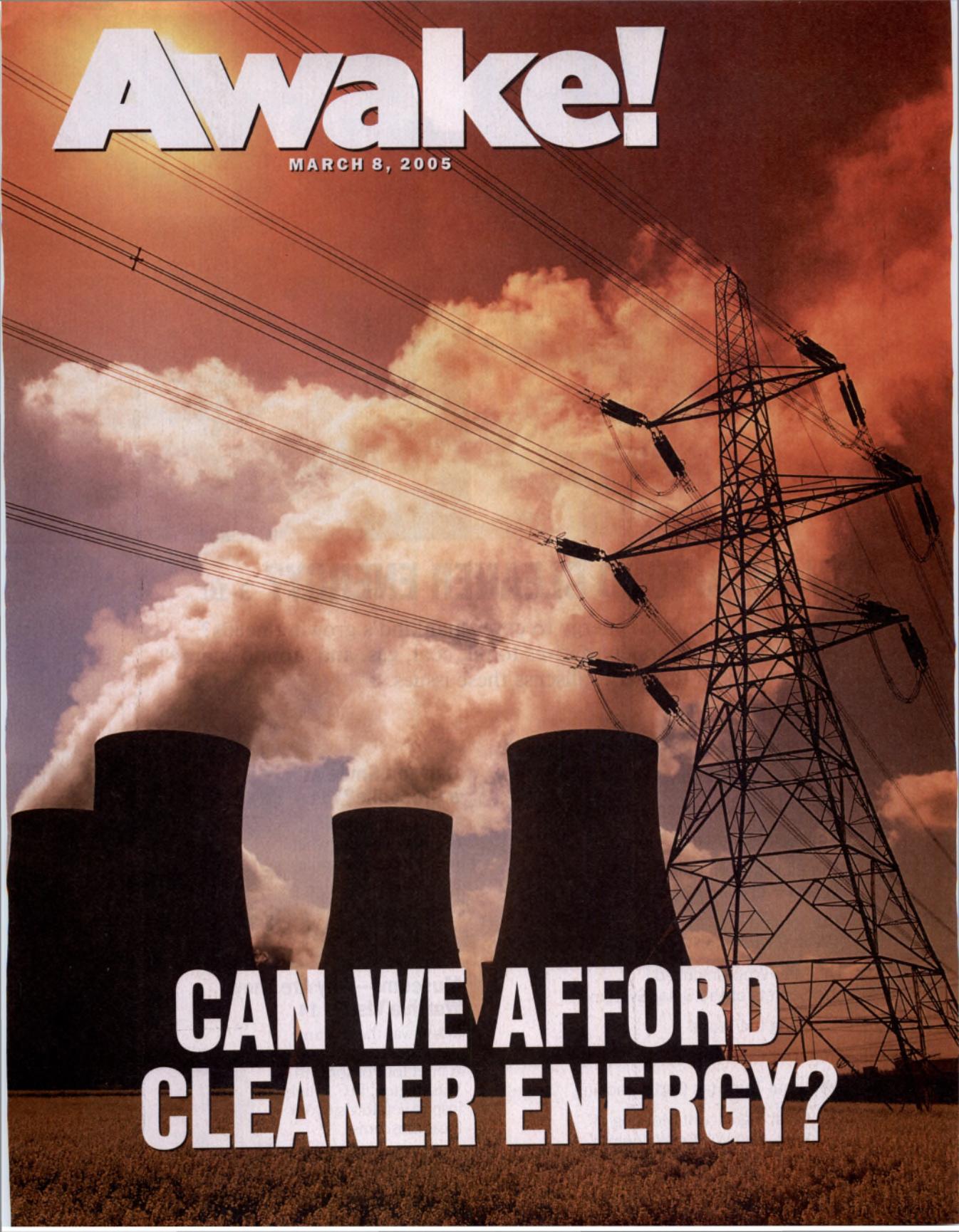


Awake!

MARCH 8, 2005



**CAN WE AFFORD
CLEANER ENERGY?**

Awake!

AVERAGE PRINTING 22,842,000
PUBLISHED IN 87 LANGUAGES

SUN

WIND

GEOHERMAL

WATER

DOE Photo

CAN WE AFFORD CLEANER ENERGY? 3-10

Will there be enough energy to cover mankind's growing needs?
Are there any clean alternatives to oil, coal, gas, and atomic energy?
The articles in this series discuss these issues.

- 3 Energy—Why Essential for Life?
- 4 Why the Need for New Power?
- 7 What New Developments in Energy?
- 10 Finding the Source of All Energy
- 20 The Bible's Viewpoint
Is God Everywhere?
- 22 The Tomato
—A Very Versatile "Vegetable"
- 24 The Man Who Unlocked
the Secrets of the Solar System
- 28 Watching the World
- 30 From Our Readers
- 31 'A Journal That Has God's Backing'
- 32 The Most Significant Meeting of
the Year—You Will Be Welcome!

Can You Smile at a Crocodile? 11

India has a variety
of crocodiles, but what
might make you smile
at one?

Courtesy St. Augustine Alligator Farm
Zoological Park



Museums—Why Are They Worth a Visit? 14

When was the last time
you visited a museum?
A brief tour of some in
Washington, D.C., might
inspire you to visit your
local museums.



ENERGY WHY ESSENTIAL FOR LIFE?

BABY Micah was born in August 2003. A gasoline-powered car rushed his mother to the maternity ward. A coal-burning power station lit the hospital in which he entered the world. A central heating system burning natural gas warmed the room in which he took his first breath. If any one of these traditional power sources had failed, little Micah's life could have been jeopardized.

The modern civilization into which Micah was born depends on a variety of energy sources for its very existence. Every day we rely on fossil fuels in some way—to transport us to work, to cook our food, or to light, heat, and cool our homes. The World Resources Institute says that fossil fuels are used to "meet about 90 percent of global commercial-energy demand." A report published by the Institute in 2000 says: "In energy terms, oil makes the single largest contribution to world energy supply, at 40 percent, followed by coal at 26 percent and natural gas at about 24 percent."^{*}

The journal *Bioscience* says: "On average, every year each American uses about 93,000 kilowatt-hours [of power], equivalent to 8000 liters of oil, for all purposes, including transportation, heating, and cooling." In Australia, China, Poland, and South Africa, more than 75 percent of the electricity used comes from coal-fired generators. India relies on coal for 60 percent of its electric power, while the United States and Germany burn coal to supply more than half their electricity.

"It's less well known that the world's food is now nourished by oil," states journalist Jeremiah Creedon in an article entitled "Life After Oil." "Petroleum and natural gas are crucial at every step of modern agriculture, from making fertilizer to shipping crops." (*Utne Reader* magazine) But how secure are these energy sources from which modern society draws its life and livelihood? Are there any cleaner alternatives available?

* For more information on the history of oil exploitation, see the November 8, 2003, issue of *Awake!* pages 3-12.

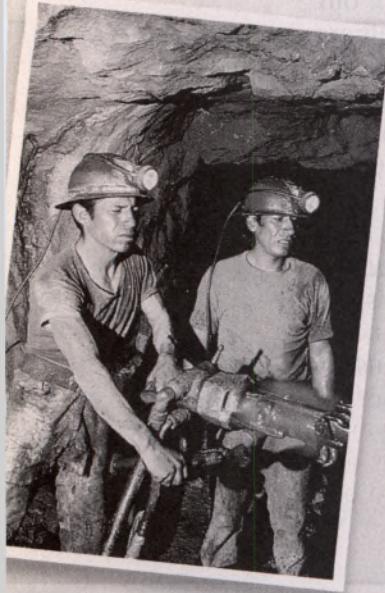
WHY THE NEED FOR NEW POWER?

“If we think oil is a problem now, just wait 20 years. It’ll be a nightmare.”

—Jeremy Rifkin, Foundation of Economic Trends, Washington, D.C., August 2003.

WITHIN about 20 years—by that time young Micah would be old enough to drive a car—worldwide energy consumption “is expected to expand by 58 percent,” claims the U.S. government’s *International*

Energy Outlook 2003 report (IEO2003). *New Scientist* magazine calls the predicted boom “the biggest surge in energy demand in history.” Can traditional sources of energy safely meet this demand? Consider these sobering facts.



COAL:

■ Of all the fossil fuels, coal is the most abundant, with enough estimated reserves to last 1,000 years. Globally, coal-fired power stations supply nearly 40 percent of the world’s electricity. Australia is the world’s largest coal exporter, supplying almost a third of all the coal traded worldwide.

Yet, a recent Worldwatch Institute press release states: “Coal is the most carbon-intensive fossil fuel, releasing 29 percent more carbon per unit of energy than oil, and 80 percent more than natural gas. It accounts for 43 percent of annual global carbon emissions—approximately 2.7 billion tons.” Aside from its environmental impact, what effect can coal burning have on human health? To cite one example, a recent United Nations *Global Environment Outlook* report stated: “In China, smoke and small particles from burning coal cause more than 50 000 premature deaths and 400 000 new cases of chronic bronchitis a year in 11 of its large cities.”

Awake!®

THIS JOURNAL IS PUBLISHED for the enlightenment of the entire family. It shows how to cope with today’s problems. It reports the news, tells about people in many lands, examines religion and science. But it does more. It probes beneath the surface and points to the real meaning behind current events, yet it always stays politically neutral and does not exalt one race above another. Most important, this magazine builds confidence in the Creator’s promise of a peaceful and secure new world that is about to replace the present wicked, lawless system of things.

Awake! (ISSN 0005-237X) is published semimonthly by Watchtower Bible and Tract Society of New York, Inc.; M. H. Larson, President; G. F. Simonis, Secretary-Treasurer; 25 Columbia Heights, Brooklyn, NY 11201-2483. Periodicals Postage Paid at Brooklyn, N.Y., and at additional mailing offices. **Changes of address** should reach us 30 days before your moving date. Give us your old and new address (if possible, your old address label).

POSTMASTER: Send address changes to *Awake!*, c/o Watchtower, Wallkill, NY 12589. © 2005 Watch Tower Bible and Tract Society of Pennsylvania. All rights reserved. Printed in U.S.A.

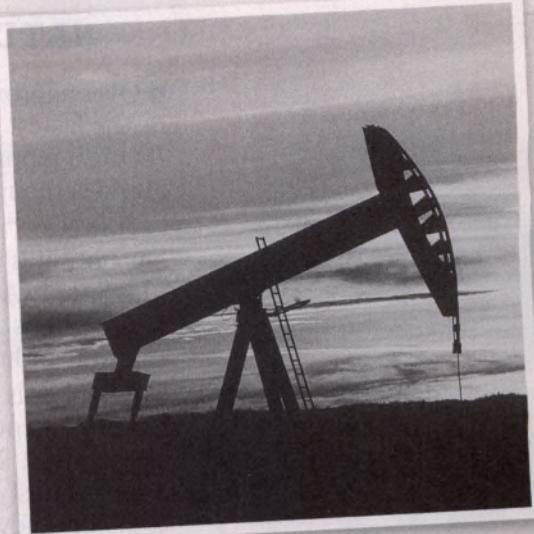
OIL:

■ The world already consumes 75 million barrels of oil a day. Of the world's total oil reserves, which are estimated to have been some 2 trillion barrels in volume, approximately 900 billion barrels have already been consumed. At present production rates, oil supplies are predicted to last another 40 years.

However, geologists Colin J. Campbell and Jean H. Laherrère claimed in 1998: "Within the next decade, the supply of conventional oil will be unable to keep up with demand." These oil-industry experts warned: "Conventional wisdom erroneously assumes that the last bucket of oil can be pumped from the ground just as quickly as the barrels of oil gushing from wells today. In fact, the rate at which any well—or any country—can produce oil always rises to a maximum and then, when about half the oil is gone, begins falling gradually back to zero. From an economic perspective, when the world runs completely out of oil is thus not directly relevant: what matters is when production begins to taper off."

When is oil production expected to taper off? Petroleum geologist Joseph Riva says that "planned oil production expansions . . . are less than half that needed to meet the 2010 world oil demand projected by IEA [International Energy Agency]." *New Scientist* warns: "If production rates fall while demand continues to rise, oil prices are likely to spike or fluctuate wildly, raising the prospect of economic chaos, problems with transporting food and other supplies, and even war as countries fight over what little oil is available."

While some analysts see dwindling oil supplies as a problem, others feel that the end of our dependence on oil cannot come quickly enough. Writ-



ing in *Utne Reader*, Jeremiah Creedon says: "The only thing worse than running out of oil might be not running out of oil. The carbon dioxide we create by burning oil continues to heat the planet, yet the economy and the environment are still usually discussed as separate issues." Highlighting the consequences of just one country's addiction to oil, the Australian Broadcasting Commission reports: "The 26 million vehicles in the United Kingdom generate one third of all the UK's carbon dioxide (which leads to global warming) and one third of all the UK's air pollution (which kills around 10,000 people each year)."

Semimonthly Languages: Afrikaans, Albanian, Arabic, Cebuano, Chinese, Chinese (Simplified), Croatian, Czech,⁴ Danish,⁵ Dutch, English,⁶ Estonian, Finnish,⁷ French,⁸ German,⁹ Greek, Hungarian, Iloko, Indonesian, Italian,¹⁰ Japanese,¹¹ Korean,¹² Latvian, Lithuanian, Norwegian, Polish, Portuguese,¹³ Romanian, Russian, Serbian, Slovak, Slovenian, Spanish,¹⁴ Swahili, Swedish,¹⁵ Tagalog, Ukrainian

⁴ Audio cassettes also available.

⁵ CD (MP3 format) also available.

Monthly Languages: Amharic, Bulgarian, Chichewa, Georgian, Hebrew, Hiligaynon, Igbo, Macedonian, Malagasy, Malayalam, Maltese, Myanmar, Nepali, Papiamento (Aruba), Papiamento (Curaçao), Sepedi, Sesotho, Sinhala, Tamil, Thai, Tsonga, Tswana, Turkish, Xhosa, Yoruba, Zulu

Publication of *Awake!* is part of a worldwide Bible educational work supported by voluntary donations. Unless otherwise indicated, Scripture quotations are from the modern-language *New World Translation of the Holy Scriptures—With References*.

Would you welcome more information? Write Jehovah's Witnesses at the appropriate address: **America, United States of:** Wallkill, NY 12589. **Australia:** Box 280, Ingleburn, NSW 1890. **Britain:** The Ridgeway, London NW7 1RN. **Canada:** Box 4100, Halton Hills (Georgetown), Ontario L7G 4Y4. **Ghana:** P. O. Box GP 760, Accra. **Jamaica:** P. O. Box 103, Old Harbour, St. Catherine. **New Zealand:** P.O. Box 75-142, Manurewa. **Nigeria:** P.M.B. 1090, Benin City 300001, Edo State. **South Africa:** Private Bag X2067, Krugersdorp, 1740. **Zambia:** Box 33459, Lusaka 10101. **Zimbabwe:** Private Bag WG-5001, Westgate.

NATURAL GAS:

■ Over approximately the next 20 years, "natural gas is projected to be the fastest growing primary energy source worldwide," states the *IEO2003* report. Natural gas is the cleanest burning of the fossil fuels, and it is thought that the earth holds vast reserves of natural gas.

However, "no one really knows exactly how much natural gas exists until it is extracted," states the Washington, D.C.-based Natural Gas Supply Association. "Each estimate is based on a different set of assumptions . . . It is thus difficult to get a definitive answer to the question of how much natural gas exists."

Methane is the primary component of natural gas, and methane is "a very potent greenhouse gas. In fact, methane has an ability to trap heat almost 21 times more effectively than carbon dioxide," states the previously quoted association. Nevertheless, this source says that a major study performed by the Environmental Protection Agency and the Gas Research Institute "concluded that the reduction in emissions from increased natural gas use strongly outweighs the detrimental effects of increased methane emissions."

ATOMIC ENERGY:

■ "Some 430 nuclear reactors supply about 16 per cent of the world's electricity," reports *Australian Geographic*. In addition to these existing reactors, the *IEO2003* report says: "As of February 2003, the nations of developing Asia accounted for 17 of the 35 reactors currently under construction worldwide."

Dependence on nuclear power persists despite the possibility of disasters, such as that experienced in 1986 at Chernobyl, in the former Soviet Union. *New Scientist* reports that "America's existing reactors are being plagued by cracks and corrosion" and that in March 2002, the Davis-Besse reactor in Ohio "came close to a catastrophic meltdown" as a result of corrosion problems.

Given the limited supply of and inherent dangers in existing energy sources, the question arises, Is mankind doomed to ruin the earth in their quest to feed their seemingly insatiable thirst for energy? It is obvious that we need clean, reliable alternatives. Are such alternatives both available and affordable?

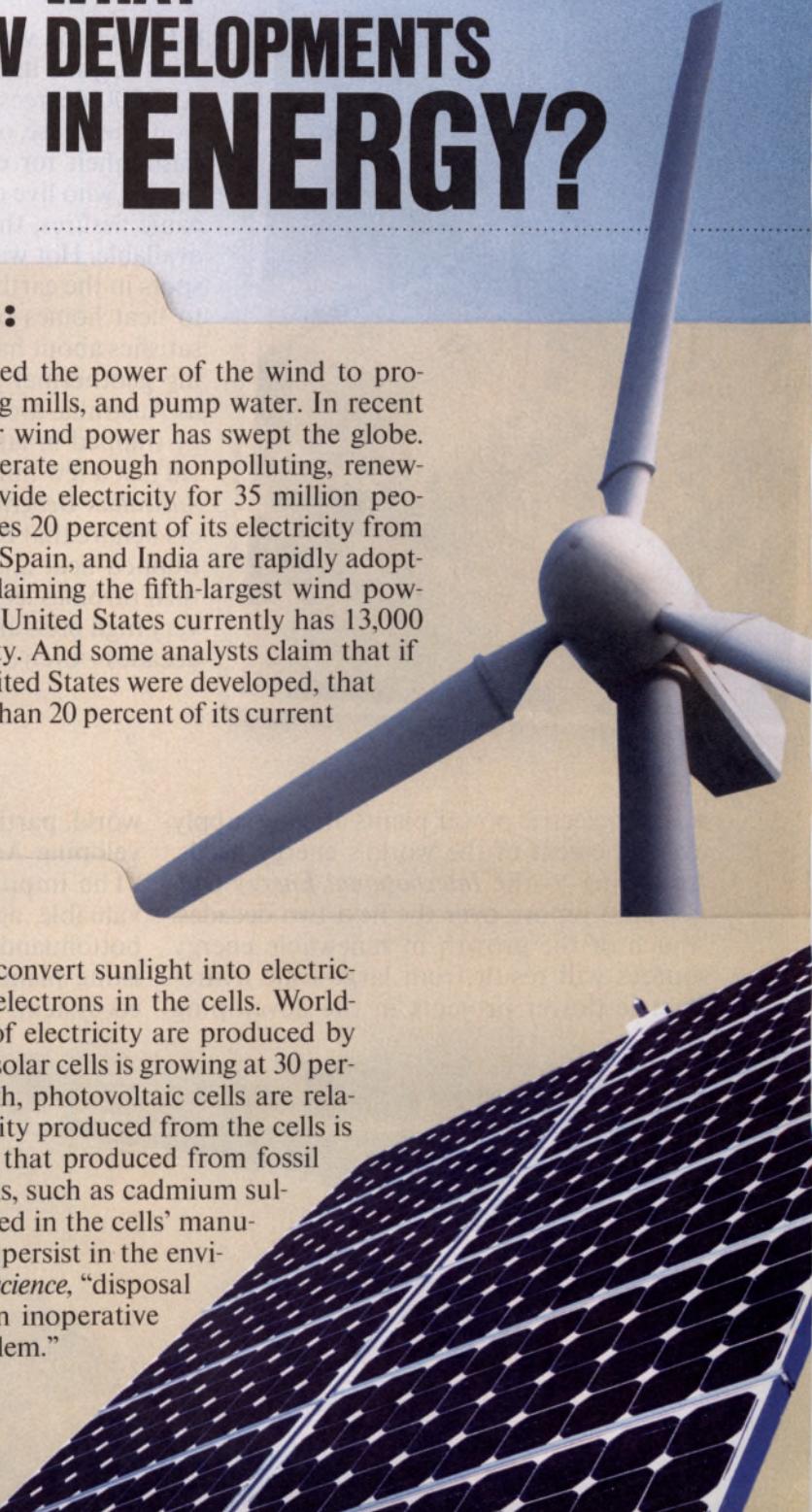
WHAT NEW DEVELOPMENTS IN ENERGY?

WIND:

■ Mankind has long harnessed the power of the wind to propel sailing ships, turn grinding mills, and pump water. In recent years, though, enthusiasm for wind power has swept the globe. High-tech windmills now generate enough nonpolluting, renewable power worldwide to provide electricity for 35 million people. Denmark already generates 20 percent of its electricity from wind power alone. Germany, Spain, and India are rapidly adopting wind power, with India claiming the fifth-largest wind power capacity in the world. The United States currently has 13,000 windmills generating electricity. And some analysts claim that if all the suitable sites in the United States were developed, that country could generate more than 20 percent of its current electric needs from the wind.

SUN:

■ Man-made photovoltaic cells convert sunlight into electricity when the sun's rays excite electrons in the cells. Worldwide, nearly 500 million watts of electricity are produced by this method, and the market for solar cells is growing at 30 percent per year. At present, though, photovoltaic cells are relatively inefficient, and the electricity produced from the cells is expensive when compared with that produced from fossil fuels. In addition, toxic chemicals, such as cadmium sulfide and gallium arsenide, are used in the cells' manufacture. Because such chemicals persist in the environment for centuries, notes *Bioscience*, "disposal and recycling of the materials in inoperative cells could become a major problem."



GEOTHERMAL ENERGY:

If a person were to dig a hole in the earth's crust toward its hot core, which is an estimated 7,000 degrees Fahrenheit, the temperature would increase, on average, by about 90 degrees Fahrenheit for every mile dug. However, for people who live close to thermal springs or volcanic fissures, the earth's heat is more readily available. Hot water or steam produced by hot spots in the earth's crust is used in 58 countries to heat homes or generate electricity. Iceland satisfies about half its energy needs by harnessing geothermal power. Other countries, such as Australia, are looking into tapping the energy trapped in large areas of hot, dry rock buried just a few miles beneath the earth's surface. *Australian Geographic* reports: "Some researchers believe that by pumping water down to that trapped heat and then using the hot water to turn turbines as it returns to the surface under very high pressure, we could generate power for decades—even centuries."

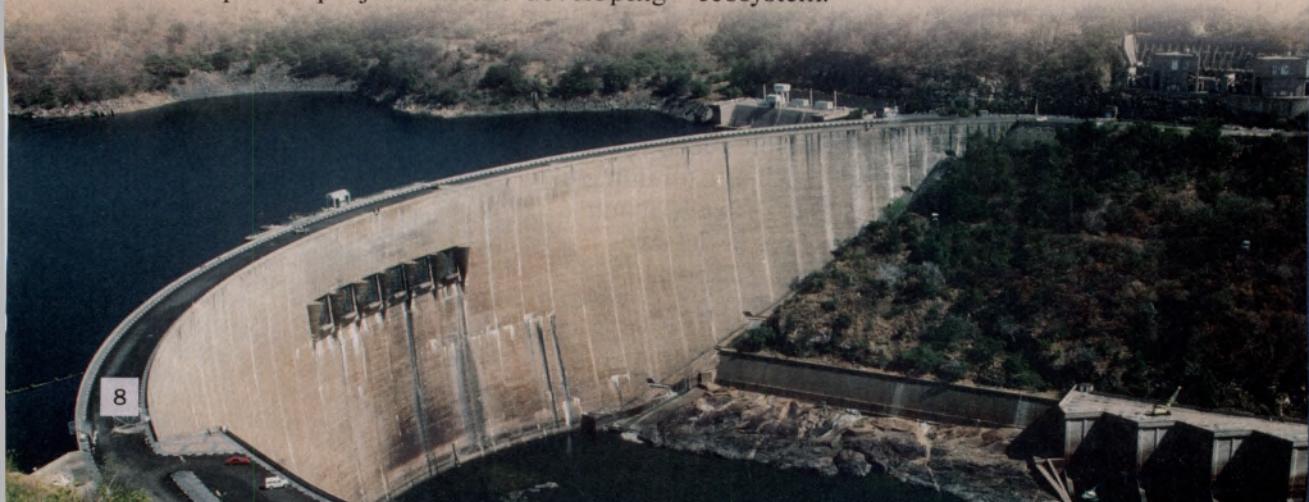


DOE Photo

WATER:

Hydroelectric power plants already supply over 6 percent of the world's energy needs. According to the *International Energy Outlook 2003* report, over the next two decades, "much of the growth in renewable energy sources will result from large-scale hydroelectric power projects in the developing

world, particularly among the nations of developing Asia." However, *Bioscience* warns: "The impounded water frequently covers valuable, agriculturally productive, alluvial bottomland. Furthermore, dams alter the existing plants, animals, and microbes in the ecosystem."



HYDROGEN:

■ Hydrogen is a colorless, odorless, combustible gas and is the most abundant element in the universe. On earth, hydrogen is an integral part of plant and animal tissue, is bound up in fossil fuels, and is one of the two components that form water. In addition, hydrogen burns more cleanly and more efficiently than fossil fuels.

The journal *Science News Online* states that water "can [be] split into hydrogen and oxygen when electricity passes through it." While this method could produce abundant amounts of hydrogen, the journal notes that "this seemingly straightforward process isn't

yet economical." Factories already produce some 45 million tons of hydrogen globally, mainly for use in fertilizers and cleaning agents. But this hydrogen is extracted in a process involving fossil fuels—a process that also gives off the poisonous gas carbon monoxide and the greenhouse gas carbon dioxide.

Still, many see hydrogen as the most promising of the alternative fuels and feel it is capable of satisfying mankind's future energy needs. This optimism is based on recent dramatic improvements in a device known as the fuel cell.

Mercedes-Benz USA ▼

FUEL-CELL POWER:

■ A fuel cell is a device that produces electricity from hydrogen—not by burning it, but by combining it with oxygen during a controlled chemical reaction. When pure hydrogen is used rather than a hydrogen-rich fossil fuel, the only by-products of the reaction are heat and water.

In 1839, Sir William Grove, a British judge and physicist, developed the first fuel cell. However, fuel cells were expensive to build, and the fuel and components were awkward to obtain. Thus, the technology lay dormant until the mid-20th century when fuel cells were developed to provide power for American spaceships. Modern spacecraft still use fuel cells to provide onboard power, but the technology is now being refined for more down-to-earth uses.

Today, fuel cells are being developed to replace the internal combustion engine in motor vehicles, to provide electricity for commercial and domestic buildings, and to power small electric devices, such as mobile phones and computers. Even so, at the time of writing, the power generated from existing stationary fuel-cell plants is more than four times as expensive as that from fossil fuel sources. Still, hundreds of millions of dollars are being invested in developing this emerging technology.

The environmental benefits of adopting cleaner energy sources are obvious. However, the cost of doing so on a large scale is likely to remain prohibitive. The *IEO2003* report says: "Much of the increment in future energy demand . . . is projected to be for fossil fuels (oil, natural gas, and coal), because it is expected that fossil fuel prices will remain relatively low, and that the cost of generating energy from other fuels will not be competitive."

Fuel-cell vehicle, 2004



FINDING THE SOURCE OF ALL ENERGY

THE sun is the earth's primary energy source. Many scientists believe that coal and oil are the decayed remains of trees and plants that drew their energy from the sun.* The water that flows into hydroelectric dams is initially drawn from the oceans by heat from the sun and is transported overland in the form of clouds. The sun's warming rays also propel the breezes that drive wind-powered generators. Yet, it is estimated that only about half a billionth of the sun's energy reaches the earth.

Although awesome in power, the star we know as the sun is just one among billions of similar massive sources of energy in the universe. What is the ultimate origin of all this power? Referring to the stars, the Bible writer Isaiah says: "Raise your eyes high up and see. Who has created these things? It is the One who is bringing forth the army of them even by number, all of whom he calls even by name. Due to the abundance of dynamic energy, he also being vigorous in power, not one of them is missing."—Isaiah 40:26.

When contemplating the sheer power of the stars, we may feel overwhelmed—and even more so when we consider their Creator. However, the Bible encourages us: "Draw close to

God, and he will draw close to you." (James 4:8) Yes, the Creator of the earth and its abundant energy resources, the one who gave us the spark of life, can be found by those who look for him.—Genesis 2:7; Psalm 36:9.

When they see the earth and its resources being polluted and distributed unfairly, some people may find it hard to believe that God is interested in the earth and the individuals upon it. Nevertheless, the Bible assures us that change is soon to come, promising a major change in both the way the world's resources are distributed and the way the earth itself is governed. (Daniel 2:44; Matthew 6:9, 10) By installing one heavenly global government under the direction of his Son, Christ Jesus, Jehovah God will ensure that everyone living will share the earth's abundant resources fairly. (Micah 4:2-4) He will also "bring to ruin those ruining the earth," that is, those who corrupt the earth's environment, whether in a spiritual or a physical way.—Revelation 11:18.

At that time the promise recorded at Isaiah 40:29-31 will prove true both spiritually and physically: "He is giving to the tired one power; and to the one without dynamic energy he makes full might abound. Boys will both tire out and grow weary, and young men themselves will without fail stumble, but those who are hoping in Jehovah will regain power. They will mount up with wings like eagles. They will run and not grow weary; they will walk and not tire out." You too can learn more about the Source of all energy and the solution to earth's energy problems if you take time to study the Bible.

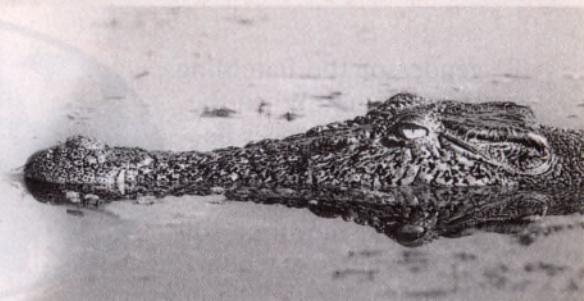
* See the box "How Did Petroleum Form?" in *Awake!* of November 8, 2003.

In Our Next Issue

- Mountains—Vital for Life on Earth
- Venice—"City in the Sea"
- Why Should I Do Manual Labor?

Can You Smile at a CROCODILE?

BY AWAKE! WRITER IN INDIA



WOULD you ever think of smiling at a crocodile? In a musical version of the children's story *Peter Pan*, the character Captain Hook gives his reason for advising, "Never smile at a crocodile." The crocodile is, he says, "imagining how well you'd fit within his skin!"

Although it is true that among the many types of crocodiles worldwide, there are some that attack humans, "this happens so infrequently . . . that crocodiles cannot be generally regarded as maneaters." (*Encyclopædia Britannica*) Viewed by some people as ugly, frightening creatures, crocodiles are fascinating to others. Let us take a look at the three species indigenous to India—the saltwater crocodile, the mugger, and the gavial.

The Big "Salty"

Saltwater, or estuarine, crocodiles—the biggest reptiles on earth—can grow to a length of 23 feet or more and weigh up to 2,000 pounds. Living exclusively in salt water, they are found in river estuaries, seas, and mangrove swamps along the coasts from India to northern Australia. Carnivorous, they eat rats, frogs, fish, snakes, crabs, turtles, and deer—in small

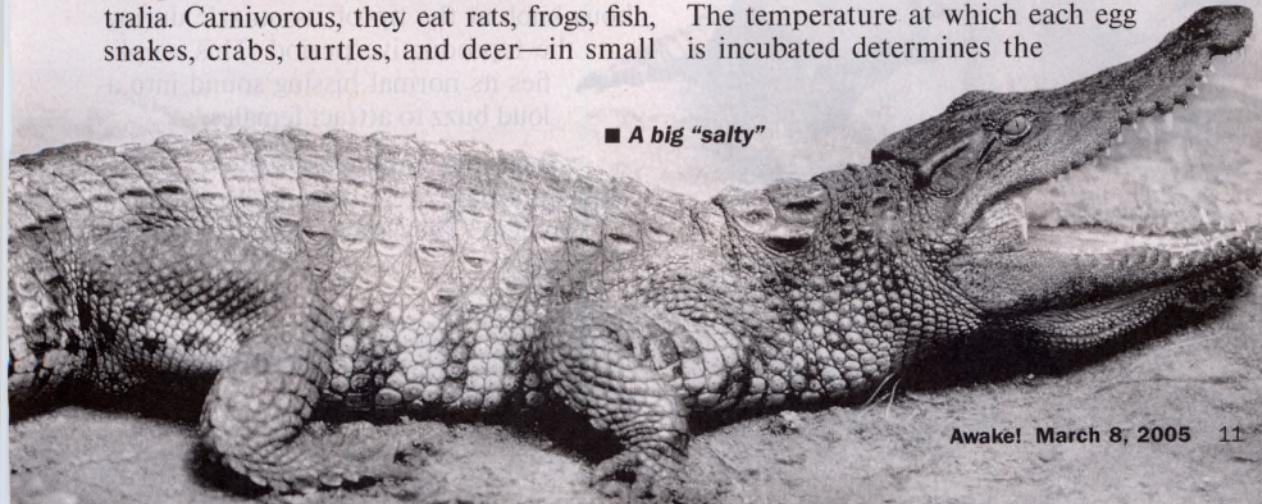
quantities; large males average only 18 to 24 ounces of food a day. An easygoing life-style of basking in the sun or floating in the water and an efficient digestive system keep their energy requirements low. A big "salty" may occasionally attack an unwary human. Salties swim by moving their tail from side to side, with their body submerged except for nostrils and eyes, and they walk on their short legs. They can leap up to catch food and are known to gallop after prey at times. Like all other crocodiles, their senses of smell, sight, and hearing are good. The male salty is fiercely territorial during the mating season, and the female is equally fierce when guarding her eggs.

Devoted Mothers

The female crocodile builds a nest near the water, usually a mound of decaying vegetation and mud. She lays up to 100 oval, hard-shelled eggs, covers them, and guards them from predators. Then, she splashes water onto the nest to promote the decay of the covering vegetation, thus generating heat to incubate the eggs.

Now something fascinating takes place. The temperature at which each egg is incubated determines the

■ A big "salty"



gender of the hatchling.

Imagine that! When the temperature ranges between 82 and 88 degrees Fahrenheit, females are produced in about 100 days; whereas, when the temperature is 90.5 degrees

Fahrenheit, males hatch within 64 days. Eggs incubated between 90.5 degrees Fahrenheit and 91 degrees Fahrenheit can produce either gender. A nest built with one side at the water's edge and the other side facing the hot sun could produce males from the warm side and females from the cooler side.

When the mother hears chirping sounds, she removes the nest covering, sometimes breaking the eggs if the hatchlings have not already done so with their specially provided shell-breaking tooth. She lifts them very gently in her great jaws and carries them in a pouch under her tongue to the water's edge. They are independent at birth and immediately forage for insects, frogs, and small fish. Some protective mothers, however, stay close for several months, creating nursery areas

in the swamps, where father can share in baby-sitting and protecting the young.



■ A female saltwater crocodile carries her hatchling in her jaws

© Adam Britton, <http://crocodilian.com>

The Mugger and the Long-Nose Gavial

The mugger, or marsh crocodile, and the gavial belong exclusively to the Indian subcontinent. About 13 feet long, the mugger—found in freshwater marshes, lakes, and rivers throughout India—is much smaller than the saltwater crocodile. It catches small animals in its powerful jaws, drowns them, and swings them around to break off eatable chunks of flesh.

How do muggers meet to mate? When searching for a mate, the male slaps his jaws on the water and growls. Later he will share nest-guarding duties with the female, help the hatchlings out of their eggs, and stay with them for some time.

The rare gavial, not a true crocodile, is unique in several ways. It is easily recognizable by its very long, narrow jaws, ideal for catching fish—its main food. Although equaling the saltwater crocodile in length, the gavial is not known for attacking humans. Its smooth, streamlined body makes for speedy movement in the deep, fast-flowing rivers of northern India. The male gavial grows a bulbous knob at the tip of its muzzle during the reproductive period. This amplifies its normal hissing sound into a loud buzz to attract females.

Their Place in the Ecosystem

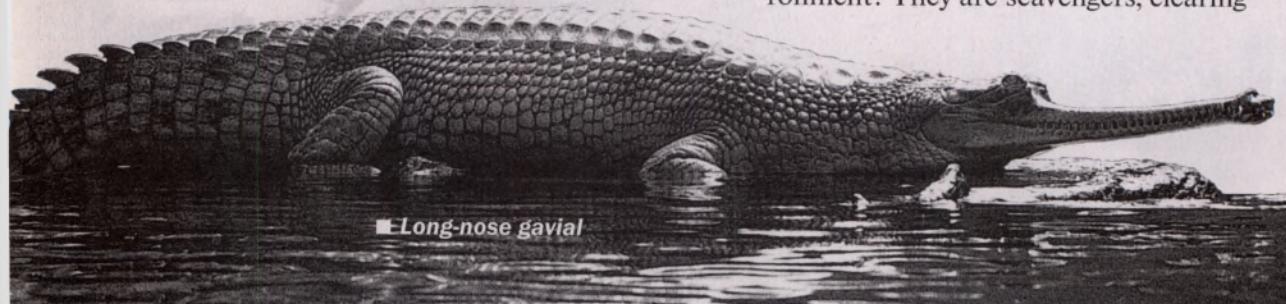
How important are crocodiles to our environment? They are scavengers, clearing

■ Mugger

© E. Hanumantha Rao/
Photo Researchers, Inc.



■ Long-nose gavial



the rivers and lakes, as well as nearby land areas, of dead fish and animals. This helps keep the water system clean. As predators, they target weak, injured, and sickly creatures. They eat fish, such as the destructive catfish, which feed on carp and tilapia, major commercial catches for human consumption.

The Fight for Survival —Not Crocodile Tears

Have you heard it said that someone was shedding crocodile tears? That means the tears and sadness were not genuine or sincere. Actually, a crocodile sheds tears to rid its body of excess salt. However, in the early 1970's, perhaps tears could have been shed sincerely for the crocodile. Only a few thousand crocodiles remained in India, about 10 percent of their former numbers. Why? As humans encroached on their habitat, crocodiles were killed because they were considered a threat to young and weak domestic animals. Many people found the meat and

the eggs of the crocodile delectable. Crocodile musk glands were used to make perfume. Added to this, dam building and water pollution diminished the crocodile population. But perhaps what brought them to the brink of extinction was the demand for their skin. Shoes, handbags, luggage, belts, and other items made from crocodile skin are beautiful, durable, and very desirable. These threats remain, but conservation measures have proved very successful!—See the box below.

Remember to Smile!

Now that you have become better acquainted with some members of the crocodile family, how do you feel about them? We hope that any negative views have given way to interest. Worldwide, many animal lovers look forward to the time when there will be no need to fear even the huge salty. When the Creator of reptiles renews the earth, we will be able to smile at all the crocodiles.—Isaiah 11:8, 9.

The Madras Crocodile Bank

In 1972 crocodile conservation in the Madras Snake Park began after a survey showed that very few crocodiles remained in the wild in some parts of Asia. The Madras Crocodile Bank is the oldest and largest of the more than 30 reptile centers in India. It was set up in 1976 by herpetologist Romulus Whitaker. Spread over eight and a half acres on the Coromandel Coast, it boasts 150 species of trees, which attract beautiful birds and insects.

Crocodiles and gavials are bred in captivity and then released into swamps and rivers, or they are passed on to other breeding and research

centers. The bank has a nursery where baby crocodiles, up to 2,500 at a time, are kept in ponds and fed chopped fish provided daily by local fishermen. Nets over the pens keep marauding birds from stealing the fish or the weak baby reptiles. As the youngsters grow, they are transferred to larger pools, where their diet is whole fish until they are about three years old and between four and five feet long. Then they are fed beef waste from a large meat-packing company. The bank originally bred just the 3 types of crocodiles indigenous to India, but it now has 7 more species and plans eventually to stock all species



known worldwide. Commercial farming of the reptiles for their skins and their meat has been debated. Whitaker told *Awake!* that the reptiles' meat is tasty and low in cholesterol. Successful conservation brought these great creatures from the brink of extinction to the threshold of surplus. The Madras Crocodile Bank, a popular tourist draw, also aims at eradicating misconceptions about crocodiles and enhancing their public image.

Romulus Whitaker, Madras Crocodile Bank

Museums

Why Are They Worth a Visit?

THE capital city of the United States, Washington, D.C., is a magnet for tourists.* What brings them here? One of the main attractions is the White House, the president's official residence at 1600 Pennsylvania Avenue. This landmark draws more than one and a half million visitors each year. They are allowed to wander through certain rooms that are decorated in period styles. The rooms are furnished with valuable antique furniture in addition to antique china and silverware.

Another impressive edifice is the Capitol, the center of government for this country of nearly 300 million people. As you walk through its halls and corridors, you will see statues of famous leaders of the past. If you stay alert, you might also glimpse some famous senator or congressman. But not all tourists are attracted to these buildings. Many are drawn by the centers of culture to be found in this city—the museums and art galleries.

There are so many museums and galleries in Washington, D.C., that it would be impossible to cover them all, and it would require a very long stay in Washington to visit them. Let us see how many we can explore in a visit of just a few days.

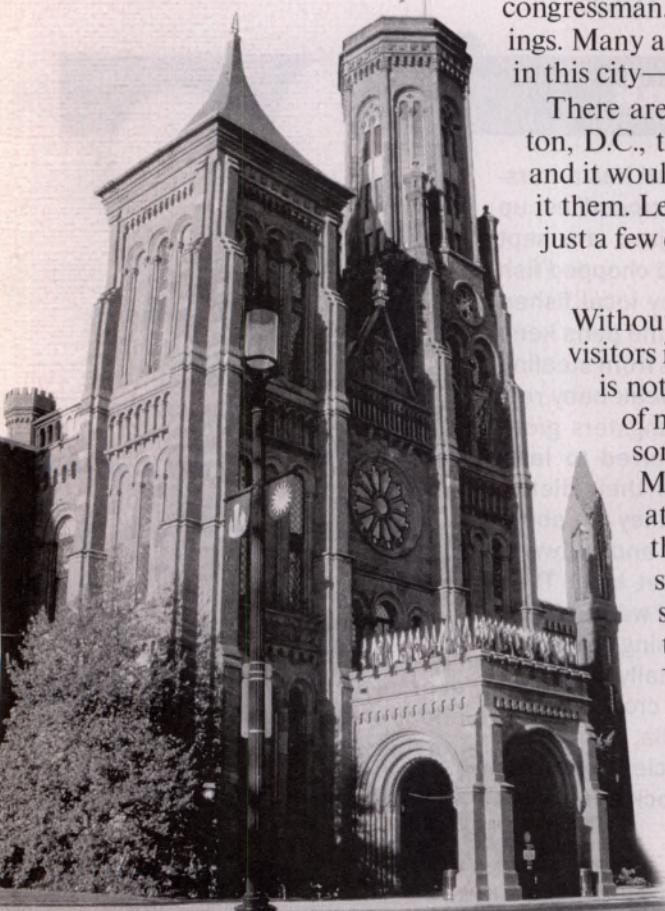
A Museum of Museums

Without a doubt, the preeminent center of interest for visitors is the Smithsonian Institution. Why? Because it is not merely one museum—it is a whole collection of museums and centers of knowledge. The Smithsonian Castle is easy to pick out on the National Mall—the mile-long green swath with the Capitol at one end and the Washington Monument at the other. The castle is the colorful red sandstone building that rears into view on the left side of the famous mall as you face the Washington Monument obelisk.

* Why "D.C." (District of Columbia)? Because the capital does not belong to any state but occupies a federal land area of 68 square miles. The "D.C." also distinguishes it from the state of Washington, on the West Coast, some 2,000 miles away.

Smithsonian photo by Eric Long

The
Smithsonian
Castle



The National Air and Space Museum contains the original "Flyer" from 1903 (at right) and Lindbergh's "Spirit of Saint Louis" (below)



Which is the most popular of the Smithsonian facilities? In our age of science, it is the National Air and Space Museum—according to one travel guide, “the most visited museum in the world.” Why is it so popular? It has 23 extensive galleries, and its exhibits, many hanging from the ceiling, illustrate the exciting history of flight. The vast Milestones of Flight gallery even has the *Flyer* on display, the very airplane that Orville Wright used for his historic flight at Kitty Hawk, North Carolina, in 1903. Nearby is Charles Lindbergh’s *Spirit of St. Louis*, the plane he had arranged to have specially built in order to win the prize for the first solo flight across the Atlantic in 1927. And, of course, there are modern exhibits of history-making spacecraft as well as rocks brought back from the moon.

Does Money Attract You?

Just south of the mall, and walking distance from the Washington Memorial, is a building that draws thousands of curious citizens, who are probably carrying samples of the products that emanate from

this place—bank notes! It is the Bureau of Engraving and Printing. The 40-minute tour displays the process of engraving and printing that is necessary to manufacture the dollar bills that people use in their daily transactions. Over \$140 billion worth of money is printed here each year! Is the special paper that is used a State secret? How long does a dollar bill last in circulation? What

steps are taken to frustrate counterfeitors? These and many other questions are answered on this tour.

Next-door to the Bureau is a unique building, opened in 1993, which draws visitors from all over the world. It is the sobering U.S. Holocaust Memorial Museum.

A Museum Dedicated to Mass Murder and Survival

The name Holocaust comes from a Greek word used in the Bible that means a complete burnt offering. (Hebrews 10:6) However, in relation to this museum, “the Holocaust was the state-sponsored, systematic persecution



The Bureau of Engraving and Printing attracts many visitors





***The Tower of Life
rises up through
three floors***

***A concentration
camp uniform worn
by one of Jehovah's
Witnesses***

and annihilation of European Jewry by Nazi Germany and its collaborators between 1933 and 1945.” Jews were the primary victims, but the State policy also sought to eliminate Roma and Sinti (two gypsy tribes), the disabled, Poles, Soviet prisoners of war, homosexuals, Jehovah’s Witnesses, and political dissidents.

The first impression you get as you walk into the building is hardly that of a warm welcome. Nazi concentration camps were designed to intimidate. The museum echoes that feeling. What you see around you is a towering, cold, impersonal steel-and-brick industrial structure. From the Hall of Witness

on the first floor, you can see up to the steel-and-glass roof over the third floor. The view through the skylight, as described in an official brochure, “is warped, deformed, and eccentrically pitched.” The architect set out to create an atmosphere in which the visitor feels that “something is amiss here.”

The museum has five floors, but the main touring area for the public extends from the fourth floor down to the second, and it is suggested that you start your tour on the fourth floor. The tour is self-guided and can last two to three hours. Because of the graphic images of the hounding and murder of the victims, it is recommended that children under the age of 11 not visit the Permanent Exhibition. On the first floor, there is a separate exhibition for young children, called Daniel’s Story. It gives the history of the Holocaust from the perspective of a child in Nazi Germany.

The elevators to the fourth floor are like cold, grim steel containers. The story starts

on this floor and covers the “Nazi Assault”—1933-39. Here you see how Nazi propaganda achieved control of the German population and instilled fear and terror, especially in the hearts of the millions of European Jews. What do you find on the third floor?

This floor has the ominous theme “Final Solution”—1940-45. It “describes the ghettos, deportations, slave labor, and concentration camps, and the implementation of the ‘Final Solution’ [elimination of the Jews and others] through instruments of destruction such as mobile killing units and the death camps,” according to the visitors guide.

The second floor has a more positive theme, “Last Chapter.” It explains “rescue, resistance, liberation, and survivors’ efforts to rebuild their lives.” On one side of the floor is the Wexner Learning Center, which includes something of great interest to many of Jehovah’s Witnesses. At computer terminals the visitor can access histories of some of the Witnesses who suffered and, in some cases, paid with their lives.

For example, you can trace the heroic account of Helene Gotthold, from Dortmund, Germany. The mother of two children, she insisted on attending Christian meetings in spite of a Nazi ban. She was executed by guillotine in December 1944. Many more histories of victims and martyrs of the concentration camp era can also be viewed.

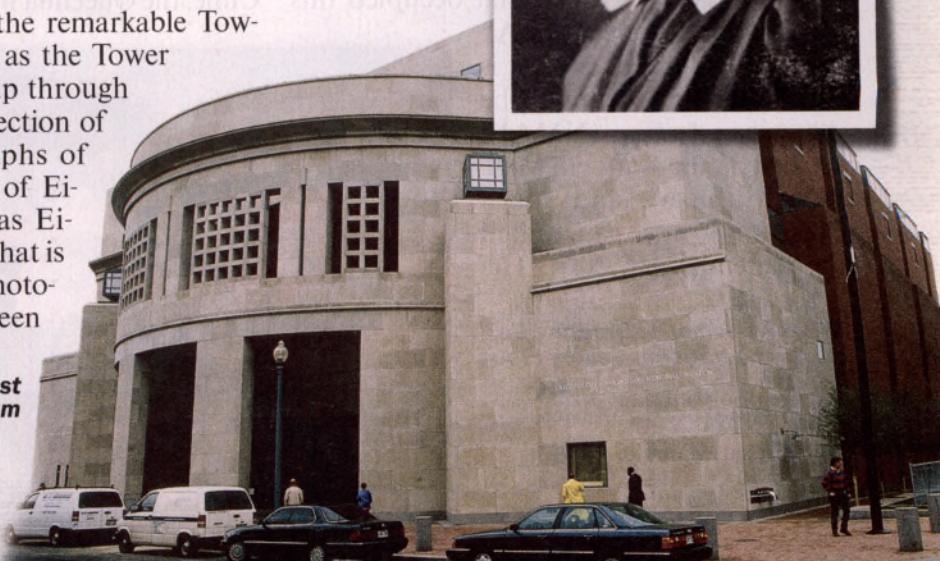
On this floor too is the remarkable Tower of Life (also known as the Tower of Faces), which rises up through three floors. It is a collection of hundreds of photographs of the Jewish inhabitants of Eishyshok, now known as Eissikes, a small town in what is now Lithuania. The photographs were taken between

1890 and 1941. It was a Jewish community that flourished for 900 years. Then in 1941 a mobile SS killing squad (*Einsatzkommando*) massacred the whole Jewish population in just two days! According to official Nazi records, 3,446 Jews were eliminated—989 males, 1,636 females, and 821 children. The Nazi bureaucracy was very thorough.

Also on the second floor is the Hall of Remembrance, which has Bible texts, such as Deuteronomy 30:19 and Genesis 4:9, 10, inscribed on the marble walls. Included are several evidences of the persecution of Jehovah’s Witnesses, such as the purple triangle they had to wear as an identifying badge. Keep your eyes open to pick them out as you take your tour. There are many more features of the museum that are worthy of

**Helene
Gotthold**

USHMM, courtesy
of Martin Tillmans



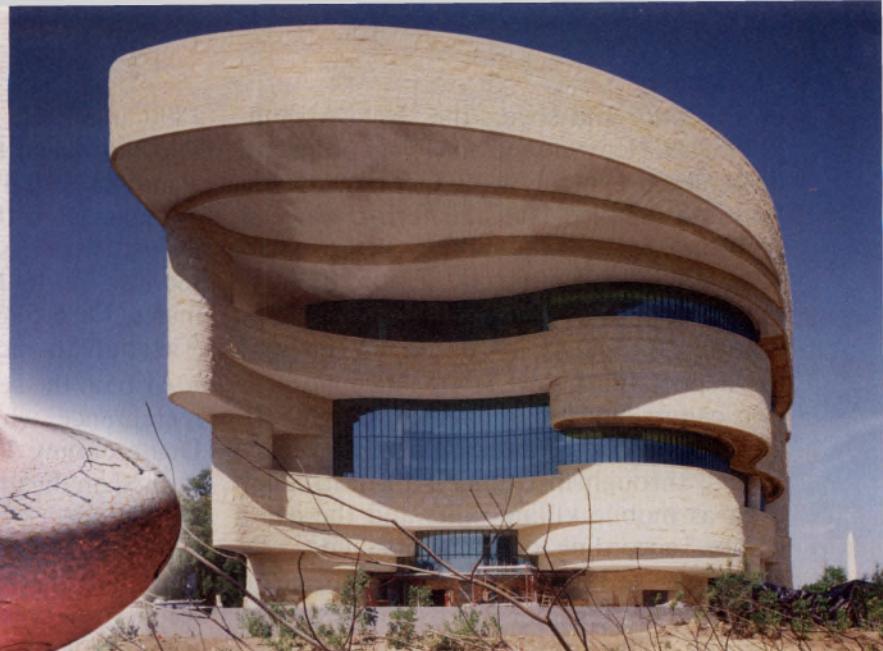
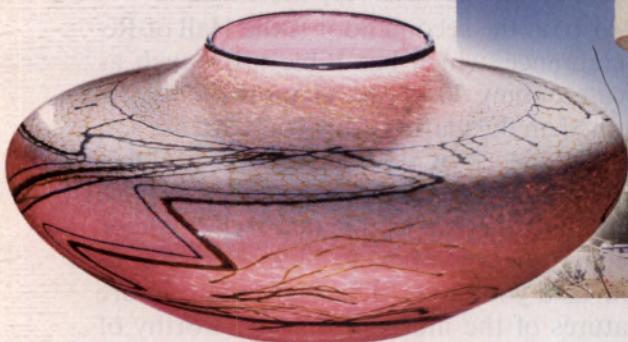
**The United States Holocaust
Memorial Museum**

**The National Museum
of the American Indian
has a unique
curvilinear design**

Photo by Robert C. Lautman

**A blown-glass vase by
a modern American
Indian artist**

Photo by Ernest Amoroso, © Smithsonian
Institution/National Museum of the
American Indian



investigation, including the huge research facility on the fifth floor.

When you leave the museum and get back out on the street, you will breathe a sigh of relief. But now let us move on to the newest of Washington's museums, one that covers a different kind of history that also includes attempted genocide.

The Most American of the Museums

This latest in the Smithsonian collection of museums commemorates the early inhabitants of the Americas—the more than 500 Native American tribes that occupied this land before Europeans or Africans ever set foot here. It is the National Museum of the American Indian (NMAI), located on the National Mall, next to the Air and Space Museum. It was inaugurated on September 21, 2004. The

museum is easily identified by its unique curvilinear design. The 250,000-square-foot building has an exterior covering of Kasota limestone from Minnesota. It gives the appearance of "a stratified stone mass that has been carved by wind and water."

What can you expect to find in it? The five major inaugural exhibitions "feature approximately 7,000 objects from the world-renowned NMAI collection of some 800,000 ethnographic and archaeological objects." (*Insight*, the Smithsonian newsletter) There are baskets, pottery, and beadwork representing tribes as far apart as the Mapuche in Chile, the Quechua in Peru, the Lakota in the

**Winslow Homer's "Breezing Up,"
in the National Gallery of Art**

Winslow Homer, *Breezing Up (A Fair Wind)*, Gift of the W. L. and May T. Mellon Foundation. Image © Board of Trustees, National Gallery of Art, Washington



United States, and the Anishinabe in Canada.

In the words of W. Richard West, Jr., who is Southern Cheyenne and the founding director of the museum, its purpose is to "correct misconceptions and help bring about a better understanding of the lives and cultures of the Native peoples of this hemisphere by all peoples, Native and non-Native alike." It takes about two hours to visit this American Indian collection. Where can we go next in our rapid tour of Washington's many exhibitions?

Art Down Through the Centuries

Let us just walk across the mall to the magnificent National Gallery of Art. The gallery was opened in 1941. The tour will take you through eight centuries of art. If you are an art lover, you had better start a new day here, since, depending on your favorite art era, it is going to take you several hours of walking, staring, and meditating to cover this wonderful collection. Happily, there are plenty of seats if you want to sit and study any particular work or just rest.

As the Catholic Church was the main patron of the arts between the 13th and the 15th centuries, most of the paintings have religious themes. You will find Giotto's "Madonna and Child," Raphael's "The Alba Madonna" (1508), and works by Leonardo da Vinci. For the 16th century, there are works by Tintoretto, Titian, and others. Bible students will be interested in Tintoretto's "Christ at the Sea of Galilee" (about 1575/1580), which portrays Christ's disciples in a storm-tossed fishing boat. Another Biblical reference is El Greco's "Christ Cleansing the Temple." Compare the very different styles of these artists—note El Greco's vivid colors and dramatic action.

The 17th-century collection includes works by Rubens and Rembrandt, among others. Bible students will again be fascinated by Rubens' depiction of "Daniel in the Lions'

Den," painted about 1615. Notice Daniel's calm as he thanks God for preserving him alive. Now let us take a leap in time to the 19th century and the French Impressionists.

This is one of the best Impressionist collections outside of Paris. If one has lived with prints of paintings for years, it is a thrill to come face-to-face with an original. Famous works by Cézanne, Manet, Renoir, Degas, and Monet will take your breath away as you study their styles and their interpretation of light. Also featured are some outstanding works of such American artists as Mary Cassatt ("Children Playing on a Beach"), James Abbott McNeill Whistler ("The White Girl"), and Winslow Homer ("Breezing Up").

There is one more exhibition you might want to visit, the East Building, with its collection of modern and contemporary art. In the courtyard, it includes some large sculptures by Alexander Calder, Henry Moore, and others. You will also find a tapestry by the Catalonian artist Joan Miró.

As you can see, the National Gallery will keep you occupied for hours or at least as long as your energy lasts. Of course, there are more art galleries to visit, such as the Corcoran Gallery of Art, which has a fine collection of European and American masters, including Impressionist paintings by Monet and Renoir. It also has the largest collection of works by Jean-Baptiste Camille Corot outside France. How much time and energy do you have available? That will determine how many more galleries you are able to visit.

But you will come away from Washington with an enhanced appreciation for culture. And maybe you will better understand French author Destouches' expression, "Criticism is easy, art is difficult." Your visit might also encourage you to tour the museums and galleries that you have in the area where you live. Check them out, and see to what extent religion and the Bible have influenced them.

IS GOD EVERYWHERE?

GOD is fittingly described as omnipotent and omniscient—almighty and all-knowing. Yet, when attempting further to describe God's greatness, some add a third term—omnipresent. They believe that God is present everywhere simultaneously.

While none of these descriptive terms are found in the Bible, the first two are clearly supported by Scriptural teachings. (Genesis 17:1; Hebrews 4:13; Revelation 11:17) God is indeed omnipotent, and he is omniscient in the sense that nothing can be hidden from him. But is he omnipresent? Is God everywhere, or is he a person with a specific dwelling place?

Where Is God?

In several Bible verses, "the heavens" are mentioned as God's "established place of dwelling." (1 Kings 8:39, 43, 49; 2 Chronicles 6:33, 39) However, one Bible account describes the magnitude of Jehovah God with the following terms: "Will God truly dwell

with mankind upon the earth? Look! Heaven, yes, the heaven of the heavens themselves, cannot contain you."—2 Chronicles 6:18.

"God is a Spirit," says the Bible. (John 4:24) Therefore, he resides in a spiritual realm independent of the physical universe. When the Bible refers to "the heavens" as God's dwelling place, it is referring to the loftiness of the place where he resides in contrast with the material environment in which we reside. In any event, the Bible teaches that God's abode is, indeed, clearly distinguished from the physical universe but is at the same time a very specific location.—Job 2:1-2.

God Is a Person

Jesus spoke about Jehovah's dwelling place when he said to his disciples: "In the house of my father there are many abodes. . . . I am going my way to prepare a place for you." (John 14:2) Where did Jesus go? Eventually, he "entered . . . into heaven itself, now to appear before the person of God for us." (Hebrews 9:24) This account teaches us two

important facts about Jehovah God. First, he has a literal place of dwelling, and second, he is a person, not simply an indefinable force that resides everywhere.

That is why Jesus taught his followers to pray this way: "Our Father in the heavens," directing their prayers to a person, Jehovah, who is in a place, namely, the spiritual heavens. (Matthew 6:9; 12:50) This teaching was consistent with the way God's people had been taught to pray for more than 1,500 years. The oldest writings inspired by God contain the following prayer: "Do look down from your holy dwelling, the heavens, and bless your people."—Deuteronomy 26:15.

God's All-Reaching Holy Spirit

While the Bible always refers to God as having a specific dwelling place, it often speaks of his holy spirit in ubiquitous terms. "Where can I go from your spirit, and where can I run away from your face?" asked the psalmist David. (Psalm 139:7) Some have been confused by such references and may conclude that God is omnipresent. Yet, when considering the context of this and other texts, it becomes clear that Jehovah's holy spirit—or power in action—can be extended from his fixed location to any place in the material universe.

Like a father's hand extending down to console and support his children, Jehovah's hand—or holy spirit—can extend to any part of the spiritual realm or the physical universe to accomplish Jehovah's purpose.

Hence, the psalmist could say: "Were I to take the wings of the dawn, that I might reside there in the most remote sea, there, also, your own hand would lead me and your right hand would lay hold of me."—Psalm 139:9, 10.

You Can Be God's Friend

Jehovah God humbly and lovingly allows himself and his dwelling place to be described in the human terms that most closely relate to his state of being. In this and other ways, it is as if he "stoops down to look on the heavens and the earth." (Psalm 113:6, *New International Version*) Yet, God's nature is truly beyond complete human comprehension.

Jehovah is simply too magnificent, too great, and too wonderful to be fully described in human terms. So while the Scriptures speak about his heavenly abode as a place with a specific location, to understand such a spiritual dimension completely is simply impossible for humans.—Psalm 139:6.

Still, there is great comfort in having some understanding of Jehovah's true nature, realizing that he is not some indefinable, impersonal force permeating everything in the universe. Rather, he is an individual, with a specific place of dwelling and a definite personality characterized by love and tenderness. Such knowledge opens the door to the greatest opportunity possible for any human—the chance to have a lifelong, personal friendship with the Almighty Sovereign of the universe.—James 4:8.

“WHAT would I do without tomatoes!” exclaims the Italian housewife. This is a sentiment shared by countless other cooks around the world. Indeed, the tomato features in recipes of many cultures. Home gardeners grow it more than any other food. But is it a fruit or a vegetable?

Botanically the tomato is a fruit because it is a berry containing seeds. However, most people think of it as a vegetable, as it is usually eaten with the main course of a meal. This tasty food has a fascinating past.

Colorful History

In Mexico the Aztecs cultivated the tomato for food. During the early 16th century, returning Spanish conquistadores took it to Spain and, borrowing the Nahuatl word *tomatl*, called it a *tomate*. Soon Spanish enclaves in Italy, North Africa, and the Middle East were enjoying the new delicacy.

Later that century the tomato reached northern Europe. At first it was thought to be poisonous and was grown as a decorative garden shrub. Although a member of the nightshade family, with strongly aromatic leaves and stems that are toxic, the fruit proved to be completely harmless.

Likely this newcomer to Europe was yellow, since the Italians called it *pomodoro* (golden apple). The English called it *tomate* and later tomato, but the term “love apple” also became fashionable. From Europe the tomato made the long journey back across the Atlantic to North America, where eventually, during the 19th century, it became an important food.

Remarkable Variety and Popularity

Ask what color tomatoes are, and the answer will most likely be “red.” But did you know that varieties can be yellow, orange, pink, purple, brown, white, or green, and some are even striped? Not all are round.

The Tomato

A Very Versatile “Vegetable”

Some are flat or plum- or pear-shaped. They can be as small as a pea or as large as a man’s clenched fist.

This popular food is grown as far north as Iceland and as far south as New Zealand. Major producers are the United States and southern European countries. Cooler climates rely on greenhouse production, and arid regions grow the crop by hydroponic techniques—that is, in a nutrient solution without soil.

The tomato remains a favorite of the amateur gardener. It is easy to grow, and a few plants provide enough tomatoes to feed a small family. If you have limited space, look for varieties specially developed for patios and window boxes.

Hints and Health Tips

Cold temperatures impair the flavor of tomatoes, so do not store them in the refrigerator. To speed up the ripening process, you could set them on a sunlit windowsill or you could keep them at room temperature in a bowl with a ripe tomato or banana or in a closed brown paper bag for a few days.

Tomatoes are good for you. They contain vitamins A, C, and E, as well as potassium, calcium, and mineral salts. Researchers are discovering that they are also an excellent source of lycopene, a powerful antioxidant, which, it is suggested, lowers the risk of certain illnesses, such as cancer and heart disease. Tomatoes are 93 to 95 percent water, and weight watchers will be glad to know that they are very low in calories.

Deliciously Versatile

When you buy tomatoes, what type will you choose? The familiar red, classic variety are useful for salads, soups, and sauces. The tiny red, orange, or yellow cherry tomatoes, which are very sweet because they have a high sugar content, are delightful eaten raw. If you are making a pizza or a pasta dish, maybe the oval-shaped plum tomato with its firm flesh would be a good choice. The large beefsteak tomato—called such because of its dense, beefy flesh—is ideal for stuffing or baking. The green tomato, sometimes with distinctive stripes, makes excellent relish. Indeed, tomatoes add their distinctive flavor and color to a huge range of delicious vegetable, egg, pasta, meat, and fish dishes. If you cannot obtain fresh tomatoes, no doubt you will find many processed tomato products in your local store.

Each cook has his or her own tomato recipes, but here are a few suggestions you may want to try.

1. Prepare a quick and colorful **appetizer** by overlapping slices of tomato, mozzarella cheese, and avocado. Sprinkle with a dressing of olive oil and black pepper, and garnish with basil leaves.

2. Make a **Greek salad** by combining chunks of tomato, cucumber, and feta cheese with black olives and sliced red onion. Season with salt and pepper, and serve with a dressing of olive oil and lemon juice.

3. Create a **Mexican salsa** with freshly chopped tomato, onion, green chillies, and coriander, mixed together with a little lime juice.

4. Produce a simple yet tasty **tomato sauce** for pasta by placing in a pan the contents of a can of chopped tomatoes, a pinch of sugar (or catsup), some olive oil, a minced garlic clove, a few herbs such as basil, bay leaf, or oregano, and some seasoning. Bring the mixture to a boil, and then simmer it for about 20 minutes until the sauce thickens. Pour it over your cooked and drained pasta.

The versatile tomato is just one example of the wonderful variety of foods that have been created for our use.



The Man Who Unlocked the Secrets of the Solar System

SI XTEENTH-CENTURY Europeans regarded comets with awe. So when a comet made famous by Danish astronomer Tycho Brahe was visible in the night sky, Katharina Kepler got her six-year-old son, Johannes, out of bed to see it. Over 20 years later, when Brahe died, whom did Emperor Rudolf II appoint to replace him as imperial mathematician? At 29 years of age, Johannes Kepler became the imperial mathematician to the Holy Roman Emperor, a position he held for the rest of his life.

Mathematics is not the only science in which Kepler is held in high esteem. He distinguished himself in the fields of optics and astronomy. Kepler, small in stature, had an astonishing intellect and also a resolute character. He suffered discrimination when he would not convert to Roman Catholicism, even under great pressure.

Mathematical Genius

Johannes Kepler was born in 1571 in Weil der Stadt, a small town on the

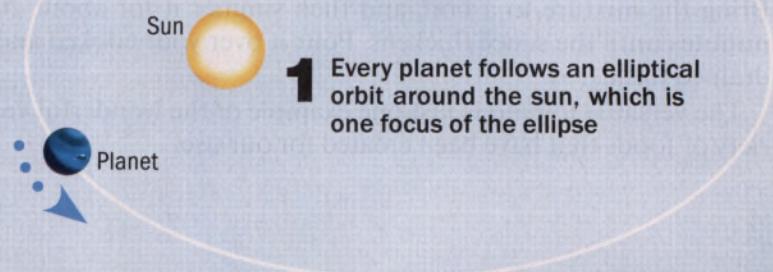
edge of the German Black Forest. The family was poor, but scholarships from the local nobility secured Johannes a good education. He studied theology at the University of Tübingen, as he planned to become a Lutheran minister. But his genius for mathematics was recognized. When in 1594 a mathematics teacher at the Lutheran high school in Graz, Austria, died, Kepler replaced him. While there, he published his first major work, *Cosmographic Mystery*.

Copernicus and Brahe: Brown Brothers; Kepler: Erich Lessing/Art Resource, NY; Jupiter: Courtesy of NASA/JPL/Caltech/USGS; Planet: JPL

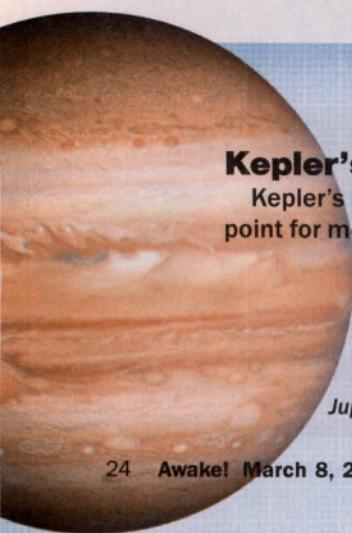


Kepler's Laws of Planetary Motion

Kepler's laws of planetary motion are still regarded as the starting point for modern astronomy. They can be summarized as follows:



- 1 Every planet follows an elliptical orbit around the sun, which is one focus of the ellipse



The astronomer Brahe had spent years keeping a painstaking record of planetary observations. When he read *Cosmographic Mystery*, Brahe was impressed with Kepler's grasp of mathematics and astronomy, and he invited Kepler to join him in Benátky, near Prague, now in the Czech Republic. Kepler accepted the invitation when religious intolerance forced him to leave Graz. And, as described previously, when Brahe died, Kepler succeeded him. In place of a meticulous observer, the imperial court now had a mathematical genius.

Milestone in Optics

To benefit fully from Brahe's collection of planetary observations, Kepler needed to understand more about the refraction of light. How is reflected light coming from a planet refracted when entering the earth's atmosphere? Kepler's explanations were contained in *Supplement to Witelo, Expounding the Optical Part of Astronomy*, which expanded on the work of the medieval scientist Witelo. Kepler's book was a milestone in optics. He was the first man to explain the workings of the eye.

Kepler's main pursuit was not optics, however, but astronomy. Early astronomers believed the sky to be a hollow globe with stars stuck to the inner surface like sparkling diamonds. Ptolemy viewed the earth as the center

of the universe, whereas Copernicus believed the planets all revolved around a stationary sun. Brahe suggested that the other planets revolved around the sun, which in turn orbited the earth. Since in relation to the earth, all other planets were heavenly bodies, they were viewed as perfect. The only form of motion considered appropriate for them was a perfect circle, each planet traveling at a constant speed. This was the environment in which Kepler took up his work as imperial mathematician.

Beginnings of Modern Astronomy

Equipped with Brahe's tables of planetary observations, Kepler studied cosmic movements and drew conclusions based on what he saw. His genius with figures was matched by a strong will and a restless curiosity. His voracious capacity for work is evidenced by the 7,200 complex calculations he completed in studying the observation tables of Mars.

And it was Mars that first caught Kepler's eye. Punctilious study of the tables revealed that Mars orbited the sun but not in a circle. The only orbital shape that fitted the observations was an ellipse with the sun as one of its foci. Kepler sensed, however, that the key to unlocking the secrets of the heavens was, not Mars, but planet Earth. According to Professor Max Caspar, "Kepler's inventiveness moved him to a touch of genius." He put the tables to an unconventional use. Instead of



Venus

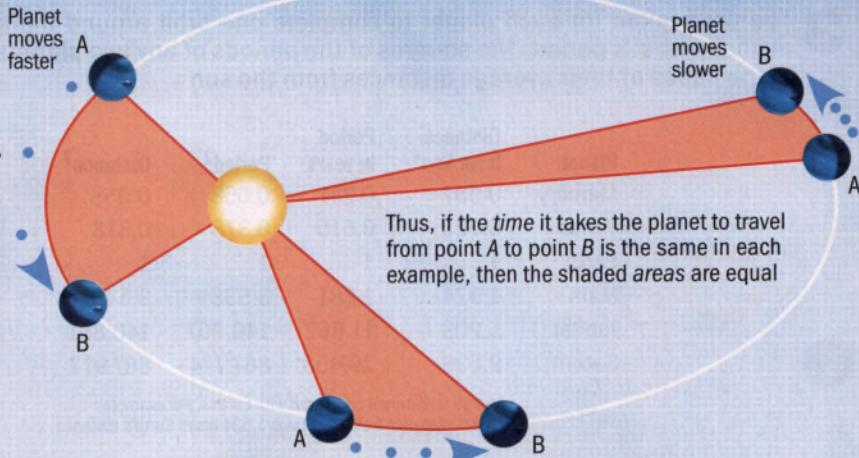
Venus: Courtesy of NASA/JPL/Caltech; Planet: JPL



Newton

2

Each planet moves faster when it is closer to the sun. Regardless of the planet's distance from the sun, a line drawn from the center of the sun to the center of the planet sweeps out an equal area in an equal length of time





Neptune

Kepler is recognized as one of the greatest scientists ever—one who helped to drag astronomy out of the Middle Ages and into modern times

using them to investigate Mars, Kepler imagined himself standing on Mars looking back at the earth.

Neptune He calculated that the speed of the earth varied in inverse proportion to its distance from the sun.

Kepler now understood that the sun is not simply the center of the solar system. The sun also acts like a magnet, rotating on its own axis and exercising a force on the movement of the planets. Caspar writes: "This was the grand new concept that guided him from then on in his research and led him to the discovery of his laws." To Kepler the planets were all physical bodies harmoniously governed by a uniform set of laws. What he learned from Mars and Earth must be true of all planets. He thus concluded that each planet travels around the sun in an elliptic orbit at a speed that varies in relation to its distance from the sun.

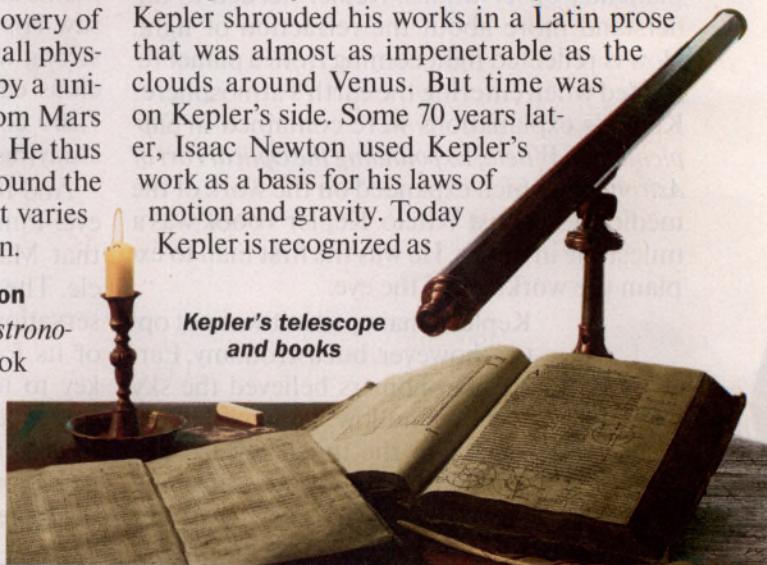
Kepler's Laws of Planetary Motion

In 1609, Kepler published *New Astronomy*, which is recognized as the first book on modern astronomy and one of the most important books ever written on the subject. This masterpiece contained the first two of Kepler's laws on planetary motion. His third

law was published in *Harmonies of the World* in 1619, when he was living in Linz, Austria. These three laws define the basics of planetary motion: the shape of a planet's orbit around the sun, the speed of a planet's movement, and the relationship between a planet's distance from the sun and the time it takes to complete a circuit.

How did Kepler's fellow astronomers react? They failed to grasp the impact of Kepler's laws. Some were even aghast in disbelief. Perhaps they were not entirely to blame. Kepler shrouded his works in a Latin prose that was almost as impenetrable as the clouds around Venus. But time was on Kepler's side. Some 70 years later, Isaac Newton used Kepler's work as a basis for his laws of motion and gravity. Today

Kepler is recognized as



Kepler's telescope and books

3 The time taken for each planet to complete one orbit around the sun is known as that planet's period. The squares of the periods of any two planets are proportional to the cubes of their average distances from the sun



Planet	Distance from Sun*	Period in years	Period ²	Distance ³
Mercury	0.387	0.241	0.058	0.058
Venus	0.723	0.615	0.378	0.378
Earth	1	1	1	1
Mars	1.524	1.881	3.538	3.540
Jupiter	5.203	11.862	140.707	140.851
Saturn	9.539	29.458	867.774	867.977

*Relative distance compared with Earth's. For example, Mars' distance from the Sun is 1.524 times Earth's distance.

Notice that on this chart these two numbers are equal or nearly equal for each planet. The difference increases the farther the planet is from the sun. Later Isaac Newton, in his law of universal gravitation, adjusted Kepler's law, providing the necessary corrections by including the mass of the respective planet and the sun.

Religious intolerance was anathema to Kepler, who believed that the harmony among the planets ought to be evident among humans

one of the greatest scientists ever—one who helped to drag astronomy out of the Middle Ages and into modern times.

Europe Engulfed in Religious War

The same month that Kepler formulated his third law, the Thirty Years' War broke out. During that period (1618-48), Europe was decimated by religious murder and plunder and Germany lost a third of its population. Witch-hunts were widespread. Kepler's mother was charged with witchcraft and narrowly escaped execution. Whereas Kepler's salary at the court was reportedly paid irregularly before the war, during the war it was hardly paid at all.

Throughout his life Kepler, a Lutheran, experienced religious persecution and prejudice. He was forced to leave Graz—which meant loss and hardship—because he refused to become a Roman Catholic. In Benátky he met with further efforts to persuade him to convert. But Kepler could not accept the worship of images and saints; such practices were, for him, the works of the wicked one. In Linz, disagreement with his fellow Lutherans who believed that God is omnipresent led to his be-

ing excluded from their Evening Meal. (See pages 20-1 of this magazine.) Religious intolerance was anathema to Kepler, who believed that the harmony among the planets ought to be evident among humans. He stuck to his beliefs and suffered willingly. "Suffering along with many brothers for the sake of religion and for the glory of Christ by enduring harm and disgrace, by leaving one's house, fields, friends, and home—I would never have believed all of this could be so agreeable," Kepler wrote. —*Johannes Kepler*, by Ernst Zinner.

In 1627 he published the *Rudolphine Tables*, which he regarded as his major astronomical work. Unlike his earlier books, this one was widely applauded, soon becoming indispensable to astronomers and navigators. Finally, in November 1630, Kepler died in Regensburg, Germany. One of Kepler's colleagues was continually amazed to find in Kepler "such well-founded learning and such a wealth of knowledge of the most profound secrets." A worthy tribute to the man who unlocked the secrets of the solar system.

Kepler's Astrology and Theology

While Johannes Kepler established a brilliant reputation for his discoveries in the field of astronomy, it must be acknowledged that he was influenced by the prevalent religious ideas of his day. Thus he wrote extensively on astrology, although he rejected "much of what was claimed to be known about stellar influence."

He was also a firm believer in Christendom's Trinity. "One of the ideas to which he was most strongly attached—the image of the Christian Trinity as symbolized by a geometric sphere and, hence, the visible, created world—was literally a reflection of this divine mystery (God the Father::centre; Christ the Son::circumference; Holy Spirit::intervening space)."—*Encyclopædia Britannica*.

In contrast, what did Sir Isaac Newton have to say about

the Trinity doctrine? He denied the Trinity teaching. His principal reason for rejecting it was that when he sought to verify the statements of the creeds and the church councils, he found no support for the doctrine in the Scriptures. In fact, he believed strongly in the supreme sovereignty of Jehovah God and the Scriptural position of Jesus Christ as inferior to his Father.*—1 Corinthians 15:28.

* See *The Watchtower*, April 15, 1977, pages 244-7.



Courtesy of NASA/JPL/Caltech/USGS

Watching the World

Deforestation in Latin America

In just 13 years, 125 million acres of forest in Latin America has been destroyed, an area equivalent to all of Central America, says a report published by the United Nations Environment Programme. Brazil saw 57 million acres damaged, while Mexico lost 16 million acres of forest and had 990,000 acres of cultivable soil degraded. Haiti, El Salvador, and the island of St. Lucia lost between 46 and 49 percent of their forests in the same period. These statistics are "horrifying," says *¿Cómo Ves?* a scientific magazine of the National Autonomous University of Mexico, and "they are even more so when we think about ... the hundreds of thousands of plants and animals that have disappeared from our increasingly arid planet."

Exercise for CFS Sufferers

Despite extensive research, the causes of and possible cure for chronic fatigue syndrome (CFS) continue to elude medical science. "There has been a remarkable lack of benefit demonstrated from any of the broad array of antiviral, immunological, hormonal, antidepressant and other treatments evaluated," says a report published in *The Medical Journal of Aus-*

City Heat Affects Plant Growth

Satellite observations of eastern North America appear to show that the heat generated by cities influences the growth of vegetation, says a report published in *Science News*. The report notes that plants in cities bud earlier in the spring and retain their leaves longer in the fall than do plants in surrounding rural areas. According to *Science News*, city temperatures during one five-month period were measured to be "on average, 2.28°C [4.10° Fahrenheit] warmer than they were at spots about 10 km [6 miles] away from each urban center." Between northern Florida and southern Canada, there are at least 70 urban locations that encompass an area of more than four square miles each. "These data suggest that those cities significantly affect local climate," says *Science News*.



tralia (MJA). Programs involving physical exercise, such as walking, cycling, or swimming, however, have been found to produce better results than a number of other therapies. Some CFS sufferers avoid exercise because they find that doing too much of it worsens their symptoms. Yet, balance is needed. Some individuals who exercise carefully, staying within the limitations imposed by their symptoms, experience 'significant improvement' in depression tests, perceived

well-being, work capacity, and blood pressure, reports the *MJA*. "Graded physical exercise should become a cornerstone of the management approach for patients with CFS," concludes the report.

Pandas and Their Bamboo

"The giant panda, symbol of China and of wildlife conservation, is not as endangered as thought," says *The Daily Telegraph* of London. A four-year study by the Worldwide Fund for Nature and the Chinese government has found that instead of the

previously estimated 1,000 to 1,100 pandas in the wild, there are more than 1,590. The more accurate count was obtained with the use of improved technology, including the satellite positioning system, to map out the areas to be searched. Although the results are good news for conservationists, the World Conservation Monitoring Centre, in Cambridge, England, warns that bamboo, the giant panda's main food source, is seriously threatened by deforestation. What makes bamboos particularly vulnerable to rapid deforestation is that "individuals of

each species flower once simultaneously every 20 to 100 years and then die," reports *The Guardian* of London.

Mosquito Repellent Caution

Two studies indicate that mosquito coils—one of the most widely used insect repellents in Asia—can be harmful, especially to children, reports *Down to Earth* magazine of India. First, scientists at the University of California, U.S.A., say that the smoldering coils expose users to powerful lung carcinogens. Many families in developing countries use mosquito coils inside their small

houses. "Moreover, windows are kept closed during sleeping hours," note the study's authors. The second study, by scientists from Malaysia and the United States, found that one coil burning for eight hours "releases as much particulate matter as 75 to 137 cigarettes." As an alternative, experts recommend plant-based products, such as those made from the neem tree. "They are not only efficient and good for health, but easier on the pocket," states the report.

Slide in Movie Ratings

"Today's movies contain significantly more violence, sex, and profanity on average than movies of the same rating a decade ago." That is the conclusion reached by researchers at the Harvard School of Public Health, in the United States, after studying movie ratings, a system common in some lands. The study assessed the relationship between the rating and content of films released between 1992 and 2003. The results suggest that age-based movie ratings have become increasingly lenient. The researchers concluded that "parents must recognize their responsibility in choosing appropriate films with and for their children, and in discussing the messages in films with children to mediate any potential adverse effects and reinforce any potential beneficial effects."

Animal Friendship

Farmers and herdsmen have long suspected it, but now a scientific study conducted by biologist Anja Wasilewski claims that hooved animals can forge personal friendships with other individuals in their flock or herd. According to Wasilewski, who observed horses, donkeys, cattle, and sheep, friendship is shown by animals' frequently being close to one another, by bodily contact while they are resting or feeding, by sharing feed, and by social grooming. Sheep, for example, rub heads with a friend that has been in conflict with another animal. This behavior seems to calm and comfort the sheep, reports the German newspaper *Die Zeit*. Donkeys usually have only one friend, but their friendships last longer. In efforts to avoid humanizing the animals, however, researchers are cautious when it comes to speculating about the function and effects of such social bonds.



From Our Readers

Disfigured Child I was deeply touched by the experience of Mailyn. ("A New Face for Mailyn," May 22, 2004) Reading about how this 11-year-old child fights a terrible affliction and yet talks to others about her Bible-based hope encouraged me.

M. B., Italy



The positive outlook of Mailyn and her family was very encouraging to me. In today's world the media places undue emphasis on personal appearance. This can be disheartening. I would like

Mailyn to know that her true beauty is abundantly clear to me. I hope that I will get the chance to rejoice with her when Jehovah gives her a new face in his new world. Her faith has made me stronger.

M. S., United States

I am soon to undergo surgery to have a breast removed. When your appearance suffers because of an illness, it takes strength and courage not to break down. Mailyn's courage and optimism strengthened me. To Mailyn I say: All the best to you. I think you are beautiful!

G. R., France

I was born with a physical deformity known as a harelip. I got many strange looks from other children at school. Some even spit on me. I believe that what helped me to muster up courage and self-confidence was the instruction my mother gave me from the Bible. Even now, at age 31, I still feel bad about my appearance. So I was very touched by Mailyn's experience. I know that with Jehovah's help we can overcome whatever further challenges we will face.

T. S., Japan

Mailyn proved to me that it's not physical form that brings happiness and contentment. This comes only when we are serving and loving our God.

Mailyn's example has been an inspiration to me.

A. T., Philippines

Abusive Courtship I was grateful for the article "Young People Ask . . . Why Does He Treat Me So Badly?" (May 22, 2004) I was in an abusive relationship. When things went bad, my boyfriend always said that it was my fault. I grew up in a family where there was violence and abusive speech, so his behavior seemed normal to me. I am happy now to be out of that relationship; he has shown himself unfit to be a marriage mate.

Name withheld, Belize

The article put my feelings into words. Before and during my marriage, I went through the kinds of situations you described. The psychological violence I experienced shattered my sense of self-respect. I hope the article moves many to examine their relationships while courting. How wise it is to get to know each other *before* marriage, so as to avoid such problems.

M. M., Germany

Traveling Seeds Thank you for publishing the article "A Seed That Sails the Seas." (May 22, 2004) A few years ago, I picked up one of those seeds on a beach near my house, but I didn't realize that it was a seed. On reading the article, I was awestruck by the knowledge that I had picked up a seed that may have traveled from Central or Western Africa! Thank you very much for preparing such interesting articles.

M. K., Japan



The MOST SIGNIFICANT MEETING *of the YEAR*

You will be welcome!

On Thursday, March 24, 2005, an event will take place that you will not want to miss. That is the day when over six million of Jehovah's Witnesses worldwide together with millions of friends will meet locally to recall the last evening meal that Jesus had with his disciples. In accordance with Jesus' instructions, unleavened bread and red wine will be passed at each meeting, and the meaning of this ceremony will be explained.—Mark 14:22-24.

For many people this event is known as the Lord's Supper, or the Lord's Evening Meal.



Jehovah's Witnesses call it the Memorial of Christ's death. It is a vital reminder of the sacrifice that Jesus Christ made in behalf of sinful mankind when he died. (John 3:16; 1 John 2:2) After his final meal, Jesus was arrested and later died on a stake as though he were a common evildoer.

—John 19:17, 18.

You will be warmly welcomed at this special meeting, the most important in the yearly calendar of Jehovah's Witnesses. Please check at your local Kingdom Hall for the exact time and the location in your neighborhood.