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ВВЕДЕНИЕ

Настоящая хрестоматия рассчитана на студентов 2 курса специальности «022900 Перевод и переводоведение». Работа по данной хрестоматии развивает навыки ориентированного чтения аутентичных текстов и навыки устной речи.

Хрестоматия состоит из двенадцати тематических разделов:

1. Man and Nature.
2. Ecology
3. Education and Language
4. Historical Wonders
5. Culture and Arts
6. Some Theoretical Issues and Scientific Discoveries
7. Law
8. Physiology and Diseases
9. Interesting Facts
10. Political and Economical Issues
11. Some Social Issues
12. Cloning

Хрестоматия предназначена как для студентов языковых специальностей, так и для лиц, изучающих английский язык на курсах или самостоятельно.

Материал хрестоматии апробирован на кафедре межкультурных коммуникаций и переводоведения.

MAN AND NATURE

Text 1

Global Warming

Polar bears could face extinction, whales go hungry, and seals have nowhere to rest – all because of the warming.

On a frigid afternoon in May, I slipped through a crack in the sea ice and dropped into the Arctic Ocean. The icy water hit my face and neoprene-clad head. I was diving just south of Lancaster Sound, off the northern tip of Baffin Island in the Canadian Arctic. The water was 29 degrees (-2ºC), about as cold as sea water gets before it freezes. My breath slowed and I swam down into the blackness. At one point I looked back up at the ice, expecting it to appear as it most often does this early in the season – blue, featureless, lifeless. But something wasn't right.

The ice was stained green and brown. It moved. I blinked and checked my depth. I tried to make sure I wasn't suffering vertigo, which can be deadly to a diver working alone under the three-foot-thick (one meter) roof of ice. Then it hit me: It wasn't ice at all – I was watching a massive cloud of amphipods, tiny shrimp like crustaceans, as they fed on phytoplankton that grow on the underside of the ice in spring when the sun returns to the Arctic. I was seeing the foundation of the ecosystem, the combination of ice and minute life-forms upon which all the bigger animals – polar bears, whales, birds, and seals – depend.

I've lived in the Canadian Arctic all my life and have spent most of my career photographing the edge where ice meets open sea. When I began working, sea ice seemed invulnerable: Even in the warmest months much ice remained. Ice is not just a landscape. It is part of the biology of every creature that lives in this frozen vastness. Year-round, but especially in spring, polar bears roam and hunt on the ice. Seals rest and give birth on the ice. Massive bowhead whales arrive to feed on amphipods and copepods. Beluga whales and narwhals join them and chase arctic cod, which hide in finger-thin channels of ice. An Arctic without ice is unimaginable.

Scarcely ten years later, things have changed. The Poles are melting at an alarming rate; as global warming grinds on, the possibility of an ice-free Arctic, at least during the summer, creeps closer each day. Some scientists even believe the Arctic will be void of summer ice, dooming species such as polar bears to extinction in less than a century. This is one of the most disturbing predictions I've heard. One thing I understood with sudden clarity that May day as I watched amphipods flit along the ice and heard the clicks and squeaks of approaching whales: If global temperatures continue rising, the ice will likely disappear. An Arctic without ice would be like a garden without soil.

What Is Global Warming?

Glaciers are melting, sea levels are rising and wildlife is scrambling to keep pace. It's becoming clear that humans have caused most of the past century's warming by releasing heat-trapping gases as we power our modern lives. Called greenhouse gases (GHGs), their levels are higher now than in the last 650,000 years.

SEE HOW IT WORKS

We call the result global warming, but it is causing a set of changes to the Earth's climate, or long-term weather patterns, that varies from place to place. As the Earth spins each day, the new heat swirls with it, picking up moisture over the oceans, rising here, settling there. It's changing the rhythms of climate that all living things have come to rely upon. What will we do to slow this warming? How will we cope with the changes we've already set into motion?

GREENHOUSE EFFECT

The "greenhouse effect" is the warming that happens when certain gases in Earth's atmosphere trap heat. These gases let in light but keep heat from escaping, like the glass walls of a greenhouse.

First, sunlight shines onto the Earth's surface, where it is absorbed and then radiates back into the atmosphere as heat. In the atmosphere, "greenhouse" gases trap some of this heat, and the rest escapes into space. The more greenhouse gases are in the atmosphere, the more heat gets trapped.

Scientists have known about the greenhouse effect since 1824, when Joseph Fourier calculated that the Earth would be much colder if it had no atmosphere. This greenhouse effect is what keeps the Earth's climate livable. Without it, the Earth's surface would be an average of about 60 degrees Fahrenheit cooler. In 1895, the Swedish chemist Svante Arrhenius discovered that humans could enhance the greenhouse effect by making carbon dioxide, a greenhouse gas.

Levels of greenhouse gases (GHGs) have gone up and down over the Earth's history, but they have been fairly constant for the past few thousand years. Global average temperatures have stayed fairly constant over that time as well, until recently. Through the burning of fossil fuels and other GHG emissions, humans are enhancing the greenhouse effect and warming Earth. Other factors briefly influence global temperatures. Volcanic eruptions, for example, emit particles that temporarily cool the Earth's surface. But these have no lasting effect beyond a few years. Now, humans have increased the amount of carbon dioxide in the atmosphere by more than a third since the industrial revolution.

Why is this a concern?

The rapid rise in greenhouse gases is a problem because it is changing the climate faster than some living things may be able to adapt. Now, with concentrations of greenhouse gases rising, Earth's remaining ice sheets (such as Greenland and Antarctica) are starting to melt too. The extra water could potentially raise sea levels significantly. As the mercury rises, the climate can change in unexpected ways. In addition to sea levels rising, weather can become more extreme. This means more intense major storms, more rain followed by longer and drier droughts (a challenge for growing crops), changes in the ranges in which plants and animals can live, and loss of water supplies that have historically come from glaciers. Scientists are already seeing some of these changes occurring more quickly than they had expected.

Text 2

Global Warming Changing Inuit Lands, Lives, Arctic Expedition Shows

Jon Bowermaster

An arduous expedition to highlight how rising temperatures, melting sea ice, changing wildlife, and other effects of global warming are altering life for the native peoples of the Arctic has finally reached its conclusion.

After 78 days of trekking across sub-Arctic Baffin Island in the Canadian province of Nunavut, veteran polar explorer Will Steger and his team pulled into the town of Iglulik. The 1,000-mile (1,600-kilometer) journey was the first in a series of planned expeditions called Global Warming 101 designed to raise awareness of the impacts of climate change in the polar regions. The expedition was funded in part by National Geographic Society Mission Programs. This journey was about the remote Inuit population living on the edge of the Arctic. "We really wanted to hear from the people on the front line about how the Arctic is changing," Steger said. "And we did, everywhere we went."

Changing Land

At every stop team members engaged the Inuit in conversation about climate change. There has been a large increase in animals not previously seen this far north, including robins, finches, and dolphins, the adventurers learned. And faster-melting ice is causing a decrease in hunting days each year, while igloos, which native hunters prefer to tents when they are on the trail, are much harder to build with less snow and ice.

Three Inuit hunters – Theo Ikummaq, 53, born in an igloo near Iglulik; hunting guide Simon Qamanirq, 53, an internationally known carver; and Lukie Airut, 65 a veteran hunter, dog musher, and Canadian ranger who speaks only Inukitut – also traveled with the team to help point out changes.

Ikummaq, for example, showed how shifting winds were changing the shape of ice formations used as landmarks by generations, making reading the terrain more difficult.

But "we have lived in this region for centuries and we will continue to," he added. "As the climate changes, we will adapt."

The Poles have been two of the regions most affected by climate change. Temperatures there have risen at twice the rate of the rest of the world, and some scientists estimate that large areas of the Arctic will be completely ice-free by the end of the century.

Warm Homecoming

The journey was not an easy one. When the expedition set off during the dark days of late February, wind chills often dropped to minus 50 degrees Fahrenheit (minus 46 degrees Celsius).

The route led the team across ice caps, frozen rivers, thawing ice. Still, the open ice allowed the team to quickly cover their last 400 miles (640 kilometers) – including a crossing of the Barnes Ice Cap, a remnant of the Ice Age that is receding like the rest of the ice in the north.

Iglulik turned out all the stops for the returning adventurers. Greeting them upon their arrival at the frozen edge of the ice was the town's entire population of 1,600. The Inuit guides were especially glad to return to their home of Iglulik ("home to the igloo people"), which has been populated for 4,000 years and has long served as the cultural center of Nunavut.

So what did the veteran Steger, who has traveled in the high Arctic for 40 years, learn from his Inuit travel partners? "A lot. About weather and ice and running dogs. And that even as things are changing here, and changing fast, the Inuit are changing too," he said. "Theo, Simon, and Lukie and their experience were quite inspirational to me."

Text 3

Irrigation catastrophes

Irrigation catastrophes have befallen civilizations since the dawn of time. Archaeological evidence suggests that much of the Sahara was once a green and pleasant land until depletion of groundwater turned it into desert. The Maya civilization in Mexico is thought to have ended because of a sudden drought. In what is now Arizona, Hohokam Indians developed a remarkably sophisticated irrigation system. But too much irrigation waterlogs the ground and when the water evaporates it leaves salts behind. Just such a lethal salinization seems to have overtaken the Hohokam who died out suddenly in the early 15^{th} century. Researchers maintain that, with the single exception of Egypt, no civilization based on irrigation has survived for long either because the water has run out or because of silt or salinization.

Yet it is modern engineering that has made possible irrigation disasters on a massive scale. One of the examples is the Aral Sea, once the world's fourth-biggest inland sea. The two rivers that feed the Aral, the Amu Darya and the Syr Darya, were diverted to irrigate cotton crops in the near-desert terrain of central Asia. The Aral soon started to dry up. Since 1960 it has shrunk by three-quarters in volume and almost all the fish have died out. A once-thriving fishing fleet that had supported several villages has disappeared. Moreover, rapidly rising salinity has killed many crops.

The history of the American west is another example of overexploitation of limited water resources mainly for the benefit of farmers at huge cost to federal and state taxpayers and with severe environmental side-effects.

Text 4

Phenomena, Comment and Notes

By James Trefil

Iceberg armadas and flickering climates: how one good idea led to more, and we appreciated anew the world's complexity.

There are few things in life more exhilarating than getting a really good idea – one that just sings as it solves a problem that's been bothering you for God knows how long. We've all had this experience. Sometimes the ideas work out. Sometimes the ideas are total flops, in which case we bury them and move on.

The sciences are a branch of human endeavor in which ideas are the main item of commerce, the principle coin of the realm. Over the centuries, the scientific community has developed a complex set of rules about how ideas are to be evaluated, as well as some pretty definite criteria that tell you when they can be accepted. So if you want to follow the story of a good idea, what better place to look than science?

Douglas MacAyael, a young scientist of the University of Chicago has a good idea about why Earth's climate developed as it did during the last ice age.

Doug works in glaciology. Having spent months camping on Antarctic glaciers and years trying to model their flow with computers, he knows about how ice behaves when it piles up. The problem he addressed had to do with a strange phenomenon people had found in cores drilled out of the ocean floor in the North Atlantic. Geologists were amazed to discover successive layers of rock debris and gravel that seemed out of place: the rocks in those layers appear identical to stuff you'd expect to find on land in northern Canada. Other evidence suggested that these layers, which formed every 7,000 to 12,000 years, marked periods of rapid climate change. Average temperatures climbed more than 10 degrees – the equivalent of moving

the climate of Atlanta to Boston – in a few decades, followed a few thousand years later by an equally rapid return to normal. These sudden shifts in climate, accompanied by out-of-place rocks being dumped into the North Atlantic, were called "Heinrich events" after the German scientist who first discovered them.

Doug's idea was that you could understand both the origin of the rocks in the ocean bottom cores and the dramatic shift in the weather in terms of the behavior of the ice sheet that covered North America over much of the past 80,000 years. The depth of the sheet would increase as snow fell and compressed into ice, but when the ice lying on top of Hudson Bay reached to a height of about 10,000 feet, the soft rocks underneath would crumble and mix with melt water, forming a slippery paste, and the whole thing would slough down Hudson Strait and eventually into the ocean, sending out an armada of icebergs, each with a load of crushed rocks frozen into its undersides. When the icebergs melted, the rocks were dumped. At the same time, the additional fresh water changed the patterns of ocean currents while the absence of two vertical miles of ice changed wind patterns.

Text 5

Elephant seals, the champion divers of the deep

By Kathleen McAuliffe

These ponderous pinnipeds continually set new records for diving to crushing depths; researchers are hard at work to discover just how they do it.

The California bathers do not welcome a truck on the beach overlooking Monterey Bay. Annoyance quickly gives way to curiosity, however, when a coffin-shaped cage becomes the center of activity. As parents and children gather round for a closer view, marine biologist Burney Le Boeuf signals a team of six to unload the crate at the water's edge. Out rolls Camille, a juvenile northern elephant seal with a video camera attached to her back. Big brown eyes blinking in the noonday sun, she circles once, snarls at her human abductors and then galumphs toward the ocean. Moments later, the world's first video-shooting elephant seal disappears under a big wave.

Le Boeuf, a professor at the nearby University of California at Santa Cruz, is gambling that the animal's homing instincts will guide it back to a beach on the mainland behind the island of Ano Nuevo, a popular spring gathering ground of elephant seals 18 miles up the coast. "You never know – the film might just reveal something we didn't expect" he enthuses. A moment later, his jubilant spirit falls prey to realism. "Or it might just be all murk."

Such are the risks of animal trials with undersea technologies. But the hope is that Camille will return from the deep with clues to how elephant seals have evolved into the greatest diving champions on Earth. These blimp-shaped creatures plunge to record-breaking depths – more than 4,000 feet – and stay down long enough to defy our understanding of physiological limits. They accomplish this feat with dizzying regularity, demonstrating an ease and endurance that no other marine mammals, not even the great whales, can match.

They typically stretch from 16 to 18 feet in length and weigh from two to four tons. During the mating season, the bulls bellow and charge one another on the beach, delivering bloodletting bites to the neck. The winners of these macho contests command among the largest harems of any mammal, with a single victor sometimes inseminating as many as 100 cows.

Scientists had no inkling of their extraordinary diving feats until the introduction of portable depth-recording equipment in the early 1960s. The earliest prototypes were tested on Antarctica's Weddell seals, which returned from the frigid depths registering dives of nearly 2,000 feet. Awestruck, scientists launched a series of studies that led them to revise radically their theories of how marine mammals withstand oxygen deprivation and crushing depths. The first elephant seal to dive with recording equipment immediately broke the record set by Weddell seals. In 1988 three northern elephant seals made steep descents. The animals had exceeded depths of 3,300 feet. "Our theories were blown clear out of the water," recalls Le Boeuf. "They were breaking every record in the book."

Today Le Boeuf still can't say for sure just what their true limit is. Although a northern elephant seal recently reached slightly more than 5,000 feet – just under a mile – he doubts that that record will go unchallenged for long. "It seems like every time we put a dive recorder on an elephant seal it breaks a new record," he laughs. "Things just implode at those depths," says Le Boeuf. "Many of our earliest instruments were made of metal and looked really tough, but after being deployed on animals, they came back all pushed in from the pressure." Many animals do live at such depths, but they die when pulled to the surface. Elephant seals appear to be equally at home at depth and at the surface – environments as different as Earth is from the moon.

To appreciate their tours, Le Boeuf asks us to imagine four Empire State Buildings stacked one on top of the other. An elephant seal is capable of descending from the uppermost floor of the top building to the base of the bottom building in about 20 minutes. It then ascends at the same speed, making the round-trip journey of almost two miles in just 40 minutes. By contrast, the elephant seal shows no signs of distress. What's more, this virtuoso diver can remain submerged for seemingly impossible durations. A southern elephant seal recently logged two hours down under. How do they do it?

Marine biologists have been trying to coax the secret from these Olympian divers for more than a decade. Aware that colleague Randall Davis, chairman of the department of marine biology at Texas A&M University at Galveston, was studying Weddell seals by attaching video cameras to their backs, Le Boeuf proposed a collaboration. The rationale of recruiting the elephant seals to spy on themselves was irresistible and the men quickly reached an accord: Le Boeuf would supply the animal and Davis would supply the camera.

Rather than releasing the seal miles out at sea, they would set it free from the Monterey shoreline during the spring molting season, when seals taken from Ano Nuevo usually make a bee-line back to their colony to complete the shedding of their coats on land. The camera mount would be attached with – of all things – epoxy. The camera could be retrieved at the trial's end, and when the seal molted, the mount would simply fall off, and the seal would be none the worse for wear.

Elephant seals do not rely on oxygen from the lungs to sustain them during long dives (as diving birds and turtles do), Le Boeuf explains. Rather, the oxygen is stored in blood and muscle. Blood constitutes as much as 20 percent of their body weight, in comparison with only 7 percent in humans. What's more, research by Jesper Qvist of Herlev Hospital in Copenhagen suggests that the spleen of Weddell seals may double as a scuba tank. According to this theory, the organ serves as a reservoir of oxygen-rich red blood cells which, under pressure, are squeezed into the circulatory system.

Elephant seals lower their temperature by from 5 to 6 degrees F before long dives. At depth, they shut off circulation to the kidneys, stomach and other organs, conserving more oxygen. Meanwhile, their heart rates slow from 120 beats per minute at the surface to as low as 6 per minute on the bottom.

If the Weddell seal is a source of wonderment to scientists, the elephant seal is downright mystifying. Not only does it dive deeper and longer, but it does so again and again, barely pausing at the surface. While Weddell seals rest from 11 to 13 hours out of every 24, the elephant seal never seems to sleep. In the mid-1980s, using a long-running time-depth recorder, Le Boeuf's team made a discovery that shook him more than any other finding of his career. The recorder revealed that elephant seals were diving continuously, 24 hours a day, week after week.

How do these animals stay submerged for so long? And why do they dive so relentlessly? Is it to hunt for food? Or to escape becoming food themselves? Finally, when – if ever – do they get a wink of sleep?

From analyzing the depth recordings of hundreds of elephant seals, Le Boeuf now believes that the vast majority of their dives are foraging expeditions. They dive to the tops of seamounts, where they lie in wait for prey. Among the animals whose remains have been recovered from their stomachs are skates, rays and sharks – some as long as six feet. Le Boeuf is not sure how well

they can see their prey, for they descend so quickly that their eyes have little time to adjust to the blackness. By venturing where no other large competitors dare to go, however, elephant seals have gained a virtual monopoly on some of the richest marine waters off the continental United States. And by spending so little time at the surface, they reduce their risk of being devoured by two formidable predators that patrol shallow water: the great white shark and the killer whale.

Elephant seals present another mystery: why the animals never seem to doze at sea? The animals, Le Boeuf speculates, sleep submerged. One likely time that they may be dozing, he proposes, is during drift dives, when they float down and up rather than actively swim. "My guess is that they don't sleep like us – but they reduce their level of vigilance once they're outside the range of predators below 130 feet," says Le Boeuf. "That would give them about ten minutes' rest on the way down and ten minutes on the way up."

For all the reams of data and rich abundance of theories, the most basic answers are not yet in hand. The question of whether the seals sleep while diving remains open. The species' resistance to high-pressure nervous syndrome also remains a profound enigma. Most problematic of all the scientists can't explain how an elephant seal can stay submerged for as long as two hours.

The answer to these riddles is not just of academic interest. The Navy, among others, is eager to know how the animal protects itself against nervous convulsions at depth, for this deadly reaction is the single greatest impediment to scuba divers who want to go deeper than they now can. At the University of Alaska, marine biologist Robert Eisner is keen to study how seals regulate their heartbeat, with the goal of uncovering new strategies for controlling arrhythmic human hearts. He is also fascinated by how they lower their temperature and other metabolic functions during dives because these adaptations, he believes, could help to shed light on how young children sometimes survive being submerged in icy water for more than half an hour. Still other researchers are scrutinizing both Weddell and elephant seals for clues to the cause of sudden infant death syndrome, which occurs when babies stop breathing during sleep.

Clearly, marine biologists have their work cut out for them. Camille proved maddeningly unpredictable in her pioneering trial. Expected back at Ano Nuevo within two days of her release, she instead took a detour that delayed her return by a week. But after apparently wandering off the continental shelf into deep water, she did return to land. The camera housing held up to depths of 2,600 feet, and the film was retrieved undamaged. Le Boeuf and Davis declared the mission a success.

Text 6

Przewalski's horse

Przewalski's horses are the last surviving subspecies of wild horse. First described scientifically in the late 19th century by Russian explorer N. M.

Przewalski, for whom the horse is named, the horse once freely roamed the steppe along the Mongolia-China border. Never again seen in the wild, Przewalski's horses have since been kept and bred in captivity and have recently been reintroduced in Mongolia.

With a short, muscular body, Przewalski's horses are smaller than most domesticated horses. They have a pale belly and beige to reddish brown coat that is short during summer and thicker and longer in winter. Their muzzle is white, and they don an erect and dark mane that lines their large head and neck. They stand about 12 to 14 hands tall at the shoulder, or about 48 to 56 inches (122 to 142 centimeters), and weigh about 440 to 750 pounds (200 to 340 kilograms).

While extant in the wild, these horses ate grasses and other vegetation on the steppe, shrub lands, and plains of western Mongolia and northern China. Herds observed at reintroduction sites appear to be affectionate. Females, or mares, and foals live in family groups with a dominant stallion, while younger males live in bachelor groups. Mares give birth to a single foal after an 11- to 12-month pregnancy.

Considered a wild subspecies because its ancestors were never domesticated, the extinction in the wild of the Przewalski's horse was due primarily to interbreeding with other domesticated horses. About 1,500 exist today, a large number living in zoos, but many also making up herds that have been reintroduced at several sites in Mongolia.

While their greatest threats today include a loss of genetic diversity, their extinction in the wild was also brought on by hunting, loss of habitat, and loss of water sources to domestic animals.

ECOLOGY

Text 1

Extinction of amphibian species

When was the last time you saw a frog? Chances are, if you live in a city, you have not seen one for some time. Even in wet areas once teeming with frogs and toads, it is becoming less and less easy to find those slimy, hopping and sometimes poisonous members of the animal kingdom. All over the world, even in remote jungles on the far side of the globe, frogs are losing the ecological battle for survival and biologists are at a loss to explain their demise. Are amphibians simply over-sensitive to changes in the ecosystem? Could their rapid decline in numbers be signaling some coming environmental disaster?

This frightening scenario is in part the consequence of a dramatic increase over the last quarter of the century in the development of once natural areas of wet marshland, home not only to frogs but to all manner of wildlife. Yet there are no obvious reasons why certain frog species are disappearing from rainforests in the Southern Hemisphere which are barely touched by human hand. The mystery is unsettling, to say the least, for it is known that amphibian species are extremely sensitive to environmental variations in temperature and moisture levels. The danger is that planet Earth might not only lose a vital link in the ecological food chain (frogs keep populations of otherwise pestilent insects at manageable levels), but we might be increasing our output of air pollutants to levels that may have already become irreversible. Frogs could be inadvertently warning us of a catastrophe.

An example of a bizarre occurrence regarding a species of frog dates from the summer of 1995 when 'an explosion' of multi-coloured frogs of the species Rana klepton esculenta occurred in the Netherlands. Normally these frogs are brown and greenish-brown but some unknown contributory factor is turning these frogs yellow and/or orange. Nonetheless, so far, the unusual bi- and even tri-coloured frogs are functioning similarly to their normal-skinned contemporaries. It is thought frogs with lighter coloured skins might be more likely to survive in an increasingly warm climate due to global warming.

One theory put forward to explain extinct amphibian species that seems to fit the facts concerns the depletion of the ozone layer, a well-documented phenomenon which has led to a sharp increase in ultraviolet radiation levels. The ozone layer is meant to shield the Earth from UV rays but increased radiation may be having a greater effect upon frog populations than previously believed. Another theory is that worldwide temperature increases are upsetting the breeding cycles of frogs.

Text 2

Some ideas on the natural balance in the biological world

Man's chief offence against nature has been to damage the earth's natural covering of vegetation without replacing it with a system of farming able to maintain the fertility of the soil. Man the farmer penetrated new lands in many directions, and the forests and grasslands were vulnerable to his various activities.

The roots of plants help to bind and protect the all-important soil and keep it in place. Falling dead vegetation and animal remains ensure a regular return of nutrients to the soil. If kept in good condition a layer of soil acts as a sponge and regulates the movement of water in the area. Also, green plants perform a further vital function on our planet. Carbon dioxide is taken in by the leaves in the daytime because it is one of the raw materials needed for the making of food substances such as sugars and starches in the green cells during the process known as photosynthesis. At the same time oxygen is given out. The carbon dioxide given out by the living world during respiration is thus used and turned into valuable plant products of all kinds. In this way a healthy balance of gases is maintained in our atmosphere.

As farming spread through Europe, Africa and Asia, this natural balance in the biological world was altered in a variety of ways. Cultivators needed to ensure that crops received maximum sunlight and rain and the minimum of competition from other plants. They therefore cleared the land as completely as possible of the previous vegetation.

The 'slash-and-burn' method, as it is called, was developed very early in the history of agriculture, and present-day primitive Dyaks of Borneo, in the East Indies, still provide us with an example of this type of farming. They clear the tropical rain forest of their land with methods very similar to those used by the New Stone Age people in Europe five or six thousand years ago. The bark of the trees is cut so that they gradually die. Other vegetation is also cut down and, when it has dried out, is burned. This leaves gaps of bare soil between the dead trees which now cast little shade. In these gaps the seeds are planted and from them harvests of a sort are finally removed.

After a year or two the harvests begin to get smaller and smaller because the plant food in the soil has been used up. The soil becomes exhausted and the community moves on to the next area to deal with that in the same way. The forest soon invades the abandoned plots and to some extent fertility is restored. During the period of clearance, however, valuable soil will have been lost by erosion and this is especially serious in hilly areas in the tropics where rainfall may be frequent and heavy. While populations were low and stable little permanent damage was done, but with a steady increase in the

size and number of human communities the forest and soil have little time to recover.

Forest felling and the burning of vegetation was frequently practiced in New Zealand by nineteenth-century immigrants from Europe who 'opened up' the country for farming. Such activities loosened the hold the vegetation had upon the soil, resulting in rapid, widespread erosion as the soil that had accumulated over the centuries was carried away by the rainwater draining off the land.

Text 3

Waste Utilization

Growth, so devoutly desired by politicians and public alike, generates more and more rubbish. Getting rid of this rubbish is more and more expensive and there are no financial incentives to encourage consumers to cut back on waste. Municipal waste – mainly generated by households – has been growing by 3% a year broadly in line with the rate of economic growth. Britons currently dispose of about 30 m tones of garbage a year.

Until now Britain has opted for burying most of the stuff. Around four-fifths of municipal waste is sent to landfill sites. This approach has made considerable sense in an island with sites to spare because of its particular geology and a history of quarrying. But landfill sites are getting scarce especially in southern England where most people live. And they are becoming more expensive to run as the government insists on safeguards against environmental hazards like the leaking of toxic wastes into underground aquifers. But the biggest constraint on dumping the stuff in landfill sites is Britain's commitment to meet European Targets to slash the amount of biodegradable waste that is put into landfill sites. These targets are intended to cut emissions of methane (a greenhouse gas) and to reduce the risk of water contamination from landfill.

If you can't bury it, an alternative is to burn it. A programme to build as many as 130 new incinerators was envisaged. But burning also entails environmental risks. Although new incinerators are now much cleaner than previous ones people are scared about exposure to dangerous chemicals like cancer-producing dioxides. So the government now appears to be backing away incinerations.

If you have to bury less and you can't burn more, another option is to recycle more. There is certainly ample scope to do this in Britain which recycles only about a tenth of municipal waste – far less than most European economies do. The government wants to step up its recycling rate to 25%.

Recycling appears to be a possible solution but it can only work if there is demand for recycled materials. The market for recycled metals like alumi-

nium works well but this is not the case for other materials such as plastics. Recycling also remains the most expensive option which is why New York, for example, is going to give up the recycling glass and plastics.

Even if Britain does meet the government's recycling targets a gap will remain between the growth in waste and a landfill capacity that will be increasingly constrained by the European targets. The obvious solution is to get households to throw less away. But this will happen only if household and consumers are made to pay directly (rather than indirectly through taxation) for the amount of waste they generate. Charges can also be used to create incentives for households to separate waste before collecting, something that is vital if recycling is to become more cost-effective.

There was a political kerfuffle when a proposal to this effect by the Cabinet Office was leaked and the government appeared to back away from it. But plenty of European countries do charge for collecting rubbish. It may be politically painful but the only remaining alternative.

EDUCATION AND LANGUAGE

Text 1

Striving for a satisfactory education

The need for a satisfactory education is more important than ever before. Nowadays, without a qualification from a reputable school or university it is very difficult to get a good job. Moreover, one's present level of education could fall well short of future career requirements.

It is no secret that competition is the driving force behind the need to obtain increasingly higher qualifications. In the majority of cases the urge to upgrade is no longer the result of an insatiable thirst for knowledge. The pressure is coming from within the workplace to compete with ever more qualified job applicants, and in many occupations one must now battle with colleagues in the reshuffle for the position one already holds.

Striving to become more educated is hardly a new concept. Wealthy parents have always been willing to spend the vast amounts of extra money necessary to send their children to schools with a perceived educational edge. Working adults have long attended night schools and refresher courses. Is the present situation so very different to that of the past?

The difference now is that the push is universal and from without as well as within. A student at a comprehensive school receiving low grades is no longer as easily accepted by his or her peers as it was once the case. Similarly, in the workplace they may be frowned upon by their employers and have difficulty even standing still. In fact, the expectation is for careers to go backwards and earning capacity to take an appreciable nosedive.

At first glance the situation would seem to be laudable; a positive response to the exhortations of politicians for us all to raise our intellectual standards and help improve the level of intelligence within the community. Yet there are serious ramifications according to at least one educational psychologist. Dr. Brendan Gatsby has caused some controversy in academic circles by suggesting that a bias towards what he terms 'paper excellence' might cause more problems than it is supposed to solve. Gatsby raises a number of issues that affect the individual as well as society in general.

Firstly, he believes the extra workload involved is resulting in abnormally high stress levels in people. Secondly, skills which might be more relevant to the undertaking of a sought-after job are being overlooked by employers not interviewing candidates without qualifications on paper. These two areas of concern for the individual are causing physical as well as emotional stress.

Gatsby also argues that there are attitudinal changes within society to the exalted role education now plays in determining how the spoils of working life are distributed. Individuals of all ages are being driven by social pressures to achieve

academic success solely for monetary considerations instead of for the joy of enlightenment. There is the danger that some universities are becoming degree factories with an attendant drop of standards. Furthermore, our education system may be rewarding doggedness above creativity; the very thing tutors ought to be encouraging us to avoid. But the most undesirable effect of this academic paper chase, according to Gatsby, is the disadvantage that 'user pays' higher education confers on the poor who invariably lose out to the more financially favoured.

Naturally, Gatsby's comments regarding university standards have been roundly criticized as alarmist by most educationists who point out that, by any standard of measurement, Britain's education system overall, at both secondary and tertiary levels, is equal to that of any in the world.

Text 2

Language as a system of symbolic communication

All people known to anthropologists, regardless of their kind of society, have had a highly complex system of spoken, symbolic communication that we call language. Language is symbolic in that a word or phrase can represent what it stands for whether or not that thing is present.

This symbolic quality of language has tremendous implications for the transmission of culture. It means that a human parent can tell a child that a snake, for example, is dangerous and should be avoided. The parent can then describe the snake in great detail giving particulars of its length, diameter, colour, texture, shape and means of locomotion. The parent can also predict the kind of places where the child is likely to encounter a snake, then he or she will probably recall the symbolic word for the animal, remember as well the related information and so avoid danger.

If symbolic language did not exist, the human parents would have to wait until their baby actually saw a snake and then, through example, show the child that such a creature was to be avoided. Without language we could not transmit or receive information symbolically and thus we would not be heir to so rich and varied a culture.

Kanzi is a pygmy chimpanzee. When he was two and a half he was separated briefly from his mother (who had already begun her own language training) and he suddenly, without any coaxing at all, began to use her board and the symbols on it to request food and activities and announce what he was about to do. In one day he showed that he had learned signs his mother had failed to learn. His trainers decided that from that point on Kanzi should be trained to use symbols but that his training would reflect the casual, spontaneous learning he had already demonstrated. Kanzi has never been required to use symbols to get anything – if he does use them it is because he has seen someone else using them, in much the same way a child learns to speak.

Kanzi is quite different from all other chimpanzees that have been taught to use symbols to express their thoughts. For one thing, he understands spoken English. Kanzi's trainers have even tested him with words produced by a speech synthesizer, one that produces a sound for every letter of the alphabet and comes out with a very weird, flat, clipped, monotonous kind of speech, only two-thirds of which is understandable by adult humans. Kanzi understands about two-thirds of it as well, meaning that the emotional content, unintentional stresses on words and any of the other cues that might have tipped him to the meaning of the words spoken by his trainers cannot explain his understanding of speech.

There is also evidence that he can comprehend grammatically complicated commands, as long as they are precise. So if there is an orange sitting in front of Kanzi and he is told, 'Go to the sitting room and get the orange', he hesitates (is he thinking 'which orange'?). But if the sentence is rearranged: 'Get the orange that is in the sitting room', he has no trouble, even though there is that complicated (for a chimp) phrase in the middle, 'that is in the'. In fact at the age of eight Kanzi was better at understanding such sentences than a two-year-old girl who was being asked the same sorts of questions. However, even a brilliant performance by Kenzi is going to be treated with caution by the skeptics, and there has already been some doubt cast on exactly what the symbols on the board mean to Kenzi. It has been argued that because Kanzi switches from one meaning to another for a given symbol, depending on the context, the symbols cannot mean the same thing to him as a word means to a child. For instance, Kanzi will use 'juice' to refer to the 'drink', the place where he gets the drink or the act of going to that place. But when tested for his vocabulary, he links the symbol 'juice' with the picture of a glass of juice. Critics use this evidence to claim that Kanzi just uses the symbol as a means of solving different problems in different circumstances and has no idea that it means 'juice' all the time. This sounds like a tricky argument, because children do what appears to be the same sort of things, like pointing to the chair and saying 'Daddy'. But the critics say that children rarely use a word for two different kinds of things, like using 'table' to mean both the thing in the kitchen and breakfast, whereas Kanzi does.

Text 3

Genes May Influence Language Learning

Mason Inman

If you get tongue-tied when trying to learn a new language, your genes may be to blame, a new study suggests.

While there is no gene yet found that is responsible for preprogramming a person with a given language, there does appear to be a link between types

of two genes and the languages people speak. The new findings could be the first sign of a subtle effect in which people's DNA could bias them toward learning a particular set of languages.

Robert Ladd and Dan Dediu at the University of Edinburgh in Scotland noticed the possible link while studying the genes dubbed Microcephalin and ASPM. These genes play a role in brain development and appear to still be evolving in humans. "I looked at maps of the distributions of the old and new versions of the genes," Ladd said. "And I said, that looks like the distribution of tonal languages."

In tonal languages, the same word can have widely different meanings depending on the inflection of the speaker. The researchers scoured records of genes from societies around the world and compared their findings with the languages those groups speak. While they didn't prove there's a direct link, they did reveal a strong connection between the versions of the two genes that people had and whether their native language was tonal or non tonal.

About half of all existing languages are tonal. In Mandarin Chinese, for example, the syllable "ma" can take on several unique meanings. When it's pronounced with a single high-pitched tone, "ma" means "mother." But when it has a low-pitched lilt in the middle, it means "horse"—making it a word you don't want to mispronounce.

The other half of all languages are non tonal, meaning they use pitch only for things like marking a question.

If your ancestors were from Southeast Asia or sub-Saharan Africa, where the native languages are nearly all tonal, you probably have the older versions of both genes. If your ancestors were all from Europe, where people mostly speak non tonal languages, you probably have the new version of Microcephalin and have a 50-50 chance of carrying the new ASPM gene.

These genes may give you a bit of a tin ear for tone, the study suggests.

Evolving Tongues

The effects of these genetic markers might not be obvious in babies learning their native tongues. As far as anyone has been able to tell, babies can learn any language on Earth equally easily, as long as they are exposed to it from a very early age.

But the differences could show up more strongly in adults struggling to learn a foreign language. "Children don't have quite the same language that their parents have," Ladd said. That's why Shakespeare's English is different from today's.

The new study suggests that genes could also play a role in this phenomenon. "If there was really a gene for tone, you would expect even native speakers of a tone language to vary greatly in terms of their abilities to perceive or use tones in their languages," said Suzanne Flynn, a linguist at the Massachusetts Institute of Technology in Cambridge.

Ladd plans to look for this kind of effect in follow-up studies.

Text 4

Japan Can’t Get School Reform Right

Japan is in the midst of a full-blown education crisis. Or at least that's what media experts and conservative educators would have the Japanese public believe: "Classroom collapse gripping schools nationwide," shouts one recent head line. The reason that parents are ready to storm the ramparts of the education bureaucracy is that little Noriko and Satoru no longer have to go to school every other Saturday.

You read that right: Some fear Japan is becoming a nation of slackers, and that dimwitted bureaucrats are accelerating the process. The Education Ministry began a program of school reforms; including cutting out Saturday classes and rolling back by 30% the number of hours of core course work students must devote to math, science, history, and Japanese language. Now, the press, egged on by concerned parents, is chock-full of stories about collapsing standards at Japanese schools.

Are Japanese schools really on a downward slide? Hardly. In fact, if criticism is being ladled out, it should fall on the university system, not the primary and secondary schools, which continue to turn out highly literate students. That's why the school flap reveals more about the national psyche than it does about real school problems. Japanese pine for the old values—a strong work ethic married to a quiet conformism—that served them brilliantly during its postwar recovery. But the current system, which relies too much on rote memorization and good behavior, isn't going to serve Japan well in an era of nonstop global competition and rapid technology shifts.

The opponents of the school reforms completely distort the threat they pose to young Japanese. On balance, Japanese students still blow away their Western counterparts in international test comparisons. There may be more bullying and unruly 12-year-olds with orange hair, but that hardly constitutes a national crisis.

Once the reforms are in place, basic educational skills will still matter, but so will problem solving and learning to express oneself clearly and logically. The new system, including those free Saturdays, will also allow more time for independent study, reading. And when it's all in place, getting through a Japanese school still won't be a walk in the park. Kids, for example, will still need to memorize 1000-plus Chinese ideographic characters by age 12. Giving students more time to pursue personal intellectual interests and hobbies will teach them the flexibility they need to thrive in a more fluid economy.

So why all the fuss? There are those old values, of course: With the whole economy in crisis, the natural reaction of many Japanese is to make kids work harder, not smarter. But the profit motive is at work, too. The sense

of crisis is being manufactured in part by Japan's massive test-preparation industry, which has an obvious commercial interest in fueling parental anxiety about the still-required entrance exams for competitive high schools and colleges. The irony is that parents should be irate about one aspect of Japanese education, but it's not the primary and secondary schools. It's the universities. Once Japanese kids pass all those gruelling exams and make it to the university level, demands on them are minimal, and they wind back big-time. "It's a four year moratorium on study, and time to learn how to drink," quips Hirotaka Takeuchi, dean of the Hitotsubashi University Graduate School of International Corporate Strategy. It's at the college level— where precious few flunk out no matter how little work they do— that parents are wasting millions of yen. As a result of the failings of the universities, executives complain that new hires often lack basic economic and managerial training. Employers are therefore getting increasingly picky about the college grads they hire. Once a degree from the University of Tokyo or Kyoto University was a ticket to success. No longer. If Japan doesn't improve the caliber of its college graduates, notes Takeuchi, "we are talking about a decline in Japan's global competitiveness.

Text 5

Around the Mall and Beyond

By Michael Kernan

To teach elementary school science, says the ten-year-old National Science Resources Center, there is nothing better than getting young hands on simple experiments to learn more about the world.

I recently attended a conference sponsored by the Smithsonian and the National Academy of Sciences (NAS), and it reminded me of Miss Wells, my fifth-grade teacher at the Utica Country Day School in Utica, New York.

We were studying ancient Rome, and Miss Wells told us about the aqueducts with their stone arches. She actually got us thinking: What made them stay up? Why did they need a keystone? Books didn't tell us much, so Miss Wells had an inspiration. We would build a Roman arch. It took all fall. We constructed little cardboard boxes and poured in plaster of Paris to make our bricks, and piled them up in a somewhat rickety arch. Halfway through, I decided I knew all I needed to know about arches, so went off and built a working guillotine. "A guillotine?" said Miss Wells in a tone of admiration and panic. "Yes. Well, all right, Michael." It was one of those Thirties progressive schools, you understand. The guillotine was displayed without comment alongside the arch at the school fair.

So. Back to the conference. It is called the Elementary Science Leadership Institute, and it is run twice yearly by the ten-year-old National Science Resources Center (NSRC). The NSRC's mission and the purpose of the Institute is to help American students catch up with the world in science. Scott Stowell, a curriculum coordinator from the Spokane public schools and a member of the Resource Team, put it this way: "One of the United States' eight national education goals is being first in the world in science and math. The only way is to have a strong kindergarten through 12th grade program. Computers are just one tool. To understand the ideas of science in a meaningful way, you need to do experiments."

"Hands-on" is the magic word here. Having discovered that the regular old textbooks were not exactly thrilling, the education industry for some years now has been trying in a systematic way to let children all across the nation—especially in the first seven grades, – do some simple experiments, get their hands on rocks and wires and small living things.

The problem, as with any new idea, has been to interest the people who run the schools and control the way things are taught. And this is what the Institute is about. Its initiators are way ahead already.

As many as three hands-on workshops were scheduled at once, with such titles as "The Human Body" for grades three and four, "Lifting Heavy Things" for the second and third grades, and "Food Chemistry" for grade four. The only thing that wasn't hands-on was the language. For example, the Institute's goals for "systemic reform" include: "Construct a model for leadership development in elementary science education that can be used to cultivate other leaders in their communities," "develop strategic plans," "identify and assess," "implement inquiry-centered elementary science programs" and so forth.

But to my surprise we got on fine just the same. It was amazing how much everyone could agree on. Asked to list their goals, the group came up with almost exactly the same priorities as in previous years: to get the children to relate concepts to the real world; to see science as a wonder; to learn to use technologies, including libraries; to know what questions to ask; to know when to take risks and to communicate their discoveries.

Today, Stowell said, the Spokane school system "is in the process of a major implementation." It is even working up its own set of hands-on learning kits to go with the commercial ones already in use.

The kits on the market are rigorously tested for reliability and teaching value. The Full Option Science System, for instance, put out by the University of California and the Encyclopedia Britannica, has modules in four areas—life science, physical science, Earth science, and scientific reasoning and technology. The kits involve such basic scientific studies as magnetism and electricity, air and weather, water, insects, and the physics of sound. They are telling both the students and the teachers that learning can be fun.

We had a demonstration workshop in "Floating and Sinking" – one of 24 curriculum units developed by the NSRC. Each team was given a kit that included little cylinders of wood, metal and plastic, a mystery cylinder, a scale and a pail of water. We were supposed to find out what we could. Right away our team determined that the wood floated and the metal sank. One cylinder was hollow, a tiny bucket, and this obstinately stayed erect on the water because, as we determined, it was light and had a large air space inside it. We took bets on the plastic one. I said it was Teflon and predicted it would sink. Everyone else said no, it was nylon and would float. It floated. Turned out it was polyethylene.

You could read a textbook all day and not find out something like that. Around us, people were getting noisier. Some were roaming from table to table. Some were laughing. Some were looking as if they might start throwing cylinders of water at any moment. "They're out of control!" muttered Sally Shuler. And she sounded just like Miss Wells.

HISTORICAL WONDERS

Text 1

Schliemann discovery

Homer, the great blind poet of ancient Greece, wrote a long account of the Trojan war in the 'Iliad'. People had long been interested in finding the city of Troy, but the only man who took Homer's description seriously was Heinrich Schliemann. Using Homer as his guide Schliemann discovered what was almost certainly the ancient city of Troy. Though he had made it his aim to find Troy as a young man, Schliemann was only able to realize his ambitions after he had become a successful merchant.

Schliemann at once realized that the spot in Asia Minor generally believed to be Troy did not match Homer's detailed description. According to Homer, a palace of sixty rooms had been built on a hill and the Greeks had marched between their ships and the city several times a day. The hill on which Troy was supposed to have been built was not only very small but was a great distance from the sea as well.

Much nearer the sea Schliemann came across a bigger hill. Homer had written that Achilles and Hector had run round the walls of Troy three times while fighting each other. Having calculated that this would have been possible Schliemann decided to dig. It was not long before he discovered the remains of a city – not Troy but a much later one called New Ilium. When his workmen dug deeper Schliemann was most surprised to find that there were no less than nine cities built on top of each other. But which of these was Troy? Homer again provided Schliemann with two important facts: the city had been built of stone and had been burnt to the ground by the conquering Greeks. Schliemann believed that the second city must have been Troy for he found the ruins of a palace and a large gate blackened by fire. Yet the most astonishing discovery was still to come. After noticing something shining in the soil Schliemann got so excited that he dug with his bare hands. He unearthed the beautifully preserved treasure of King Priam: gold, silver and jewellery, thus completing one of the most important historical discoveries ever made.

Text 2

The Great Pyramid

The only one of the Seven Wonders of the Ancient World that still exists is also the oldest of them all. The Great Pyramid at Giza in Egypt was built some time around 2560 BC; it was already two thousand years old when

work began on the next Wonder, the Hanging Gardens of Babylon. The age of the Great Pyramid – more than 4500 years – is so great that it seems almost as if it has been there for ever, and that it will last for ever. In the words of the Arab proverb, 'Man fears Time, but Time fears the Pyramids'. It is so old that it appears almost indestructible.

But age is only one of the reasons why the Great Pyramid is so extraordinary. Another is its size: it is by far the largest of the Seven Wonders and, except for frontier walls such as the Great Wall of China, it is the largest single thing made of stone that has ever been constructed. Then, there is the amazing effort and skill that were needed to cut all that stone and put it together into what is a near-perfect geometrical form, with only simple tools and technology. In fact, if we were asked today for a list of Seven Wonders, the Great Pyramid would certainly still be on it. But why was such an extraordinary thing ever built? What exactly is it? The achievement of the builders seems incredible to us, reliant as we are on modern machinery.

The Great Pyramid, like the other larger pyramids in Egypt, is the burial place or tomb of one of the country's ancient kings. During the period in Egyptian history known as the Old Kingdom (3100-2180 BC), more than twenty pyramids were built at different places along the River Nile. Three of the larger ones are at Giza which is now a suburb of Cairo. Like all the other pyramids, they are on the west bank of the Nile with only the desert and the setting sun beyond. To the ancient Egyptians the west was the home of the dead. This was where the sun-god Ra who sailed across the sky in his boat during the day began his nightly journey down through the Underworld. These structures serve as the final resting place of kings.

For a person's spirit to survive death, the Egyptians believed that the body had to be preserved. This was because the spirit of the dead person left the body at night but had to return to it in the morning for food and rest. Without these things the soul would be lost. Members of a family or their priests would therefore place food in the tomb together with furniture and the other necessities of life. Nourishing the spirit was considered important for life after death.

So that the returning spirit would recognize its home, the body had to be kept as life-like as possible which is why the Egyptians perfected the art of embalming bodies to produce what we now call mummies. We do not know what the ordinary people who could not afford to pay for embalming thought would happen to their spirits after their bodies had decayed. Perhaps they simply accepted that in death as in life they would not be as lucky as their rulers.

Class and economic differences are apparent in the Ancient Egyptians' approach to death.

Their king, or pharaoh, was considered to be a god — a son of the sun-god Ra – and his body had to be especially well protected after death. We can

therefore understand why the pyramid which was his royal tomb was so large: by placing the mummy of the dead pharaoh deep inside such a huge structure, the builders thought that no one would ever be able to disturb it. Special security precautions were taken when burying a 'divine' royal.

The shape of the structure was important too: a pyramid represented the rays of the sun as they spread out and touched the earth. Its design is symbolic.

Text 3

Some Ideas on Pyramids Construction

The ancient Egyptians were sticklers for detail. Despite their size the pharaohs' tombs are positioned with extraordinary accuracy – the east and west walls of the Khufu pyramid, for example, are aligned north-south to within one-twentieth of a degree. Over the centuries many competing theories have tried to explain how the pyramids' builders accomplished this feat of precision engineering. Was it luck, geometric prowess or the helping tentacle of a visiting alien? Now an Egyptologist seems to have solved the riddle – by looking at how the ancients got it wrong rather than how they got it right.

Using the heavens as a compass is complicated by precession – the slow swiveling of the earth's axis that causes the celestial north pole to trace out a circle every 25,800 years. At the moment the celestial north pole is near the star Polaris; in 13,000 years' time it will be near the star Vega. In the night sky of ancient Egypt, though, no such placeholder was present. Kate Spence of Cambridge University suggests that the pyramid builders must have used a couple of nearby stars to fix the location of the pole instead.

Dr Spence suggests that the Egyptians aligned the pyramids according to an imaginary line connecting two stars on opposite sides of the invisible pole – one in Ursa Major and one in Ursa Minor (familiar to Americans as the Big Dipper and Little Dipper). Using a plumb line an ancient Egyptian astronomer could have determined when the line linking the two stars was vertical. The point at which the plumb line met the horizon would then indicate precisely the direction of true north.

Or at least it would for a couple of years either side of 2467BC. Before and after that date this method would give an answer that was slightly wrong. But the error turns out to correspond closely with the observed errors in the pyramids' positions: the further their estimated dates of construction are from this window of accuracy, the larger the errors in their alignments. All of which strongly suggests that Dr Spence's method may indeed have been the one used to align the pyramids.

Furthermore, by working backwards from the alignment error this theory can be used to provide more accurate estimates of the dates of the py-

ramids' construction. Existing chronologies of ancient Egypt involve uncertainties of up to 100 years. But this new approach could narrow down that margin to just five years or so.

No doubt Dr Spence's work will disappoint some people – most notably those who take the meticulous design of the pyramids as evidence either of extraterrestrial intelligence or of the omniscience of the ancients. But, although this new hypothesis seems to demonstrate that the ancient Egyptians were unaware of the effects of precession, at least it restores credit for the design of the pyramids where it is due: they were built by ordinary men using the stars as their guide.

Text 4

The Lost Continent

It all started with the Greek philosopher Plato. About 347 BC in two of his famous dialogues Plato described a prosperous continent inhabited by people of great learning and culture. This continent or island was located beyond the "Pillars of Hercules" which today we know as the Straits of Gibraltar. One day in 9600 BC, according to Plato, the island was destroyed by a volcanic explosion and a huge tidal wave. Overnight it sank to the bottom of the ocean. Only a few people escaped. The name Plato used in his dialogues for this island was Atlantis.

The story of the lost continent, as it is often called, was one told originally by a Greek statesman named Solon. He had heard of the island during a trip to Egypt in the sixth century BC and he found out all he could about it. What Plato wrote two centuries later was based on Solon's findings.

For thousands of years Plato's story of Atlantis was the only one; no one else wrote about it. The two dialogues were full of descriptive detail about the island and many of Plato's fellow Greeks were convinced the story was true. Others, however, including Plato's famous pupil Aristotle, were not convinced: they said it was an invention he used to illustrate his philosophy. Plato insisted that his account of Atlantis was completely authentic.

Since Plato's time millions of words have been written about Atlantis. There is a wide variety of opinion, however, about the location of the island and the exact date that it blew up and sank into the sea. Some authorities on the subject claim that it was located beneath the Azores and that these Portuguese islands in the Atlantic are the tops of mountains on Atlantis. This coincides with what Plato believed. Others feel it is farther south under the Canary Islands.

Certain French archaeologists have announced that the Sahara Desert in North Africa was once covered by an inland sea and that by digging in the sand of the desert we will find Atlantis.

Spanish authorities on Atlantis insist that it is somewhere off the coast of Spain. Russian scientists tell us that the lost continent is in the Caspian Sea. There are many other fascinating theories too. They differ in many ways but all agree on one basic point: long ago there existed a continent that blew up one day and disappeared beneath the waves of the ocean.

In 1882 an American named Ignatius T Donnelly gathered together all the information he could find about the mysterious island and published it in "Atlantis: The Antediluvian World". Today Donnelly's book is still considered the 'bible' of Atlantis. The lost island, he reported, was where all the civilizations of the world, from Egyptian to Incan, originated. Survivors of the catastrophe in 9600 BC fled to the lands east and west. Some of them reached what is now America. There exists the belief among some people that Indians living in the Americas are descendants of these survivors. The Mayan and Incan cultures according to this belief developed from the original civilization of Atlantis. Incan and Mayan folktales relate the story of a people who escaped to America from a terrible disaster in a distant island.

Early in the twentieth century attention turned to yet another explanation of Atlantis: Santorini, an island in the Aegean Sea. In ancient times this was called Thera and was part of the Minoan Empire. Scholars note similarities between Atlantis and the Minoan civilization which was centred at Knossos on the island of Crete. This was a powerful empire until about 1400 BC when a disastrous explosion caused much of Santorini to disappear into the sea. The tidal wave that followed reached Crete destroying much of its coastline. This weakened the Minoan Empire which depended on sea trade. It never got back its former strength as a Mediterranean power.

A great difference in time can be seen here. According to Solon's account Atlantis disappeared in 9600 BC but Santorini was destroyed in 1400 BC. There is a simple explanation for this great difference: Solon read the numerical symbols in the Egyptian records incorrectly. He read 100 as 1000. If we remove one zero we can then read every number in Solon's story of Atlantis quite differently; the destruction of Atlantis thus took place about 900 years before Solon's time, not 9000 years; this places the tragic event in the fifteenth century BC which is when Santorini was destroyed.

More recently an American visionary Edgar Cayce looked into the past and said he saw Atlantis. Although he had never read Plato's dialogues his description of the lost continent was similar to the one written 2300 years before in Athens. Cayce said that in his vision he saw Atlantis located near North Bimini, an island in the Bahamas. He predicted that in 1968 and 1969 some temples of the ancient kingdom would be found there.

In 1968 a deep-sea diver J Manson Valentine came upon the ruins of some ancient buildings while swimming underwater off the coast of North Bimini. Since then other divers have explored the area. They declare that the 'buildings' were not made by man but were formed by nature.

In 1975 and 1977 expeditions conducted by David Zink in the same area brought blocks of stone to the surface. Zink insisted that because of the way these blocks had been formed and placed one on the top of the other, they could only be man-made. Until now no one has been able to dispute this theory.

Where Atlantis was located has been the subject of many arguments but for the moment all that has been claimed, either for or against the existence of Atlantis from Plato's day to the present, has been speculation. The mystery of the lost continent remains unsolved.

Text 5

The Story of the Oldest Seafaring Ship

One of the oldest seafaring ships in the world has been reconstructed after seven years' patient archaeological work. The ship, a sixty-foot sailing vessel, sank off the coast of Cyprus in the days of Alexander the Great around the year 300 BC. Its discovery and restoration have now thrown new light on the ancient trade routes and shipbuilding techniques.

What makes the Cyprus ship so informative is the remarkable state of preservation – mainly due to an unusual feature of its design. The hull was sheathed on the outside with lead that was fixed to the timber with bronze tacks which helped the wooden frame survive 2000 years under the sea.

The first clue to the wreck's existence came in 1964 when a sponge diver from the present-day resort of Kyrenia came across a pile of amphorae (ancient storage jugs).

Unfortunately his diving air supply ran out just at that moment so that he had no time to mark the spot. It took him three more years and hundreds of dives before he chanced upon them again.

He reported his find to an underwater archaeological team from the University of Pennsylvania which was surveying the Cypriot coasts for wrecks. After checking his description, the team decided to concentrate their resources on the Kyrenia ship, and over the next two years a team of no few than fifty archaeologists and divers took part in the excavation.

With the help of a metal detector the team discovered that wreckage lay scattered over a 2000-square-feet area, often buried beneath sand and seaweed. Each item was carefully photographed in its place, and a system of plastic grids stretched over the whole site so that it could be accurately mapped.

More than four hundred amphorae lay buried in the sand. The ship had been carrying a cargo of wine and almonds. More than nine thousand of these were found in or near the amphorae, their outer shells still perfectly preserved. As well as these, there were twenty-nine stone grain mills, being car-

ried both as cargo and as ballast. These were carefully stowed in three rows parallel to the axis of the keel.

As well as the main cargo, there were other small finds. Four wooden spoons, four oil jugs, four salt dishes and four drinking cups suggested the number of crew on the ship's last voyage. There was an axe, and near the intricately carved mast lay a wooden pulley used to raise and lower the yard. A bronze cauldron, used perhaps to prepare the crew's meals, was also lying in the wreck.

Of five bronze coins found none dated earlier than 306 BC. Carbon-14 analysis of the almond cargo pinpointed their date at about 288 BC, but that of the ship's planking suggested an earlier date of 370 BC. Thus the Kyrenia ship was more than eighty years old the day she sank – a long life for a wooden hull and proof of the good craftsmanship of her builder.

Raising the delicate timber of the ship presented grave problems. The archaeologists decided that trying to lift them out in one piece would be too risky. Instead the hull was cut into sections on the site by an electric underwater saw. Then each carefully labeled piece was raised to the surface by a lifting balloon. Once out in the air again, each timber section was treated with a preservative called polyethylene glycol. This replaces the water in the weakened wood so that the timbers do not disintegrate when they dry.

Until the discovery of the ship little was known of the Eastern Mediterranean trading vessels, their routes or their cargoes. Thanks to the different shaped amphorae the Kyrenia ship's last voyage can be traced. She had been threading her way southwards along the coast of Anatolia, stopping at the islands of Samos, Kos and Rhodes before continuing eastwards to the north coast of Cyprus.

What calamity caused her to sink about a quarter of a mile east of the horseshoe harbour of Kyrenia remains a mystery. There are no traces of fire on board which rules out the possibility of lightning. Perhaps a sudden autumn storm simply caught her four-man crew unawares. They seem to have abandoned ship, for no human remains were found on board.

Text 6

Great Wall of China, Damaged, Disappering

Paul Mooney in Beijing

Archaeologists announced the discovery of a new section of the Great Wall of China near the Mongolian border – the northernmost segment ever found.

But what's most noticeable about the wall today is not what's reappearing but what's vanishing. After decades of government neglect and intentional destruction, the Great Wall is by turns crumbling and riddled with relatively new gaps you could literally drive a truck through.

Now, a new national law aims to protect the national treasure, though the first penalties have been relatively mild.

Thirty percent of the Great Wall is in ruins, and another 20 percent is in "reasonable" condition, according to a survey of a hundred sections of the wall carried out by the Great Wall Society of China. The remaining 50 percent has already disappeared. "The Great Wall's greatness lies in its totality," said William Lindesay, the founder of International Friends of the Great Wall. "If there's one brick less, or another gap to make way for a dirty road, then the continuity of the wall is broken and the value is reduced."

The Great Wall was never actually a single wall but many walls, snaking along a 4,000-mile (6,400-kilometer) east-west path across northern China. Some of the barricades are said to date back to the seventh century B.C. But most of what we think of as the Great Wall was built during the Ming dynasty (1368–1644). Attacks on the Great Wall are nothing new, from Han-dynasty battles with the Huns to damages sustained during the 1930s and '40s war with Japan.

Some of the greatest destruction, however, has been fairly recent. In the 1950s, for example, Chinese leader Mao Zedong exhorted the masses to "allow the past to serve the present." Farmers were mobilized to demolish parts of the wall and use the bricks for building houses, pigpens, and walls. As capitalism began making inroads in the 1980s, many officials believed that tourism money would save the wall. But today the industry may pose the biggest threat to the wall's survival. Poorly executed restoration efforts have left sections near the capital, Beijing, looking like a Hollywood set. Entrepreneurs have set up cable cars, souvenir stalls, fast-food restaurants, amusement facilities, villas, and crowded parking lots – all within a stone's throw of the structure. In Gansu province a portion of the wall was rented out to farmers, who "restored" the wall by covering it over with cement, then installed a gate, so they could charge admission. A short distance away tourists have pulled grass from rammed-earth walls – among the oldest and most endangered segments. And Christmas lights have been nailed to the 14th-century towers guarding Gansu's Great Wall gate.

For his new book, The Great Wall Revisited, Lindesay, a photographer by training, gathered hundreds of old photos of the Great Wall. He then set out to rephotograph 150 of the locations in the earlier images, creating sobering pairs of then-and-now scenes. In some cases, he found that sections had disappeared altogether. "Delivering the evidence is very important," Lindesay said. "You can really see the wall disappearing."

The New York-based World Monuments Fund put the Great Wall on its list of the World's 100 Most Endangered Sites. Chinese government officials sat up and took notice. "It was a wake-up call," said Lindesay, who's spent more than 1,200 days on the wall over the past 20 years.

Beijing announced its first regulations to protect the Great Wall in the capital area. Then the central government announced a new national law to protect the wall. It is now illegal to remove bricks or stones from the wall, carve names in the bricks, hold raves on the wall, or build a house against the wall. Also important, the law says that "all citizens, legal entities and organizations" are charged with protecting the wall and reporting illegal activity to government agencies. Vice chairman of the Great Wall Society of China, said the new rules are significant. "Now the government has clearly made the protection of the Great Wall a national effort," he says. "The law states what can and can't be done and it says who's responsible. And it defines society's responsibility to protect the Great Wall." The drafting of the law is a sign of the government's growing awareness of the problem. The Chinese are realizing that a lot has been lost. Already the new law is showing its teeth. A construction company became the first to be fined under the new rules. For dismantling large pieces of the wall to make way for in illegal highway, the authorities fined the builders the equivalent of U.S. $6,500.

The wall's biggest problem today is the lack of understanding among the Chinese, who he said don't realize the true significance of the Great Wall. The survey team, for instance, found parts of the wall covered in Chinese graffiti and farmers carting bricks away from the wall, just as they've been doing for decades. Three men in Inner Mongolia were detained for taking earth from an ancient 2,200-year-old section of the wall to use as a landfill for a village factory. "It's just a pile of earth," village head told to the official. Outside of Beijing the Great Wall is in very poor and backward areas. Trying to get the significance of the wall across to a people worried about their survival is not easy.

CULTURE AND ARTS

Text 1

The Power of Music

Music, after all, is nothing more than a sequence of sound waves. So why did the music of Wolfgang Amadeus Mozart fill his rival, Antonio Salieri, with longing and pain? Why do we fill our own lives with music – in the concert halls of Vienna, in the streets of Harlem, on the plains of India? What is it that allows a sequence of sound waves to touch us so deeply?

Part of the answer seems to lie in the physics of the sound waves. Scales and chords, for example, are constructed from pitches that are mathematical progressions of one another. When we hear a middle C, the air is vibrating some 260 times per second. Double that to 520 vibrations per second, and we hear a C exactly one octave higher; multiply middle C's vibrations by 3/2, and we hear the G in that octave at 390 vibrations per second.

Over the centuries musicians have elaborated such relationships into an enormous body of music theory. But valuable as it is, theory only tells us how music works, not why. It cannot explain why one tune is utterly banal and another is magic.

Obviously, a great deal of our appreciation for music is learned. You may like a song that I hate simply because it resembles other songs that you like. On a more fundamental level, the aesthetics of music vary widely between cultures. In the Orient the stress is on pitch and tiny intricate intervals. In sub-Saharan Africa the rhythms reach dizzying complexity. In the 18th-century Europe of Bach and Mozart, the ideal was order, structure and balance.

But again, none of this explains why almost everyone responds to some kind of music, or why music in one form or another appears in every known human society.

In the last analysis, it seems that the power of music lies not in the sounds but in ourselves. Just as our eyes are receptors to light and our ears are receptors to sound, we somehow have in our brains a receptor to music. In fact Harvard psychologist Howard Gardner argues that musical intelligence is something that is separate and coequal with other forms of intelligence, such as an ability with words or with numbers.

In many ways, Gardner says, music and language abilities are very similar. Babies start to babble fragments of 'song' as early as they start to make little word sounds. Older children progress in stages showing an ability to sing longer and more complex songs in much the same way as they start to use longer and more complex sentences.

But music is not just language in another form. For example, the Soviet composer V. Shebalin suffered a stroke in the left temporal lobe of his brain, the area for language comprehension. Afterwards he had great difficulty communicating, yet his compositions were as brilliant and as sensitive as ever.

On the other hand, a young musical composer suffered damage to the right hemisphere of his brain. He had no trouble communicating and eventually returned to teaching music. But he had lost all interest in composition. He even lost much of his enjoyment in listening to music.

Studies such as these, Gardner says, indicate that some key essence of our musicality is located in the right front of the brain. The exact location, however, and the exact nature of that essence is far from clear. Even if we do someday track down the brain's 'music receptor', we are still left with one final mystery: Why is it there? Some scholars have suggested that our musical abilities evolved at the same time we acquired language, anywhere from a few hundred thousands years ago to a million years ago. Yet language gave our tribal ancestors a clear evolutionary advantage: better communication meant a better chance at survival. What need did music serve?

Of course we would also ask that question about painting or sculpture, dance or poetry. Why do humans respond to beauty of any kind? To that question we have no more answer than Shaffer's tortured Salieri who cried up to his 'sharp old God': "What is this? Tell me, Signore! What is this pain? What is this need in the sound? Forever unfulfillable, yet fulfilling him who hears it, utterly."

Text 2

"Family Heirlooms"

The sale by the University of Manchester of certain books from the financially exhausted John Rylands Library has caused widespread indignation. So too has the Government's proposed legislation permitting national museums and galleries to sell works in their collections.

That is wholly understandable. No one likes the idea of selling family heirlooms, even when they are dull, ugly things. This has nothing to do with the question. Everyone feels better for knowing that they are in the cellar. Sometimes they are of particular emotional value – when they are in languages we cannot understand, or their acquisition is associated with a romantic legend of piracy or fraud.

One trouble with cellars, however, is their tendency to be damp. Another is that over time the cellars begin to get rather crowded. If you have so much that you no longer even know what you do have, and visit your cellars very infrequently, you may find on your next incursion that time has worked its wicked inartistic way with your priceless bins of art.

This is the trouble with the British Museum and the Victoria and Albert Museum in London. Both were accused of scandalously neglecting the millions of works which lie unexhibited in their collections. Many items are said to be already beyond repair. The task of saving others would swallow more than the museums' entire annual budget.

Meanwhile, there are millionaires in America – and, increasingly, in Asia – who would cheerfully pay fortunes for many of these works and would exhibit or at least preserve them. Surely then, the sensible thing would be to sell some of them for the greater good of the majority.

There are, however, some arguments against such sales which are worth considering. In the first place, this is the slippery slope to a time when the Government will reckon that galleries can support themselves by these means, and will cut subsidies still further. Desperate galleries will then start raffling off their treasures to cover current expenses. This would of course be a disaster.

The profit from sales must be spent only on purchase of new works or restoration of old ones. The level of state funding should not change in response to sales. Secondly, these works must be kept for reasons of scholarship. In the Rylands Library case, the books were said to be unnecessary second copies but they were not 'duplicates' in the strictest sense. Scholars need to be able to lay them side by side to study their differences. Scholars, however, have modern reproduction techniques available to them, and in most cases have no choice but to compare works that are thousands of miles apart. They will have to lump it.

Thirdly, it is argued, works have been bequeathed to the museums concerned. To sell them will be illegal, or at least a breach of trust. The answer to this is that not showing works bequeathed is in any case an implicit breach of trust. To sell off the whole of a particular bequest would be wrong. To sell some of it to save – and be able to display – the rest is quite justifiable. The prospect of such sales might also ensure that givers as well as receivers pay attention to the costs as well as the benefits of keeping a precious collection intact.

Lastly, no one can know at a given time whether in fifty or a hundred years a work now considered minor may not suddenly be recognized as a masterpiece. It must be admitted, however, that the works concerned are hardly likely to be destroyed; they will still be available for study and reproduction.

There should certainly be some reticence about selling works by British artists, or ones by artists few of whose works exist in Britain. But museums cannot possibly hang onto every work of art they possess – especially in view of the tendency of our age to swoon for an ever shorter time over what is fashionable, then wake up and forget about it leaving last year's masterpiece to lie gathering dust.

The melancholy truth is that Britain acquired many of its art treasures when it was the richest country the world had ever seen. The world now sees many richer – and the finances of museums and galleries reflect this.

SOME THEORETICAL ISSUES AND SCIENTIFIC DISCOVERIES

Text 1

New Planet Offers Clues in Search for Other "Earths"

Stefan Lovgren

Twenty-eight new planets have been discovered outside the solar system in the past year, scientists announced.

The new discoveries raise the total number of exoplanets—worlds that circle other stars—to 236. Most of the new planets are probably huge balls of gas, more like Jupiter than Earth. But scientists say the increasing rate at which they're finding new exoplanets makes it almost certain that the galaxy is swarming with smaller, rocky, and potentially habitable worlds that have so far eluded detection.

"We're finally now getting a sense that our solar system is not a rarity. There are indeed tens of billions of planetary systems out there, no doubt some of them rocky Earths, lukewarm, and suitable for life ", said Geoff Marcy, who led the California and Carnegie Planet Search team that made many of the discoveries.

Advanced Wobbles

Because exoplanets are too far away to be seen directly, the 28 new planets were discovered by looking for the so-called Doppler wobble among stars. This technique is based on the idea that if an unseen planet orbits a star, its gravitational pull causes a slight "wobble" in the light wavelengths coming from that star.

In addition to revealing the 28 new planets, advances in this technique recently allowed a postdoctoral astronomer at the University of Geneva in Switzerland to pin down the size of a large exoplanet that was discovered by Marcy's team. This planet, which is about 22 times the size of Earth, orbits a star called Gliese 436 that sits some 30 light-years away. From the planet's size and mass, scientists were able to calculate its density, which turns out to be similar to Neptune's. Marcy said that that planet had a composition made of rock in its core and water compressed into a solid form in a surrounding envelope around that core … with perhaps small amounts of hydrogen and helium [on its surface]. "So we're actually getting a very clear sense of the composition of a planet orbiting another star for the first time, and that it has water. And of course water is the essential ingredient for life here on Earth", he said.

Today more powerful technology is also enabling scientists to spot smaller gas giants than they have seen before. "We're just now getting to the point where, if we were observing our own solar system from afar, we would

be seeing Jupiter," Jason Wright, a UC Berkeley postdoctoral fellow, said at the AAS meeting. But the Doppler technique can only be advanced so far and may never be strong enough to find an Earth "twin." I am skeptical that the Doppler method will ever be able to find a terrestrial planet around a sunlike star," Charles Lineweaver, a senior fellow at the Planetary Science Institute in Weston, Australia, commented.

Based on data gathered so far, of the more than 200 billion stars in the Milky Way galaxy, at least 10 percent are thought to have planetary systems. And at least 30 percent of all stars that are known to host planets have more than one. "Many of them remind us of our home solar system," Marcy said."We're finding a lot of cases in which the larger planets—the Jupiters and the Saturns – orbit further from the star than the smaller planets, and that is in fact the case for our solar system," he said.

Among this year's exoplanet finds are at least four new multiple-planet star systems.

Astronomers are finding that stars harboring the most planets are those that are rich in heavier elements, such as silicon, oxygen, iron, and nickel. This may give researchers a clue as to where to look for possible habitable worlds. "It's those richer stars that we're focusing our attention on, because those heavy elements are the building blocks of rocky planets like our Earth," Marcy said. After all, he said, "it's not just the planets that require the heavy elements, it's the organisms themselves, should any exist."

Text 2

Mars Rovers Find "Best Evidence Yet" of Water

Richard A. Lovett

The Mars rover Spirit has found new evidence that the red planet was once quite wet.

A malfunctioning wheel on the rover accidentally unearthed whitish mineral deposits when it scraped through the top layer of soil. “When the rover scientists saw the white patch in the subsoil, they scanned it with an instrument called an x-ray spectrometer and discovered that it was 90 percent pure silica”, said Albert Yen, a geophysicist at NASA's Jet Propulsion Laboratory.

There are two ways such silica-rich deposits might have been formed, but both require water.

One is that the minerals formed when volcanic gases dissolved in water percolated up through the soil, leaching away other minerals and leaving silica behind.

Alternatively, silica-rich water might have bubbled out of hot springs and then evaporated, leaving the deposits found by Spirit. “Either way”, Yen said, "it is hard to concentrate this much material without the action of water."

At the time it came across the deposits, Spirit had been exploring a Connecticut-size basin named Gusev Crater. It had previously found other indications of water in the area, but this was the best evidence yet. "This is a remarkable discovery," added Steven Squyres, the lead scientist of the rover team, in a statement. "The fact that we found something this new and different after nearly 1,200 days on Mars makes it even more remarkable. It makes you wonder what else is still out there."

Frozen Dunes

Meanwhile on the other side of the planet, the other Mars rover, Opportunity, is also finding evidence of water.

Opportunity has spent the past eight months exploring the rim of Victoria Crater, a half-mile (800 meters) wide and 230 feet (70 meters) deep. The rover has spotted numerous outcrops of intersecting sandstone layers similar to those found in southern Utah. Such deposits represent ancient sand dunes now converted to sandstone. "You're seeing the preserved remains of ancient Martian sand dunes," Squyres said. While sand dunes are generally associated with deserts, these formations also reflect ancient water. The sand is composed of sulfates, which were most likely produced when acidic groundwater dissolved minerals out of ancient rock and brought them to the surface. The water then evaporated, leaving sulfate-rich sand that formed the dunes.

Text 3

"Smart Plane" Technology Could Help Damaged Craft Fly Right

John Roach

Airplane technology under development at NASA could bring a whole new meaning to the term "autopilot." Called the Intelligent Flight Control System, the software is meant to help keep damaged planes flying right even in the face of catastrophic failure.Fighter pilots could return to safety with a shot-up wing, for example, or a commercial jetliner could land with a busted stabilizer.

“The software knows how the airplane should fly”, said James Smolka, a test pilot at the Dryden Flight Research Center in Edwards, California, who has been working on the project.

If the plane starts to fly differently than it should, the system will adjust controls such as rudders, flaps, and engines to get it back on track. It measures the actual flight patterns and it knows what it prefers to have, and it tries to change them to fly more like the desired. With this technology, even pilots who lack special training on how to make those adjustments themselves could stay in control of the plane.

The technology can also prevent pilots from intentionally disabling a plane. "Does it make sense for the pilot to shut both engines down on a two-engine plane?" asked Smolka.

“The Intelligent Flight Control System”, he said,”can prevent a pilot from making such an error, intentional or otherwise”.

So far, Smolka has test-flown a modified F-15 aircraft with an early version of the control system. When errors are intentionally introduced, a few irregular motions are noticeable, but the airplane settles out pretty quickly. However, the project has yet to really push the system with catastrophic failures that would normally result in a plane crash.

"You can do that in a simulator pretty easily, but in the actual airplane it's a little more difficult to do," Smolka said. "But at some point you do need to validate that the results you're getting in the simulator are the results you're going to get on an actual airplane," he added. The technology would be most applicable to military aircraft, which have a greater risk of losing control.

Text 4

The Main Source for Survival

Earth is a water planet. And no matter how far researchers travel around the globe, no matter how high or deep they send their probes, if they find liquid water, they find some form of life that manages to survive.

And yet there is a cruel dichotomy about water’s nature. Liquid water cradles life, but water in its solid crystalline form destroys it. Organisms can roost in geysers, wallow in brine and gulp down acid, but they recoil from ice. The rigid ordering of water molecules in ice crystals expels impurities and tears organic tissue beyond repair. Such is the nature of ice on Earth. Yet recent discoveries about an unusual kind of frozen water that is absent from Earth but ubiquitous in interstellar space have inspired scientists to revive their assumptions about ice. In its interstellar form, water ice harbour the kind of simple organic compounds from which life arouse – and may even encourage their formation. As a result, this interstellar ice may actually have played an intrinsic role in the origin of life.

Uncovering the source of the organic materials that may have been the precursors to life has long been one of the most passion inspiring quests in origins-of-life research. For more than a decade scientists have known that organic compounds thrive in interstellar clouds and comets. They have also concluded that a frost rich in water ice exists everywhere in space where dust and gas become cold enough to condense into solids – primarily into cold molecular clouds.

Many planetary scientists have gone further, arguing that ice-bound organics could have hitched a ride to Earth. When a cold molecular cloud collapsed to form our solar system 4.5 billion years ago, as the theory goes, some of the cloud’s ice would have coalesced into comets. These balls of ice and rock could then have carried the organic compounds on a collision course with the young

Earth. After reaching the planet, the organics could have participated in the chemical reactions from which the first living organisms arose.

This scenario has offered a compelling explanation for how organic compounds could have been delivered to Earth, but until recently no one knew how they first formed in interstellar space. Now scrutiny of water's behaviour at temperatures near absolute zero has revealed that subtle changes in the structure of the ice sparked the first association of carbon, nitrogen and other biologically crucial elements.

Text 5

What Governs the Universe?

What would it mean if we actually did discover the ultimate theory of the universe? The fact is we could never be quite sure that we had indeed found the correct theory, since theories cannot be proved. But if the theory was mathematically consistent and always gave predictions that agreed with observations, we could be reasonably confident that it was the right one. It would bring to an end a long and glorious chapter in the history of humanity's intellectual struggle to understand the universe. But it would also revolutionize the ordinary person's understanding of the laws that govern the universe.

In Newton's time it was possible for an educated person to have a grasp of the whole of human knowledge, at least in outline. But since then, the pace of the development of science has made this impossible. Because theories are always being changed to account for new observations, they are never properly digested or simplified so that ordinary people can understand them. You have to be a specialist, and even then, you can only hope to have a proper grasp of a small proportion of the scientific theories. Further, the rate of progress is so rapid that what one learns at school or university is always a bit out of date. Only a few people can keep up with the rapidly advancing frontier of knowledge, and they have to devote their whole time to it and specialize in a small area. The rest of the population has little idea of the advances that are being made or the excitement they are generating.

Seventy years ago, if Eddington is to be believed, only two people understood the general theory of relativity. Nowadays tens of thousands of university graduates do, and many millions of people are at least familiar with the idea. If a complete unified theory was discovered, it would only be a matter of time before it was digested and simplified in the same way and taught in schools, at least in outline. We would then all be able to have some understanding of the laws that govern the universe and are responsible for our existence.

LAW

Text 1

Constraints

There was an early division of crimes into treason, felonies, and misdemeanors (sometimes called trespasses in the early days). High treason consisted of taking some action designed to lead towards the killing of the king, or levying war against the king by a subject, and of certain other acts of disloyalty. Petty treason, finally incorporated into the law of murder in 1828, was the killing of a husband by his wife, a master by his servant, or an ecclesiastical superior by his cleric. Treason was always punished with extreme severity, and followed special rules of procedure of its own. (In the United States, treason is defined in the federal Constitution.)

Felonies at common law entailed at least the possibility of the death penalty or mutilation, and the loss of all of the felon's property. The earliest common law felonies were criminal homicides, rape, arson**,** (malicious burning of the dwelling house of another), larceny (certain kinds of theft), and robbery (certain thefts involving violence or intimidation). At first, all homicides were in theory criminal, but pardons were automatic if investigation showed accident or self-defense. Malicious killings came to be designated as murder and other criminal killings as manslaughter**.** By the fourteenth century burglary (breaking and entering, at night, the dwelling house of another with intent to commit a felony therein) was recognized by the courts as a felony, as was mayhem (malicious infliction of certain serious injuries, as the loss of an arm or leg, resulting in loss of fighting ability) by statute early in the fifteenth century. Some escapes, as where a felon broke out of prison, were recognized as felonious at common law. Some instances of piracy were made felonious by statutes early in the sixteenth century and are usually regarded as common law felonies. Other common law crimes than treason and the felonies just mentioned were misdemeanors, punishable until modern times by fine or by whipping. After the fourteenth century imprisonment became a common punishment for all crimes, (Transportation to the colonies was sometimes authorized for serious offenders in the eighteenth and first half of the nineteenth centuries.) Today in the United States, by statute, felonies and misdemeanors are often distinguished according to the maximum prison term permitted. A year and a day is a common dividing line. Imprisonment is provided for both felonies and misdemeanors, but the distinction has continuing importance in such matters as the felony-murder rule and certain principles of justification. Originally, prisons were primarily for holding accused persons awaiting trial. Lengthy sentences of imprisonment might have amounted to death sentences in the

early days, when disease or starvation might easily be the lot of the prisoner.

While in early English times the death penalty was possible upon conviction of any felony, many in fact escaped the carrying out of the death sentence. Pardon was sometimes available, and in some situations was almost a matter of course.

Or the felon might reach sanctuary (an area under church protection, but usually available only for a limited period of time) and then agree to forfeiture of his properly for permission to abjure the realm.

Text 2

Punishment in Britain

In Britain the death penalty for murder was replaced with a mandatory life sentence nearly 40 years ago. But this change in 1965 did not arrive in time to save Peter Allen and John Walby. They were the last people to be executed in Britain and were both hanged on the 13 August 1964.

However, until the Crime and Disorder Act was passed in 1998 treason could still earn a death sentence as could piracy with violence and arson in a royal dockyard. By passing this act Britain has joined the ranks of over 70 "fully abolitionist" countries, the most recent additions to which include Canada and Mozambique. The act even removes the death penalty for military offences like mutiny- the last execution under military law was in 1942.

On 20 May 1999 the UK government ratified Protocol 6 to European Convention on Human Rights. This commits Britain to the permanent abolition of the death penalty – until a new law is passed to overturn this one. There have been at least 13 attempts to bring back hanging for various categories of murder since 1969 but the trend is for them to be voted down with increasing majorities.

PHYSIOLOGY AND DISEASES

Text 1

Smallpox

Smallpox is an acute, highly infectious disease, producing high fever and a pinkish rash of spots which, when they dry up, leave ugly scars on the skin. For centuries it killed rich and poor alike spreading fast when it took hold in an area, and often seriously disfiguring or blinding those sufferers who escaped death. It was not until 1980 that the World Health Organization declared that the disease was eradicated.

About two hundred years ago the English physician Edward Jenner discovered the process of vaccination which eventually offered reliable protection and caused smallpox to disappear completely. Jenner was born in 1749 and, after studying medicine, lived and worked as a doctor in a small village in rural Gloucestershire. Here he saw people suffering both from smallpox and from cowpox, a weaker, much less dangerous form of infection frequently found in cows. He made an interesting observation that the local country people who caught cowpox because of their daily contact with cattle, did not catch smallpox even if close friends and family were infected. By experimenting on local people, therefore, Jenner was able to prove in 1796 that injections of the cowpox virus could provide protection against smallpox. This process was called vaccination from vacca, the Latin word for cow.

Although other studies were being carried out elsewhere in Britain during the eighteenth century, Jenner made the clinical breakthrough, and the immunity he provided against one of history's most terrifying diseases brought him fame and fortune. He was paid generous sums by the British government when the authorities realized the importance of his achievement. He was also given the freedom of the City of London in l805, an honour not lightly granted. He died in 1823.

Smallpox was not finally wiped out, however, until almost two centuries later. By this time vaccination had become a compulsory part of many countries' public health programmes. It may seem surprising that Jenner's great discovery was not fully exploited at the time. This can be partly explained by the fact that complete eradication required a concerted effort from all countries.

In the village of Berkeley in Gloucestershire, where Edward Jenner used to live, there is a museum which aims to remind us of this English physician's pioneering achievement. The lives of thousands of people have been saved by this one man's careful observation and clinical work.

The onset of the last known case of smallpox was recorded in two remote area of Ethiopia. Because man is the only known reservoir of the smallpox virus, the disease will be eliminated forever when the last infected person

recovers. If epidemiologists of the World Health Organization discover one, the victim will be isolated under 24-hour guard and everyone who has been in contact with him will be vaccinated. An effort will be made to trace the chain of infection back to a previously known, contained outbreak. For two years after the last case is recorded the search will continue for additional outbreaks. If none is found and if a WHO international commission can be satisfied that the search has been thorough, it will be declared that smallpox has been eradicated from the earth.

Text 2

Madness and Creativity

For thousands of years philosophers have pondered the ties between madness and creativity. Now this link has been examined with statistical rigour by Professor Arnold Ludwig of Kentucky University who outlined his findings in a new book.

Instead of leafing through medical notes searching for clues to genius, Prof Ludwig relies on biographies of 20th-century people reviewed in The New York Times from 1960 to 1990. In this way he gathered the names of 1004 poets, journalists, artists and business leaders. He analysed the extent of mental illness in each field, examined other emotional factors fostering greatness, and then created a so-called template for success.

Prof Ludwig believes that genius requires a precise blend of brain chemicals (inherited) and environmental cues. He found that members of the artistic rofessions or creative arts suffer more types of mental difficulties and do so over longer periods of their lives than members of other professions. He also found that 24 per cent of his sample had suffered the death of a parent before the age of 14. A previous study of 24 British prime ministers suggests that 63 per cent had suffered the loss of a parent by the age of 15. The rate in the general population is 17 per cent. He concludes that contrary to conventional expectations, not all people are permanently devastated or damaged by such a loss.

Some 10 per cent of his samples suffer genetic disability and another 10 per cent have suffered illness for at least six months during their youth. Prof Ludwig speculates that physical frailty, like the death of a parent, sparks an inner angst, a feeling of inferiority that drives children to excel.

The crucial clues to genius, the heart of Prof Ludwig arguments, are revealed in his final analysis in which he subdivides his sample to distinguish thinkers such as Albert Einstein or even Agatha Christie from elite such as kings.

Outstanding individuals tend to be born with talent, have creative parents, a mentally ill mother, a tense household and a bout of physical illness. Above all, Prof Ludwig highlights 'psychological unease' as distinct from mental illness. "This is extremely important because unlike past studies that

have talked about mental illness, I talk about the sense of unease that bridges the gap between those who are normal psychologically but who have the capacity to generate inner tension", Prof Ludwig says. This inner tension, whether triggered by a psychiatric illness or by the death of a loved one, encourages the budding genius to bury himself in his work sometimes at the expense of his happiness. Prof Ludwig believes that true psychological unease is the result of a variety of factors.

Now that we all have the secret of success, the real question is whether we want to pursue it. Do we want to endure chronic inner tension to reach the top of the carrier ladder? Do we want to bring up children who are burdened by mental anguish? Not even the best psychiatrist can predict the path best for you, the merry stroll of mediocrity or the emotionally draining ascent of success. And that is why Prof Ludwig called his book The Price of Greatness.

Text 3

Quarantine

When plague was travelling across Europe in 1348 the authorities in Venice became more and more nervous as the new and terrible disease got closer to the city. They had no idea what to do, and in the end consulted the city's astrologers. The astrologers suggested putting all travellers to Venice, together with their vehicles and ships, on an isolated island and leaving them there for some time. The astrologers didn't know how long they should stay there, and so they consulted the stars and came to the conclusion that forty days would be the best period.

Starting from 30 March 1348 all travellers, ships and vehicles coming to Venice had to stay on the island, and they were only allowed into Venice after they had been on the island for forty days without developing plague. Other cities like Milan and Marseilles copied Venice in keeping travellers out of the city for a magic period of forty days. The word 'quarantine', based on the Italian for 'forty', is now used in many languages to describe isolation for people who may have contagious disease.

Text 4

Alchemy and Alchemists

Primitive man found out by trial and error how to carry out a certain number of simple chemical changes, but under the ancient Egyptian civilization men learned how to work copper, tin, iron and precious metals; how to make pottery, glass, soap and colouring agents and how to bleach and dye textile fabrics. These arts were the beginnings of the chemical industries of today. The early scientific study of chemistry, known as alchemy, grew up in

the first few centuries AD at Alexandria in Egypt. There two important things came together: one was the practical knowledge of the Egyptian workers in metals, pottery and dyes; the other was the learning of the earlier Greek philosophers such as Hippocrates and Aristotle. At the same time alchemy was much influenced by ideas from the East about magic and astrology – foretelling the future from the stars.

Greek philosophers regarded debate about the nature of matter as superior to experiment and some held that all matter was made up of the same four 'elements': earth, fire, air and water. Many people therefore thought that if these elements could be rearranged, one substance could be changed into another. For instance, a base metal could perhaps be turned into gold. The chief aim of the alchemists was to find a way of doing this.

Alchemy came under Arab influence when the armies of Islam conquered Egypt during the seventh century. The Arabs carried its study into Western Europe when they advanced into Spain. Many Arabic words are still used in chemistry: 'alkali', 'alcohol' and even 'alchemy' itself which means 'the art of Egypt'. The greatest Arab alchemist was Jabir ibn Hayyan, possibly the same person as Geber, author of two important books on alchemy known from the Latin translations of the thirteenth century. Jabir claimed that mercury and sulphur were 'elements' like the four Greek ones. He said that all metals were composed of mercury and sulphur in different proportions. To change a base metal into gold required the proportions to be changed by the action of a mysterious substance which came to be called 'the philosopher's stone'. Alchemists searched in vain for this substance for several hundred years.

Alchemy was studied widely in Europe during the twelfth and following centuries and attracted the attention of many learned men. Though they were doomed to fail in their attempts to make gold, their work led to the growth of a great deal of new chemical knowledge and of methods of making experiments. Many of the later European alchemists, however, were complete frauds who preyed upon trusting people by all sorts of tricks, and the subject fell into disrepute. By the first half of the sixteenth century the aim of the alchemists had changed from the making of gold to the making of medicines. In particular, they sought a fanciful substance called 'the elixir of life', a powerful medicine which was to cure all ills and which would turn out to be the same substance as 'the philosopher's stone'. This phase of chemistry lasted until 1700.

Text 5

Great Discovery

In 1928 Sir Alexander Fleming noted, after accidentally leaving a dish of staphylococcus bacteria uncovered, that some common green mould had grown among bacteria. As the mould grew, it formed a liquid which de-

stroyed the nearby microbe-colonies. Fleming tried this liquid out on other types of bacteria and found that some were dissolved while others were left unharmed. He named the fluid 'penicillin', unaware that his chance discovery was to have tremendous consequences.

Fleming realized that penicillin had great antiseptic qualities, but the active principle in the mould was too unstable and difficult to extract. For a time, the only practical purpose of penicillin was to separate different types of bacteria from each other.

Ten years passed before any serious attempt was made to produce penicillin from liquid cultures of mould. Two scientists, Howard Florey and Ernst Chain, carried out a great number of experiments and eventually succeeded in deriving a yellow powder from the liquid. The powder was crude and full of impurities; but it was a hundred times more active than the original discovery. It was found to possess two very important properties: it annihilated bacteria and did not harm body-tissues when applied locally to cuts and wounds. The next step was to find out whether penicillin could be introduced into the bloodstream and so be carried to every part of the body. When experiments were made with mice, penicillin acted in the same way in blood as it had done in water: the bacteria were killed and the blood-cells remained unaffected. The time had now arrived to see whether this powerful antiseptic could be used to combat human disease. Even though tests proved extremely difficult because only small amounts of the substance could be produced under laboratory conditions, results were miraculous. The remaining problem was to produce penicillin in large quantities. Because of the war, it was impossible for Britain to embark on large-scale production, and Florey was obliged to go to America. Soon sufficient qualities were available to effect a low mortality-rate among battle casualties. After the war penicillin came into general use.

Fleming has taken his place among the great benefactors of mankind. That the mould had grown by chance is of no coincidence. What matters is that he was there to observe it. Without his presence, this 'chance' would have gone undetected and might never have occurred again.

INTERESTING FACTS

Text 1

Why do we need sleep?

Most people seem to need about eight hours' sleep a day and curious and disturbing things begin to happen when the ratio is reduced. The fact that sleep is essential to life has been known for hundreds of years. A physiologist in the last century demonstrated that puppies would die if kept awake for more than five days. More recent experiments carried out on people show that sleep deprivation produces profound psychological disturbances including delusions, disorientation and a state of panic or depression.

Why do we need sleep? It is easy enough to say that our cells and specifically the cells of our brain need rest in order to recover from the stresses and strains of the waking day but 'rest' is a term that leaves some basic questions unanswered. Muscle cells are just as much at rest when we are lolling in an armchair watching television as when we fast asleep in bed dreaming of our true love or the bullying boss at the office. Think of the vivid impression you probably retain of a few recent dreams and you will be fairly satisfied that our brain cells can be just as active during sleep as they are when we sit at the office desk.

Within the past few years a number of fascinating studies have suggested that sleep is a sort of regular care and maintenance period essential to the continued function of the brain and that dreaming is a part of the maintenance process. Experimental psychologists have found that a high proportion of our sleeping time is occupied in dreaming and that dream periods are marked by rapid movements of the eyeballs. This fact was established by waking sleepers up when the characteristic flicker of the eyes was observed and finding that they almost invariably reported an interrupted dream: the subjects of the same experiment woken during quiet periods merely describe a return to consciousness out of sweet oblivion. The next stage of these investigations yielded surprisingly unexpected results. Two groups of slumbering volunteers were compared. Some were deprived of dreaming time by being woken only during dream periods; the others were made to do without an equal amount of sleep but were shaken awake only while in the dreamless state. Subjects who had their dreams interrupted for nights on end quite soon began to show acute distress symptoms similar to those experienced by people denied sleep altogether, but the others whose sleep had been equally curtailed were not affected. Strangest of all, when the dream-deprived subjects were finally allowed to sleep peacefully they dreamed continuously. They seemed to be trying to repay a 'dream-debt'.

This sort of experiment has lead to the mysterious idea that our main purpose in sleeping is in fact to dream. One theory about this compares the

brain to a computer. A computer must have off-duty spells during which the mass of information programmed into it is sorted and revised. The suggestion is that the brain needs similar periods of freedom from absorbing information so that it can, so to speak, digest one lot – by sorting, classifying, integrating and discarding various items and impressions – before facing the assault of another encyclopedic day. The dream is supposed to be the apparently irrational series of pictures which flash on to the screen during the sorting process. Whatever the truth of the matter (and clearly much is not yet fully understood) it seems quite certain that we need to dream just as surely as we need to eat and breath and we abstain at our peril.

Text 2

Plants Can Recognize, Communicate With Relatives.

Plants have family values, too, it seems, with new research suggesting they can recognize close relatives in order to work together. An ability to tell family from strangers is well known in animals, allowing them to cooperate and share resources, but plants may possess similar social skills, scientists believe.

Susan Dudley and Amanda File of McMaster University in Ontario, Canada, report they have demonstrated for the first time that plants can recognize their kin. This suggests that plants, though lacking cognition and memory, are capable of complex social interactions. "Plants have this kind of hidden but complicated social life," Dudley said. The study found plants from the same species of beach-dwelling wildflower grew aggressively alongside unrelated neighbors but were less competitive when they shared soil with their siblings.

Sea rocket, a North American species, showed more vigorous root growth when planted in pots with strangers than when raised with relatives from the same maternal family, the study found. This is an example of kin selection, a behavior common in animals in which closely related individuals take a group approach to succeeding in their environment, the researchers said.

Kin selection also applies to competition, the scientists added, because if family members compete less with each other, the group will do better overall. "Everywhere you look, plants are growing right up next to other plants," Dudley said. “Usually it's a case of each plant for itself ”, she said. "But sometimes those plants are related, and there are benefits to not wasting resources on being competitive," Dudley said. "And there is not really a cost to not being competitive as long as your neighbor is also not being competitive."

More recent, still unpublished research by Dudley's team suggests other plants besides sea rocket show similar behavior. “In addition to restraining root growth, such plants may also develop different stem lengths in the presence of siblings. But how the plants determine which of their neighbors are siblings remains a mystery”, Dudley said.

Learning and memory appear to be important for kin recognition in animals, but this isn't an option for plants. Some researchers speculate that plants communicate through their roots, identifying themselves using tiny chemical signatures specific to each plant's family.

The new study may have important implications for agriculture, since competition between plants can reduce crop yields. Planting more cooperative siblings together instead of strangers could theoretically mean better harvests. The research adds to other recent studies that plants are much better communicators than are generally thought. For example, some species react to attacks by leaf-munching insects by producing chemicals that attract wasps that prey on the unwanted bugs. But scientists have been puzzled to find that neighboring plants not being eaten by the insects send out similar calls for help. In a separate recent study from Kyoto University in Japan, researchers have found that this may be evidence of an additional SOS sent out by insect-ridden plants. Plants being eaten signaled their nearby siblings, which responded by putting out their own distress "messages," the Kyoto research suggested. "We hypothesized that plants have evolved to emit a secondary signal to help nearby relatives by promoting the recruitment of natural enemies [of the pest insects]," wrote Yutaka Kobayashi and Norio Yamamura in the latest issue of the journal Evolutionary Ecology.

Plants are also known to be able to identify close relatives to guard against inbreeding. They have self-incompatibility mechanisms where they recognize pollen. This stops them from being fertilized by their own pollen or by a plant that shares its genes.

Text 3

Cicadas as Food: Summer's Low-Fat Snack?

High-protein, low-carb dieters take note: The billions of cicadas emerging from the ground in the midwestern U.S. are a healthy alternative to that bacon double-cheeseburger without the bun. "They're high in protein, low in fat, no carbs," said Gene Kritsky, a biologist and cicada expert at the College of Mount St. Joseph in Cincinnati, Ohio. They're quite nutritious, a good set of vitamins.

Billions of periodical cicadas, known as Brood XIII, are beginning to crawl out of the ground and to carpet trees in the midwestern United States. Soon Brood XIII will be gone – not to be heard from again for 17 years. Cicadas spend most of their lives underground sucking sap from tree roots. The plant-based diet gives them a green, asparagus-like flavor, especially when eaten raw or boiled, according to Kritsky.

Crayfish, lobsters, crabs, and shrimp are part of the same biological phylum as insects, Jadin, an entomology graduate student at the University of Maryland notes in her brochure ”Cooking and Enjoying Periodical Cicada."

She said the recipe she most wanted to try is chocolate-covered cicada. "I like chocolate, and chocolate-covered insects are common worldwide," she said. "We'll see how comparable they are to chocolate-covered crickets."

Eating insects for food is common throughout the world and dates back thousands of years. For example, in parts of Africa scarab beetles are considered a delicacy.

Jadin's brochure begins with a disclaimer from the University of Maryland asking would-be cicada eaters to first consult a doctor because, like all foods, certain individuals may have an allergic reaction. Despite the warning, Jadin said there is no evidence to suggest that cicadas are unsafe to eat. Her only concern was with cicadas that emerge in areas heavily treated with pesticides and herbicides, as the insects could have absorbed the chemicals into their bodies. Eaten in moderation, cicadas are a good source of protein (about the same amount pound per pound as red meat) and are full of vitamins and minerals.

Cicada Preparation

Aspiring cicada gourmands should begin by collecting the raw ingredients.

The insects are best eaten just after the nymphs break open their skins but before they turn black and hard. They are best collected in the early morning hours, just after the insects emerge from the ground but before they crawl up trees, where they are harder to reach. If these cicadas are unavailable, the next best menu item is adult females – their bellies are fat and full of nutritious eggs. Adult males, however, offer little to eat. More crunch than munch, the males' abdomens are hollow.

With raw cicadas in hand, preparation is a matter of chef's choice. "Most people like them deep fried and dipped in a sauce like a hot mustard or cocktail sauce," Kritsky said. Other people boil or blanch them. Cicadas take on a "nutty" flavor when roasted. Many cicada recipes call for a lot of spices and sauce, which usually wind up being the dominant flavors.

Text 4

Humans Wear Diverse "Wardrobe" of Skin Microbes

The billions of microscopic critters that cloak your skin are a bit like fashionable threads – the ones you're wearing today may be out by next season.

That's the implication of a new study, which identified more than 240 distinct microbes on the forearms of six healthy people. Each person's "wardrobe" of germs seems to be as unique as his or her sense of style. No two volunteers had all the same microbes on their flesh, though they did have some overlap, said study leader Martin J. Blaser. "There's a lot of variation from person to person – tremendous variation," said Blaser, a microbiologist and infectious disease doctor at the New York University School of Medi-

cine. But a preserved set of organisms was found, which's pretty consistent." People's microbial outfits seem to be coordinated: Left and right arms matched in any given test. But volunteers who were tested repeatedly showed little similarity among the microbes they sported from one time to another. "The skin is an extremely complex ecosystem affected by our environment," Blaser said. "When we change our soap or shampoo or laundry detergent, when we change whether we're wearing a cotton shirt or a wool shirt, all of these are going to have an effect on our skin flora," he said.

Wardrobe Malfunction?

For their study, Blaser and three colleagues probed small skin samples from the six volunteers and found 1,221 signatures of nonhuman DNA. From these they identified 182 distinct species, some of which are new to science. Eight to ten months later they retested four subjects and found 65 additional species.

Blaser and other experts want to know whether certain skin microbes are connected to chronic inflammatory diseases such as psoriasis and eczema—which would make the critters our skin's version of a wardrobe malfunction. David A. Relman is a microbiologist at Stanford University and chief of infectious diseases at the VA Hospital in Palo Alto, California said "A lot of skin diseases look as if they ought to be caused by an infectious agent. But we don't have an infectious agent to blame".

Relman suggests that "orchestrated manipulation" of the skin's ecosystem, perhaps with science-based cosmetic products, might someday suppress disease-causing skin bacteria and nurture friendly ones. "A better understanding of the indigenous microbiota of the human body," he said, "will lead to much more prudent strategies for maintaining and restoring health."

Text 5

Concrete

Concrete has been a high-tech material since Roman times, when it was discovered that adding volcanic ash to the mix allowed it to set under water. Similarly, the Romans knew that adding horsehair made concrete less liable to shrink while it hardened, and adding blood made it more frost-resistant. In modern times, researches have added other materials to create concrete that is capable of conducting electricity. It heats up when a voltage is applied, making it possible to build runways and drives that clear themselves of snow. Bill Price of the University of Houston now has an ambitious plan to make concrete with an even more unusual property: he wants it to be transparent.

That is not as absurd as it sounds. Technically, concrete is simply a mixture of three ingredients: big lumps of material called the coarse aggregate (such as gravel), smaller lumps called the fine aggregate (such as sand) and a binding

agent, or cement, to glue it all together into a solid. So transparent concrete, in theory, should be fairly easy to make using bits of plastic or glass of various sizes, with some kind of transparent glue to act as a binding agent. Tests of his initial samples suggest that, structurally, translucent concrete is just as good as the traditional kind. But it would cost around five times as much.

Text 6

Fossils

As each layer of sedimentary rock was formed the plants and animals which were alive at that time became buried in it when they died. Usually they simply rotted away without any trace, but occasionally fossil skeletons have survived for millions of years. It is from these fossils that we learn about extinct plants, such as the giant tree ferns, and extinct animals, such as the great reptiles. We can tell from rocks that dinosaurs lived about two hundred million years ago and early fishers five hundred million.

Fossils also give us clues about the climate. For example, rocks in Greenland contain fossils of plants that can live only in a warm climate; so we can conclude that these northern regions must once have been warmer. Fossils tell us about changes to the Earth as well. Those of sea animals found in mountain ranges, for instance, show that the areas which are mountains today were once probably under the sea. This evidence suggests that great earth movements must have taken place. Indeed, there is other evidence that on some occasions these movements were so violent that even the order of the rock layers was upset. In the Grand Canyon of Arizona the river has cut a gorge 1.5 km deep so that the layers of rock (strata) built up over three hundred million years are clearly visible.

Rocks containing fossils help us to trace the Earth's history back six hundred million years. The older igneous rocks which contain no fossils cannot be used in this way but scientists can calculate their age by testing the radioactive materials they contain: as radio-isotopes decay they form stable products. It is the ratio of active to stable material that provides an age clue from which it is estimated that the Earth started to cool about four thousand million years ago.

Text 7

Underground cities project in Japan

Japan, a densely inhabited country, is bursting with people. Cities have extended outward and upward to their limits. In the future they may extend downward. Developers envision future underground cities of stores, offices, hotels and theaters extending for hundreds of miles. These underground cities would be sustained by immense under ground structures containing equip-

ment to generate power, process waste and condition the air. Engineers are confident that the structures would be safe. They would be resistant to earthquake and water leakage and would not collapse from external pressure. Engineers admit that the structures would be vulnerable to fires. An out-of-control fire could trap thousands of people underground. To prevent such a catastrophe sensitive smoke detectors would be installed throughout. If a fire originated, people would be immediately evacuated upward or sheltered in a pressurized temporary waiting room. The underground atmosphere would be carefully controlled to provide comfortable levels of temperature and humidity and to create the illusion of a natural environment. To make the artificial environment appear more natural real sunlight would be reflected from the surface and abundant green plants would flourish everywhere. Planners predict that the biggest obstacle to future underground cities will be psychological resistance to living underground. They fear people may be unable to endue for days without seeing the real world. Therefore, planners foresee few underground habitations. Instead, people would live above ground, but work, shop and enjoy themselves underground. Underground cities may be a good solution to Japan's shortage of space for expansion.

POLITICAL AND ECONOMIC ISSUES

Text 1

The new Russian Menace

By JAMES A. LEACH

James A. Leach, a Republican Representative from Iowa, is the chairman of the House Banking Committee, which will hold hearings on international financial corruption.

Recent allegations that American and European banks have facilitated money laundering for Russian organized-crime figures underscore how intractable a problem corruption in Russia is and how vulnerable Western institutions are to the lure of servicing the world's most virulent klepto'cracy.

Russia is hardly the first country to be victimized by a culture of corruption. The plundering of the Philippines under Marcos, the looting of Zaire by Mobutu and Indonesia' s crony capitalism stand as parallels. What sets Russia apart is the pervasiveness of politically tolerated corruption in a country of such size and geopolitical significance.

The Russian Government estimates that criminal syndicates control 40 percent of the economy and perhaps half of the country's banking assets, though others put the figures higher. In any country where political stability is questionable and legal protections of property are unreliable, those who come to control wealth, legally or otherwise, can be expected to invest abroad. In Russia, theft exceeds investment, resulting in negative economic growth and a disillusioned society.

The question is how the West should respond. Americans have both a vested and a humanitarian interest in helping the Russian transition to democracy. But there's no credible way to suggest to taxpayers that they should support assistance to a government that allows insiders to recycle aid from the West in the form of laundered bank deposits, personal investments in the stock market. American policy in this circumstance should be directed to helping the Russian people, not its rulers.

The struggle of the last half century was to defeat Communism; the challenge in the years ahead will be to constrain corruption. The second struggle may well prove more difficult.

We should begin by enforcing our laws, issuing indictments if necessary. Such actions might prompt Russian prosecutors to do the same, calling Russia's new class of thieving oligarchs to account for domestic crimes more serious than international banking violations. We should also emphasize retrieving stolen assets for the Russian people rather than giving new aid, except perhaps food assistance. For the Russians' part, instead of propelling the flight of capital through a banking system that principally serves as a platform

for money laundering, they should establish community-oriented banks and press for the opening of branches of well-regulated Western banks in which people can trust that their savings will be turned into loans for local enterprises. No nation, after all, can prosper if it lacks institutions where people can safely put their money and seek secure loans.

Most of all, we have an obligation to insure that the corrosive impact of foreign corruption is blocked from our shores. America may be as challenged today by the threat of a deterioration of values galloping corruption as it was yesterday by Marxist ideology.

Text 2

The origin of taxation

The Bible records that Jesus offered his views on a taxation matter and converted a prominent taxman. In its early days taxation did not always involve hanging over money. The ancient Chinese paid with pressed tea and Jivaro tribesmen in the Amazon region stumped up shrunken heads. As the price of their citizenship ancient Greeks and Romans could be called on to serve as soldiers and had to supply their own weapons. The origins of modern taxation can be traced to wealthy subjects paying money to their king in lieu of military service.

The other early source of tax revenue was trade, with tolls and customs duties being collected from travelling merchants. The big advantage of these taxes was that they fell mostly on visitors rather than residents. One of the earliest taxes imposed by England's Parliament in the 13th century was 'tonnage and poundage' on wine, wool and leather, targeted at Italian merchants. Sometimes rulers went a little over the top. Excessive taxation was one reason why King Charles I of England lost his head. Many of those guillotined during the French Revolution of 1789 were much-resented private tax collectors.

Income tax, the biggest source of government funds today, is a relatively recent invention, probably because the notion of annual income is itself a modern concept. Governments preferred to tax things that were easy to measure and therefore to calculate liability on. That is why early taxes concentrated on tangible items such as land and property, physical goods, commodities and ships. The first income tax was levied in 1797 by the Dutch Batavian Republic. Britain followed suit in 1799 and Prussia in 1808. Like most new taxes these imposts were first introduced as temporary measures to finance war efforts.

What stands out about the 20th century is that governments around the world have been taking a growing share of their countries' national income in tax mainly to pay for ever more expensive defence efforts and for a modern

welfare state. Taxes on consumption, such as the sales tax that is a big source of revenue for America's state and local governments, and the value-added tax on goods and services in Europe have become increasingly important.

Big differences between countries remain in the overall level of tax. America's tax revenues amount to around one-third of its GDP, whereas Sweden's are closer to half. There are also big differences in the preferred methods of collecting it, the rates at which it is levied and the definition of the 'tax base' to which those rates are applied, as well as the division of responsibility for taxation between levels of government.

The increasing globalization of economies in the 20th century was accompanied by a rare outbreak of internationalism by the tax authorities. Many countries chose to tax their citizens on their global income whether or not they had already paid their due on some of it abroad.

The League of Nations in 1921 commissioned a report by financial experts who concluded that this practice of 'double taxation' interfered with economic intercourse and the free flow of capital. It suggested rules for determining when tax should be paid to the country in which the income is generated and when to the taxpayer's country of residence. It drafted a model treaty that spawned many bilateral agreements. Initially intended to stop income being taxed twice, these bilateral treaties opened the way for multinational companies to avoid tax on their profits altogether by setting up in business where taxes were lowest. Combined with greater mobility of capital this new flexibility encouraged tax competition between countries

SOME SOCIAL ISSUES

Text 1

The science and practice of persuasion

The science and practice of persuasion: from business owners to busboys, the ability to harness the power of persuasion is often an essential component of success in the hospitality industry.

Research reveals that there are six basic principles that govern how one person might influence another. Those principles can be labeled as: liking, reciprocation, consistency, scarcity, social validation, and authority.

We will highlight some of applications of these principles in the hospitality industry--for instance, how a restaurant manager might reduce the reservation no-show rate by two-thirds; how to influence the size of the gratuity patrons leave for their servers; how to encourage customers to order additional food when they do not really want it; and how to get customers to comply with employees' reasonable requests.

Simply put, in general people are inclined to favor and to comply with those whom they like. A good illustration of this fundamental principle of influence in action is the Tupperware party, in which salespeople invite their friends and neighbors to their homes to pitch useful household plastic products. A study done by Frenzen and Davis confirmed what the Tupperware Corporation knew all along: guests' liking for their hostess was twice as important as was their opinion of the products in influencing their purchase decisions.

In the case of the Tupperware party, the seller is not just a likeable person, but is probably a friend and respected community member as well. The power of the "liking" principle is so pervasive, however, that even perfect strangers can recognize whether there is any affinity between them within a relatively short time. Researchers have identified four primary determinants of our fondness for another person: physical attractiveness, similarity, cooperation, and the extent to which we feel the person likes us.

Looking good. Most of us acknowledge that those who are physically attractive have a social advantage held by few others, but evidence suggests that we have grossly underestimated the degree to which that is true. For example, good-looking candidates received more than two-and-a-half times as many votes as did unattractive candidates in the 1974 Canadian federal elections, despite the fact that most voters denied that attractiveness had any influence on their decisions.

One possible explanation for such findings is that we tend to view attractive individuals as possessing numerous other positive qualities that would be considered relevant to our liking them – such as talent, kindness,

honesty, and intelligence. One practical (and unfortunate) result of the "attractiveness" principle is that less-attractive individuals who rely heavily on tips for income may have to work especially hard to gain customers' affection, approval, and cash.

The social and monetary rewards that beautiful people garner extend far beyond those benefits; they are also more successful at eliciting compliance with their requests. Reingen and Kernen found that an attractive fundraiser for the American Heart Association collected almost twice as many donations as did less-attractive individuals. That finding suggests that training programs in the hospitality industry could increase the effectiveness of trainees by including, for instance, grooming tips.

Simpatico. Similarity is another important factor that affects our liking for others. The effects of similarity-- however superficial --can be quite astounding because of the instant bond that similarity can create between two people. Consider that in one study a fundraiser on a college campus more than doubled the contributions received by simply adding the phrase "I'm a student, too" to the request. Just as salespeople are trained to find or even manufacture links between themselves and their prospective clients, individuals whose livelihoods depend on quick-forming rapport with their customers--such as food servers or valets--may enhance their earnings simply by pointing out a connection between themselves and their guests. "Hold the mayonnaise? Yeah, I don't eat it very often myself," and "Wow, you're from Chicago? My wife is from just south of there. She sure doesn't miss the winters" are examples of commonplace attempts to create such a similarity.

Text 2

The Loneliness of the High-Powered Woman

For six months, I have been reading *The New York Times's* "Portraits in Grief"– heart-rending profiles of the people who died on September 11 – and I've noticed a pattern: most of the men killed in the attack on the World Trade Center, particularly those in their 30s and 40s who worked in the financial industry, left wives and children. More often than not, however, their female colleagues were single and/or childless and were lauded as loving aunts and friends.

The probable reasons for this gender dichotomy are detailed in the latest in a long line of books about women, work, and family: Creating a Life: Professional Women and the Quest for Children by economist Sylvia Ann Hewlett. This is not just another polemic about how hard it is for women to "have it all." Hewlett, the author of several books on work and family, gives a nuanced picture of what life is like in the U. S. for career women, based on extensive research. The heart of the book is a national survey of the parental

and marital status of 1,168 high-achieving professional women, a further 479 women with advanced degrees who've dropped out of the workforce, and 472 high-achieving men, all between 28 and 55.

The study shows that 49% of women over 40 who earn more than $100,000 a year are childless. That compares with 19% of men in the same category. And lest you assume that these women chose the life they're living, only 14% said they had not wanted children.

So what happened? Based on a lot of the press commentary, it seems that one popular assumption is that most of these women cared more about their careers than about marriage and children, and now they are paying the price.

But Hewlett reveals a more uncomfortable reality, one that is not getting much attention from the commentators who see this as strictly a woman's problem, or fault. A primary reason so many career women don't have children is that they don't have spouses. Only 57% of the high-achieving women over 40 in corporate jobs are married, compared with 83% of male achievers. Overall, high-achieving women either marry early or not at all. Just 10% of the women surveyed got married for the first time after age 30, and 1% after age 35.

One woman interviewed, an associate in the municipal-securities department at UBS Paine Webber Inc., relates how those statistics play out in her office. "Half of the male associates in my group are already married with children. And in all cases they have stay-at-home wives. In contrast, most of the female associates are single. Only two of them are married, and neither have children." Further up the career ladder the male-female divide becomes even more marked", she says. The men are all married with kids, while the two forty something executive women are both divorced and childless.

It seems that boys don't make passes at girls who get MBAS. Interview after interview features women who, as they became more successful, were rejected by a man, or found it difficult to get a date in the first place, or ended up with men who either didn't want children (often because they already had kids by their discarded first wives), or saw no reason to "rush" into parenthood. As one practical woman acknowledges: "The hard fact is that most successful men are not interested in acquiring a peer as a partner."

Hewlett does a good job of laying out the problems facing professional women, and her data are brought vividly to life by the many interviews she did with women, and some men, who are grappling with these issues. She devotes a heartbreaking chapter to the problem of infertility and the many women who do not want to believe that the odds are firmly against successfully giving birth once they're past the age of 40. She also shows how hostile the corporate world is to family life, regardless of your sex. Longer and longer workweeks for the managerial classes make it tough for anyone to spend time with children—although, as she notes, at least men with stay-at-home

wives get to have them. Where Hewlett falls down is in her proffered solutions. She wants women while still in their early 20s to construct a plan for getting married and having kids, just as they do for their careers. But life has a nasty way of derailing plans.

So here's a thought: How about viewing this as a male rather than a female problem? *Creating a Life* could be assigned to all men in graduate programs. Classes could be set up to encourage men to marry women who are their professional equals. Classes could start changing a corporate culture that seems to have been designed by and for men not eager to spend time with their families. And perhaps we all could recognize that, since children are the future of society, it might be worthwhile to reconcile their needs with the demands of the workplace.

Text 3

Youth's Problems

To some observers, teens today may seem spoiled (undisciplined and egocentric) compared to those of earlier times. The reality, however, is different. While poverty has decreased and political turmoil has lessened, young people are still under many types of stress. Peer pressure, changing family conditions, mobility of families and unemployment are just a few reasons why some young people may try to escape reality by turning to alcohol or drugs. However, most young people in the United States do not have problems with drinking, drug abuse, teen pregnancies or juvenile delinquency. Drug use has decreased among young people in the United States within the last 10 years, though alcohol abuse has increased.

According to one of the government's surveys, about 8 million teenagers are weekly users of alcohol, including more than 450,000 who consume an average of 15 drinks a week. And, although all 50 states prohibit the sale of alcohol to anyone under 21, some 6.9 million teenagers, including some as young as 13, reported no problems in obtaining alcohol using false identification cards. Although many teenagers say they never drive after drinking, one-third of the students surveyed admitted they have accepted rides from friends who had been drinking.

Many young Americans are joining organizations to help teenagers stop drinking and driving. Thousands of teenagers have joined Students Against Driving Drunk (SADD). They sign contracts in which they and their parents pledge not to drive after drinking. In some schools, students have joined anti-drug programs. Young people with drug problems can also call special telephone numbers to ask for help.

Aside from drug abuse, another problem of America's youths is pregnancy among young women.

One million teenagers become pregnant each year. Why are the statistics so high? The post-World War II baby boom resulted in a 43 percent increase in the number of teenagers in the 1960s and 1970s. The numbers of sexually active teens also increased. And some commentators believe that regulations for obtaining federal welfare assistance unintentionally encourage teenage pregnancies. Many community programs help cut down on the numbers of teenage pregnancies. Some programs rely on strong counseling against premarital sex and others provide contraceptive counseling. The "Teen Health Project" in New York City has led to a decline of 13.5 percent in the rate of teenage pregnancies. Why? Their program offers health care, contraceptive counseling, sports programs, job referrals and substance abuse programs.

About one million young people run away from home each year. Most return after a few days or a few weeks, but a few turn to crime and become juvenile delinquents. Why are young people committing crimes? Among the causes are poor family relationships (often the children were abused or neglected while growing up), bad neighborhood conditions, peer pressure and sometimes, drug addiction. Laws vary from state to state regarding juvenile delinquents. Once arrested, a juvenile must appear in a juvenile court. Juvenile courts often give lighter punishments to young people than to adults who commit the same crime. Juvenile courts hope to reform or rehabilitate the juvenile delinquent. New programs to help troubled youths are created every year. For example, the city of New York and the Rheedlen Foundation provide an after-school program at a junior high school to help keep teens from becoming juvenile delinquents. Young people can talk with peer counselors (people their own age), receive academic tutoring or take part in athletic and social activities. One New York community's library offers weekday evening workshops in dance, art, music and theater. They also sponsor social events, such as theater productions, in which young people can participate. Another group, the "Youth Rescue Fund" has a celebrity peer council of 15 teenage actors and actresses who volunteer their time to increase teen crisis awareness. As one young television actress said: "Teenagers are an important resource in improving the quality of life for all people."

CLONING

Text 1

Troublesome Business

Cloning or nuclear transfer involves shifting the nucleus of an adult cell into an egg which has had its nucleus taken out. The resulting cell or zygote then has all the genetic material and biochemical machinery it needs to get on with the business of becoming an embryo.

It also becomes a ready source of embryonic stem cells which can transform themselves into the different cell types needed to build a body. Most adult cells lack this versatility. But when their nuclei are transferred into eggs something happens which gives them the potential to get into new lines of work.

Many researchers and needy patients are hopeful that embryonic stem cells might one day provide a supply of replacement tissue for organs worn out through disease and old age. Because the transplanted nucleus could come from one of the patient's own cells the resulting stem cells would be genetically identical to the donor. Therefore any 'spare parts' grown from such cells and popped back into the patient might avoid the problem of transplant rejection which comes with genetically mismatched grafts.

But cloning is a troublesome business. Experience with species cloned thus far including sheep, cows and pigs shows it to be very inefficient; according to one estimate it would take 280 human eggs to produce a single line of embryonic stem cells. Human eggs are in short supply and hard enough to obtain for routine in vitro fertilisation, let alone to meet the additional demands of therapeutic cloning.

There are ethical dilemmas to deal with too. Therapeutic cloning is essentially the same as reproductive cloning. Regulations in Britain which were recently amended to allow research into therapeutic cloning stipulate that the cloned embryo must end its days in the laboratory within 14 days of creation. Even with this safeguard, together with stern prohibitions on the reproductive cloning of humans in most countries with sufficient resources to do it, many feel therapeutic cloning is a step too far.

Text 2

Genetic Engineering

Genetic engineering is a subject which is rather complicated for the public. As the science of genetic engineering advances, science fiction is being turned into reality. Such developments, however, are totally unacceptable to a large proportion of the general public.

Many people object to the use of genetic engineering in food production. In research centers throughout the world experiments are being carried out to produce genetically modified plants that can resist pests or produce a higher yield or last longer. For example, tomato products are already being sold which do not spoil quickly. They are labelled by people as 'Frankenstein' tomatoes. The main concern of many people is that these changes are unsafe.

They fear that such alterations will in turn ultimately lead to changes in the environment and food chain, which scientists have not thought of. Similarly, people are anxious that certain altered micro-organisms which are dangerous might accidentally escape into the environment with catastrophic consequences. Can scientists confirm categorically that the modifications they have made to the structure of plants and animals will not affect the health of both humans and animals?

Another major argument against is that the morality of using genetic engineering is questionable. Recently, the general public were shocked and disturbed to see on TV and in many newspapers the sight of a mouse which had been genetically engineered to have no immune system. What disturbed most people was the sight of a human ear growing under the skin of the mouse's back. The ear was developed for cosmetic reasons, for example to help deformed children. While everyone would agree with the aim of helping people with physical deformities, few people could not but be appalled at the immoral use of helpless animals in this way.

These are but a few examples of the main arguments against the practice of genetic engineering.

Text 3

More of an Art than a Science

In February 1997 the picture of a sheep appeared on the front pages of newspapers around the world. Dolly was the world's first clone of another adult animal- a genetically perfect copy of a ewe made using DNA extracted from a single sell. Months later the same team of scientists from the Roslin Institute in Scotland unveiled two more cloned lambs, Molly and Polly, whose DNA had been engineered to carry a human gene so that their milk contained a blood-clotting agent to treat haemophilia.

These first successful cloning experiments were recognized as a big step towards "pharming" where animals are specially created to mass-produce pharmaceutically useful compounds. But it later emerged that Dolly was the sole success from almost 300 attempts at the Roslin Institute to clone embryos and was suffering from premature arthritis – possibly because she was the clone of an adult animal. Further experiments confirmed that Dolly's telomeres (the "caps" on the end of the chromosomes) were shorter than nor-

mal for a sheep of her age – they indicated that she was biologically six years old when born.

Scientists are beginning to realize that cloning remains more of an art than a science, the success being the exception rather than the rule. Dolly's creator Ian Wilmut preferred to go back to the lab where he is trying to better understand the basic biology nuclear transfer and crack some of the technical barriers involved.

Text 4

Everything You Need to Know about Cloning

Plus, what's at stake if Congress makes human cloning a criminal offense

Less than a year after President George W. Bush set limits on government-funded stem-cell research—the cellular building blocks that develop into different parts of the body—he has stepped into another contentious scientific debate. This time, the issue is whether to prohibit human cloning. Bush called for passage of a Senate bill sponsored by Senator Sam Brownback that would make it a crime to carry out human cloning. Here are some questions and answers to help clarify the debate:

What is cloning?

"Cloning" simply means copying. Identical twins are clones, copies created naturally when cells divide in the womb. Scientists routinely produce clones of all kinds of human and animal cells for research purposes. The issue is whether to make it a crime to do experiments in which a copy of somebody's DNA is inserted into a human egg.

Why is that controversial?

Human cloning involves taking someone's DNA—extracted from, say, a skin cell or a hair follicle—and inserting it into an unfertilized human egg from which the existing DNA has been removed. Such an egg could theoretically develop into a human being if implanted in a uterus. Most researchers, biotech companies, politicians, and many others oppose the use of cloning to create children. Others say it is unethical because it is so unsafe. Given the present state of knowledge, such children could be born with severe deformities, if they survived at all.

But aren't researchers more interested in cloning for its therapeutic benefits?

Here's where things start to get a little tricky. Those who oppose cloning on moral grounds believe that these embryos are human beings and therefore experimentation on them, even at their earliest stages of development, is wrong. Moreover, they fear cloning can't be partially restricted: Allowing the technique for research purposes could lead to reproductive cloning, since the

same techniques are involved. Scientists note, however, that the process by which children could be created can also be used to produce some types of human cells. Because the human egg grows, divides, and gives rise to all the cells of the body, researchers think they will be able to use the genetically altered egg to produce a lab dish full of certain kinds of human cells, such as neurons or pancreatic cells. Many consider this research to be ethical and very promising.

Why would anyone want to make these specialized cells in the laboratory?

The potential benefits of therapeutic cloning are huge. Suppose you've been the victim of a stroke or Alzheimer's disease or some other condition resulting in the loss of brain cells. Implanting new brain cells might correct or ease the symptoms. But such implants could be rejected by the body if they came from another donor in the same way that liver or kidney transplants are often rejected.

With therapeutic cloning, doctors could theoretically take a sample of your DNA, put it into a human egg, and grow neurons genetically identical to your own— and thus unlikely to be rejected. That's the theory, anyway. It may be years before such techniques are perfected. Proponents say blocking the research would make it impossible to see if it works.

What kinds of diseases could be treated by therapeutic cloning?

In addition to their value in the treatment of strokes or Alzheimer's disease, cloned neurons could be used to correct the movement disorders of Parkinson's disease or to restore movement to people who are paralyzed. Cloned pancreatic cells could be transplanted into diabetics to produce the insulin that their own pancreases are not producing. Eventually, many other diseases might become treatable using cloned cells. Again, however, more research is needed to determine the potential benefits.

Is any of this work being done now?

Researchers are at the very earliest stages of experimenting with such treatments. Work is just beginning with neuron implants in Parkinson's, for example, though no one has yet tried the experiment with cloned cells. Researchers do not yet know how to transform a generically altered egg into neurons, pancreatic cells, or other specialized cells.

So far, only one U.S. company has claimed to have cloned a human embryo for this type of research: Advanced Cell Technology Inc. in Worcester, Mass. Other companies, such as Geron Corp. in Menlo Park, Calif., and Infigen Inc. in DeForest, Wis., have cloned animals. Because of the difficulty of cloning human cells and the fact that it might be made a crime, other U.S. companies have hesitated to enter the field.

Can't much of this work be done through stem-cell research?

Stem cells can be used to treat many of these conditions. Bush's decision on stem cells allows researchers to study how to convert stem cells into neu-

rons or other kinds of cells. But stem cells have a drawback: they carry the genes of the donor they came from, not those of the patient who needs a transplant. Thus, they do not solve the potential problem of rejection.

Who else has taken sides in the debate?

Many conservative and right-to-life groups support making human cloning a crime. Many scientific groups have taken the opposite side. 40 Nobel laureates signed a letter saying that "by declaring scientifically valuable biomedical research illegal, Senator Brownback's legislation... would have a chilling effect on all scientific research in the U. S."

What effect would passage of Brown-back's bill have on the biotechnology industry?

For now, it wouldn't have a significant economic effect because so little of this research is now being done. But there is a danger that the U.S. could lose the lead on this research to England. It allows therapeutic cloning on embryos up to 14 days old, but forbids the use of cloning to produce a child. Moreover, the Biotechnology Industry Organization, which represents 1,100 biotechnology companies, is concerned that the bill could set a precedent that would encourage opponents to try to block other kinds of biomedical research. The Brownback bill could deter researchers from doing any work remotely related to cloning for fear that it might land them in jail.

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