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Spring 1995

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21st CENTURY SCIENCE & TECHNOLOGY

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On the cover: Satellite image of the Mideast region, courtesy of NASA. Cover design by Rosemary Moak.

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EDITORIAL

21st Century Announces Annual Panda Award

Pity the Poor Panda! We would like to rescue our friend, the panda, from the embarrassment of serving as a mascot for the World Wildlife Fund. Condemned to consume more than 100 pounds of virtually nutritionless bamboo every day, the poor creature can barely drag itself from tree to tree; needless to say it is not very *sexually active* either.

Only 1,000 of these sadly dysfunctional creatures exist, so every one of them should receive serious consideration. We are therefore establishing an annual Panda Award.

As the first recipient, we have chosen the National Audubon Society, since it is proving itself to be as dysfunctional as the Panda.

In its January-February 1995 issue, the Society's

one-million run magazine featured an attack on our associate editor Rogelio Maduro, for his work in helping to stall ratification of the Biodiversity Treaty by the Senate.

The editorial is headlined, "Biodiversity and Strange Bedfellows," and begins with an incredibly naive assertion: "The word *biodiversity* refers simply to the sum total of all life on Earth. Politically, it hardly seems like a concept to generate controversy, much less opposition. If you don't favor biodiversity, what do you favor? Biological simplicity? Death on earth?"

Really, fellows!

As most of our readers should be aware, the Biodiversity Treaty is not a simple statement of the joys of multiplicity, but a program for protecting ani-

mal subspecies at the expense of human settlements. The treaty, which unfortunately has been ratified by more than 60 unsuspecting countries, creates a legal enforcement regime that will allow environmental fascists to dictate national economic policies and land use policies down to local levels to preserve what they call the biological diversity of the Earth.

In effect, the treaty establishes belief in biodiversity, a scientifically fraudulent

concept, as one of the dogmas of a new Earth-worshipping religion.

The signed editorial, by Michael W. Robbins, editor of *Audubon* magazine, complains that although the treaty was expected to pass, no vote was taken in the last Congress and "prospects for passage in the 104th

Congress are dim." The editorial states:

"Whence came the opposition? Some of it is surely due to partisanship and to reservations about specific measures. But the Senate opposition crystallized after a late-summer disinformation campaign by a combination of Wise Use groups, and supporters of political fantasist (and convicted felon) Lyndon LaRouche.

"Their 'message'—which describes biodiversity as a new religion and the treaty as a threat to U.S. sovereignty, private-property rights, control of natural resources, and individual freedom—was written by LaRouche associate Rogelio Maduro."

Debate is the last thing these ecofascists wanted. The treaty was moving like a submarine through the Senate and the vast majority of senators simply had not





even read it. By keeping such secrecy on the treaty the ecofascists hoped the senators would vote it up before they realized what a dangerous document they were adopting.

Furthermore, the treaty as voted would have been little more than a preamble. The actual treaty is now being written in the course of a massive international undertaking called the Global Biodiversity Assessment. The Assessment task force has produced a draft of the treaty that is more than 3,000 pages long and dictates draconian policies to severely curtail all economic activity and human consumption to save "biodiversity."

In the present budget-cutting environment in the Congress, it is likely that environmental protection measures will suffer the same slash-and-burn treatment being threatened for far worthier objects of government spending. There will be no reason to cheer, however, if the opponents of the treaty and other insanities propagated by Prince Philip's World Wildlife Fund and the Audubon Society do not rally themselves to fight for the kind of large-scale infrastructure development projects that can transform the biosphere into a productive garden. Otherwise, mankind will follow in the paw-prints of the unfortunate panda.

How to Stop Proliferation

From its beginning 25 years ago, the Nuclear Nonproliferation Treaty (NPT) aimed to limit the number of nuclear-weapons-capable states to the big five—Britain, China, France, Russia, and the United States. Although many individuals involved with the NPT negotiations are genuinely concerned with weapons proliferation, it is the case that the NPT has been used to prevent the transfer of nuclear technology to certain of the non-nuclear nations.

This latter purpose was the policy of Lord Bertrand Russell and other one-world utopians who saw peaceful nuclear energy as an obstacle to their plans for world government and a reduced world population. (See "The Great Atom Bomb Hoax," Fall 1994, p. 28.) Today the antinuclear nongovernmental organizations (NGOs) are carrying the Russell banner, lobbying for the indefinite extension of the NPT and a ban on the use of plutonium as nuclear fuel.

It is not the banning or regulation of nuclear weapons that will raise the threshold for war but a defense based on new physical principles. Had President Reagan's Strategic Defense Initiative

been implemented as intended in 1983—a ballistic missile defense based upon "new physical principles" incorporating use of plasma, electron, and laser beams—no nation today would be in a position to use nuclear weapons preemptively or as blackmail.

What's needed today to begin to bring about real international security is the rapid implementation of unfinished nuclear projects: the Clinton administration's plan for light water reactors in North Korea, the General Atomics agreement with Russia to build a gas turbine modular helium reactor that burns plutonium fuel, completion of Ukraine's conventional light water reactors to replace its Chernobyl-style reactors, completion of Brazil's and Argentina's unfinished reactors, and a host of other projects for Third World countries.

As this issue's Special Report makes clear, development is the only road to peace and economic recovery. If the parties to the Mideast peace process can agree on taking the development road, there is hope that the rest of the world's nations can do the same.

Letters



UV-B, Altitude, And Ozone

To the Editor:

Within the past decades, the reduction of the thickness of the ozone layer in the stratosphere over the midlatitudes has not been more than a very few percent and the trend is on the order of about 0.2 percent per year.

Hugh W. Ellsaesser has calculated that an ozone decrease of 1.0 percent causes as much additional UV-B radiation as you would get if you moved 25 km toward the equator. And H. Hoenigsmann stated that for a northern European, a 14-day vacation in the south causes a doubling of his annual UV-B dose, which can be said to be equal to about a 50 percent reduction in the stratospheric ozone.

However, another example seems to be important:

Simultaneous measurements by Reiter et al. (*Arch. Met. Geoph. Biokl.*, Vol. 30, p. 1982) in the Bavarian Alps at 740, 1,780 and 3,000 m above sea level have shown that the UV-B intensity in this height range increases by 23 percent per 1 km height difference (for all days, independent of the weather).

In the high-level Alpine valleys in Austria and Switzerland, tens of thousands of people have lived for generations and are exposed to UV radiation that is 30 to 60 percent higher than in the plains. They obviously don't suffer from skin cancer.

Consequently, an increase of the UV intensity following a decrease of the stratospheric ozone on the order of some percentage points is obviously unimportant, even in the case of a long-term exposure.

Dr. Reinhold Reiter, retired director
Fraunhofer Institute of Atmospheric
Environmental Research
Garmisch-Partenkirchen, Germany

On Wegener's Contributions

To the Editor:

I was interested in the article on ice ages ["The Coming (or Present) Ice Age" by Laurence Hecht, Winter 1993-1994, p. 22] and in seeing, I believe for the first time, portraits of Alfred Wegener and Milutin Milankovitch.

In addition to Wegener's contributions to the theory of continental drift and to the astronomical theory of ice ages, he made a fundamental contribution to the understanding of the mechanism for precipitation from clouds.

The modern version is often described as the Wegener-Bergeron-Findeison mechanism of precipitation. Clouds are colloidal suspensions of water droplets in air that are stable for days against coagulation and precipitation. The droplets are also stable against freezing, unless contacted by an aerosol that induces freezing, or unless the temperature drops below about -40°C .

Much of winter clouds exist at altitudes above the freezing (0°C) level (that is, are colder than 0°C), but are warmer than -40°C . Wegener pointed out that because the saturated vapor pressure of water vapor over ice is less than the value over liquid water, any droplets that froze to become ice crystals would preferentially take up water vapor in the cloud.

So when a 1 micron-sized droplet freezes, the resulting ice crystal grows from micron size to millimeter size and sediments, and at the same time, about a billion micron-sized water droplets evaporate.

When or if the snow or hail falls into warmer air below the freezing level, it melts and becomes rain. This is the basic process leading to winter air-mass precipitation. So we have a lot to be thankful to Wegener for!

Brian A. Tinsley
Professor of Physics
The University of
Texas at Dallas
Richardson, Texas

More on Acoustic Wave Cold Fusion

To the Editor:

Here are some minor corrections and additions to the article reviewing the work of Roger Stringham and myself, "Achieving Cold Fusion with Acoustical Waves," in the Winter 1994-1995 issue (p. 57).

Roger Stringham is not retired. He is, in fact, a full time employee of E-Quest and has been for nearly three years. Prior to the formation of E-Quest he owned and operated Photo Sonication Consulting and worked on contract research with a variety of organizations, including EPRI.

Our calorimetry is complex and is very similar to the methods described by [Martin] Fleischmann last year at Maui. It is based on monitoring the total heat balance of the system using calibration via Newton's Law of Cooling. It is incorrect to refer to this as not providing "exact measurement."

The temperature of 5,000 K that is mentioned is a minimum bubble temperature. Some workers in cavitation are claiming temperatures inside the bubble at 80 million K.

Three independent laboratories other than Rockwell have measured anomalously high levels of helium on numerous occasions.

Russ George
E-Quest Sciences
Palo Alto, Calif.



"Die Weisseüste" by K. Aerdemerten

Alfred Wegener (1880-1930) in Greenland.

Theosophy Defended

To the Editor:

It is astonishing to find the statements concerning Theosophy and Madame H.P. Blavatsky, the founder of the Theosophical Society, by Michael S. Coffman printed in your Fall 1994 issue, which contains his article on "The Pagan Roots of Environmentalism," for there are glaring errors which one would not expect to find in a magazine claiming to be scientific.

It is alleged that Madame Blavatsky was "a blatant racist and Malthusian." In fact, she was the contrary. She was one of the two founders of the Theosophical Society established in New York in 1875.

From the beginning the Society which they founded has had as its first and primary object "To form a nucleus of the Universal Brotherhood of Humanity, without distinction of race, creed, sex, caste or color." This is a verifiable fact.

As for Madame Blavatsky being a Malthusian, please see Annie Besant's autobiography. It is a known fact of social history that Annie Besant was a pioneer in spreading the Malthusian philosophy and that she published the Knowlton Pamphlet. However, in her autobiography, in the chapter dealing with the Knowlton Pamphlet, she says that her view changed when she ceased being a materialist and realized that the woes of mankind had deep psychological causes. Her change of view, according to her, came about on contact with Madame Blavatsky, for the latter was not a Malthusian.

The article published in your journal also alleges that after Blavatsky's death, Annie Besant and Alice Bailey took the leadership of the Society and that "Bailey brought theosophy to the United States." This is an amazingly untrue statement because Theosophy came to the U.S. with the founding of the Theosophical Society in 1875, as stated above, and the publication of Madame Blavatsky's *Isis Unveiled* in 1877, while Alice Bailey, then Alice Anne Evans, joined the Theosophical Society only in 1915. It was af-



New York Public Library Picture Collection

Madame Helena Petrovna von Hahn Blavatsky: Anyway you look at it, she's the mother of today's environmentalists.

ter resigning from the Society that she created the Lucifer Trust. She resigned because she was not in agreement with Theosophical principles nor with the leaders of the Theosophical Society.

Radha Burnier, President,
The Theosophical Society
Madras, India

To the Editor:

It is trusted that "The Pagan Roots of Environmentalism" (Fall 1994) contains a higher proportion of homework, truth and goodwill than does the box on p. 62.

Alice Bailey (1880-1949) did *not* bring Theosophy to the United States. The Theosophical Society was founded in New York in 1875 with Col. Henry S. Olcott (a lawyer) as President and Helena P. Blavatsky (1831-1891) as Secretary. Alice Bailey *never* took leadership in the Society; she was eleven when H.P. Blavatsky passed on.

In 1917, Alice Bailey ran the cafeteria in the Theosophical community of Krotona near Hollywood. In 1919, she was first contacted by the master Djwahl Khul who subsequently dictated most of her books. In 1920, she and Foster Bailey, the National Secretary, were both thrown out of the Society and were married.

There was *never* a "Lucifer Trust." The "Lucis Trust" was founded in 1922 under that name. Foster Bailey founded

the Lucifer Publishing Co. about the same time, and changed its name to "Lucis" in 1925.

But the important matter is: Do the books of Alice Bailey or any of the Theosophists in any way promote any form of evil such as black magic, witchcraft, or mental/spiritual domination? "Absolutely not," said an 86-year-old friend of mine who has read almost everything in the field, "in fact they warn of the severe karmic penalty of such." I can verify this about Theosophy, of which I have read about 10 books.

The writings of Alice Bailey and the Theosophists provide information and understanding, and are as much in advance of the New Testament as it is over the Old. If you

suspect that the Bible does not contain it all, or that your church is missing something; and if you can overcome your phobia of that terrible word "occultism," I'd suggest starting with some of the books of the Theosophist Charles Leadbeater or with H.P. Blavatsky's fascinating *Isis Unveiled*.

Benson Boss
Deming, New Mexico

Dr. Michael Coffman Replies

The acid proof of any belief is how it is applied in practice. Communism was espoused as a belief system that would create a people's paradise, but instead created hell on Earth. Likewise, although the elitist god-like powers and esoteric knowledge promoted by theosophical doctrine are supposed to be balanced with humility that leads to love and brotherhood, history instead reveals a bloody heritage.

Theosophy played a role in the French revolution and was the guiding religion of Adolf Hitler. And once again it has raised its ugly head within modern environmental leadership—from Prince Philip and the British royal family, to Maurice Strong and the United Nations, to the Sierra Club and others.

Blavatsky claims that only the occultists have the necessary wisdom to save the world. As she writes in *The Se-*

Continued on page 9

Linus Pauling (1901-1994): Two Views

A Life of Scientific Contribution

by B.A. Soldano

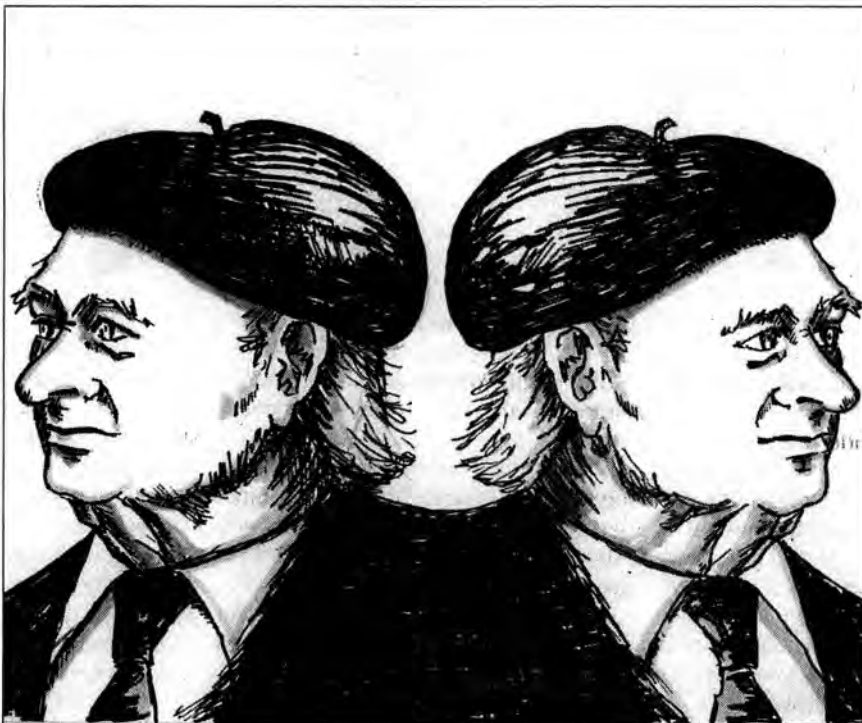
The scientific contributions of Linus Pauling have played a major role in advances in the field of structural chemistry in this century.

In the early 1940s, Pauling applied the revolutionary concepts of quantum mechanics, then being developed in theoretical physics, to the complex field of chemical structures. Whereas theoretical physics

studies in quantum mechanics had led to a profound insight into the nature of the interactions of a single electron, Pauling evolved semiempirical, relatively simple quantum techniques for understanding the behavior of complex collections of electrons characteristic of chemical structures, thereby enabling chemists to systematize and compare many of the properties of chemical compounds.

For example, he demonstrated that the quantum concept of resonance could be quantified for complicated structures. This led to the conclusion that resonance enhanced the stability of chemical compounds. Our present understanding of the nature of the chemical bond in no small measure can be traced to his pioneering efforts.

That his deep scientific insight was not limited to the field of structural inorganic chemistry was confirmed by Francis Crick, who shared with James



D. Watson the Nobel Prize for discovering the spiral structure of DNA, an achievement that sparked a far-reaching revolution in molecular biology. Crick acknowledges in his book on the discovery the great effort he made to glean any shred of information on the progress his competitor Pauling was making in their contest to be first in arriving at the structure of this basic building block of living matter.

As for personal and for the most part indirect stories concerning Pauling: His public lectures represented a synthesis of first-rate science with an unparalleled sense of drama. Several of my scientific associates received their Ph.D.s under his supervision. They inevitably recounted tales that could well be apocryphal. For example, one of them claimed that Pauling could dictate a flawless final draft of a submission to a technical journal!

The story I found most revealing

Pauling's Other Side

by Thomas H. Jukes

Linus Pauling, who died on Aug. 19, 1994, at the age of 93, kept in the limelight for most of his professional life.

Pauling was remarkable for the way he challenged people who disagreed with his ideas. His advocacy of daily consumption of large amounts of vitamin C as a universal remedy became a crusade in his later years, and he sought to be nominated for the Nobel Prize ►

goes as follows. A colleague had evolved a theory that he claimed could resolve major difficulties encountered in concentrated aqueous solutions. Not surprisingly, his theory was greeted with derision. This led him to seek an opinion on the work from Pauling.

I was privileged to read Pauling's response. It was a masterpiece of letting a young scientist down with grace and kindness. Contrary to the usual practice of ignoring a scientist who was indeed in error, Pauling took the time not only to read the entire submission but also to demonstrate in detail where the young man had gone astray.

The scientific contributions of Pauling go far beyond the few sketched here. Needless to say, he represented a worthy successor to that giant of American chemistry, G.N. Lewis.

Dr. Soldano is a retired professor of physics.

in Medicine.

Pauling's advocacy of vitamin C was his major preoccupation over the last two decades. It was also central to his efforts to raise money.

When it was found that he had prostate cancer, he rationalized that he would have developed it sooner were it not for his consumption of large doses of vitamin C. Pauling said "controlled tests can be carried out only by skeptics." He preferred his intuition.

Pauling vigorously attacked his critics. For example, concerning his promotion of vitamin C as a cancer preventative, Pauling said that the report by Dr. Charles Moertel of the Mayo Clinic on the lack of effect of vitamin C on cancer was "lies," a "fraudulent paper," and an "outrageous action against the well-being of the American people." Pauling demanded "a retraction and apology" of Moertel's publication in the *New England Journal of Medicine*. Otherwise, he said, he might file suit.

Dr. Moertel's reaction was "one of great sadness that a scientist as revered as Dr. Pauling would make such statements."

A Remarkable Cleverness

Mr. and Mrs. V. Goertzel, authors of a biography of Pauling (*The Life of Linus Pauling*, New York: Basic Books, in press), have said that he was an individual whose life "has made a discernible impact on the contemporary world." But they also ask, "How much of Pauling's eminence was due to original contributions, and how much to his remarkable cleverness at promoting himself and his work?"

Another example is the case of Pauling's colleague, Dr. Harvey Itano, and his finding that the hemoglobin of patients with sickle cell anemia (hemoglobin S) migrated differently in an electric field from "normal" hemoglobin. This was published by Pauling, Itano, Singer, and Wells in *Science* (Vol. 110, p. 543, 1949).

The molecular change in hemoglobin S was discovered by Vernon Ingram, who showed that it was caused by a change from glutamic acid to valine at position 6 of the beta chain of hemo-

globin. Ingram invented a new procedure, electrophoretic two-dimensional paper chromatography, for identifying the change (*Scientific American*, January 1958). Ingram's finding was a landmark in molecular evolution.

In the text of Pauling's 1989 book, *How to Live Longer and Feel Better*, there is an appendix that says, "Working with Harvey Itano and others, Pauling showed in 1949 that the abnormal hemoglobin (sickle cell) was caused by just a single amino acid abnormality in one of the polypeptide chains." However, this was shown, *not* by Pauling in 1949, but by Ingram in 1957!

Pauling took credit for the concept of "molecular disease." In so doing, he omitted the fact that in 1908, A.E. Garrod, a British physician and scientist, published the book *Inborn Errors of Metabolism*. In this work, Garrod discusses one such error known as alkaptonuria, a disease in which the urine turns black on standing. The black pigment settles in cartilage and other tissues. By studying family histories, Garrod showed that alkaptonuria was genetic in origin.

Another such disease was phenylketonuria, and both were caused by defects in the enzymes that metabolize phenylalanine and tyrosine. These ailments were truly molecular diseases in Pauling's terminology.

Contrast Pauling and George Beadle; both were professors at the California Institute of Technology, 1946-1958. George Beadle and Edward Tatum received the Nobel Prize in Physiology or Medicine in 1958, "for discovering how genes transmit hereditary characteristics." Their discovery is often termed the "one gene, one enzyme" theory. They showed that mutations in the gene often produced defective enzymes, which produced "molecular disease."

Beadle wrote in 1974: "By 1942, we had gone a fair way in the process of identifying genes with specific chemical reactions. Then classical work by Garrod was rediscovered . . . by J.B.S. Haldane and Sewall Wright. . . . On learning of this long-neglected work, it was immediately clear to us that in principle

we had merely rediscovered what Garrod had shown so clearly 40 years before" (*Ann. Rev. Biochem.*, Vol. 43, pp. 1-13, 1974).

Vitamin Therapy

Pauling's first foray into the field of vitamin therapy was in what he called "orthomolecular psychiatry." He praised the work of Canadians A. Hofer and H. Osmond, who treated schizophrenic patients with nicotinic acid (niacin) doses of 3 to 18 grams daily and claimed beneficial results in two publications, 1957 and 1964. The claims were investigated by the American Psychiatric Association (APA), which found that in a number of controlled experiments, treatment with niacin made no difference. In some studies, the treated patients got worse.

As a result, the APA issued a strong statement against the use of large doses of vitamins, especially niacin, to control schizophrenia (Task Force Report 7: Megavitamins and Orthomolecular Therapy in Psychiatry, Washington, D.C., American Psychiatric Association, 1973). R. Languetot describes, regretfully, the ineffectiveness of any current medication in the treatment of schizophrenia (*Wall Street Journal*, Aug. 31, 1994).

In 1970, Pauling published a popular book titled *Vitamin C and the Common Cold*. He says that in April 1966, he received a letter from Irwin Stone, a brewing chemist whom he had met at a dinner in New York. The latter recommended a high-level intake of vitamin C to prolong life expectancy. Pauling and his wife began the regimen and "noticed an increased feeling of well-being and especially a striking decrease in the number of colds we caught and in their severity."

From then on, Pauling became a strong advocate of high intake of vitamin C for numerous beneficial effects, including the prevention of cancer. He has advised high dosage of vitamin C because "the optimum intake for man is much larger than the recommended daily allowance (RDA), perhaps 100 times as large." This larger intake would be 6 grams daily. He recommended high dosage of vitamin C for

the common cold, the healing of wounds and burns, back trouble, heart disease, cigarette smokers, mental alertness, and general well-being. He drew attention to the inactivation of viruses *in vitro* by vitamin C. (Actually, this is probably due to its acidity.)

The Case of Vitamin C

On May 7, 1984, Pauling said he took 12 grams of vitamin C a day and "about 6 grams gets into the intestinal contents and the other 6 gets into the bloodstream. *The 6 grams in the intestinal contents destroys the carcinogens, the mutagens, presumptive carcinogens in the intestinal content and protects the lower bowel against cancer. Also, of course, it helps control polyps in the colon and the rectum.* The 6 grams that gets into my body, about 2 grams is eliminated in the urine *which protects the urinary tract so that the other 4 grams is . . . converted to oxidation products . . . which have been shown by Dr. Omura in Japan to have a greater anti-cancer activity than vitamin C itself.*"

These assertions have no experimental support.

Pauling's assertions about wound healing and back trouble are based on the loss of connective tissue formation in scurvy. However, individuals without scurvy have normal connective tissue and do not need treatment. This is a crucial point. Vitamin A deficiency causes night blindness and iodine deficiency produces goiter. Yet intake of vitamin A or iodine in excess of the RDAs does not enhance vision or improve thyroid function.

Pauling's vitamin C campaign extended to the courtroom. He defended a physician who was charged with "neglect and incompetent treatment" of a patient with cancer of the cervix.

11 EHEM. NATO- GENERALE: WETTRÜSTEN IM ALL FÜHRT ZUM KRIEG!

Niemand soll sich Illusionen machen: Nicht für den „Krieg der Sterne“ sondern für einen Atomkrieg auf der Erde werden Weltraumwaffen gebaut. Zusammen mit den Angriffsraketen MX, Pershing II und Trident II zerstören die Weltraumwaffen die Zweitschlag-Fähigkeit des Gegners und ermöglichen so den Erstschlag.

Erstschlag-Fähigkeit aber führt mit Sicherheit zum Krieg. Wir fordern mit Entschiedenheit: Laßt uns das wahnsinnige Wettrüsten nicht auch noch im Weltall fortsetzen! Laßt uns stattdessen die Kräfte der Menschheit vereinen zum Kampf gegen den Hunger, die Armut und für die Versöhnung der Völker!



Linus Pauling in Hannover, Germany, at a September, 1985 conference protesting the Strategic Defense Initiative. The poster behind him is titled "11 former NATO Generals: Arms Race in Space Leads to War."

The physician was president of the Orthomolecular Medical Society. Hearings were held before the California Board of Medical Quality Assurance in March 1984. The physician had used 99 remedies, including coffee enemas, buttermilk enemas, and chelation therapy. The patient died. A second complaint against the defendant was that he treated twin boys, aged 4 years, with coffee enemas twice daily for earache, plus 70,000 units of vitamin A daily for chronic otitis media.

Pauling testified that it is the duty of every physician to give proper nutrition to every cancer patient, and prop-

er nutrition involves 10 grams of ascorbic acid (vitamin C) per day. He said that vitamin C detoxifies agricultural chemicals, seeks out poisonous substances, and destroys them. Coffee enemas have some value, Pauling said, because they clean out the lower bowel, and that buttermilk enemas might be valuable in some circumstances. He also said that mutagens in material in the lower bowel diffuse back into the body.

Pauling also defended Oscar Falconi in a trial brought by postal authorities in 1983. Falconi advertised by mail a paper test for vitamin C levels in the urine, with the claim that keeping lots of the vitamin flowing through the kidneys "probably offers 100 percent protection against bladder cancer." Falconi lost the case.

Like a Classical Tragedy

R.J.P. Williams commented about Pauling in 1989:

"From being a public figure of high stature with an idealistic philosophy to being viewed as a lonely crank is indeed a fall as great as in any clas-

sical tragedy. Often his approach can only be described as a consequence of a reckless wish to be in the picture. The flaw of self-belief, perhaps even a cult of personality enveloped him. Much though Serafini tries to promote the image of the scientific genius, there may be no such thing, and this very image may well have been the trap into which Pauling fell" (*Nature*, Vol. 342, pp. 135-136, 1989).

Thomas H. Jukes is a professor at the Space Sciences Laboratory, University of California, Berkeley, and has had a career of more than 60 years in the field of nutrition and biochemistry.

Letters

Continued from page 5

cret Doctrine (Vol. 1, p. 611): "The exact extent, depth, breadth, and length of the mysteries of Nature are to be found only in Eastern esoteric sciences. So vast and so profound are these that hardly a few, a very few of the highest Initiates—those whose very existence is known but to a small number of Adepts—are capable of assimilating the knowledge."

As for science and reason, Blavatsky proclaims (p. 477): "[Modern science] cannot, owing to the very nature of things, unveil the mystery of the universe around us [Only] the occultist, arguing from metaphysical data and by probing the inmost secrets of Nature, can transcend the narrow limitations of sense, and transfer his consciousness into the . . . sphere of primal causes." She concludes (p. 323): "Hence we have no choice but either to blindly accept the deductions of Science, or to cut adrift from it, and withstand it fearlessly to its face, stating what the Secret Doctrine teaches us."

Thus, the unbridled arrogance of Blavatsky and her modern environmental protégés, who claim for themselves the divine right of determining right and wrong for us mere commoners.

Today, the completely unsubstantiated apocalyptic horror stories of environmental leadership have killed or destroyed the lives of millions of people around the world. Policies resulting from mystic beliefs rather than hard science have taken jobs away, rendered homes and land valueless, regulated people into a state of poverty, or denied them the use of a safe pesticide or medicine that could have saved their lives from starvation or disease.

But these are merely the outward symptoms of something more heinous. The mystic solution of the environmentalist nature-worshippers is defined in sections 9 and 10 of the Global

Biodiversity Assessment, which is the basis for implementing the United Nations Environment Program's Biodiversity Treaty. These sections call for the reversion of *half the arable land on Earth to wilderness*. Their esoteric wisdom has concluded that either we go back to the feudal system, where everyone but the elite "Adepts" are peasants, or we reduce global human population to less than 2.5 billion people. And most of those billions eliminated will be people of color.

So much for brotherhood. Now these modern mystic Malthusians are telling us we must sacrifice ourselves for the greater good of Earth herself.

Two later chapters in my book, *Saviors of the Earth*, from which the 21st Century article was adapted, recount some of the dangers and recent heinous examples of what happens when men define Mother Nature as God.

Science, Economics, And Politics

To the Editor:

The Winter 1994-1995 issue is filled with excellent articles, but I am stunned by the editorial ["Gambling with Our Future," p. 2]. It's an editorial of innuendo of politics. How could this happen, I thought, in a magazine devoted to science? . . . It smacks of conspiracy.

Whoever wrote the editorial should come out and detail exactly what political policies lead to slave labor camps—regardless of which political party is deemed to be the one whose policies are so geared. Define the policies that lead to slave labor camps. Then send the editorial to a tabloid magazine. . . .

This is not to say that those in political power do not resort to underhanded means. That, I think, is a given. It's the nature of political power. Where power in the social world is simply "control over action." But the editorial is all tabloid. Let the tabloids handle the gossip—even if it's true.

Edward T. Marshall
Los Alamitos, Calif.

The Editor Replies

That the Nobel Prize committee had the temerity to award a prize honoring the application of the methods of game theory to economics is certainly germane to a science magazine. National

and international monetary and fiscal policies that favor speculation have created the conditions for a cataclysmic economic collapse. Solutions such as privatizing prison labor and eliminating the social welfare reforms enacted under the New Deal are a giant step toward creating conditions in which the term used by trade unions—"wage slavery"—becomes the reality, whether it be in the form of cottage industries or of actual work camps.

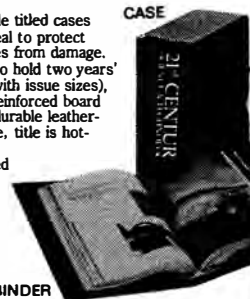
We back alternative policies that favor investment in major infrastructure development, as featured in this issue. If the consequences implicit in the award of the Nobel Prize were not so deadly, the stupidity of the judges (not to mention the recipients) would surely be an appropriate subject for humor. We're sorry you find that to be tabloid journalism.

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Correction

Figure 1, p. 54 ("High-Intensity Short-Pulse Lasers: Leading Lights of Science") in the Winter 1994-1995 issue should have been credited to G. Mourou at the Center for Ultrafast Optical Science, University of Michigan, Ann Arbor.

NEWS BRIEFS



Stuart Lewis /EIRNS

"Green Scissors": Greens and conservatives unite to cut advanced nuclear projects. Here, Ralph DeGennaro of Friends of the Earth at the Jan. 31 joint press conference.

CONSERVATIVES, GREENS JOINTLY ATTACK ADVANCED TECHNOLOGIES

Under the banner of "The Green Scissors Report," the National Taxpayers Union (NTU) and the Friends of the Earth have jointly proposed \$33 billion in cuts for what they call "wasteful and environmentally harmful spending and subsidies." The top 10 proposed cuts include funds for the National Ignition Facility and the Atomic Vapor Laser Isotope Separator (AVLIS) program at Lawrence Livermore National Laboratory, the Gas Turbine Modular Helium Reactor, the Advanced Light Water Reactor Program, the tokamak experiment at Princeton Plasma Physics Laboratory, the Yucca Mountain High-level Nuclear Waste Repository, and the Advanced Neutron Source at Oak Ridge National Laboratory. On this last project, "The Green Scissors Report" notes that the device "would enable certain research to be conducted for the first time . . . [including] materials research" and production of "isotopes for research and medical use." The National Taxpayers Union is headed by James M. Buchanan, former president of the Mont Pelerin Society, and includes on its boards other Mont Pelerin members, the head of the Reason Foundation, and members of the Heritage Foundation and Cato Institute. Last year the NTU campaigned against the Integral Fast Reactor.

EDWARD TELLER CALLS FOR PUTTING NUCLEAR BACK INTO DOE

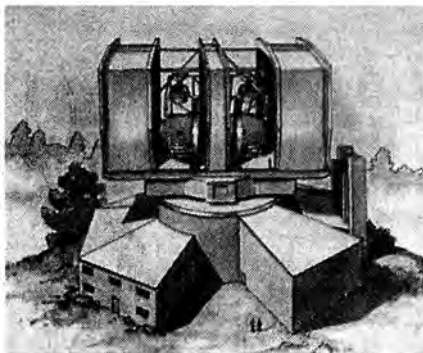
Dr. Edward Teller was the lead witness at hearings on the future of the Department of Energy Jan. 31, held by The Energy and Water Subcommittee of the House Committee on Appropriations. "The Department of Energy has practically stopped all development and even all research on nuclear reactors for electricity production," Teller said. He proposed to shift the emphasis to "obviously safe reactors," based on modifications of the General Atomics high-temperature gas-cooled reactor placed 300 feet underground. He also urged that DOE clean-up programs be curtailed until it was determined "whether and to what extent this cleanup is actually necessary for public safety" by research on the "actual consequences of low-level radiation exposures." In addition, Teller scored efforts to cut back weapons research.

NUCLEAR DESALINATION AN OPTION, SAYS JORDANIAN EXPERT

"Nuclear desalination is definitely not excluded from our equation," said Dr. Munther Haddaddin, the leading Jordanian representative on the Regional Development Working Group and a cochairman of the Rift Valley Development Project. Haddaddin was speaking at a Dec. 12 meeting of the Washington Institute on the Middle East. "There will be a new generation of reactors out on the market next year which will be easier to control. We are definitely interested in utilizing that option . . . Even with the development of the canal projects," Haddaddin said, "we will still have a great need of water in the long term. And there wouldn't be enough with even the building of a canal."

NATURE TURNABOUT FAVORS 'ENDANGERED' MT. GRAHAM TELESCOPES

Biologist Bruce Walsh and astronomers Roger Angel and Peter Strittmatter from the University of Arizona authored a hard-hitting attack ("Endangered Telescopes or Species?") on environmentalist actions against the Mt. Graham International Observatory, which appeared in *Nature*, Nov. 17. When the Apache Survival Coalition responded with a letter to the editor Dec. 15, objecting that the article "ignores the views of Native Americans about our Mother Earth," *Nature* countered in an editorial noting that the coalition does not represent the Apache. The editorial also reported that the Coalition "has been sending hate mail to all and sundry" to block the observatory and noted that a recent Coalition flyer stated that "the building of the telescope is comparable with the Holocaust."



The University of Arizona

The Large Binocular Telescope is the last of three to be build on Mt. Graham. Already completed are the Max Planck and Vatican telescopes.

N.Y. BILL TO REPEAL STATE BAN ON IRRADIATED FOODS

New York State Senator William R. Sears is considering resubmitting a bill he drafted last year to repeal the state's ban on irradiated foods. The ban is spelled out in section 199-e of the New York Agriculture and Markets Law. The New York Public Interest Research Group, along with the rabidly antinuclear Food & Water grouplet, had used lies and scare tactics to push the ban through the legislature two years ago. To support Sears's effort, write him at the N.Y. Legislative Office Building, Room 944, Albany, N.Y. 12247, or call him at the N.Y. Senate, (518) 455-3334.

INDONESIA TO BUILD 600-MEGAWATT NUCLEAR PLANT IN JAVA

Indonesia announced that it would begin building a 600-megawatt nuclear power plant on Java in May 1996, a project under discussion for 20 years. The \$1.2 billion plant is scheduled to generate electricity around the year 2004. As reported by the official news agency Antara Jan. 23, Indonesian Minister for Research and Technology B.J. Habibie talked about the need for energy sources to generate electricity and said that "the Indonesian people . . . are aware of the importance of the modern [nuclear] technology. . . ."

EDMUND STORMS REVIEW OF COLD FUSION PHENOMENA AVAILABLE

Dr. Edmund Storms, recently retired from Los Alamos National Laboratory, has completed a "critical review of 'cold fusion' phenomena" available to readers at \$7 to cover postage and handling. Requests should be sent to Dr. Edmund Storms, 270 Hyde Park Estates, Santa Fe, N.M. 87501.

NEW COLD FUSION MAGAZINE ANNOUNCED BY EUGENE MALLOVE

Atlantis Rising is the name of a new bimonthly cold fusion magazine to begin this spring, announced Dr. Eugene Mallove, the editor. Subscriptions are \$29.95 and should be sent to Cold Fusion Technology, Dept. AR1, P.O. Box 2816, Concord, N.H. 03302-2816.

ASTEROID SITE GIVES CLUES TO DINOSAUR EXTINCTION

Examination of the site where a giant asteroid is thought to have collided with Earth 65 million years ago has led a team of geologists and space scientists to conclude that the resulting dust cloud produced a global freeze that wiped out the dinosaurs and many other species. The asteroid, estimated at about 6 to 12 miles in diameter, struck a geologically unique sulfur rich region of Mexico's Yucatan peninsula, kicking up a cloud of particulate matter that blacked out the Earth's atmosphere for about six months. Researchers from NASA's Jet Propulsion Laboratory and private firms based their work on studies of the crater impact site at Chicxulub, Mexico, and extensive field work at a rock quarry 223 miles south.

TO PROTECT SALMON, JUDGE PUTS THOUSANDS OUT OF WORK IN IDAHO

Federal District Court Judge Dan Ezra ruled Jan. 12 that all grazing, logging, mining, and road-building activities in central Idaho must be halted until further notice in order to "protect" endangered salmon. The ruling bars economic activities in six huge national forests, an area larger than the state of Maryland. It shuts down 190 active mines, denies 532 grazing permits, and prohibits the logging of tens of millions of board feet of timber under contract. Judge Ezra ruled in favor of a suit brought by the Sierra Club Legal Defense Fund "for failure of the Forest Service to review forest plans . . . in light of the listing of salmon as endangered." Unmentioned is that the greatest threat to the salmon comes from the huge increase in the population of Pacific seals that resulted from the 1972 ban on seal hunting to protect the "endangered" seal. The seals, voracious salmon eaters, are wiping out fish populations as they return to spawn.



IAEA

Studies show that U.S. consumers want the benefits of food irradiation and that only a tiny group of antinuclear extremists oppose the technology. Here, a sampling of irradiated products with the international symbol for food irradiation.



Mideast 'Mega-projects' to Build Infrastructure and Peace

by Marcia Merry

Since the historic Sept. 13, 1993, Mideast peace accords between the Palestine Liberation Organization (PLO) and Israel, economic infrastructure plans have been put forward by many parties to the peace process. Despite differing priorities and approaches, these proposals give an overall direction for development that provides the basis for a real peace and sets the example for economic development worldwide.

In particular, this is an opportunity for advanced technologies and new scientific discoveries that otherwise have been relatively little used; for example, new seawater desalination breakthroughs, magnetically levitated train lines, or new housing construction methods.

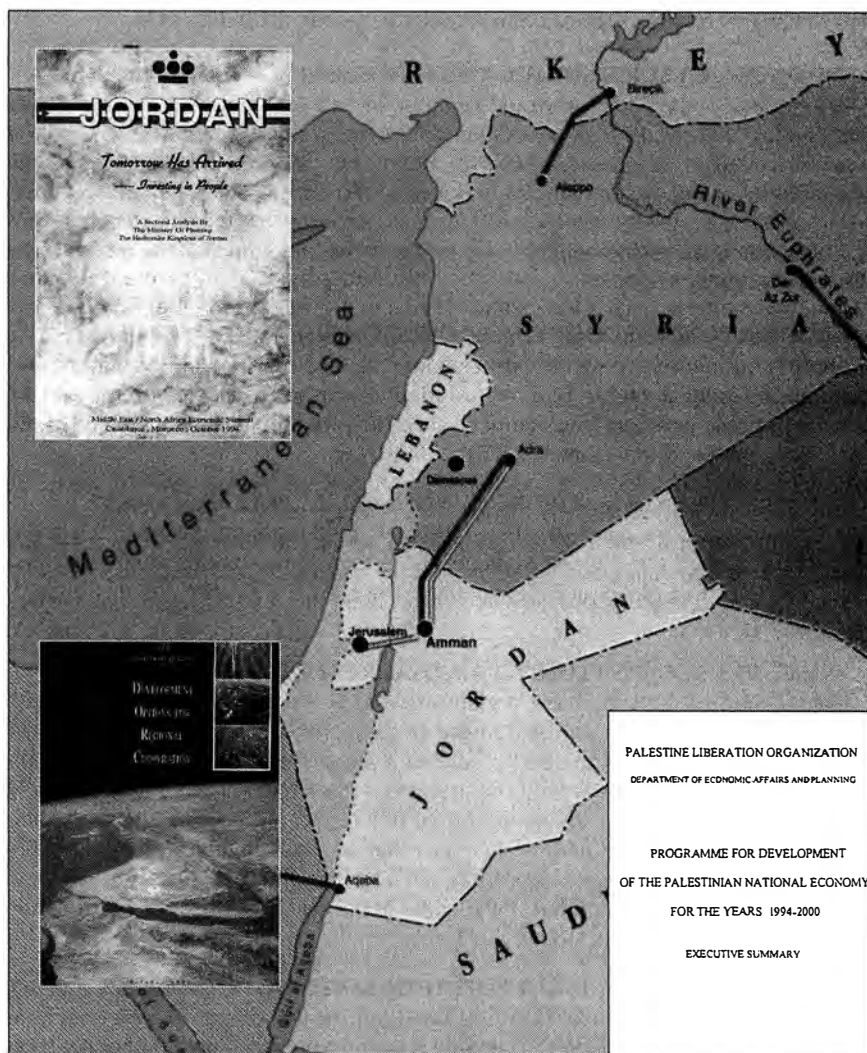
As of early 1995, the impediment to the peace through development process was the continuing obstruction of basic infrastructure projects (water, sewer, power) by the financial interests associated with the International Monetary Fund and World Bank—the disintegrating Bretton Woods system. The terrorism in the region can be directly and indirectly traced to these same circles.

We here provide a summary picture of the regional infrastructure proposals advanced by Israel, the PLO, and Jordan, as a contribution to the mobilization to get the building process under way before it is too late.

The Casablanca Conference

Representatives of 60 nations attended the "Middle East and North Africa Economic Summit" Oct. 30-Nov. 2, 1994, in Casablanca, for which occasion special economic development reports were released by the three governments in the greater Jordan Basin region: the Palestine Authority, Israel, and Jordan.

Because the international agencies sponsoring the Casablanca conference included the New York-based Council



Jordan Ministry of Planning

Development proposals presented at the October 1994 Mideast economic summit meeting in Casablanca. In the background is a map from the Jordanian government report showing proposed new electricity interconnections in the region.

on Foreign Relations, the World Economic Forum, and the World Bank, there were many on hand who opposed basic infrastructure projects and instead proposed only casinos, "ecotourism hotels,"

wildlife preserves, and the like. A counterforce group, including Egypt, Israel, Jordan, and the PLO proposed a regional Mideast development bank to finance general-interest infrastructure projects but

this was stiffly opposed by the World Bank axis, and the idea was shelved.

The scope of the three principal development reports presented at Casablanca, however, shows what can and must be done.

'Invest in Palestine'

At the Casablanca meeting, a 100-page executive summary of the first official development program in the history of Palestine, "Programme for Development of the Palestinian National Economy for the Years 1994-2000," was circulated.

Called PDP for Palestine Development Program, the document discusses the essential "underpinnings" (*muqawwimat*, in Arabic) for the Palestine national economy, drawing on previous work by economics professor Yusif A. Sayigh and colleagues. It reviews the hostile setting for development in the past, and gives the investment overview for the future, by sector—water resources and agriculture, industry, energy, housing, and "infrastructural services" (schools, scientific research, health care, training, communications, and so on), and social services (cultural, recreational, and so on).

Along with the lengthy PDP document is a 22-page appendix, "Invest in Palestine," presented at Casablanca by the Palestine Economic Council for Development and Reconstruction (PECDAR), an agency established soon after the 1993 PLO-Israel peace accords to coordinate economic planning and projects.

The "Invest in Palestine" document presents three categories of projects. First, a project budget of U.S. \$128 million for 1994-1995 for "Emergency Rehabilitation" in Gaza and the West Bank of roads, water and sewage facilities, schools, and health care. Second, a list of projects amounting to U.S. \$165 million for "Emergency Investment" in eight economic sectors as the groundwork for the future.

The third element, what PECDAR calls "long term, large scale projects," includes the Gaza Port, the Gaza and Jericho airports, regional highways, a Palestinian corridor between Gaza and the West Bank, Gaza and West Bank industrial parks, and a Mediterranean-Dead Sea Canal.

The Palestinian plans foresee a population, including returnees, in the Palestine Authority lands of 2,985,000 people by the year 2000, up from about 2,200,000 today. The expected labor

force by the year 2000 is projected to be 597,000. At present, the population of the Gaza Strip, for example, numbers around 800,000 Palestinians, about half of whom are under age 15, and mostly unemployed.

With a combined land area of West Bank and Gaza covering about 6,160 sq km (Gaza is 1,550 sq km), the population density ranges today from 2,500 people per sq km in Gaza to 10 times less than that in the West Bank.

Whatever the differences in population density, the common feature is that the per capita and per square kilometer infrastructure to support the population is absent. For almost 30 years, virtually no new water pipe systems, electricity lines, and similar hard infrastructure have been installed. Thousands of people have been subsisting in camps.

Starting up the rehabilitative and new infrastructure projects will provide the needed physical improvements for higher living standards and give hope to future generations. The situation is a world stage for showing off new housing construction techniques, advanced plastic pipes, and other advanced technologies.

Most of the PDP seven-year plan and the "Invest in Palestine" plan consists of straightforward lists of projects of the most basic kind—housing units, plumbing lines, and the like, reflecting the urgency of need. However, also reflecting the World Bank's bias against generalized economic development, the PDP report (for which the World Bank was among the advisers) states: "We should, at the very least, be cautious about proposed regional megaprojects. Do they address real needs? Might they not create more problems than they help to overcome? How thoroughly have we assessed potential environmental impacts? And are there any realistic alternatives?"

In reality, both emergency and the long-term "mega projects" are essential for the required levels of population potential per square kilometer in the region.

Israel: 'Development Options'

The 250-page report released at Casablanca by the government of Israel, called "Development Options for Regional Cooperation," contains a mix of both local and larger-scale projects.

Decorated with a cover photograph of a satellite view of the Syro-African Rift

Valley with Suez and Aqaba gulfs in the foreground, the report presents 10 categories of "sectorial development options" and models, with maps, of selected "integrated regional development centers."

For example, the 10th section is titled "Canals to the Dead Sea" and gives route maps, elevation profiles, and hydrologic data on three optional locations: (1) a "Med-Dead" route consisting of a conduit running from Gaza, south of Beer-sheba through a tunnel, to plunge south of the Dead Sea; or (2) a "Red-Dead" route, running in the Rift Valley between the Gulf of Aqaba and the Dead Sea; or (3) a conduit to the Rift Valley from the Mediterranean, beginning south of Haifa, tunnelling under Mt. Carmel, and dropping into the valley at Beisan.

All three proposals are for a combination of turbine energy generation, and optional desalination of a desired amount of seawater. The Haifa to Beisan, or "Northern Canal" option, however, is special, because engineers recommend that the topography is perfect for using advanced reverse osmosis membranes in the desalination facilities at Beisan, where the pressure of the water plunging the 400-meter elevation difference between the Mediterranean and the Rift Valley, would be enough for the seawater to desalinate itself, without need of additional power.

It is estimated that a volume of fresh water equal to the existing flow of the Jordan River could be made in this way.

The other nine options in the Israel report cover (1) water (2) agriculture, (3) combatting desertification, (4) tourism, (5) transportation, (6) energy, (7) communications, (8) logistics, trade and industry, and (9) environment.

The kinds of "options" given for these other categories range from casinos near Eilat for a "Red Sea Riviera," to agriculture extension programs to introduce a new crossbreed of sheep that tends to bear twin lambs, not singles.

Many of the proposed projects are straightforward; for example, making the key cross-border connections of power transmission lines, railroads, and highways between Egypt, Israel, Jordan, Gaza, the West Bank, and Lebanon.

The most urgent proposals are for such projects as 26 new water purification stations in Gaza.

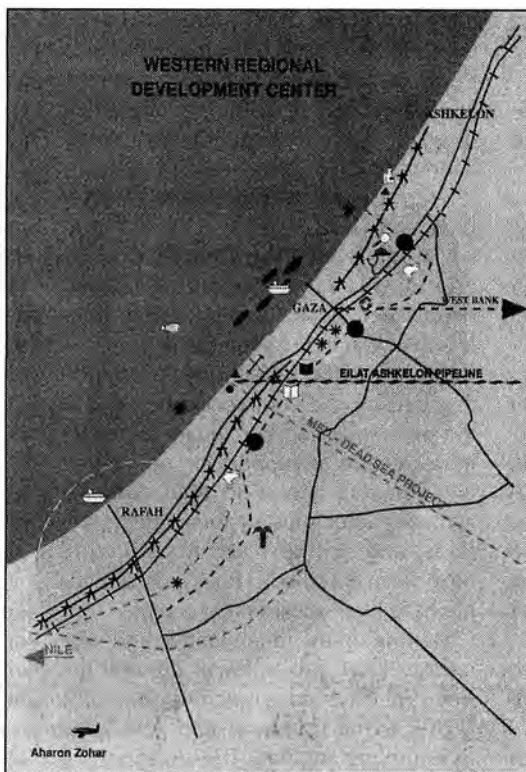
The first chapters of the report are taken from the 1993 book *The New Middle*

East, by Israeli Foreign Affairs Minister Shimon Peres, and stress the mutual benefit of regional projects. "Our ultimate goal is the creation of a regional community of nations, with a common market and elected centralized bodies, modeled on the European Community," Peres writes.

The strong point from Minister Peres's statements is that initiation of the projects of development must not be thwarted. The Israeli Casablanca report states:

"There is no doubt that it would be possible to get assistance from existing sources such as the World Bank, the European Investment Bank [now funding European advanced rail lines], and private banks. However, it is preferable to concentrate all investment money for Middle Eastern development in a bank set up exclusively for that purpose. This approach offers a number of important advantages. First, only 1 percent of the necessary capital is needed to establish the bank. Second, from a sociopsychological standpoint, the bank will encourage people living in the Middle East to see the regional framework as an entity in its own right."

The World Bank, IMF, and co-thinkers have so far succeeded in blocking this proposal. However, at a Jan. 11 press briefing on a Washington, D.C., meeting on Mideast development, U.S. Undersecretary of State Joan Spero indicated that the United States was strongly in favor of the bank and said



Israel's proposed Western Regional Development Center from its October 1994 report, showing the infrastructure plans for the greater Gaza development region. The plan calls for 26 new water treatment plants, a transit link with the West Bank, electricity transmission lines, the Med-Dead Sea Project, the Eilat-Ashkelon pipeline, new ports, and rail, road, housing, and other infrastructure.

that the "difference of opinion" on the bank "had narrowed quite significantly" and a consensus was developing.

'Jordan: Tomorrow Has Arrived'

The Hashemite Kingdom of Jordan released in Casablanca a 158-page

special report by the Ministry of Planning, titled "Jordan: Tomorrow Has Arrived—Investing in People."

After an introduction of development principles, this document presents a summary table and then separate discussion sections and maps of 10 sectors of the economy: agriculture, energy, environment, health, human resources, industry, transport, telecommunications, tourism, and water.

Accompanying this overview document is a 60-page guide on equity investment in Jordan from "The National Securities Company."

The summary table gives seven pages of line-by-line projects for each of the 10 economic sectors, along with the estimated cost, priority (high, medium or low), and classification (national, regional, or international).

The maps show the location of such priorities of the key proposed link-ups of the electricity grids to surrounding nations—Egypt, Jordan, Iraq, Syria, and Turkey; a new Iraqi-Jordanian crude oil pipeline; and vital rail, road, and port improvements. The energy, industrial and agriculture projects call for expanding on the pre-existing limited base; for example, oil-shale electricity or small-scale agro-industries for rural communities.

Among the water project proposals given are the Red-Dead Sea link, a water conveyance system from Disi-Mudawara to Greater Amman (350 km length), a Jordan pipeline link-up to the Euphrates in Iraq, and a water pipeline southward from the southwestern Turkey watershed of the Ceyhan and Seyhan Rivers (the "Peace Pipeline"). Estimates for the cost of the Peace Pipeline were based on the cost of the "Great Man-Made River" in Libya, which is an underground tunnel conveying well water from under the Sahara to the Libyan coast. The Peace Pipeline would cost accordingly about U.S. \$3 billion.

Nuclear Power Is Cheaper

Missing from all three national reports—which otherwise give a comprehensive overview of essential needs and optional projects—is the role of advanced nuclear plants to provide both

Desalinating with Aerogels?

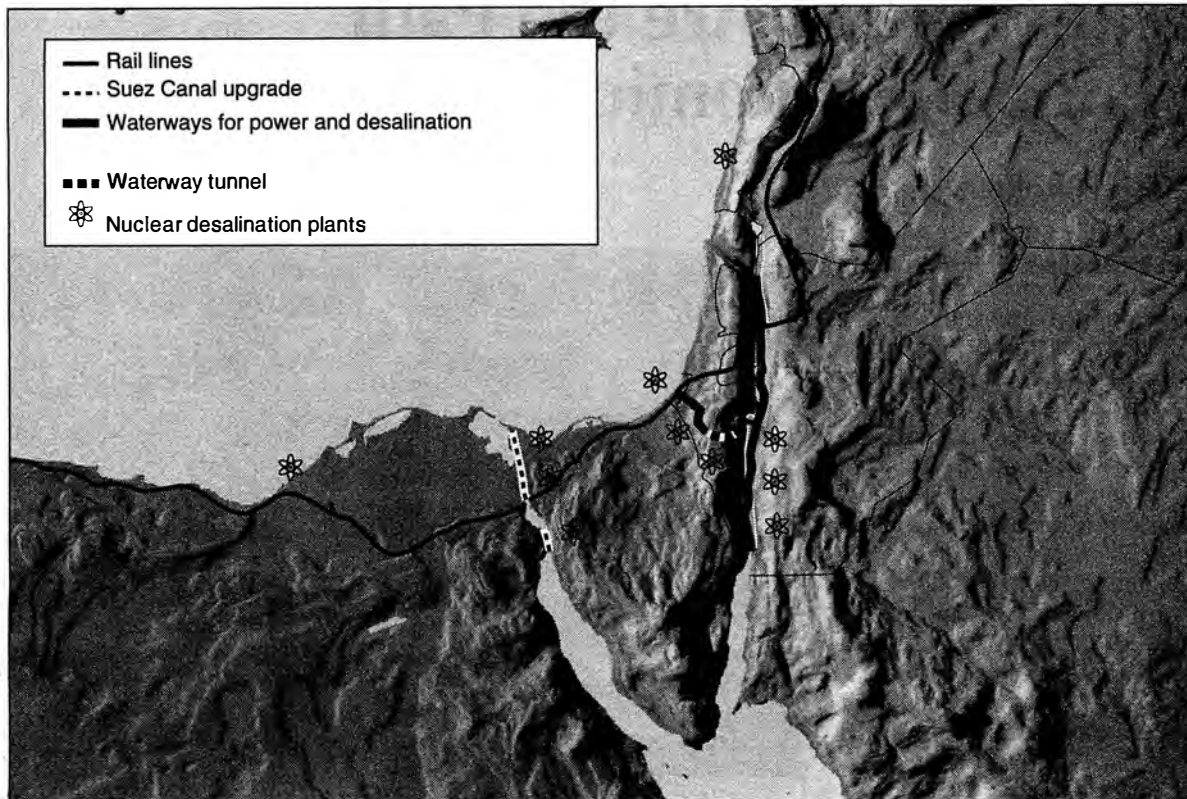
There are many new technologies waiting to be explored for use in development projects. Scientists at Lawrence Livermore National Laboratory, for example, have suggested a potentially low-cost method of waste-water treatment or desalination using aerogels—extremely low density materials (0.003 g/cm³ to 0.6 g/cm³). Nicknamed frozen smoke, aerogels can support 1,000 times their own weight.

Water is passed through a cell and flows between two electrodes com-

posed of a metal sheet with a thin sheet of aerogel on both sides. The electric field attracts the ions to the electrodes; the aerogel then captures the ions. The trapped ions (the impurities) would be released by flushing the aerogel.

Joe Farmer, the scientist at Livermore who invented the process, estimates that water could be purified for a fraction of the energy cost of conventional desalination.

—Mark Wilsey



LAROUCHE'S OASIS PLAN

LaRouche has proposed a series of canals linking the Mediterranean with the Dead Sea and the Red Sea with the Dead Sea to provide freshwater for agriculture. The symbols show the locations of proposed nuclear-powered desalination plants. Also shown is the proposed Suez Canal upgrade, a proposed waterway tunnel, and proposed rail lines.

cheap and plentiful electricity and to power desalination from the numerous seawater channels.

There are 250 million people in the greater Mideast region extending through 17 countries from the west coast of the Red Sea (Sudan and Egypt) all the way across the Arabian Peninsula, and the Jordan and Tigris-Euphrates Basins. Taken on a per capita, per household, and per hectare basis, the available water and power for these populations are now far too low to meet their needs for agriculture and industry. In addition to water transfers and rehabilitated urban and rural water delivery systems, nuclear-powered desalination provides the cheapest water available.

At the time of the 1993 peace accords, Israeli Foreign Minister Peres spoke of the possibility of nuclear power installations run jointly on "international islands" of multinational cooperation. Peres's proposals were omitted from the 1994 Israeli Casablanca report, and no

mention of nuclear power of any kind appears in the other reports.

In line with this omission, the reports likewise do not advocate high-energy, high-output agriculture methods—though many of these practices have been perfected in the Middle East, such as aeroponics and hydroponics, which give high yields of biomass output per input of water and energy.

LaRouche's 'Oasis Plan'

Economist Lyndon LaRouche has proposed that nuclear power should play a key role in changing the economic geography of the arid Mideast by providing the water and power for an "Oasis Plan" approach to building nuplex sites. Nuplexes are nuclear-powered complexes and corridors that would be man-made oases of development. There are new designs for modules of underground high temperature gas cooled reactors that can be installed along coastal sites and inland locations on canal corridors (the Med-Dead, or Red-Dead) or along

the Mediterranean, Red Sea, and other coastlines. These would provide the needed volumes of water and power for hydroponics and industry that could uplift living standards and productivity throughout the region.

Proposed designs include those of California-based General Atomics and Europe-based ASEA Brown-Boveri/Siemens. In addition to improved power plant designs, a new technique for desalinating water may one day be applicable on a large scale to green the hills of the Mideast deserts (see box).

The backlog of needed infrastructure projects is fully presented in the Palestinian, Israeli, and Jordanian national development reports. Implementing these projects, and including the advanced science and technology outlined by LaRouche, can turn the Mideast into the model for world development.

Marcia Merry covers agriculture and economics for Executive Intelligence Review magazine.

Great Projects Are the Path To Global Economic Recovery

by Lyndon H. LaRouche, Jr.

The Schiller Institute launched a series of conferences on international development Nov. 30 in Washington, D.C. In the keynote address, economist Lyndon H. LaRouche, Jr. discussed the impending economic collapse and the looming New Dark Age, counterposed to the "Great Projects" approach to building a general economic recovery. He recounted the history of his organizing for development as the way to peace and the political opposition to this approach, with an emphasis on his Mideast efforts during the 1970s.

*Excerpts from his speech follow. A few of the specific development projects proposed are illustrated in the accompanying maps.**

... **W**e are in the middle of the end of an entire dynastic cycle in modern Western European civilization, which, of course, has become, because of its power, a worldwide civilization. Every part of the world is assimilated, in some degree or another, into Western European civilization, as it emerged over the period from about 1440 to about 1600. It is that civilization, that dominant civilization, which is in the process of collapsing. . . .

The disintegration of our civilization became obvious from about 1964-1968. Those of you who have studied the experience of developing nations . . . recognize that from the middle of the 1950s, until the assassination of John F. Kennedy in the United States, at least a lip-service policy of the United Nations and of the leading nations of the world was a policy which was that of President Franklin Roosevelt during the Second World War.

The policy of Roosevelt was, that what we call today the developing nations, should be freed from slavery to British and other forms of imperialism and colonialism, and that these nations had the right to develop. They had the right to access to the technology by which they could meet their own needs, and take



Stuart Lewis

LaRouche addressing the Nov. 30 Schiller Institute meeting: "We know certain things. A lot of things we don't know, a lot of things we have yet to find out. But what we know, we know, and it will work. Shall we say, 'I have seen the future and it works,' and it wasn't communism."

equal standing in the community of sovereign nation-states.

Churchill violently opposed the policy, and, much to Churchill's gratification, Roosevelt died in 1945, and a man who was more tractable to the ideas of London, Harry Truman, took office.

The Preconditions for Peace

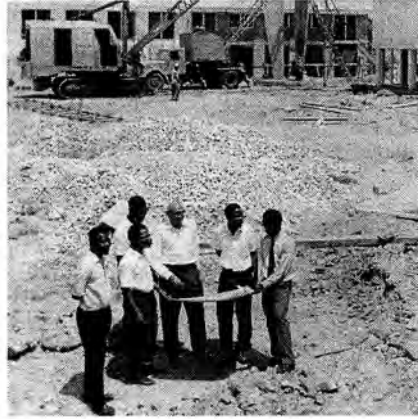
But, despite the fact that Truman betrayed, in effect, the policies of his predecessor, Mr. Roosevelt, and capitulated to Churchill, nonetheless, as a veteran of that period, coming back from India and Burma at the end of that war, I can attest to the fact that most of us returning veterans, particularly who had seen something of Asia as well as Europe, but particularly Asia, recognized, in the condition and the oppression of the peoples of Asia, that if we did not cure this problem and bring economic and related justice to the peoples of these oppressed areas, that we were leaving one war to plant the seeds of another.

And it was the general mood of us among the returning veterans who came to political power and leadership in the

United States at about the time that Kennedy became president. And we were for this, just as we generally supported the ideas that Kennedy is associated with, whether or not we agreed with him on his marital behavior, or whatever else. The man represented a generation of which we were a part. . . .

[D]uring that period of the 1950s and the early 1960s, it was considered *only just* that the people of the developing countries should have a right to access to technology and the other trappings of national sovereignty, to attain their dignity, and to build a community on this planet of sovereign nation-states, which would be the precondition for peace.

This was reflected in the United Nations Organization's First Development Decade. The last gasp of that Development Decade policy appeared in the middle of the 1960s, when U Thant, then the UN General Secretary, issued a Second Development Decade proposal, which was the last time that anybody in the UN, in the officialdom or anybody in the metropolitan countries in terms of



United Nations

"During that period of the 1950s and the early 1960s, it was considered only just that the people of the developing countries should have a right to access to technology and the other trappings of national sovereignty. . . ." Left: Israel, 1954: Irrigation workers pause for lunch during construction of a 225-km pipeline to bring water to the Negev desert. Center: Ghana, 1963. Engineers review plans for the Institute of Public Administration in Achimeta, built with U.N. help. Right: Jordan, 1961. Workmen bundling irrigation pipes unloaded at the port of Aqaba. The port expanded 12-fold between 1952 and 1959 under a U.N. development plan.

governments, seriously proposed that the developed countries, the industrialized countries of the planet, should make it a mission to bring the underdeveloped countries of this planet into full access to the technologies, to the science, to the development, which would make them independent nations standing on parity with the other nations of this planet. . . .

The Decline of Progress

. . . [T]he productive powers of labor, as measured in actual products and services, as opposed to prices, have been declining. The United States is decaying. The United States, by the early 1980s, could no longer have launched the Apollo Moon landing; we couldn't have done it. We had shut down whole categories of industry, and put out of business whole categories of technology which were essential to the successful Moon landing by the 1980s.

Today, we're in far worse shape.

All throughout the world, essential industries are collapsed and destroyed, and consumption in real terms is far less per capita, per household, and per square kilometer. Our infrastructure, our rail systems, our water systems, our sanitation systems, have been decaying without repair. Our municipalities are becoming hellholes. This is obvious to us in the United States; it's also true in other parts of the world.

We have reached the limit of the ability to control resistant strains of infectious disease by means of antibiotics, and means of immunization; and yet, we

have halted medical research. What is being done to the physician in the United States, as a result of changes introduced in the past about 15 to 17 years, is no longer legally permitted to follow his conscience in the treatment of his patients. This has been taken over by the malpractice rules, by the insurance companies, and so forth and so on.

The quality of health care available to the population today, is, by and large, vastly inferior to that available earlier, largely because government and other busybody agencies, and malpractice practices, have stripped away from the physician, the physician's right to practice medicine. . . .

Building the Recovery

In my view, we now have to build a general economic recovery program for this planet, and that's what I wish to devote myself to. But let me just make a few more remarks on a couple of points before getting to the recovery program.

In 1964, I happened to see something I knew because I had been involved in my professional work in economics in combatting Norbert Wiener, John von Neumann, and others. So I knew what the New Age was, and how dangerous it was. I saw, in 1964, some proposals, including the so-called Triple Revolution, which informed me that the most hideous and most evil movement which could be imagined, was about to be unleashed upon the populations of North America and Western Europe, as a mass

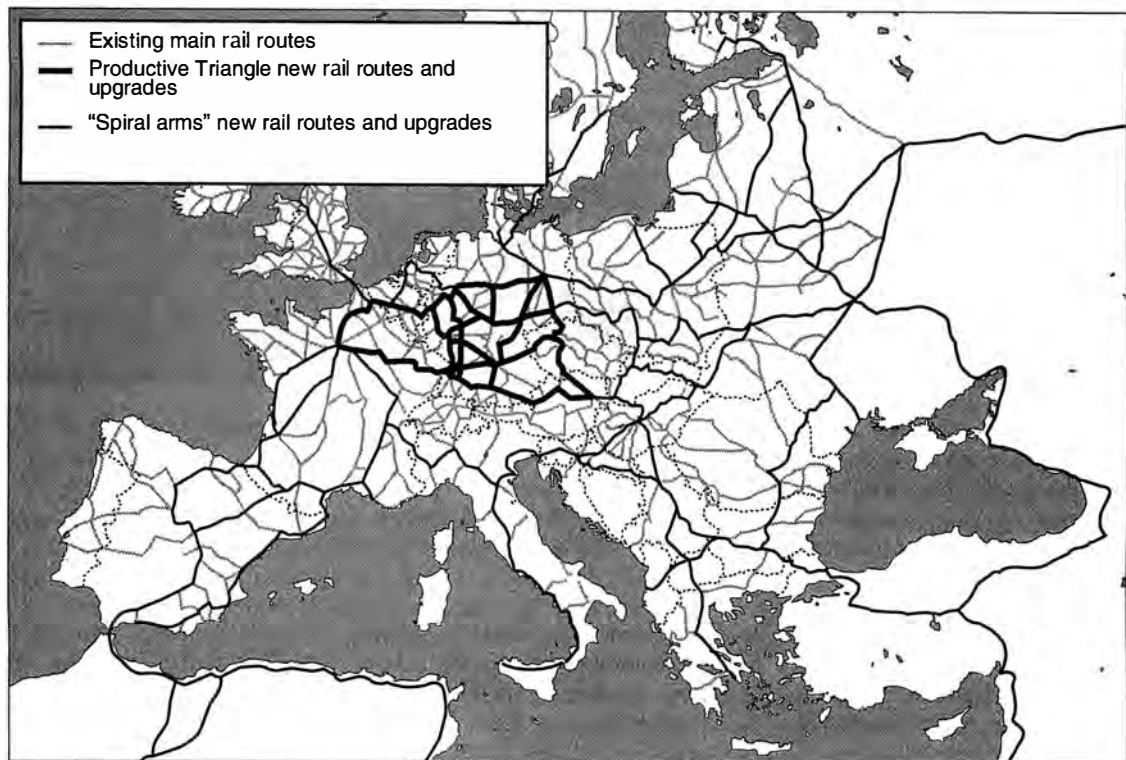
recruiting project: what became known as the counterculture, the New Age postindustrial society.

So, I didn't know what to do. I was only an individual. I was a management consultant privately. I'd worked for corporations, management consulting firms, and I was largely working with people I knew, on projects. What could I do?

In about 1966, I had the opportunity to teach, and I got into teaching. And I found myself getting into trouble, because a good number of young people seemed to like what I was doing, and what are we going to do about this. Well, all I was trying to do, was to try to intervene on the campuses, hoping that I could help rescue a few talented minds from the garbage that was about to be dumped on those minds.

So, we began to fight on practical issues. I was concerned about poverty in the United States, how it was unnecessary, how it could be understood. Research projects were done by these students, university students, some graduate students. . . .

We organized around the point which I was committed to, of course, as a matter of course, being a World War II veteran, that the solution for the problems of the United States, was that the United States must make a commitment to the technological development of the developing sector. This, even in the narrowest way, would be advantageous to the United States, because if you have a company, and you're manufacturing a



PRODUCTIVE TRIANGLE WATER AND RAIL PROJECTS

After the fall of the Berlin wall, LaRouche proposed the development of Eurasia, starting from what he called the "Productive Triangle," bounded by Paris, Vienna, and Berlin and with spiral arms stretching up into Russia, down into the Balkans and North Africa, and east across Asia. This area of Europe is the most highly developed area of the world, with the greatest productive potential in terms of infrastructure.

The idea is to harness the productive capabilities of the Triangle, with its high concentration of rail and inland waterways, as an engine for developing the economies of Eastern Europe and beyond, where there are limited rail and waterway systems for the movement of goods. LaRouche proposed using the most advanced technologies—a high-speed rail system for transportation of people and goods, using magnetically levitated trains, for example.

The large and increasing surplus of high technology capital goods from the Triangle would upgrade the European economies at the same time that it provided the infrastructure for Eurasia to industrialize and develop. As LaRouche put it Nov. 30, "It's the best place in the world to invest."

product, you don't believe in killing your customers. As a matter of fact, you try to sell them products which will make them more prosperous, because then they'll buy more products. And that was the way we proposed it.

We said, the people of the developing nations, if they're given the opportunity through infrastructure and investments to develop their own economies, will become bigger customers. So isn't it very stupid to keep them poor, to keep your customers bankrupt? That's not a very good business practice. So, we organized around that.

Mideast Peace

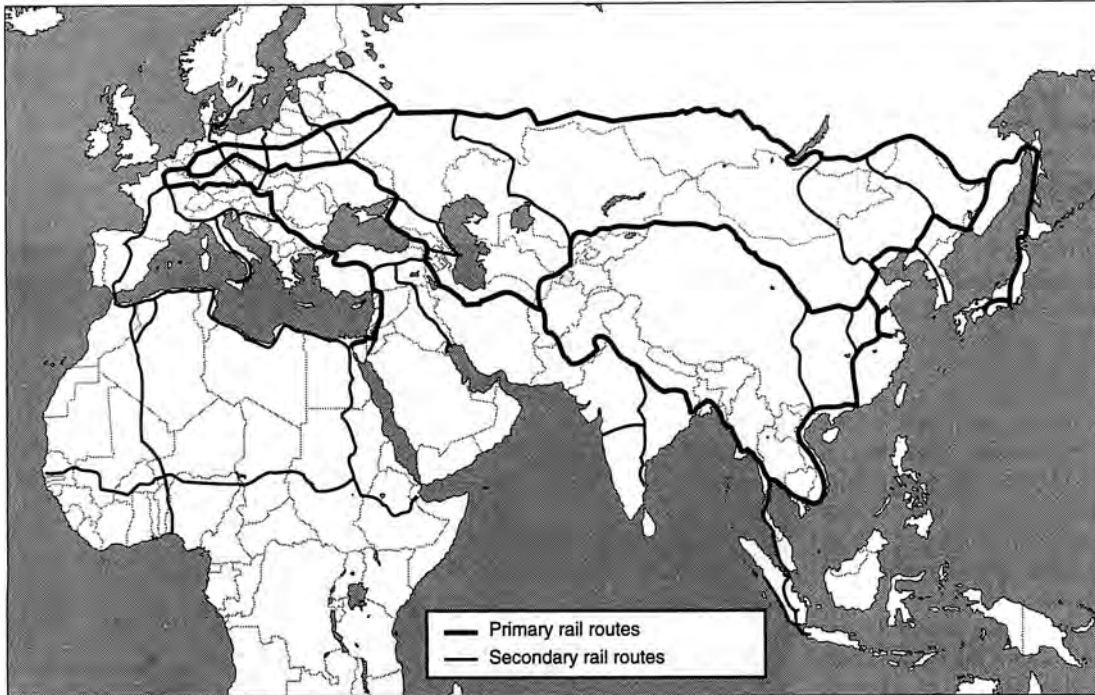
Well, we got into a lot of trouble, but just to make short and get to this point. In April of 1975, I was invited to go to

Iraq and spend several weeks there. The occasion of the visit was the Ba'ath Party had its anniversary of its formation every year in April, and I went there, because I liked the opportunity of talking to the Iraqis, finding out what they're up to, and talking also with many other Arabs and others, who were there, from every part of the Arab world, the Islamic world. And we had some wonderful conversations. . . .

I told them that Lebanon was about to be divided by civil war, which some fellows in London and Henry Kissinger were about to unleash. And they said, "No, that can't happen, we've got the situation under control." I said, "You don't know London and Henry Kissinger." And while we were there, in

Iraq, if some of you are old enough to remember that, the civil war in Lebanon broke out, orchestrated from London, with weapons supplied in part by Henry Kissinger through the State Department.

So, they became very interested in what I had to say, in that circumstance, and we began to talk about some things, and I expressed my ideas on a number of subjects, including Arab-Israeli peace, and stated that the only possible basis for peace in a situation such as that between the Israelis and the Palestinians, is to find a common interest, and the only common interest which existed in that circumstance, considering the bloody bitterness which had erupted—It's like the Northern Ire-



THE NEW SILK ROAD: EURASIAN RAIL GRID

"The object is to build a land bridge to and from Europe into China, into Japan, and into Southeast Asia, so that the littoral development, the coastal waterway system in Eurasia, in Asia in particular, is supplemented and integrated with a rail bridge situation," LaRouche told the Nov. 30 meeting.

There are three rail bridges from China into Europe: one goes north to intersect, through Kazakhstan, the Trans-Siberian artery. Another goes along a more southerly route through Iran and up into Turkey. A third route goes down into the area near Bamu from Kuoming, across to Dhaka in Bangladesh, and across into Egypt.

land situation and other situations around the world—is a vital common interest in economic development of the region, to mutual benefit.

If people can share, as separate sovereign peoples, the idea of cooperation to mutual benefit, including economic development to improve the life of their people, that common interest can be the mortar which puts the bricks together and makes peace possible. It doesn't guarantee it, but it makes it possible.

So, the Arabs said, "Well, if you can pull it off, and get these guys together, we're all for it."

So, when I left Baghdad . . . and I decided to make a detour into Germany. . . . I went to my friends in Germany, and we organized around that, and we had a big mobilization, including a couple of press conferences. . . . We mobilized two things: a general international economic development program to counter the effects of the Rambouillet type of process . . . and also, special efforts with both Israelis, the sane Israelis,

and our friends in the Palestine Liberation Organization, to see if we could put this together and get some negotiations between Israelis and Palestinians going again on this idea of economic development. Because economic development then as now, in the context of Middle East peace now, is vital to the peace of the world.

The Middle East is not merely an area of conflict between Israelis and Arabs, or among Arabs and Arabs. It is the crossroads of civilization. It is where the Mediterranean, which is the heart of Europe, meets the Indian Ocean, which is the gateway to the Indian and Pacific Ocean basins. It's the gateway to India, to Pakistan, to Southeast Asia, to China. The greatest concentration of population in the world, including the population of West Africa or East Africa; this is the future of civilization, where the most people are, that's where the most development can occur.

Therefore, it's important that we have peace in the Middle East, and that we

have nations in the Middle East which will administer, as their business, the things we need to establish: better communications between the Mediterranean and the Atlantic and the Indian Ocean and Pacific Basin, where the great population concentrations of this planet are located.

I saw that then, and it's clearer, of course, now, when there has been a serious effort. And some of the same forces, the forces around Arafat—the forces in Israel which are associated with [Foreign Minister] Shimon Peres and [Prime Minister Yitzhak] Rabin now—these were the forces we talked to in 1975. In 1976, we were very close to pulling something off. It was very difficult. Not "we," but we as a catalytic agent. Then the Likud government came to power, and it collapsed. . . .

Notes

* The 25-page text of LaRouche's speech is available in the Dec. 16 issue of *Executive Intelligence Review* magazine, P.O. Box 17390, Washington, D.C. 20041-0390.

AN INTERVIEW WITH LYNDON H. LAROUCHE

On Creativity, Technology, and Transforming the World

Editor-in-chief Carol White interviewed Lyndon LaRouche Dec. 4, 1994, a week after the Schiller Institute conference on world development, which he keynoted. (See p. 16.)

I asked LaRouche to what extent his Army experience during World War II had influenced his later thinking about Third World development. I knew that he had been stationed in India, at a high point in their fight for independence from British colonial rule.

During the war, American GIs despised what they saw of the British command. In India they saw the brutality of British colonial rule firsthand. There was tremendous poverty and an obvious failure to develop infrastructure in the areas they occupied. It was from this oppression that the Indians were determined to free themselves. Was it this experience, I asked, which made him aware of the crucial role of technological development?

"Not really," he answered. "I was concerned about the denial of technology to these people, the denial to the people the right to the thing which they needed to survive. I saw the condition of the Indians and saw that they couldn't survive without major infrastructure development. I was motivated when I saw how the poor Indian had grasped that idea. That struck me. I already understood the importance of technology, but from an entirely other point of view.

"There was famine in India, and I was very conscious of that, but that was not the immediate motivation for my study of technology. I was not driven by a practical circumstance, either in my own life or even that of the Indians."

This reminded me of things he had said in the past about how the Communist Party joined with the British government to suppress an uprising by the Indian people, who had demanded an end to British rule. When I mentioned this, his reply was:

"As a result of my experiences in India then, I had the bitterest contempt for the



Stuart Lewis

LaRouche (center) at a February 1994 meeting in Washington, where Russian scientists Taras Muranivsky (left) and Wolter Manusadjan (right) conferred upon him membership in the Universal Ecological Academy, a professional association of scientists (also known as the Academy of 100). In the background is Helga Zepp-LaRouche.

Communist Party and everything associated with it.

"I was raised in New England. New England—and New York City—were like the old Confederacy. In the main, people there thought of the British as the good guys, in my time. But there was also a strong current the other way; some people knew that the British were the enemy.

"Those of us who went overseas and got to know the British, knew the British were the enemy. An American soldier who went into India or Burma and met the Brits and saw what they were doing reacted to this, just as did Americans of President Clinton's generation who went to Oxford and didn't like what they saw."

The conversation then took a surprising and provocative turn, as is often the case when speaking with LaRouche. "Hadn't his experiences in India and his concerns about the shape of the post-

war world led to his interest in the necessity for the advancement of technology?" I asked.

"Those of us who went overseas and got to know the British, knew the British were the enemy."

Again his answer was, "No, not really."

"I was worrying that the world was going down hill culturally," was his reply. "This was very obvious to me, and it led me to fight against the education to which I was being exposed. I was convinced that the method of that education—as opposed to the facts which were being presented—was incompetent."

He described how in the aftermath of World War II he was disgusted by the emergence of "information theory"—the

theory that the brain's function is to process sensory data in the form of information.

Such a denial of the role of creativity is nothing but a repackaged version of traditional British empiricism, which attempts to reduce human thought to a mechanism. Unlike most of us, LaRouche recognized this as a young man, and his rebellion against the triviality of the education to which he was exposed in school and then at university, led him to the study of philosophers like Gottfried Leibniz on the one hand, Locke, Hume and Hobbes on the other, and then Immanuel Kant.

"As an adolescent," he reminisced, "I struggled through the conflict between, particularly, Gottfried Leibniz on the one side and the empiricists on the other. Then I found Immanuel Kant's works, and I realized that while he appeared to attack empiricism, he was incompetent. I saw this by proving for myself that Kant was incompetent when he attacked Leibniz."

LaRouche was referring to the fact that Leibniz argued as a Christian Platonist, that man has the freedom to transform the universe in accordance with God's will, while Kant asserted that the universe is fundamentally unknowable to man.

"On that basis of my intense study of these questions before I went into the Army, I was persuaded that the formal academic university education to which I was exposed was incompetent. It was not incompetent in dealing with material that I wanted to learn about technology, but it was epistemologically incompetent throughout.

"I was particularly unhappy about this when I returned to the university after my service, and it was in this frame of mind that I reacted to the enraging characteristics of the claims of information theory. It was not my experiences in India which made me focus upon questions of technology. It worked the other way around.

"My concern was to deal with the incompetence of the prevailing epistemological method which dominated the university education to which I and my peers were exposed. I came to technology as a way of showing what was incompetent in that prevailing method."

"How did you come to challenge the empiricist method at such a young age?" I wondered.

"It's very difficult to say. When you look at the people who stand out in history for doing creative work, you cannot account for their creativity in the outward circumstances of their existence. Most of my peers were busy playing sports and doing other things. My interests ran in another direction because I was concerned about the incompetence and the untruthfulness around me.

"Because of my wartime experience, this concern was accelerated, but at that point my motivation was not to solve any practical problem, it was the epistemological. What I met in the postwar period in the academic life, what I met in the greater Boston community, what I saw in theories about music, in a course on Shakespeare, in all kinds of ways—was pervasive incompetence. I was driven to define rigorously the alternative to this incompetence, and to understand where it came from.

"Creativity is the issue. Both the empiricists and Kant deny the existence of human creativity or treat it only as some kind of irrational intuitive impulse. From childhood I understood that the act of discovery is itself an object of thought, just as much as any sense perception is an object of thought.

"No human knowledge occurs as an object of the senses or some algebraic or mechanical combination or associative combination of data from the various senses; it comes from treating discoveries, which have no basis directly in sense perceptions as such, as objects of thought.

"The only fundamental discovery that I ever made in my life was in the form of what Plato would define as a hypothesis. I don't mean what I consider to be a misuse of the term hypothesis in the general

"No human knowledge occurs as an object of the senses or some algebraic or mechanical combination or associative combination of data from the various senses; it comes from treating discoveries, which have no basis directly in sense perceptions as such, as objects of thought."

practice of education in the university level in my time and today. What I mean by hypothesis is the complete set of interrelated axioms and postulates that underlie any particular theorem or assertion.

"Take Euclidean geometry as an example. I would consider the set of interrelated axioms and postulates of a Euclidean geometry as, in total, a single hypothesis. In contrast, all of the non-Euclidean geometry so-called, which overturns that set of axioms, is a different hypothesis.

"Anyone who knows formal geometry or similar methods, or who has studied the classics, knows that knowledge does not come in the form of any explicit algebraically representable system but comes in the form of breakthroughs. These take the form of new hypotheses, which overturn previously existing assumptions."

"The single significant discovery I made, from which all of my views flow, was provoked over the period from between 1948 and 1952 by my adverse reaction to the doctrine of 'information theory,' that you could have a mechanistic or probabilistic representation of intelligence. To me it was intrinsically absurd. I found the idea to be abhorrent, that human intelligence could somehow be represented by a derivation of the general Boltzmann theorem [defining entropy and therefore implicitly negative entropy], which is used by Norbert Wiener in all of this.

"Anyone who knows formal geometry or similar methods, or who has studied the classics, knows that knowledge does not come in the form of any explicit algebraically representable system but comes in the form of breakthroughs. These take the form of new hypotheses, which overturn previously existing assumptions.

"In any formal set of axioms, all of the theorems which one can derive deductively are consistent with that set of axioms. If you make a discovery for which no such theorem can be defined or no such proposition can be defined, then if the discovery is valid, you have to over-

turn the existing set of axioms and postulates and start with a new set. All fundamental discoveries are of this form.

"Contrary to those who are misguided to believe that you learn from experience, man does not learn from experience. Animals learn from experience. Mankind learns from fundamental discoveries which are essentially revolutionary in character.

"It was already obvious to me when I undertook the refutation of Wiener (and John von Neumann) on this issue, that all human knowledge occurs in the form of metaphor. That is that sense perceptions or concepts derived from sense perceptions or experimental observations are not truly knowledge. Rather knowledge is the validation in practice of those discoveries which have a revolutionary character.

"Progress in technology involves discoveries which cannot be derived from a formal mathematical representation of pre-existing knowledge but occur only as previously existing knowledge is overturned."

"When I approached this question of how to prove this, to prove how knowledge works, it seemed to me that human progress in technology was the obvious way to prove it. Progress in technology involves discoveries which cannot be derived from a formal mathematical representation of preexisting knowledge but occur only as previously existing knowledge is overturned. This occurs discontinuously, and involves axiomatic discontinuities from the standpoint of any existing mathematical representation.

"By the age of 14, I detested Bacon, I detested Hobbes, I detested Locke, I detested Hume. And then later on I ran into Kant, by the time I was about 16, and I realized, when I read *The Critique of Pure Reason*, that Kant was also the enemy. So that's what motivated me, and that has been, that was the germ of my motivation. It was that simple. It was an intellectual not a practical motivation."

"You were a bright child," I commented, "an egregious child, were you not?"



LaRouche revisited India in the 1980s to discuss development policies. Here he is speaking to the Indian Council of World Affairs in New Delhi, April 23, 1982. With him are (at left) Harcharan Singh Josh, president of the council; K.B. Lall, former secretary to the Government of India; and Mrs. LaRouche.

Most children who stand out in this way are attacked by their peers and by most of their teachers. Then their parents get nervous and pressure them to conform. Was this kind of pressure brought to bear on you? Was it in response to this that you immersed yourself in philosophy?"

"Not at all," he replied. "It's the other way around. I was bright and egregious because I had already understood that empiricism is evil. I think it is an important thing to avoid looking for a practical stimulus, a practical circumstantial motivation. In my case there was none. For me it is always a purely intellectual one.

"Children make discoveries. The problem in society is that somewhere around three, four, five, or whatever age, this gets knocked out of the children and they no longer seek the simple childish delight in discovery. Other things enter in. Some of us don't get it beaten out of us, so we exist.

"What happens, as I saw it with my peers, is that most people in U.S. society have a different kind of intellectual concern. The thing which I always resented, which I fought against, was someone saying to me, 'you must be practical.' To me the words, 'you must be practical,' are the signs of the presence of an enemy.

"How impractical these practical people really are! Without these processes

of discovery mankind would never have exceeded the population level of the higher apes.

"I think that there is an overemphasis on the so-called practical circumstances, as stimulus for intellectual development. Rather I think it works the other way. I think that practical circumstances, which are aversive, tend to destroy the creative impulse. I do not think that it's a reaction to bad practical circumstances which determines the motivation.

"Children make discoveries. The problem in society is that somewhere around three, four, five, or whatever age, this gets knocked out of the children and they no longer seek the simple childish delight in discovery."

"It's more difficult for children today than it was for me. We're destroying children who otherwise would be talented."

The implications of this for education are especially important today. "How," I asked him, "do you think the schools today should be transformed to encourage creative thinking?"

His reply was: "As children, as young students, we learn this by reexperienc-

ing in our own mind the acts of discovery, such as the Pythagorean theorem in geometry.

"We reexperience those discoveries and we realize that what constitutes the sum total of human knowledge is really the re-experiencing of discoveries made by people who preceded us over many thousands of years."

I brought the conversation back to some personal history, asking him when he first came across Norbert Wiener's information theory or cybernetics.

"I picked up a copy [of Wiener's book *Cybernetics*] in January 1948 from a friend. I read it because I was interested initially in very innocent material on feedback control and control theory for machinery. Then, in the course of reading it, I ran into something of which I had heard about before but had not taken seriously—Wiener's treatment of information theory.

"What Wiener represented as information theory represented to me everything which I'd always considered abhorrent. This was the face of the enemy. I knew, from the beginning, that information theory and similar dogmas running loose at the time were wrong, but my concern was to provide a rigorous refutation of them. To do this, I chose the case of creative discoveries in science, as they were expressed economically in technology. . . .

"The reason was simple: Technology increases mankind's power over nature and enables us to improve mankind's condition of life per capita and per square kilometer. And the fact that technology enables us to do this, demonstrates—is a practical demonstration—that the ideas which have led to improvements of technology are superior to the ideas they replace.

"It is, therefore, discoveries which lead to these families of new technologies—that is, fundamental scientific discoveries—which demonstrate that the creative act which brings these scientific discoveries into being represents a valid overturning of the previously reigning scientific opinion.

"Since you can represent any formal mathematics by a fixed interrelated set of axioms and postulates, every valid fundamental scientific discovery represents an overturning of any existing mathematics. In the discontinuity, or the axiomatic discontinuity introduced to



Muriel Mirak-Weissbach/EIRNS

In Sudan in December 1994, LaRouche (center) lectured at the University of Khartoum. With him are (left) Prof. Hassan Mohamed Salih, Dean of the Faculty of Economics at the university, and Prof. Mohamed Hashim Awad, former Minister of Economics.

knowledge by this act of discovery, you have a representation from a formal standpoint—if in a negative way—of the nature of the creative act.

"This led to the possibility of proof. This intellectual pursuit led me first to [the mathematician Georg] Cantor and his notion of the transfinite, and then to a reconsideration of the work of [mathematician Bernhard] Riemann. Of course, I was familiar with the discoveries in relativity theory, and I saw this as a representation of the very problem I was attacking.

"The fundamental point is that people wrongly base mathematical formalism on a correspondence to the visual imagination. This is a false conception of the universe, a misinterpretation of our senses. We must go beyond our senses to understand the universe. And the attempt to locate bodies in simple, flat, zero-curvature extended space and time is incompetent.

This is exactly the problem I was facing: the fact that a formal mathematics contains, *per se*, an intrinsic incompetence.

"When you locate events in terms of visual imagination with a naive faith in a fundamentally linear universe, one in which curvature is defined by a deviation from a zero-curvature extension of

space-time, this is not reality. True reality contains physics."

Bringing the conversation back to a specific discussion of the enormous scope of the development projects which he is now advocating, I asked, "How did you come to make the big leap from there to here—from being concerned with philosophical issues to do with science, to becoming a recognized political leader?"

"Very simple. After the war I began working as a consultant to a number of industries and small businesses in the Boston area. Later on I moved to New York City and worked on computer applications as well. I enjoy doing this kind of work.

"When you are an individual, you have no sense of a world historical impact of your personality. I enjoyed my work, and I knew it to be good and useful. It gave me the time to be able to do the kind of study I wanted to do.

"But I also began to be drawn into politics, especially after the 1948 election process. Even before that I had reacted to what I saw as the stupidity of my fellow man. I was sure that there was a better way of living and being than being this kind of person.

"I realized from my experience in consulting and other things in the after-

math of the war that I have the ability to influence things. Ordinarily, when you are not aware that you have superior abilities, you to try to find a niche for yourself in which you can do something you know to be useful which gives you pleasure.

"This was my situation. But then I began to find that I was superior in handling problems to those around me. When I saw what was happening in government and other institutions I began to find myself superior here, too. I found myself to be intellectually superior, on the epistemological side, to people in various aspects of science.

"All of this gave me a certain enhanced sense of responsibility.

"At the same time I was very critical of my fellow American veteran. I was persuaded, from my experience with veterans during the war and at the end of the war, that they had learned a lesson—that we had all learned a lesson, from the experience of being overseas and seeing that conditions existed in the world—that it was up to us to see that new wars or new conflicts and injustice would not prevail in this planet.

"At that time, it seemed to me that we had all understood that we were in danger. We could not sit back in the United States and go on as we had been going on before. I thought that that was the condition of my fellow returning veterans in the spring of 1946.

"By early 1947, I was disabused. I saw my friends, including people I knew from the boats in India, concerned only about their own petty personal lives in the most narrow, practical way. They had lost all their commitment to humanity. And what I saw in them was typified by the Truman administration. Everywhere, this sort of wicked, malicious mediocrity was prevailing.

"I saw most of the institutions tolerated and supported by my peers as corrupt. I saw these as corrupt and as leading us back to the same kind of destruction we thought that we had ended with the end of the war. Political parties, businesses, university campuses, academic faculties—you name it. Every institution that I saw was permeated by a kind of postwar malaise, a moral malaise.

"It was this moral malaise which allowed the phenomenon we call McCarthyism to occur.

"The Communist Party leadership in

the United States and the leadership of most of the so-called left organizations were corrupt—just as rotten as the Communists had been in India. They embodied every kind of stinking, rotten immorality that I found characteristic of this malaise in the population—practical men, opportunists, corrupt rhetoricians, fakers.

"But McCarthyism represented an extreme of the same thing. There was no difference in one sense, except a difference in power.

"For the average American, it was a question of capitulating to those who held power, not a question of principle. People who were supporters of McCarthy—and these included people who had been or were my friends—turned into completely immoral monsters.

"We must go beyond our senses to understand the universe. And the attempt to locate bodies in simple, flat, zero-curvature extended space and time is incompetent."

"They had morality in a very narrow way, up to a point, within their family. They said, 'I'm living my personal life. I'm not getting into trouble. I'm going to be practical. I'm going to make a living. I'm going to make a career. I'm not going to risk anything, and I will do anything which I can to protect myself, even if it means hurting someone I know to be innocent.'

"It was this postwar malaise which led me to take a serious interest in politics. Then, in the 1960s, I saw in the universities the children which my generation produced. They were bright, corrupt, shallow, and immoral in the 1960s in the universities. This generation is now ruling the United States.

"It was not just the influence of the counterculture, but the influence on them of the corruption which the majority of their parents adopted, by adapting to the McCarthyite phase in American history."

My question then was: "Where do you get the optimism today to think that your global development scheme could possibly gain sufficient acceptance to actually be put into practice? How can you hope to change a world that has

gone so far down hill since the end of World War II?"

His answer was upbeat: "The American presupposes that there are powerful authorities and agencies up there to which he can appeal. The present collapse of our society, economically as well as culturally, is inevitably forcing people to question this assumption. Like the soldier in World War II, they will be forced, despite themselves, to look beyond the immediate and reconsider the *axioms and postulates* on which they believe their existence and that of their families to be premised—axioms and postulates which they had held to be (or at least hoped to be) inviolate."

Pointing to the tendency of the typical populist who thinks of himself as an independent thinker but is really always looking to authority, he went on: "Let's take the case of the typical American populist. Such a person is the failure of our society. This is the radical failure, the populist, who is sure that he knows what's wrong with the society. He protests, but he is just as bad as the people against whom he's protesting.

"What does the typical American populist say? They're great on contracts, and they say, 'Look, you see this sentence here, in this Constitution; you see this sentence in this law; or you see this obscure law I've dug up, this obscure precedent. Now the way we're going to win, we (you see what this means) we're going to enforce the letter of this agreement. We're going to get them to submit to this precedent.'

"This is the worst pettifoggery because they don't believe in anything except authority. And they believe that they can appeal to some authority based on the written word or some similar gimmick. They take no moral responsibility for society. They're always looking for somebody upstairs, whom they can get to help them out with their problems.

"Today that's no longer possible. The American people have reached a point (and so have most people in the world) where they know that all of the institutions that rule us—the corporate structure, government—are rotten. They see about them a spectacle of failure. Once they begin to understand what caused the collapse, in their own inadequacies, then we can mobilize to build something better.

“Scientific and technological progress is moral. The rejection of scientific and technological progress is essential immorality. You cannot be a moral person and reject enthusiasm for scientific and technological progress.

“Happy people are more moral people. Truly happy people are people who are enjoying the superiority of the human mind over the mind of the beast.”

“This is the way the human being is organized. When human beings are learning new things—even if they are not aware of creativity as such—when they’re acquiring new ideas through an exercise of their mental creative powers, and when these ideas solve problems which are not otherwise solvable, then the human beings who experience that are happy.

“The practical aspect is indispensable, but that’s not the essence of the need for a global development effort. Happy people are more moral people. Truly happy people are people who are enjoying the superiority of the human mind over the mind of the beast, who are experiencing those creative powers that only human beings have.

“Miserable people, wicked people, are people who hate creativity, who like to scheme but only to do evil to their fellow human beings, or to cheat them or something of that sort.

“If you’ve ever worked in a factory or seen people working in the fields who were year after year engaged in repetitive toil, this is enslaving. I saw this in India and you can still see it in India today. This is evil. It’s not the ultimate evil, but the failure to provide the means for societies to develop is evil.

“People need to improve the physical conditions of their lives. It is being able to experience the joy of discovery as the way to solve problems—as opposed to being chained to bestial repetition as the only means to provide for oneself and one’s family and society—that is the important distinction.

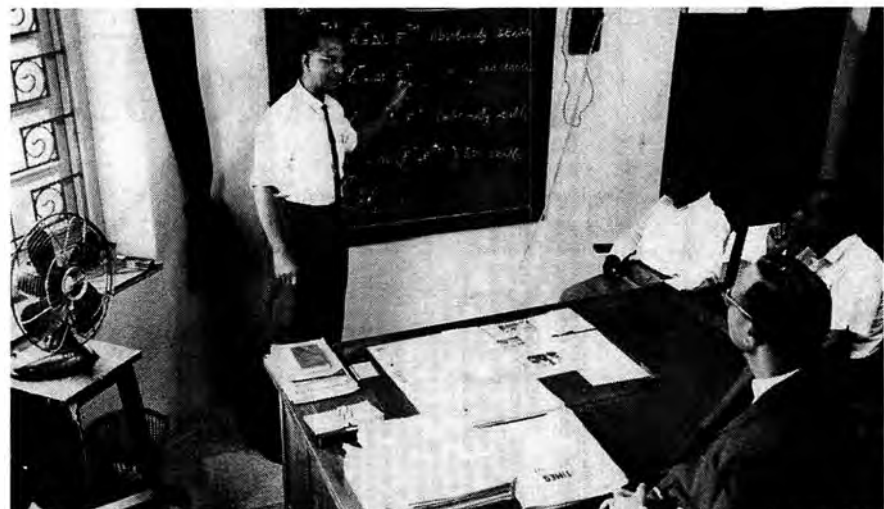
“When you can show that discovery is the way of solving human problems, then you have created the conditions for true happiness for humanity as a whole.”



United Nations



M. Nasr/UNRWA



United Nations

“The rejection of scientific and technological progress is essential immorality. You can not be a moral person and reject enthusiasm for scientific and technological progress”: Here, teacher training in Nigeria, computer training in a Palestinian refugee camp, and a discussion of weather prediction at the Institute of Tropical Meteorology in Poona, India.

CANCER



Weizmann Institute of Science

A Genetic Disease
That Can Now Be
Conquered

Evidence that cancer is caused by abnormalities in genetic makeup has led to new ways of detecting, preventing, and curing cancer.

by Marsha Freeman

Over the past decade, the recognition that cancer is a disease of the body's genetic material has replaced other theories about the cause of this group of deadly diseases. This new understanding is opening the door to revolutionary new approaches to both cure and prevent a disease that one quarter of all Americans alive today are expected to develop.

Scientists believed at one time that cancerous tumors resulted from diminution of the immune system, especially that associated with the process of aging. Left unexplained, however, was how otherwise healthy children could fall victim to this disease. Cancer causes more deaths in children under the age of 15 than any other disease, and is responsible for half of all deaths before age 65 in the United States.

Although external factors—for example, smoking, high doses of ionizing radiation, and some natural toxic substances like aflatoxin—were known to be associated with specific cancers, that correlation could not explain why some people exposed to these substances developed cancers, while others did not.

As long ago as 1914, the German scientist T. Boveri had proposed that chromosomal changes were the cause of cancer. However, only over the past decade, making use of the tools of biotechnology, have scientists been able to identify, isolate, reproduce, and study the genes that cause cancer, as well as those that protect the body from the unregulated growth characteristic of cancerous tumors. This research work has provided empirical verification for the theory of the genetic causes of cancer.

One of the pioneering research teams looking at the genetic causes of cancer is led by Professor Varda Rotter, head of the Department of Cell Biology at the Weizmann Institute of Science in Israel. In a discussion in October 1994 at the Institute, Prof. Rotter summarized the research in laboratories and in clinical settings around the world, which scientists hope will lead not only to more effective treatments, but also to the cure and prevention of this family of diseases.

'The Patient Is the DNA'

Every cell in the human body has threadlike structures, or chromosomes, in its nucleus, consisting of units of genetic material known as genes. The carrier of information in the gene is deoxyribonucleic acid, or DNA. Each pair of chromosomes has pairs of genes, or alleles, at the same position, which control the same activity and characteristics. If a trait, such as blue eyes, is recessive, both alleles (maternal and paternal) would have to contain the same genetic information for the individual

◀ *Prof. Varda Rotter (center) along with Prof. Moseh Oren (left) and Prof. Adi Kimchi at the Weizmann Institute. Their research over the past 14 years helped lay the foundation for determining the role of the p53 gene in the genetic causes of cancer.*

to exhibit the characteristic eye color. This duplication also functions as a protective mechanism in the case of some genetic diseases, for only when both alleles are changed do some cancers develop.

There is now overwhelming evidence that alteration in the genetic makeup of cells causes cancer. This alteration includes additions, deletions, or mutations in genetic material. There are several ways that the damage can occur: Chemical irritants and radiation can alter or subtract genetic material; the duplication of DNA during normal cell reproduction can introduce "mistakes" into the genetic material; and certain viruses can cause cancer by adding their genes to those of the otherwise healthy host organism.

Genetic abnormalities can be germinal, that is, inherited. What is passed on to the next generation is not the disease, however, but the genetic *predisposition* to develop cancer. This may result from inheriting a mutation in one gene of a pair within a group of genes that, when activated, causes the development of cancerous tumors. Or, the predisposition may result from mutation or lack of a gene that protects the genetic integrity of the cell.

In the overwhelming number of cases, even if an inherited predisposition exists, somatic genetic mutations must occur during the lifetime of an individual in order for that individual to develop a cancerous tumor. The relationship between germinal and somatic abnormalities is a complex one. Multiple gene mutations are required to cause the cancer, but the risk is naturally higher for those who inherit damaged genetic material.

Studies indicate, for example, that in breast cancer there are changes at several sites on certain chromosomes that show some correlation with the disease. But researchers do not yet know which changes are inherited and which are acquired.

A correlation definitely exists between increasing age and the incidence of many kinds of cancer. The reason seems to be simply that the longer the cells are reproducing, the more likely it is that errors in DNA replication will be introduced. Because the development of cancerous tumors requires the accumulation of several somatic mutations, the older the individual is, the more time there has been to accumulate the mutations.

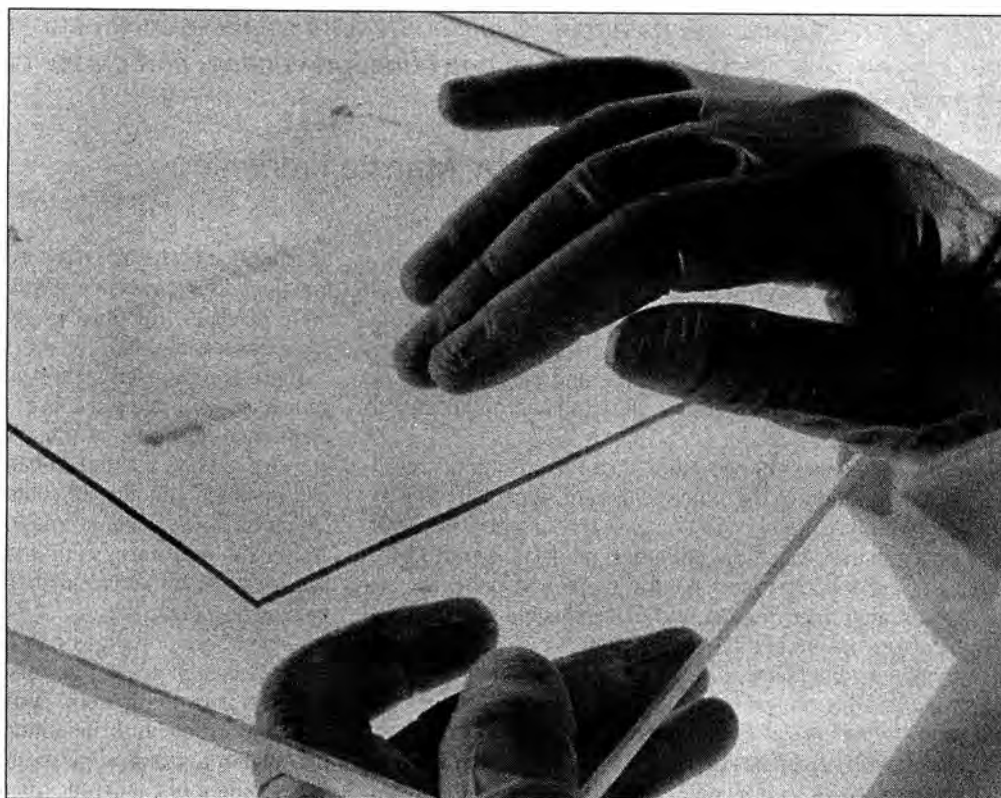
Given the fact that multiple mutations are needed for somatic expression of the disease, there may be a long delay between exposure to gene-altering factors and the development of cancer. It has been found, for example, that some patients exposed to X-rays for the treatment of tuberculosis developed breast cancer 15 years later, after there was time for additional genetic mutations to occur.

As Prof. Rotter explained, in cancer, the genetic material is sick and "the patient is the DNA."

Two classes of genes have been found to be associated with cancer development: oncogenes and tumor suppressor genes. The activation of oncogenes is evident in cancerous tumors. Also evident is the breakdown in the function of tumor sup-

pressor genes, which regulate various phases of normal cell replication and growth and prevent cancer development.

So far, more than 100 oncogenes have been identified, along with 8 to 10 tumor suppressor genes. Each type of cancer has been found to have its own characteristic combination of altered or missing suppressor genes and mutated oncogenes. About 70 percent of cancer tumors exhibit alterations of one of the best known suppressor genes, p53. Unraveling the complex functioning and interactions of these genetic structures will allow treatments to become, as Prof. Rotter stated, "a fine therapy, with better tuning. If you know there is a problem with the gene, just address your cannons against the 'sick' gene and not against the whole system."



National Cancer Institute

The cancer "patient" is the DNA: Here, fragments of DNA from human genes, isolated by electrophoresis onto an agarose gel plate for identification and study.

'Waking Up' the Oncogenes

Each of us carries proto-oncogenes in our normal genetic material. It is believed that these proto-oncogenes may contribute to the growth regulation of normal cells. In cancer cells, these proto-oncogenes are activated and are then referred to as oncogenes. The conclusion that these are cancer-inducing genes was proven when it was found that cutting out an oncogene from a cancer cell and placing it in a normal cell induced the conversion of the normal cell to a cancerous one.

As an extreme example demonstrating one mechanism by which the oncogene can be activated, Dr. Rotter noted that after the atomic bomb was used against the Japanese population at the end of World War II, the incidence of leukemia soared in Nagasaki and Hiroshima. Scientists found breaks in the chromosomes of patients afflicted with the disease. Prof. Rotter said that the recent application of the tools of recombinant DNA revealed a molecular mechanism that involved the activation of an oncogene in these cancer cells:

Apparently when the cells were exposed to very high energy, there was severe damage to the cells, and chromosomes broke. Afterwards, the chromosomes had the urge to rebind, but unfortunately, they did not bind to their original structures. Some pieces of chromosomes were then hooked to other pieces, but not to the original one.

Genes are composed on two important motifs: one is the regulation of the 'turn on' and 'turn off' of gene expression, located in the control region and called the

promoter. The other is a part responsible for the release of the encoded genetic information.

Unfortunately, upon exposure to high energy following the atomic bomb explosion a number of genes were cleaved and a coding region coming from one gene was united with a promoter coming from another gene. In this situation, the promoter of immunoglobulin, a gene that encodes for antibodies, was fused with the coding region of an oncogene. This generated a hybrid gene between the very active promoter of the immunoglobulin gene and an information coding part coming from the oncogene. The end product was the expression of forbidden information of the oncogene controlled by a very active promoter.

In addition to the translocation of the individual's own chromosomal material, oncogenes can be introduced externally into the genetic material of a cell by cancer-causing viruses. Each virus group has its own set of genes that function as oncogenes in the human host by altering the information carried by the host cell's DNA.

A retrovirus can pick up a proto-oncogene that does not cause cancer in a normal cell and incorporate it into its own chromosome. Frequently this added proto-oncogene is altered by mutation. When it is transferred to the normal cell, it is now an oncogene and its expression can cause cancer. The activity of the retrovirus supplies the oncogene's ability to spread from cell to cell and from the host even to other individuals. This is referred to as "infectious" cancer, although it is not the cancer that is spread but the virus containing the can-

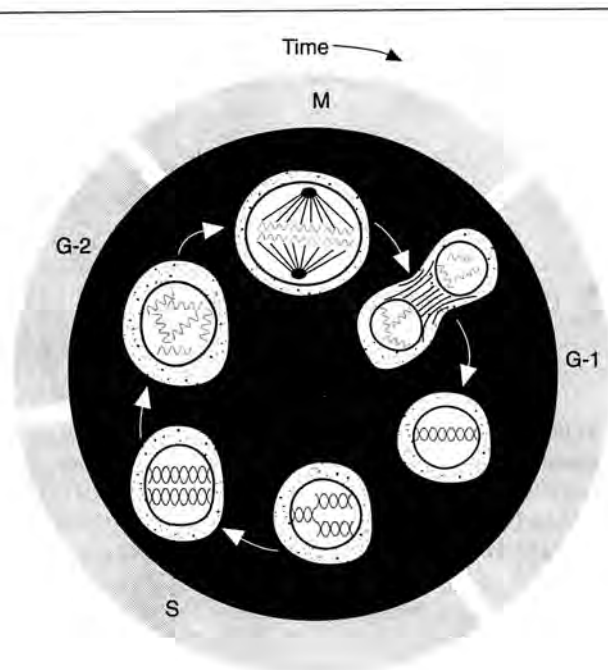


Figure 1
THE NORMAL CELL CYCLE

When a cell begins its cycle of reproduction, the DNA replicates in the S or synthesis phase. Next comes a rest period, G-2, denoting a time gap between the active phases. In the M or mitosis phase, the two DNA copies separate to produce two daughter cells. During the G-2 gap, p53 and other regulatory tumor suppressor genes activate a system to repair gene damage or program a severely damaged cell for death.

cer-causing genetic material. So far, this has been found to occur in animal models.

**Suppressor Genes:
Guardians of the Genome**

Oncogenes can be activated in a number of ways, one of which is genetic damage from environmental substances such as the chemicals in cigarette smoke. But, as Prof. Rotter stressed, not everyone who smokes even five packs of cigarettes per day develops lung cancer. It has also been observed that we all get microscopic premalignant tumors that do not develop into larger, life-threatening conditions. This suggests that there are mechanisms that prevent cancer development in the normal cell. The genome has a protector against genetic mutation in a handful of remarkable genes known as tumor suppressor genes.

In a normal cell, the DNA in the nucleus is copied during a period called the S, or synthesis, phase. This period may occupy about one third of the total 18 to 24 hours it can take the cell to divide. As seen in Figure 1, the cell rests after DNA synthesis.

The rest period is needed for the p53 gene to be able to protect the integrity of the genome. During the rest period, the p53 examines the newly replicated DNA. If an error occurs, what Prof. Rotter described as a "DNA repair machine" is activated. She likened it to "quality control." If the mistake is not severe, it is repaired before mitosis. If it cannot be repaired within the time provided, the p53 gene will initiate a process that leads to the death of the cell.

"Apparently, this is one of the most important control systems," Prof. Rotter stated, "to know when to get rid of cells that carry improperly programmed genetic information by a system of programmed cell death" (Figure 2). If the suppressor gene is missing or a mutant fails to induce growth arrest, the cell can keep proliferating, carrying damaged genetic material. If this "genetic drift" in-

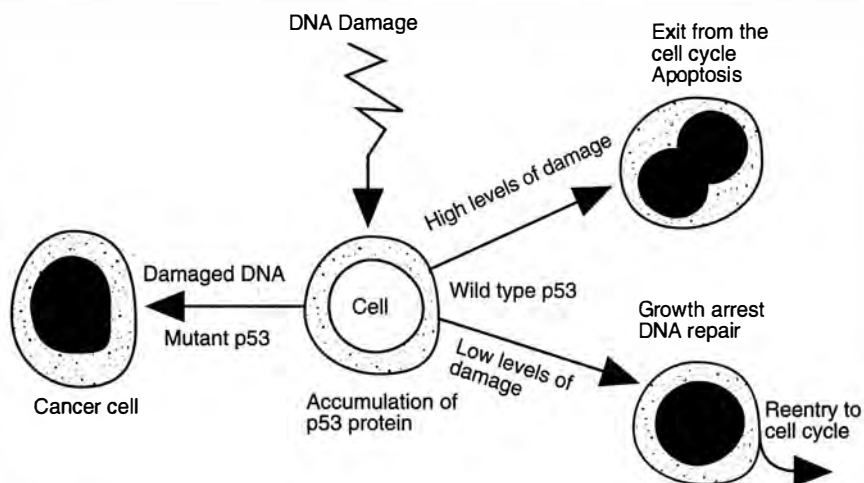


Figure 2
HOW p53 GUARDS THE CELL'S GENOME

If there is damage to the DNA of a replicating cell, the ability of the p53 tumor suppressor gene to function normally can determine whether uncontrolled cancerous growth will develop. If the p53 gene is normal (known as wild type p53), it will either initiate the process of repairing the DNA, or, if there is severe damage, send the cell to a programmed death, or apoptosis. If the p53 gene is a mutant and neither genome-protecting process is initiated, the daughter cells will contain damaged DNA and can become cancerous cells that multiply out of control.

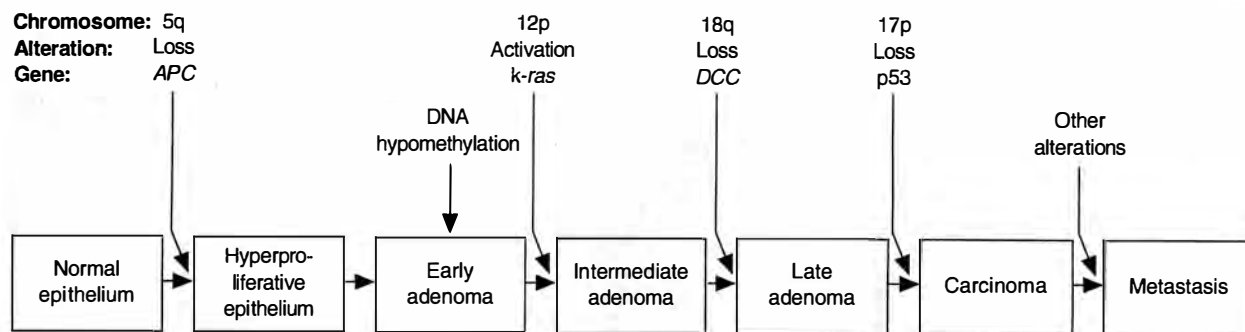


Figure 3

A GENETIC MODEL FOR COLORECTAL TUMORIGENESIS

Dr. Bert Vogelstein and his colleagues at Johns Hopkins have developed this model of the sequence of genetic alterations that are observed in the course of tumorigenesis from a benign growth (adenoma) to colorectal cancer. The genetic alterations involve both the activation of oncogenes and the loss of function of tumor suppressor genes. The details of the final step, from carcinoma to metastasis, are not yet known but this is the most lethal phase of the disease.

Source: B. Vogelstein, K. Kinzler, 1993. *TIG*, Vol. 9, No. 4, p. 140

volves an activated oncogene, Prof. Rotter said, "that is enough to give it the advantage of being expressed and then facilitate the appearance of cancer."

Mutant suppressor genes can be inherited. If a p53 gene is mutated in the germline, the risk of developing cancer is very high—in some families 100 percent—because this gene plays a central role in cellular growth regulation and genome integrity.

The p53 gene was discovered in 1979. For the past 14 years, Prof. Rotter and other scientists at the Weizmann Institute have been studying its role in both normal and cancerous cells. They researched how the gene functions in mice and found mutant versions of the gene in tumors. By 1993, several thousand human tumors representing more than 30 types of cancer had been analyzed for p53 mutations in laboratories around the world. According to Prof. Rotter, it has now been established that about 70 percent of cancer tumors present evidence of a problem with the p53 gene.

Several mechanisms can result in the inactivation of the p53 tumor suppressor gene, including viral insertions of gene rearrangements, or deletions. According to Prof. Rotter, the predominant mechanism is point mutation of the gene. The p53 gene sits on the 17 p13 chromosome, which seems to be a frequent target for chromosomal alteration in human tumors. At the Weizmann Institute, researchers are investigating ways of activating the suppressor genes to restore the body's own ability to guard its genome.

Dr. Bert Vogelstein and his colleagues at the Johns Hopkins University School of Medicine have been intensively studying the familial genetic causes of colorectal cancers. They have determined that the inheritance of a mutant form of another tumor suppressor gene, APC (for adenomatous polyposis coli) leads to development of thousands of small but visible benign polyps by the second or third decade of life. This causes a predisposition to colorectal cancer, but without additional mutations the disease does not develop. In addition to the APC mutation, larger polyps were found to also contain a mutation in the *ras* oncogene.

Dr. Vogelstein estimates that five or more somatic (as opposed to inherited) genetic alterations are prerequisite for a cancerous tumor to develop. Figure 3 is a diagram of the mutations that appear to be present in each stage from normal cell growth to carcinoma and metastasis.

Using Genes to Detect, Treat, and Prevent Cancer

Until now, detection and treatment of cancer have addressed the symptoms, not the disease. Using the tools of genetic engineering, gene therapy, and cloning, as well as methods that are yet to be developed, it will be possible to intervene in the cancer process from the standpoint of the genes themselves.

Treatments for cancer have been largely limited to trying to kill cancerous cells using radiation and chemotherapy in addition to, or instead of, surgery. Radiation therapy is aimed at killing the specific tumor cells, but leaves intact undetected tumors or small groups of metastasized cancer cells. Chemotherapy is administered throughout the entire body and attacks all reproducing cells, including those that are beneficial, such as those of the immune system. It can leave perhaps 1 percent of the cancerous cells intact to continue to reproduce and it is not effective in killing large tumors.

Aside from the well-known and unwelcome side effects of such treatments, a more serious problem is the formation of secondary cancers like leukemia in patients who have undergone radiation or chemotherapy treatment for cancer. These therapeutic agents can become carcinogenic when the primary tumor exhibits germline mutation of the p53 suppressor gene. Such tumors are also less sensitive to the therapeutic effects of radiation and chemotherapy.

Tumors that do not exhibit p53 mutations are very sensitive to radiative and chemical therapy, Prof. Rotter reported, but "paradoxically, the same agents leave other footprints of their activity by inducing p53 alterations," which are mainly mutations. Screening patients for germline p53 mutations would help determine which therapies should be applied in specific cases.

Early detection of cancer increases the patient's survivability in nearly every form of the disease. Since it is the genetic material that is "sick" in a cancer cell, scientists are finding that using highly sophisticated methods, genetic changes can be markers for early detection of the disease.

One of the phenomena observed by clinical researchers is that mutated tumor suppressor cells produce abnormal proteins, termed mutated gene product. Dr. Vogelstein reports that the screening of blood or feces for such mutant gene product could lead to early detection. In the case of colorectal cancer, it has already been proven that detection prior to the metastatic stage can prevent death.

In addition, the patient makes antibodies against some forms of mutant gene product, which, if detected, can be used as an indirect but effective marker for disease.

The reason the immune system does not attack and destroy cancer cells is that it does not recognize them as foreign because the defect is in the nucleus and not the cellular membrane. There is evidence that the normal immune system, by eliminating the strongly immunogenic tumor cells, permits a selection (survival) for the weakly antigenic cancer cells that the immune system ignores, allowing them to proliferate. Cancer cells also seem to act to suppress the normal immune system by altering the basic genetic material in the cell, and they build up immunity by mimicking the host tissue or camouflaging any surface antigens.

As a result, therapies that stimulate the overall immune system have shown little success. There are indications, however, that specific, or tuned, immune-system intervention may be more effective than global intervention. Various tumor-associated antigens, recognized as foreign molecules, may be useful in mobilizing the immune system for attack on a specific, primary cancer. Unfortunately, the metastases generally adopt different characteristics. It has been most effective to try to use specific active immunotherapy after the tumor is removed or reduced in size through surgery.

In the future, there may be extremely precise ways to intervene into the genetic diseases causing cancer. It may be possible to deactivate oncogenes or neutralize their mutated product. On the other hand, in cases where the body no longer produces sufficient p53 protein because a gene is mutated or deleted, the p53 might be artificially added to the cells to restore this critical regulatory function.

Various retroviruses have been modified and used as vectors for mammalian cells. Such "carriers" might introduce healthy genes to a diseased tissue. Gene replacement therapy could one day be used to entirely replace damaged genes with healthy ones grown in cultures (in vitro) and then placed into the body.

The genetic makeup an individual will inherit is determined at the moment that an egg is fertilized by a sperm. At any time during gestation and certainly after the birth of a child, the genetic makeup can be examined and germline ge-



Weizmann Institute of Science

Prof. Rotter: "If we can reconstitute or repair the mutant p53 gene, then we have solved 70 percent of the cancer problems."

netic mutations can be determined. As Prof. Rotter explained, if you could screen for p53 and identify individuals with mutant genes that put them at higher risk for developing cancers, you could design diagnostic programs to detect tumors at an early stage.

Researchers hope that in the future the defective tumor suppressor gene could be replaced with a healthy one, thus reducing the risk of cancer for a large portion of the population that inherits a genetic predisposition to cancer. For those who do develop the disease, as Dr. Rotter put it, "if we can reconstitute or repair the mutant p53 gene, then we have solved 70 percent of the cancer problems."

There is great hope that understanding the genetic causes of cancer will revolutionize its detection, treatment, cure, and eventually prevention, and also shed more light on other genetic diseases.

Marsha Freeman is an associate editor of 21st Century magazine.

References

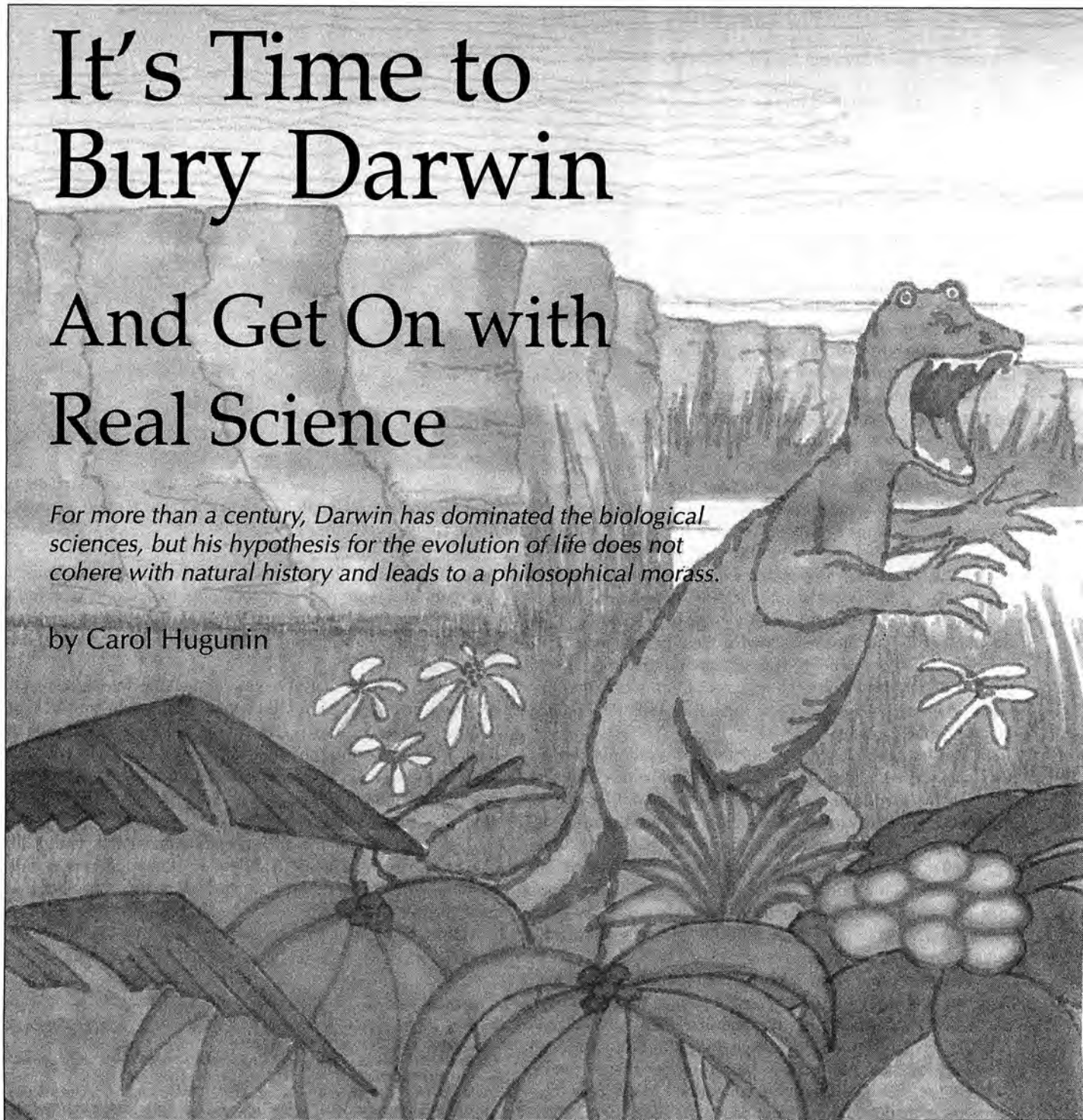
- Peter B. Farmer and John M. Walker, eds., 1985. *The Molecular Basis of Cancer* (New York: John Wiley & Sons).
- Curtis C. Harris, 1993. "p53: At the Crossroads of Molecular Carcinogenesis and Risk Assessment," *Science*, Vol. 262, pp. 1980-1981.
- Curtis C. Harris and Monica Hollstein, 1993. "Clinical Implications of the p53 Tumor-Suppressor Gene," *New England Journal of Medicine*, Vol. 329, pp. 1318-1327.
- Richard E. LaFond, ed., 1988. *Cancer: The Outlaw Cell* (Washington, D.C.: American Chemical Society).
- Arnold J. Levine, 1995. "Tumor Suppressor Genes," *Scientific American Science & Medicine*, Vol. 2, No. 1.
- Miron Prolocimer and Varda Rotter, 1994. "Structure and Function of p53 in Normal Cells and Their Aberrations in Cancer Cells: Projection on the Hematologic Cell Lineages," *Blood*, Vol. 84, No. 8.
- Eric R. Fearon and Bert Vogelstein, 1990. "A Genetic Model for Colorectal Tumorigenesis," *Cell*, Vol. 61, pp. 759-767.
- Varda Rotter et al., 1994. "Does Wild-type p53 Play a Role in Normal Cell Differentiation?" *Seminars in Cancer Biology*, Vol. 5, pp. 229-236.
- Bert Vogelstein and Kenneth W. Kinzler, 1993. "The Multistep Nature of Cancer," *TIG*, Vol. 9, No. 4 (April).

It's Time to Bury Darwin

And Get On with Real Science

For more than a century, Darwin has dominated the biological sciences, but his hypothesis for the evolution of life does not cohere with natural history and leads to a philosophical morass.

by Carol Hugunin



Today Charles Darwin and Isaac Newton are still taught to students as the figures fundamental to the development of the biological and physical sciences. Although Darwin is still very much debated and some scientists have deliberately devised experimentation to refute him, the epistemological assumption behind the Newton-Darwin pair—the idea that fundamentally matter is little hard balls randomly interacting entropically in empty space—still dominates science. Life is thus considered to be merely a more complicated version of

this simple epistemological model, which *appears* to be quite adequate for the physical sciences.

Since Darwin first introduced the idea that chance could serve as the deepest causality explaining the evolution of life, epistemological approaches based on chance, in the form of statistical methods and chaos theory, have come to dominate mainstream science. In fact, the modern synthesis of the Darwinian thesis, developed by Julian S. Huxley and others in the late 1930s and early 1940s, is much more deeply en-



Illustration by Brenda Brown

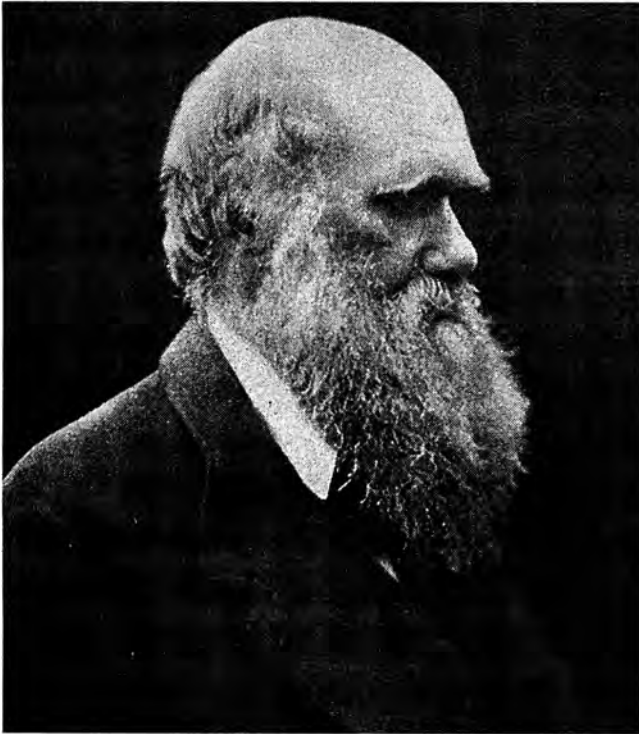
meshed in chance as a *method* of inquiry—in the form of the statistical approach and systems science—than was the historical Darwin. And today in the social and political realm, that old Tennyson concept, “Nature, red in tooth and claw,” is very much alive and well in the form of a revival of Darwinian eugenics.

In order to get beyond Darwin and the perennial Darwinist-Creationist debate, it is necessary to go back to the historical Darwin and the period in which he lived. What was the sci-

ence of his day? What were the epistemological assumptions behind Darwin’s approach, and were they in any way different from those of other scientists in his period?

The latter part of the 18th century and the first half of the 19th century was a period of tremendous advances in the natural sciences, including the study of life.

At the start of the 19th century, the German biologist Carl Friedrich Kilmeyer pondered the nature of the evolution of life and its relationship to different geological epochs. “Many



Library of Congress, from a photograph by Mrs. J.M. Cameron

Charles Darwin (1809-1882): "I admit that if we really now know the beginning of life on this planet, it is absolutely fatal to my views."

species have apparently emerged from other species, just as the butterfly emerges from the caterpillar," wrote Kiehmeyer in 1804. "The idea of a close relationship between the developmental history of the Earth and the series of organized bodies [life forms], in which each can be used interchangeably to illuminate the other, appears to me to be worthy of praise."

"Finally," stated Kiehmeyer during a 1793 lecture, "the task is to understand how both the continuity and change in species are grounded in the causes and effects of these forces," including sensibility, reproductive power, and power of propulsion. In this lecture, Kiehmeyer proposed several intriguing ordering principles and areas for exploration; for example, that the species with the greatest reproductive capacity expressed by number of new individuals reproduced are the most primitive, least complex, and smallest. Species with a capacity to regenerate damaged parts, he proposed, have little or no sexual differentiation.

At a time when the science and technology of organic chemistry and biochemistry hardly existed and genetic material was an unknown but postulated mysterious vital force, Kiehmeyer pressed for the study of embryogenesis as a way of understanding the continuity between different species. This led to a century of tremendous advances in embryology.

However, with the later rejection of the idea that ontogeny recapitulates phylogeny (that is, that the history of a lineage reappears in compressed form in the embryological development of its present descendants), worthwhile scientific babies were thrown out with the bathwater. Georges Cuvier, for example, a correspondent of Kiehmeyer's student Christian Heinrich Pfaff, excluded embryology from the study of life forms

and deprecated the idea of evolution. Yet, he made suggestive explorations of the principle of order and harmonies among organ systems in his study of the internal structures of various species.

Most relevant for today is the work of Cuvier's student Alexander von Humboldt, who took nothing less than the entire cosmos and its fundamental laws of development as his field of investigation.

Humboldt's Exploration of the Harmonies of Nature

Humboldt is best known today for his exploration of South and Central America, during which he also visited the United States. On the eve of his first voyage, in 1799, Humboldt wrote to his former instructor at the Freiberg mining school: "I shall endeavor to find out how nature's forces act upon one another and in what manner geographic environment exerts its influence on animals and plants. In short, I must find out about the harmonies of nature."

Humboldt's *Personal Narrative* and other writings describe how this quest guided his immense empirical studies during the voyage. He brilliantly described flora and fauna, climbed into volcanic craters, investigated ancient civilizations, made celestial observations, and took geomagnetic readings. It was Humboldt who developed the notion of what is now called an ecosystem, but he did this as a basis for fostering human population growth and scientific progress—the opposite of the Malthusian insanity it has become today. He systematically related the occurrence of zones of differing life forms with climate, precipitation, latitude, elevation, soil composition, and other geological conditions. Crossing the Andes, Humboldt found six zones of vegetation, each with its corresponding animal life.

Such concepts were invaluable for agricultural innovation and thus for expanded population potential. Humboldt discovered that a ton of guano (the droppings of Peruvian sea birds) was the fertilizer equivalent of 33 tons of barnyard manure. He then recruited the great chemist Justus von Liebig to continue systematic analysis of chemicals that might be used as artificial fertilizers, as well as of different soils.

In exploring unknown territories (often at the risk of his life), Humboldt investigated past and present languages, institutions, and demography—all from the standpoint of how mankind could make these regions more productive: He evaluated soils and minerals, mapped natural waterways for transportation, and even planned canals, including what later became the Panama Canal.

Thus, everywhere Humboldt went in the Americas (and also in his 12,000-mile journey across the Russian empire in 1829), he focused on expanding the potential human population density of these vast, scarcely inhabited areas by means of the latest science and technology. He recruited fellow scientists to work on the problems involved in developing these frontier areas, promoted new mining and farming techniques there, and introduced individuals interested in rapid development of the Americas and Russia to scientists and like-thinking political figures in Europe.

'The Realm of Mind'

Although Humboldt thought that there was relative stability in living forms during the past few thousand years, he hypothe-



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Alexander von Humboldt (1769-1859) was insatiable in his quest for knowledge of "the harmonies of nature." He explored South and Central America in 1799, at age 30, and led a 12,000-mile expedition across Russia and Asia in 1829, at age 60. His seven-volume work, *Cosmos: A Sketch of a Physical Description of the Universe*, defines man and his creative intellect as the pinnacle of the universe. His descriptive studies of flora, fauna, and geological resources provided the basis for agricultural and industrial development of frontier areas.

sized that life had evolved considerably over geological time, above all as a result of lawful changes in the flux density of the solar energy reaching the Earth. We know more today about how the intensity of sunlight reaching the Earth changes with long-term astronomical cycles, creating ice ages. However, it is clear from the continuing debate around the ozone and global warming issues and the failure of computer weather modeling, that we do not yet have a good handle on the way the Sun continually influences weather and climate on Earth.

In the 1840s, toward the end of his life, Humboldt published a seven-volume work, *Cosmos: A Sketch of a Physical Description of the Universe*, whose immense span of knowledge and investigation of fundamental principles encompass the geological development of the Earth and the development of life in its myriad manifestations. It is fascinating to note the way Humboldt bridges the gap between the evolution of the inorganic world and living creatures and the evolution of man:

By maintaining the unity of the human species, we at the same time repel the cheerless assumption [here a footnote refers the reader to Aristotle's *Politics*] of superior and inferior races of men. . . . Laws partially known have enabled us in some degree, to arrange these [natural] phe-



HUMBOLDT'S SOUTH AMERICAN EXPEDITIONS

Humboldt's famous journey took him from the Venezuelan coast into the Amazon and from Cartagena, Colombia, to Lima, Peru.



HUMBOLDT'S CENTRAL ASIAN EXPEDITION

Beginning in Riga (now the capital of Latvia), Humboldt went through St. Petersburg, Moscow, and Gorki, and sailed on the Volga to Kazan. Then he traveled overland through Sverdlovsk to Barnaul in the Altai Mountains, ending near Lake Zaisan.

Source: Maps adapted from Ann Gaines, *Alexander von Humboldt: Colossus of Exploration* (New York: Chelsea House Publishers, 1991)

nomena; other laws of a more mysterious nature prevail in the highest sphere of the organic world, in that of man which has varied conformation, the creative intellectual energies with which he is endowed, and the languages which have sprung therefrom. We have thus reached the point at which a higher order of being is presented to us, and the realm of *mind* opens to the view: here, therefore, the *physical* description of the universe terminates: it marks the limit, which it does not pass.

In the late 1820s and 1830s, Ernst Heinrich Weber and his brother Wilhelm, working in Leipzig, founded the latter-day

discipline of physiology by applying to biological problems Leonardo da Vinci's method of studying wave functions. Later Humboldt brought them together at Göttingen University to collaborate with the great mathematician Carl Friedrich Gauss. The Webers' friend Ernst Chladni, a physicist and musician,

had reproduced some of Leonardo's experiments in the visualization of nodal lines of waves; Weber approached fluid dynamics through anatomy, at first studying the circulation of blood as a fluid in closed pipes, as Leonardo had done.¹ Although much of the Webers' work continues to be ignored,



From a portrait by J. Linnell, 1833

Thomas Malthus (1766-1834)



Library of Congress

Francis Galton (1822-1911)

Darwin's theory of survival of the fittest was inspired by Thomas Malthus (1766-1834), who, in turn, took his theory from the Venetian Giannaria Ortes (1713-1790). Francis Galton (1822-1911), Darwin's cousin, added to Malthusianism the idea of eugenics, of preventing the so-called inferior races and classes from reproducing.

The Darwinian Duo: Reductionism and Holism

For the past 100 years, ever since the Darwinian view took hold, it has become fashionable to limit science either to a statistical approach that reduces the world to readily observable phenomena or, alternatively, to a holist approach that pretends to look at the whole picture. The rationale for this change from the old-fashioned tradition of not separating science from philosophy was that science had to be made more objective and independent of any particular philosophical outlook.

Let's look at the consequences of this divorce:

Reductionism. Imagine that a very bright race of fleas is trained as good empiricist scientists and that they have gathered together for a convention to discuss the nature of the beast they live on. Each reports on the nature of the beast from the standpoint of the area that his researchers have investigated. They argue—for they are very spirited about getting down to the truth of the matter—over the statistical dominance of long hairs versus short hairs, over the dominance of various colors of hairs, over whether the surface of the beast is predominantly warm or cool, moist or dry, pitted or smooth.

Let's say that these fleas are as bright, relatively speaking, as the best of humans, and let's give them considerable time to figure this question out. Even if a few flea groups stumble over a really lucky research find, will they ever be able to figure out the kind of geometry they are in? Will they discover whether it is a baboon, a dog, a cat, a rat, or even a skunk?

This is the problem of reductionism, ever so busy studying life, but with absolutely no idea what geometry it is in.

Why take a bunch of brilliant scientists and cripple them with reductionism, so that they spend their lives discovering relatively trivial things, when they are quite capable, if they rejected this method, of making much more profound discoveries?

British Holism. Holism appears, at least superficially, very similar to that old-fashioned Christian-Platonic tradition associated with Leibniz, Nicholas of Cusa, and continental science. However, in British holism, all the terms have been redefined so that the quest for the deeper reason and causality in life—those questions bordering close to the areas of philosophy and religion but still part of a scientific approach to a problem—are no longer possible.

Although not reductionist, holism is like Darwinian reductionism in that it does not allow for any studies bordering on those deeper issues of causality and reason: of first cause.

this approach to blood circulation was used as the basis for the recent development of the artificial heart.

By 1838, under the influence of the embryologist Karl Ernst von Baer, biologist Theodor Schwann had elaborated his theory that all life was organized into cells and repro-

duced itself through these units. By 1842, the chemist Justus von Liebig had elaborated the notion of catalytic forces so essential to the development of biochemistry. In 1852, Liebig's colleagues Carl Bergmann and Rudolph Leuckart published a least-action approach to physiology, in the spirit



Also, like reductionist Darwinism, holism holds that all species are equal. Rather than studying up close a multitude of sense-certain things, holism steps back and looks at the whole. But it is an undifferentiated, unfocused whole. Things become blurry and mystical because there is no avenue left open for redifferentiating the soupy field holism has generated.

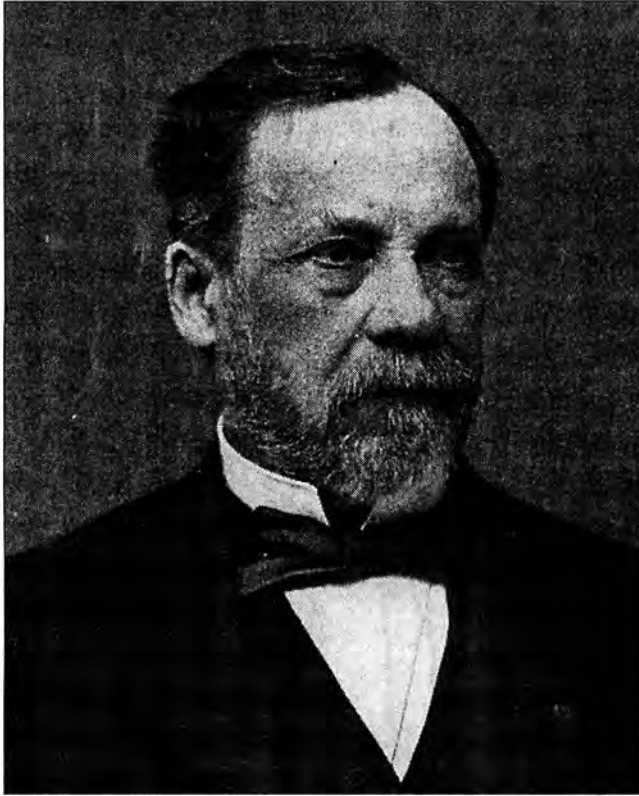
To return to the fleas: Imagine that they are holding another convention. One flea who has attended hundreds of such conventions, and becomes tired of hearing the same sorts of arguments over and over, gets up and announces that after reading British holists J.B. Haldane and J.C. Smuts, he has concluded that the convention attendees are wasting their time with this reductionist approach, and they should go with British holism instead.

Meanwhile, unbeknownst to the fleas, their beast has been dead for 10 hours, and it is getting dark and cold, really cold, much colder than usual, for unknown reasons. Times change. The entire convention of fleas is becoming

upset with the rapidly dropping temperatures. They all convert to holism, and begin worshipping the great beast on which they reside. The temperature is still dropping rapidly.

Because holism gives them no way to scientifically study their beast, to figure out why the great beast became so angry with them as to deprive them of warmth, they become desperate. A shivering flea gets up and demands sacrifices to the great beast to appease its anger. The motion carries. Group sacrifices of flea scientists begin. Will their conversion to holism lead the dwindling numbers of fleas to an answer to the question of what geometry they are in?

Is either the reductionist or the holist approach superior to the tradition of not totally separating science and the so-called objective approach from the so-called subjective approach of philosophy, religion, and the arts? Does this separation really lead to a superior understanding of such fundamental questions as what is life or what kind of geometry are we in?



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Louis Pasteur (1822-1895) exemplified the thinking of the continental school in his approach to science and the question of the evolution of life. He hypothesized that life was a function directly or indirectly of the “dissymmetry” of the universe—a hypothesis that totally negates the Newtonian view of a universe of Euclidean geometry.

of von Baer and Ernst Weber, exploring the higher-order principles that subsumed the chemistry and physics involved in life forms’ solutions to problems of reproduction, metabolism, and locomotion.²

Humboldt’s French collaborator Joseph-Louis Gay-Lussac, a physician and pioneering chemist, taught not only Justus von Liebig but also another of the greatest chemists of the 1820-1850 period, Jean-Baptiste Dumas. Dumas, in turn, became the teacher of Louis Pasteur. Centered around Göttingen and the heirs of the Ecole Polytechnique, along with others, including the anti-Darwinian naturalist Louis Agassiz and the geologist James Dwight Dana in the United States, these scientists were opening up new fields of inquiry with a rigorous search for causal, higher-order unifying principles. The potential was strong for a theory of biological evolution coherent with their approach.

Enter Darwin and Malthus

By 1831, Charles Darwin had “read and reread” Alexander Humboldt’s *Personal Narrative*. It fired him with enthusiasm and zeal. In fact, Darwin was the only British scientist willing to meet Humboldt when Humboldt came to England. He came back to the Humboldt work repeatedly in the rough parts of his long voyage on *H.M.S. Beagle*, which began in 1831. But later he and his advisers abandoned Humboldt’s vision.

Instead, Darwin’s stunning brilliance was to come up with the idea that evolution worked by tiny, random variations in living organisms, of which only the fittest variant specimens survived in a competition for scarce sustenance. In an entry to his diary dated October 1838, the affable Darwin tells exactly how he came up with this hypothesis:

I happened to read for amusement Malthus *On Population*, and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favorable variations would tend to be preserved, and unfavorable ones to be destroyed. The result of this would be the formation of new species. Here, then, I had at least got a theory by which to work.

Parson Thomas Malthus, an economist working at the British East India Company college in Haileybury, England, had insisted that population (of men and of other living creatures) tends to expand geometrically, while food supply expands arithmetically. Hence, the Malthusian world is so arranged that in the natural course of things, horrible crises must occur as population presses against fixed resources. This cycle can be alleviated only by the depopulating effects of “vice and misery”—that is, nonreproductive sexual activity and death-dealing poverty. To cull the human flock, neo-Malthusians advocated active social measures beyond acceptance of starvation and disease.

The original full title of Darwin’s 1859 opus, it should be noted, is *Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life*.

UNDERLYING AXIOMS	
Darwinian science	Continental science
(1) Chance Random changes	Directedness Nonrandom changes, purposeful, teleological
(2) Linear Continuous Gradual mutation in the small on the level of genes	Geometric Discontinuous jumps Chromosomal reordering
(3) Survival of fittest, fierce competition	Harmony of nature mirroring external and internal bounding conditions
(4) Inbreeding Bred for specific traits suitable to fixed environment	Outbreeding Bred for plasticity in changing environment
(5) All species equal Man is just another beast	Man is pinnacle of evolution Man is in the image of God

Francis Galton, Charles Darwin's cousin, went a step further than Malthus in explicitly proposing that the human race should be culled on the basis of the inferiority of certain sub-groups, thus winning his title as the father of British eugenics. With the support of T.H. Huxley, Darwin's publicist, Darwin's son Leonard wrote *The Need for Eugenic Reform*, "dedicated to the memory of my father. For if I had not believed that he would have wished me to give such help as I could towards making his life's work of service to mankind, I should never have been led to write this book."

As for Malthus, publication of his dogmas led to the enactment of the 1830s Poor Laws in England, which abolished "outdoor relief"—the equivalent of today's welfare payments—and forced the unemployed into workhouses, where they slaved for scant rations of food until they took sick and died. This was the practical corollary of Malthus's precept that charity (or, even worse in his view, policies of elevating a nation's per capita living standards and productive capabilities) would simply lead to disastrous overpopulation.

Like Alexander von Humboldt, Malthus and the East India Company knew that statecraft can transmit the benefits of scientific progress throughout society. The United States was already a living example of geometric expansion of new resources when Malthus assembled his *Essay*. Humboldt and his associates devoted themselves to promoting that statecraft, while the Malthusians devoted themselves to opposing it.

Malthus's collaborator Sir James Mackintosh at Haileybury was the father-in-law of Darwin's cousin Hensleigh Wedgwood; Charles himself married his Wedgwood cousin and lived on his wife's Wedgwood wealth. The Darwin-Wedgwood clan were among the leading merchant-banking clans with immense control over colonial raw materials.

Can we simply ignore those dark, Malthusian thoughts, or are they perhaps relevant to the scientific issues? It is generally said that Darwin synthesized and subsumed the work of the scientists such as Humboldt who preceded him, but can this be the case, when we consider how at variance their fundamental assumptions really are?

Let's look at the underlying assumptions of the Darwinians and what we will loosely call the continental tradition, those scientists, like Humboldt, who rejected the Newtonian empirical approach (box, p. 38).

Something funny seems to be going on here: Darwin's axiomatic approach leads directly to modern views on the significance of chance, random changes, and, ultimately, chaos theory. On the other hand, the continental tradition emphasizes directedness, teleology, purposiveness—or, might we not say, God. For Darwin the universe is definitely entropic. The continental school, in contrast, does not rule out the possibility that entropy is merely local reality and not global.

Let us examine the Darwinian axioms one by one.

(1) Chance and Random Changes

The more ordered life becomes, both in its origin from simple molecules and in its further development into more and more complex, differentiated, least-action geometries, of course, the further one gets from chance, randomness, and symmetry. But are these geometries themselves arbitrary or are they in some sense, as one contemporary paleontologist put it, "organized around one exigency: the accelerated pop-



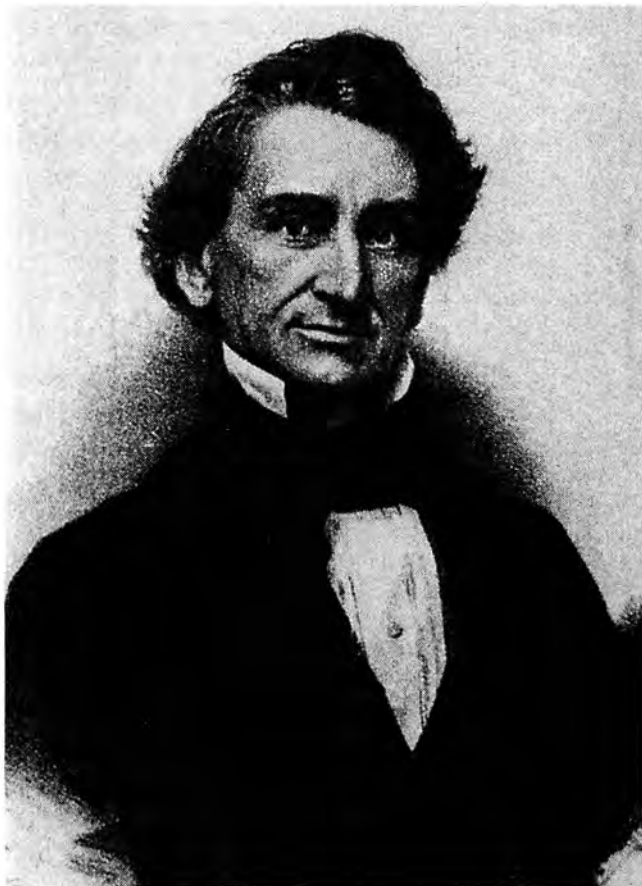
New York Public Library

Beggars on the streets of London in the mid-19th century. Malthus argued that both humans and animals produced more offspring than the Earth could support and that in the competition for limited resources, only the fittest would survive the struggle.

ulating of the surface of the Earth and the taking in charge of the planet by man?"³

In this latter tradition, from the 1850s through the 1870s, as Darwin was busy compiling the *Origin of Species* and the *Descent of Man*, the great French biologist Louis Pasteur was studying the optical dissymmetry of biological molecules.⁴ He had been inspired in this direction by the suggestions of Humboldt's friend, the Göttingen University-trained crystallographer Eilhard Mitscherlich.

"The universe," wrote Pasteur, "is a dissymmetrical whole, and I am persuaded that life, as manifested to us and observed by us, is directly or indirectly a function of the dissymmetry of the universe." Pasteur used polarized light to study the symmetry or dissymmetry of various chemical substances. "If we consider material objects," Pasteur wrote, "we quickly recognize that they fall into two classes, characterized as follows: those which, when held before a mirror, give an image which can be superimposed on the original; and those whose image . . . cannot be superimposed upon it." Pasteur then gives ex-



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James Dwight Dana (1813-1895), an American naturalist who criticized Darwin's theories, hypothesized that the evolution of life was purposive and directed, moving in the direction of cephalization—increasing development of the brain.

amples of a straight staircase or a cube for the former; and of a spiral staircase, a screw, or a leaf stalk with spirally arranged leaves for the latter:

All substances produced artificially in the laboratory and all mineral species, have a superimposed image. On the other hand, most organic natural substances . . . are dissymmetrical, and their dissymmetry is of the kind whose image is not superimposable.⁵

In this century, Swiss physicist Charles-Eugène Guye made a simple calculation: What is the probability—by totally random changes and normal thermal action—of producing just one molecule of a molecular weight of 20,000 and possessing the high dissymmetry found in the optically active molecules of life. Egg albumen has a molecular weight of 34,500, so this hypothetical molecule is the size of a simple protein. Setting 0.5 as zero dissymmetry, or perfect symmetry, and 1.0 as maximum dissymmetry, Guye did his calculations for a molecule of 0.9 dissymmetry.

Guye concluded a probability of 2.02×10^{-321} , which is a chance of almost nil. If one assumed 500 trillion shakings per second—corresponding to the order of magnitude of light frequencies—it would take 10^{243} billion years for such a single

molecule to be formed in a volume equivalent to that of Earth. But life has existed for only 3 billion years, and the Earth itself for roughly 4.5 billion years. To complicate matters, this is the probability for only one such dissymmetrical molecule (typical of what is found biochemically in life) to develop by chance. In order for life to originate, many, many such molecules would have had to have developed by chance and become ordered in an exceedingly complex way.⁶

This calculation is *not* a refutation of the possibility of the natural origin of life: Life obviously did originate billions of years ago, under conditions that we still do not fully understand. It neither refutes nor forms a mathematical model for the experimentation of A.I. Oparin, Harold Urey, and Stanley Miller on the formation of simple sugars and amino acids, the building blocks of starches and proteins, respectively, under conditions hypothesized to be similar to those under which the origin of life once occurred. (Oparin, Urey, and Miller synthesized much, much simpler molecules, probably in optically inactive mixes.) Guye's calculation is simply for the formation of one simple protein, of average size and of the type of high dissymmetry found in living forms.

In spite of its limitations, this calculation shows that given the underlying assumptions of the Darwin view of the universe, life could not possibly have begun without bringing in miracles from the outside. Is the universe entropic, with little hard balls of matter interacting randomly? Or is it nonentropic, a nonrandom universe, in which the geometry of space-time, far from being a totally empty construct, determines the nature of the lawfulness found in that space? If it is entropic and random, as both Newton and Darwin hypothesize, then how can the origin of life and the sudden development of man possibly be explained?

This is by no means a trivial question or one that biologists can afford to overlook.

Obviously, Darwin did not have access to the same sophisticated biochemistry that permitted Guye to make such calculations. But was he aware of such problems?

Consider Darwin's exchange of letters with the American scientist James Dwight Dana, best known as a geologist, who in 1838-1842 had taken a surveying voyage sponsored by the U.S. Navy on a path very similar to that of Darwin and *H.M.S. Beagle*. Dana thought that the evolution of life was characterized by directedness, that it was purposive, and that the Earth with its geological forms and organic kingdoms evolved as a unitary whole.

Specifically, Dana hypothesized, evolution moved from the development of the most primitive species in a direction he called *cephalization*: increasing development of the brain and nervous system and deemphasis on lower functions like locomotion. This culminates in man and his unprecedented capacity for creative reason, Dana said.

Dana had written to Darwin on Feb. 5, 1863, citing his empirical points of criticism against Darwin's *Origin of Species*, including "the absence, in the great majority of cases, of those transitions by small differences required by such a theory," as well as "the fact of the commencement of types in some cases by their higher groups of species instead of their lower," and the discontinuous resumption of pathways of evolution following "exterminations of species."

Darwin replied on Feb. 20, 1863:

With respect to the change of species, I fully admit your objections are perfectly valid. I have noticed them, excepting one of [geological] separation of countries, on which perhaps we differ a little. I admit that if we really now know the beginnings of life on this planet, it is absolutely fatal to my views. I admit the same if the geological record is not excessively imperfect; and I further admit that the *a priori* probability is that no being lived below our Cambrian era.

Nevertheless I grow yearly more convinced of the general (with much incidental error) truth of my views. . . .⁷

Thus, Darwin knew that his hypothesis would be considered workable only so long as his followers could claim that the missing fossil links exist to show that life evolves by small continuous changes, but that these links had not yet been found. Today, more than 130 years later, it is difficult to argue that these missing fossil links are still to be found. In cases where the evolution of a species has been well documented, such as that of the modern horse, intermediate stages indeed appear (six, in this case, starting with Hyracotherium and Eohippus in the Eocene period), but each intermediate stage appears abruptly.

Directedness in Development

In contrast to the hypothesis of evolution proceeding by chance and random changes, scientists in the continental tradition hypothesized that the development (or evolution) of life was directed and purposeful. For example, the great 19th century mathematician Bernhard Riemann, in discussing the mechanism of hearing and the general function of the ear, asks how the ear

solves the problem of the organ. . . . We must, as it were, reinvent the organ, and, insofar as we consider what the organ accomplishes to be its purpose, we must also consider its creation as the means to that purpose. But this purpose is not open to speculation, but rather is given by experience, and so long as we disregard how the organ was produced, we need not bring into play the concept of final cause.⁸

Dana, a naturalist and a minister, put it in a different way:

Thus God throughout nature has evolved diversity out of unity, eliciting ten thousand concordances out of single profound enactments in His plan of creation. These laws are universal truths, limited in so far only as the range of objects to which they relate is limited. Thus any truth with regard to life which characterizes all living beings, is a law in the Science of Life. . . .

The external attributes of existences have indeed been graciously made so transcendent in beauty and full of harmonies, that "he may run that readeth." But there are also revelations below the surface, open to those who will earnestly look for them. For God's hand was never outstretched to create, but beauty and wisdom appeared in every tracing; and, if seemingly wanting in the outer vestments, they are still profoundly exhibited through the structure beneath, in the ordering of the parts from

which the externals are deduced, and in the universal laws there contained; these are literally secrets of the Almighty, to be diligently "sought out of all them that have pleasure therein."

Thus, these scientists saw no conflict between their religion and science, viewing science's task as to seek out this hidden lawfulness in order to continue creation in the image of the Creator, through the capacity of creative reason to imitate and thus participate in the creative quality of the intellect of God the Creator.

The aging Karl Ernst von Baer, an Estonian nobleman famed as an embryologist, first learned of Darwin's theory in 1859 from T.H. Huxley and Richard Owen, while visiting London. Unlike many of the continental scientists mentioned above, von Baer was still alive as the Darwinian theory began to take hold even on the continent. By 1871, when Darwin published *The Descent of Man*, von Baer, acting on behalf of the continental science tradition, began to challenge the Darwinian view. Von Baer points out that

In Darwin's hypothesis all goal-directedness is avoided as much as possible. Nothing happens without sufficient reason; that is certain. But natural forces which are not directed to an end cannot produce order, never a mathematically determinant form much less a complex organism. . . . How is it possible to mistake that all of these [physiochemical] operations are ordered with respect to a future need? They are directed to that which is to come into being. Such a relationship was designated by the Latin philosophers a *causa finalis*, a cause "which lies in an end or result."

(2) Continuous, Gradual Mutation

Darwin, in all his examples, talks about variation within the species, and extrapolates this to become a mechanism for evolving new, totally different species. He does this by hypothesizing the random occurrence of the tiniest changes, variations, and assumes that given enough time, one small change can be added to another until one has something totally unlike the previous species. In the modern synthesis, these tiny, inherited changes are assumed to be changes on the gene level. If enough genes change, one by one, the assumption is that over time, a new species could occur. But then how could one explain much larger changes, such as the difference between the plant, animal, and fungi kingdoms, or the difference in different families within the animal kingdom?

Darwin glides over this crucial point, confessing to his friend and collaborator Asa Gray:

As an honest man, I must tell you that I have come to the heterodox conclusion that there are no such things as independently created species. That species are only strongly defined varieties. I know this will make you despise me.⁹

Here we see that Darwin, who wrote a monumental work on the origin of species, does not even believe in species!

In contrast to Darwin's approach, the continental school focuses on large-scale changes of a discontinuous and geo-

What Is the Difference Between Man and Beast?

Is there any fundamental difference between man and beast? An intelligent young dog will mimic its human pack leader, and will develop a sign and body language, clear to both, to roughly communicate its desires. Think of the dog's behavior in the kitchen, for example, that tells the cook it is hungry.

In fact, any bright member among the higher mammals that have a highly organized social structure in the wild can, if domesticated, readily be trained to do a very intricate series of tasks. This is not because it understands the rationale behind the tasks or the human technology that might be employed along the way, but because it has an innate drive to communicate with, mimic, and please its human "pack leader." Primates are not unique in that sense, although, to some, a chimpanzee might look more human than a dog or a raccoon.

Give a young dog a ball. It will play with it and explore the ball's behavior. A young chimp or a young child would do the same, and each appears on the surface to be playing with the ball in the same way. However, only the human being can take the ball, toy with it, study it, and come up with a totally hypothetical abstract idea that does not exist in tangible form: the absolutely perfect sphere.

Only the human sees the ball as the solution to a least-action problem of enclosing the maximum volume within a minimum surface area. And the human sees something else no other species can see in that ball: a hypothetical center, from which a point can be rotated, by circular action, at a fixed distance from that center in order to generate the surface of the sphere.

From this conception of rotation, of circular action, a whole geometry and science can be built up. And from this geometry and science, man creates specific practical technologies, all based directly or indirectly on circular action—from the obvious, like the wheel and ball bearings, to the less obvious.

From the technological spinoffs of this simple idea of rotation, man has been able to transform his way of life from that of a simple hunter-gatherer, in which each human required an immense tract of land to maintain himself calori-



Linda Ray

It may be cute, cuddly, and even affectionate and loyal, but it can't create the science and technology to discover new worlds.

cally, to what it is today. This is an increase of several orders of magnitude! No beast ever did that, not even the cleverest, just as no other species has been able to create the science and technology to put itself on the Moon.

This is the difference between man and the beast. Through the power of creative reason, man exerts dominion over nature and generates new technology that continues to increase his power over nature and transform it at a still more rapid pace. Man, through successive generations of technology, continues evolution on a nonbiological level.

metric nature. By 1834, von Baer, perhaps better known for developing the science of developmental morphology, had developed a very rich concept of adaptive radiation, exploring the idea of the way one life form is modified to generate others:

The development of life in this or that direction produces variations of the major types, which are themselves essentially different in their vital manifestations. . . . The classes divide themselves further into lesser variations, which we call families. These not only bear the modification of the major type but also include a particular modification of the class, which forms the characteristic of the family.

Modifications of lesser degree in these families give rise to species and similarly for races and varieties. . . . Every type may be manifested in higher and lower degrees of organization, for Type and degree of development together determine the individual forms. This produces, therefore, grades of development for each Type, which in certain instances form series, but not a continuous developmental series and never one which completes all possible developmental grades. . . . It is no accident that certain forms of organization are realized in fewer variations. The cause must lie in the essence of the forms themselves. . . . But these subordinate modifications of a particular grade [classes, families, species, and so on] are

mostly quite similar, and only a few ever appear to be radically different, so that a theme of these organic variations can be compared to a sphere, which consists of a densely compacted center surrounded by thinly populated atmosphere. . . . From this emerges two noteworthy rules: First, that the more compressed the center of the sphere, the more limited is the extent of the atmosphere, both in the larger, higher spheres, as in the smaller, lower spheres. . . . Second, in each large sphere, spheres subordinate to the center are richer in subordinate forms than those subordinate to the periphery.¹⁰

Von Baer insisted that all potential for variation is not actually developed because environmental factors must be conducive for the potential capacity in order for variation to be realized.

In criticizing Darwinian evolution, Louis Agassiz states flatly that

the study of species as the basis of a scientific education is a great mistake. It leads us to overrate the value of species, and to believe that they exist in nature in some different sense from the other groups; as if there were something more real and tangible in species than in genera, families, orders, classes, or branches.¹¹

(3) Survival of the Fittest

The Darwinian view stresses a fierce dog-eat-dog competition: survival of the fittest. But what does survival of the fittest really mean? What is the most fit, but that which survives? So, here we have a tautology: whatever survives, survives—a fitting view for an empire to ride roughshod over all other interests. In contrast, the continental science tradition believed in the harmony of nature and was republican, not colonial, in its politics.

Like Alexander von Humboldt, von Baer had a distinct, non-simplistic notion of the harmony of nature. Von Baer wrote:

What we have discussed here: the reciprocal interconnections of organisms with one another and their relationship to the universal materials that offer them the means for sustaining life, is what has been called the harmony of nature, that is a relationship of mutual regulation. Just as tones only give rise to a harmony when they are bound together in accordance with certain rules, so can the individual processes in the wholeness of nature only exist and endure if they stand in certain relationships to one another. Chance is unable to create anything enduring, rather it is only capable of destruction.¹²

But what is the evidence? If one looks at the most primitive species, it might appear that the Malthusian-Darwinian view is appropriate. Lower species have a prodigious number of offspring, of which very few survive to adulthood. Why one individual rather than another survives in such species may appear superficially to be the result of chance. Fish, reptiles, and insects eat each other and even, in some cases, their sexual partners and their own eggs.

If you look at the highest species, however, such as higher mammals, the opposite seems to be the case. Most higher

mammals have elaborate social structures and extensive collective nurturing of the young. Even with dogs, which can fight to kill for food or to establish rank, once rank is established, the fight ends with the less successful individual acknowledging defeat. Social rituals, which maintain the cohesion and population size of the pack, dominate over the Darwinian model of individual dog-eat-dog fights to the death.

Why should the reproductive strategy of the higher species be so drastically different from that of the lower species?

(4) Inbreeding versus Outbreeding

Darwin developed much of his hypothesis by studying the way British horse and dog breeders produced separate breeds. Indeed, genetic variation allows breeders to select for specific traits: the fastest, the largest, the most brightly colored, and so on. From this he extrapolated the idea of “natural” selection as a selection for the individuals best adapted to conditions in the wild. However, horse and dog breeding produce variation only *within a single species*.

In addition to this limitation, the show-animal breeding method has its problems. Inbreeding mother to son, sibling to sibling, does indeed often produce progeny very similar to the proven champion parents, but the price paid for this shortcut to riches is a rapid increase in very serious genetic diseases, poor temperament, and other problems.

Farm animals and other working animals, as well as agricultural plants, are *outbred* to maintain both physical and—for the animals—psychological versatility and vigor. They are generally bred for vigor, endurance, and versatility (plasticity) under a wide variety of circumstances. For example, new strains of seed are judged agriculturally by whether they produce well under a wide variety of climate and soil conditions, including how well they can withstand diseases common to that crop. Hybrid vigor, the wellspring of modern agriculture, is produced totally by outbreeding.

What does this question of outbreeding or inbreeding have to do with evolution?

There is a basic flaw in the assumption that one can breed for just a few very specific traits to get a species perfectly adapted to very fixed and limited conditions, and that this is the way evolution generates speciation: This view assumes that the environment—nature—remains fixed and stable. However, living conditions are *not* fixed. External bounding conditions change. Continents and oceans have come and gone. Climatic conditions have fluctuated from extremely hot, steamy tropical conditions or hot arid conditions to glacial ice ages. Numerous species have emerged and died out. Perfect adaptation to fixed environmental conditions is not the way evolution proceeds. Although this strategy may work on the race track or in the show ring, the species that used this strategy are long since extinct. Instead, successful species must have a certain flexibility and vigor that makes them adaptable to changing environmental conditions.

It took life eons to generate species that are progressively more and more adaptable to different and varying conditions. Life becomes increasingly homeostatic (able to regulate its own physiological conditions internally) as higher forms of life evolve. First, life escapes from dependence on an aqueous environment and becomes able to regulate its

own salt and water content, protecting itself, by various means, from desiccation and other extremes. With mammals and birds, homeotherms evolve: species able to regulate their own body temperature.

Finally, man appears. From the physiological standpoint, man appears in Darwinian terms to be the least well adjusted to environmental conditions, being both weak and naked. Yet, from the standpoint of adaptation to changing environmental conditions, he is the best adapted, because he has creative reason and develops language and society. Man is thus free from the fixed instinctual drives of lower animals. During a prolonged child-rearing phase, the young develop the mental aptitude to generate new technologies that can conquer any environment—and even colonize space.

The Earth and its biosphere are the antithesis of a fixed environment. Looked at from the perspective of geological time—the eons during which life has evolved—life is constantly changing with the biospheric environment; it is constantly modifying and transforming for its own ends. From this standpoint, the number of species that have become extinct as a result of changes wrought by human civilization is paltry in comparison with the number of species extinctions caused by major climatic and similar drastic environmental changes that occurred prior to man's appearance.

In reality, the natural world is filled with extinctions of species that could not adapt to a changing environment; man,

like other more highly evolved forms of life, is more capable of transforming his environment than are the more primitive species.

There is a general lawfulness of evolution that is not unique to man: life forms evolve to generate new species with greater versatility and greater capacity to transform the biosphere.

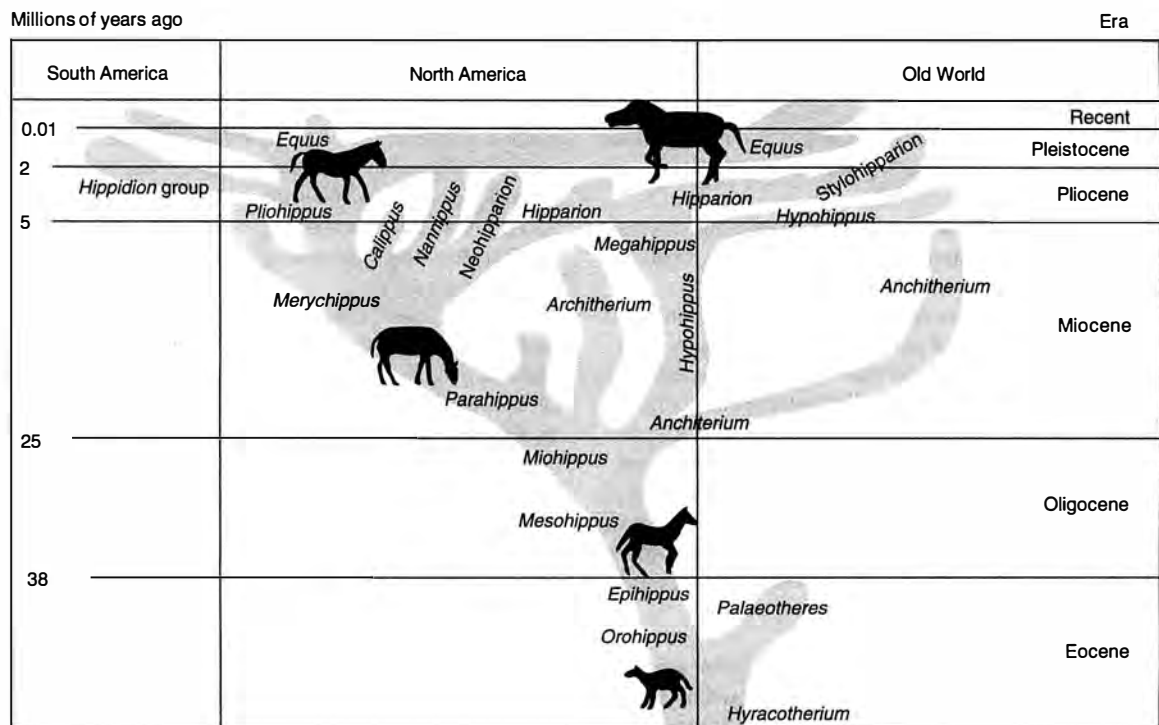
(5) Man Just a Beast?

This brings us to the last assumption on the chart. The Darwinians assume that man is just another beast. Darwin states:

It is absurd to talk of one animal being higher than another. We consider those, where the intellectual faculties most developed, as highest,—A bee doubtless would [use] . . . instincts.

Man, in Darwin's view, is just another beast and thus the human herd might be culled (via eugenics) just as one might cull a herd of cattle. And once one tries to justify eugenics, inevitably the claim is made that some groups of men, for reasons of skin color, religion—or whatever—are more fit than another.

Compare Darwinian eugenics to Alexander Humboldt's view: Humboldt insists that man and human civilization are of a higher order that is not dominated by the same kind of lawfulness that characterized the evolution of life up to that point.



THE EVOLUTION OF THE HORSE

If evolution followed the linear model of Darwin, the evolutionary path of the modern horse would not look like a complex tree with many branches (shown here), some of which appear abruptly. Instead it would be a straight line that proceeded with incremental, gradual changes. The horse evolved in the context of the development of grasslands.

Source: Adapted from *The Encyclopedia of Animal Evolution*, eds. R.J. Berry and A. Hallam (New York: Facts on File Publications, 1987)

Humboldt, Dana, and others of the continental science tradition assert not only that man is the crowning glory of the process we call evolution, but also that man goes beyond this, taking evolution into a different, a higher realm.

This is very much a hot issue today. The much publicized book *The Bell Curve*, for example, by scientists Charles Murray and Richard Herrnstein, claims that human beings of darker pigmentation are just not as "fit" as those of lighter pigmentation. The research for the book was supported by The Pioneer Fund, which had its start in the eugenics movement of the first half of this century. Before World War II, Harry Laughlin, leader of the Pioneer Fund, wanted the "lowest" 10 percent of the human population sterilized, in order to better build a race of human thoroughbreds. Laughlin and his Fund distributed Hitler's propaganda films in American schools, while Hitler put the Darwinian implications of eugenics into practice in slave labor camps.

Other contemporary researchers with a eugenics theme include neuroscientist Xandra Breakerfield at Harvard University, who is trying to prove that violent behavior is genetic, while others are trying to prove that homosexual behavior is genetic.

At this point, it ought to be clear that no scientist studying something as broad as the origin and evolution of life can totally avoid issues that have political, philosophical, and religious connotations. As much as such scientists might want to stay out of politics, the political questions are raised because of the very nature of the underlying assumptions adopted.

The End of Darwin

And so we come to the embarrassing moment of having to acknowledge that the views of Darwin and friends do not stand up well to the massive amount of scientific evidence accumulated about how evolution works. In fact, from the standpoint of the paleontological record and similar evidence, the Darwinian hypothesis is a miserable failure.

There have been many "improvers" of Darwin's theory during this century, and the holist school has pretended to offer an alternative theory. None of these scientists, however, has been willing to contradict any of Darwin's fundamental axiomatic assumptions about the nature of the universe and man, as outlined in the box. Nor is any such scientist willing to expose the fraud in the still-taught dogma that modern biology and physical anthropology rest upon Darwin's fundamental discovery.

Yet, as we finally bury Darwin and his comrades in arms, as we watch the clods of dirt fall upon their coffins, let us contemplate the humbling admission that, fundamentally, science today does not really know much about life and how it evolves. What is life? What is the difference between the biochemical composition of the components of various tissues and the living form of those tissues? Why are those biochemical components found in life only in specific, optically active forms? What does this have to do with other cosmic forces Pasteur noted that are dissymmetric—the universe with its magnificent spiral galaxies, polarized sunlight, magnetic and electromagnetic fields? Why are the biochemical components of life found in crystallized forms only after death? How have the numerous changes in both the polarity and field strength of the Earth's magnetic field affected the evolution of life? How did the origin of life occur? How do chromosomal reorderings

occur in a stable form that leads to new forms of life? What is the difference between those chromosomal reorderings, and the unstable chromosomal reorderings that can occur in multinucleated cancer cells? Is it only a difference in geometric stability? Does the genetic material of life have other vital roles beyond the genetic code? Why does DNA have all kinds of fascinating properties, such as its piezoelectric capacity, and what does this have to do with functions beyond the immediate role of the genetic code?

We have a lot of work to do. What we know is clearly dwarfed by what we don't know. But attempts to answer these fundamental questions, no matter how imperfect, in the long run will open up exciting discoveries and new realms of medical technologies that we cannot even dream of today, but that we know our grandchildren and our grandchildren's children will understand.

A century has passed since the Darwinians drove the proponents of the continental science tradition out of science. It is impossible now to judge what scientific breakthroughs and new technologies would have occurred had this not happened. We cannot simply turn back on that road. But we can use the continental science tradition as a sort of road map to move out into that great dark void and begin to explore it. We can reexamine the underlying axioms of these continental scientists. We can study the method, the philosophical tradition of Gottfried Leibniz and Nicholas of Cusa, that guided these men and apply it to today's world of scientific knowledge and technology. But we can only do so if we are honest enough to admit that Darwin has died and that it is time to get down to some really hard work.

Carol Hugunin is a biologist on the staff of 21st Century.

Notes

1. See the Appendix to *Leonardo da Vinci on the Human Body*, edited by Charles D. O'Malley and J.B. de C.M. Saunders, eds. (New York: Greenwich House, 1982).
2. Carl Bergmann and Rudolph Leuckart, *Anatomisch-physisch Uebersicht des Thierreiches. Vergleichende Anatomie und Physiologie. Ein Lehrbuch fuer den Unterricht und zum Selbststudium* (Stuttgart, 1852), as cited in Timothy Lenoir in *The Strategy of Life—Teleology and Mechanics in 19th Century German Biology* (Chicago: University of Chicago Press, 1982).
3. See Jean-Michel Dutoit, "Man Is Evolution Become Conscious," *Fusion*, Vol. 9, No. 1, Jan.-Feb. 1987, pp. 36-43.
4. Whether this dissymmetry is right- or left-handed depends on the chemical involved. Amino acids are all in the levo form, rotating to the left, or counterclockwise, while sugars are in the dextro form, rotating to the right.
5. Hilaire Cuny, *Louis Pasteur: The Man and His Theories* (Greenwich, Conn.: Fawcett Publications Inc., 1963), pp. 68-69, 150-152.
6. See Lecomte du Noüy, *Human Destiny* (New York: Longmans, Green and Co., 1947), chapter 3.
7. This exchange of letters is found in Daniel C. Gilman, *The Life of James Dwight Dana: Scientific Explorer, Mineralogist, Geologist, Zoologist, Professor in Yale University* (New York: Harper & Brothers, 1899), pp. 294-295. Darwin adds, "I should not much value any sudden conversion, for I remember well how many years I fought against my present belief."
8. Bernhard Riemann, "The Mechanism of the Ear" (1866), translated from the German in *Fusion*, Sept.-Oct. 1984, Vol. 6, No. 3, pp. 31-38.
9. Adrian Desmond and James Morse, *Darwin* (New York: Warner Books, 1991), p. 457.
10. Karl Ernst von Baer, *Ueber die Entwicklungsgeschichte der Thiere* (Koenigsberg, 1828); and "Beitraege zur Kenntniss der Niedern Thiere" (*Nova Acta Leopoldina*, Vol. 13, 1827, pp. 740-743), as cited in Timothy Lenoir, *Strategies of Life* (Chicago: University of Chicago Press, 1982), pp. 89-90.
11. Louis Agassiz, *Gists from Agassiz*, John Kasper, ed. (New York: Karper and Horton, 1953).
12. Karl Ernst von Baer, "Ueber den Zweck in den Vorgaengen in der Natur," in *Feden*, Vol. 2; and "Ueber Zielstrebigkeit in den organischen Koerper insbesondere," *ibid.*, as cited in Timothy Lenoir, *Strategies of Life* (Chicago: University of Chicago Press, 1982).



The Breeder Reactor—Affordable Energy Forever

Nuclear breeder reactors can produce all the energy humankind will ever need.

by Bernard L. Cohen

Many areas of the United States are already short of electrical generating capacity. Brownouts—situations in which voltage has to be reduced, causing lights to dim and motors to run slow—have been necessary in several places. The situation is getting worse as our electricity consumption increases much more rapidly than the generating capacity needed to provide for it. The nation will soon have no choice but to launch into a large program of new power plant construction.

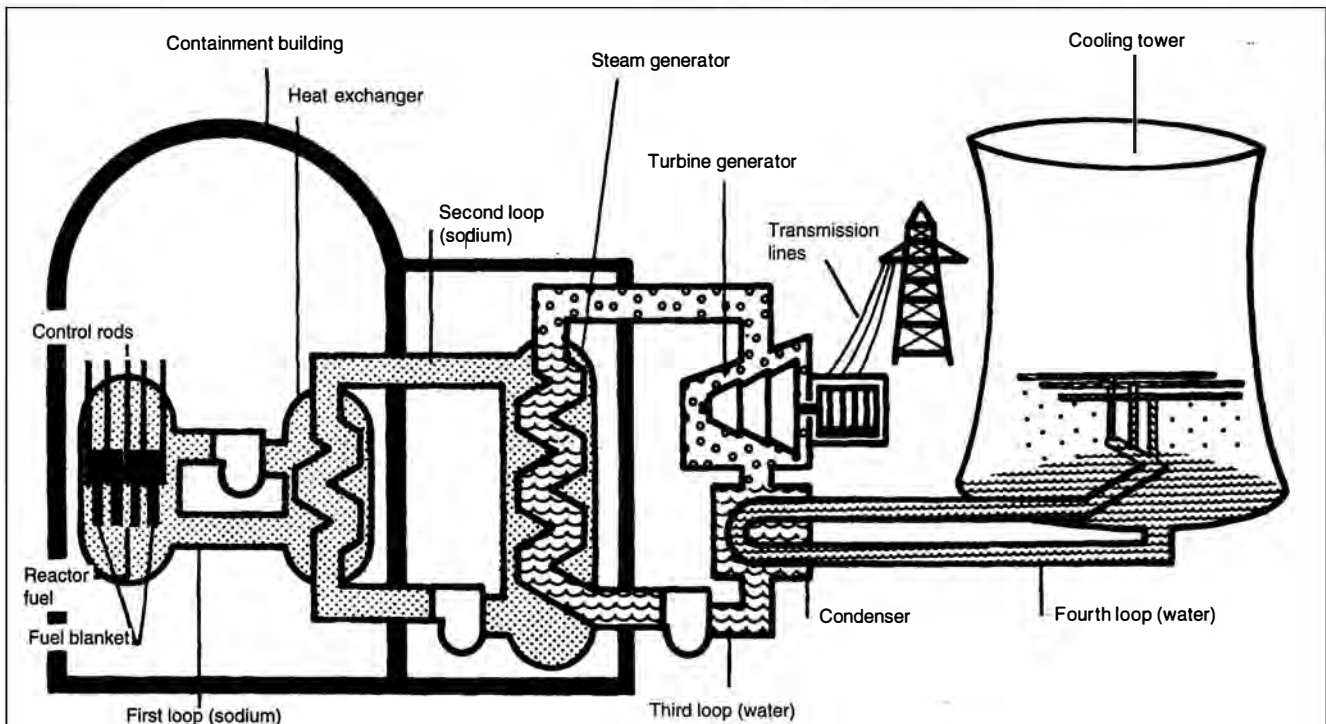
With minor exceptions, these new plants will have to be powered by coal, oil, natural gas, or nuclear fuels. But burning fossil fuels cannot go on indefinitely; the Earth's supply is limited, and we are burning them up at a rate of many millions of tons per day. Shouldn't we leave some of the coal, oil, and gas for future generations to use for transportation and feedstock for the manufacture of plastics and other essential products?

Nuclear power avoids all of the adverse health and environmental effects resulting from burning coal, oil, or natural gas to produce electricity. As the public becomes more concerned about these problems, its attitude toward nuclear power is changing. A substantial majority of the public believes that nuclear power will, and should, supplant coal as our primary source of electricity generation in the very near future. By early in the next century, the nuclear industry expects to be building

new nuclear power plants.

Because of exaggerated concern about nuclear safety, regulatory requirements on nuclear power plants were constantly tightened in the late 1970s and early 1980s. This process required frequent design changes in the course of construction, which led to a great deal of wasted time and effort. As a consequence, the cost of a nuclear plant, corrected for inflation, quadrupled—dollar costs increased 10-fold. The effect was to make nuclear power economically unattractive. No nuclear power plant construction projects have been started since the mid-1970s, and many dozens of projects have been cancelled.

The ostensible problem was that nuclear power plants were not conceptually designed for the super-super safety that the public now demands. Achieving improved safety by add-on systems is both inefficient and limited in what can be achieved. The nuclear industry has therefore started over with new conceptual designs and is developing a new generation of reactors that will be much safer even than those now in service. They will also be smaller and simpler, with far fewer things that can go wrong. One of their new features is passive stability; that is, even if electric power fails and the reactor operators simply walk away, no serious consequences occur. Electricity produced by these new nuclear reactors will be

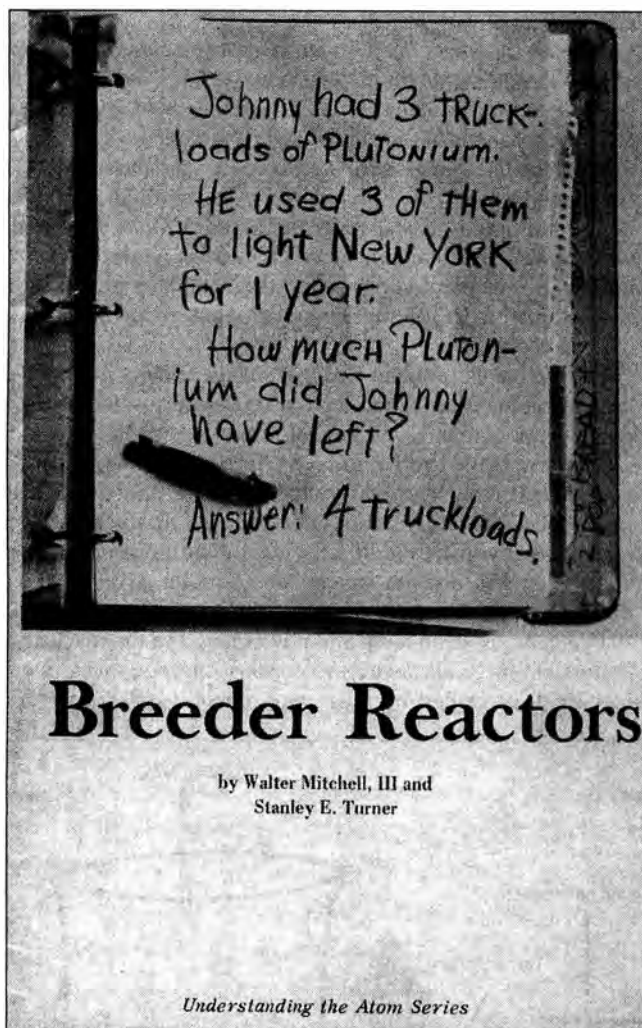


Source: DOE

Figure 1
HOW THE BREEDER REACTOR PRODUCES POWER

In this schematic of a liquid metal fast breeder reactor, sodium is circulated through the reactor core, which heats it to about 540°C (1,000°F). The sodium then passes through a heat exchanger to transfer its heat to an intermediate sodium loop. From there, the sodium moves to the steam generator where it heats water in a third loop to steam—about 480°C (900°F). The steam then turns the powerplant turbine and is then condensed and cooled in the fourth loop.

The breeder reactor fuel assemblies contain a mixture of plutonium-239 and uranium 238. Around the core is a "blanket" of fuel assemblies that contain only uranium-238. The blanket uranium absorbs the neutrons from the fission process in the core, turning the U-238 into Pu-239.



This is the cover of a 1971 educational booklet, one of 50 different topics published by the U.S. Atomic Energy Commission in its "Understanding the Atom" series.

somewhat cheaper than that produced by coal-burning power plants, their principal competitor.

But what about solar energy? some might ask. Isn't it true that solar causes no air pollution and will be available for billions of years, as long as life can exist on this Earth? Actually, nuclear and solar electricity are not in competition, because the latter is not available at night. Even if all goes very well in the development of solar electricity, it can be useful only for providing some additional power needed during the daytime. Any real competition between nuclear and solar electricity must therefore await the time when technology for storage batteries develops far beyond its present program goals.

Even if there were a competition between solar and nuclear electricity, there is no technically valid reason to prefer the former. Production of the materials for deploying a solar cell array requires burning 3 percent as much coal as would be burned in generating the same amount of electricity in coal-burning power plants. Roughly the same is true for the power tower and wind turbine applications of solar energy. That means that they produce 3 percent as much air pollution as coal burning. This is not a great environmental problem, but it still makes

them more harmful to health than nuclear power.

In addition, there are long-term waste problems of solar energy, which pose many times more of a health problem than the widely publicized nuclear waste. There are poisonous chemicals used in fabricating solar cells, and there is much more construction work needed for solar installations than for nuclear. Solar construction is a dangerous industry from the standpoint of accidents to workers.

There are some people who foresee the day when all our electricity will be solar, but they envision a very different world than our present one. It is a world of low technology and a simpler life, a more desirable lifestyle, in their view. It will of necessity be a life of more nonmechanized farming and manual labor, of fewer machines, comforts, and conveniences. They call it living in harmony with nature, but it might also be called sliding back toward the lifestyle of our primeval ancestors.

In such a world, they contend that there would be no place for large nuclear or coal-fired power plants, and little place for other large industrial operations except, presumably, for manufacturing solar cells.

Cheap, Plentiful Energy

For those looking for a nonpolluting and virtually infinite energy supply for an industrial—and not a primeval—society, however, there is another option: the nuclear breeder reactor system.

The breeder takes its name from the fact that it not only generates electricity but also produces its own plutonium fuel with extra to spare. (See Figure 1 for details on how the breeder works.)

The breeder reactor system has many other advantages.

It consumes *all* of the uranium fed in as nuclear fuel to produce energy, whereas the reactors now in use consume less than 1 percent of the uranium. Consequently, the raw fuel cost for the breeder is only 1 percent of that for present reactors. At the present uranium price of about \$25 per pound, the raw fuel cost for the breeder is equivalent to that of buying gaso-

Fact Vs. Fiction About Plutonium Toxicity

I have been closely associated professionally with questions of plutonium toxicity for several years, and the one thing that mystifies me is why the antinuclear movement has devoted so much energy to trying to convince the public that it is an important public health hazard. There is nothing in the scientific literature to support their claims. There is nothing scientifically special about plutonium that would make it more toxic than many other radioactive elements.

Eating or inhaling plutonium, as with any radioactive material, exposes a person's body organs to radiation which can cause cancer. Since 99.99 percent of plutonium entering the stomach fails to pass through the intestine walls and is directly excreted, the risk from eating it is relatively small—comparable to the risk of eating a similar quantity of

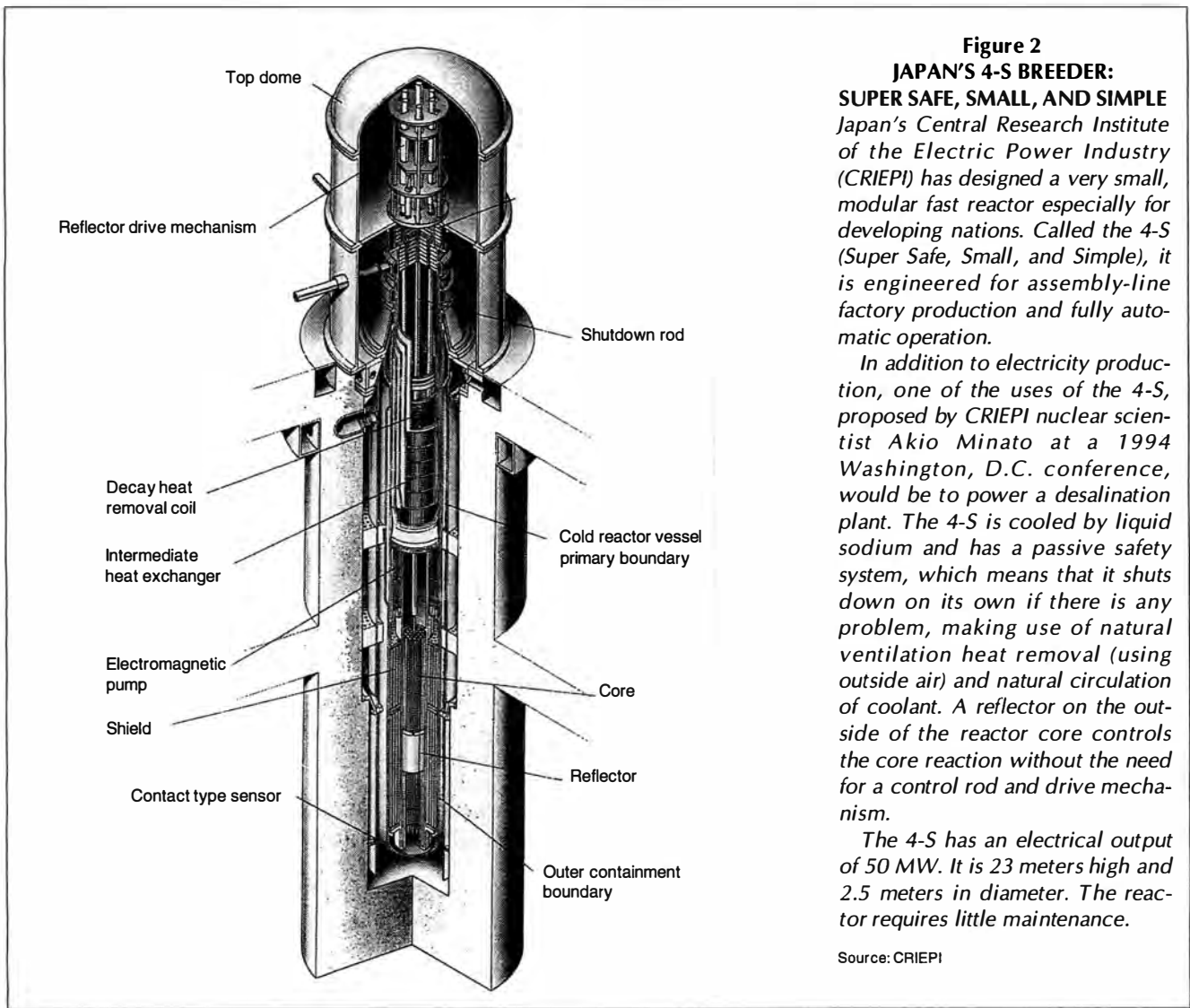


Figure 2
JAPAN'S 4-S BREEDER:
SUPER SAFE, SMALL, AND SIMPLE
 Japan's Central Research Institute of the Electric Power Industry (CRIEPI) has designed a very small, modular fast reactor especially for developing nations. Called the 4-S (Super Safe, Small, and Simple), it is engineered for assembly-line factory production and fully automatic operation.

In addition to electricity production, one of the uses of the 4-S, proposed by CRIEPI nuclear scientist Akio Minato at a 1994 Washington, D.C. conference, would be to power a desalination plant. The 4-S is cooled by liquid sodium and has a passive safety system, which means that it shuts down on its own if there is any problem, making use of natural ventilation heat removal (using outside air) and natural circulation of coolant. A reflector on the outside of the reactor core controls the core reaction without the need for a control rod and drive mechanism.

The 4-S has an electrical output of 50 MW. It is 23 meters high and 2.5 meters in diameter. The reactor requires little maintenance.

Source: CRIEPI

caffeine. Thus, the principal danger is inhaling plutonium as a fine dust. This gives an 0.4 percent chance of a fatal cancer per microgram of plutonium inhaled. But the magnitude of this risk has little meaning until we consider the probability of inhalation.

Elaborate analyses indicate that if one pound of plutonium dust were dispersed in the most effective way over a large city in average weather conditions, enough plutonium would be inhaled in the first hour or so, while it remains in the air over the city, to cause 19 eventual cancer deaths.

If no clean-up activities were undertaken, in the next year or so enough plutonium would be resuspended in air from places where it had settled to eventually cause an additional 7 cancers. After that, it would be sunk deeper into the ground, from where it could become inhalable only by plowing, construction, or equivalent natural processes.

Over the many thousands of years before the plutonium would decay away, these processes would have only a 20 percent chance of causing a single cancer death. If food

crops were later grown in that soil over a long time period, they might cause one additional death. Thus, the total health impacts of dispersing a pound of plutonium in the most effective way would be about 27 eventual deaths.

These cancers would not develop until 10 to 50 years later and would not be noticeable among the tens of thousands of cancers normally developing in the same population. It could not be used as a blackmail threat because, if people were forewarned, they could avert harm by breathing through a folded handkerchief or by remaining indoors for the first hour or two. There are many other materials that terrorists can obtain and disperse much more easily and that would instantly kill 100 times as many people.

Existing plants handling plutonium (for military applications) have little difficulty in complying with Environmental Protection Agency regulations on plutonium releases. Under these regulations, if *all* of our electricity were derived from breeder reactors, plutonium releases would cause less than 1 death per century in the United States.

Fission and the Breeding Process

The principal isotopes of uranium are U-235 and U-238; U-235, which is less than 1 percent of the total, is fissionable, while the more plentiful U-238 is not.

In a conventional fission reactor, a chain reaction of fissions of uranium-235 nuclei is set off; each nucleus splits, emitting fast neutrons in the process. When a U-235 nucleus is hit by a neutron, it can break in two (fission), releasing a great deal of energy and also some neutrons in the process—an average of 2.1 neutrons per hit. If one of these 2.1 neutrons hits another U-235 nucleus, and one of the neutrons from that reaction hits still another U-235 nucleus, and so on, there is a self-sustaining chain reaction with a steady release of energy rapidly converted into heat. This heat can be used to produce steam, which drives a turbine. The turbine then turns a generator to produce electricity.

If 1.0 of the 2.1 neutrons released in each collision is used to sustain the chain reaction, what happens to the other 1.1? Typically, 0.5 of the neutrons hit a U-238 nucleus that is also part of the fuel, while the other 0.6 are absorbed by structural materials or escape out the sides of the

reactor; that is, they are wasted.

When a U-238 nucleus is struck by a neutron, it is converted into plutonium, which can also be used as a nuclear fuel. Thus the overall effect of a neutron hitting a U-235 nucleus is to destroy 1.0 fuel atom (U-235) and create 0.5 (Pu). This is a net *consumption* of 0.5 fuel atoms, so the nuclear fuel will eventually be used up.

However, the plutonium can be mixed with U-238 to fuel a different type reactor in which an average of 2.5 neutrons rather than 2.1 is emitted when a neutron strikes a fuel nucleus. With improved design, fewer neutrons are absorbed by structural materials. By surrounding the reactor with a blanket of U-238, some of the otherwise escaping neutrons are caused to hit U-238, and in this way the number of wasted neutrons is reduced from 0.6 to 0.4.

Now, when a neutron hits a fuel nucleus, one of the 2.5 neutrons released is used to hit another fuel nucleus to sustain the chain reaction, 0.4 is wasted, and the remaining 1.1 hit U-238 nuclei to produce a new plutonium fuel atom. In this case, 1.0 fuel atom is destroyed while 1.1 is produced, so the fuel supply is increased.

line at a cost of 40 gallons for 1 penny!

Of course, many other costs are involved in producing the final energy product. In fact, purchasing raw uranium fuel contributes only about 0.03 percent to the cost of electricity from a breeder. Thus, even a 30-fold increase in the price of uranium would increase the cost of electricity by less than 1 percent (30×0.03 percent = 0.9 percent).

As rich uranium sources are depleted by fueling present-day nuclear reactors, the cost of uranium will go up. Sometime during the coming century it will be high enough to make breeders more economical than present reactors. How high can it go? One obvious very large source is the uranium dissolved in seawater which can be extracted at a cost of about \$500 per pound. Even at that price it would still increase the cost of electricity by much less than 1 percent.

But how long would that supply last? If all the world's electricity were derived from breeder reactors utilizing fuel derived from seawater, the uranium now dissolved in oceans would last for 7 million years. But this ignores the uranium that rivers dissolve out of rocks and carry into the oceans. When this is taken into account, there would be essentially no depletion of the uranium in the oceans. In fact, we could withdraw 25 times the amount of uranium required to provide the entire world's present electricity usage—which is twice the world's present total energy consumption—without appreciably affecting the concentration of uranium in the oceans.

With due consideration for geologic cycles of erosion and uplift of land masses, uranium in rocks will be available and this process can continue for billions of years, which is as long as the Sun will survive in its present form before swelling into a giant star that will convert the Earth into a molten mass, incapable of sustaining life. Effectively, it is "forever."

We thus conclude that the breeder reactor can provide all of mankind's energy requirements forever, without the raw fuel costs increasing the price of electricity even by as much as 1 percent. This makes it an equivalent of solar energy as an everlasting energy source that produces no air pollution.

Short-term Political Thinking

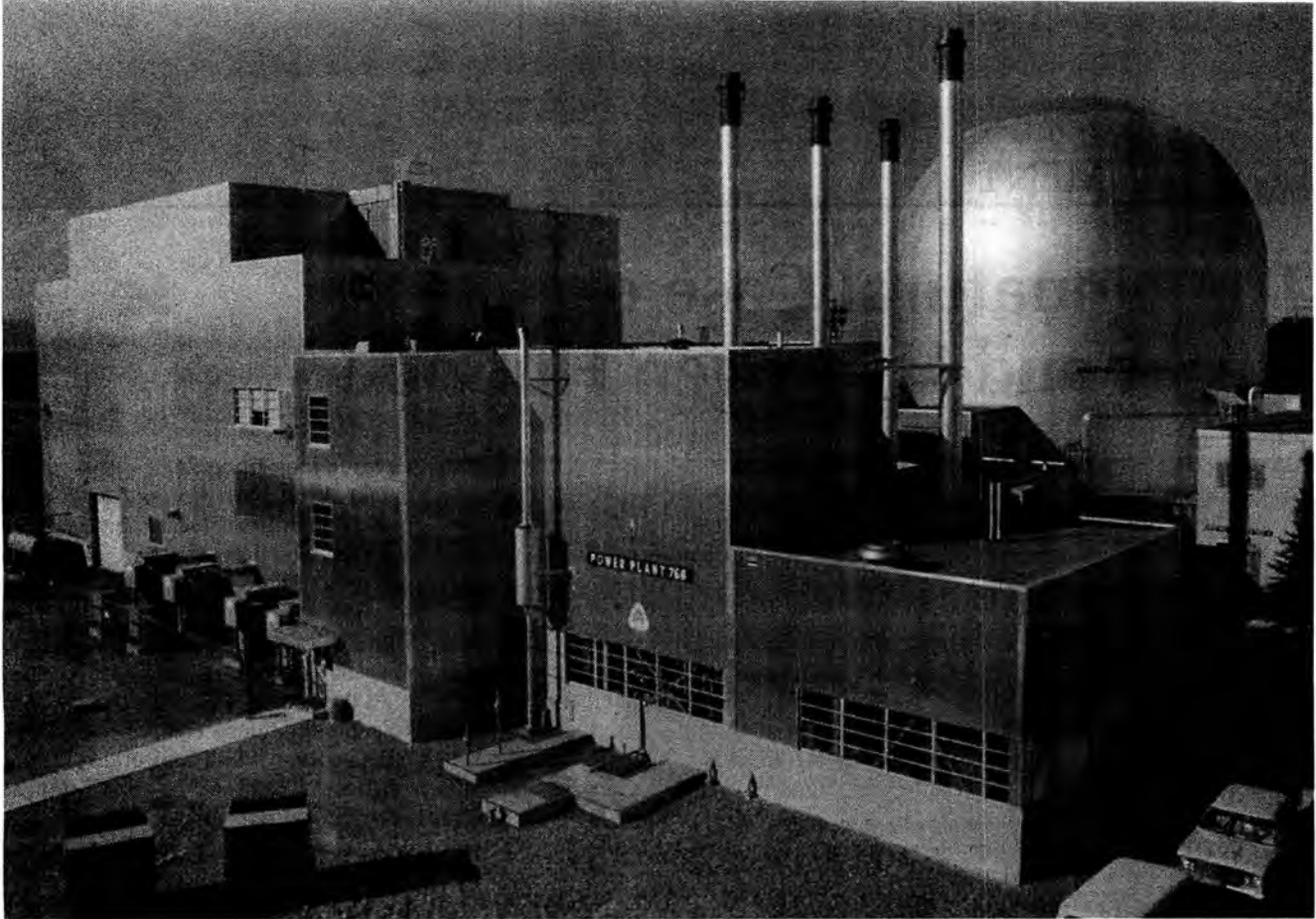
Of course, political decisions are made to satisfy problems of the next decade or so, with little consideration for the far future. Because of the increased complexity of breeder reactors, the electricity they generate initially would cost about 25 percent more than electricity from present-day reactors. Recent discoveries of rich new deposits of uranium ores have put off the time when uranium price escalation will make the breeder competitive.

The U.S. government program to develop the breeder was terminated, for political reasons, using the argument that there was plenty of uranium. Breeder development continues in Japan, France, and Russia, but there is substantial political pressure to stop it. Most of this comes from antinuclear groups that oppose nuclear energy at every turn.

The antinuclear propaganda has "demonized" plutonium, which is produced and consumed in breeder reactors. The antinuclear groups have grossly exaggerated its toxicity and the problems in handling it safely and in keeping it contained (see box). Responses to those claims are amply presented in the scientific literature, and in a scientific debate, the arguments of the antinuclear activists would get nowhere. Things are very different in propaganda battles, however, and the antinuclear activists have had a large impact.

Aside from the irrationality of the antinuclear groups, why should breeder reactor development continue now?

First, even if development goes forward at the hoped-for



U.S. Department of Energy

For about 30 years, the United States led the world in the development of breeder reactor technology, carrying out the spirit of the postwar Atoms for Peace program. Taking their cue from the United States, the other industrialized nations, in particular France, began nuclear power programs, including the development of the breeder reactor.

The world's first breeder reactor, Clementine, started up at Los Alamos National Laboratory in 1946, just after World War II and produced 25 kilowatts-thermal. By 1951, the nation put on line the world's first nuclear breeder that produced usable amounts of electricity—the Experimental Breeder Reactor or EBR-I, which produced 200 kw-electric at its peak. Constructed by Argonne National Laboratory in Arco, Idaho, the EBR-I was followed by EBR-II (shown here), which was connected to the Idaho power grid and began producing power in 1962, reaching a full operating power level of 62.5 megawatts-thermal. The next stage U.S. breeder reactor, the Integral Fast Reactor at Argonne, has been killed by antinuclear opposition.

pace, it will be many years before the first commercial breeder can become operational and many more before its use could become widespread. It is better to start up a new technology slowly, allowing the “bugs” to be worked out before a large number of plants are built.

Second, we are not that certain about our uranium resources; they may be substantially below current estimates. Having the breeder reactor ready would be a cheap insurance policy against that eventuality, or against any sharp increase in uranium prices for whatever reason.

Third, the breeder reactor development program has substantial momentum, with many scientists, engineers, and technicians deeply involved. It is much more efficient to carry the program to completion now than to stop it, and then start over later with a new team of personnel, who would have to be educated and trained.

Fourth, it is possible that a fully developed breeder reactor system may provide electricity at a competitive price. Breeder reactors have some inherent technical advantages over present-day reactors; for example, they can operate at higher temperatures, and they avoid the high pressures that lead to most potential accident scenarios for today's reactors. Furthermore, the United States is now generously supporting solar electricity de-

velopment, which is infinitely further away than breeder reactors from ever becoming cost competitive.*

If we develop the breeder reactor, we may well go down in human history as the generation that solved mankind's energy problems for all time. Perhaps that would help to compensate for the fact that we have consumed such a large fraction of the Earth's mineral resources, including not only the coal, oil, and gas, but also the copper, nickel, zinc, lead, tin, and a host of other materials. Every generation provides benefits and burdens for future generations. Surely we want the former to exceed the latter for our generation.

Bernard L. Cohen, Professor of Physics and Environmental and Occupational Health at the University of Pittsburgh, is one of the nation's foremost nuclear authorities. He has authored more than 250 scientific articles as well as articles and books for nontechnical audiences on nuclear energy, including The Nuclear Energy Option: An Alternative for the 90s.

Notes

- * The Japanese have estimated that by applying the latest research developments to the breeder reactor plant design, the construction costs could be cut to less than that of conventional light water reactors today. See “The World Needs the Plutonium Option!” by Masao Hori, *21st Century*, Winter 1994-1995, p. 44.

The Unnatural Case of NASA and Hydrogen Fluoride



No natural sources? Dr. Mark Schoeberl, UARS Project Scientist, and Dr. Anne Douglass, UARS Deputy Project Scientist, at the Dec. 19 press conference.

"Three years of data from NASA's Upper Atmosphere Research Satellite (UARS) have provided conclusive evidence that human-made chlorine in the stratosphere is the cause of the Antarctic ozone hole," stated a NASA press release Dec. 19, 1994.

"These results confirm our theories about CFCs," said Dr. Mark Schoeberl, UARS Project Scientist. "The detection of stratospheric fluorine gases, which are not natural, eliminates the possibility that chlorine from volcanic eruptions or some other natural source is responsible for the ozone hole," Schoeberl continued.

"Hydrogen fluoride [HF] has no natural source; it is not produced by volcanic eruptions or salt spray," added Dr. Anne Douglass, UARS Deputy Project Scientist, who joined Schoeberl in a press conference at the Goddard Space Flight Center. Their Dec. 19 NASA press conference, as with previous such press

conferences on the ozone hole, became headlines around the world, in articles and editorials using even more absolute terms to tell a gullible public that NASA scientists had now "proved" once and for all that *only man-made chlorofluorocarbons* were destroying the ozone layer and thus putting Earth's inhabitants in great danger.

If Volcanoes Could Talk . . .

The problem with this latest NASA campaign on the ozone hole is the same as that of previous pronouncements blaming man-made CFCs: It simply is not true. For decades, scientists have been measuring hydrogen fluoride from both volcanoes and sea spray, and these observations are readily available in the scientific literature—which should be known to NASA scientists. When questioned on this point, Schoeberl replied that natural sources are "not significant."

Readers of *21st Century* will be familiar with this documentation from *The*

Holes in the Ozone Scare: The Scientific Evidence That the Sky Isn't Falling, the book written by Associate Editor Rogelio Maduro, which notes that volcanoes inject more than 6 million tons of fluorine into the atmosphere yearly, compared with the 2,480 tons of fluorine allegedly released by CFCs.*

As the accompanying articles indicate, volcanic fluoride is emitted primarily as HF. Even the World Meteorological Organization (which has supported the ozone hoax) states this in its 1989 "Scientific Assessment of Stratospheric Ozone," and the data are not new.

The real question is why NASA decided at this particular time to release the hydrogen fluoride story and proclaim in such absolute terms that the ozone case was closed. Is it possible that the absoluteness of ozone pronouncements has escalated in response to the growing numbers of people who are looking beyond the scare story—at the scientific evidence that the sky isn't falling?

—Marjorie Mazel Hecht

Notes

* *The Holes in the Ozone Scare* is available from *21st Century* for \$18 postpaid or for \$10 when purchased with a subscription to this magazine. See the inside back cover for details.

Atmospheric Scientist 'Shocked' By NASA Ozone Announcement

Dr. Hugh W. Ellsaesser, an atmospheric scientist with more than 45 years of experience in atmospheric and climate research, talked with *21st Century's* Mark Wilsey about the NASA press conference and announcement on hydrogen fluoride. Ellsaesser is now a guest scientist at Lawrence Livermore National Laboratory. Here are excerpts from his re-

FRENCH VOLCANOLOGIST: Volcanoes Emit Tons of HF

by Emmanuel Grenier

"NASA should subscribe to *Nature* magazine," was the comment of French volcanologist François Le Guern, upon learning of the NASA press conference on hydrogen fluoride (HF) and ozone depletion. Le Guern was referring to an August, 1988 article by Robert Symonds, et al.¹ in which the global volcanic emissions of HF were estimated to be between 60,000 tons and 6 million tons per year.

Le Guern specializes in studying and measuring gases emitted by volcanoes throughout the world. Last year he was part of a French expedition to Mt. Erebus in Antarctica where he measured precisely the contents of gases emitted into the atmosphere by the volcano's lava lake. He presented his results to the annual congress of the Volcanological Society of Japan.

He found that Mt. Erebus was emitting between 150 and 240 tons per day of chlorine, 50 to 80 tons per day of fluorine, and 350 kg per day of lead. "Fluorine is a very difficult gas to measure," Le Guern said. "That is why many teams in the world do not measure it. But that certainly does not mean that it is not emitted by volcanoes."

"Fluorine analysis of plants collected near active volcanoes," he added, "showed fluoride pollution up to a few

tens of kilometers from active craters." Even around Mt. Etna in Italy, he said, "the content of fluorine in the surrounding vegetation is 10 to 30 times greater than normal."²

'Impossible' Not to Know This

Symonds et al. estimated that 5,000 to 500,000 tons per year of HF were explosively injected into the stratosphere by volcanoes.¹ This wild discrepancy of the daily and yearly measurements should not be a surprise, Le Guern said. There is a very large natural variation of the amounts of gases emitted by volcanoes and the measurements are still very rare. Even for a well-known volcano like Mt. Etna, he said, there is no continuous measurement of gases for periods longer than a few weeks. That is why most of the honest figures about gases emitted by volcanoes are given with such a wide range of variation.

The fact remains, however, that contrary to what NASA's Mark Schoeberl said at the Dec. 19 press conference, volcanoes emit huge quantities of fluoride.

"It is impossible that they did not know that," Le Guern said of the NASA scientists. "Even if they were not specialists in that particular field, a simple bibliographical search would have shown them dozens of articles on the subject."

chlorine. And most people have interpreted this to mean either that there was a higher level of chlorine in the stratosphere previously, so that the percentage changes are less, or that there are sources of chlorine other than just the CFCs. . . .

"We have also been aware that the temperature, the amount of water vapor, and the amount of sulfate particles are more important in determining the year-by-year development of the ozone hole than is the level of chlorine.

"When the hole was originally being observed in the 1980s, we saw a biennial oscillation; it would go deeper one year than the next year. It



NASA

The Halogen Occultation Experiment (Haloe) measurements of hydrogen fluoride during the Antarctic spring, Sept. 21 to Oct. 15, 1992. The gas was used as a tracer to track the transport of ozone from the edge of the vortex region to the midlatitudes and tropics.

Emmanuel Grenier is editor of the French-language magazine *Fusion*.

Notes

1. R.B. Symonds, W.I. Rose, and M.H. Reed, 1988. "Contribution of Cl- and F-bearing Gases to the Atmosphere by Volcanoes," *Nature*, Vol. 334, No. 6181 (Aug. 4), pp. 415-418.
 2. F. Le Guern, R.X. Faivre-Pierret, and J.P. Garrec, 1988. "Atmospheric Contribution of Volcanic Sulfur and Its Influence on the Surrounding Vegetation," *Journal of Volcanology and Geothermal Research*, Vol. 35, pp. 173-178.
- See also: J.P. Garrec, A. Lounowski, and R. Plebin, 1977. "The Influence of Volcanic Fluoride Emissions on the Surrounding Vegetation," *Fluoride*, Vol. 10, pp. 152-156.

marks:

"I was a little shocked when I saw it [the NASA announcement] because I saw nothing new in it. . . . It just rings of propaganda, because it was nothing new, it simply repeated claims that had been made before, and now acts as though this information makes it clear.

"Not too many years ago there was a volcanic eruption in Iceland which put out enough fluorine to kill hundreds or thousands of people and animals. I think it was Hekla in 1947. . . .

"They have been tracking the levels of fluorine and chlorine, and the fluorine has been increasing percentage-wise much more rapidly than the

would jump back and forth on a biennial oscillation, while chlorine was increasing steadily. . . .

"There has also been a recent paper which claims that the previous statements that nitrogen oxides were the dominant factor in reducing ozone in the lower stratosphere are incorrect; that the dominant destruction of ozone in the lower stratosphere is due to oxides of hydrogen—HO, HO₂. I haven't seen any particular responses to this paper, and I think most people are accepting it as being correct. It is going to change the ideas on stratospheric chemistry considerably if it holds up. . . .

GLOBAL CLIMATE CHANGE

'We Are Unable to Answer Even the Most Basic Questions'

by Marsha Freeman

From the way news reports and periodicals describe global warming, the ozone hole crisis, and other climate catastrophes, anyone would assume these dire predictions and calls for government action are based on the most rigorous scientific data. Not so.

In an eye-opening presentation at the 45th Congress of the International Astronautical Federation in Jerusalem in October 1994, John E. Estes from the National Mapping Division of the U.S. Geological Survey demolished the idea that we have the information needed to make policy decisions regarding global climate change.

Estes showed that different data sets have discrepancies in values of *as much as 100 percent* in basic categories of information needed to assess influences on world climate. In one example—that of land cover—estimates of forest land worldwide vary from 50 to 100 million square kilometers, Estes said (see figure).

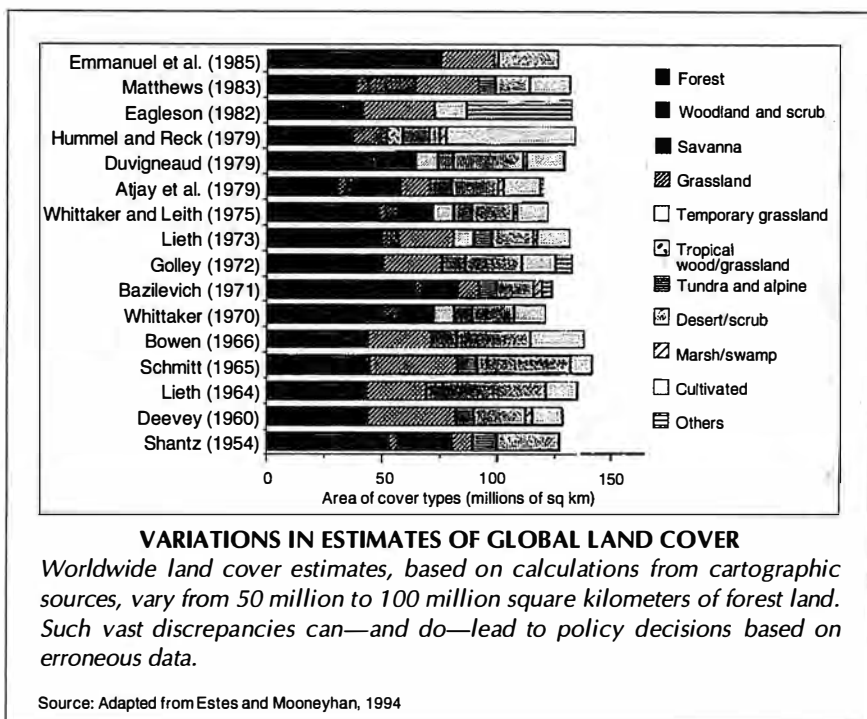
He concluded, quoting from a report of the International Geosphere/Biosphere Program, "At present we are unable to answer even the most basic questions."

We do not know if the deserts are really spreading, he stated, or whether deforested land is being used for agriculture or being wasted. So how can we make predictions of how these supposed changes will effect factors such as the net emissions of greenhouse gases? A model without data has no predictive value, Estes said, yet important policy decisions are being made based on such faulty models.

The Mythical Map

In order to make sensible decisions about the environment, Estes explained, we "need to stop perpetuating the mapping myth." Common misconceptions about maps and mapping, Estes said, are:

- The Earth is well mapped.
- Maps represent reality.
- Maps are accurate and up to date.



VARIATIONS IN ESTIMATES OF GLOBAL LAND COVER

Worldwide land cover estimates, based on calculations from cartographic sources, vary from 50 million to 100 million square kilometers of forest land. Such vast discrepancies can—and do—lead to policy decisions based on erroneous data.

Source: Adapted from Estes and Mooneyhan, 1994

- Mapping is easy, fast, and inexpensive.
- Everyone knows how to read maps.
- Satellite images are maps.

It must be recognized, Estes warned, that all maps are generalizations, and not exact replicas of reality. All maps have inherent biases: The cartographer decides what is important to map, which may not be the data needed for specific purposes. Maps are also perishable and become obsolete as data change with time.

In a recent article for *Photogrammetric Engineering & Remote Sensing* magazine, Estes and D. Wayne Mooneyhan review the many difficulties that preclude the scientific mapping of the Earth.¹ These include the classified status of high-resolution data gathered by military satellites; a lack of resources and expertise in developing countries; and the paucity of political and financial support even in developed nations to produce scientific sets of data.

As if to prove Estes right on this last point, the new Republican leadership of the U.S. Congress is now actually considering closing the U.S. Geological Survey to "save" \$580 million annually, according to the daily *Fairfax Journal of Fairfax, Va.*, Nov. 25, 1994.

The State of U.S. Maps

One would expect that the United States, which pioneered the science and the technology for remote sensing from satellites and other platforms such as airplanes, would at least have accurate, up-to-date high-resolution maps.

Estes and Mooneyhan report that although 100 percent of the United States has been covered at a scale of 1:24,000, only 14 percent of the mapping data of the country is less than 10 years old, while 9 percent is more than 40 years old.

The authors recommend that researchers need to "look beyond pursuit

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El Niño, Not Global Warming, Likely Culprit in Weather Anomalies

by Carol White

NASA

An artist's rendering of the Topex/Poseidon satellite. This joint project of the U.S. and France has provided details of the ocean's topography and currents, including the El Niño phenomenon.

With the mercury hovering at 100°F for the whole of August 1994, the Japanese had something to complain about—and environmentalists had a field day. Disregarding the fact that the southern United States had an unusually cool summer, the greens tried to convince the credulous that Japan's temperature was a confirmation of the global warming hypothesis. The Earth's atmosphere is heating up because of an enhanced greenhouse effect caused by carbon pollutants, they claimed.

For those of us who remember that global warming is supposed to raise temperatures perhaps as much as 7°F over a 50- to 100-year period, this was a pathetic effort. Moreover, recent climate data have failed to substantiate predictions of global warming models. One reason given to explain this is the supposed counter-cooling effect of sulfur particulate emissions into the atmosphere.

While weather anomalies over the past decade are unconnected with purported thinning of the ozone layer or a possible greenhouse effect, they do appear to relate to cyclical shifts in atmospheric and oceanic currents, known as an El Niño/Southern Oscillation (ENSO).

The name El Niño (Spanish for the Christ Child) was chosen because every winter at Christmas time there is a shift

in the Pacific Ocean current that brings warm water off the coast of Peru. This benefits agriculture by bringing heavy rains to the region during the Southern Hemisphere's growing season. Easterly trade winds in the equatorial Pacific sweep up the warmer, upper ocean layers in the western Pacific and carry them eastward, heating the coastal waters in the process.

An El Niño event is more severe and of longer duration than this current shift, sometimes several years. Lapses between these events may be as little as two years or as long as seven. The period 1982-1983 saw the most severe El Niño of the century, and now we are in another such cycle. This has created a serious problem for the Peruvian fishing industry because anchovies need cold water to thrive.

Global Weather Shifts

An ENSO is really a global rather than a local weather shift. In 1982-1983, not only was anchovy fishing disrupted off the coast of Peru, but there was a below-average Indian monsoon and at the same time severe rainfall in Colombia, Paraguay, and the border area between Argentina and Brazil.

Meteorologists also believed that there was a correlation between the Pacific ENSO and the severe drought in the African Sahel, equatorial East Africa and

Australia, although they had no way of modeling such a correlation. ENSO events such as this appear to be rotations of the weather system as a whole, so that there is an easterly shift in ocean currents, accompanied by a southerly shift of the jet stream.

One effect of this is to cause abnormally light monsoons in India. It is when the jet stream gets "stuck" that one gets abnormal droughts and heat spells because there is then less of the normal variation of high and low pressure regions with accompanying rainfall.

The 1967-1977 El Niño brought drought to California and a record cold winter in the central and eastern United States. In 1991-1992 there was another relatively mild El Niño, and apparently now we are at the beginning of yet another ENSO. NASA announced in January that data from the ocean-observing Topex/Poseidon satellite had confirmed that El Niño "is back and stronger than in 1993." In a Jan. 24 press release, NASA noted that El Niño "can bring devastating weather to several parts of the world, including the recent heavy rains and flooding in California, and the warmer than normal winter in the eastern United States."

The 1982-1983 El Niño was the most intense in this century, and evidence

Continued on page 57

Earth First! Admits It's a Terrorist Cult

We reprint here from Earth First! Journal, Dec. 21, 1994, Vol. 15, No. 2, the column by Earth First! leader Mike Roselle, which states plainly what Earth First! is about—terrorism.

The column is reprinted in its entirety, including its crude language, so that readers can use it in representing what Earth First! stands for in the group's own words, taken in full context.

Although other environmentalist groups have professed not to support the terrorist policies of Earth First!, it is not always true.

To note two examples: Barry Clausen, an undercover investigator who infiltrated Earth First! for several months, documented that many Greenpeace members were openly active in Greenpeace by day while stealthily active in Earth First! by night. (See Barry Clausen, "Inside Earth First! A True Story about Terrorists," 21st Century, Spring 1994, p. 52.)

The Danish television documentary on Greenpeace, "The Man in the Rainbow," shows film footage of demonstrations in California sponsored by Greenpeace and Earth First! and includes an interview with Mike Roselle bragging about the long-standing collaboration between the two groups.

Another undercover investigation, this one by the Sahara Club, documented that mainstream environmentalist group leaders were willing to turn over cash to Earth First! for "a felony mail fraud operation" in order to "embarrass a major oil company" (Sahara Club U.S.A. Newsletter #6).

Forest Grump

by Mike Roselle, Earth First!

Their Big Ten memberships decline because people no longer believe the braggadocio that saturates their direct mail like the smell of urine in the bathroom of a biker bar. They whine and worry. The mainstream environmental groups are quickly becoming irrelevant.

Their Democratic lunch mates are out shopping for bubble wrap to protect the bone china on their trip back home, where these frightened little dems will wrap themselves in the flag, call for mandatory school prayer, and support

Earth First!

The Man Without a Bioregion

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Their Democratic lunch mates are out shopping for bubble wrap to protect the bone china on their trip back home, where these frightened little dems will wrap themselves in the flag, call for mandatory school prayer, and support concentration camps for anyone caught without papers. Endangered species will cease to mean anyone who is white, male, with a "decent job" raping the Earth. Ollie North was a role model for these chumps—any sleazy thing it takes to get reelected.

So who needs them? Good-bye Tom Foley, you pathetic has-been. You've played too long for the salmon-shredding aluminum companies and big timber. Too bad you didn't take Max Baucus with you. (Still helping that sheep over the fence, Max?) We are, however, a little bummed that we lost Dan Hamburg. Dan told us in Washington last year that although he supports the Headwaters bill, what he'd really like to see is Charles Hurwitz behind bars!

Sadly we retained the ultimate liberal scumbag, Pat Williams, who tried to give the Wild Rockies to his bosses in timber, mining, oil and grazing. He actually convinced the Montana Wilderness Society, the Sierra Club and Senator Conrad Burns that his bill was a pro-wilderness bill. It's a good thing Conrad believed our corporate patsy, or else, with Burns' support, the Williams bill could have become law.

It's ironic that if Montana had selected another philosophical liberal instead of Mr. Burns, we'd see Williams and his newly-minted succubus back in Congress with a new plan to transfer control of Montana's last roadless areas to the criminals we call businessmen. With the "new bipartisanship," the corporate-government twine will try to squeeze one more drop of blood from the planet before retiring to their condos in Maui.

FOREST GRUMP

What the Democrats are guilty of, and what the big national environmental groups are guilty of, is complacency in the face of serious crimes. In an outrageous example, they fear to say what they know is true about Ollie North. These plaintiffs are acting like they actually enjoy being walked all over! Bend over Sierra Club Legal Defense! While sucking up to forest health or ecosystem management they say cutting thousand-year-old trees is okay. It doesn't pose any kind of moral, legal, or ecological problem. Like Eichmann, the big groups have suspended moral judgment and now collaborate with the exterminators of the forest. Read Hannah Arendt: the Nazis, like the US Forest Service, could not succeed without such support.

Fortunately the grassroots groups, with a few exceptions, are sticking to their guns. We don't care who is in power in Washington, but whoever stands on the wall of Babylon will be a target for our arrows. When we see the crowd, it will matter not who holds the keys to the corporate wastelands, or who has severed pecking at National Airport, because we will be out trading their lies and deluding ghosts on the grounds of their racist country clubs. What we want is nothing short of a revolution.

Back that crap you read in Wild Earth or in Consequences of an Eco-Warrior. Monkeywrenching is more than just sabotage, and your goddamn right it's revolutionary! This is jihad, pal. There are no innocent bystanders, because in these desperate hours, bystanders are not innocent. We'll broaden our theater of conflict. What happens in Berkeley, Ho Chi Minh City, Rio de Janeiro, in the frozen and radioactive wastes of Siberia does matter—even if it's not in our wilderness proposal.

Everything, every assumption, every institution needs to be challenged. Now! Now, because it will reveal unconceivable truths conveniently overlooked. Of course this may lead to a decline in speaking fees or hurt your chance to buy that ranch in the Rockies. But since you're confessin', Dave, why do you still

want to be buddies with the cheap suits who, after two decades in still polluting the agenda in Washington, D.C., care if it really is the movement's interest to make sure the message sounds reasonable in Orange County and does not critique the capitalist system?

It may also alternate some of our big shot new age businessmen whose hands are dripping with milk and petroleum, whose profits are wrapped up the flesh of ancient forests, and who think that just because they made a billion dollars they own it all and that they get doesn't stink.

Remember tree spitting? As I write this, I am looking up at the three-pound hammer that Spitzer used to nail the Post Office Timber Sale to the Sierra-Salween's green forest. Everyone knows these politicians have had to be spitted high and low. Why? Because it would save them? Not because it was necessary to send a message to those bastards in green slippers, those cowards with forestry degrees. Examine the profile of the chief butcher himself, Jack Ward Thomas, and you'll find the lingering label impression of Dave Foreman, who abandoned Spitzer and all monkeywrenchers when he copied a glass and deserted his friends. Spitzer, who also stood up for what he did and what he knew was right. Dave dismissed Spitzer's wisdom as an insult judgment. Read my book, he says, and read those don't get caught.

Yeah, right. At the New Year comes in, I am saddened to find Consequences marked down from \$20 to \$12. Who says the public can't recognize the truth? Spitzer was right to spite the four Ollie Timber Sale. If he had stayed home, ABC News would not have flown out to Cover/Maui to take the struggle national.

And more spitting is needed to corrupt the agency of the streets in very little is happening. Too many anarchists are nervous walking around town in camouflage and get their suckers all over half of street, and I promise you this: you might get caught, you might be right to spite the four Ollie Timber Sale. But you will never have to split the same one more time.

Spitzer was ahead of them. Climb out of the same one. Now! Now, we will not wait up an answer. We will not wait the Democrats on the Sierra Club. As Orange County said once, "Don't cry for me Arizona!"

—MIKE ROSELLE

concentration camps for anyone caught without papers. Endangered species will come to mean anyone who is white, male, with a "decent job" raping the Earth. Ollie North was a role model for these chumps—any sleazy thing it takes to get reelected.

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with Burns' support, the Williams bill could have become law.

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Fortunately the grassroots groups, with a few exceptions, are sticking to their guns. We don't care who is in power in

Washington, for whoever stands on the walls of Babylon will be a target for our arrows. When we raze the citadel, it will matter not who holds the keys to the corporate washroom, or who has reserved parking at National Airport, because we will be out trashing their limos and doing donuts on the greens of their racist country clubs. What we want is nothing short of a revolution.

F[—]k that crap you read in *Wild Earth* or in *Confessions of an Eco-Warrior*. Monkeywrenching is more than just sabotage, and your g[—]damn right it's revolutionary! This is jihad, pal. There are no innocent bystanders, because in these desperate hours, bystanders are not innocent. We'll broaden our theater of conflict. What happens in Bangkok, Ho Chi Minh City, Rio de Janeiro, in the frozen and radioactive waters of Siberia does matter—even if it's not in our wilderness proposal.

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“Go out and get them suckers, fill 'em full of steel, and I promise you this: you might get caught; you might do some time; your friends might abandon you. But you will never have to spike the same tree twice.”

It may also alienate some of our big shot new age businessmen whose hands are dripping with teak and petroleum, whose profits are wrapped in the flesh of ancient forests, and who think that just because they made a billion dollars they own it all and that their shit doesn't stink.

Remember tree spiking? As I write this, I am looking up at the three-pound



Mike Roselle, as seen in the Danish television documentary “The Man in the Rainbow.”

hammer that Spicer used to nail the Post Office Timber Sale in the Salmon-Selway's green forests. Everyone knew these magnificent trees had to be spiked high and low. Why? Because it would save them? No! Because it was necessary to send a message to those butchers in green uniforms, those cowards with forestry degrees. Examine the posterior of the chief butcher himself, Jack Ward Thomas, and you'll find the lingering labial impression of Dave Foreman, who abandoned Spicer and all monkeywrenchers when he copped a plea and deserted his friends. Spicer, who alone stood up for what he did and what he knew was right. Dave dismissed Spicer's selfless act as bad judgment. Read my book, he says, and next time don't get caught.

Yeah, right. As the New Year comes in, I am saddened to find *Confessions* marked down from \$20 to \$2. Who says the public can't recognize the truth? Spicer was right to spike the Post Office Timber Sale. If he had stayed home, ABC News would not have flown out to Cove/Mallard to take the struggle national.

And more spiking is needed to convey the urgency of the situation! Very little action is happening. Too many armchair eco-warriors walking around town in camo. Go out and get them suckers, fill 'em full of steel, and I promise you this: you might get caught; you might do some time; your friends might abandon you. But you will never have to spike the same tree twice.

We are not afraid of Newt Gingrich or the wise use movement. We will not suck up to anyone. We will not miss the Democrats or the Sierra Club. As George Bush said once, “Don't cry for me Argentina.”

El Niño

Continued from page 55

shows that the Pacific waters have never recovered from it. In particular, waters off the shore of Japan are known to be abnormally hot, and this is believed to have caused the abnormally hot August.

Some researchers believe that the record rainfall that caused severe flooding in the Mississippi river basin in 1993 was a delayed effect of the 1983 El Niño. Efforts are now being made to check out this hypothesis.¹

Normally, an El Niño is followed by a counterbalancing, opposite shift in atmospheric and ocean currents (called La Niña). In the past 10 years there has been only one La Niña event, while there have been four ENSOs in the past five years. Why this is, nobody knows, but it is certainly creating an anomalous weather situation.

A provocative article by Richard Kerr in *Science* reports that some weather model simulations show that ENSOs could “masquerade” temporarily as greenhouse warming over 20-year periods.²

There may also be an interesting correlation between sea surface temperatures and ozone thinning. In a recent article in *Air & Space* magazine, Carl A. Posey reports on a thesis by meteorologist James Angell, who has worked at the National Oceanic and Atmospheric Administration air resources laboratories for the past 30 years. According to Posey, Angell believes that thinning of the ozone layer is correlated with a stratospheric wind known as the quasibiennial oscillation because of its pattern of reversing direction approximately every two years.

The same article points also to work by Walter Komhyr, a colleague of Angell, who also sees a correlation for 21 of 27 years between sea surface temperatures in the eastern equatorial Pacific during June, July, and August and the amount of ozone in the Antarctic stratosphere in October. Such temperature shifts correlate to ENSOs as well.

Notes

1. Michael J. McPhaden, 1994. “The Eleven-year El Niño?” *Nature*, Vol. 370 (Aug. 4), p. 326.
2. Richard A. Kerr, 1994. “Did the Tropical Pacific Drive the World's Warming?” *Science*, Vol. 266 (Oct. 28), p. 544.
3. Carl A. Posey, 1994. “Ozone Forecast: Partly Cloudy” *Air & Space* (Oct.-Nov.), p. 28.

'Controlled Fusion, Soon!'

by Charles B. Stevens

Dr. Edward Teller gave the keynote address to a privately sponsored international meeting held to review the status of fusion energy, in Washington, D.C., Nov. 14-18. Teller noted that the inertial confinement fusion program is the most promising line of development, at least in the short term, and he also discussed the short-term possibility of coupling a nuclear reactor with a plasma focus device as a source of neutrons.

The meeting, the First International Symposium on the Evaluation of Current Trends in Fusion Research,* was sponsored by the Global Foundation, Inc., a nonprofit foundation set up to examine global issues like energy and the environment, as well as issues at the frontiers of science, from particle physics to the evolution of the universe.

More than 40 papers on fusion concepts and technologies were presented, almost all of them on alternative approaches to the mainline tokamak. The deliberations included the review of the mainline laser fusion approach in inertial confinement, various dense magnetic plasma systems, electrostatic confinement, colliding beam, and combined inertial-magnetic fusion systems.

Although the meeting invitation was extended to the entire fusion community, only one tokamak representative responded and presented a paper—Dr. Bruno Coppi from the Massachusetts Institute of Technology—according to the conference organizers.

The gathering brought together many pioneers of U.S. nuclear research, including Teller, Glenn T. Seaborg, and researchers from Russia, Europe, and Japan, with more than 100 scientists participating. In addition, the symposium convened an independent panel of distinguished scientists to begin an "evaluation of current trends in fusion research." A written panel report is expected by the spring.

Members of the panel are Edward

Creutz, Arthur Kantrowitz, Joseph Lan-nutti, Hans Schneider-Muntau, Glenn Seaborg, Frederick Seitz, and William Thompson.

'Soon!'

Teller's speech, titled "Controlled Fusion, Soon!," opened the symposium on an optimistic note. "There is wide interest and substantial support for controlled fusion," Teller said. "There are also real possibilities for a success in the short term. . . . Specifically, I want to mention two approaches.

"One is the coupling of a low-power fusion device with a high-power fission device. It has been suggested to use a subcritical fission device driven by neu-

trons produced by an accelerator. Instead of the accelerator, a plasma focus may be used. A plasma focus can produce a trillion neutrons. A 100-fold increase together with 10 pulses per second may serve the purpose of driving a fission reactor with a substantial increase in safety.

"Another approach would be the further development of inertial confinement fusion."

Teller also noted that the fusion community should not assume that because the fusion process was cleaner than fission it could avoid coming under attack by the antinuclear movement with its irrational fears of radiation.

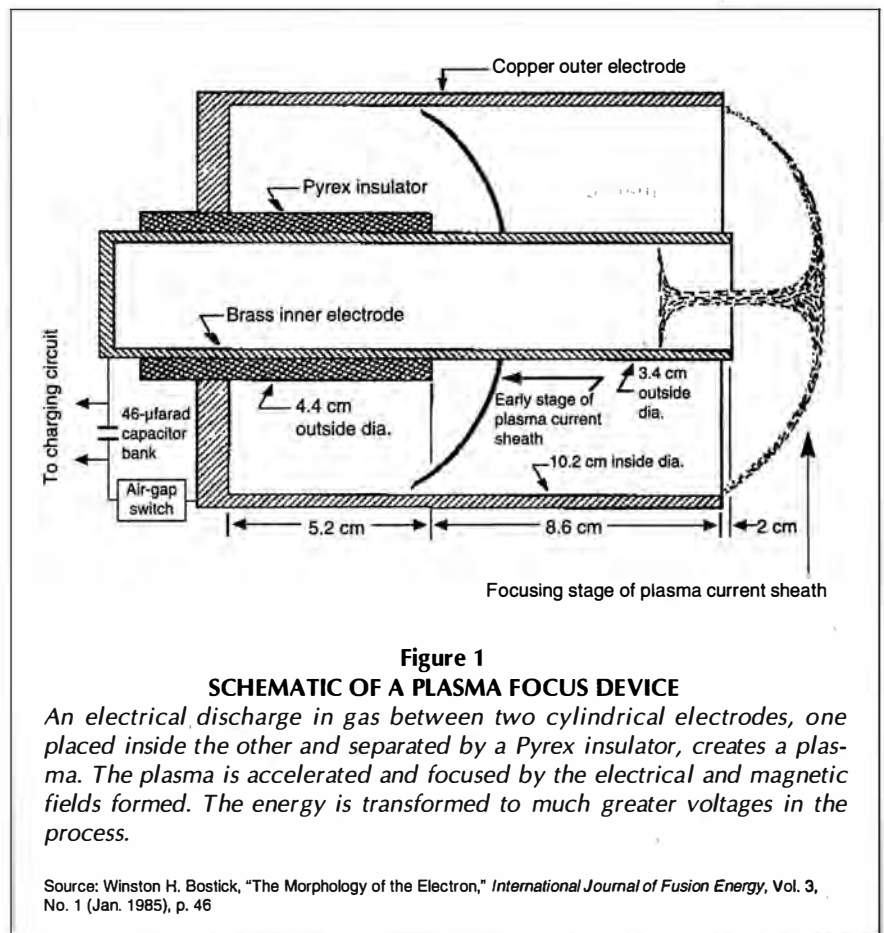
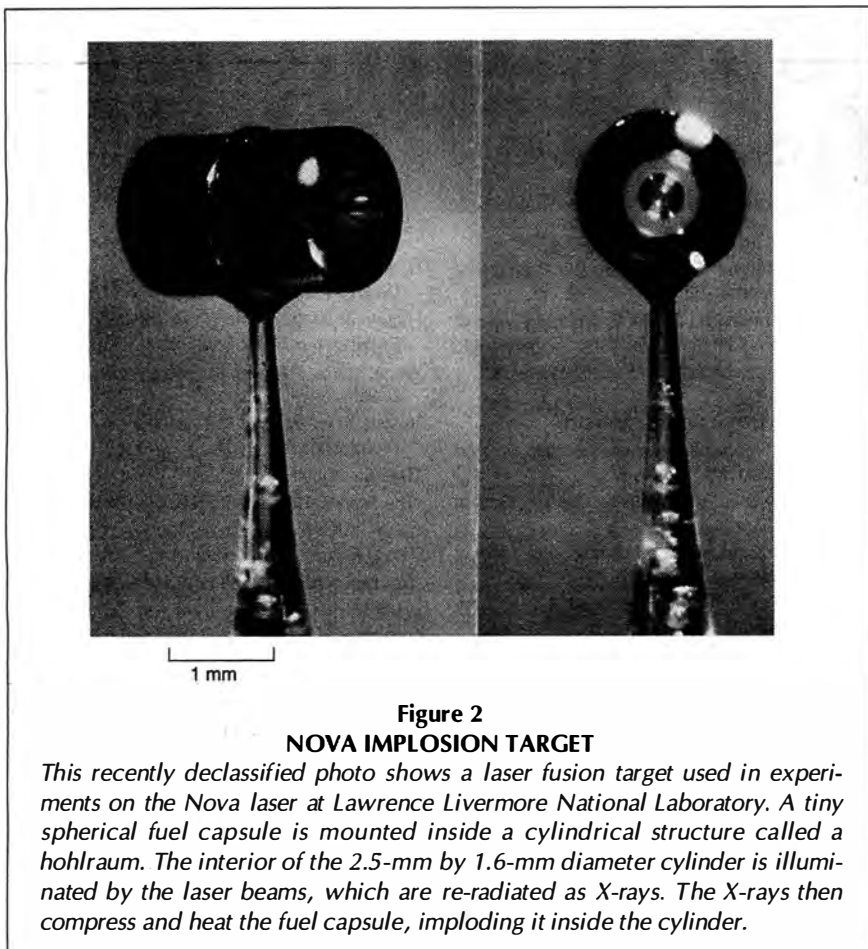


Figure 1
SCHEMATIC OF A PLASMA FOCUS DEVICE

An electrical discharge in gas between two cylindrical electrodes, one placed inside the other and separated by a Pyrex insulator, creates a plasma. The plasma is accelerated and focused by the electrical and magnetic fields formed. The energy is transformed to much greater voltages in the process.

Source: Winston H. Bostick, "The Morphology of the Electron," *International Journal of Fusion Energy*, Vol. 3, No. 1 (Jan. 1985), p. 46



Fusion Powers the Universe

It is well known that fusion energy provides the main source for active energy for the universe. Our Sun and other stars are giant fusion reactors in which hydrogen atoms fuse to form helium, in the process generating vast amounts of energy.

One gallon of seawater contains sufficient heavy hydrogen—the deuterium used as fusion fuel—to generate the energy equivalent of 300 gallons of gasoline. It costs on the order of 1 cent to extract this fusion fuel from the gallon of seawater.

When the conditions for generating fusion reactions are mastered, the fuel will be readily and cheaply available. Furthermore, the high temperatures involved will provide the conditions for transmuting materials virtually at will. Research today is concentrated upon confining plasmas in order to realize a meaningful energy gain, but other engineering design and materials problems remain to be solved.

The situation with regard to inertial

confinement research has improved recently because of the decision by the U.S. Department of Energy to allow a wave of declassification in the last couple of years. This has allowed U.S. researchers to discuss their work more openly and has given the rest of the scientific world a closer look at the nuts and bolts of the U.S. inertial confinement effort.

Recent Developments

- **PACER.** In his presentation, Edward Teller revealed for the first time that in the 1980s the United States succeeded in building a chamber to contain small nuclear explosions. Many important scientific and military experiments were carried out in this facility, including the Halite-Centurion program to demonstrate pellet designs for high-gain laser fusion.

The facility has since been shut down, but as Teller noted in passing, the technology opens the prospect for directly harnessing the energy of small fusion explosions—driven by fission—along the lines of the PACER project

first proposed in the 1970s.

- **Plasma focus.** Major proof-of-principle experiments are currently being carried out in Russia under the direction of Dr. N.V. Filippov of the Kurchatov Institute in Moscow; and in the United States at the Phillips Laboratory at Kirtland Air Force Base and Los Alamos National Laboratory in New Mexico, and also at the Stevens Institute of Technology in New Jersey by Dr. J.S. Brzosko.

A paper by the Stevens group discusses the feasibility of achieving breakeven in a plasma focus machine. Scaling from available data, one may expect breakeven to occur at 300 MJ. However, if the plasma were to remain more stable than expected at higher energies, breakeven might occur at 30 MJ. This is still an energy level several times higher than previous experiments have been able to achieve.

Current plans are to power a plasma focus device at a facility in Troitsk, Russia, to produce plasma energies of 20 MJ and then in the next phase to increase this level 100-fold.

- **Laser fusion.** The National Ignition Facility (NIF) has recently been given the go-ahead by the U.S. Department of Energy. NIF, a laser fusion facility for demonstrating net energy generation, is scheduled to be completed by the year 2002.

Scientists from Los Alamos National Laboratory reported that computer calculations have shown that NIF's 1.8 MJ laser could ignite targets to yield 7 to 9 MJ of fusion energy, depending on the target material.

- **U.S.-Russian joint programs.** In addition to work on the plasma focus, joint programs are under way with Russian scientists to demonstrate several advanced concepts, including colliding-beam fusion and inertial confinement-magnetic target fusion. A colliding-beam experiment is being constructed at Novosibirsk in Russia under Dr. V. Balakin. The magnetic target concept is being explored in Sorova, Russia, under the direction of Dr. A. Buyko, in collaboration with Los Alamos.

Mark Wilsey also contributed to this article.

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* For further information on the conference proceedings, contact ALFT Inc., 189 Deveau St., Unit 7, Hull, Quebec, Canada J8Z 1S7.

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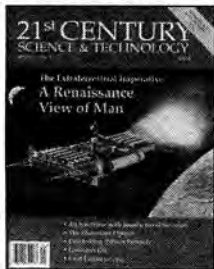
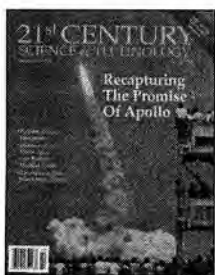
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by Marsha Freeman

The Rocket and the Reich: Peenemünde and the Coming of the Ballistic Missile Era

Michael J. Neufeld

New York: Simon and Schuster, 1995
Hardcover, 367 pages, \$25.00

In November 1992, when I was completing the research for my book, *How We Got to the Moon: The Story of the German Space Pioneers*, I called the history division of the Air and Space Museum in Washington, D.C., to inquire about research material. Michael Neufeld took my call.

Neufeld told me that he was working on a book covering a similar topic, and that it would be published in 1994. Do not refer to the Germans as "rocket scientists," he advised. Very few, if any, were really "scientists," he said, because they did not have Ph.D.s in anything—a point I thought was quite peculiar for him to stress.

Neufeld reported that he had done a lot of research using original documents, and that his book would *prove* that rocket pioneer Arthur Rudolph was promoting the use of slave labor in the rocket program, although Rudolph had always denied it. (Rudolph was production manager of the V-2 rocket program in Germany and manager of the Saturn V rocket that took American astronauts to the Moon.)

There was no evidence that Rudolph was *responsible* for the use of slave labor in the rocket program, I replied, even though the U.S. Justice Department had coerced him into the leaving the United States by threatening him with a trial they said would prove he was guilty of war crimes. Indeed, after a thorough investigation, the West German government had cleared Rudolph of any charges and granted him German citizenship. Surely the German government would have access to any documents Michael Neufeld would, I thought.

When I mentioned some of the scien-

tists and others in the United States who had looked into the charges against Rudolph and found them to be unsubstantiated, Neufeld dismissed such people as "LaRouchites."

After I disagreed with his statement that "Arthur Rudolph has not yet paid back enough to society" for all the horrible things he had done, we ended our conversation. It was clear that Michael Neufeld had no interest in writing history but, rather, that he had decided the German space pioneers were guilty when he started his research.

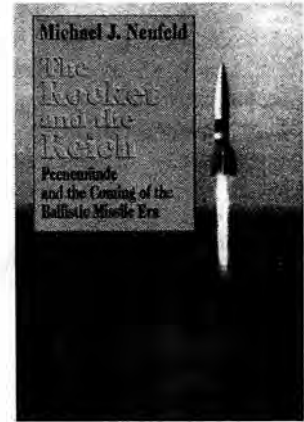
Revising History

One year later, in October 1993, Michael Neufeld gave a presentation in Washington at a history symposium. In his talk, Neufeld attacked, and said he would finish off, once and for all, what he called the "Huntsville school of historiography."

By this he meant the histories of the German space pioneers written by the pioneers themselves or the histories written about them from personal interviews. These histories, Neufeld claimed, have whitewashed the rocket pioneers' real motives and role in the horrors of World War II.

There has been an "official mythology" created about Wernher von Braun, he stated. The World War II Peenemünde research facility was a "military project which had nothing to do with space," no matter what the Germans might have said to the contrary after the war, Neufeld asserted. He dismissed the experiments in the 1920s by the fledgling amateur rocket societies in Germany (some of the best of whose members ended up at Peenemünde) as a romantic fad and the result of the German "authoritarian personality."

Neufeld also described what has been written in the past as "a partisan brand of history," which came out of "space advocacy" instead of being "objective." It has been written as part of "selling the




space program," he said, as if this were comparable to selling poisoned candy to small children. It seems that Neufeld has never understood what produced a generation of young people in Germany committed to "space advocacy." Therefore, he does not understand that this commitment to space is what the German space pioneers saw as defining their lives, no matter what their particular circumstances might have been over the course of 50 years.

Although Neufeld cites one good source in his bibliography on this subject, he clearly has refused to understand the differences between being involved in a war mobilization in the United States in the 1940s, and living under a Nazi totalitarian dictatorship that threw its own people into concentration camps if they did not follow orders. Yet, he expects that Wernher von Braun or Arthur Rudolph should have been able to challenge the authority of, at various times, Albert Speer's Armaments Ministry, the German Army high command, Adolf Hitler, Heinrich Himmler, and the SS.

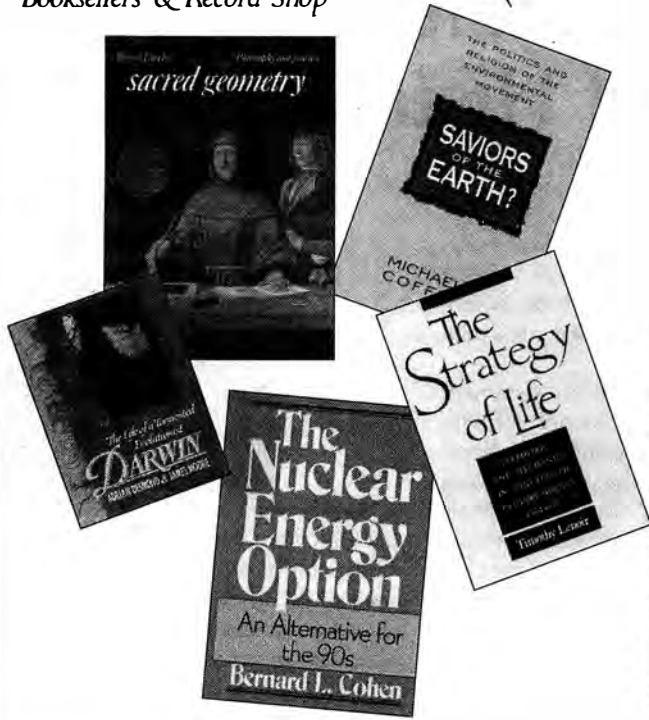
Michael Neufeld's book is no effort to search for the truth. Quotes are taken out of context and half-truths are told instead of the full story, a situation that cannot be compensated for by having hundreds of footnotes.

Neufeld's piece of "evidence" that it was Arthur Rudolph, and not the SS, that

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first ordered the "slave labor" for the rocket program is a memorandum written by Arthur Rudolph in April 1943, after Albert Speer's Armaments Ministry had demanded that thousands of V-2 rockets be manufactured each month without any more German workers provided to man the factories.

Foreign labor—both forced and voluntary and especially prisoners of war—was being used throughout the German armaments industry at that time. By using the term "slave labor" to describe the production factories Rudolph was responsible for setting up, Neufeld dishonestly implies that the rocket program's leaders were requesting the use of inmates to be worked and starved to death in concentration camp "factories" such as Auschwitz.

Neufeld says *directly* that the use of "slave labor" was first proposed by Arthur Rudolph and the Army command at Peenemünde, *not* at the underground V-2 factory tunnels run by the SS at Mittelwerk, which is what the rocket pioneers claim. Yet Neufeld knows full well that the armaments production plants run by the army had a different purpose and bore little resemblance to the actual slave labor liquidation "factories" run at

the camps by the SS.

Actually, in those parts of the April 16, 1943, memo that Neufeld neglects to quote, Arthur Rudolph describes how the Heinkel aircraft factory that he had visited had retrained the workers who were not as highly skilled as they had requested, how the workers had a 54-hour week with time off on Saturday and Sunday, and how the foreign workers were offered bonuses for achievement to supplement the paltry wages dispensed by the SS. This was not exactly Auschwitz.

On the other hand, in the production program of the V-2 rocket in underground tunnels run by the SS following the August 1943 British air raid on Peenemünde, labor was considered expendable and concentration camp victims were killed wholesale through brutal physical labor, starvation, and disease.

Michael Neufeld's book contains 288 pages of text (and 40 pages of footnotes), of which 6 pages deal with the use of "slave labor" in the rocket program. The majority of the book consists of imputing motives to people in the rocket program, for which there is no documentation. In addition, there are chapters of technical detail; some of these are interesting and

others have been better described by the participants themselves.

To adequately respond to each of Neufeld's false assertions would require an entire book. To understand who the German space pioneers are, where they came from historically, what motivated them, and what they accomplished, as a start I recommend that readers look at my own work, *How We Got to the Moon: The Story of the German Space Pioneers*.

Global Climate Change

Continued from page 54

of the latest technological "flavor of the day" (read: where the bucks are)" and work to get the research done in the relevant scientific fields.

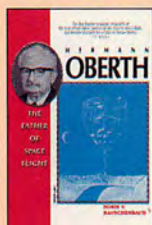
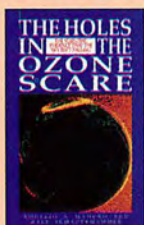
"Adequate maps do not exist to support research in the area of land processes," Estes stated categorically in his conference presentation. Before more decisions are made by politicians, he said, a "great deal of fundamental work" needs to be done.

Notes

* John E. Estes and D. Wayne Mooneyhan, "Of Maps and Myths," *Photogrammetric Engineering & Remote Sensing*, Vol. 60, No. 5 (May 1994), pp. 517-524.

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Illustration by Brenda Brown