(Continued on page 76)*

The promise of cell transplants

IN THE FUTURE, injecting key cells rather than transplanting entire organs may provide a less invasive alternative to major surgery.

In the case of the pancreas, groups of cells called islets of Langerhans produce insulin and glucagon, hormones that regulate the body's blood sugar. High sugar levels accompany diabetes, which can lead to kidney failure and other complications. Recently doctors separated islet cells from a donor pancreas and transplanted them into the liver of a patient whose own diseased pancreas had been removed. There they embedded and became fully operational, turning the liver into a "double organ."

Such transplants raise the hope that one day, if the body's natural response to reject foreign tissue can be safely suppressed, similar procedures may be performed in the early stages of disease, before major damage to vital organs occurs.

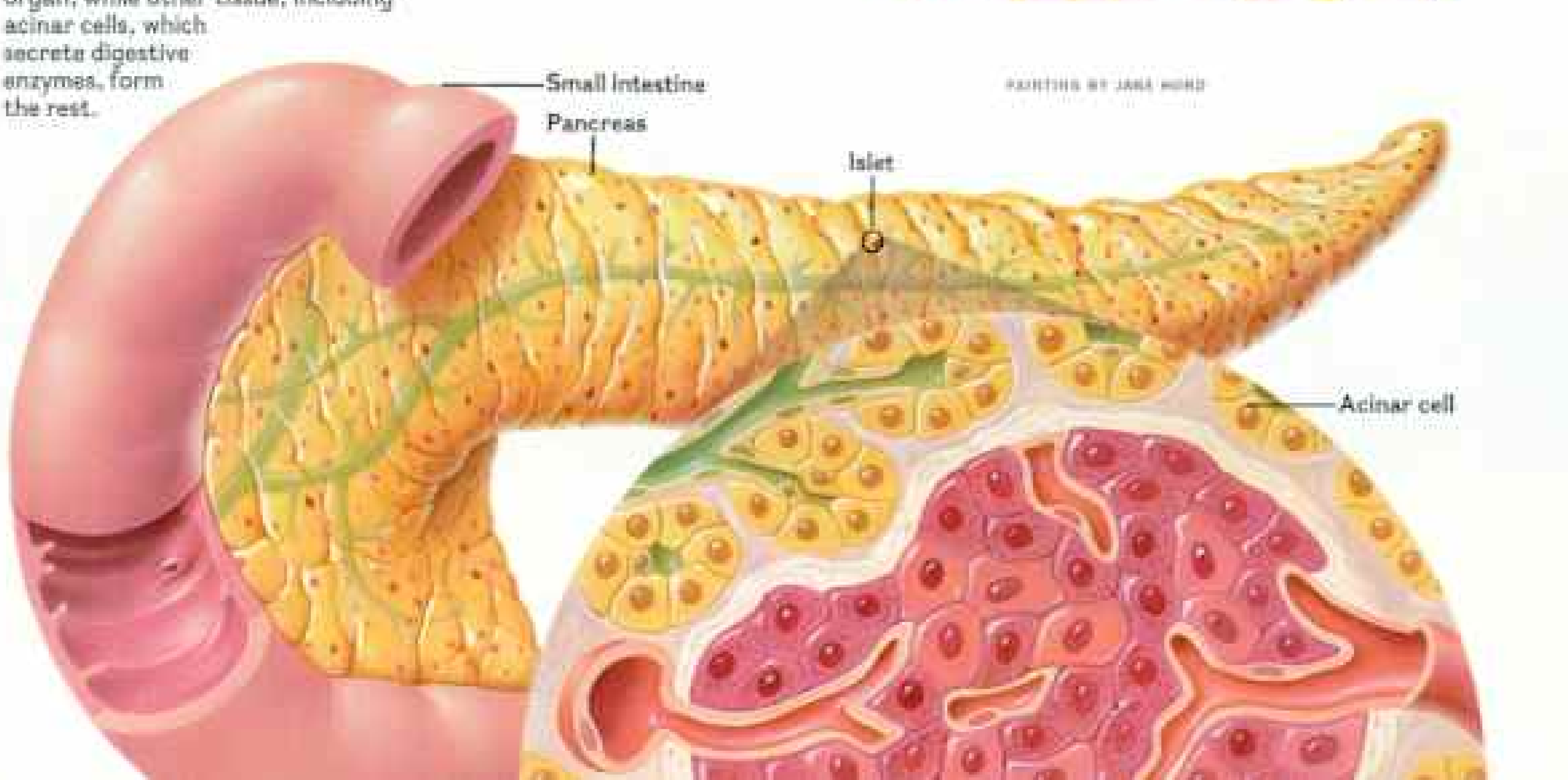


3 Centrifuge separates acinar cells from islets, which are injected into the patient's portal vein, the liver's primary blood vessel. Tiny vessels in the liver trap islets, which take root and begin hormone production.

2 Pancreatic tissue breaks down in a solution of collagenase. Islet and acinar cells are liberated from the organ's fibrous mass of vessels and ducts.

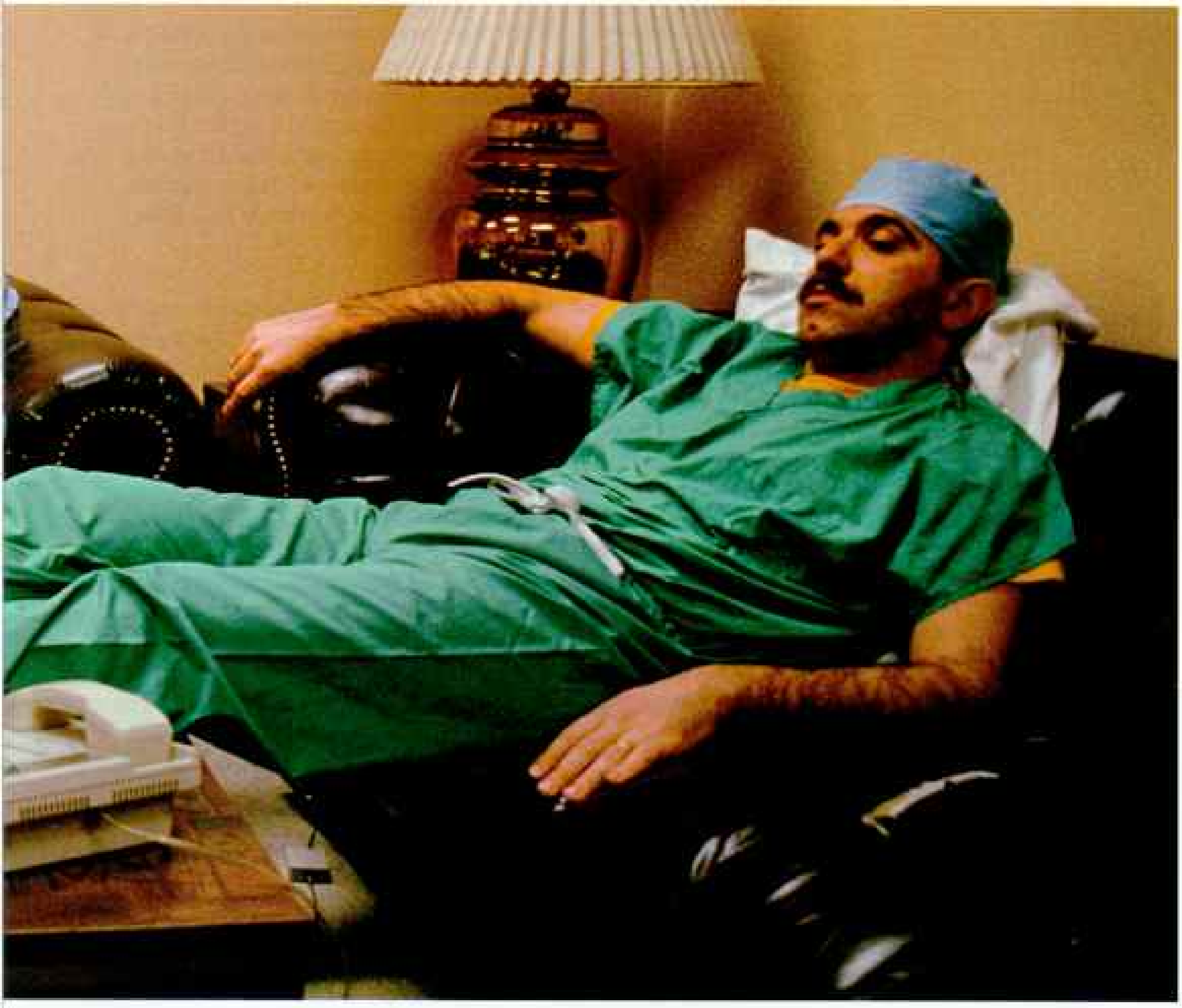
1 A pancreas is removed from a recently deceased donor. Islets make up 1 to 2 percent of the organ, while other tissue, including acinar cells, which secrete digestive enzymes, form the rest.

PAINTING BY JANE HURD



Grieving relatives console each other with embraces, while parents review a document that will allow doctors in a Merrillville, Indiana, hospital to take immediate steps to ensure that, upon their son's death, his organs and tissues can be donated.

The eight-year-old boy, involved in an automobile accident, was pronounced dead an hour later; within 24 hours his liver and kidneys were transplanted, turning one family's tragedy into a gift of life for others.



A long day only gets longer at a Tulsa, Oklahoma, hospital, where surgeons from the University of Pittsburgh Medical Center catnap while a donor—dead from an aneurysm—is readied for organ removal.

With 500 patients awaiting organ transplants at the center, Pittsburgh procurement teams rush across the country to secure organs. In Florida the doctors are joined by teams from three other transplant centers to remove organs from an accident victim (far left). Racing against the clock in Texas, a surgeon must make sure the liver packed here in ice is transplanted within 24 hours.

(Continued from page 70) or pancreas to save their offspring. Dozens of such transplants have been performed successfully in recent years. Less than half of each organ is used. It becomes fully functional within the child, while the donor's organ continues to work normally. To date, only these three organs seem to have this ability. "Once you've given someone a big piece of your heart," says Teresa Smith, a 29-year-old Texas teacher who saved her dying daughter, "it's easy to throw in a little bit of liver."

BONE MARROW, which creates all new blood cells and is potentially a cure for many fatal diseases, must come from living donors. Without a good genetic match, graft-versus-host disease often kills the recipient. Because the chance of a sibling match is one in four, an indeterminate number of women become pregnant in the hope that a new child's marrow will save a sick child.

I sit in a hospital waiting room with a three-year-old boy who sleeps between diagnostic tests. He has a beautiful face and a deadly inherited disease called Fanconi anemia. The best available treatment is marrow transplantation.

His mother already had one baby whose marrow did not

match. Now she is planning another. "Some ethicists," I say, "worry about people having babies to help other people."

She shakes her head. "That a child could save its brother," she says, "only adds to the miracle of birth."

How does it feel to save your sibling? University of Arizona football star Chris Singleton donated marrow to twin brother Kevin. "People tell me it was such an unbelievable thing," Chris says. "What's unbelievable about it?"

Children receive half their chromosomes from each parent, so parents and children rarely match genetically. But when death is the alternative, physicians sometimes attempt a parent-child marrow transplant anyway.

In 1980, 11-year-old leukemia patient Stuart Lack of Emsworth, a fishing village 70 miles from London, survived a transplant using "mismatched" marrow from his father. Seven years later, his father, Alan, then 45, developed a different form of leukemia and received marrow from Stuart. Both are cured. "When I heard my diagnosis," Alan Lack tells me, "I asked if something of what I'd given Stuart might help me. I had no reason to ask. I just had faith."

To look at their smiles as they stand next to each other is to see a new definition of family closeness. "What was most touching was to see Stuart give something that he himself had been given," oncologist Ray Powles, who cared for them both, tells me.

The chance of a suitable marrow match among nonfamily members is about 1 in 20,000. Since the likelihood of a match is greatest within ethnic groups, international linkages are crucial. A nine-country search located a donor in France for a rescue worker who contracted radiation-induced leukemia at Chernobyl.

The U. S. has the world's largest marrow donor registries, yet approximately 25 people die every day for lack of a donor.

Every community I visit has had a publicity campaign during which children with fatal illnesses smile to attract donors. They usually wind up helping someone else. Leukemia patient Allison Atlas of Bethesda, Maryland, needed a donor, and her family—like hundreds of others—went to work. "What happened," says family spokesman Nick Kotz, "was almost a miracle, a

Hope is a potent medicine for ten-year-old Eric Knapp, who in December 1990 received an experimental treatment for Duchenne muscular dystrophy, a disease that radically shortens life. Eric and his family moved from Iowa for a year to participate in a cell-transfer procedure at the Children's Hospital of San Francisco. Before the surgery Lonnie Knapp worked to keep his son's limbs flexible. In turn Eric exercised Rex, his trained support dog. Some 80 million muscle cells, grown from tissue donated by his father, were injected into one of Eric's legs (above) to try to strengthen it. Even if the treatment doesn't take, Eric's parents see a major change. "A year ago, Eric was a sad little boy," says his mother. "Now he's a different kid, just full of mischief."

marriage of medical technology and grass-roots participation." Atlas family efforts in 1989 and 1990 added more than 50,000 names to the donor pool, facilitating at least 15 matches for other people. As a last resort Allison underwent a transplant using her mother's marrow and is doing well.

The ultimate solution to marrow-donor shortages may lie in something we now throw away. When marrow is transplanted, the key element is roughly 1-in-2,000 cells called stem cells, which produce all blood, including its immune-system cells. Stem cells exist in blood, but too few to facilitate marrow transplantation without extensive processing. Fetal blood, however, is rich in stem cells, and the umbilical cord contains fetal blood. Recent transplants using umbilical cord blood have been successful.

One vision of the future: Umbilical blood from every birth is preserved, ready to save anyone in the world who needs it.

The human body replaces virtually all blood cells in less than 120 days, so transfused blood disappears. But transplanted material becomes a permanent part of the recipient. Cadaveric bone acts as a foundation for new bone growth, whereas marrow leaves donor and recipient with the exact same DNA. Genetic fingerprinting of the blood would show them to be the same person.

Raising the hopes of patients with malignant melanoma, a deadly form of skin cancer, gene therapy pioneer Steven A. Rosenberg inspects a bag of immune-system cells genetically altered to kill tumors.

To capture how this feels is the stuff of poetry. In 1989 David Lanar of Takoma Park, Maryland, donated marrow that saved Céline Larochelle of Sherbrooke, Canada. Although guaranteed anonymity, they chose to meet after the transplant. I watch footage taken by a Montreal television station. They approach silently and hug. Tightly. The silence continues. I look at my watch. They hold each other for 18 seconds before saying a word.

"My mother used to say that blood is thicker than water, that my sisters were the closest thing I'd ever have," Lanar says. "Now my blood is Céline's blood. It was like a sister coming to see me."

Transplantation is dramatic, but research using donated tissue will have a more significant and longer lasting impact.

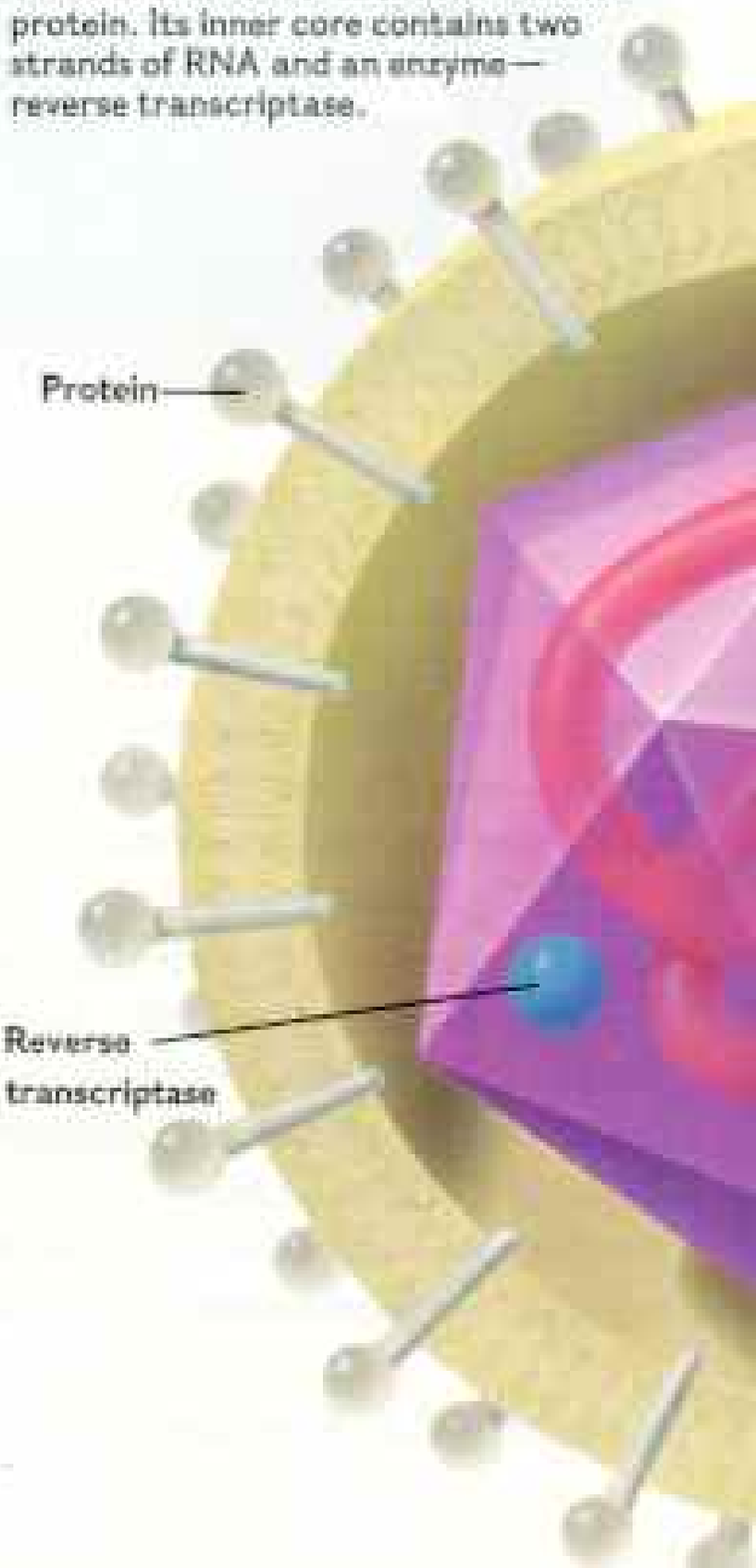
Despite continued advances based on nonhuman components such as plants, human material now permeates medicine. A 1985 survey conducted by the U. S. Congress found that researchers at half of America's medical institutions rely on human material

Putting genes to work

IN THE FIRST therapeutic trial in the U. S. using genetically engineered cells on humans, doctors attempt to treat cells unable to produce adenosine deaminase (ADA), an enzyme that breaks down toxic biological products. This failure causes a rare disease called severe combined immunodeficiency.

Without ADA, infection-fighting blood cells die, shutting down the body's immune system. The new procedure turns retroviruses, which can invade cells, into therapeutic couriers that carry the ADA gene to immune cells removed from the patient. Reinjected, the healthy cells may help boost immunity.

1 A retrovirus—a virus whose genetic material is RNA rather than DNA—consists of an outer shell studded with protein. Its inner core contains two strands of RNA and an enzyme—reverse transcriptase.



DNA

Cytoplasm

Nucleus

D

C

A

B

ADA

E

WHITE BLOOD CELL

Receptor

3 The courier virus delivers its therapeutic RNA gene package (A). Then the courier's reverse transcriptase converts its RNA (B) into DNA (C), which penetrates the nucleus and joins the host's DNA (D). Production of ADA begins (E).

2 The therapeutic gene for ADA is spliced into the courier virus's RNA, and genetic material enabling the virus to reproduce itself is removed. Proteins on the surface of the virus dock with chemical receptors on white blood cells.

Therapeutic gene

RNA

CLINICAL TRIAL PERFORMED BY W. FRENCH ANDERSON, R. MICHAEL BLAESE, AND KEN CULVER, NATIONAL INSTITUTES OF HEALTH

PAINTING BY JANE HURD

On October 16, 1990, two-and-a-half-year-old Pamela Hall was admitted to Humana Hospital in Augusta, Georgia, with third-degree burns on 66 percent of her body. Doctors gave her no chance of survival.

But her condition stabilized after the doctors had removed the burned skin and temporarily replaced it with cadaver skin to cover the wounds until skin cultured from her own cells could be produced.

At BioSurface Technology in Cambridge, Massachusetts, a technician holds up flasks to show how quickly skin cells—stained to make them more visible—grow in 12 days (top). The new skin (middle) adheres to protective gauze. Doctors stapled it to Pamela's limbs, and a week later the gauze came off, leaving the graft in place.

By March the little girl was hale enough to pedal down a hospital hall.

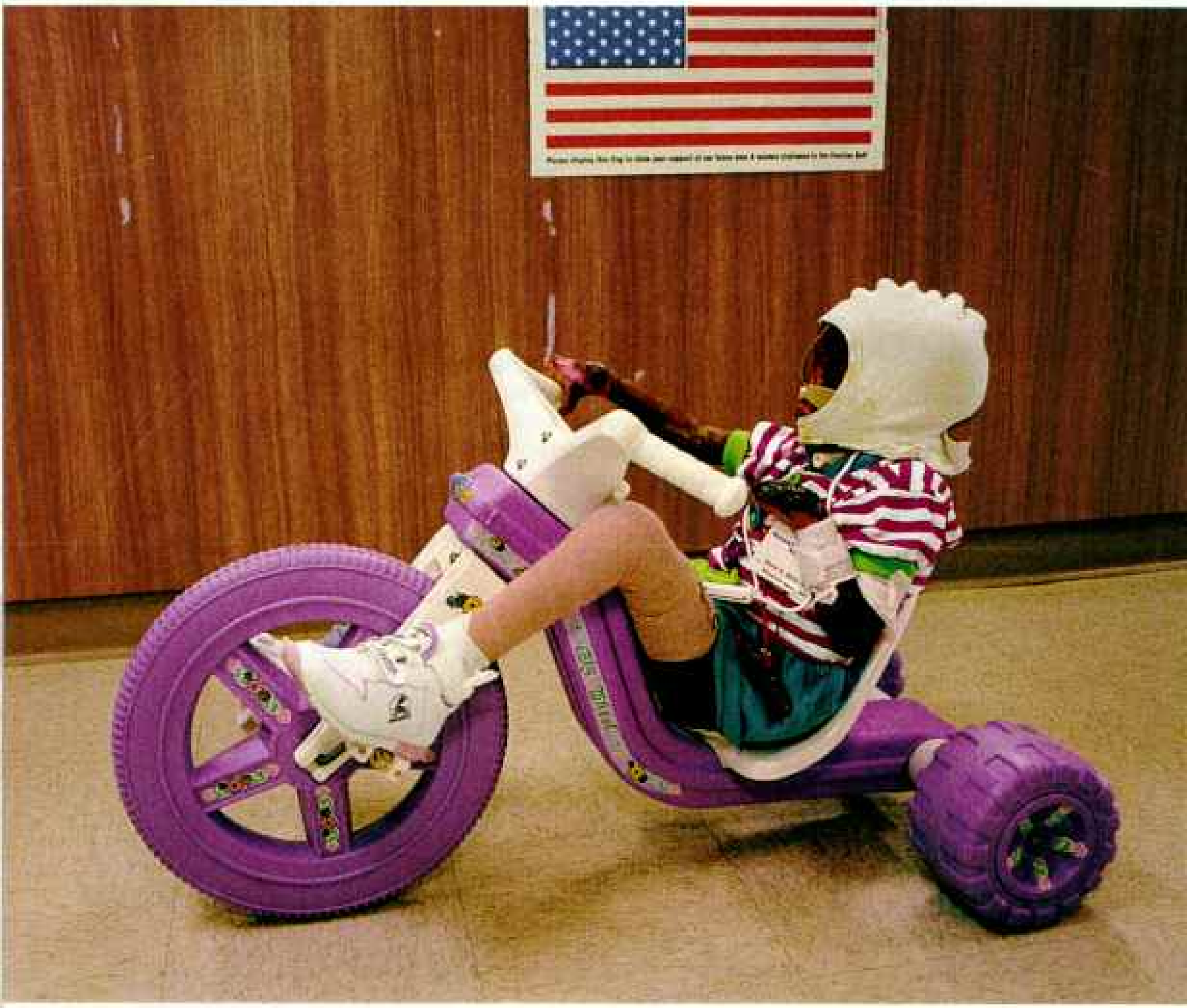
to explore how the human body works. The reason: Researchers can now measure and manipulate subcellular elements too small to see with the most powerful microscope.

At the laboratory of molecular biologist Jane Gitschier of the University of California at San Francisco, I watch technicians "immortalize" human cells by infecting them with a tumor-causing virus that makes them malignant. The result is a "cell line" that can take in nutrients and live endlessly.

Immortalization sounds straight out of *Star Trek*, but immortal human cell lines were first achieved in 1951, when researchers cultured cancerous cervical tissue obtained from 31-year-old Henrietta Lacks shortly before she died of cancer. "HeLa" cells, direct descendants of hers, still help researchers throughout the world.

"The number of cell lines has increased dramatically in recent years," Gitschier explains. "There are now thousands, all derived from donated tissues and fluids."

Sitting on the shelf, cell lines resemble jars of perfume. Under the microscope, my untrained eye sees clumps of floating balls.



Researchers need these clumps to study biological functions, trace gene mutations, and test new drugs. Alton Meister of Cornell University Medical College, for example, recently used a colony of human cells carrying the AIDS virus to show that a natural human molecule can actually suppress it.

In May 1990 Solomon Snyder and Gabriele Ronnett (page 89), neuroscientists at Baltimore's Johns Hopkins University, announced they had grown human brain cells in the laboratory using cells from an 11-month-old girl who underwent brain surgery. This could lead to treatments for neurological diseases by allowing physicians to test possible drugs on these laboratory cells.

"We were not involved in the child's care or in obtaining her parents' permission to use the tissue," Ronnett tells me. "We learned later that she died. I have a child the same age and would like to think I could show their courage."

Human material also makes possible exploration that adds to the unknown. One example: Scientists believed that different types of cells never "spoke" to one another. A new picture is emerging: Cells constantly manufacture and release chemical messengers—proteins called growth factors—that tell one another what to do. Nearly a hundred growth factors have been discovered so far, each one a Santa's bag of promises. "Osteoinductive factor," for example, induces new bone formation, and "epidermal growth factor" stimulates skin cells to heal much faster than is normally the case.

"I've gotten the quality of my life back," says Georgia schoolteacher Karen Petka, after bone transplants in both knees. Pictured with her daughter, Kari, she adds gratefully, "I can take care of my family again."

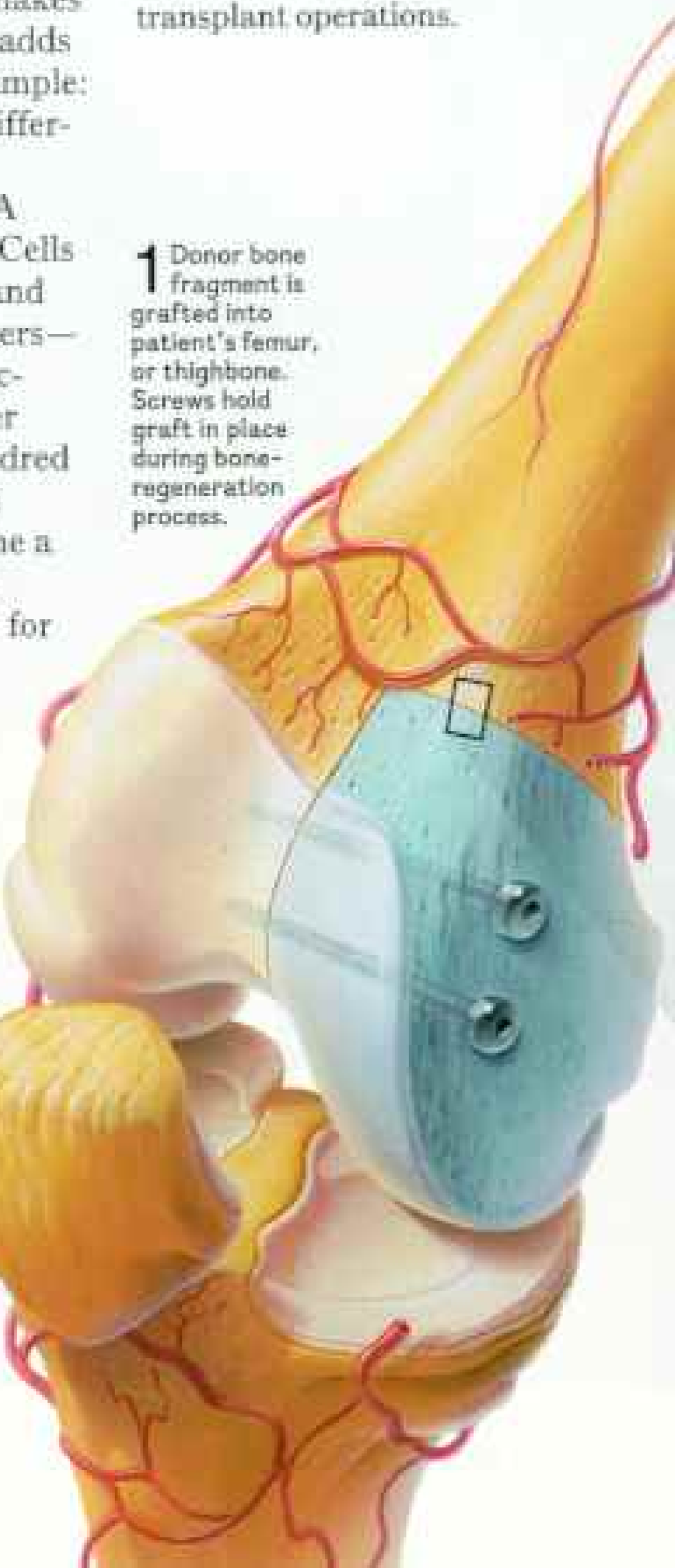
Donations may also make it possible to find the causes of thousands of diseases—including muscular dystrophy, multiple sclerosis, and diabetes—many of them associated with gene defects. Such information often leads to screening, prevention, treatment, or cure.

To find genes, researchers trace linkages and disease patterns within families. Some studies involve thousands of families; others try to go back five generations in a single family.

Participating families, who rarely receive any direct benefit, often have "blood parties" during which they roll up their sleeves. Terrie Fargo of

Banking on bones

THROUGHOUT a person's lifetime specialized cells—osteoclasts, osteoblasts, and osteocytes—replace living bone with new bone tissue. This natural process of regeneration allows the body to heal fractures or to accept grafts following the removal of diseased bone. Grafts from a patient's own body heal faster, so are used whenever possible. But in those cases in which the patient has no "spare" parts, bone banks play a crucial role in acquiring, preserving, and supplying vital bone for use in transplant operations.



1 Donor bone fragment is grafted into patient's femur, or thighbone. Screws hold graft in place during bone-regeneration process.

6 When osteoblasts become embedded in bone, some are transformed into osteocytes, which regulate bone regeneration, keeping tissue alive and well.

5 Osteoblasts build new bone tissue in cavities left by the action of osteoclasts.

4 Osteoclasts digest dead bone tissue, temporarily reducing bone mass and increasing porosity. This allows further penetration of blood vessels into the graft.

3 Connective tissue forms between graft and living bone. Blood vessels carry cells to graft. Eventually these bone cells specialize, becoming osteoclasts, osteoblasts, or osteocytes.

2 Blood fills the space between the living bone and the bone graft.

New bone tissue

Osteocyte

Osteoblast

Osteoclast

Natural channels in bone provide pathways for blood-vessel growth and bone-building cells.

PAINTING BY JANE HURD

Camarillo, California, has been fighting Fanconi anemia for 15 of her 38 years. "It was easy to give genes, much easier than the things I face," she tells me. "It's strange and exciting that an event that took only moments can have such far-reaching results."

ON THE WALLS of laboratories I see reproductions of works by 15th-century Dutch painter Hieronymus Bosch. The closer you are, the more details emerge. If you focus on one square inch, you see an entire world of intricacies—exactly as medical researchers do with the human body.

Reinaldo Gomez, then vice president for research at Genentech, one of the largest companies in the multibillion-dollar biotechnology industry, has a large blackboard across from his desk. This seems out of place until I ask questions.

"Very few drugs come from the human body," Gomez explains. "Several are still made from urine, some from blood. Growth hormone was extracted from cadaveric pituitary glands. It took materials from dozens of cadavers to treat just one child for a year. But now hormones can be manufactured using recombinant DNA technology."

He is at the blackboard, drawing lines and circles. "If we know a gene produces a certain hormone or enzyme," he says, "we can clone that gene and produce the desired element in amounts necessary for clinical treatment."

Among the biotech drugs already available are treatments for diabetes, blood clots, hepatitis, and anemia. All the drugs are produced from cells in human tissue, including placentas (previously discarded), or from human-based DNA sequences.

Human material usually works better than animal or synthetic substitutes. For instance, a few diabetics who take cow-derived insulin suffer allergic reactions; human-based insulin causes virtually no problems.

Robert Arathoon of Genentech provides a tour of production facilities—windowless buildings filled with vats, some three stories high, in which drugs grow in media roughly similar to those used to grow cells in the laboratory. Arathoon's enthusiasm runs deep. "Every hour," he says, "a life is saved."

New drugs become available more quickly than ever before. When I meet Howard Jaffe, director of clinical research, he is plotting a chart that shows early results from a clinical trial for a drug made directly from a cloned human gene to treat an inherited disorder that often kills children. "We planned a two-year study," Jaffe says. He turns the chart so I can see it. One line, showing serious infections among those on a placebo, runs up; the other line runs down. "The drug is so successful we took kids off the control and put them on it," he says.

All tissue used for research and drugs—and transplantation, for that matter—is not important to the donor. Most of it would have been thrown away. What, for example, could be more useless than a cancerous spleen?

Yet argument over who "owns" one spleen leads me to the Beverly Hills office of attorney Jonathan Zackey, who talks about a client named John Moore (page 88).

Behind many organ donations lies a wrenching story. Dubby and Diana Wilcox of Bald Knob, Arkansas, lost their three sons in a house fire. Their hearts break each time they visit the graves. What helps, says Diana, is "knowing that our boys are living in other people." Seven persons received organs from two of the boys. The Wilcoxes later contacted four of the recipients. "I just wanted them to know our boys," Diana says.


Jason Edward Wilcox
Jake Wiley Wilcox

"We all wonder if we'll get a second chance," says Mary Wilson (far right), speaking for all those on organ waiting lists. Diagnosed in 1988 as suffering from a diseased heart, Wilson, of Jacksonville, Arkansas, was given a year to live. Today she is biking and swimming, the recipient of a donated heart from ten-year-old Jared Wilcox.

Other Arkansas residents receiving organs from Jared or

his brother Jake include kidney recipient Mike McClard (bottom right), who feels reborn as he romps with a grandson. Another kidney went to Peggy Egleston (bottom left), who again has energy to play with her daughter. James Shumate (top left) lost his new kidney after 13 months, yet says he will never lose his gratitude for the Wilcoxes' decision to share their sons' organs.

In 1976 leukemia specialists thought Moore, who then lived in Alaska, might die in just two months. Thick documents chronicle Moore's discovery—made possible in large part because researchers had named a cell line after him—of what the researchers already knew: The cell line from his spleen cells produced large amounts of proteins with immune-boosting properties. Such properties are part of a new category of drugs. UCLA hematologist, David Golde, who was Moore's chief physician, says these "may effect a revolution in medicine as profound as the introduction of antibiotics."

Thanks to biotechnology, Moore's spleen has made a contribution that may live forever in research laboratories.

Moore's lawyers, in an unprecedented lawsuit, tried to convince the courts that he "owned" his body's cells. "You know how people say, 'Someone has so much energy it should be bottled,' " Zackey explains. "Well, researchers used properties in Moore's cells to develop a potentially profitable drug. And no one told him."

Moore argued that donation depends on patient-physician trust. The defendants countered that research relies on cells from so many people that ownership is usually impossible to trace. They also maintained that any value resulting from their scientific efforts should not belong to Moore and that he was told of the research when results became known. Judicial rulings have narrowed the case to questions of informed consent; all prospective donors, the courts stated, have a right to say no.

"Why did your body respond this way?" I ask Moore, who now lives in Seattle. "Was it God or chance?"

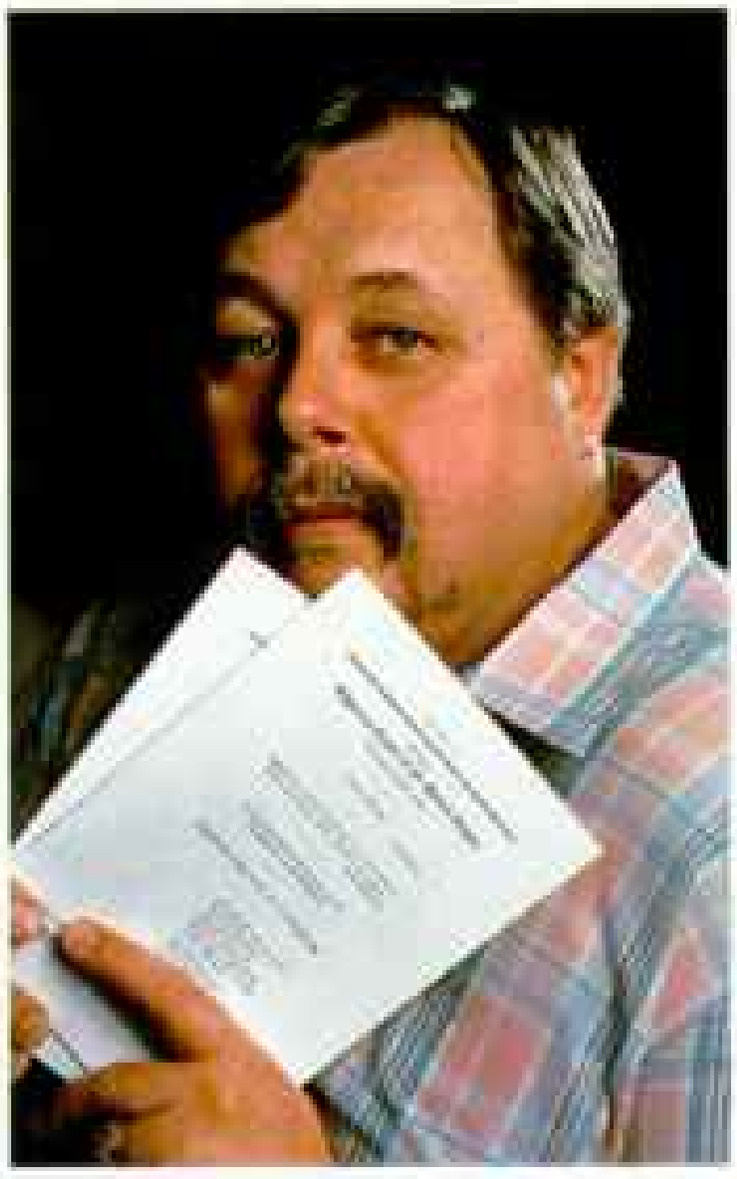
"No one knows. They tested members of my family and found nothing."

"Do you think about the people who will benefit from this?"

"I have a deep sense of the awesome potential within us, but I don't understand it."

It's sad to see such an extraordinary achievement become subject to a lawsuit. How many of us, I wonder, might effect a revolution in medicine? Moore himself thinks "there are many people like me wandering around." When I ask experts, I get vague answers that basically say, "Lots of people can contribute something fantastic. We just don't have the resources to screen them and pursue interesting possibilities."

Perhaps the best clue comes by chance. In San Francisco, I read a newspaper story about 489 men infected with the AIDS virus before 1980. Nine surviving men generate an unknown substance that keeps them vigorous and healthy.



"What about me?" wondered Seattle businessman John Moore when he sued his physician for making commercial use of his cancerous spleen.

His spleen cells have aided in finding beneficial drugs. Moore, in claiming ownership of those cells, threatened the foundations of the biotechnology industry—which uses organs and tissues for research without financial obligation. The U. S. Supreme Court rebuffed Moore in March, letting stand a ruling that he forfeited all property rights once the cells left his body. Now, in resubmitting the case, he claims he should have been informed of his cells' potential uses.

RESEARCHERS must continually combat shortages of human material. Some encourage autopsies in order to obtain tissue; others appeal through the mass media. Disease-specific registries link patients and researchers, and some patient organizations gather donor tissue to encourage work on their disease.

Shortages disrupt even state-of-the-art work. At Johns Hopkins, I see what can happen when donated tissue is insufficient. Harvey Singer, a pediatric neurologist, needs tissue to study Tourette's syndrome, which can cause a chronic involuntary

tic and affects about 100,000 Americans. "We're trying to see the abnormalities associated with this disease," he explains. In his office is 19-year-old David Figlio, recently diagnosed with Tourette's, who has volunteered to have radioactive material run through his brain so Singer can count enzyme-receiving areas.

Later I ask Singer: "If you had enough donated tissue, would you do expensive experiments like this?"

"Given the option, I'd rather do studies directly on brain tissue. This would allow me to do multiple tests instead of just one at a time on patients like David." His voice trails away. "If I just had more brain tissue."

I talk with immunologists Charles Baum and Stanford University's Irving Weissman shortly after a three-year quest ended with the successful isolation of human stem cells, often called the holy grail of blood research.

"We relied on donated marrow," Baum says. "We got a little left over from transplants. Also, when people donate organs and allow us to take a rib, we can get marrow from it."

"How much bone marrow did you use during the past three years?"

He gives me a figure, and I do some quick math. "That's only enough marrow for one routine transplant," I say.

"That's right."

"Did low supply slow you down?"

"Getting more would have sped our work significantly."

Researchers must now show that stem cells can be grown—and made to survive—in sufficient numbers to make clinical treatments possible. Mastery of stem cells will also open up new worlds of transplantation. Stem-cell transplants could, among other things, cure blood diseases such as sickle-cell anemia and thalassanemia.

"Perhaps most important would be gene therapy," says Irving Weissman. "We could, for example, put into stem cells genes that inhibit the AIDS virus, produce insulin, make marrow cells resistant to chemical agents, or fight cardiovascular disease, and then inject those cells into the patient."

Researchers have already used gene therapy to correct cystic fibrosis defects in human cells in the laboratory and have shown that foreign genes can be inserted in living humans without causing harm. Gene therapy is also the latest stop on a journey that has taken Steven A. Rosenberg, chief of surgery at the National Cancer Institute, from the crude to the refined.

"When I was a resident in 1968," he says, "I met a patient whose stomach cancer had disappeared spontaneously. I infused his blood into another terminally ill cancer patient. It had no effect." Twenty years later Rosenberg injected tumor necrosis

A future that will find new treatments for brain diseases drew closer in 1990 when researchers led by Solomon Snyder and Gabriele Ronnett of Johns Hopkins University School of Medicine reported they had grown brain cells from donated tissue. Standing before an image of a cultured neuron, which dispatches and receives electric signals crucial to thought and sensation, the team will now attempt to learn why neurons malfunction in diseases such as Alzheimer's. Some 200 laboratories have requested the cell culture for research.

factor (TNF)—a tumor-killing protein that the body produces only in small amounts—directly into the bloodstreams of his patients. That too failed because no one could tolerate enough TNF to harm the tumor.

Rosenberg's current plan: To remove tumor-infiltrating cells from each patient, infuse these cells with TNF-producing genes—identified by using tissue obtained in 1970 from a woman with leukemia—culture the cells, and inject 300 billion of them back into the patient. Rosenberg believes the transplanted cells will carry TNF directly to the tumor, while causing no serious side effects.

Rosenberg had transplanted TNF-producing genes into a 42-year-old man and a 29-year-old woman two weeks before we speak. Both have terminal cancer, untreatable by other means. Photographs of their tumors show a horror the healthy cannot imagine.

"Where are they now?" I ask.

"Home," he says. "I've been seeing them every week. They know they are helping others, and they have hope." His voice drops so low I lean forward. "The worst thing," he almost whispers, "is loss of hope."

I think about the woman whose cells yielded knowledge of the TNF that may save Rosenberg's unsavable patients. She died long before anyone imagined gene therapy. But I visualize her: strong, defiant, reaching across time and death to all who will benefit from Rosenberg's work.

Comeback winners, four organ recipients lifted hands to celebrate a relay-race victory at the U. S. Transplant Games in Indianapolis. Nearly 400 athletes with transplanted organs joined in the 1990 games organized by the National Kidney Foundation. Events included swimming, tennis, bicycling, and track and field (above). Before the games, participants joined in silent prayer to honor donors and their families.

WHAT I HAVE SEEN fills me with a sense of wonder but also raises troubling questions. Tampering with germ—sperm and egg—cells could permanently change future generations; one possibility is to produce mindless workers straight out of *Brave New World*. Of more immediate concern are aborted fetuses and anencephalic newborns—who have incomplete brains and rarely live longer than a few days. They have proved invaluable sources of material for research and transplantation, but could this encourage the killing of helpless beings?

At present, government restrictions and restraint within the medical community prevent work on human germ cells and most uses of fetal and anencephalic material. "Each new development," says ethicist Willard Gaylin, "has the potential for enormous good and for great harm."

While traveling, I receive the type of telephone call we all


1990
U.S.
TRANSPLANT
GAMES

dread: "Joel, sorry to tell you this, but. . . ." A close friend lost control of her car. She is dead. That evening I call her husband, who knows nothing about my interest in donation. "Her heart was not beating so she could not donate organs, but I've given permission for her to be a tissue donor," he says. Tears overtake his words. "They said they really needed skin for people in the burn unit," he says. The rest of the conversation is a rush of emotions. All I remember is his final sentence: "I'll be walking down the street, and everyone could be someone she saved."

Tissue transplantation receives little publicity but is common. Several hundred thousand Americans, for example, receive bone each year. The dozens of other tissues that can be used from recently deceased donors include corneas, middle ears, tendons and ligaments, heart valves, veins, and cartilage. Some donations are also surgical discards from the living. Thus foreskins from circumcision can relieve leg ulcers after conventional treatments fail. Although human material works better than anything else, shortages of human tissue persist.

I think about my friend and her husband's belief that her skin saved lives.

Robert Spence, a plastic surgeon at Johns Hopkins, shows me the burn unit. We stand by the tub where burned skin is stripped off, an excruciating ordeal. "About 70,000 people in the U. S. are treated for serious burns each year," he says. "Their greatest danger is infection. Donated skin is vital as a covering. Even though donors are dead, the skin is alive and stimulates growth of new skin, even in acutely burned areas."

"What about shortages?"

"Skin banks do not have enough. Lots of burn units have to call around to see what they can find."

Spence introduces me to 26-year-old Greg Poist of Hanover, Pennsylvania. A boiler explosion in 1988 burned most of his body. Physicians covered him with 6,000 square centimeters of donor skin as well as sheets of skin cultured from a stamp-size piece of his unburned thigh. The cultured skin included growth factors that help skin cells heal faster.

"Do you ever think about the donor who saved you?"

He answers with the directness found in those who have been near death. "To be alive because of a donor is too big, too much, so I don't think about it."

Donors achieve "immortality" when scientists use their tissues to grow cell cultures for research. Stored in vials inside liquid-nitrogen freezers, the cell lines allow researchers to test new drugs, to study genetic mutations, and—greatest of all—to find cures.

MEDICINE uses human material in dozens of other ways, but I have seen enough to recognize that donation for transplantation and research fosters a new kind of kinship. We help ourselves by helping others, and we help others by helping ourselves. The only requirement is deceptively simple: To give what we do not need.

Although practical and psychological impediments are inescapable, to expect to overcome them is not idealistic. Indeed, giving of our physical being is not far from our most primitive beginnings. Nomadic families who killed a large animal gave extra meat to other families, who then became more likely to share. Anthropologists call this reciprocal altruism.

The same compelling truth defines the quiet revolution I have been witnessing. The more we give, the more we have. □

BECOMING A DONOR

Finding answers to life-and-death questions

SINCE THE FIRST successful kidney transplant in 1954, modern transplant science has offered hope and health to countless Americans who have received new organs or tissues. Yet because of a critical shortage of donors, thousands of people die every year waiting for transplants. Most Americans are willing to donate organs and tissues, but only a few do so, often because of confusion and miscommunication at the time of death. The following questions and answers will help with this lifesaving decision:

WHO CAN BECOME A DONOR?

Any person 18 or older may donate all organs and tissues for transplantation or research. Someone under 18 may donate with the consent of either a parent or a legal guardian. Although most organs and tissues are taken from people younger than 65, there is no upper age limit for becoming a donor.

WHAT CAN I DONATE?

There are about 25 different organs and tissues that can be transplanted. Vital organs include the heart, lungs, kidneys, liver, and pancreas. Tissue—which can be recovered as late as 24 hours after death—includes bone, skin, tendons, blood vessels, and heart valves. Living donors can provide kidneys, bone marrow, and parts of the liver and lung.

WHO WILL RECEIVE MY DONATION?

Because an organ recipient needs to be found immediately when a donor becomes available, the hospital or an organ procurement agency will access a computerized registry—maintained by the United Network for Organ Sharing (UNOS)—of people in the U. S. requiring transplants. Any donated organs not used locally—the first preference—will be matched to recipients elsewhere on the basis of urgency of need, length of time on the waiting list, blood type, and various other physical compatibilities.

WHEN WILL DONOR ORGANS BE REMOVED?

Donation is not considered until all efforts have been made to save a patient's life. A person must be declared brain-dead before any organs can be removed. The physician who certifies a patient's death will not be involved in the organ removal or transplant surgery. In addition, neither the donor's family nor the estate is charged for costs associated with organ donation.

DOES DONATION HINDER FUNERAL PLANS?

The removal of organs and tissues will not disfigure the body, nor does it delay the funeral.

WHAT ARE THE RISKS?

For living donors, the primary risk is that infection or some other complication may result from surgery. For recipients, risks include transplant rejection, undesirable side effects from immunosuppressive drugs, and the possibility, however small, of contracting a disease such as hepatitis or AIDS.

HOW CAN I BECOME A DONOR?

Complete a donor card. It can be obtained from hospitals, organ-and-tissue-procurement organizations, and other groups. Many states also have a provision allowing a driver's license to serve as a donor card. However, even if you register as a donor or mention organ donation in your will, hospitals generally will not remove any organ without the next of kin's consent. Thus it is important to discuss your decision to donate with your family, so they can act in your interest.

If you do not have a donor card, a hospital—under the "required request" law—must ask the next of kin if they will agree to

donation. Most physicians will call in a counselor from an organ-procurement agency to help the family with this crucial decision.

For more information, check with these sources: your physician; a local hospital; a kidney, liver, lung, or heart foundation or association; a bone-marrow registry (1-800-654-1247 or 1-800-7-DONATE); the nearest regional transplant group or organ bank; the local eye bank or Lions Club; the Red Cross; or UNOS at 1-800-24-DONOR.

MAYA ARTISTRY UNEARTHED

Tunneling into the heart of a Maya temple pyramid on the great Acropolis at Copán in Honduras, an archaeological team makes a startling find: A smaller temple is entombed within. As more and more earth fill is cleared away, the magnitude of the discovery emerges. The buried temple, "mummified" by the Maya with a coating of rough plaster, has come through 1,400 years almost undamaged. Then, in the temple's first chamber, the team finds a cache of offerings, among them stone silhouettes painstakingly flaked from chert (right)—pieces of rare delicacy, artistic imagination, and symbolic power.

By RICARDO AGURCIA FASQUELLE
COPÁN ACROPOLIS ARCHAEOLOGICAL PROJECT AND HONDURAN INSTITUTE OF ANTHROPOLOGY AND HISTORY
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Photographs by KENNETH GARRETT

Tradition has it that all major discoveries in Maya archaeology come to light at the end of the fieldwork season.

We were to find that all too true. At the end of our 1989 fieldwork we had come across the buried temple. In early 1990 we went on investigating its outer walls, but by May, with the rainy season fast approaching, we were winding down our operation. Or so we thought.

We were tunneling cautiously along the west side of the inner building when we found a doorway. Clearing away the fill, we entered a narrow room about two meters wide, painted bright red. We hoped to find the kind of offering typically left when a temple was ritually "killed" before another was built atop it—some shells or jade, perhaps. But we found nothing at all.

Next we tunneled to the right, seeking to trace the outline of the room, and came up against a crudely built stone wall. After documenting it with photographs and technical

drawings, we started to remove the wall.

Behind it we found some loose rubble, which had been dumped around a crude niche made of small stones. Inside, on the first of June—the very day we had planned to end our season's excavations—we found the most spectacular ceremonial offering ever unearthed at Copán.

Over the next nine days we carefully recorded and removed three chert knives, one jade bead, one stingray spine, three spiny oyster shells, and many small shark vertebrae. But most exciting of all were nine "eccentric flints," or intricate chert sculptures (above left, one is held by Ricardo)—some of brilliant craftsmanship—with scraps of cloth wrapping still clinging to them.

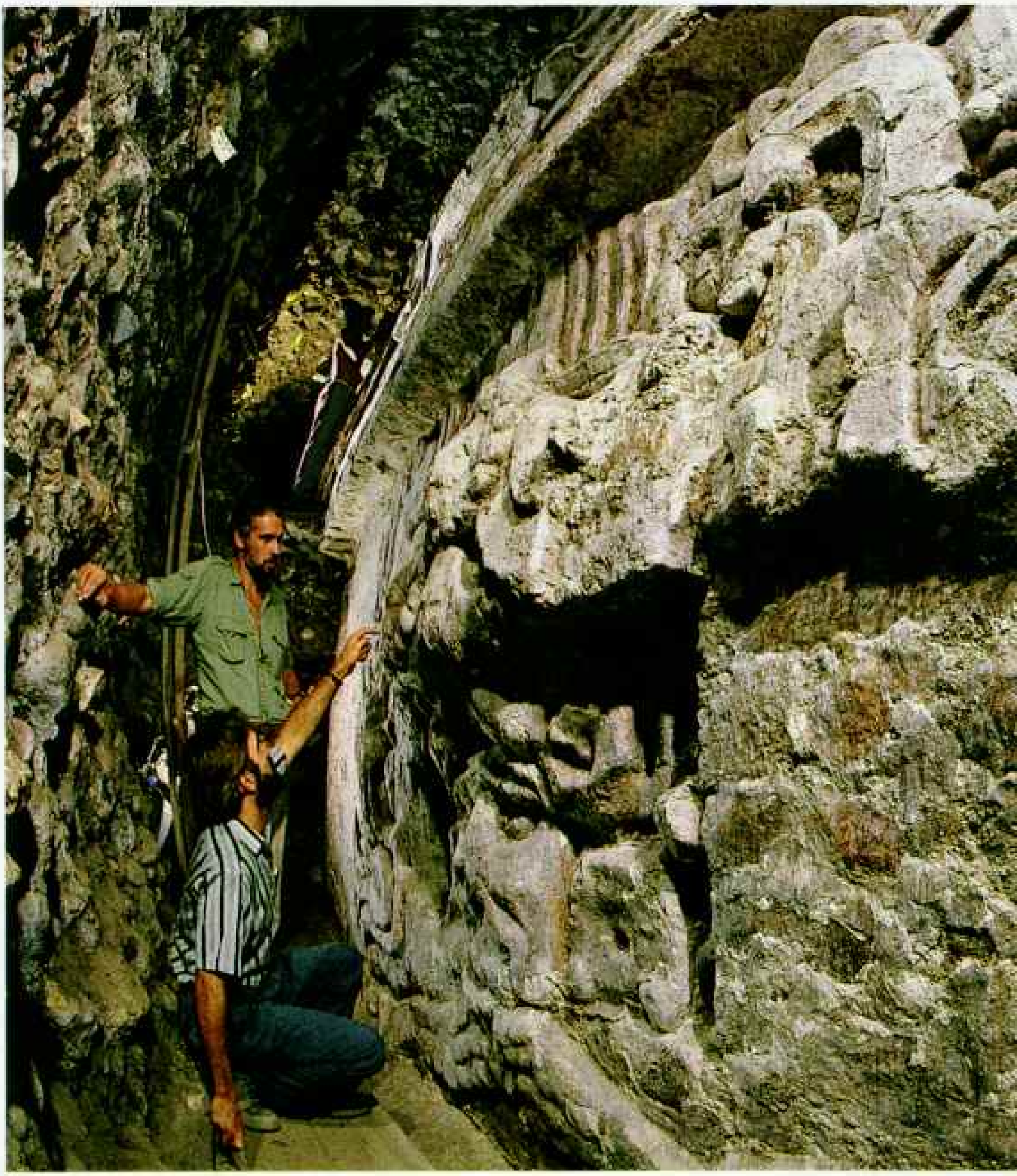
Now we had truly run out of time. The rains were upon us, and sealing the outer building, what we call Structure 16,* was as important as finding the offering. Our crews raised wooden trays of mortar (above), and we closed our tunnels for 1990.

* See "Copán: City of Kings and Commoners," by George E. Stuart, NATIONAL GEOGRAPHIC, October 1989.

The buried temple—with 200 to 250 years' worth of prior construction beneath it and three major structures atop it—is more than a relic of time. Shown here in an artist's cutaway reconstruction, the 18-by-12-meter temple depicts part of the complex Maya cosmology. On each side of the doorway the old god Itzamná emerges from the mouth of a bird of heaven; above the birds, celestial serpents slither; directly above the doorway looms a godly countenance.

A decorated roof comb rises above the second story, a typical detail in Maya temples but the first found in situ at Copán.

PAINTING BY NGS ARTIST CHRISTOPHER A. KLEIN



Discoveries as rare as these come only, if they come at all, through plain, unglamorous dirt archaeology—proceeding slowly and meticulously, especially in tunnels. The fill around the temple, which we had named Rosalila, was particularly solid—hardened dark red clay with lots of large river cobbles. Even our best workers could not advance more than a few feet a day.

taken to preserve them.

The Maya had, in effect, mummified the temple by applying a white plaster, coarse and thick, over the entire structure. Remains of this coating are most visible on the swirling forms—feathers of the bird of heaven—at the top of the photograph.

Just in front of Bill, a deep-relief portrait of the primordial deity Itzamná has been blurred by the mummification process as well as by repeated thin coatings of colored plaster, applied both as decoration and to reduce erosion by heavy rain when the temple stood in the open. In later centuries such relief sculptures were carved from blocks of local andesite, a substitute for limestone-based stucco. The growing scarcity of limestone in the area may have forced the Maya at Copán into making the shift.

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working with crowbars and picks.

As more and more of the temple opened to our view, it became evident that the Maya buried it with enormous care. If they hadn't—and in every other case at Copán they hadn't—the hand-modeled stucco sculptures on the facades would have been pulverized. We could see in even the smallest recesses (left, with Ricardo standing, Bill pointing) the extraordinary means that had been

Eccentric flints represent one of the rarest art forms of ancient Mesoamerica. Shaped by flaking chips off chert, possibly with a bone tool, the delicate objects must have required hundreds of hours of careful work by the most skilled of Maya flint knappers. In fact, the extraordinary quality and personal artistic trademarks of these four flints lead us to believe that they were the work of one person—probably among the finest flint knappers who ever lived, anywhere.

The shapes of Maya eccentric flints often appear whimsical; many include faces in profile,

perhaps portraits of ancient Maya rulers.

We are still puzzled by the meaning and function of the flints. They may have been attached to wooden staffs for use on ceremonial occasions and probably symbolized supernatural power. The nine we found may correspond to the nine divine Maya lords of the night.

In the niche we also found woven cloth (never before found at Copán), wood, seed pods, and bark cloth. Much of the blue-green woven cloth was stuck to the flints in a way that suggests that the flints were wrapped individually, then as a group.

If the flints were an instant delight, these clay offertory figurines, which we discovered as fragments in a pyramid near Structure 16, revealed their artistry only after painstaking reconstruction.

Guardians of a royal scribe's tomb, the likenesses seem to be paired, except for the central figure. He may be Yax K'uk' Mo' (Green Quetzal Macaw), fifth-century founder of Copán's great dynasty. □

America's Illegal Wildlife Trade

A SHAMEFUL HARVEST

By CONSTANCE J. POTEN Photographs by JOSÉ AZEL CONTACT PRESS IMAGES

For a thrill, a trophy, or a big payoff, America's wildlife is under illegal attack. As greedy hunters, guides, and black marketeers do their business, two confiscated bighorns mark this gruesome, growing problem.

Trapped in Ohio and illegally trucked to South Carolina, these red foxes were purchased by a game farm for use as hunting quarry. Wildlife

agents picked up the trail and arrested the violators, who were fined. Rabies and tapeworm tests required that the foxes be destroyed.

The story on the following pages is a grim one, that of massive and illegal slaughter of our country's wildlife for profit at home and abroad. Though the scale is enormous, the story is little known. We present it here on behalf of all threatened wildlife.

—THE EDITOR

SOFT, DARK CLOUDS float over Montana's frozen eastern plains. On this Thanksgiving weekend, in the spare ranch town of Wibaux, the main industry for a number of people is illegal hunting, and they are waiting for their payoff. At dawn Montana's lone undercover state wildlife agent and I sit in his pickup, waiting too.

The agent, call him "Roy," is a big, patient man with a sly wit. His beat covers 147,000 square miles and often takes him out of state—Montana's wildlife has a far-flung market.

"Montana," he says, "is one of the last states with astounding numbers of wildlife. It's made for poachers."

Two voices rise from the metal suitcase between us: wildlife agents on loan from another state, bodywired. We see them emerge from the worn, brick Palace Hotel a block away. Behind them is Neal Atkinson, an outfitter from Florida, who has allegedly taken 23 people on illegal hunts in Montana this fall alone. He thinks the agents are genuine clients.

Roy picks up his radio mike. "They're leaving. Let's take 'em down." Fourteen Montana game wardens hear this. The scene unfolds on empty Main Street: Atkinson scraping ice off his windshield; Atkinson suddenly surrounded by vehicles; he and his partners, stunned men in dirty jeans and down vests, frisked and handcuffed; someone leaving to wake up the justice of the peace.

This is not the first time Atkinson has been caught; he's already been convicted in Alaska. Two other states and two Canadian provinces have investigated him for illegal hunting. His meticulous records, seized by wardens in the shoddy hotel room, outline three years of unlicensed hunting. Deer carcasses and photographs were found in the hotel and nearby in homes and an old prairie school.

On this brilliant, cold day, Atkinson—a lean 47-year-old—is led to jail. He will be facing 23 federal counts, but he knows from experience that wildlife-crime sentences tend to be lenient and probation requirements are difficult to enforce. Casually, he asks the warden about other good hunting areas.

Atkinson is a player in a lucrative American industry—poaching. Officials say the trade in illegal wildlife has become a booming tax-free business. No one really knows the bottom line; United States Fish and Wildlife Service (FWS) officials estimate that the illegal profits from U. S. animals are 200 million dollars a year and growing. The trade attracts organized crime, agents say, because the return is high, the risk of getting caught is low, and, until recently, the penalties have been minimal.

"There's big money out there," says Terry Grosz, the Rocky Mountain region FWS special agent in charge. "The people involved are everybody—rich, poor, outfitters, taxidermists."

Increasingly, wildlife officers rely on undercover operations like the one in Wibaux to penetrate networks of poachers and buyers. "As we get more sophisticated, so does the poacher," says Alaska senior FWS agent Al Crane. "There's more illegal activity than ever."

Despite a 94 percent conviction rate for those caught, poachers feed global demand for American wildlife. They decapitate walruses for ivory tusks, net thousands of night-roosting robins for Cajun gumbo, and shoot anhingas nesting in the Everglades and raptors for their decorative feathers. In Alaska they track and shoot wolves from airplanes. They catch sturgeon and rare paddlefish and sell their eggs for caviar.

Unscrupulous outfitters purchase illegally trapped mountain lions and endangered jaguars for hunters willing to pay substantial trophy fees. Poachers shoot protected polar bears for collections, or to sell the skins, or for the $3,000 a South Korean will pay for the gallbladder. The illegal trade supplies an Asian market with elk antlers and tails, bear parts, seal penises, even herring spawn attached to kelp, stealing the habitat too.

For the biggest trophies, collectors sometimes cross into national parks and shoot elk, deer, mountain goats, grizzlies, and bighorn sheep for the record book, wall mounts, pictures in albums, and quick profits.

Poaching has long been a tradition in the rural United States: spotlighting deer at night, a coffee can over the gun barrel to muffle the shot; using dead animals as bait for cougars

A BIG-GAME VACATION GOES ALL WRONG

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

Pursued by a posse of game wardens and undercover agents, outfitter Neal Atkinson, at right, brought client Bobby Bagley to Montana in 1989. "This was the first time I went hunting out West," says Bagley, "and I thought I was going to have the best time of my life. But it didn't turn out like that." Accused of killing two deer—one over his limit—and bringing them home to Florida, first-time offender Bagley pleaded guilty and was given three years' probation and a $2,000 fine. "I didn't have the money to fight the federal courts, so I had to swallow it and go on with my life." For two weeks of illegal work, Atkinson was found guilty of 21 federal wildlife violations, but he remains free on appeal. "They railroad people," says Atkinson about wildlife officials. But in court, prosecutor Kris McLean argued that "Neal is a greedy, flagrant violator."

and bears; shooting a duck or two in the farm pond for dinner. But over the past decade the stakes have soared. Word has passed among hunters that a black bear gallbladder is worth $30 to $100, a bobcat pelt $200, or a bighorn sheep head $3,000 (by the time these reach the consumer, the value will have increased substantially). Poaching has become big business.

"It's a terrible waste," says Daryl Gadbow, outdoor editor for the *Missoulian* in Montana. "As sportsmen, we hunters pay to support game management for herds to expand, not for poachers to exploit. Every year there are more hunters and fewer places to hunt. Poachers are stealing from me directly."

The demand is outstripping the supply. In less than ten years the average age of legally killed bears in southern Appalachia has dropped by half. So few bighorn sheep are left in certain prime habitats that they must be transplanted to prevent inbreeding. The bobcat—one of the few spotted cats still legally sold—has been trapped off-season and without permit for breeding purposes. The fur, highly prized for coats, accounts for 60,000 animals killed in the United States each year.

Nationwide, the illegal kill of animals equals or exceeds the legal kill, wildlife officials say. Only a fraction of the violators are caught.

Some hunters groups question the extent of illegal trade, charging that FWS undercover operations are public-relations ploys. "Protecting wildlife no longer is enforcement's principal mission," says a Wildlife Legislative Fund of America report. "Making arrests is."

"I used to think that only a small percentage of hunters broke wildlife laws," says Montana Assistant U. S. Attorney Kris McLean, whose Helena office is filled with confiscated trophies. "But after five years as a federal prosecutor I know that's not so. An unethical trophy hunter wants that trophy, and he thinks he'll never get caught. In Montana we have 17,000 nonresident hunters a year; we'd need 30 more federal officers to enforce the Lacey Act."

That act, the strongest law used against illegal trade, was passed in 1900 in large part to save the buffalo from extinction by poaching in Yellowstone National Park. Amended over the decades, the act makes it a federal crime to transport illegally taken wildlife across state lines.

In February 1991, a year after his Montana arrest, outfitter Neal Atkinson was sentenced for perhaps the most Lacey Act violations in history—21 felonies. He was ordered to pay $21,000 restitution to Montana and serve 37 months in prison. Upon release he will be banned from hunting, fishing, guiding, and trapping, worldwide, for three years. He has appealed the conviction.

"WE HAVE A WAR GOING ON," says Fish and Wildlife Service agent Dave Hall. "And as long as enormous profits are attached to wildlife, wildlife loses."

In New York City's Chinatown, when I ask the manager of an apothecary shop if she sells bear galls, she wants to know where I'm from. "Montana," I say. Can I get her bear galls? she asks. Send them COD, then she'll tell me how much she'll pay. We're discussing a felony, a gallbladder shipment from Montana, but the chance of getting caught is slim. To give me an idea of size, she unlocks a cabinet and draws out a clear plastic corsage box. Inside are two shellac-shiny galls, big and round as softballs.

"For the Asian gentleman who has everything," says attorney McLean, "present a bear gall in a nice case. A grizzly gall is even better, more potent as an aphrodisiac." Galls, ingested a tiny bit at a time with liquor, are also believed to cure a host of ailments from blood toxins to backaches to eye problems. The latest price paid to a hunter for prized Alaska grizzly gall, about five ounces, is $1,300. A New York State wildlife investigator who lived undercover with professional poachers during Operation Berkshire in New England says, "Of all animals, deer and bears are poached the most, bears often just for the gall. I've seen 2,000 galls at one time in Chinatown."

Bear meat and bear-paw soup, special-occasion foods in Asia, are gaining popularity as exotic foods in America. "People have romantic ideas about wild meat," says FWS special agent Doug Goessman. "They see the mountain man. Or Robin Hood. They don't see the poacher." The claws, head, teeth—all parts of a bear are sold like a stripped-down car. For the Asian market thousands of bears

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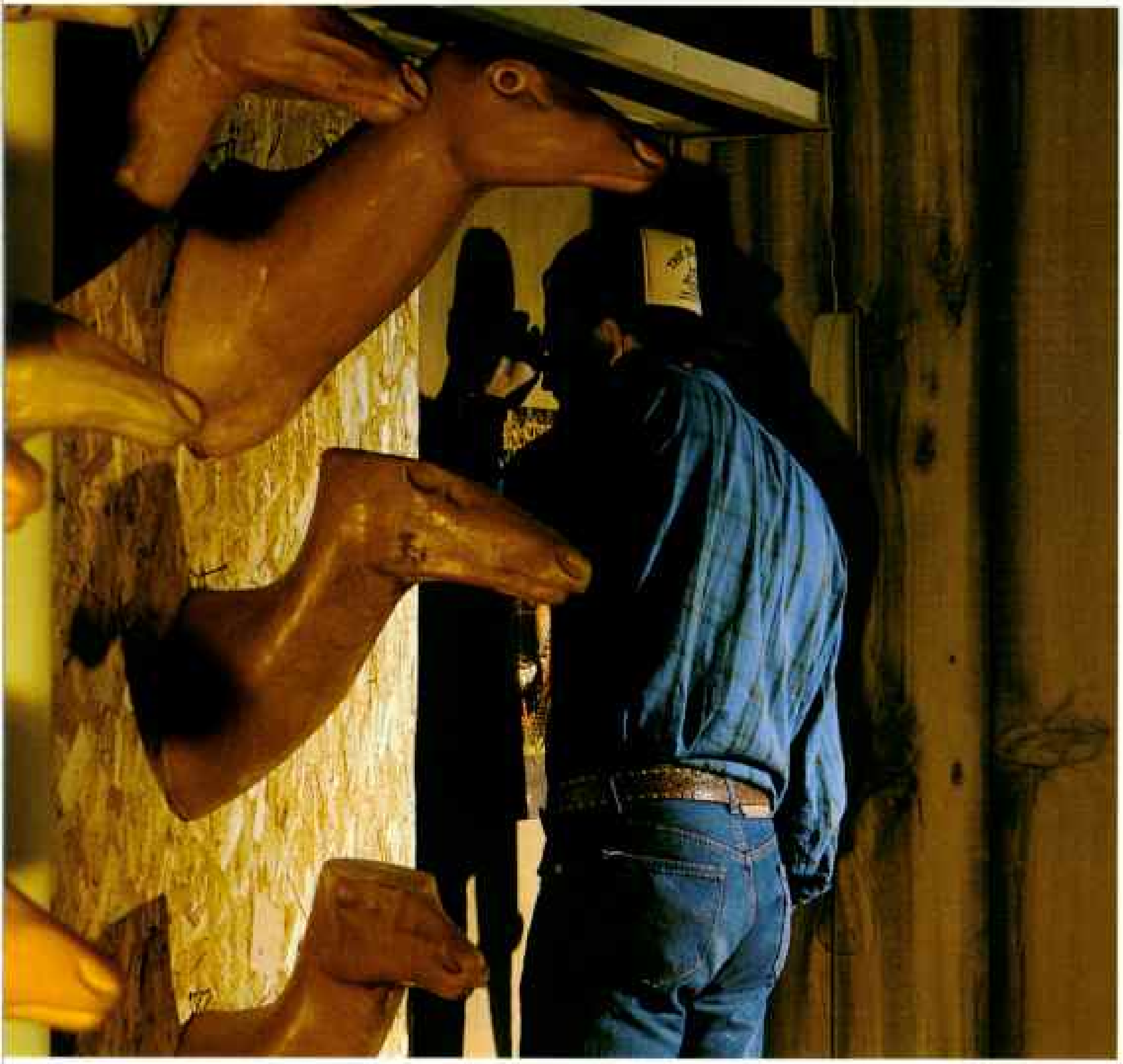

BOTH BY ERIC LARS BAKKE; AGENTS' IDENTITIES INTENTIONALLY OBSCURED

Peeping proprietor (and state undercover officer) "Terry Atkins" checks on business from the back room of the Buck Rub, a taxidermy store in Jeffersonville, Indiana. Wide-eyed deer forms furnished a realistic backdrop as Terry and partner "Jeff Clark" (manning the video surveillance monitor upstairs) conducted their investigation of local poachers. From 1988 to 1991 they gathered evidence to indict 28 people on more than 150 wildlife violations. Says Jeff, "We make arrests that uniformed officers can't."

POACHERS' WHO'S WHO

Dead ducks—29 of them—put Raoul Chaisson almost ten times over his limit in Louisiana. Pleading guilty, he was fined $425 and sentenced to two years' probation and ten days of community service. Chaisson said he stopped shooting only because he ran out of shells.

DAVE HALL, U. S. FISH AND WILDLIFE SERVICE

"William Heuer gets his trophy no matter what the cost," says Montana undercover agent "Roy." The cost for illegally taking this bull elk from a no-hunting area in Montana and attempting to transport it out of state: three years' probation, 200 hours of community service, and $13,300 in fines.

For two rare gyrfalcons Lothar Ciesielski paid a government informant $11,000 and allegedly smuggled the birds to West Germany; he remains at large. To maintain the illegal supply of falcons, Ciesielski offered the informant an 80-acre ranch and a six-figure salary.

are poached in Washington State; game wardens are finding bears stuffed in Dumpsters, paws and galls gone. The importation of 35 frozen black bears by South Korean businessmen made the *Korea Herald* because the galls were selling for as much as $18,300 each. Working undercover, agents documented the loss of 366 bears from the Great Smoky Mountain region over a three-year period.

Since the sale of bear parts is legal in some states, merchandise from poached bears is very difficult to track. "Until we have standardized laws throughout the United States and Canada," says Washington State wildlife enforcement officer Ron Peregrin, "trade in illegal bear parts will flourish."

Bear-claw necklaces are de rigueur at mountain men rendezvous and, set in silver and turquoise, are big-ticket jewelry pieces. I try on a necklace with 20 claws at a fair on the Crow Indian Reservation in Montana. It is frighteningly beautiful. Legal? Who knows? In a shop next to Glacier National Park, a possibly illegal claw from a grizzly (on the FWS threatened list) is tucked away among the items.

In Alaska a wealthy hunter will pay $10,000 to hunt an illegally guaranteed brown bear, often illegally baited with dead caribou. Until an undercover operation interrupted his business, legendary Alaska guide Ron Hayes used airplanes to herd trophy animals toward the gun barrels of hunters. In 1988 Hayes was arrested and pleaded guilty to federal charges. He served 13 months in prison, paid a $100,000 fine, and forfeited three planes.

ALASKA FISH AND WILDLIFE SERVICE

Once the hunter, Australian Peter Stapley is now the hunted. He allegedly shot this Alaskan brown bear in 1986, breaking three state wildlife regulations, and then disappeared. Today Stapley remains a wanted man. Apprehending poachers is one of many responsibilities shouldered by state and federal wildlife agencies that are strapped for money and manpower. According to a recent government report on the U. S. Fish and Wildlife Service, some 3,600 endangered or threatened species are receiving little or no federal protection.

THE BLACK MARKET FLOATS across the country like a seine, silently emptying rivers and seas of fish and shellfish by the millions. A Texas fish study showed that illegal netters are the largest harvesters of redfish, killing more than 40 percent of a species whose population has already collapsed from overfishing.

"If they weren't dealing in fish, it would be crack," says Bob Marshall, outdoor editor for the New Orleans *Times-Picayune*. "These are thieves, career criminals. The fish business is a haven because of lack of enforcement. The National Marine Fisheries Service guards federal waters from Puerto Rico to Brownsville, Texas, with only six resident agents."

New York City's Jamaica Bay, a three-by-seven-mile reach with countless marshy islets, is so polluted that commercial shell fishing has been outlawed since 1914. When it rains, raw sewage may flush into the bay: The city's archaic system can't handle any overload. Shellfish here are covered with malodorous muck.

Two days before Christmas, shellfish prices are up, so New York conservation officer Dave Baker, two partners, and I take a boat to check out the bay. The sun is a yellow stain over Manhattan, the chill damp and deep. "A couple of nights ago we arrested two guys digging shellfish right off the dump," says Baker, pointing to a brown bulge of land. "They got a dismissal from the Brooklyn Criminal Court." Why? He shrugs, "Digging clams is nothing compared with rape. It's a misdemeanor. The diggers' defense was that everybody knows you shouldn't eat raw clams."

In his grab-and-go business a reptile poacher makes fast cash for a few hours' work. He squirts gasoline into the branches of a Florida banyan tree and lets the fumes flush out his prey—threatened eastern indigo snakes, prized as pets. This indigo sold for $120, fueling the black-market bonanza in a wide variety of reptiles. "If poachers can sell it," says photographer José Azel, "they'll poach it."

Contaminated clams may cause hepatitis A and gastroenteritis, but once shellfish make it to market, tracing their origins is hopeless. We throttle toward a distant blue boat Baker recognizes, a boat that's been caught with illegal shellfish before. The fishermen are after crabs today. When they see our boat, they raise the dredges and start dumping the contents. Baker orders them to dump all the crabs, worth $50 a bushel, and fines the men $500.

In the Midwest one Great Lakes investigation exposed dealers in four states selling tons of illegal trout and salmon marked as whitefish—some contaminated with PCBs—depleting those populations and spreading toxins to consumers. The volume of illicit fish was so huge it brought more than $150,000 in penalties. So widespread is the illegal fishing trade that in Chicago alone a 1982 raid on five fish wholesalers resulted in all dealers being charged. In 1986 another operation laid open a lucrative network selling illegal sport and game fish in Illinois.

For the spoon-billed paddlefish, swimming America's rivers for 68 million years, depletion of the species became a concern in the

1980s. When Iranian students took U. S. hostages in 1979, the beluga sturgeon caviar source was abruptly cut off. U. S. commercial caviar producers taught Tennessee fishermen how to prepare caviar from paddlefish eggs. Suddenly the profits from this "black gold" went beyond fantasy. For this rare, ponderous fish that can produce ten pounds of caviar—worth as much as $500 a pound on the retail market—it amounted to a death sentence.

In 1985 low water in Missouri's Table Rock Lake exposed 15 dead paddlefish, their stomachs split open, their heads and tails tied together, and the carcasses weighted down with rocks. So many similar instances occurred that in 1987, at the Turn It Loose Bar near Missouri's Harry S. Truman Reservoir, two undercover agents joined paddlefish poachers in the shadowy business of contraband caviar.

They found that at least 4,000 paddlefish were killed that year. One poacher boasted of clearing $86,000 in five nights. When the agents emerged in 1988, 23 people faced 200 state and federal charges. At the top of the list was a prominent politician. But the market for paddlefish roe continues to grow.

IN THE COLUMBIA RIVER, the great fishery of the Pacific Northwest where fishing-rights issues simmer constantly, the roe and meat of salmon, sturgeon, and steelhead trout are worth enough money to fuel large-scale poaching. Native Americans claim treaties protect their freedom to fish in their original territory. Court decisions over the decades have reaffirmed the treaties, and

DAVE HALL

non-Indian impact on fisheries—commercial take, dams, and pollution—has further reduced the catch.

"Ten years ago I worked for the biggest mover of steelhead from the Northwest to New York City's Fulton Fish Market," boasts a Seattle-area veteran illegal fish broker. Apprehended and convicted, he now acts as an informant. "I shipped 20,000 pounds a day. Had 14 aliases going at once. You don't need an ID to get a license. I had the Indians protecting me, erasing and reusing fish tickets to hide the real numbers of fish I was buying.

"In the past ten years Washington's natural spawning runs are down 75 percent," he says, pointing to a chart. "I'd say the illegal take is responsible for a third to a half of that."

The spawning of sturgeon has been so drastically reduced in the Columbia River's Bonneville Pool that biologists are gravely concerned about the future of the fish. Washington wildlife officer Ron Peregrin agrees. "It is illegal to catch fish longer than six feet there, because that's the size when they begin to spawn. Now the spawners are disappearing. The direct implication is the illegal harvest, particularly of the roe."

Tonight a full spring moon, bright as a stadium light, shines down the broad Columbia. With the informant as their front man, agents posing as fish buyers drive to the river to buy into the illegal trade. Each night Indians bring in boatloads of illicit sturgeon—outsize or shorter than four feet. They throw back only those too small to have a commercial value.

BILL COOK, NATIONAL PARK SERVICE (ABOVE AND BELOW)

Spoils from the slaughter, animal parts are prescribed by doctors practicing traditional Asian medicine. To treat indigestion, fever, hemorrhoids, and a litany of other ailments, doctors recommend gallbladder from a bear. After the fist-size galls are hung out to dry (left), they are diced, mixed with wine or liquor, and ingested. For sustenance and strength, doctors suggest tea steeped with sliced elk antlers, available at Asian medicine shops in the U. S., on the streets of Seoul, South Korea (below), and elsewhere in Asia.

In a less therapeutic vein, bear paws (below, middle) are boiled to make bear-paw soup, another Oriental specialty. In Alaska, where native peoples may legally kill walruses and sell handicrafts fashioned from the animals' tusks, raw ivory (far left) can still be obtained by nonnatives—illegally and for a price. Valued at 200 million dollars, the annual U. S. illegal wildlife trade represents a hefty slice of the 1.5-billion-dollar worldwide market.

ALAN BARKER

In the beam of a flashlight the agents measure their truckload of purchased fish. Two out of 18 are legal size. Still alive—sturgeon can take four days to die—one stands out. She is eight feet long (two feet over the legal limit), 390 pounds, and more than 60 years old. She will be sold to an illegal fish broker in Tacoma, a sacrifice agents must make for a solid case. Seattle FWS agent Dick Lichtenberg studies the fish sadly.

"That fish was here before the Grand Coulee Dam," he tells me. "She survived the hooks and nets, didn't succumb to the logging, the industrial waste—and then some dirtbag nets her and throws her out of the water illegally."

The meat will be taken by airfreight to the East Coast, the roe to Europe. The market is substantial. Washington State wildlife agents continue to broker hundreds of pounds of illegal fish, building a case that promises to tighten fishing regulations and strengthen fish populations in the Northwest.

PROFIT IS ONLY ONE of the motives behind the illegal traffic in big-game animals in the United States. Another is the obsession by some to possess, at any cost, these symbols of power and freedom.

Bill Day, a Texas banker, wanted a trophy so badly he paid $20,000 for record-book white-tailed deer antlers, which he then proceeded to have mounted on the skull of a Mexican deer.

"Day had his picture in *Outdoor Life* for getting the biggest Mexican nontypical

whitetail ever," says Joel Scrafford, a senior FWS agent for Montana and Wyoming. "He got to portray himself as the big guru to whitetail hunters." The real story came out when Canadian officials recognized the antlers: They had been stolen from a Canadian taxidermy shop. Day was sentenced to five years' probation and a $20,000 fine.

During the fall hunt Pennsylvanian William Heuer's elk and deer don't make the record books. He pressures his Montana guide for an under-the-table hunt. He illegally buys a resident's license but doesn't know the salesman is Montana's undercover agent, "Roy."

"I consider myself a sportsman, whether anyone else does or not," Heuer tells Roy, who is taping it all with a hidden recorder. At dark, in a no-hunting area on the edge of Yellowstone, Heuer sets his gun on the hood of Roy's truck and aims at a huge bull elk. He has instructed the guide to fill a plastic bag with blood and let it drip from the legal area to the illegal kill. The shot rings out.

Months later, Roy's tape blasts the sound of the shot through the quiet of a federal courtroom. Members of the jury flinch. They look at Heuer. The tan, trim, steel-haired man in a pin-striped suit sits impassively. The recorder is switched off.

The jury doesn't know that Heuer has prior convictions in two other states. But their decision is quick: guilty of one Lacey Act violation. His federal sentence is three years' probation, $13,300 in fines, and 200 hours of community service.

Founded by Theodore Roosevelt to recognize exceptional hunting skills with fair-chase criteria, the prestigious Boone and Crockett Club publishes a record book of trophy animals. "Trophy hunting does not appreciably affect wildlife populations," executive director Lawrence Means says. "Nearly 1,900 record-book trophies were entered in the past two and a half years alone, which suggests big game populations are doing well."

But so are hunters, getting into places

In the hands of serologist Wayne Ferguson, a frozen bobcat is still a valuable one. At the new National Fish and Wildlife Forensics Laboratory in Oregon, its blood and tissue samples will augment a comprehensive data base designed to help investigators answer such questions as: Does the blood on a poacher's pants come from a bear—or a protected bobcat?

Set for the night shift, Buckshot—a decoy for Delaware's Fish and Wildlife Division—will stand rigid in a poacher's spotlight, just like a real

deer. When poachers shoot, they get arrested. Says Capt. Rick Burritt, "Buckshot never complains about the pay or the working conditions."

nobody could reach before. "Teddy Roosevelt and the Boone and Crockett Club," Roy says, "would not condone the illegal use of aircraft, laser night scopes, one-million-candlepower spotlights to transfix deer, two-way radios, silencers, poison, or all-terrain vehicles. We're losing a lot of quality wildlife."

"Seventy percent of my caseload involves trophy poaching," FWS agent Scrafford says. "They're killing off the biggest, the best of the gene pool for future generations."

Not so, declares Warren Parker, former president of the Safari Club International, the largest hunting organization in the world. "Trophy hunting doesn't affect animal populations. It actually works for the good. It takes the old animals out of a herd."

Until 1990 the Safari Club's most coveted award was presented for taking the top 27 game animals of North America. Public criticism persuaded the board to drop the award because the list included three protected species—the walrus, polar bear, and jaguar. It is illegal to import or hunt them in the United States. Parker, a top-27 winner, was convicted of a misdemeanor in 1985 for illegally transporting the skin of an endangered Mexican jaguar.

TROPHY-SIZE ANIMALS have become so rare in the wild that "people are hitting the parks hard now," says agent Scrafford. In his zeal to acquire a Roosevelt elk trophy, a former Safari Club chapter president contacted an outfitter about hunts in Washington's Olympic National Park. "He wanted to skip the hunt," the outfitter, an FWS undercover agent, tells me, "and just have the elk delivered to the Seattle airport."

In competition for record-book animals, hunters will pay guides huge prices for trophies. "That creates unethical business relationships between the guides and those hunters whose skills and ethics are not developed," says FWS agent John Cooper. "It puts tremendous pressure on guides to produce."

Alaska state trooper Sgt. Joe D'Amico says, "Last year we cited 6,000 hunting and fishing violations, and we have only 66 field officers in all Alaska. That indicates the magnitude of the poaching problem."

For one of the most prized trophy targets, North America's wild sheep, hunters are willing to pay more than $100,000 at auction for the year's last legal Montana permit. "You don't see bighorn sheep over eight years old any more," says agent Scrafford. "For 30 minutes of work, I can get at least $3,000 for a bighorn trophy. People invest in record-book trophies like art collectors collecting Remington bronzes. Hold one for five years, and it can be worth $50,000. People poach on speculation now."

One of the most valuable live animals today is the elk, for the antlers alone. American elk antlers (especially illegal ones taken from national parks where the forage has no chemicals) are number one with South Koreans. "Apothecaries sell them in Seoul," says Montana antler dealer Don Schaufler. "They slice them paper thin, boil ginseng and herbs with them, then squeeze the blood out of the horn. It's like a tonic—they believe it wards off flu and colds."

Elk produce new antlers each year, worth $140 a pound in the blood-filled velvet stage. The resulting boom in elk ranching has encouraged illegal trapping of wild elk to stock the ranches. At up to $16,000 a head for a legally purchased animal, high prices make the temptation to trap wild elk palpable.

In a landmark case Leo Smith, the manager of the Chama Land and Cattle Company, faces a lawsuit from New Mexico for stealing state property. Smith, a small volcano of a man, a cigar perpetually clamped between his teeth, is charged with 99 felonies, including larceny, racketeering, and embezzlement. The company is accused of stealing and transporting out of state 250,000 dollars' worth of migratory wild elk.

States are rethinking the wisdom of game ranching. (Washington has already outlawed it.) In the West dozens of game ranches have sprung up in the past decade. Wyoming law bans private ownership of game animals and can prohibit importation of exotic species. The state is being challenged by one heir of the Campbell Soup fortune, who has been denied permits for a large game ranch. But as the debate continues in other states, the market for game ranches grows.

Meanwhile, Valerius Geist, professor of environmental science and biology at the University of Calgary in Alberta, predicts that game ranching will have lethal results. By November 1990 a major outbreak of bovine tuberculosis had spread through Canadian game farms, traced, says Geist, to elk brought

American-style caviar—eggs from the rare freshwater paddlefish—was seized in 1989 in Missouri, where commercial taking of paddlefish is illegal but seductively lucrative: The roe from a large female may retail for as much as $5,000. Sentencing three defendants in this case, a federal judge said, "We can no longer tolerate the destruction of our nation's natural resources for the short-term profit of a few."

BOTH BY LARRY KECK, U. S. FISH AND WILDLIFE SERVICE

in from Montana. The highly contagious disease is fatal to animals and is debilitating and difficult to treat in humans.

The disease spread faster than anyone anticipated. By February 1991 nearly a hundred Montana and Canadian game farms were placed under quarantine, and several herds were destroyed. By April, 11 people tested positive, and the disease had spread to cattle and pigs. "The tragedy," says Geist, "is that Canadians have lost the advantage of TB-free status for their cattle, meaning the loss of potential markets. The cost is estimated to go into the hundreds of millions of dollars."

FOUR MAJOR FLYWAYS funnel migratory waterfowl from Arctic regions to Mexico and South America, and from beginning to end illegal killings are withering populations. In a Corpus Christi, Texas, shopping center, surrounded by duck decoys, packed boxes, and framed artwork, a federal agent and I sift through stacks of court records. The papers document a three-year undercover investigation on the Gulf Coast of Texas that brought charges against 210 people for 1,300 violations. The store we are in sold wildlife art but was really the front for the Texas Takedown, the biggest waterfowl

MARK S. TAYLOR, THE ALBUQUERQUE TRIBUNE (LEFT AND ABOVE)

The end of the game for outfitter-turned-outlaw Bobby Coombs came in 1989 when he was arrested and handcuffed in Raton, New Mexico (bottom). To gather evidence on Coombs's interstate hunting scam, undercover agent "Hank" signed up for a bear hunt. Coombs led Hank to Colorado and, without a valid license, used garbage to attract a bear, which dogs treed and Hank shot (above). Then Coombs trucked the carcass across the state line to New Mexico—a federal offense. For this crime and two others, Coombs pleaded guilty, served eight months in prison, and is now out on parole. "Bobby's not really a troublemaker," says case agent Tim Barraclough. "He just took the lazy way out."

So do other hunters, from thrill-seeking weekend poachers to professionals who shoot animals from aircraft while monitoring police radios to stay a step ahead of the law. Says federal agent and hunter John Cooper, "The American public won't settle for having its wildlife only in zoos."

PAT DAVISON, THE ALBUQUERQUE TRIBUNE

undercover operation in history. On December 13, 1988, a hundred FWS agents—half the entire force—served papers on the violators.

"The hunters and their guides did everything illegally," says the agent, who asks to remain anonymous. "Shot too early and too late in the day, used lead shot and electronic callers, shot over bait, left crippled birds to die, and herded birds with airboats. It's been going on like this for years."

Bored with waterfowl, the hunters blasted kingfishers, killdeer, ibis, and red-tailed hawks, illegally killing 2,800 birds. When 88 geese fell in one volley, one of the guides complained, "It could have been better." He happened to be one of the justices of the peace who handle wildlife cases.

Operations do not end for wildlife agents until they've been through court, and in this case the worst was still to come. So many charges stacked up against the LaBove Shooting Resort and its owner that she entered a plea bargain, offering to pay fines of $275,000, serve five years' probation, and forfeit two trucks and an airboat. The U.S. district judge's sentence: $1,975 in fines, three years' probation, and forfeit of the vehicles.

"There was laughing in the court," recalls the agent. "These people were indicted on felonies, pleaded to misdemeanors, and still got lighter sentences. The message is that it's OK to defy the law."

The extinction of the Labrador duck in the 1880s and the near extinction of a dozen other species of waterfowl compelled the United States and Canada to sign the Migratory Bird Treaty Act of 1918. The enactment of kill limits and the ban on commercial market hunting helped remnant populations of birds begin a slow recovery. Today waterfowl populations have collapsed again, down 60 percent from the 1940s, and continued loss of habitat and chemical poisons have drastically reduced the chances for revival.

But tradition lingers. For generations many in the small community of Tangier Island in the Chesapeake Bay have supplemented their income with duck hunting. Tangier native Donald Thorne's grandfather was a market hunter, and until he was jailed for poaching, Thorne was a guide for wealthy hunters who ignored the limits. He also sold birds illegally.

"I've been doing these things since I was 14," says Thorne, 36. "I've sold to every man around here. When that gets in your blood, it's just like an alcoholic. You can't get it out."

Federal wildlife agent Dave Hall is videotaping Thorne as he says this, to show to schools and hunting groups. When Hall realized that poaching was a social problem, he launched a crusade he calls Poachers to Preachers. "The poacher is a folk hero in his community," says Hall. "The answer is to get the violators to help change the attitudes of their neighbors."

Royley Folse, one of Hall's converts, served six months in a Louisiana federal prison for a one-day killing spree that netted over 600 protected yellow-crowned night-herons, locally called *gros-becs*, a prized food. A charismatic, compact man in his early 40s, Folse and his wife, Theresa, sit with Hall and me in the prison lobby before his release.

"Where I live, you were very important if you came out with a bunch of ducks or gros-becs," Folse says. "How many ducks did we kill? Until we got tired or ran out of shells."

BESIDES MIGRATORY WATERFOWL, nearly all birds except starlings, house sparrows, upland game birds, and feral pigeons are protected by U.S. law. An international fascination with Native American artifacts fashioned from feathers has focused a demand on eagles, hawks, owls, scissor-tailed flycatchers, anhingas, flickers, even bluebirds and magpies. A golden eagle tail may go for $260; kestrel and flicker hatpins, $10; a scissortail fan, $700.

"We have an annual million-dollar black market in eagle feathers in the West right now," says FWS agent Scrafford. "Most of them go to Japan, Germany, Britain, and Eastern Europe, to history buffs and cowboy-and-Indian clubs."

It is illegal for anyone to buy or sell eagles or their parts in the U.S., and only Native Americans are allowed to possess the feathers. The National Eagle Repository in Ashland, Oregon, stores frozen carcasses sent in from wildlife agencies around the country. The repository supplies about 800 requests a year from tribes for eagle carcasses and feathers. Yet a large underground trade moves on and off reservations throughout the country. A Montana trading-post owner tells me, "Indians offer me eagle feathers at least three times a week, five dollars each. They are desperately poor people."

Seattle agents attached radio transmitters to

Getting to the bottom of the illegal bald eagle trade, federal agent Larry Keeney worked undercover in Washington State as a taxidermist. He hid radio transmitters inside mounted eagles and sold them to a suspected smuggler, who stashed the birds inside a legally mounted black bear. Before it could be shipped to collectors in Japan, Keeney swooped in for the seizure, here reenacted.

BOTH BY ERIC LARS BAKER

two illegal stuffed eagles in a taxidermist's shop. One transmitter surfaced later, inside a mounted elk being shipped to Japan. "We opened the elk up, and there were five eagles inside," says West Coast FWS special agent Dave McMullen.

Alive, raptors are worth thousands of dollars. During a four-year undercover operation federal agents and an informant, Jeff McPartlin, penetrated a black market of endangered peregrine falcons, gyrfalcons, goshawks, and Harris' hawks that stretched from the Alaskan Arctic to Saudi Arabia.

"In 16 months two Canadian smugglers netted $750,000 on North American birds," says McPartlin. "They stole a hundred birds in one season alone. They also smuggled eggs by taping them to their bodies, outfitted briefcases with incubators, and recycled ID bands to get birds through customs. The treatment of the birds was atrocious." The bands are used to identify captive-raised birds, which are legal to export.

Although more than 50 people have been convicted in Operation Falcon, the key figures of a worldwide smuggling network are still at large: members of the Ciesielski family of Cologne, Germany, who supply raptors to wealthy Japanese, European, and Arabian falconers. "Lothar Ciesielski paid me $7,000 cash for one white gyrfalcon," says McPartlin. "He resold it immediately for $135,000. They call these birds feathered cocaine."

COLLECTORS OF REPTILES are a specialized lot, like falconers, and competition for rare specimens provides a keen market for contraband. Ten years ago FWS agents set up a storefront operation in Atlanta, Georgia. They discovered hundreds of thousands of U. S. reptiles were being stolen from the wild every year. It's illegal to ship snakes through the mail, but 100,000 are mailed each year. About 60 percent of them die. Destinations include Japan, Belgium, Czechoslovakia, and Britain.

"Human commercial activity," says Dez Crawford, founder of the Reptile Defense Fund, "has put the populations of at least four dozen indigenous American snakes and amphibians on the threatened list. The pet trade is no longer the primary culprit in species decline," she adds. "Fashion fads are now number one." The U. S. demand for Indian python boots like John Travolta's in *Urban Cowboy* and reticulated python jackets like Paul Hogan's in *"Crocodile" Dundee II* have endangered both species.

It's against the law to pour gasoline down holes to flush denning snakes, but that's the most popular way to collect them for Texas rattlesnake roundups. The method has side effects: Gas poisons water and kills den-sharing turtles, tortoises, and burrowing owls. Purging the land of these necessary predators upsets the balance of nature. Crawford says the depletion of western diamondback rattlers by rattlesnake roundups costs farmers 25 million dollars a year in crop loss to rats, mice, and rabbits, not counting the price of pesticides to replace the snakes.

WORLDS AWAY, in Alaska's Bering Sea, walruses and their tusks have become the focus of a frantic, escalating trade. "What poachers did to the elephant is a blueprint for what could happen to the walrus," says Dave Cline of the National Audubon Society.

The Marine Mammal Protection Act of 1972 makes it illegal for non-Native Americans to hunt or sell walruses, seals, sea otters, sea lions, or polar bears. So, many white dealers use Alaska native people to disguise unlawful ivory trade. Other outlaws claim skins and ivory were taken before 1972. Alaska FWS agent Wally Soroka says that the tonnage of old inventory never seems to diminish, but it's hard to prove when ivory was obtained.

In remote outposts like Nome, Alaska, the illegal ivory trade is blatantly casual. "I buy raw ivory," a Nome merchant tells me. "Sell it back to native carvers. Been doing that for years, and they haven't caught me yet." By law native carvings must be traditional, but he shows me a carved ivory nut and hollowed-out bolt. "It's for a cocaine stash," he laughs.

To kill walruses for ivory, some natives drive motorboats out to ice floes, shoot the animals with semiautomatic weapons, and cut off the heads of those they can retrieve, although "wanton waste" is illegal in Alaska, as in most states. Half the animals sink, washing to shore in the spring. In 1988 approximately a thousand walrus bodies washed up on St. Lawrence Island; nearly all were found headless.

"It wasn't until you guys came up here with a monetary system that this started happening," Darryl Trigg, vice president of the Nome Eskimo Community, tells me.

On a hunting holiday four men from Florida and Alabama arrived in Montana in 1989 and left carnage behind. They allegedly shot 27 antelope and 3 deer, far more than their legal limit, and removed only the choice animal parts—the hindquarters and backstraps—leaving the rest to rot (left). Although these species are not endangered, such wanton waste infuriates Montana undercover agent "Roy," who denounces "the total lack of concern for wildlife."

Roy, who collected the evidence (above) and posed as an outfitter (below), is a former vice-squad officer. "When I worked prostitution, gambling, or narcotics, the crime got committed and I made the arrest. But when investigating wildlife violations, I get more involved, because it's not immediately obvious who is a legal hunter and who isn't." In this case, he got a close look. "They were fairly well-to-do businessmen," he says. Their airport departure, though, wasn't business as usual (next page).

AGENT'S IDENTITY INTENTIONALLY OBSCURED

"People can't get by without selling ivory."

Few of the walruses killed are used for meat or waterproof clothing any more: A large head with tusks brings $1,000; five buy a new snowmobile. "Young men jump on a plane to Anchorage to get $200 worth of drugs for $5,000 worth of ivory," says Trigg. Though raw ivory is illegal to sell, it changes hands like currency, buying gas, groceries, drugs, liquor, even airfare. "Some people have turned subsistence into an unrestricted slaughter," says FWS special agent Gary Mowad.

You can find ivory in practically every store in Alaska, and often sealskin, baleen, and walrus penis bones, called *oosiks*. In a gift shop of the Hotel Captain Cook in Anchorage, next to a $2,000 walrus trophy head is an oosik, for sale for $135, in a locked case. What are they used for? "Conversation pieces," says the salesman. "That's it."

The unlawful killing of marine mammals is difficult to track, but agents say the take is widespread. Valuable skins of sea otters are surfacing around the world through a quiet, lucrative black market. Some buyers pay huge amounts for live sea otters for their aquariums. Agent Soroka recently seized 13 polar bear skins from one individual in Anchorage who was selling them for as much as $4,000 each.

To protect its wildlife, the nation has fewer than 200 federal agents and about 7,000 state officers—about half the Chicago police force. "Knock one bad guy down and ten step forward," says FWS agent Terry Grosz. "I think Custer had better odds."

THERE ARE SUCCESS STORIES. Creatures have survived illegal pillage and made strong comebacks when enough human resources were directed at a single species. Poaching threatened the survival of the American alligator two decades ago, but continuous law-enforcement operations and closely monitored harvest and trade controls brought it back. Hunters—who almost poached themselves out of a market—were making only $2.50 a linear foot in an illicit skin trade controlled by buyers. Now, legally, they make more than $60 a foot for the skin, and one skin averages seven to eight feet.

The black market hasn't stopped completely, but, says FWS agent Dave Hall, "alligators are plentiful again. People can look back and see how harmful and unproductive poaching really was."

Arrested at a Montana airport in 1989, this poacher and three partners pleaded guilty last June to shooting more than the legal limit of antelope. As wildlife agents and prosecutors scramble to bring violators to justice, most poachers go undetected, leaving America's wildlife on the run and under the gun.

Agents say people are responding; poaching hot lines in every state have become major sources of information. If the drain on wildlife is to be reversed, it is this kind of grass-roots intervention that will be the most effective.

States are working to strengthen penalties and standardize laws to prevent the smuggling of animal products. Artists like Bill Pease on Montana's Crow Indian Reservation are making bear claws, teeth, elk antlers, and skulls from plastic resin. A Japanese pharmaceutical firm is working on a synthetic substitute for bear galls.

A hope for the future is the National Fish and Wildlife Forensics Laboratory, which is dedicated to suppressing world wildlife crime. In its storeroom—like seizure rooms in every fish and game office throughout the country—the shelves are piled high with thousands of seized animal products, many from endangered species. In Ashland, Oregon, top scientists in many fields, including chemical analysis, serology, and morphological studies like feather identification, have come together to work for what they call "a new lab in a new frontier."

By this autumn, evidence analysis will be able to trace a tanned, dyed, and glued leather purse back to the animal; identify cut and frozen meat; trace a bloodstain to a specific deer. The lab's mission is to strengthen legal cases; in the past the difficulty of proving the origins of animal products has stymied cases against poachers.

"We have a time limit. It makes us anxious," says Miami FWS agent Dean Freeman. "When we're talking about wildlife, we're talking about something our children might not see." Poachers take away more than the animals; they take away a freedom for lawful hunters and undermine an already precarious natural balance. They take beauty and leave only waste. □

National Geographic EXPLORER will rebroadcast its four-part series "Wildlife Wars U.S.A." during November, on Sunday nights at 9 p.m. E.T. on TBS SuperStation.

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THE PRESIDENT'S REPORT ON THE

Education Foundation

Dear Members:

Over the past few years, I've spoken enthusiastically about teachers who participate in the Society's campaign to improve geography education in our schools. There is another group whose involvement is equally meaningful—parents.

I'd like to share with you three reports that highlight the crucial role parents play in this effort. I am pleased that the Society has been able to be a part of these activities and pledge that we will continue to look for ways to encourage family involvement in education.

Gilbert M. Grosvenor
Chairman and President

BOTH BY MARK THIESSEN

Parents Can Be Teachers Too

To help her son David prepare for the National Geography Bee this year, Carol Stillman turned to the computer on their family farm in Nezperce, Idaho. Whenever she got a few minutes, she would type in facts until she had created a data base of information for him to study.

It must have done some good, because 14-year-old David (top, at left) didn't miss a single question on May 23 at the national finals, moderated by Alex Trebek (above right). David won a $25,000 scholarship for first place. Carlos De La Fuente (top, at right), 12, of Chandler, Arizona, took second place and $15,000. Eliot Brenner, 14, of Richmond, Virginia, won third place and $10,000. Some five million students took part in the Bee, sponsored by National Geographic WORLD, Amtrak, and Kudos Snack.

Gathered in the gymnasium of Mary Maguire Elementary School in Mount Pleasant, Michigan, 190 children and parents participated in an evening of hands-on geography instruction in May. Using inflatable globes, laminated maps, and videotaped news broadcasts about the Kurdish refugee crisis, they discussed the effect of distant events on the rest of the world.

At the end of the evening each family left carrying a map and a contract, signed by the student and parent, pledging to view and discuss the news together once a week for a period of ten weeks. The project is being sponsored by the Michigan Geographic Alliance and the Michigan Council for the Humanities.

Fourth- and fifth-grade students at Monte Vista Elementary School in Santa Ana, California, helped their parents test a Spanish supplement to the NGS Kids Network last February. As the students eagerly shouted directions—in both Spanish and English—parents gingerly tapped out commands on computers. For many it was their first time at a keyboard.

The program, which is funded by the Telecommunications Education Trust of California, aims to make science more accessible to the growing number of Hispanic children in the state. Said one parent: "It makes me happy to see the wonderful opportunity my child has to learn about computers."

Karen Economopoulos' Kindergartners Count On Each Other To Find The Right Answers.

They also count on building blocks, buttons and whatever else they can think of. That's because in Karen Economopoulos' kindergarten, using different strategies for problem-solving is part of her "Show and Tell Math Conference."

The conferences began one day when four of Karen's twenty-one kindergartners at Fayerweather Street School in Cambridge, Massachusetts were absent. She challenged the children to find ways to determine that day's actual attendance. How many children were there? How many were missing? How do you find out?

It wasn't an easy problem. Keeping track of a count, representing it, and using the concept of one-to-one correspondence are challenging tasks for five-year-olds.

One child made a tower of 21 blocks, removed four and counted those remaining. Another gave each child a button, then collected and counted them.

"Children listened to each other, challenged each other, and grew more and more confident as they saw their own solutions backed up by many different strategies for arriving at the same answer," said Karen. "The conference is a tool for finding out how young children think, and helps me gear subsequent work to the appropriate level."

These ongoing conferences also show the kind of innovative thinking that makes State Farm proud to honor Karen Economopoulos with the Good Neighbor Award. We are also delighted to contribute $5000 to Fayerweather Street School in her name.

Karen Economopoulos. A good neighbor you can really count on.

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Good Neighbor Award

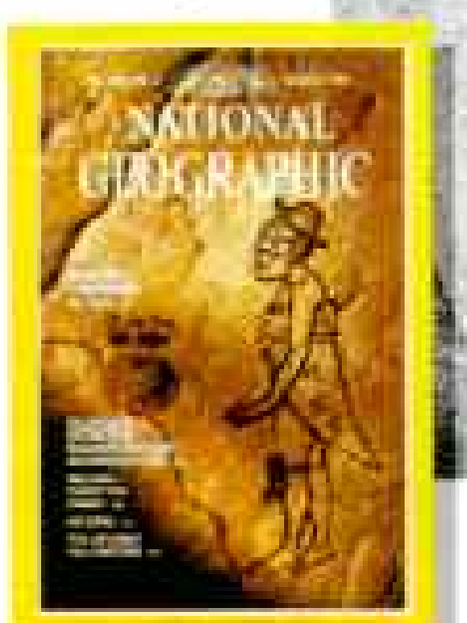
The Good Neighbor Award was developed in cooperation with the National Council of Teachers of Mathematics (NCTM).

Geographica

Vandals Ruin Maya Art in a Guatemala Cave

Vandals in Guatemala have damaged 23 of the 90 known drawings in Naj Tunich, the only cave yet found that contains a large body of Maya inscriptions and artwork. Among the defaced drawings is a figure called the ball-player (right), which appeared on the cover of the August 1981 NATIONAL GEOGRAPHIC with an article reporting the cave's discovery.

JAMES E. BRADY



American archaeologist James E. Brady, who directed one investigation of the site and has continued to study the cave with Geographic support, announced the vandalism in the Society's scientific journal, *Research & Exploration*. In some cases mud was smeared across drawings; others were scratched or struck with a hard object. Some were wiped completely off the wall. Brady reported no signs of looting in the attack. Guatemala has now tightened security at Naj Tunich.

"Archaeologists who work for years at a site form a bond with it that is intense and personal," says Brady. "For me the job of checking the inscriptions, drawing by drawing, was like conducting an inquest for a murdered friend."

Trailing a Precocious Arctic Wolf Pup

They called him Superpup. L. David Mech, a U. S. Fish and Wildlife Service biologist who has been studying wolves on Ellesmere Island in the Arctic since 1986 (GEOGRAPHIC, May 1987), marveled at the newborn wolf he and a colleague found on a 1990 visit.

"He was runty, he'd have to take ten steps for every adult step, and tundra hummocks were like hills to him," Mech says. "But he kept up."

Mech has been studying the pack since his first trip to Ellesmere. Last year it included only three adults—Mom, the major breeding female in past years; Whitey, Superpup's mother, first seen by Mech in 1987 and now in her first year as a breeder; and Left Shoulder, the alpha male since 1988.

Wolves usually bear litters of four to six, but Superpup was the lone 1990 infant. Mech doesn't know if he was a singleton or if siblings died at birth. But he is convinced of Superpup's precocity. The pup moved from a den to a rendezvous site at seven weeks, a week earlier than normal, and took trips of more than eight miles with the pack, seven and a half miles more than pups Mech had observed before.

L. DAVID MECH

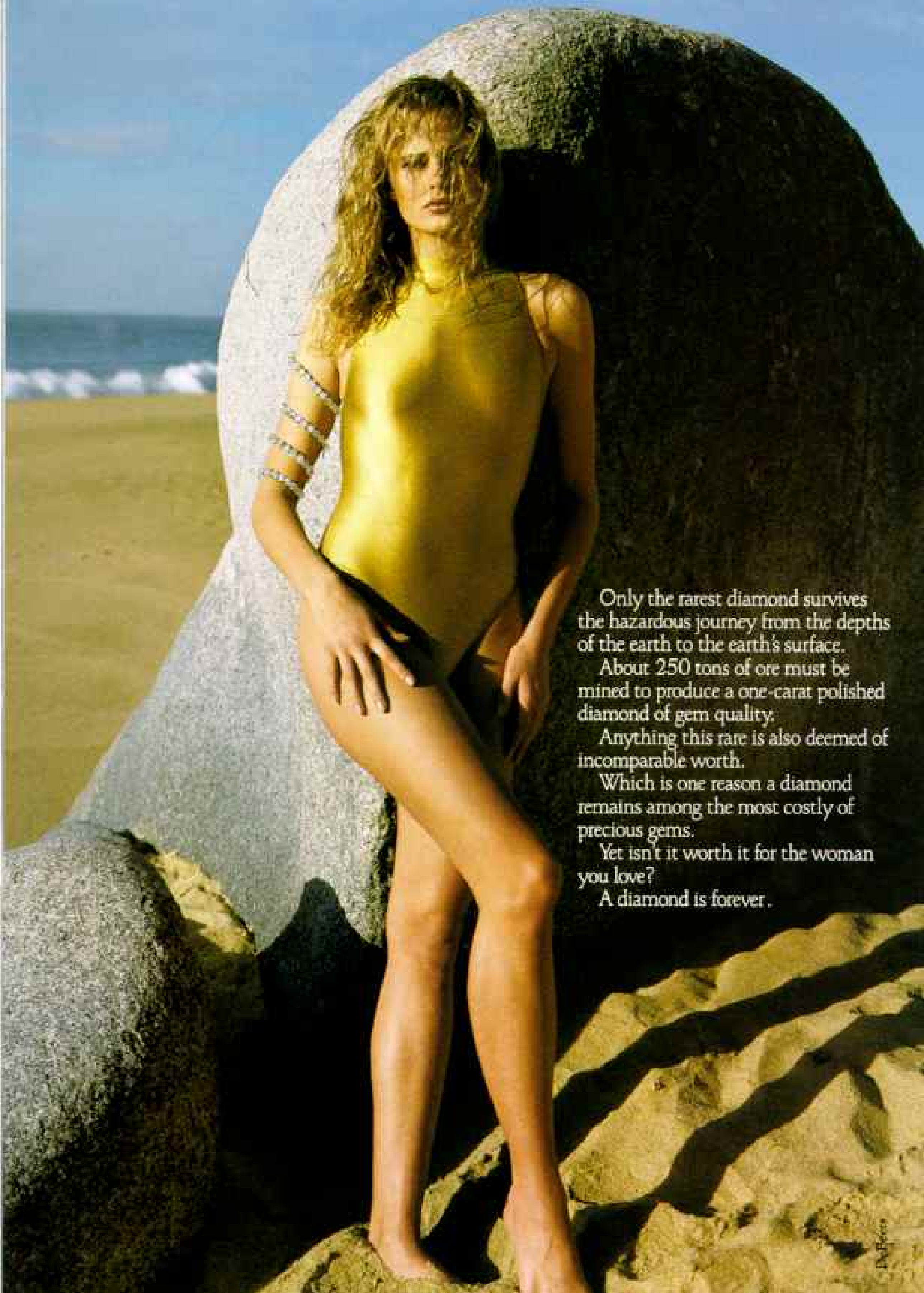
Modern Arthritis Form Found in Neandertals

Scientists have found evidence of a modern type of arthritis in the bones of Neandertals known to have lived 40,000 to 54,000 years ago—the oldest documentation of calcium pyrophosphate deposition disease (CPPD) in humans.

A study of the remains of three Neandertals (GEOGRAPHIC, October 1988) from La Chapelle-aux-Saints in France and six from Shanidar in Iraq turned up signs of CPPD in the bones of one skeleton at each site. CPPD is characterized by deposits of certain calcium crystals in the joints.

Bruce Rothschild of the Arthritis Center of Northeast Ohio studied the remains with Pierre Thillaud of the Musée de l'Homme in Paris. They found that the CPPD in the ancient bones is similar to a genetically caused modern variety. If the

A mere 250 tons.



Only the rarest diamond survives the hazardous journey from the depths of the earth to the earth's surface.

About 250 tons of ore must be mined to produce a one-carat polished diamond of gem quality.

Anything this rare is also deemed of incomparable worth.

Which is one reason a diamond remains among the most costly of precious gems.

Yet isn't it worth it for the woman you love?

A diamond is forever.

"AT GM, WE'RE GETTING HIGH MARKS IN QUALITY FROM THE PEOPLE WE CARE ABOUT MOST."

Our customers are the people we care about most.

So it's very gratifying to learn that after thousands of miles of driving, 95% of our newest customers would recommend a Chevrolet, Pontiac, Oldsmobile, Buick, Cadillac or GMC Truck to a friend.[1]

Since satisfying our customers is GM's very definition of quality, we take this as a sure sign we're delivering it.

QUALITY PAYS

We've learned over the years that the more quality we deliver to our customers, the more satisfied they become.

That's borne out by the results of our national customer satisfaction study.

In the past six years, as we introduced more and more new cars and trucks redesigned and engineered for quality, our customer satisfaction steadily increased.

Today, GM has 99 new redesigned and engineered models.

Today, 95% of our new owners would recommend a GM car or truck to a friend.

That's more than 80% of our cars and 50% of our trucks. No wonder our customer satisfaction ratings are now the highest in our history.

And this year, we'll bring out more new models than Ford, Chrysler and Toyota combined.

That's not just new looks. That's new substance.

Quality from the inside out.

In engines. Transmissions. Electrical systems. Braking systems. Emission controls.

And we don't ever plan to stop, because the heart of quality is *continuous* improvement.

ENGINES YOU CAN COUNT ON

Our 3800 V-6 engine balances power, emission control and fuel economy with technological advances such as counter-rotating balanced shafts, electronic engine controls and sequential-port fuel injection.

Result: No U.S. carmaker builds better six-cylinder engines than the 3800 V-6 offered in many popular Pontiac, Oldsmobile and Buick models.[1]

The 4.9-liter V-8 engine in Cadillac is unsurpassed in customer satisfaction compared with any European or domestic luxury nameplate.[1]

CLEANER AIR

Today, it's not good enough to

build strong performing engines that are reliable and dependable.

Today, they must also be *clean*.

GM continues to work vigorously to minimize emissions in all of our vehicles.

So it's not surprising that GM has the lowest average emissions of all American carmakers.[2]

In fact, it takes twenty-five 1991 GM models to produce the same amount of emissions as it took *one* model to produce 21 years ago.

In air quality, it's clear, GM has come of age.

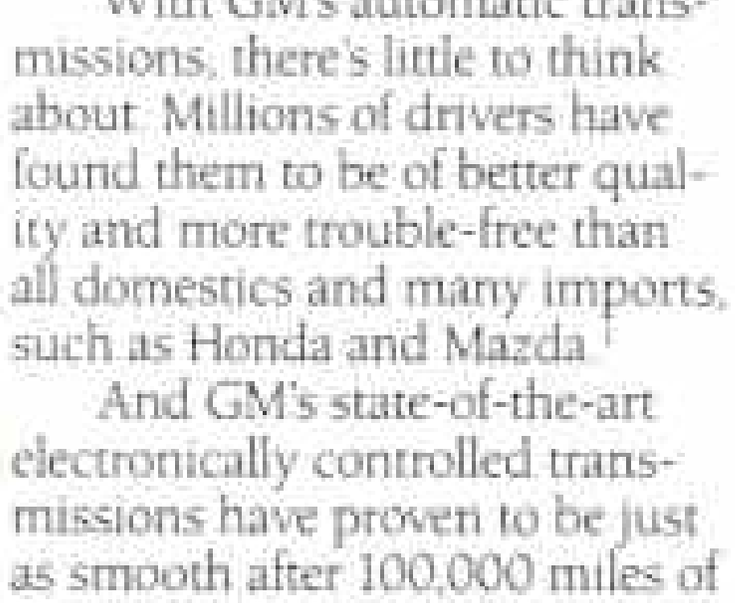
TRANSMISSIONS: TOUGH, SMART AND SMOOTH

If you have to think about your transmission, something's wrong.

With GM's automatic transmissions, there's little to think about. Millions of drivers have found them to be of better quality and more trouble-free than all domestics and many imports, such as Honda and Mazda.[1]

And GM's state-of-the-art electronically controlled transmissions have proven to be just as smooth after 100,000 miles of grueling taxi-fleet testing as when they were new.

These electronic wizards monitor a dozen different car and atmospheric conditions to perform quick, smooth shifts with maximum efficiency and utmost reliability—whether you're driving up snow-packed peaks or through heat-baked deserts.



A SURE START

The first sign of quality is a sure start.

As thousands of tests have proved, our starting power is 999% sure every time you turn the key on your new GM car.

So it doesn't matter if you're in Maine or Mexico, in January or June, your new GM car or truck *will* start.

A SAFE STOP

We are the only U.S. carmaker to design, test and manufacture brakes.

We design and test brakes to high standards for lining wear and fade-resistance.

As a result, owners of 1991 GM cars report fewer problems with their brakes than owners of Ford, Chrysler, Nissan, Mazda or Volvo.[1]

And GM offers more cars and trucks with anti-lock brakes as standard equipment than any other manufacturer in the world.

ALL PICKUPS: REAR ANTI-LOCK BRAKES

Today, GM offers an Anti-lock Braking System on all new pickups.

In panic stops, this patented GM system modulates the braking action to stop you faster and help prevent your pickup from skidding out of control—even when unloaded.

It's another reason why no American full-size pickup truck is more problem-free than full-size pickups from GMC Truck.

VALUE DOWN THE ROAD

Today, you're probably planning to keep your car or truck longer than you did in the past.

That makes long-term reliability and dependability more important to you than ever.

According to thousands of consumers, no U.S. carmaker has built more dependable cars over the past five years than GM.[1]

In addition, the cars and trucks built by General Motors have kept more of their original value, on average, than cars and trucks made by any other U.S. maker.[3]

WE CARE ABOUT YOU

Today, there's a new commitment to quality in everything we do at GM. It's a genuine caring for you and a spirit of teamwork that pervades our company—from the people who design our cars and trucks to the people who build them.

We invite you to see for yourself at a Chevrolet, Pontiac, Oldsmobile, Buick, Cadillac or GMC Truck dealer.

1. 1991 GM Customer Satisfaction Survey.
2. Based on Mobile Exhaust Emissions Standards for passenger vehicles.
3. Based on National Automotive Research Black Book for ten most recent available calendar years.

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GM

PUTTING QUALITY ON THE ROAD

Chevrolet Pontiac Oldsmobile
Buick Cadillac GMC Truck

Geographica

NATIONAL ARCHIVES OF CANADA

French and Iraqi Neandertal populations are genetically similar, they may have been related, Rothschild says.

People with CPPD in the wrist have trouble using their hands and gripping objects, which raises the question of how Neandertals with CPPD coped. "Did others in their group show compassion and care for them?" Rothschild wonders.

Forest's Living History Imperiled by Logging

The alerce tree of southern Chile, among the world's longest lived plant species, may become extinct if loggers continue to exploit loopholes in Chilean law designed to protect it. Living alerces nearly 2,000 years old have been found, and one stump has been dated at 3,600 years. The longest lived plant species known, the bristlecone pine (GEOGRAPHIC, March 1958), survives for more than 4,000 years.

The alerce grows to a height of 200 feet and 16 feet in diameter. It has been on a list of imperiled species compiled under the Convention on International Trade in Endangered Species since 1975, and Chilean law forbids logging of living alerces. But loggers may cut fallen or burned alerces. Because the trees are found in remote forests in the coastal ranges and Andes, the logging ban on living trees is easily evaded and enforcement is spotty, says Antonio Lara of CODEFF, a Chilean environmental group. The red alerce wood is highly prized by the wood-products industry. "It's the best quality wood in Chile," reports Lara.

Rick Klein of Redway, California, formed Ancient Forest International to raise money to buy private alerce tracts and preserve them. "It's important to save these remnants of a great ecosystem," Klein says. "They're as spectacular as U. S. redwood forests."

GALEN ROWELL, MOUNTAIN LIGHT

Hudson's Bay Company Ending its Fur Sales

Even the vice president and secretary of the Hudson's Bay Company admits it is "the symbolic end of an era." The company (GEOGRAPHIC, August 1987) is going out of the fur business.

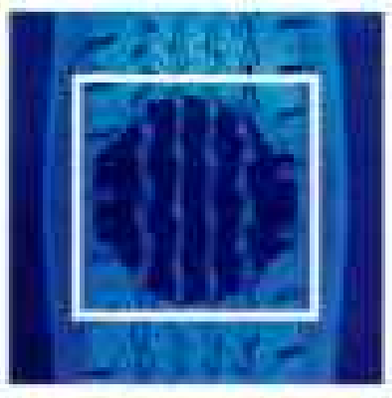
The Hudson's Bay Company—Canada's oldest corporation and one of its largest retailers—began as a fur-trading enterprise under a charter granted by England's King Charles II in 1670. Establishing outposts in the Canadian wilderness so it could trade with trappers there, the company opened up much of Canada to settlement. It has already closed all its fur auction houses in Toronto, London, and New York; now all of the firm's 400 department stores will be fur free.

Rolph Huband, the firm's vice president and secretary, says retail fur sales declined by 30 percent over the past three years and accounted for only one-half of one percent of revenue in the company's flagship Bay chain. Getting out of the fur business was "based on business economics," Huband says. "Retail fur isn't profitable."

Canada's anti-fur activists hail the decision. Says Ainslie Willock of the Animal Alliance of Canada in Toronto, "People are beginning to equate furs with animal cruelty, and they are saying they don't want it."

National Geographic, September 1991

WE'VE GONE TO THE ENDS OF THE EARTH TO HELP YOU SURVIVE A TRIP TO THE MARKET.

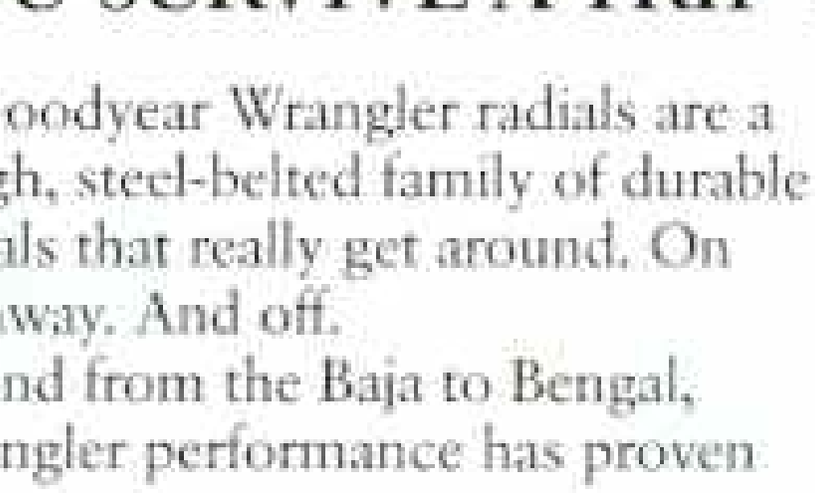


Goodyear Wrangler HT keeps you in touch with the road.

Goodyear Wrangler radials are a tough, steel-belted family of durable radials that really get around. On highway. And off.

And from the Baja to Bengal, Wrangler performance has proven to be a winner.

In fact, in rigorous comparisons against other makes of tires, Goodyear Wrangler radials have been chosen as original equipment by top manufacturers like Ford, Range Rover, Jeep and Chevrolet.



Wrangler radials are the choice of off-road racing legend Walker Evans.

And true to its family heritage, you will find Goodyear Wrangler HT to be a tough, steel-belted, all-weather radial that will give you sure handling, excellent treadwear and a smooth, quiet ride on the highway.

But no matter where you're going, on highway, off highway or merely off to work, you can rest assured that Goodyear Wrangler radials will not only take you there, they will also bring you back.

TREAD LIGHTLY!
ON PUBLIC AND PRIVATE LAND

Chevy Z71 StepSide

Jeep Wrangler Renegade

These vehicles use Goodyear Wrangler radials. You should, too.

Goodyear wins the most important tests of all.

GOODYEAR

THE BEST TIRES IN THE WORLD HAVE GOODYEAR WRITTEN ALL OVER THEM.

Geographica

RICHARD THOMPSON

Too Tired to Work? Try a Hint of Mint

A whiff of peppermint makes you alert. Sniff lily of the valley and you relax. And both fragrances, it seems, can help you work better.

These new findings on the sense of smell (GEOGRAPHIC, September 1986) were made by William N. Dember and Joel S. Warm of the University of Cincinnati and Raja Parasuraman of Catholic University.

Earlier fragrance researchers claimed that the aroma of peppermint seemed to invigorate people. Dember and Warm wondered if it also would help them perform better. Volunteers were asked to note variations in patterns on video screens. Those receiving a piped-in peppermint scent did the job better than those who did not. Lily of the valley also elicited superior performance. It wasn't just psychological; Parasuraman later found that peppermint scent really does stimulate the brain's electrical activity.

Dember envisions scents being used to counter drowsiness in the workplace. But he warns that employers should not install fragrance pumps without employees' consent; some may be allergic.

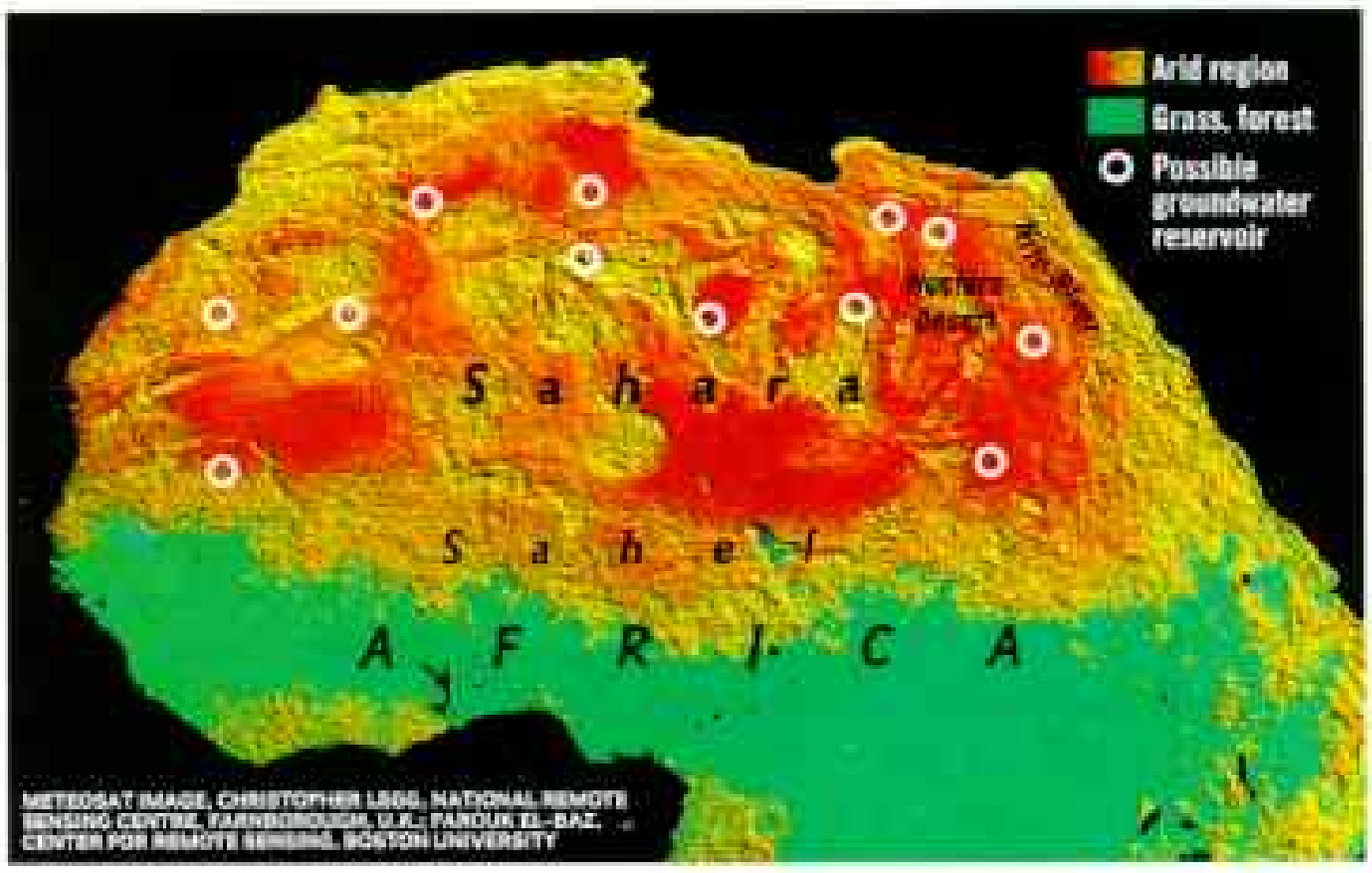
"Acting Young" to Win Kea Social Standing

Thanks to New Zealand customs agents and conservation officials who rescued eight kea parrots captured for the illegal wildlife trade, researchers had a chance to observe an astounding sight. They saw an adult kea act like a juvenile to gain reentry into kea society.

Judy Diamond and Alan Bond—husband-and-wife zoologists from the University of Nebraska State Museum whose work is aided by the National Geographic Society—have been studying keas in Arthur's Pass National Park on New Zealand's South Island. When the rescued birds were released last year, one adult male joined the group Diamond and Bond were watching.

Dominant adult keas will vigorously attack lower ranking adults foraging in their vicinity. But they generally leave juveniles alone. After several fierce battles the newcomer began to act like a young bird. He fluffed his feathers and bowed his head in juvenile fashion and soon was allowed by the others to forage at "their" garbage dump.

Diamond says the freed bird's actions hold an important lesson. It shows wildlife managers that they must take into account social behavior as well as physical well-being when they reintroduce an animal into the wild, she says.



Making a Desert Bloom With Underground Water

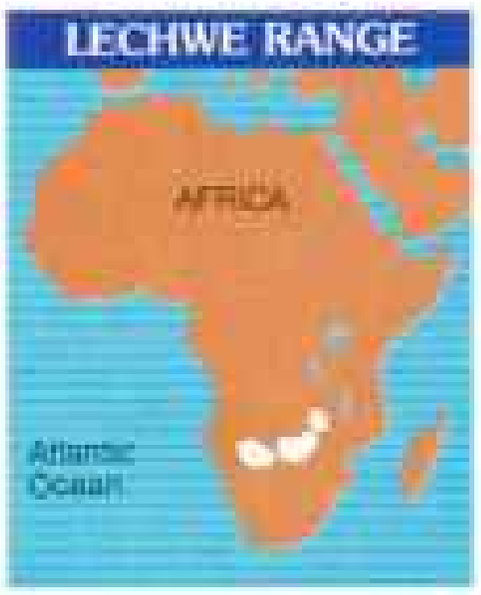
Water has begun to flow—and wheat and corn to grow—in the southern portion of Egypt's Western Desert, where satellite images and photographs taken by American shuttle astronauts revealed the possibility that underground reservoirs existed beneath the sand (GEOGRAPHIC, February 1982).

Workers have dug a dozen developmental wells in southwest Egypt to test for water potential and flow levels. Meanwhile agronomists have established a 5,000-acre farm—it soon will double in size—to see what crops can be grown in the newly irrigated sandy soil. One pleasant surprise: Wheat, which seemed unlikely to grow this far south in the desert heat, has flourished.

These aquifers in Egypt and throughout the Sahara are in sand-covered basins formed when water flowed through the area. The basins were filled in some time in the past 200,000 years, says Farouk El-Baz, head of the Boston University Center for Remote Sensing. El-Baz, author of the 1982 article, believes the Egyptian reservoirs alone could supply 200,000 acres with water for 200 years, opening up new lands for food production.

Suggestions for GEOGRAPHICA may be submitted to Boris Weintraub, NATIONAL GEOGRAPHIC magazine, Box 37357, Washington, D. C. 20036, and should include the sender's address and telephone number.

WILDLIFE AS CANON SEES IT



Lechwe
Genus: *Kobus*
Species: *leche*
Adult size: Length, 130-180 cm; tail, 30-45 cm; height, 85-110 cm
Adult weight: 60-130 kg
Habitat: Floodplains and seasonal swamps in southern Africa
Surviving number: Approx. 130,000 (includes 3 subspecies)
Photographed by Peter Johnson

Red lechwe leap gracefully across an African floodplain. Long narrow hooves enable this aquatic antelope to travel swiftly through its marshy habitat. Due to hunting or habitat loss, the three distinct subspecies of lechwe—red, black and Kafue—have all declined markedly in recent decades. Many herds that once numbered in the thousands have dropped to only hundreds; some have disappeared altogether. To save endangered species, it is essential to protect their habitats and understand the vital role of each species within the earth's ecosystems. Color images, with their unique ability to reach people, can help promote a greater awareness and understanding of the lechwe and our entire wildlife heritage.

NATURE

Watch "NATURE" on PBS, Sunday 8:00 p.m.
This program is funded, in part, by Canon U.S.A., Inc.

Canon

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Ever wo
it's called a t

In case you were wondering, this is the Honda Gold Wing motorcycle. Technically speaking, what you'd call a luxury touring bike. Our engineers designed it especially for adventurous motorcycling enthusiasts who like to cover great distances at a time.

Yet, some of the longest trips it ever makes are from our shipping docks at the Honda motorcycle plant in Marysville, Ohio.

You see, that's the only place in the world where we make them. And have for ten years. In fact, Honda was among the first Japanese companies to ever manufacture motorcycles in America. That early success helped pave the way for our automotive, power equipment and engine plants throughout the United States. A total capital investment from Honda of more than $1.7 billion to date.

nder why ouring bike?

Today, the Marysville facility is one of the most technically advanced and efficient factories of its kind. Which might explain why Honda sells more motorcycles than any other company in America. Not to mention the world.

As with any Honda product, our associates make sure each piece and part, no matter how small, measures up to Honda standards. And that's no easy task by anyone's standards.

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HONDA

Forum

Elephants

Douglas H. Chadwick's painful overview (May 1991), combined with an excellent photo essay, confirmed heartbreaking truths about these wondrous vanishing creatures. If this article does not move people to take action before it's too late, I don't know what will.

PATRICIA STOWBRIDGE-GOUGH
Abilene, Texas

If culling is necessary, it should be done by professionals in a professional manner. No economic considerations can justify the so-called sport of hunting elephants. I suggest a better demonstration of concern would be for prospective hunters to contribute the price of their safari to the World Wildlife Fund.

PAUL MCCOLGAN
Bremerhaven, Germany

Almost all the quoted experts, conservationists, and spokespersons for African elephants were of European or American ancestry. They should be involved, but there are many Africans working for elephants under far less luxurious conditions than those of the quoted Westerners. Africans poach elephants, but it is also Africans who make the most sacrifices for them. In one central African national park, I saw a stone honoring more than 25 rangers who had died defending the park, its elephants, and other wildlife.

JOHN G. SIDLE
U. S. Fish and Wildlife Service
Grand Island, Nebraska

As a third-generation, former professional hunter from East Africa, I can truly state that although the elephant is the most visible and impressive of the endangered species, many more animals are disappearing faster and may not have time to make it onto the endangered list. They will go straight to the extinct list. I suggest to Western governments that all development and military aid to an underdeveloped nation have a 5 percent provision to go toward wildlife-habitat preservation.

R. PALMER-WILSON
Essen, Germany

All animals have as much right to inhabit this planet as we do.

STEVE GABRIO
Everett, Washington

I was shocked to learn that the Kenya Wildlife Service has a policy of shoot to kill regarding suspected poachers. I agree that poaching should be stopped but not with such a "frontier justice" approach. It's as if the value of a human life has fallen below that of an elephant's.

PATRICK CARPENTER
St. Paul, Minnesota

Chicago

Richard Conniff's description of Chicago neighborhoods demonstrates that our inner cities have the potential to offer a humane and diversified lifestyle and avoid decline. It is a message of hope for all architects, urban planners, and design professionals who strive to make cities a good environment to live in.

GEORGE P. MELAS, A.I.A.
Marietta, Georgia

In your article a Vietnamese person living in Chicago said, "We are Midwesterners." This comes close to my dream for this country, the day we all will say "I am an American."

RICHARD BUTSCH
Piqua, Ohio

Chicago has so many worthwhile attractions and things to do that a listing would be endless. Why was the subject of fashion-show bars thrown in? These bars are a disgrace to their communities. Trying to close down such establishments is an alternate career for many concerned citizens. The photograph condones the behavior as lighthearted, lunchtime entertainment.

DANIEL D. and DONNA L. JUDAY
Melrose Park, Illinois

You state that 41 percent of the population is African American and 18 percent is Latin American, yet three-quarters of the photographs feature people of European extraction. Only one shows Latin Americans. Five pictures show African Americans, including a shoeshine boy, a street musician, a doorman, and men eating hot dogs. What we need is a better mirror to see ourselves.

PETE LEKI
Chicago, Illinois

As a public school teacher, I resent the remarks made about public schools. Of course private schools can claim remarkable results. After all, where does principal Paul Adams send students who don't want to handle three hours of homework? To the public schools. Give public school teachers the same powers and be assured of comparable, if not better, results.

WILLIAM JOSEPH MILLER
Los Angeles, California

Bhutan

Has half the population of Bhutan recently left the country? My children's *National Geographic*

JOHN STOBART

A TIME-LIMITED PRESENTATION

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Picture Atlas of Our World (1990) indicates a country of 1,534,000. The May article lists "approximately 700,000."

JOEL A. BOTTESINI
Holliston, Massachusetts

The government of Bhutan has revised its figures, and we published the current estimate.

As a former exchange student from Bhutan, I was disappointed in your coverage. The heavily populated south—home to culturally, politically, and economically oppressed people of ethnic Nepalese, Lepcha, and Indian tribal origins—was completely ignored. This assists the regime in hiding the population figure of minorities and lends credibility to the regime's statement regarding recent illegal immigrants from Nepal. Rather, thousands of Nepalese Bhutanese have emigrated to Nepal. The news of violence in Bhutan makes me wonder whether my country is reverting to the civil war conditions of the 19th and early 20th centuries.

HARI SHARMA
Prosser, Washington

Ancient Iraq

Your article on the "Crucible of Civilization" just hinted at the debt our Western culture owes to the Tigris-Euphrates region. We would be tremendously poorer if Islamic scholars had not absorbed knowledge from the many civilizations they encountered as they seized control of much of the Mediterranean basin. After the great Alexandrian library was burned in A.D. 641, the focus of intellectual activity (including mathematics) shifted to Baghdad, a center of scholarship, while Europe slept.

NORMAN WENGERT
Fort Collins, Colorado

Garbage Archaeology

Professor William L. Rathje's article on landfills was enlightening and interesting for the many myths it dispelled. But one statement requires clarification. I am familiar with the subsurface at Kennedy and Newark airports; neither is constructed on landfill of the type described, although localized pockets of domestic refuse may be found. Both were developed by filling over marine tidal marshes with clean natural sand in a controlled manner. The distinction is not trivial, as refuse fills continue to produce methane and other gases long after filling is completed. Paving over refuse fills requires designing a venting system so that methane does not accumulate in potentially explosive concentrations. The cost is significant; thus most refuse landfills are used for facilities with porous surfaces such as parks and golf courses.

JOHN S. HORVATH
Civil Engineering Department
Manhattan College
Riverdale, New York

The article emphasizes recycling to solve the problem, but this is costly and wasteful of energy. The answer lies in reuse. We have urged standard size and shaped glass containers for all beverages. These bottles would carry a deposit to cover collection and rewashing. They could be used interchangeably by milk, fruit juice, beer, liquor, or soda bottlers. Also it is more efficient to incinerate paper, plastics, and organics—thereby creating electric power or steam energy—than it is to recycle them. The residual ash can be used in making building blocks and soil-sludge stabilizers.

PHILIP T. GIDLEY
Gidley Laboratories
Fairhaven, Massachusetts

My hat is off to "pearl divers" such as the Garbarinos. I have been pearl diving myself for years and have found thousands of dollars' worth of immediately reusable, mostly clean, recyclable material, needing little if any work. I have kept much for my own use and sold the rest at flea markets.

WALT GEBHART
Wilmington, Delaware

Since moving to Germany, I have fallen into the rhythm of routine recycling and careful economy and find the effort causes no more inconvenience than wasteful habits I thoughtlessly practiced while living in the U. S. This densely populated region must keep trash levels low to avoid being buried in refuse; recycling has been done for years. Consumers can buy almost all beverages in refillable bottles. Most households buy beverages and return empties by the case. Also households are alerted to when collectors will pick up dangerous household wastes such as solvents, oil, old batteries, and medications. These are sealed in drums to avoid groundwater contamination. A new regulation allows consumers to leave excess packaging at the store after purchase for return to the manufacturer. Eventually all Western nations must adopt similar recycling practices.

JENNIFER GANTERT
Grafenhausen, Germany

I have been recycling housing materials for 22 years. We've saved tons of money and tons of old building materials that are now serving as structure, sound barrier, and insulation rather than clogging landfills. A friend and I are starting a new project on a nearby farm, using old nylon carpet, fuzzy side down, as mulch mat and growing vegetables through pre-cut holes. The roots breathe, but the carpet prevents weeds and washout and cuts down on the need to cultivate.

RUDY HARBUR
Boulder, Colorado

Letters should be addressed to FORUM, National Geographic Magazine, Box 37448, Washington, D. C. 20013, and should include sender's address and telephone number. Not all letters can be used. Those that are will often be edited and excerpted.

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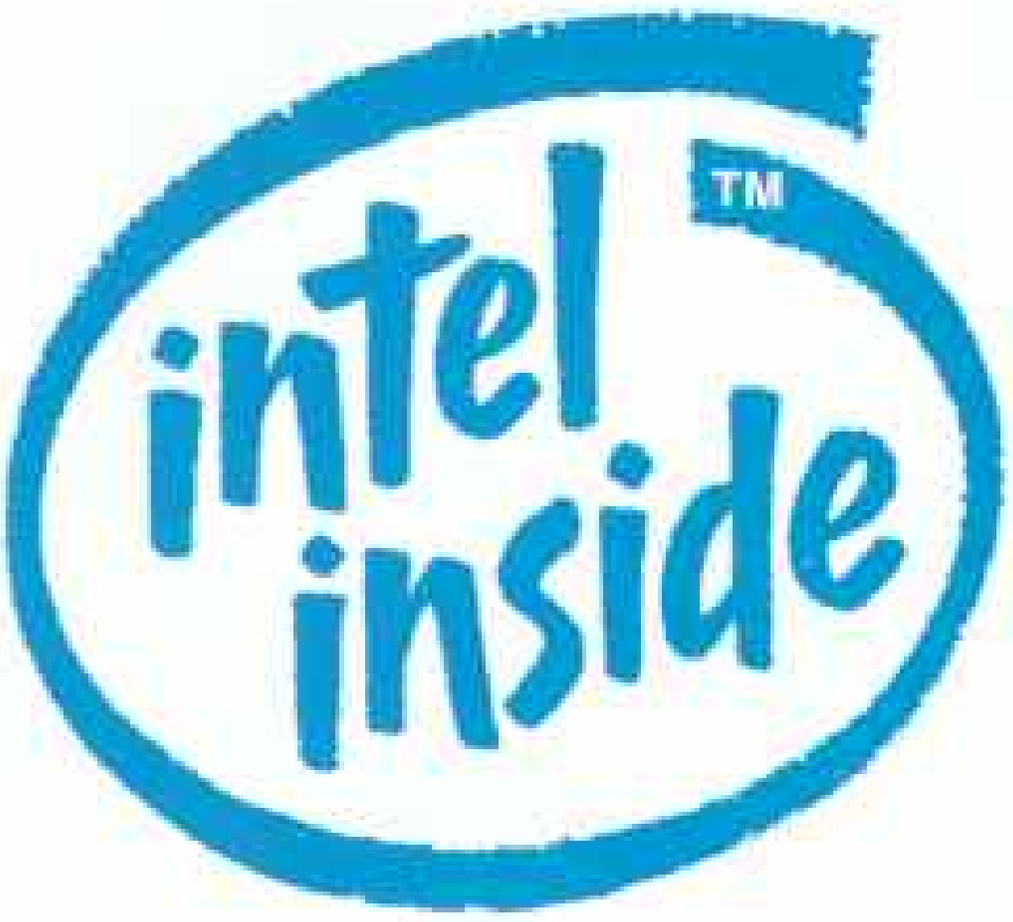

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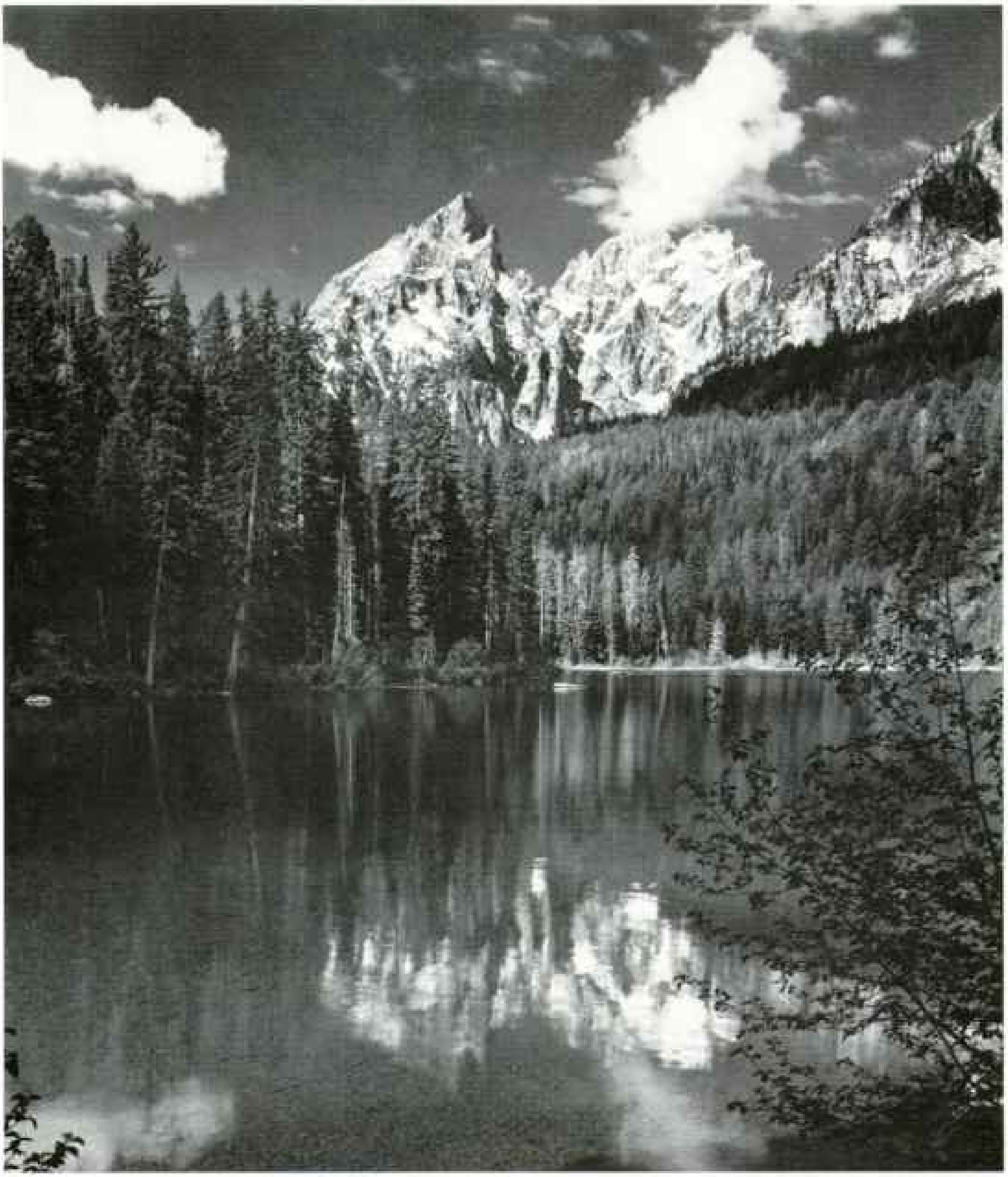

To confirm the benefits of nuclear energy, we got an outside opinion.

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For more information, write to the U.S. Council for Energy Awareness, P.O. Box 66080, Dept. BE04, Washington, D.C. 20035.

Nuclear energy means cleaner air.

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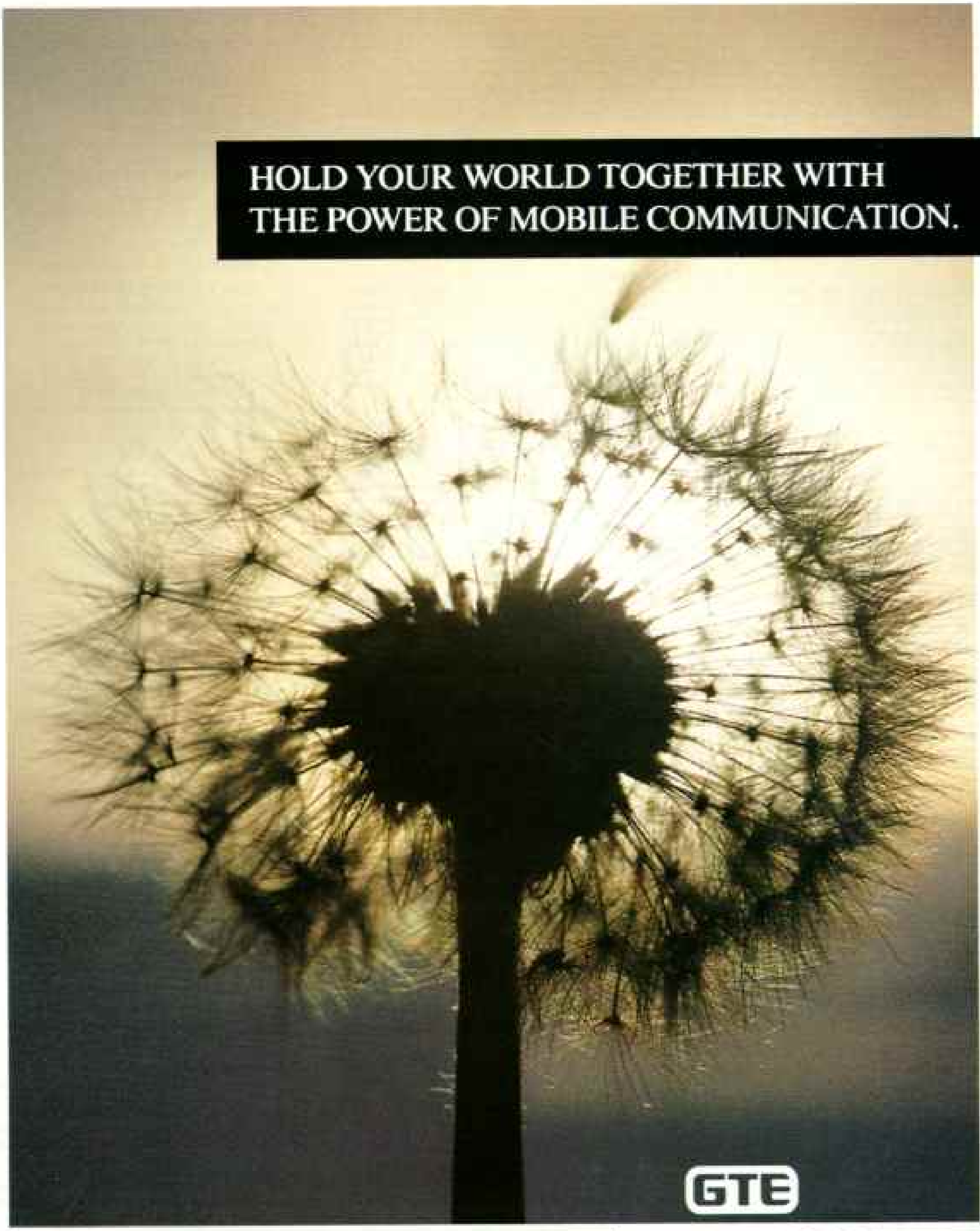

THE POWER IS ON

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Be there!

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Pink dolphins.

And half the medicine known to man.

This is the rain forest.

Every second another acre of rain forest is destroyed forever. The World Wildlife Fund needs your help. 1-800-CALL-WWF.

World Wildlife Fund Rain Forest Rescue Campaign

You're passing a tank
hazard signs on the
to you that you have no
really is, which gets
the guy hauling

Let's face it, it's an unsettling question. Especially when you're traveling alongside it at 55 miles per hour.

Fortunately, though, the answer is a good deal more reassuring. Because the drivers who transport our chemicals know precisely what they're hauling.

truck with one of those back and it occurs idea how hazardous it you wondering whether it does either.

And they know precisely what to do if something goes wrong.

Which means, first and foremost, that they're trained to handle their rigs. In good or bad weather, on busy or desolate highways. And since hazardous materials don't suddenly become harmless the moment the engines are turned off, our people are also trained in the proper ways to load and unload them.

The statistics bear this out. Of the half-million or so hazardous materials shipments moving through the U.S. every day, 99.99% arrive at their destination safely, without incident. Unfortunately, that leaves 0.01% that don't.

Which is why the member companies of The Chemical Manufacturers Association are schooling local firefighters, police and ambulance teams in the right ways to respond to accidents involving hazardous chemicals.

It's also why we have something called CHEMTREC. A twenty-four-hour emergency center designed to get accurate advice into the hands of emergency response personnel in the earliest stages of an accident, when it counts the most. And to quickly dispatch any of 225 emergency response teams to the site of serious incidents. Anywhere in the country. Day or night.

We do all this for one simple reason. The risks associated with our chemicals don't end when they leave our plants. And neither do our efforts to make them safer.

To find out more about what we're doing to produce, transport and handle chemicals more safely, call for our Responsible Care® Brochure at 1-800-624-4321.

The Chemical Manufacturers Association.

We want you to know.

Earth Almanac

© PERRY CONWAY, AUDIE NATURE SERIES

Wildlife Up Close: New Guides for the Watchers

Are more Americans becoming couch potatoes? Emphatically, the numbers say no: In 1980 a survey showed that 93 million people watched wildlife for recreation, whether by hiking in the nation's 630 million acres of public lands or at least by feeding their backyard birds. Five years later that figure had leaped to 135 million people. And in the watching they spent 14 billion dollars.

A new program will help those eager to grab binoculars or camera and glimpse an eagle on the wing, a wolf on the hunt, or—like photography students in Colorado—a mountain goat on the graze (above).

The program, called Watchable Wildlife, links eight federal agencies, wildlife departments from all 50 states, and four national conservation groups. The coalition plans to mark about a hundred of the best wildlife viewing sites in each state with roadside signs—a logo depicting binoculars—and publicize them with comprehensive state-by-state guides. The network will involve only protected lands.

"We're creating an interstate system, but it won't be on the interstate," says Mark Hilliard, the Bureau of Land Management's national coordinator of the program.

LORAY PARKER, WYOMING GAME AND FISH DEPARTMENT

Black-footed Ferrets: a Risky Return to the Wild

"It is with great pleasure that we introduce this handsome new species," wrote John James Audubon and John Bachman in 1851, describing the black-footed ferret. Today the pleasure is equally great among this tenacious little weasel's champions, who may have rescued it from extinction.

With their main prey, prairie dogs, nearly wiped out, black-footed ferrets have not been seen in the wild since 1987. The last 18 known wild ferrets were captured to be bred by the Wyoming Game and Fish Department and other agencies. The program—one of the most successful of its kind—has produced a pool of more than 300 ferrets.

This month officials plan to release about 50 of the animals in Wyoming's Shirley Basin, where a 39,000-acre white-tailed prairie dog complex should provide pickings aplenty. However, biologists expect a heavy toll among the ferrets, naive to the wild and not yet prairie-wise to predatory badgers and coyotes. Plans call for reintroducing more ferrets at nine other complexes throughout the West to eventually build a population of 1,500.

National Geographic, September 1991

Lookin' good. Keep it down by keeping it off.

Often the best way to keep that blood pressure down is by keeping that weight off. And you're doing it. Congratulations. Bet you feel wonderful. After all, you're in control and the easy part is taking your pills and cutting down on salt.

So take a bow; you should feel great. You sure look great.

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HIGH BLOOD PRESSURE
Treat yourself right.

The National High Blood Pressure Education Program; The National Heart, Lung, and Blood Institute; National Institutes of Health; Public Health Service; U.S. Department of Health and Human Services

Take a walk on NordicTrack and discover why it's 8 ways better than a treadmill.

1. Better exercise. NordicTrack simulates the world's best exercise, cross-country skiing. This smooth, total-body motion exercises all major body muscles including arm and shoulder muscles that are neglected in walking or running.

2. Non-jarring. NordicTrack's smooth, efficient skiing motion has none of the jarring motions which can damage joints and ligaments.

3. Safer. NordicTrack is human-powered and has no electric motors or high-speed belts that require constant concentration or that can throw off a user or child.

4. You are in control. NordicTrack lets you set the pace of your workout. No panic starts and stops as with motorized devices.

5. Quieter. NordicTrack's smooth skiing motion is inherently quiet and has none of the pounding footstep noise associated with running on a treadmill.

6. No electric cord or outlet required. Put a NordicTrack wherever you want. You are not constrained by outlet location and you won't trip over the cord.

7. Costs far less for equal quality. NordicTrack's efficient and human-powered design needs no expensive electric motors and speed controls. And, because NordicTrack is simple and uncomplicated, little upkeep is required.

8. Non-boring. People love their NordicTracks. In fact, 7 out of 10 owners are still using their machines more than 3 times a week, 5 years after purchasing one.

In fact, these NordicTrack owners are so enthusiastic about the results they've achieved, that in a market research study conducted by Maritz Research in 1988, 97% responded that they would recommend NordicTrack to their family and friends.

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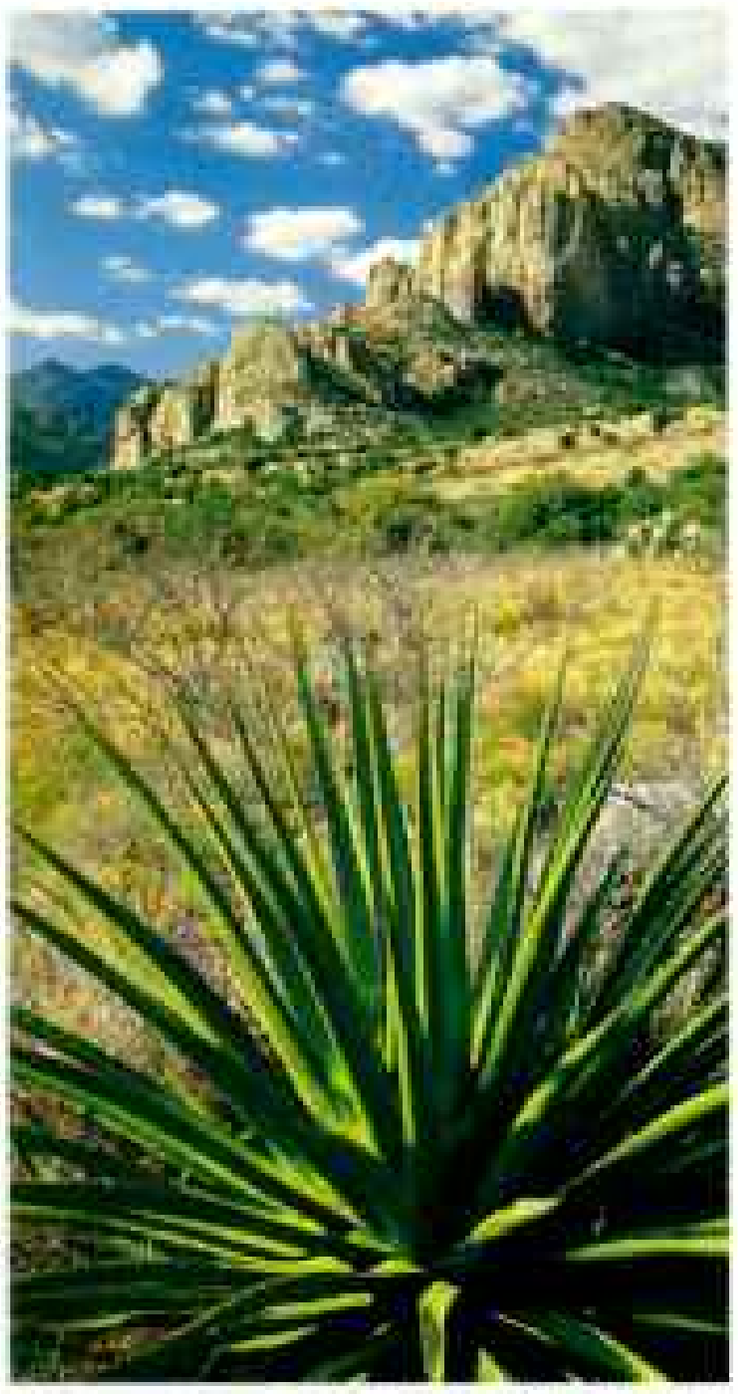
ARTHUR SIDEY

British Go Hog-wild to Save Their Hedgehogs

Spiny little creatures with endearing faces that waddle through British backyards, common hedgehogs are uncommonly accident-prone. They drown in ponds and drainpipes, become ensnarled in garden netting, and, worst of all, die on roads at the estimated rate of 100,000 a year.

Saving hedgehogs has become a near national obsession. Lucky survivors wind up at St. Tiggywinkles, named for a Beatrix Potter character. This patient with a broken jaw mends in the wildlife hospital started by Les and Sue Stocker in their Aylesbury backyard in 1978. Each year the facility treats some 8,000 birds and animals, including nearly 2,000 hedgehogs.

"They are the one wild mammal most often seen in this country. That's why people love them," Les explains. But large-scale farming is driving hedgehogs—along with foxes, badgers, and deer—en masse from the countryside into suburbia. Thus St. Tiggywinkles and kindred organizations address a growing real-life drama affecting all creatures great and small.



LARRY ULRICH, DRK PHOTO

Tale of Two Gold Mines: Protest Versus Patience

Today in the not-so-Wild West, there is no romance in gold mining. Claim jumpers and rags-to-riches prospectors are out. Cavernous pits and toxic chemicals are in. In Portal, Arizona, scientists and residents challenged a Denver firm seeking to drill test holes for gold near the mouth of Cave Creek Canyon (left), revered as an ecological gem. Local biologists Noel and Helen Snyder helped lead the opposition. "People were horrified at the idea of an open-pit mine in an area with such diverse flora and fauna," says Helen. Under pressure, the company postponed exploration.

Yet pay dirt has been struck in a compromise some 400 miles northwest. In California's East Mojave National Scenic Area, a Canadian company—to avoid a lawsuit by environmentalists—has agreed to spend a fortune to operate perhaps the closest thing to a clean gold mine. Closed tanks will substitute for open ponds to stop wildlife from drinking cyanide-laced water, and the corporation will create a two-million-dollar reclamation fund.

Is Africa's Windblown Loss the Amazon's Gain?

What do a desert and a rain forest have in common? Dust, say scientists. Some believe that tons of soil from Africa's Sahara and Sahel are blown 4,000 miles across the Atlantic to South America. There dust-laden rain deposits nutrients on the Amazon Basin, enriching its thin soil.

NGS CARTOGRAPHIC DIVISION

Thus one of earth's most biologically diverse regions may be vitally linked to one of its poorest. "It's a comment on the highly interconnected nature of our planet," says meteorologist Michael Garstang of the University of Virginia. He and his colleagues calculate that each year about 25 giant storms over the northeastern Amazon suck in 12.6 million tons of dust blown in vast plumes from Africa. The dust spreads about a pound of fertilizing phosphate—probably from the Sahel—per acre of rain forest.

National Geographic, September 1991

A real Surprise story on beef.

Fire up the skillet and man the steak knives. I've traveled down route 258 to Surprise, Indiana, and what did I find? A major surprise. Never have the facts proved so delicious; never have figures looked so good. Surprise: lean, trimmed beef has no more cholesterol than chicken without the skin. And only 1.5 grams more saturated fat—or about 14 calories.** No wonder those Hoosiers are happy. They've also discovered the Skinniest Six, the leanest cuts of beef. So need I say the magic words "marinated sirloin"? Unwrap the steak, toss the salad and call in the army of friends. People in Indiana are already celebrating with—you guessed it—a Surprise party. See you in the next town.

ROUND TIP 157 calories
5.0 gms total fat* (2.1 gms sat. fat)

TOP ROUND 153 calories
4.2 gms total fat* (1.8 gms sat. fat)

TOP LOIN 176 calories
5.0 gms total fat* (2.1 gms sat. fat)

EYE OF ROUND 143 calories
4.2 gms total fat* (1.5 gms sat. fat)

TENDERLOIN 179 calories
8.5 gms total fat* (3.2 gms sat. fat)

TOP SIRLOIN 165 calories
6.1 gms total fat* (2.4 gms sat. fat)

Beef.
Real food for real people.

*Source: USDA Handbook 8-13 1000 Rev. Figures are for a cooked and trimmed 3 oz. serving. 4 oz. uncooked yield 3 oz. cooked.
**Here are the respective averages for saturated fat, fat and cholesterol in a 3 oz. serving. Lean beef: 3.2 gms; 8.4 gms; 73 mgs.
Skinniest Six Cuts: 2.3 gms; 5.2 gms; 70 mgs. Skinless chicken: 3.3 gms; 6.9 gms; 85 mgs. ©1001 Beef Industry Council and Beef Board

On Assignment

JULIAN ANDERSON

"People of my generation growing up in postwar Germany didn't have a feeling of being German," says free-lance photographer GERD LUDWIG, who was born in a village near Alsfeld. "There was nothing to be proud of. We wanted to be known as Europeans."

Covering German reunification on his first assignment for the GEOGRAPHIC was a bittersweet experience for Gerd, who now makes his home in New York City. "If it's going to be a unified country again, it will take another generation to work out all the differences," he says. That next generation gets a push (above), as Gerd joins preschoolers on an outing in Zossen. "I have a three-year-old boy myself. I wanted to test how it feels to have more than one."

The urge to travel seized Gerd early; as a teenager he once hitchhiked as far as Istanbul. Two years of university routine left him bored, and Gerd set out again to see the world. While working on a Norwegian freighter, "I wanted to bring back souvenirs of travel," he says, "but as a dishwasher I didn't have a lot of money, so I started to snap pictures." Back home, his portfolio landed him in the best art school in Germany. Soon he was working for magazines and was part owner of a photo agency. "Why not do for a profession what you like best? I just decided, I will be a photographer."

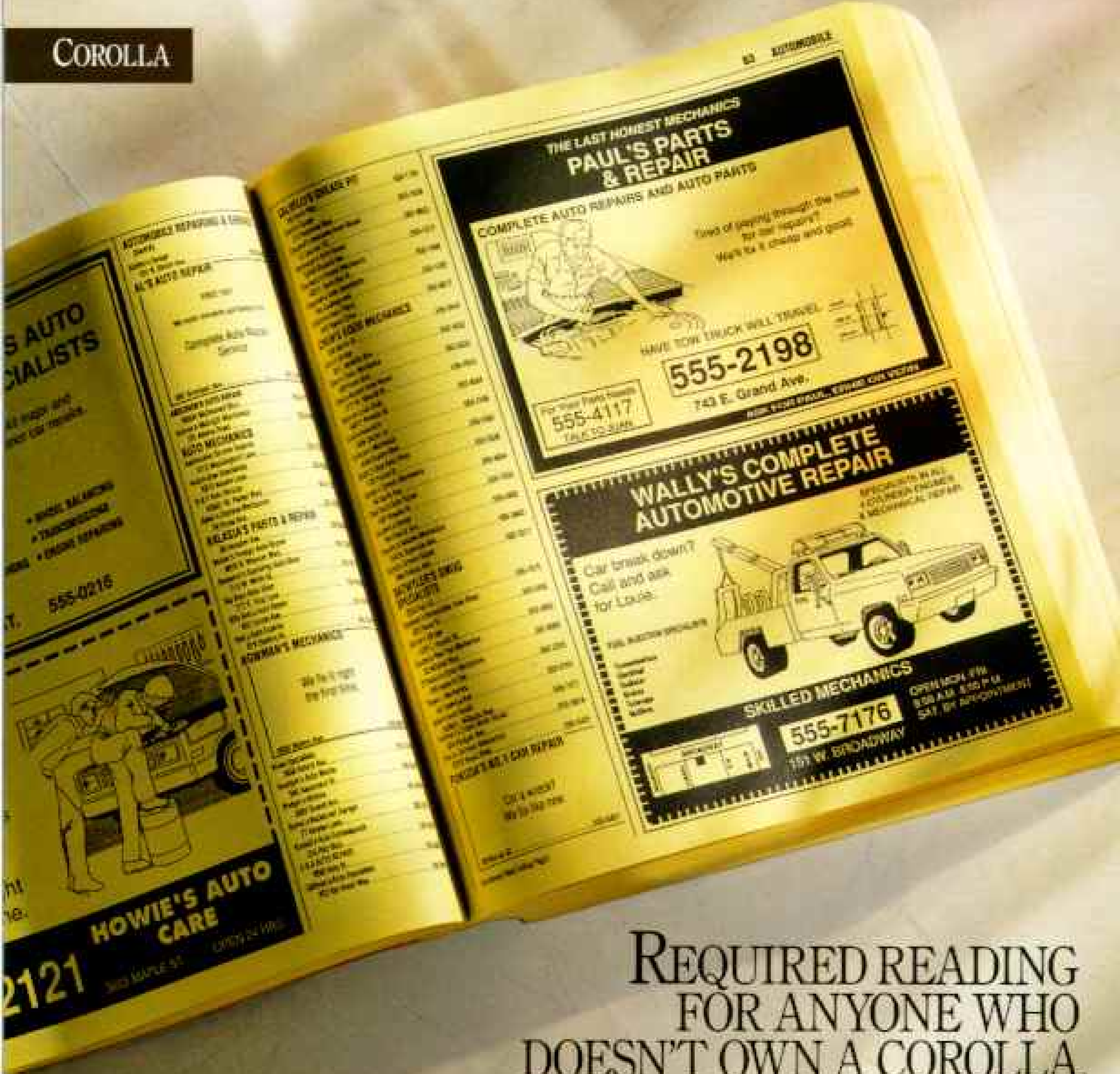
SIMON POLLARD

Fulfilling a "childhood ambition since about age five" to learn more about jumping spiders, biologist-photographer MARK W. MOFFETT—a frequent contributor to NATIONAL GEOGRAPHIC—traveled the tropics in pursuit of those eight-legged jewels.

In Australia with Robert Jackson, the top expert on jumper behavior (left, at right), Mark observes a web-making species that is itself preyed upon by jumpers. This huge female *Nephila maculata*—the largest web-weaving spider in the world—can ignore *Portia* jumpers, but the tiny male she carries on her back is not so lucky. *Portia* feed on the males, after traversing the deadly web—a web so strong it has been used in New Guinea to catch birds and fish. The hunting prowess of the *Portia* jumping spider is a story yet to be told in Mark's ongoing chronicles of high drama in the lives of small creatures.

NATIONAL GEOGRAPHIC (ISSN 0027-9358) IS PUBLISHED MONTHLY BY THE NATIONAL GEOGRAPHIC SOCIETY, 17TH AND M STS., N.W., WASHINGTON, D. C. 20036. $21.00 A YEAR, $2.65 A COPY. SECOND-CLASS POSTAGE PAID AT WASHINGTON, D. C., AND ELSEWHERE. POSTMASTER: SEND ADDRESS CHANGES TO NATIONAL GEOGRAPHIC, P.O. BOX 2774, WASHINGTON, D. C. 20013.

COROLLA



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