21st CENTURY SCIENCE & TECHNOLOGY

SUMMER 2001 www.21stcenturysciencetech.com $3.50/IN CANADA $4.50

PLANCK'S CHALLENGE TO QUANTUM THEORY

Let the Stones Speak

- The Barry Fell Decipherments
- Bring Science Back to Life—Vernadsky's Method

12>

0 74470 74216 6

Expand your world view with

21st CENTURY SCIENCE & TECHNOLOGY

NASA

The International Space Station, backdropped against black space, was photographed with a digital camera from the Space Shuttle Discovery, March 18, 2001

Subscriptions

U.S.—6 issues for $25
Foreign—6 issues for $50

Books

The Holes in the Ozone Scare: The Scientific Evidence That the Sky Isn't Falling
by Rogelio A. Maduro and Ralf Schauerhammer
$15 each, plus $3 shipping
OR $10 postpaid with a subscription

How We Got to the Moon: The Story of the German Space Pioneers
by Marsha Freeman
$15 each, plus $3 shipping
OR $10 postpaid with a subscription

Global Warming: The Rest of the Story
by Dr. Gerd Weber
$11 each, postpaid
OR $8 postpaid with a subscription

Hermann Oberth: The Father of Space Flight
by Boris V. Rauschenbach
$15 each, plus $3 shipping
OR $12 postpaid with a subscription

Give *21st Century* subscriptions and gifts

ORDER FORM

Enclosed is $_____ for:

____ 6 issues/ U.S.— $25 ____6 issues/ foreign airmail—$50
____12 issues/ U.S.—$48 ____12 issues/ foreign—$98

____$10 for *The Holes in the Ozone Scare* with a subscription
____$18 postpaid for *The Holes in the Ozone Scare*
____$10 for *How We Got to the Moon* with a subscription
____$18 postpaid for *How We Got to the Moon*
____$8 for *Global Warming* with a subscription
____$11 postpaid for *Global Warming*
____$12 for *Hermann Oberth* with a subscription
____$18 postpaid for *Hermann Oberth*

Please print or type name and address of gift recipients on a separate paper. Gift cards are available.
Note: Back issues are available at $5 each ($8 foreign)

Name _____

Address _____

City _____ State _____ Zip _____

Daytime telephone (_____) _____ e-mail _____

Send check or money order (U.S. currency only) to:
21st Century, P.O. Box 16285, Washington, D.C. 20041.

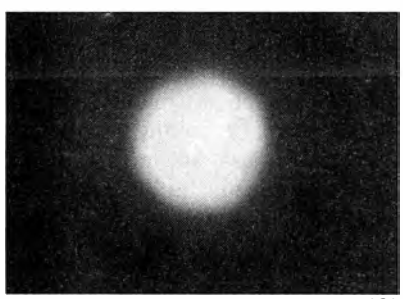
New: Subscribe online! www.21stcenturysciencetech.com

21st CENTURY SCIENCE & TECHNOLOGY

Vol. 14, No. 2 Summer 2001

Features

Since its discovery in 1930, Pluto has been thought of as the ninth planet. Now the evidence shows it to be a large asteroid in the Kuiper Belt. See p. 80.



NASA

News

Departments

On the cover: Ogam and Tifinag inscription from the Tomb of Ollamh Fodhla, ca. 1,000 B.C., at Loughcrew, the highest mountain in central Ireland. The readings of the Tifinag indicate an astronomical/calendar use of the site. Photograph © Warren W. Dexter; cover design by Alan Yue.

21st Century Science & Technology (ISSN 0895-6820) is published 4 times a year in 2000, every third month, by 21st Century Science Associates, 60 Sycolin Road, Suite 203, Leesburg, Va. 20175. Tel. (703) 777-7473.

Address all correspondence to **21st Century**, P.O. Box 16285, Washington, D.C. 20041.

Second-class postage is paid at Leesburg, Va. and additional mailing offices.

21st Century is dedicated to the promotion of unending scientific progress, all directed to serve the proper common aims of mankind.

Opinions expressed in articles are not necessarily those of 21st Century Science Associates or the scientific advisory board.

We are not responsible for unsolicited manuscripts.

Subscriptions by mail are $25 for 6 issues or $48 for 12 issues in the USA and Canada. Airmail subscriptions to other countries are $50 for 6 issues. Back issues are $5 each ($6 foreign). Payments must be in U.S. currency.

POSTMASTER: Send address changes to 21st Century, P.O. Box 16285, Washington, D.C. 20041-0285.

Printed in the USA ISSN 0895-682

www.21stcenturysciencetech.com

Free Science From Linearity

The currently ongoing and worldwide collapse of financial valuations, signals the failure of the fraud known as the New Economy. While a proverbial "sucker" may be born every minute, there was never any excuse for men of science to have been taken in by the New Economy hoax. That so many were, is symptomatic of a deep, axiomatic flaw which infects the thinking of the victims of this hoax in all areas, science most of all. Greed alone, cannot explain the error.

In this century, the problem dates to the insistence by Bertrand Russell and his followers that physical processes can be reduced to closed systems of mathematical formalisms, based on the anti-Leibnizian ideology of linearity in the small. As promoted by Norbert Wiener and the early founders of systems analysis, this led to the current insanity that "modelling" can replace experiment as the determinant of truth. We do not exaggerate. Just consider the celebrated case of the application of methods of computer "benchmarking" to product design in the Mercedes A-class, the luxury car that rolled over on demand.

But once one understands the problem, this shocking example of failure in the heart of one of the world's once-great engineering firms, is itself trivial. In fact, it is the entire world economy that has been subjected to such lunatic methods. The argument which drove the collapse of the real physical economy of the U.S.A. from the early 1970s, that a nation can dispense with its agro-industrial productive capability, and become a "service economy," is symptomatic of the disease. So, too is the assumption that cheaper is better (or more "efficient"), and the lunatic worship of a so-called free market. Cost-benefit analysis, a fraudulent accounting practice deeply intertwined with systems analysis, is based on acceptance of the same methodological error.

The scientist who argues that these are matters of economics, not science, is missing the point. He is usually the same one, who, in the next breath, is heard bemoaning the lack of respect and funding for science by government and the public. He has bought into the New Economy delusion, whether or not he currently holds title to NASDAQ paper.

Principles of Economy

Just to review the essential principle of economy involved, the fuller treatment of which can be found elsewhere:[1] The modern conception of economy derives from a notion enunciated by Gottfried Wilhelm Leibniz in the essay "Science and Society." This is the understanding that the only provable source of generation of wealth is the development of the creative powers of human intellect. Wealth does not lie, as one school had it, in agricultural land and mines, nor, as another had it, in the process of exchange ("buy cheape, sell deare"), nor in the average hours of labor embodied in a commodity.

Leibniz's conception was that which had already proven itself in the rapid rates of increase of population and lifespan experienced in Louis XI's France, and Henry VII's England. From the successful experience of these first modern, sovereign nation-states, emerged the notion that came to be known in English usage as *Commonwealth*. The conception of the United States, in the mind of such founders as Benjamin Franklin, Alexander Hamilton, and Franklin's protégé Mathew Carey, was the explicit

realization of the Leibnizian doctrine of economy.

Science, as seen from this standpoint, is the means by which human society progresses. The discovery of a new physical principle, and its implementation in the form of technology, is the only basis for human progress. So, a paradox arises: A creative thought which leads to discovery of a new physical principle (a colorless, odorless, and almost mass-less "object"), is the primary driver of economic growth. This non-thing, which Leibniz would call a greater monad, is not reducible to any material elementarity.

Failure of Information Theory

In close connection with this discovery comes another paradox for the Lockean empiricist, or any believer in the modern cult of information theory: The very possibility of science, of having any lawful knowledge of the natural world, is dependent upon what Leibniz had called a "pre-established harmony" between mind and matter. It is provably the case that mind and matter are expressions of a creative principle.

Physical economy provides the proof in demonstrating the unique ability of human society to increase its power over nature, as expressed by increase in the relative population potential of successively improved forms of human society. The driving force here is the unique capability of the human mind to generate new creative conceptions, which modern science recognizes as discovery of new physical principles. But it is the nature of any such discovery of new physical principle, that it introduces some fundamentally new element, in resolving what appeared to be a paradox, or anomalous physical effect, to the previous system of thought. This new element, or quality, could not have been derived from rearrangement of the already existing axioms of the former system. It is thus impossible to adduce any new universal physical principle on the assumption that nature can be reduced to a set of already given elementarities. Just look at Bertrand Russell's miserable failure.

Leibniz's discovery of the calculus (and the failure of other schools to do so) was a parallel development to his conception of economy. Only by rejecting the doctrine of linearity in the small, was it possible for him to recognize how to resolve the problems connected with the understanding of non-algebraic curves, under study by Huygens, Bernoulli, and other of his collaborators. The modern insistence on treating the essentially non-linear thing known as curvature by attempting to define it in terms of a linear elementarity, the Cauchy fraction, is precisely the problem we face today in both science and economy. (One might say the New Economy is the straight way to hell.)

In the physical sciences, we find the frequent, tragic case of the gifted experimenter whose attempt to describe a genuine discovery falters, the moment he goes to the blackboard to present it in the terms he considers to be acceptable forms of classroom mathematics. Or, the many gifted, scientific minds that are suppressed or destroyed by the reigning tyranny of such methods in textbook and teaching.

Shortly, the effects of the collapse of the New Economy will be felt with full force in the U.S.A. and other advanced-sector nations, as is already the case in nations such as Turkey, Argentina, and much of the rest of the world. Trillions of dollars in market valuation of New Economy assets will be wiped out by hyperinflationary blow-out, deflationary collapse, or both. To make our way out of this mess, it will be necessary to revive the methods of discovery which have always been the driving force of science. A new generation must be trained who will not suffer from the crucial axiomatic flaw that brought us to the present crisis. To do so, requires a break with the bankrupt doctrine of linearization in the small.

—Laurence Hecht

Notes

1. A partial treatment is found in the "Bring Science Back to Life" feature in this issue. For fuller treatment, see Lyndon H. LaRouche, Jr. "How to Define a Physical-Economic Collapse: Marat, De Sade, and 'Greenspin,'" *Executive Intelligence Review*, June 29, 2001, pp. 12-55.

Vernadsky Book Review Draws Fire from Publisher

To the Editor:

Thank you for sending me a copy of your review of our edition of *The Biosphere* by Vladimir Vernadsky ["New Vernadsky 'Translation' Is Not Vernadsky," *21st Century,* Spring 2001, pp. 82-85]. Like the cockamamie magazine in which it appears, the review is full of absurdities.

First, the review complains about the translation. As an example of how terrible our translation is, a sentence from our revised Langmuir translation is compared with the same sentence translated by one of your devotees. While I admit I am not conversant in Russian, so that I am not qualified to judge the accuracy of either version, I am conversant in American English. To me the two versions are saying basically the same thing: the conversion of solar energy by living matter into chemical energy is subject to the same universal laws to which celestial and atomic systems are subject.

Second, that being said, your reviewer goes on to quote at length from our translation. If our translation is so flawed, how does she justify relying on it to make her points?

Third, your reviewer makes the particularly bizarre claim that "although organic matter can pass back into an inorganic state (through death, or metabolic processing), it is not possible for inorganic matter to transform into organic matter." Hello, this is what plants, fungi and some bacteria are doing 24 hours a day. One of Vernadsky's central discoveries is that over time, more and more parts of Earth are incorporated into the biosphere.

Fourth, your reviewer uses our book mostly as a platform to criticize Lovelock's Gaia hypothesis. As the introduction by Lynn Margulis and the notes by Mark McMenamin make clear, there are significant differences between Vernadsky's biosphere and Lovelock's Gaia. Your beef

is with Lovelock's *Gaia* and *Ages of Gaia,* not with our translation of *The Biosphere.*

Finally, your review ends with an *ad hominem* attack on Darwin. Darwin's work, like that of all scientists, is subject to criticism. I do note, however, that Vernadsky in neither *The Biosphere,* nor in any of his other writings, at least those available in English, disputes Darwin's central theory of the evolution of species via natural selection. I challenge any one to show me in our "false translation" or your own where he does so.

Far be it for your magazine to applaud the efforts of so many people to bring Vernadsky's classic to the public in its complete form. But then I forget, you're right and everyone else is wrong.

Peter N. Nevraumont
Nevraumont Publishing Company
New York, N.Y.

Reviewer Elisabeth Pascali Replies

Thank you for your comments. Your letter, aside from the adolescent insults and denial of responsibility, only confirms and reinforces the point that I was making in my review.

Life does not come from non-life. Life never spontaneously generates from inert matter. Louis Pasteur, whom Vladimir Vernadsky greatly admired, proved this conclusively in the 19th Century. As you should know, Vernadsky is very careful to distinguish between living matter and bio-inert matter. He is very clear that living matter is in a different physical state, or thermodynamic regime, from what he terms inert matter. Thus, carbon dioxide cannot be made a part of life, except through a living process such as photosynthesis.

Man's ability to change the face of the planet through exercise of his creative reason, defined yet another thermodynamic regime which Vernadsky called the *noosphere.* He understood that the noosphere was a natural evolution of the biosphere; and, contrary to James Lovelock, was very optimistic about the interaction of the noosphere with the biosphere. He recognized that the noosphere could bring about a higher level of organization of the biosphere than that which the biosphere could accomplish alone.

Vernadsky, as well as many other scientists of the 19th and 20th centuries,

Cover of the translation in question of The Biosphere, *by Vladimir I. Vernadsky, published in Russian in 1925, and in English in 1998, translated by D.B. Langmuir and edited by Mark A.S. McMenamin.*

such as Etienne Geoffroy Saint-Hilaire, Alexander von Humboldt, Louis Pasteur, and Pierre Curie, among others, had been discussing the causality of evolution and the behavior of life on a much more profound level than the idea of poor, Thomas Malthus-inspired Charles Darwin. It is exactly Darwin's mechanistic explanation of evolution, along with the more vitalistic theories of life (such as Gaia), that Vernadsky warned about on page 51 of your book. The question is, why have these kind of simplistic theories become so hegemonic, especially in the West?

What you, and your co-thinkers from the Gaia Society, seem to be doing is to try to bury Vernadsky, yet again—this time under a pile of Gaian bologna. Vernadsky, who, as you point out, has been previously unknown to the English-speaking public, is now presented by you as another theory like Gaia, with some differences. It is very difficult for upcoming students of biology to distinguish the uniqueness of Vernadsky in this way. Their thinking is constantly muddied by trying to take into account false, arbitrary theories like Darwin's and Lovelock's.

And please do not insist on your claim that you didn't know and could not have known that the Gaia Society was involved in publishing this book.

This is not at all a tit-for-tat academic debate. I agree with economist Lyndon H. LaRouche, Jr., who has pointed out that the mastery of Vernadsky's idea of "natural products" of the noosphere is crucial to our being able to re-build civilization from its current state of globalized collapse. LaRouche has developed the idea of such a natural product which he calls a "development corridor." We can use a high-speed rail network which cuts across previously inaccessible areas of the globe as the basis of roughly 100-km-wide areas of industrial and agricultural development. By this means, we will create a fundamental advance of both civilization and the biosphere by freeing Mankind from its historical dependency on water transport.

Vernadsky himself was very active in Russian politics (see Jonathan Tennenbaum's conference presentation in this issue, p. 14). Among other things, he led the development of Russia's nuclear industry. He understood that industrialization and other forms of economic development were a *natural evolution* of the Biosphere.

Vernadsky's ideas have inspired a whole school of economic science and scientific methodology in Russia, which is today planning the economic development of the Arctic North as the lawful application of Vernadsky's work and of LaRouche's concept of development corridors.[1]

I was familiar with some of Vernadsky's work prior to deciding to review your book, mainly through the writings of LaRouche. Our magazine is in the process of bringing the original work of Vladimir Vernadsky, his colleague Alexander Gurwitsch, and others to light in the United States.

Ironically, I came to your book wanting to praise the fact that so many people had gotten together to publish a complete translation of *The Biosphere.* Unfortunately, what I found reeked of political correctness and cover up.

Notes

1. See Prof. Yuri Gromyko, "Russia Faces Necessity to Define Its Mission," *Executive Intelligence Review,* May 25, 2001 (Vol. 28, No. 20).

Translator Rachel Douglas Replies

While working with Jonathan Tennenbaum on the translation of V.I. Vernadsky's "Problems of Biogeochemistry II; On the Fundamental

Material-Energetic Distinction Between Living and Nonliving Natural Bodies of the Biosphere" (*21st Century,* Winter 2000-2001), I had occasion to consult with other translators about the difficulties presented by Vernadsky's flexible, and sometimes seemingly redundant, but always deliberate and rigorous language. "To translate Vernadsky," one native-speaking Russian scientific translator admonished, "is a great responsibility, and an honor. One does not translate such authors on deadline, or with one's own agenda. Or, rather, I should say that they are translated that way all the time—but what results from such efforts is quite another matter."

I agree with my Russian correspondent. The language of a scientist is the metaphorical expression of his thought process. It is the duty of a translator to attempt to understand why a scientist, especially an original thinker such as V.I. Vernadsky, said what he said in the way that he said it, by attempting to grasp his process of thought. Therefore, upon consulting the Langmuir-McMenamin version of *The Biosphere* (initially for the purpose of gaining insight into Vernadsky's use of both *prirodny* and *yestyestvenny,* which are both customarily translated as "natural," to characterize the same phenomena, often in the same sentence), I was horrified to see in one spot-checked place after another, the fast and loose play with Vernadsky's ideas, as well as his language.

One may argue, and argue productively, about whether *zakonnomernost,* which can mean "regularity," "correlation," "governing law," or "lawful process," should be translated as "laws" or "lawfulness" in the passage I wrote out for reviewer Beth Pascali—being sure to take into account that the writer could have said *zakony* ("laws"), and did not. It does not matter what sounds approximately the same in "American English"; that is not the issue here.

The sheer hooliganism of the Langmuir-McMenamin translation comes through in the rest of the passage. The concept that Mr. Nevraumont now glosses as "the conversion of solar energy by living matter into chemical energy is subject to the same universal laws to which celestial and atomic systems are subject" *is not there* in the translation he published, whereas it *is* in Vernadsky's original and in the corrected translation I drafted, and is there with very specific elaborations ("mechanical performance," "orderly motion").

The cited passage provides another clue to how this could happen. Vernadsky wrote "measure and harmony," not just "harmony." Why excise "measure"? Leafing through the unfortunate Langmuir-McMenamin rewrite of Vernadsky, and comparing it here and there with the original, it seemed to me that most Keplerian and Leibnizian ideas and language in Vernadsky's exposition, fell under the axe.

New Pitcairn Island Inscription Translated, Confirms Fell Analysis

To the Editor:

Around May of last year, I was given a copy of an article by Julian Fell, published by *21st Century* in the Winter 1999-2000 issue ["Barry Fell, Epigrapher: Biography of a Renaissance Man,"] which aroused my interest. Having originally come from New Zealand, and having spent a considerable time in the South Pacific, I am well acquainted with the Polynesian customs.

I was fascinated by Barry Fell's theory of the expedition originating from Egypt and its progression across the Pacific, and decided to carry out some research myself, concentrating initially in the petroglyphs at Pitcairn Island.

Although these inscriptions have been inspected by various authorities over the years, very few accurate photographs would seem to exist, making interpretation difficult. However, after numerous inquiries, I was eventually able to obtain a reasonable photographic reproduction, and using Barry Fell's information and alphabet (p. 47), I have been able to interpret the message contained in the petroglyph.

The story contained in the petroglyph certainly concurs with Fell's theory that the expedition called there, but this visit was after Irian Jaya and prior to Santiago, Chile. The expedition was primarily for exploration and mapping, using the Sun's altitude to determine latitude and making extensive use of lunar eclipses to determine longitude.

The petroglyph records the year as regnal 16 (of Ptolemy III) and also records the observation of a lunar eclipse. The astronomical records show a lunar eclipse occurring on Dec. 14, 233 B.C., which would have been visible at Pitcairn around 6 p.m.

Contrary to your article, however, the petroglyph does not record the loss of any ships.

The above information is only part of an extensive investigation which has been carried out on the expedition. I would welcome any enquiries or comments.

Ross Perfect
6 Magnolia Place
Causeldine, Queensland 4034
Australia

Julian Fell Replies

I read your letter with great interest, for it appears to cover an inscription unknown to my father, H.B. Fell. He certainly would have loved to know about it, and your interpretation. The inscription reporting shipwreck on Pitcairn Island is, in fact, undated, and Barry assumed it was of the Maui-Rata

Continued on page 8

USGS

Climate change moves in accordance with long-term astronomical cycles, not scare stories. As Dr. Richard Lindzen says, "The end of the world is not ahead." Here, the four-mile wide front of Alaska's Columbia Glacier.

WORLD GOING TOWARD A GLACIAL ERA, MIT CLIMATE SCIENTIST SAYS

The world is moving toward a new glacial era, MIT meteorology scientist Richard S. Lindzen told the Italian daily *Corriere della Sera* in a June 15 interview. Dr. Lindzen is a member of the National Academy of Sciences panel that published a report on climate in early June ("Climate Change Science: An Analysis of Some Key Questions"), which the global warming propagandists claim supports their scare stories. "In one century, the climate will be different from today, but simply because atmospheric changes are the rule. I am convinced that in a few thousand years we will have another glacial era," Lindzen said, "but CO_2 emissions have nothing to do with that. "Think to the 'miniglacial era' that brought snow and ice to Europe in the 17th and 18th Centuries. Or to the Middle Age Optimum, when world pollution did not yet exist, but Iceland and Greenland were temperate, inhabited areas, where wine grapes were grown. Temperatures, at that time, were between 2° and 5°C higher than today."

Asked whether man can do something to prevent things from getting worse, Lindzen told the Italian paper: "This question goes out of the scientific field and enters the domain of religion. You are asking me whether sacrifices to Gods are opportune to improve things. . . . My impression is that Europe, above all, is prey to environmentalist religion and hysteria. . . . There are more serious and urgent questions [than climate change], believe me. And that is what our report says: You can breathe, the end of the world is not ahead."

NUCLEAR POWER PROSPECTS EXPANDING IN ASIA, IAEA SAYS

In its yearly report on the state of nuclear energy worldwide, the International Atomic Energy Agency (IAEA) says that "there are clear plans for expanding nuclear power, particularly in India, China, South Korea, and Japan," although at present South Asia, the Middle East, and the Far East account for only 94 nuclear reactors. In Western Europe, with 150 reactors, the report says, overall capacity is likely to remain at existing levels in coming years. In Central and Eastern Europe, a few partially built plants are likely to be completed, and aging units will be closed down.

Corbis/Bettmann

Prince Bernhard of the Netherlands was a cofounder of the WWF, and its first head. He left the SS to marry the future Queen Juliana. Here, the Prince in 1952.

PRINCE BERNHARD SUED FOR CRIMES AGAINST HUMANITY

Dutch Attorney J. Wilgers is bringing a Crimes Against Humanity lawsuit in Belgium against Price Bernhard of the Netherlands, for his role in the genocide committed under the auspices of the World Wildlife Fund (today called the World Wide Fund for Nature). Wilgers charges that the WWF's "Operation Lock," and similar "nature conservation" schemes, caused the deaths of about 10,000 people in southern Africa. Wilgers told the newspaper *De Groene Amsterdammer:* "After 1990, a number of black elite units were operating from the nature parks, as anti-poacher brigades, security groups which seemed to be responsible for the murder of some 10,000 people in the townships. That was part of unleashing civil war between the Bantus and the Zulus . . . the purpose of which was to destabilize South Africa."

Prince Bernhard was a member of the Nazi Party and an officer of the S.S. under Hitler.

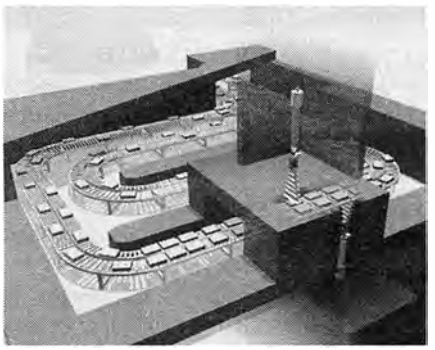
BRAZIL TO TAKE A LEADING ROLE IN FOOD IRRADIATION

The SureBeam Corporation, a San Diego-based company that has commercialized electron beam irradiators, will join a Brazilian company in launching what is expected to be the "world's largest, most comprehensive system dedicated to enhancing food safety and preservation," according to a SureBeam news release. The joint venture with the Brazilian company, Tech Ion Industrial, is expected to process 80 billion pounds of fresh fruit and vegetables yearly. Both companies announced support for Brazil's new Food Irradiation Center of Excellence, established by the state of Rio de Janeiro.

"Brazil suffers significant post-harvest losses," the Tech Ion president commented, because we have limited infrastructure across one of the world's largest and most

sensitive environments." Food irradiation "stops the spread of food-borne diseases, eliminates insect infestation, and extends shelf life without any environmental impact," he said. Brazil has the world's largest beef herd and is the world's second largest chicken producer, according to U.N. figures.

SureBeam has also contracted with a Saudi corporation, Resal Saudi, to build a network of irradiation plants in Saudi Arabia as part of the nation's ongoing program "to protect its citizens and enhance the quality of food."



Courtesy of Titan Corporation

Artist's conception of the Titan "SureBeam" electronic pasteurization plant, now operating in Sioux City, Iowa.

SENSATIONAL RUSSIAN ANNOUNCEMENT OF NEW STATE OF MATTER

Russian Academician Valerian Sobolev announced the sensational discovery of a new form of matter having the property of a magnetic monopole in a statement released to RIA Novosti July 25. He said that devices utilizing the material could help solve the economic challenges Russia is facing. They could produce electric power, serve as engines for a new type of "unsupported" aircraft, and generate a low-temperature plasma, among other things. The substance is produced from oxide melts at the cathode of an electrolysis device by a special process Sobolev calls "depletion."

But at a press conference in Moscow July 26, Academician Sobolev received treatment similar to that meted out to Stanley Pons and Martin Fleischmann in 1989, after they announced their discovery of cold fusion. Valerian Markovich Sobolev is Director of the Research Institute Science of Materials of the Russian Academy of Natural Sciences, a Lenin and State prize winner, and author of more than 300 scientific works and inventions, according to the news service pravda.ru. Academician Sobolev was questioned skeptically by Prof. Sergei Kapitsa, Academician Valery Rubakov, and the press. Charges included that he was conducting science by press release, before journal publication.

Yet, it appeared that he demonstrated small samples of his new material which is described as resembling quartz. It was ultrastrong, could cut glass and quartz; it had a magnetic charge; it could generate an electrostatic charge, and regenerate the same charge shortly after being discharged. Sobolev thinks it is being charged by the Earth's magnetic field.

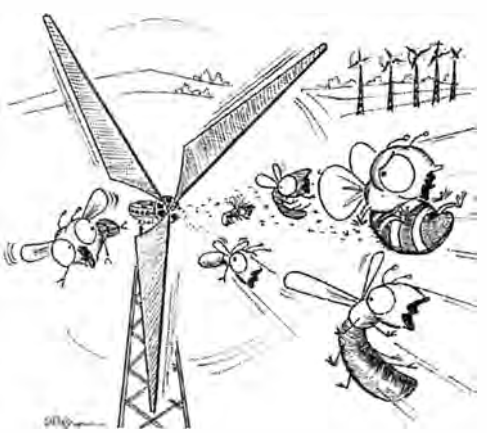
At the press conference, Professor Kapitsa said, "We just saw three pieces of some material. . . . As a matter of fact, that substance looks like the known electret." An electret is a solid possessing persistent dielectric polarization. It is thought of as the electrostatic analog of a magnet. However, it would not show magnetic properties, least of all monopolar.

In his statement cited in pravda.ru July 26, Sobolev said "the qualtitative and structural nature of these substances cannot be explained from the point of view of chemical laws which are known nowadays. A substance in this condition may radiate a time-changing magnetic flux."

BUG POWER EATS INTO THE PROFESSED EFFICIENCY OF WINDPOWER

Flying insects—such as bees, locusts, gnats, and butterflies—are cutting the efficiency of wind turbines by as much as 25 percent, according to a new study, which examined why turbine output fluctuated so widely. As reported by the Power Marketing Association Online, July 4, it appears that thousands of flying insects fly into the turbine blades and die, sticking to the blade and forming a ragged crust on the blade's leading edge. Even a millimeter of this crust generates drag that can ruin the efficiency. At low wind speeds, the crust of dead bugs on the blade has little effect, but at higher wind speeds, the efficiency of the turbine is noticeably hampered.

The problem is that the wind energy industry calculates its levelized cost of producing electricity, based on the capital cost of the wind turbine, a very low budget for maintenance, and 24-hour operation at good wind speed. The cuts in efficiency from bug death, as well as the down-time in order to pressure-wash the blades clean of the bug build-up, make it even harder to claim that wind energy is competitive with other energy sources.

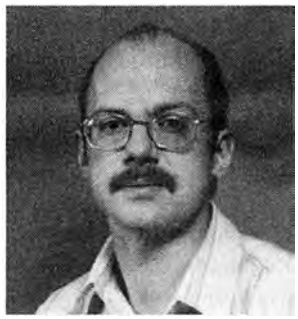


Zap Power

Mathematician and Experimenter

EDITOR'S NOTE

This new section of the magazine will highlight some of the real heroes of today, whose ideas and work have contributed toward the advancement of science in the classical tradition. Our first profile is of a leading theoretician and experimentalist, who is a long-time scientific collaborator of 21st Century Science and Technology.



Prof. Frederick Drach Tappert

Professor Frederick ("Fred") Drach Tappert of the University of Miami (Coral Gables) was among the first group of scientists to help found the Fusion Energy Foundation, an initiative of economist and statesman Lyndon H. LaRouche, from which *21st Century Science & Technology* magazine derives its heritage.

Dr. Tappert is unique, in that he is both a leading physicist and a leading mathematician, who does not permit formal considerations, or prejudices, to curtail his wide-ranging explorations of the scientific frontier. While generally acknowledged as a leading theoretician in both mathematics and physical science, Dr. Tappert has always had a close hand in experimental work. Until recently, he was leading a major effort to experimentally detect, for the first time, a detailed picture of the workings of weather systems and to answer, for example, questions about the formation and dynamics of thunderstorms, which have remained fundamentally unresolved since the time of Benjamin Franklin.

Indeed, Dr. Tappert's wide-ranging interests and intemational scientific collaborations are reminiscent of the type of work carried out by Benjamin Franklin's great grandson, Alexander Dallas Bache. Bache, a pioneer organizer of American science, was the chief scientist and technologist of Abraham Lincoln's industrial development program. This connection is not coincidental: Dr. Tappert is a graduate of Central High School in Philadelphia, Pennsylvania, the school founded by Bache, and which became the model for public education in the United States during the 19th Century. Dr. Tappert continued his studies at Pennsylvania State University and then did his graduate work at Princeton University.

In the mid-1960s, while working at Bell Telephone Labs in New Jersey, Dr. Tappert helped found the field of nonlinear science known today as solitons. In 1973, Dr. Tappert and his collaborator, Dr. Akiro Hasegawa, proposed, for the first time, to utilize soliton light waves for enhanced communication over optical fibers.

Dr. Tappert was also engaged heavily in fusion energy research from this time through the 1970s. He carried out work on laser fusion at both Los Alamos National Laboratory and the New York University Courant Institute of Mathematics. During the 1970s, Dr. Tappert also applied his mathematical discoveries to other fields, such as the realization of new techniques in determining the propagation of acoustical waves in the ocean. This revolutionary new approach to "sonar," permitted the detection of submarines over ranges of thousands of miles.

The thread which ties together the wide-ranging research and discoveries of Dr. Tappert is his passion for the revival of Riemannian nonlinear science. Dr. Tappert has always viewed this as a key to revolutionizing contemporary mathematical physics. During the late 1970s, Dr. Tappert gave two informal seminars at the offices of the Fusion Energy Foundation. The first was on Riemann and Gauss's approach to Ampère electrodynamics. The second was on a controversy between Riemann and Weierstrass on continuous and non-continuous functions.

Professor Tappert was among the first to bring to the attention of the Fusion Energy Foundation the existence of Riemann's paper on shockwaves. And Dr. Tappert was among the chief scientific collaborators who helped the Fusion Energy Foundation organize for Lyndon H. LaRouche's approach to the Strategic Defense Initiative (SDI), which President Reagan presented on March 23, 1983.

—Charles B. Stevens

Selected Reading

A. Hasegawa and F. Tappert, 1973. "Transmission of stationary nonlinear optical pulses in dispersive dielectric fibers, I & II, Anomalous dispersion," *Appl. Phys. Lett.*, Vol. 23, No. 3, pp. 142-144; and No. 4, pp. 171-172.

F. D. Tappert and N. J. Zabusky, 1971. "Gradient-Induced Fission of Solitons," *Phys. Rev. Lett.*, Vol. 27, p. 1774.

F. D. Tappert, 1977. "The Parabolic Approximation Method," in *Wave Propagation and Underwater Acoustics*, Eds. J. B. Keller and J. S. Papadakis (New York: Springer).

Letters

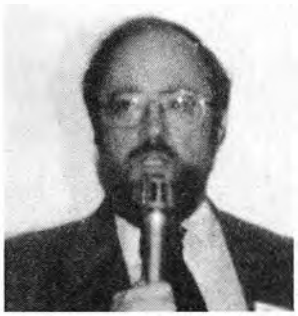
Continued from page 5

Expedition from the context. This does not have to be the case. It could have been a later voyager. They would have been speaking and writing the same language.

The inscription you report upon is very significant in that it includes the dating system measured in terms of the year of the Pharaoh (which was the Egyptian/Libyan method), and it includes navigation method details in accord with the Libyan inscriptions in Irian Jaya. The date you discovered is consistent with the outgoing voyage for the expedition.

I would strongly suggest that you publish your findings. At the moment, the *Epigraphic Society Occasional Publications* would be the best venue as the conventional anthropological journals have not yet "mentally adjusted" to recent epigraphical trends. . . .

For World Development, Go Nuclear!



by Jim Muckerheide

Nuclear energy was discovered precisely when it is essential for human survival. It alone can provide the clean, safe, and economical energy necessary for a prosperous and growing world population. Nuclear energy has been developed at a time when the world is faced with imminent prospects of monumental energy, environmental, food, water, and other resource conflicts, with enormous population pressure on seashores, and major lakes and river areas.

Development must be directed to inland areas, but at infrastructure costs that are comparable to the historical advantages of being near large water sources. Nuclear power can provide the electrified transportation and industry necessary for such development, including desalination to produce economical potable water. It is essential to relieve constraints on oil and gas supplies and the destructive human deaths and health costs and environmental devastation of coal-burning.

The question is: Will we have the public interest initiative to use nuclear energy; or will short-term economic interests limit its use, to maintain high fossil fuel prices, and, ultimately, to continue the genocide to limit world population?

Under the Administration of Clinton and Gore, the nuclear industry killed the U.S. modular high-temperature gas-cooled reactor (MHTGR) and the Integral Fast Reactor (IFR), in order to limit "competition" to the industry-favored ALWRs—advanced light water reactors. The Clinton/Gore Department of Energy (DOE) used a National Academy of Sciences committee report to say that the inherent safety of the MHTGR was not important, because the ALWR was "safe enough."

Then, as now, the nuclear industry provided negligible support for nuclear power. The nuclear organizations support nuclear utilities and companies, not nuclear power. The Nuclear Regulatory Commission (NRC) eliminated the Atomic Industrial Forum after the 1979 Three Mile Island accident, in order to make utility owners/operators more "responsible"; the NRC could lead them by the nose on their TMI "responses." Unlike the large, integrated, oil, gas, and coal industries, no equivalent major industry trade group acts as an effective advocate for nuclear energy.

Nuclear technology was a product of the Atomic Energy Commission (AEC) and the Congressional Joint Committee on Atomic Energy, created in the public interest; it was not a private venture with a commitment or investment to recoup. Even today, there is no serious industry support for nuclear power. When a nuclear power "strategy" was developed by the utilities, through the Electric Power Research Institute (EPRI), the industry excluded contributors to future industry and societal nuclear power decision-making.

Secret Progress?

The Tokyo Electric Power Company undertook the construction of the first U.S.-designed ALWRs (two 1,356 MWe units at the Kashiwahara-Kasaki site near Tokyo) in the early 1990s, and they successfully constructed them in modules (up to 650 tons), beating their 48-month construction schedule. (The second unit had to be slowed down to keep from overtaking the first!) But during this success, with the story improving with time, and even when the units went critical, and then commercial, this positive experience was largely kept a secret.

(How many Americans know that these very large General Electric boiling water reactor plants were built in Japan faster than any large plant was ever built in the United States?)

The industry made "presentations" on the Japanese ALWRs, but their need to so "control" messages, limited continuing information to the people who should know of such positive experience—especially in government and major media. (In Massachusetts, for example, we could not get routine information to regularly inform state officials about the success, even through the American Nuclear Society.)

Today, the NRC has revised its licensing rules to provide pre-approved plant designs. But, nuclear industry people don't say, "we have shown the ability to deliver plants on schedule and budget." Instead, they say that "it takes 6 to 9 years to build a plant in the U.S., and we need government to do it." Some institutional reasons (for example, labor rules) limit the direct applicability of the Japanese experience to the United States, but the "education" of that experience is lost.

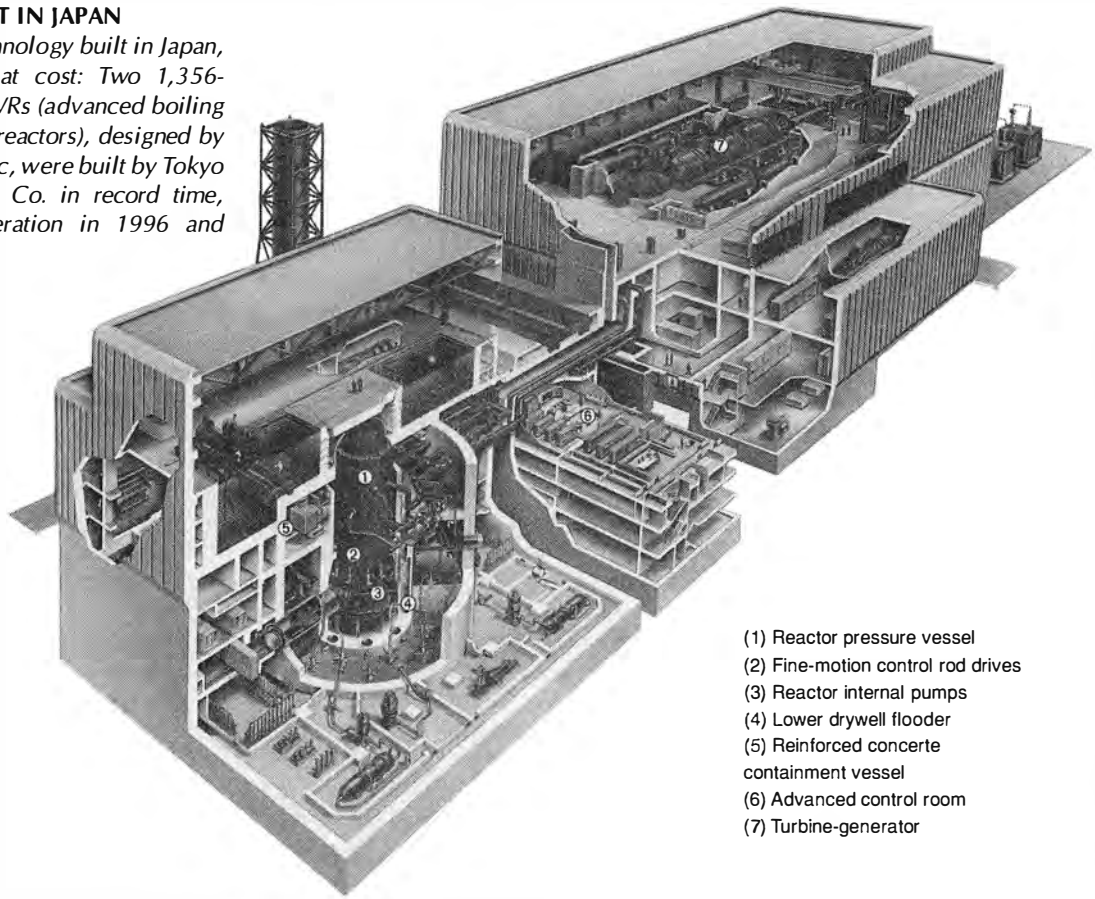
"The industry" today also is generally paranoid about "the anti-nukes," even though these anti-nukes were not

---

Jim Muckerheide, the State Nuclear Engineer for the Commonwealth of Massachusetts, is a founder and President of Radiation, Science, and Health, which is committed to establishing a radiation policy based on science. He is also co-director of the Center for Nuclear Technology and Society at Worcester Polytechnic Institute in Worcester, Massachusetts, which is working to establish a "level playing field" for decisions on the costs and benefits of nuclear technologies that are essential to human prosperity in the 21st Century.

GENERAL ELECTRIC'S ADVANCED BOILING WATER REACTOR: BUILT IN JAPAN

What U.S. technology built in Japan, on time and at cost: Two 1,356-megawatt ABWRs (advanced boiling water nuclear reactors), designed by General Electric, were built by Tokyo Electric Power Co. in record time, beginning operation in 1996 and 1997.



(1) Reactor pressure vessel
(2) Fine-motion control rod drives
(3) Reactor internal pumps
(4) Lower drywell flooder
(5) Reinforced concerte containment vessel
(6) Advanced control room
(7) Turbine-generator

the real reason for U.S. nuclear power failures. The few good utilities consistently built plants cost-effectively, despite the "anti-nukes."

Changing Regulatory Policy

What can be done? Government must still produce the environment and conditions required for nuclear power to succeed, *in the public interest.* If policies and regulatory costs remain out of balance, new plants will remain uncompetitive. Private investment cannot independently decide to implement nuclear power. NRC must take pro-active licensing actions, to focus on safety and engineering instead of hypotheticals and bureaucracy. The Administration and Congress must provide direction and support. Broad-based, open hearings on benefits and alternatives are needed.

In January 2001, Exelon made an initial presentation to the NRC, proposing that the NRC be prepared to license the South African design for the Pebble Bed Modular Reactor (PBMR). This was not a positive presentation. Neither party used this opportunity to make progress.

More substantial information and discussions may be going on separately. This would be consistent with the industry's history of *largely* unnecessary and self-defeating secrecy. NRC and Exelon both know enough about this relatively old design to have addressed key issues; for example, the need to change specific rules and technical issues.

The NRC produced a Pre-application Safety Analysis Report on the DOE/General Atomics MHTGR in 1989. No possible significant radioactivity release, even from the most extreme accidents, could be identified. However, in the recent discussions with Exelon on the PBMR, the NRC (questionably represented by its Regulatory Research division instead of its Nuclear Reactor Regulation division), played the "we don't know anything until you give us a specific proposal" game; and Exelon talked about an amorphous "process."

Necessary rule changes, and identification/closure of key technical issues, should be proposed now. Exelon's initial assessment was like traditional "undermanned" electric utility operations, instead of reflecting the urgency and magnitude of the project by a strong private industry. This wasn't a DuPont initiative for a major project, or an Apollo Project, which reflect the level of commitment that is now required.

No government funds should be used for the next nuclear plants. But government must fund its regulatory and policy processes, with clear direction, to, at least partially, "level the playing field" for potential nuclear power plant builders. A high-level initiative must identify the regulatory information that is needed to assure public health and safety. No other information should be necessary. Technical resources on any

identified critical issues should be funded and effectively implemented.

As California's recent failures show, government action must be more timely and effective. Extreme nuclear power regulation (misrepresenting "safety") is unjustified, while fossil fuel operations have massively greater human health and environmental costs compared with nuclear power. Congress should assure equitable treatment of "alternatives" that allow for judicial proceedings when agency decisions fail to be consistent.

Substantial objective bases exist to establish a more level field, in ways that can balance the political influence of fossil fuel and "renewable" energy interests from their rhetorical high ground—while the population pays the price.

It should be stressed, that safety is not the result of more regulation. Over-regulation, justified by "responding to public perceptions" (reinforced by regulator misrepresentations of nuclear risks), does not produce more safety, and often produces less. But the enhanced safety of the new plant designs compared to our present plants should result in much reduced regulation.

Concepts of "passively safe" and "inherently safe" small reactors have been discussed since the 1970s. (Note: "Passively safe" refers to using gravity and other passive physical properties without active components for fuel cooling to prevent fuel damage and hazardous release of radioactivity. "Inherently safe" refers to nuclear fuel that cannot melt, because its heat can be transferred directly to the environment, either through air or ground, without possible damage to the fuel.)

It's Time for the HTGR

The large high-temperature gas-cooled reactor (HTGR) was a great design when I first got involved at Bechtel in 1972, in the initial series of large plants ordered—the first by Baltimore Gas and Electric. In the 1980s, the large HTGR design was converted to a "modular" concept, the MHTGR (with the helium gas feeding conventional steam generators). This design precluded the reactor from having enough decay heat in the core to damage the ceramic fuel. It also has large "negative reactivity," which precludes the need for control rods to stop the reaction; a small core temperature increase stops the nuclear chain reaction.

A 1986 General Electric report to the DOE stated that the German "pebble bed design," based on almost 20 years of operation of a small prototype pebble bed helium-cooled reactor, had complete conceptual engineering, was in detailed engineering, and could be built and operational by 1992. At that time, the DOE/industry group supported the variation of the fuel configuration by General Atomics, and reasonably so. The prismatically fueled GA design can produce substantially more power from a single unit, while maintaining the "inherently safe" design.

But DOE and General Atomics did not design a commercial power reactor. By using "military" objectives—for example to produce tritium, or to burn plutonium—there was no effective, timely, commercial plant design effort. In 1992-1993, we followed the MHTGR program with some interest in Massachusetts, briefly discussing the potential to put such a plant at the (closed) Yankee Rowe nuclear plant site. A *Boston Globe* editorial was produced to that effect.

But the utility was against the MHTGR. It was clear that future builders would have to be Independent Power Producers (IPPs), as with the companies building the natural gas plants (at the intersections of a gas pipeline and a transmission line). Because the natural gas for all these plants would not be available indefinitely, these plants could be followed by MHTGRs (which, in many cases, could go on the same sites).

But gas plant builders are not good candidates to build MHTGRs. These companies want to be operational in months, with a gas contract, and are ready to "grab the money and run," when gas supplies or other business conditions get tight. Government did not consider public costs when gas supplies are constrained. This was combined with a push to close New England's nuclear plants—benefiting the gas generators, while losing secure power and cost stability for the public. No one blinked when Yankee Rowe was closed, which was not necessary, but not significant—except as a warning. Then, Maine Yankee, Connecticut Yankee, and Millstone 1 nuclear plants were all closed, also unnecessarily. It was good for corporate interests. The capital return on these plants was largely complete. Only the public/ratepayers would benefit from their continued operation.

And, decommissioning the plants would provide access to hundreds of millions of dollars in "decommissioning costs" (otherwise known as "income") without having to operate anything, while power sources that replaced these plants had larger utility returns. This, of course, was before sales of "used" nuclear plants started hitting a billion dollars each, and before generating companies figured out that the "privatized" plants would produce large returns for the operators (with some public benefit of incentives to reduce electricity costs instead of the traditional utility incentive to add capital costs to the ratebase).

HTGR Technology Advances

In the 1980s, Prof. Larry Lidsky at the Massachusetts Institute of Technology pushed to incorporate a gas turbine to replace the MHTGR's steam generator. Gas turbines had not been up to the task in the 1960s-1970s, but technology advances changed that situation.

General Atomics has now pushed ahead with an elegant, integrated turbine-generator, compressor-recuperator cycle, with this equipment all in one vessel. The South African PBMR has increased the reactor power to 115 MWe, from the smaller 1986 German design, and has also adopted the gas turbine.

In addition, the South Africans have worked with the Russians, who successfully developed German ceramic microsphere fuel production capabilities. General Atomics is also working with Russian engineers to construct a plant in Russia, in order to get a lot of energy from nuclear weapons plutonium.

However, it is not clear that these plants are engineered to be optimized. Hopefully the developers anticipate the margins that limit power output for the current plants that will enable substantial upgrades at moderate costs, after experience allows removing the traditional nuclear power "undue conservatism."

The 'Overbuild' Factor

The "overbuild" philosophy seems engrained in the mindset of these organizations. This was most telling when I was doing professional recruiting. Many companies would not consider interviewing a "nuclear-trained" engineer because, it was said, "they don't know how to do engineering to be cost-effective." We can characterize the

NRC/nuclear vendor/utility approach as: "If they built an airplane, they would have to call it a 'locomotive.' It could never get off the ground."

Clearly, by the late 1980s, the ALWR designs were for the most part unduly costly relics. The "return-on-investment" of regulated utilities produced "overbuilding" (where "everyone makes money" by sticking all "justified" capital costs to the rate-payers, and where Public Utility Commissions are unable to question wasteful costs "required" by the NRC).

In the utilities' ALWR design effort, this costly overbuilding was not reviewed; instead, they focussed on "constructibility." This was indeed critical, but not to the exclusion of reviewing the safety-significant plant design bases.The utilities were right on the need for certainty in plant construction cost/schedule in order to raise the future construction funds. However, there was a large, "missing" link: Their approach was offered as though utilities would build nuclear plants.

In that case, the "certainty" of high costs is just as good as (and even better than) the "certainty" of low costs. However, clearly, for an independent power producer, such high capital costs would produce an uncompetitive product—with certainty.

Corbin McNeill, CEO of the largest U.S. nuclear utility, Exelon, told the industry just that about three years ago. He said he would build a nuclear plant for the "privatized market"—at a cost of about $900 per kilowatt (vs. a range of about $1,500 in ALWR cost estimates). In response, some cost estimates have come down over the last three years, but the capital cost gap that the utilities built into these fixed, "certified," designs is very real.

It was also clear that utility "nuclear owners" doing the ALWR "Plant Owners' Design Requirements," through the Electric Power Research Institute (EPRI), was a mistake. The utilities would not build another plant. Any near-future (decade-plus) plants would be built by IPPs—unless government would take the policy-making lead to build a plant. But that would also be disastrous: government (presumably DOE) would build, and effectively "institutionalize," the highest-cost plant.

Also, no industry initiative exists to explain to the public the reasons to stop using fossil fuels, and to use nuclear power. No one addresses the enormous, virtually unimaginable, environmental advantages of using nuclear energy, from all aspects of the fuel cycles, and the economic advantages, especially price stability (including competition to control fossil fuel prices, as happened in the 1970s); the increased energy security (and reducing world conflicts to appear over oil supplies), the enormous and growing balance of payments transfers, and so on.

Low-Level Radiation Costs/Benefits

An additional area of nuclear cost reduction is to eliminate the extreme radiation dose limits that cause nuclear energy to be uneconomical. Present radiation protection limits are based on false science. Radiation is presumed to be hazardous linearly, down to zero dose. Some limits are small fractions of the variation in natural background radiation doses.

In fact, the scientific evidence shows that supplements to natural background radiation enhance general health, and can prevent, and cure, some cancers, infections, inflammations, and other conditions and diseases, such as diabetes and high blood pressure.

With a committed effort, this growing evidence will overturn extreme radiation protection limits in the near future. This will produce public health benefits, and greatly reduce the unjustified costs that can make nuclear energy "uneconomical."

What We Need

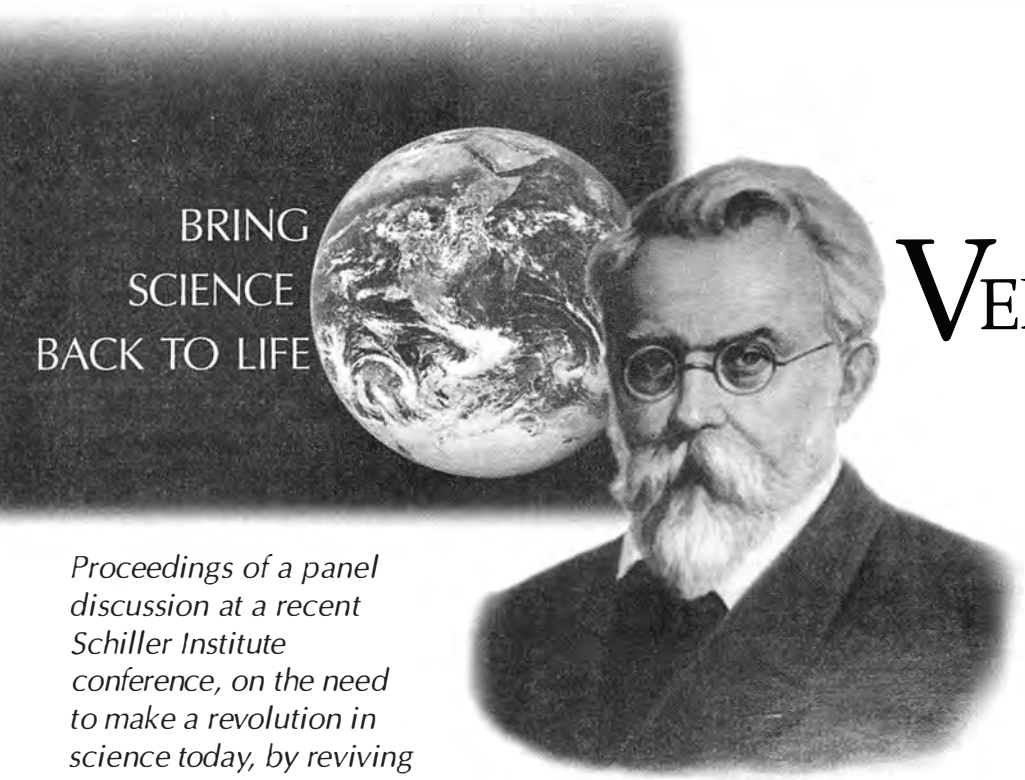
From the utility point of view, the MHTGR seemed to be the more reasonable option, compared with the small, passive, light water reactors and other inherently safe designs (for example, the PIUS reactor). But the MHTGR can only be an interim step to apply the essential, large contribution that nuclear energy must make to the world's energy supply, for a prosperous society approaching 10 billion people by the year 2050.

Consider: A threefold increase in total energy, and a target of at least 30 percent of world energy—not just electricity—from nuclear power by 2050. (This 30 percent would equal about the total energy use in the world today.) Obviously, fossil fuel use is not likely to be reduced. Nuclear energy must supply direct heat, for industrial processes and seawater desalination, for example; and hydrogen for transportation energy. To enable 80 percent (or more) of the world population to live with efficient energy sources at one quarter of the per capita energy use in the developed world today, we would need an equivalent of 5,000 to 7,000 large nuclear plants of 1,000 MWe size (many more with small reactors, but these could be assembly-line manufactured and modular, instead of constructed on-site).

We would also probably begin to need substantial nuclear fuel contributions from breeder reactors. There could possibly be large wind energy contributions, but solar energy is too great a risk to substantially rely on. A large fraction of solar energy can be interrupted (for 1 to 7 years) by large volcano eruptions, as happened twice in the 1800s—Krakatoa in 1883, and Tambora in 1815 (which was referred to as "the year without a summer." Krakatoa also erupted in the year 535, producing many years with loss of solar energy, leading to famines and economic devastation.)

We need MHTGRs, which are an interim contribution, and not exclusive. We also need ALWRs—where large power centers with substantial growth require large blocks of power. For example, ALWRs could be built at Palo Verde in Arizona, contributing to Western U.S. demand, led by California. However, we must reduce the ALWR capital costs (Japan is leading such an effort).

Will we certify such plants with the NRC for the United States? Or, will Japan get them certified for U.S. orders?



VERNADSKY'S METHOD

Proceedings of a panel discussion at a recent Schiller Institute conference, on the need to make a revolution in science today, by reviving the method of Vernadsky.

EDITOR'S NOTE

This feature includes four presentations from the science panel at the Schiller Institute conference, "The Ecumenical Battle for the Common Good," held in Bad Schwalbach, Germany, May 4-6, 2001.

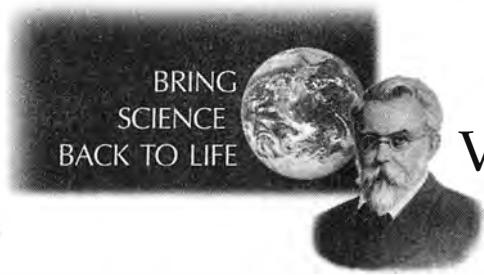
Economist and 2004 U.S. Democratic Presidential candidate, Lyndon H. LaRouche, Jr., set the context for this panel in his keynote address [excerpts, p. 29], by locating the importance of the work of Vladimir Vernadsky as a unifying figure in the scientific work of Russia and Ukraine, which can aid the contribution of those nations to the development of Eurasia as a whole. LaRouche defined his Eurasian Land-Bridge proposal for global economic development as "the greatest single opportunity before all mankind for development," and counterposed it to the folly of the Bush administration today, on all policy fronts.

LaRouche's remarks provoked intense discussion among conference participants, who included representatives of 40 countries and many governmental figures. The opening panel of the conference, for example, featured presentations commenting on LaRouche's keynote address, by two distinguished Russians, Dr. Sergei Glazyev, chairman of the Committee on Economic Policy and Business of the State Duma (parliament) of the Russian Federation, and Prof. Stanislav Menshikov of the Central Mathematical Economics Institute of the Russian Academy of Sciences.

As he has repeatedly warned in many public broadcasts in the past few months—LaRouche reiterated that the economies of Europe, Asia, Africa, and the Americas can not survive the present, accelerating financial and economic collapse, without a program for large-scale infrastructure-building, and an increase in the productive powers of labor throughout Eurasia. The technologies to develop this new frontier—the internal land-mass of Central and North Asia—must be seen through the eyes of Vernadsky, LaRouche said, in particular, Vernadsky's focus on human cognition and its "natural products," which improve the biosphere.

Transcripts of the other conference panels appeared in *Executive Intelligence Review*, and are available on the magazine's website, www.larouchepub.com.

CONTENTS



VERNADSKY'S METHOD

1. Vernadsky And the Science of Life

by Jonathan Tennenbaum

What is life? If you ask modern molecular biologists today, they will generally tell you: Life is just a peculiar sort of biochemical process which emerged on the Earth through a series of very unlikely, chance events. So, you ask such a biologist, "Well, are you alive?" If they are honest they would have to answer, "Probably not." And then if you ask them, "Do you believe you are just an assemblage of interacting molecules?" "Yes," they answer. "Then, please tell me, which molecule is talking now?"

We have come to a point, where the methodological incompetence dominating present-day biology and medical research can no longer be tolerated. We are facing mass outbreaks of old, and newly emerging, epidemics and epizooics all over the world, including AIDS, tuberculosis, malaria, cholera, polio, hepatitis, dengue, BSE, hoof-and-mouth disease, and so on.

These outbreaks reflect a sudden acceleration in the rate of evolution of the relatively lower forms of life in the biosphere—of bacteria, viruses, parasites, and so on—as a result of the economic breakdown and looting of Africa and other developing regions of the world, of the free-trade insanity which led to the epidemics of BSE and foot-and-mouth disease in Britain, plus the probability of artificial creation of new pathogens in laboratories. If this process continues, we cannot rule out, that Mankind itself might become a virtually extinct species within a few generations. There is no way that the techniques of molecular biology and genetic engineering can provide an answer to this ongoing "biological holocaust." We need a scientific revolution, based on a comprehension of the principle of life itself, as a distinct, active principle embedded in the geometry of the Universe.

There is a second urgent consideration, which Lyndon LaRouche has underlined at this conference. The array of large-scale infrastructure projects, required for the development of Eurasia in the coming period, implies a scale of human intervention into the so-called natural ecosystem—into the Earth's biosphere, and even into its weather and climate—beyond anything Man has undertaken until now. Not only governments and planning agencies, but also the general population, whose political support has to be mobilized, need a clear conception of the deeper principle that must guide us in a coming period of great development undertakings. The viciously incompetent, pseudo-scientific garbage which dominates the teaching of so-called "ecology" today—such as the assertion that the biosphere is, or has ever been, in equilibrium—must be swept away immediately, and replaced by a scientific notion of Man's necessary role in mastering and deliberately *improving* the Earth's biosphere as a whole.

This means reviving the work of the great Vladimir Ivanovich Vernadsky—about whom I will say more a bit later—and actually going beyond Vernadsky in some crucial respects.

I recommend to everyone here, to study the 1938 essay by Vernadsky, entitled "On the Fundamental Material-Energetic Distinction Between Living and Nonliving Natural Bodies in the Biosphere," which you can find in English translation in *21st Century* magazine [Winter 2000-2001]. In that location, and in other writings, Vernadsky presents a rigorous proof, that living processes are an expression of a physical principle which is *absolutely distinct* from those principles, which appear to govern the processes of nonliving matter on the Earth. The attempt by molecular biologists, and others, to reduce living processes to physics and chemistry as presently understood, is as futile and incompetent as the attempts by badly educated people over centuries, to

Science panel participants ➤ (from left) Dino De Paoli, Wolfgang Lillge, Poul Rasmussen (chairman), Laurence Hecht, and Jonathan Tennenbaum (at podium).

Jonathan Tennenbaum: "Living processes are the expression of a physical principle that is absolutely distinct from those processes that appear to govern nonliving matter." ➤

Chris Lewis/EIRNS

Maria Schmitz/EIRNS

square the circle with ruler and compass. The circle, as Cusa demonstrated, represents a higher species of existence, which is not reducible to the domain of straight lines and polygons that can be constructed by the methods of ordinary geometry.

Vernadsky thus spoke of a "deep, unbridgeable gap" separating the processes of life from all other processes occurring on the Earth. But, merely establishing that crucial difference, is not the same thing as conceptualizing the principle of life itself, as a *universal* physical principle! That is the great scientific task which we have to take on in the coming period.

"But, what is a 'universal physical principle?' " Someone will ask. Well, if you want to know that, go back and read Plato's *Timaeus*. There, Plato develops the conception that the Universe is not an object of the sort that can be seen or otherwise grasped by sense perception. Rather, the Universe is a process of becoming, unfolding according to an *idea*. Just as a classical composer composes a work of music, in such a way, that every moment of the composition's performance will be shaped and governed by a single idea, the composer's *intention*, just so, the development of the Universe as a whole expresses an *intention*, a *universal principle of creation*. By its very nature, however, an intention cannot be seen, but only grasped by the mind.

It is from this point of view, for example, that we have to read the meaning of the crucial anomaly of visual geometry—the fact, that five, and only five types or species of regular solids, can be constructed in visual space (Figure 1). The uniqueness of the five regular solids pervades all of visual geometry and underlies all possible forms that can exist in it. Moreover, the solids have a hierarchical ordering, all being derivable from a single one, the dodecahedron, and this figure is bounded by, and derived from, the sphere (multiply-connected circular action), through a process which generated, as a necessary by-product, the geometrical relationship known as the Golden Mean or Divine Proportion.

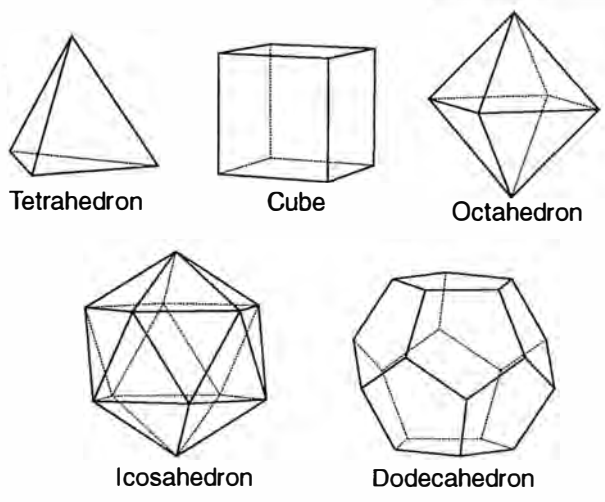


Figure 1
THE FIVE PLATONIC SOLIDS
Only five self-similar solids can be constructed in visual space. Self-similar means that all the edges are the same length, all the faces are the same shape, and all the internal angles are equal.

The uniqueness of the five regular solids pervades all of visual geometry, and underlies all possible forms that can exist in it. Their uniqueness expresses a universal principle of creation.

Figure 2
LEONARDO'S DRAWINGS OF HYDRODYNAMIC FLOWS

Leonardo studied the unseen principles governing the universe by looking at the characteristic forms of motion caused by those principles. He and his collaborator Luca Pacioli demonstrated that the morphology of living organisms is pervaded by the geometrical relationships of the Golden Proportion, which is not generally true for nonliving processes. Here, examples of Leonardo's water studies.

Source: The Royal Library at Windsor Castle

Plato's "reading" of the significance of the regular solids constitutes a first step toward the more developed notion, by Kepler, Leibniz and Riemann, that the highest principle of universal creation subsumes an ordered multiplicity of knowable ideas or principles, all having different sorts of characteristic *effects* in the Universe. These principles themselves are in a sense eternal; they are always there, but their mode of expression changes according to the moment, circumstance, and media in which their activity is reflected.

So, the idea of Man, and the principle of cognition, *precedes* the physical emergence of Man and his mental processes. That puts an end to Darwin's silly, empiricist conception of evolution by so-called random variation. Actually, the real father of an evolutionary conception of the Universe—including the evolution of living species as a directed process—was Cardinal Nicholas of Cusa. That notion of directed evolution was brilliantly confirmed, in fact, by the work of Vernadsky.

Nicholas of Cusa also launched the development of higher forms of physical geometry, beyond the simple visual geometry associated with Euclid, but already implied by Plato's *Timaeus*. The existence of an ongoing process of discovery in the Universe, embodied in human creative Reason, implies that the geometry of the Universe cannot be merely spherical, but must embrace a notion of non-uniform curvature. This led directly to the physical discoveries of Kepler, and from there to Leibniz's creation of a comprehensive function theory (including integral-differential calculus), followed later by the synthetic geometry of Monge and Gauss, and, finally, by Riemann's revolutionary conception of a general physical geometry of multiply connected manifolds.

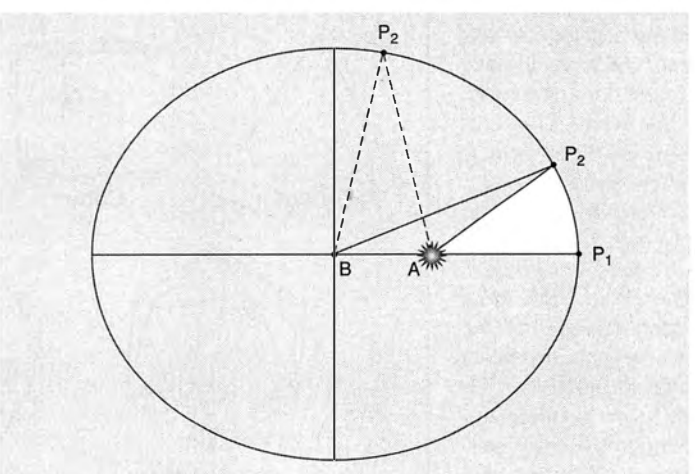
Riemann's conception was grounded in recognition, that the Universe can only be known *from the inside,* through the deliberate experiencing of an internally ordered series of fundamental discoveries of principle, as a single conception, and in which all *a priori* assumptions are rigorously excluded.

Meanwhile, Leonardo da Vinci executed the intention of

Figure 3
THE ELLIPTICAL ORBIT OF A PLANET

In demonstrating the noncircular, elliptical orbital motion of Mars, Kepler created a paradox: If the path of a planet is changing in every arbitrarily small interval in a nonlinear fashion, then how does the planet know how to move? Here, P_1, P_2, and P_3 represent points in an elliptical planetary orbit. If the orbit were a circle, the line from the center of the circle, B, to each point would remain constant. In this elliptical orbit, the length of the line PB is constantly changing, at a changing rate.

Source: Jonathan Tennenbaum and Bruce Director, "How Gauss Determined the Orbit of Ceres," *Fidelio*, Summer 1998.



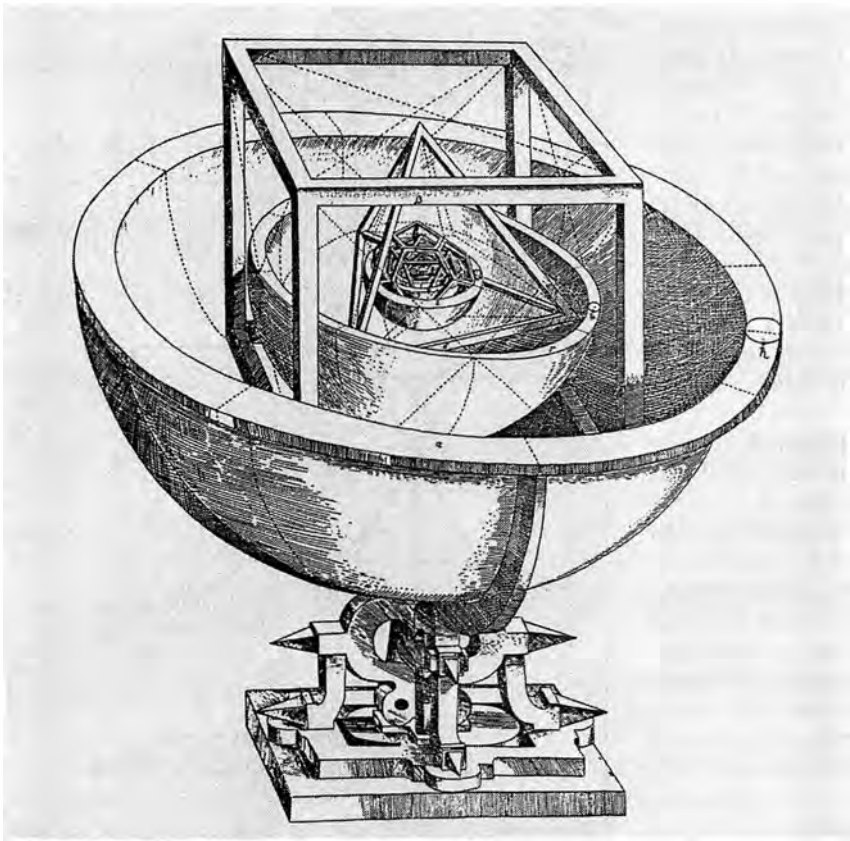


Figure 4
KEPLER'S HARMONICALLY ORDERED SOLAR SYSTEM

Kepler saw that the combined action of a multiplicity of principles in the solar system was subsumed by a higher ordering principle, which he identified in the action of the Sun. Here, his depiction in the Mysterium Cosmographicum *of that harmonic ordering, where the planetary orbits are nested according to the ratios of inscribed and circumscribed Platonic solids.*

Plato and Cusa by systematically investigating *all* phenomena in the visible Universe from a single standpoint, namely, to seek knowledge of the unseen principles governing the Universe, by examining and juxtaposing the characteristic *forms of motion* of processes or effects, caused by those principles (Figure 2). In particular, Leonardo and his collaborator Luca Pacioli demonstrated, that the morphology of living organisms, their growth, motion, and internal organization, is pervaded by the geometrical relationships of the Golden (or Divine) Proportion; whereas, the Golden Section is not ordinarily manifested in nonliving processes, at least not on the scale of visible bodies on the Earth.

This set the stage for Johannes Kepler's attack on the anomalies of planetary motion. By demonstrating the non-circular, approximately elliptical orbital motion of Mars (Figure 3), Kepler created a paradox: If the path of a planet is not simply circular, and not a simple mathematical function, but is changing in every arbitrarily small interval in a nonlinear fashion, then how does the planet *know* how to move? The orbit and the orbital motion must embody the effect of a *principle,* which does not correspond to a precise mathematical number or function, but is nevertheless a *distinct existence:* the "mind of the planet," as Kepler called it, or a *monad* in Leibniz's terminology. However, in causing the *effect* of the planet's Keplerian orbital motion, the monad does not act alone, in isolation from the rest of the Universe; rather, its action must react or adjust to the existence of all the other monads (or active principles) in the Universe. The result is a harmonically ordered solar system, in which the combined action of a multiplicity of principles, is subsumed by a higher ordering principle, which Kepler identified in the action of the Sun (Figure 4).

This Keplerian notion of "universal gravitation," was brilliantly confirmed by Gauss, when he demonstrated that the asteroid belt is the effect of a lawful *dissonance* generated by the multiply-connected (polyphonic!) composition of the solar system. On the other hand, Kepler showed that the ordering of the solar system as a whole manifests the same Golden Mean-associated harmonic relations, otherwise found only in living processes on the Earth. Kepler hypothesized, that the existence of life in the specific form we find it on the Earth, must somehow be connected with the specific harmonic characteristics of the Earth's orbit.

At the same time, in his "Snowflake" paper, Kepler founded the method of *crystallography* as the first experimental technology for penetrating from the macroscopic domain down into the domain of microphysics. Kepler presented evidence, on this basis, of a systematic distinction between the organization of living and nonliving matter on the microphysical level. Later Mendeleyev applied Kepler's methods to work out the periodic or natural system of chemical elements; a crucial input into Vernadsky's work.

Around the same period, at the middle of the 19th century, Louis Pasteur applied the same method to lay the basis for

modern biology and biophysics in two interconnected demonstrations (Figure 5). First, Pasteur demonstrated that the fermentation process, which produces beer and wine, for example, is uniquely the effect of a *living process.* Secondly, he showed that the products of that living process, as exemplified by crystals of tartaric acid created in the production of wine, exhibit crystallographical (that is, microphysical) characteristics, which are absolutely distinct from those of the products of ordinary, nonliving chemical processes. In all chemical compounds synthesized completely outside the influence of living processes, the two mirror-image forms of any molecular substance are produced in equal proportions; whereas the natural products of living processes (including living tissue) generally contain only *one* of them, either the left- or right-handed version.

Vernadsky: A Universal Natural Scientist

With this background, let us turn to the work of Vladimir Ivanovich Vernadsky, founder of the new branch of science known as biogeochemistry. Vernadsky was born Feb. 26, 1863 in St. Petersburg, and died in Moscow January 6, 1945. His father was a prominent intellectual and professor of political economy, his mother a music teacher and singer in a famous choir, both Ukrainian. Vladimir Vernadsky studied chemistry, crystallography, mineralogy and other natural sciences at St. Petersburg University, studying under the great chemist and nation-builder Dmitri Mendeleyev, the chemist Alexandr Butlerov, the mineralogist Vasili Dokuchayev, a pioneer in the science of soils. In the 1880s, Vernadsky made the first of a long series of travels to France, Germany, and other European countries.

With a colossal capacity for intense and prolonged intellectual work, Vernadsky became a universal natural scientist in the sense of Alexander von Humboldt and Humboldt's *Cosmos."* At the same time, he was also a great organizer of scientific and educational undertakings, including the Ukrainian Academy of Sciences; the founder of dozens of institutes and research projects, including not least of all the nuclear energy program of the later Soviet Union. Recognizing already by 1910, that nuclear energy would transform Man's relationship to Nature, Vernadsky worked with Marie Curie in Paris in the early 1920s, and set up a comprehensive program of research in Russia and Ukraine. In 1934, he formed the Commission on the Study of Heavy Water, and in 1939, the Commission on Isotopes; finally, in 1940 he took the initiative to bring together the 14-member Special Committee for the Problems of Uranium, including Kurchatov, Khariton, Ioffe, Mandel'stam and others, which became the core of the Soviet nuclear weapon and nuclear energy effort.

Vernadsky was an intensely political person, devoted to universal education, and to scientific progress for Russia, Ukraine and all nations. He was already a major figure in the republican ferment among university students at the turn of the century, became a leader of the Constitutional Democratic Party, was repeatedly elected to the Russian State Council and held high posts in the Russian government, including assistant minister of education, in the period immediately preceding the Bolshevik revolution. But probably his most important single post, was as initiator and director of the Commission for Investigating the Natural Productive Forces of Russia within the Russian Academy of Sciences, the famous KEPS, from 1915 to 1918 (and then again, of its post-World War I continuation, in 1921-1930).

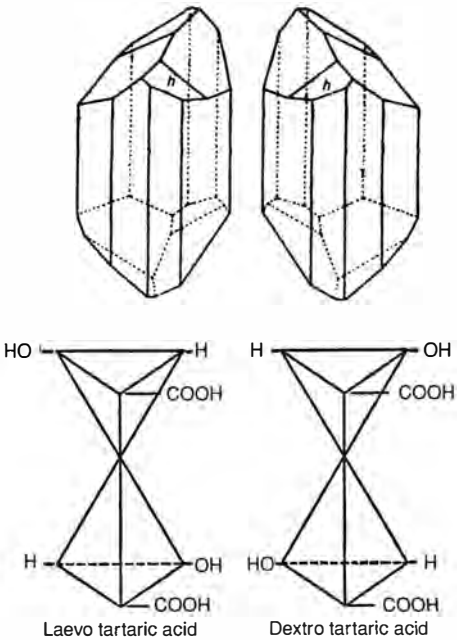


Figure 5
TARTARIC ACID IN ITS LEFT- AND RIGHT-HANDED FORMS

Louis Pasteur showed that the natural products of living processes generally contain only one form of crystallographic forms—left- or right-handed, while those compounds synthesized outside of living processes produce both forms in equal proportions.

Above, Pasteur's sketches of left-handed and right-handed tartrate crystals, which he discovered, had hemihedral facets that were inclined in the same direction as the optical activity of the crystals. The right-handed tartrate acid turns the plane of polarized light toward the right, while the left-handed tartrate acid turns this plane toward the left. The dissymmetrical facet of the tartrate crystal is labeled h.

Below, the structural formulas for the two forms of tartaric acid.

The KEPS was charged with comprehensively mapping out the strategic raw materials deposits and other resources of the vast Russian Empire, in the context of an economic mobilization. As Vernadsky reported in a later letter, the experience of the KEPS and the events of the First World War "radically changed my geological conception of the world." It was 1917-1921, in the midst of the political turbulence and confusion that accompanied the Bolshevik takeover and ensuing Civil War, and in the midst of constant travel from city to city in Ukraine and the Crimea, creating new institutes and educational programs everywhere he went, that Vernadsky made his fundamental conceptual discoveries.

'What Does Life Do?'

Reflect, as Vernadsky did, on the deeper implications of the KEPS and related activities. Here was Man, Russia, engaged in an economic mobilization, looking at these objects: rocks, minerals etc., from the standpoint of the man-made processes of transformation which make ores into metals etc. and then into machines and other instruments of agricultural and industrial production; of the extraction of oil and coal, and the production of power, and so forth.

On the other hand, those same mineral deposits—as investigations by geologists and geochemists (including Vernadsky himself) had shown more and more clearly—are, for the most part, products of the activity of living processes! This includes, above all, the activity of microorganisms, but also of plants and, indirectly, even animal life, acting over thousands or even millions of years. Living organisms absorb and digest material and solar radiation from the surrounding environment, integrate the transformed substance into their own living tissue, and excrete material to the outside. When an organism dies, the organic material is deposited again in the environment, often in a changed location, and with different combinations and concentrations of chemical elements. Thus, every living organism is the source of what Vernadsky called a "biogenic flux" or flow of transformed matter and energy within the biosphere.

Not only the majority of mineral deposits on the Earth, but the present chemical constitution of the Earth's atmosphere, of the Earth's oceans, its soils and surface formations down to a considerable depth, has resulted from the activity of living organisms. The biosphere, including its present system of weather and climate, is thus a *natural product* of the life process as a whole.

"A new world opened up for me," Vernadsky wrote later in his memoirs. In place of the old question "What is Life?," Vernadsky asked: "What does life *do*?—what is the impact of all living processes, taken together, upon the geology and chemistry of the Earth?" Suddenly, the entire array of accumulated empirical evidence and detailed scientific work, on the geological history of the Earth, could now be brought to bear on the ancient question of the nature of life. Vernadsky defined the biosphere as the entire region of the Earth, inhabited (colonized!) by living organisms. He called the aggregate of all living organisms existing at any given time on the Earth, "living matter," and investigated its effect on the biosphere on the scale of geological time.

Vernadsky's conclusions, were clear and unequivocal:

(1) In the course of biological evolution, the aggregate "free energy" of the living matter in the biosphere—a measure of its power to do work in transforming the environment—has been constantly increasing (in fact, not only in absolute value, but also as a *ratio* of the total energy throughput of living matter). There is no natural equilibrium in the biosphere, as the cultish ecologists believe; the biosphere is actually developing farther and farther away from equilibrium! Thus, the *power* of living over nonliving matter has constantly increased in the course of evolution.

(2) As a result of that increase in power, living matter has become the *most powerful geological force* in the biosphere—despite the fact, that the total mass of the living organisms themselves, remains a nearly *infinitesimal fraction* of the total, expanding mass of matter directly and indirectly affected by their activity.

(3) This specific sort of *directed evolutionary development,* leading to a continual increase in the free energy ratio of living processes in the biosphere, is *unique* to living organisms and is not found in the nonliving domain. Throughout the geological history of the Earth, the basic processes in nonliving matter in the biosphere have remained virtually the same over billions of years, *except* insofar as they have been modified through the influence of living organisms.

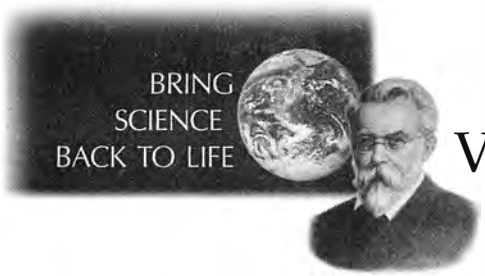
But Vernadsky asked another, even more exciting question: "What is the impact of human social activity, taken as a whole, on the development of the biosphere?" He saw clearly, that in the course of history, the physical-economic activity of human society—its agriculture and industrial production, mining, production and distribution of power, water and transport infrastructure and so forth—has had the effect of accelerating the growth and development of the biosphere as a whole, accelerating the increase in the *power* of living matter over nonliving matter and the biosphere as a whole.

At the same time, Man's own power to direct and expand that process, has continually increased. But how does that occur? As Lyndon LaRouche has demonstrated in a more rigorous and powerful way than Vernadsky could do, this occurs in only one way: through the generation and communication of *ideas*—in the form of scientific discoveries of principle, ideas bearing on their applications in technology, as well as principles of classical art and statecraft—by and among human minds. So, what Vernadsky referred to as a "new state" of the biosphere has emerged, in which the biosphere's further evolution is being driven by the generation and communication of *ideas:* the *Noosphere.* Just as the biosphere is a natural product of life, so, the Noosphere, Man's deliberate activity on the biosphere, reflects a distinct principle, different from and higher than that of life per se.

Now, ironically, we have now come to the point, that realizing the Noosphere, requires the generation of a very specific *new* idea: the idea of a discovery of the universal principle of life itself, the principle that is the *cause* of the unique effects of living processes and their systematic distinction from all other processes, demonstrated by Vernadsky. Like all great scientists, Vernadsky has not left us with finished answers; rather, his work poses, in a more powerful way than before, those profound and fundamental questions, that must become the central focus of scientific work in the period before us.

Now I want to invite my colleagues Larry Hecht, Wolfgang Lillge, and Dino de Paoli to present illustrations of three species of principles: of nonliving, living, and cognitive processes. That will set the stage, I hope, for a fruitful discussion at the end of this panel.

Jonathan Tennenbaum heads the Fusion Energy Foundation in Europe, and works closely with the Schiller Institute.



VERNADSKY'S METHOD

2. The Ampère Angular Force As a Discoverable Type Of 'Natural Product'

by Laurence Hecht

In the month of September of 1820, proceeding into early 1821, André-Marie Ampère made a great discovery, with implications for the future of all science. As we have the privilege in this case—as is not always the case—to know more or less exactly the name, address, and sequence of events involved, this discovery of Ampère provides us a very good example to elaborate upon a principle discovered in our time by a long-time friend of mine, Lyndon LaRouche. I speak of the fundamental importance of the human creative process, and of LaRouche's discovery that this capability, which is what distinguishes all human beings from the other forms of life, plays a special role in the uniquely human endeavor of physical economy.


Maria Schmitz/EIRNS

Hecht: "Science is not what the textbooks tell you."

Economic value is truly determined, not by the so-called law of supply and demand, nor by the so-called labor theory of value, but, in the final analysis, only by human creativity. That is, that the generation of an idea in the mind of a single individual, and its social realization as a technology, transforms all economic values in ways that people such as Alan Greenspan and most central bankers today are not capable of understanding.

So with Ampère's work, we have an excellent example of a revolutionary discovery in science. It is a discovery of a principle applying to the domain of inanimate objects, the domain of electricity and magnetism, but a principle which qualifies, according to the criteria of Vernadsky, as a "natural product." The most important thing for you to understand here, is that, unlike what nearly all of you were taught in school, science is not what the textbooks tell you. It is not what you see in Figure 1.

It is not the pseudo-religion of an oligarchical priest caste who tell us what we can and cannot believe, and mystify and make ugly for us a natural activity. This is a very human and fun process of real discovery—the one thing this priesthood have never allowed themselves to experience.

Science is a process that goes on in the mind of an individual, usually deriving from a faculty that has been cultivated since childhood, which is characterized by a natural curiosity, a love of paradox which leads to development of a concentration span for problem-solving, and Joy. It is fun! If you are studying science, and it is not fun—something is wrong. Stop and reconsider. Some Babylonian priest somewhere is misleading you.

So, here is where the Ampère affair begins. In September of

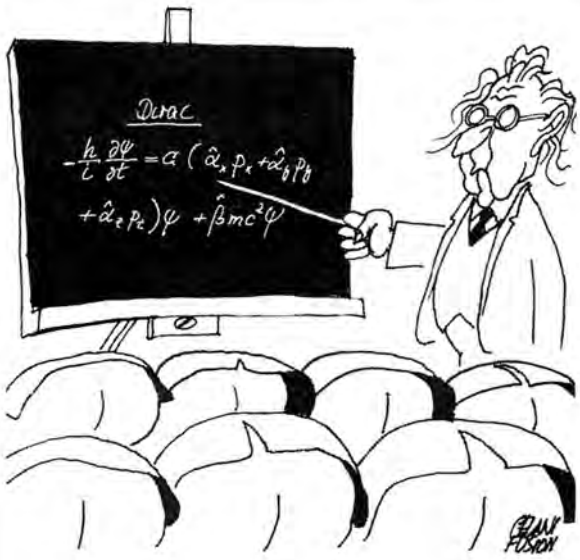


Figure 1
SCIENCE ACCORDING TO THE TEXTBOOKS

1820, a Dane by the name of Hans Christian Oersted came to the French Academy of Science, and made a simple demonstration (Figure 2).

We have nothing but a magnetic compass, a wire, and a battery. When the current from the battery passes through the wire, the magnetic needle is caused to rotate. (The compass, you must know, is nothing more than a piece of magnetized steel mounted on a pin, so it is free to turn.) That a compass needle was turned by the Earth's magnetism was known for thousands of years. But Oersted was the first to show that moving electricity, or current, affected the compass needle. (We should also know that before 1800, we did not control current electricity; 1800 was the year Alessandro Volta produced the first battery or Voltaic pile. Before that, we had lightning, and we had electrostatic generators—forms of electricity which discharged and were gone in an instant.)

So, Ampère was tremendously excited by this demonstration by Oersted, and proceeded to make his own experiments at the Ecole Polytechnique in Paris, where he was a professor. He arrived finally at a certain fundamental experiment, where he showed the identity of electricity and magnetism. He employed a very simple apparatus, known as the Ampère solenoid. It consists of nothing but a copper wire covered with insulating material, and wound around a cylindrical form (Figure 3).

When the two ends of the wire are attached to a battery, the solenoid behaves just like a magnet. A compass needle placed at one end of the solenoid will be attracted as if the end of the solenoid were the north pole of a magnet, and at the other end, as if it were the south pole. From this fundamental demonstration, Ampère makes the revolutionary conclusion that electricity and magnetism are the same phenomenon. There is no separate magnetic and electric field, as you learned in the textbook!

And if this is so, it must be possible to explain all electrical phenomena, and the phenomenon we call magnetic attraction and repulsion, on the basis of the single hypothesis of electrical action. How Ampère sought to do this makes a very interesting story. For, at the time Ampère was doing this research, France was the world center of scientific activity, and the leading figures of French science, led by the Marquis Laplace, considered themselves the ruling priesthood of the time. Their view was completely Newtonian—for, thanks to some nasty work carried out in the previous century, France had given up its own form of modern Aristotelianism, which was called Descartes, and adopted the British form of the disease, called Newton.

Now, the Newtonian system is essentially very simple, although you can make it complicated in the details, by introducing mathematical logical considerations. But, in essence, it is the view of the universe that probably most of you believe in, when you go to think about matters of physical science. (It's not your fault. You were taught to think this way, and perhaps didn't realize what was being done to you, or didn't know how to fight it. So, now we will teach you that important survival skill.)

The State of Newton's System

In Newton's view, which came from a Venetian by the name of Paolo Sarpi, the universe is very simple. There is a big empty container called space. Inside this empty container are objects, which are made up of smaller objects, called particles. These objects, or the particles within them, relate to each other according to certain universal laws. When you

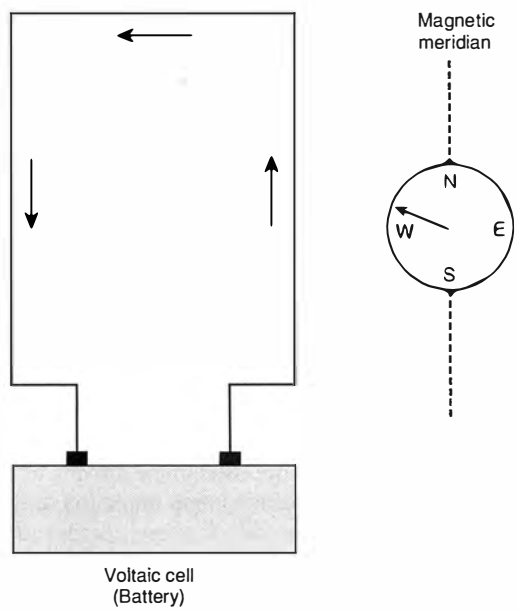


Figure 2
THE OERSTED EXPERIMENT
Hans Christian Oersted first definitively demonstrated a relationship between electricity and magnetism. He showed that a magnetic compass needle, placed near a current-carrying wire, will turn in the direction of the wire.

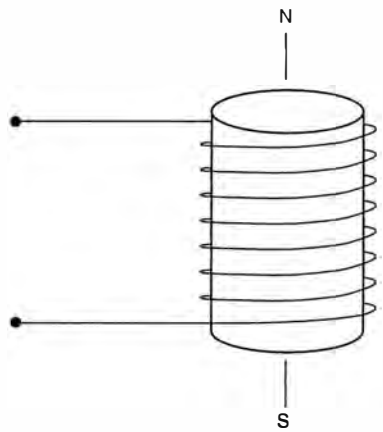


Figure 3
THE AMPERE SOLENOID

Ampère hypothesized that the true cause of magnetism is the motion of resistance-less electrical currents in tiny orbits around the molecules of matter. To prove it, he constructed the world's first electromagnet, a conducting wire coiled around a cylinder, which he named a solenoid. When the solenoid is attached to a battery, the ends of the cylinder become like the north and south poles of a bar magnet. Ampère believed that the large-scale circular motion of the electricity in the solenoid coil mimicked the tiny circular orbits which he conceived to be present in a magnet.

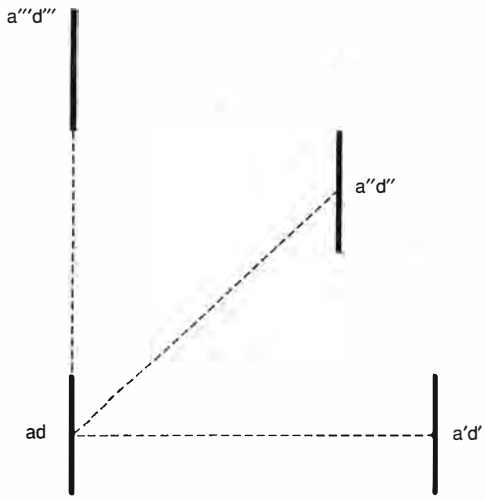


Figure 4
THE FORCE BETWEEN CURRENT ELEMENTS

Early experiments with two parallel wires showed that the wires attracted each other when the current flowed through them in the same direction, and repelled in the opposite case. From this Ampère could conclude that any two parallel, small sections of the wire (current elements) would behave accordingly. This is the relationship of element ad to a'd' in the diagram. But what if the second element is in another position, such as that of a'''d''' or a''d''? Direct observation could not decide these more general cases.

have really mastered these universal laws, you are able to write a formula which describes the pairwise relationship between any two of these particles at any place and any time. Predicting the future, consists of being able to tell where all the particles are and how fast they are going at the present time, and then you will know where they will all be at a later time, and that is called the state of the system. (Nice world, isn't it?)

So, by 1820, the French Newtonians, led by Laplace, thought that they had pretty well perfected their system of the world. It had been shown, that the three fundamental physical forces known at the time all seemed to follow the same law, or were describable by the same simple formula. These were the forces of gravitation; of electrostatic attraction and repulsion (that is of static electricity, as opposed to the moving or current electricity of Ampère); and of magnetic attraction and repulsion. And, it appeared that all of these forces could be described by the simple formula that was called the inverse square law. This meant simply, that if you took, for example, two heavy objects, like the Earth and the Sun, the force between them depended solely on their distance apart, and if you doubled this distance, the force was reduced not by two, but by four, that is by the square of two, and so forth—the inverse square. And they were very happy and contented with the fact that two electrostatically charged objects, or two magnetic poles, apparently behaved in the same way.

But Ampère did not like this game very much. He found it a bit boring, I imagine. Having been a close student of the philosophy of Leibniz, in particular, he knew that this view of the universe was rather childish. So, he was looking for a way to demonstrate this. Now, Ampère knew the Newtonian system very well, as well as any one of the time. He was an accomplished mathematician, but of the kind which our friend in France, Professor Maurice Allais, calls the "good type"—that is, one who does not believe that there is any truth in a mathematical formalism, but that it must be proved in physical experiment. He puts the laboratory before the blackboard.

So, what Ampère did was a very devilish thing for these Laplacian-Newtonians. He found a way to blow up their little game from the inside. By carrying out certain experiments in electrodynamics, and analyzing them from the strictly Newtonian standpoint, he proved that this simple unification of the three fundamental forces under the inverse square law did not work! And some people have never forgiven him for it, even to this day.

Ampère's Current Elements

This is how it was done: One of the fundamental phenomenon Ampère had discovered, was that two electrical wires attract or repel each other, according to the direction of the current flowing in them. Ampère decided to analyze the force between these wires, in what might seem to be a very Newtonian way. He decided to reduce the problem to that of determining the force of attraction or repulsion

Courtesy of the Museum of Electricity at Polymieux

André-Marie Ampère (1775-1836)

Lithograph by Siegfried Bendixen, courtesy of Historical Collection of the Göttingen University I. Physical Institute

Carl Friedrich Gauss (1777-1855)

E. Scott Barr Collection, American Institute of Physics Emilio Segrè Visual Archives

Wilhelm Eduard Weber (1804-1891)

between any two small elements of current in the wires. These "current elements," as he called them, will then be like the gravitational masses of the Newtonian law. Is the pairwise relationship between them governed by the inverse square law, or not?

So, if, in Figure 4, *ad* is the current element in one wire, and *a"d"* in another, we want to know the force between them. One cannot just make an empirical measurement of the force, because the current elements do not exist separately. They are part of a complete circuit. Moving electricity occurs only in this way, in a circuit. So one has to use some cleverness to figure out experiments where one can mentally isolate the effect of a single small piece, or element, of the current flowing in one wire, upon a single element of current in the other wire. Ampère was very good at doing this.

And it turned out, to make a long story short, that Ampère's careful researches led to the conclusion that the force of attraction or repulsion between these two elements of current was not simply dependent on the square of the distance, but also on the angles which the directions of the current elements make with each other.

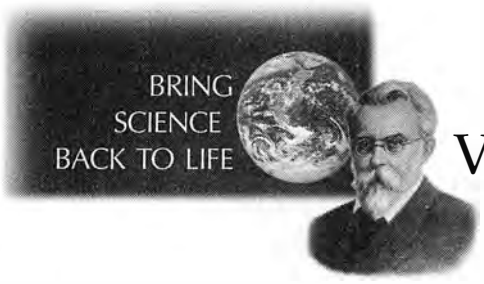
So, as the directions change, so does the force—not such a surprising fact! We call this the Ampère Angular Force. And 10 years later, when Carl Friedrich Gauss and Wilhelm Weber investigated the same phenomena, but using different apparatus, and a slightly different hypothesis about what the current consisted of, they came to the same conclusion. In their hypothesis, the current consisted of moving electrical particles, and their results showed that the force between them was dependent on the relative velocities of these particles. But, the dependency was measurably the same as that determined by Ampère; thus Weber wrote in 1844 that Ampère's Law was conclusively proved.

But this is not accepted, even to this day. For reasons that can only be explained as the ideology of a Babylonian priesthood which governs science, it is not permitted to believe that anything other than the inverse square law exists as a fundamental force in this realm. So, in James Clerk Maxwell's 1858-1868 reformulation of the laws of electricity and magnetism, the Ampère Angular Force, or the Weber force (which is dependent on the relative velocities), is conveniently ignored. If questioned, the argument is made that we do not have empirical confirmation of the existence of this law, because one can never isolate the individual current element from the whole circuit of which it is part. And it is the case, as Ampère well understood, that this effect, which would exist between separate current elements, is eliminated when the total integrated effect of the whole circuit is taken into account.

However, the foolish empiricist ignores that apparently very small effect of the angular force at his own peril. For, it turned out that in the hands of Weber, this discovery led, in 1870, to an advanced understanding of the atom. Weber's paper of 1870 (which was my introduction to this whole matter), describes the structure of the atom, today called the Rutherford-Bohr atom, which was supposedly only arrived at 40 years later, in 1913! But Weber's conception is even superior to the modern, accepted view. For, Weber describes many phenomena, which cannot yet be lawfully described today—for example, his description of the orbital motion of an electron around a central nucleus, and his prediction of the reversal of the Coulomb force (that is, the repulsion of like particles), which he showed would occur below a certain prescribed, critical length.

So, there is much more of interest to discuss about these things, which will have to await another occasion. For now, it is sufficient that you get some idea of this process by which the sovereign individual mind makes a scientific discovery, which fits the description of a "natural product" in Vernadsky's terminology, and that you understand that it was not, and can never be made as the empirical priesthood would like it.

Laurence Hecht is the editor-in-chief of 21st Century. *His article on Ampère's electrodynamic theory and the 1830's experiments of Gauss and Weber to test this theory, "The Significance of the 1845 Gauss-Weber Correspondence," appeared in* 21st Century, *Fall 1996.*



VERNADSKY'S METHOD

3. Biophysics And the Life Process

by Wolfgang Lillge, M.D.

It has been the legacy of Vernadsky to the future world, to continue the broad-based research effort he began, to uncover the physical principles that are behind the differences between living and non-living processes. As we have heard in Jonathan Tennenbaum's contribution (p. 14), Vernadsky himself always emphasized a universal approach to this problem: What is needed is an understanding of what are the physical *characteristics* of life that can be measured, among others, in terms of different types of radiation, different wavelengths, magneto-biological criteria, the coupling between various living systems, between living and non-living systems, between living systems and astrophysical systems, and also between non-living and astrophysical systems, and so on.

Dean Andromidas/EIRNS

Wolfgang Lillge: "We are only at the beginning of the era of 'life technology.' "

I want to report here about a number of biological technologies that have been developed completely outside of the molecular biology mainstream in the last 30 years, which provide fascinating insights into the inner state of living cells. What has been established by these means is, that cells have a specific kind of communication that is closely connected to extremely weak, but biologically highly effective, electromagnetic signals. By that, a new pathway of biophysical research has been opened, which focusses exactly on those key aspects of life that are systematically ignored by standard methods of molecular biology and genetics.

In fact, the question "What is life?" has been effectively removed from the established thinking in biology. Molecular biology, which focusses exclusively on researching only the "building blocks" of nature, has completely lost sight of the characteristic differences between living and dead matter. For molecular biology, there is no qualitative difference between a living and a dead cell: Just before and after dying, a cell still contains the same molecules and structures.

But what has happened in between? Where is the "living force" or *"animus vitae,"* as was once speculated about?

Before we elaborate more on the nature of those electromagnetic signals, which can also be called "biophotons," we should look at some of the phenomenal achievements of which living processes are capable. In growing tissue, it can be estimated that every single cell produces some million molecules per second, which is more, by several magnitudes, than what can be produced by laboratory means.

There is another astounding figure: On average, every human being consists of approximately 10 trillion cells (10^{13}), which are generated by 43 successive rounds of cell doublings. Only after this impressive precision work, will a human being reach adulthood.

However, at the same time, there is a constant turnover of cells coming and going: In every individual, every second,

approximately 10 million cells die, and must be replaced in a short period of time, in order to prevent an entropic decay. It cannot be predicted where and when a cell will die, but if the replacement rate were to be only slightly lower (or higher), the body would disintegrate quickly. For example, if the growth rate of intestinal cells, which have a large turnover themselves, would exceed the cell death rate by only some percent, the body would rapidly die from obstruction of the intestines.

The biophysicist Fritz Popp has pointed to the conditions which must be fulfilled such that all these complex processes occur in a controlled way. There must be an intimate coupling of cell-to-cell-communication, which, according to his calculations, can only be possible when the key control processes occur at the speed of light. Any other means of "information" transmission, including biomolecules, chemical messengers, and so forth, would not be sufficient. They would be too slow to guarantee the integrity of the organism. Already, from this simple calculation, it follows that light, or some electromagnetic action operating at the speed of light, must be involved in some form in the organization of living processes.

The first sytematic research into the role of light in living processes was done by the Russian scientist Alexander Gurwitsch, a contemporary of Vernadsky, in the 1920s. Gurwitsch established as a conclusive hypothesis that every living cell emits light, though at a very weak level.

Alexander Gavrilovich Gurwitsch (1874-1954)

Mitogenetic Radiation

His original experiment was very simple (Figure 1). Gurwitsch mounted an onion root in such a way, that the tip of this first onion root pointed to the side of another onion root, but without direct contact. When the second onion root, after a certain time, was investigated under the microscope, it was shown that at exactly the point of near-contact, there was a significant increase of cell divisions (mitosis) compared to the opposite side.

This "mitogenetic effect," as Gurwitsch termed it, continued to appear when a small quartz window, which is specifically transparent to ultraviolet light, was inserted between the two onion roots. However, the effect disappeared when the quartz window was replaced by normal window glass, or other material, which is opaque to ultraviolet light. With several other experiments Gurwitsch was able to definitely prove that the medium of this mitogenetic effect was, in fact, a very weak ultraviolet radiation emanating from the tip of the first onion root. He called this "mitogenetic radiation."

Subsequently, Gurwitsch and his collaborators developed a method to indirectly measure the intensity and spectral distribution of the "mitogenetic radiation." This technique, together with Gurwitsch's other original contributions to biology, including his notion of the biological field and the existence of a long-range effect between cells during mitosis, became one of the main fields of biological research during the 1930s, in the Soviet Union, and elsewhere.

However, increasingly, this approach to biology came under fierce attack by the proponents of genetics and molecular biology, which then, after the war, was made the dominant field of research. The major point of criticism from these circles was, that the mitogenetic radiation did not exist at all, or, if it did exist, it had no biological relevance whatsoever.

Actually, at Gurwitsch's time, it was technically impossible to directly measure the weak light emission from cells. This became possible only in the 1950s, when a group of Italian astronomers developed a very sensitive photo multiplier, which they used to make distant stars visible. When used on biological samples, it was shown that leaves, germs of wheat, corn, beans, and so on, emit a constant, but weak light. These results created a brief uproar in the West, but the affair was then essentially forgotten.

Only in the early 1970s was this basic insight taken up again, when German biophysicist Fritz Popp, in his work on cancer research, found some very peculiar properties of a very

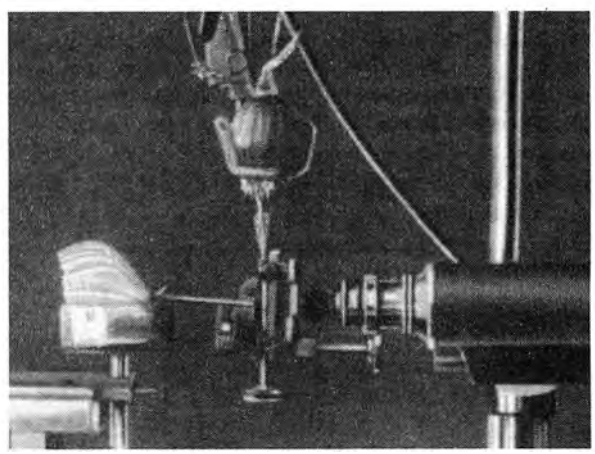


Figure 1
GURWITSCH'S FAMOUS 'ONION EXPERIMENT'

The roots of two onions are positioned perpendicularly so that the tip of one root points to one side of the other root. Gurwitsch found that there was a significant increase in cell divisions on this side, compared to the opposite, "unirradiated" side. The effect disappeared when a thin piece of window glass was placed between the two roots, and reappeared when the ordinary glass (which is opaque for ultraviolet light) was replaced with quartz glass, which is transparent for ultraviolet light.

Source: A.G. Gurwitsch, *Das Problem der Zellteilung* (The Problem of Cell Division), 1926

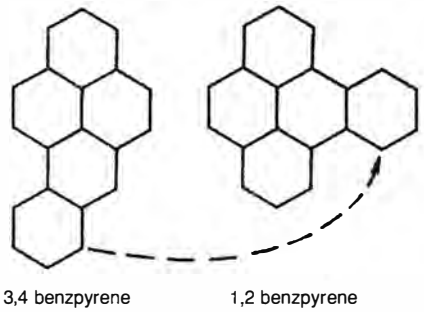


Figure 2
TWO FORMS OF BENZPYRENE
The 3,4 benzpyrene, which is found in coal-tar and in cigarette smoke, is chemically very similar to 1,2 benzpyrene, which is considered harmless. The only major difference between them is that 3,4 benzpyrene has a strong absorption/emission anomaly in the ultraviolet area of the spectrum. Popp asked himself, could these optical properties of the molecule be the direct cause of its carcinogenicity?

strong carcinogenic substance.

Shown in Figure 2 is benzpyrene in two forms: the 3,4 benzpyrene, which is found in coal-tar and in cigarette smoke, and a chemically very similar substance, 1,2 benzpyrene, which is considered harmless. The only major difference between the two substances is that 3,4 benzpyrene has a strong absorption/emission anomaly in the ultraviolet area of the spectrum. Popp asked himself, could these optical properties of the molecule be the direct cause of its carcinogenicity, rather than any assumed chemical (molecular) effect? That idea, of course, went directly against the established position of cancer research.

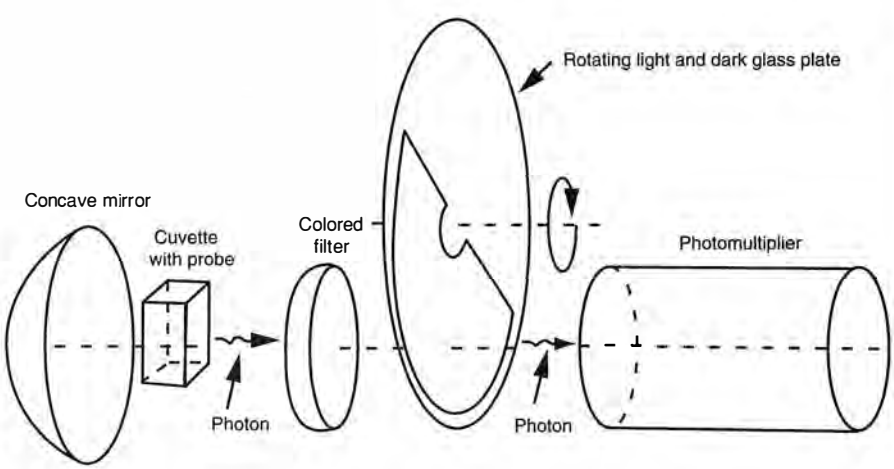
In that context, Popp learned about Gurwitsch's work on mitogenetic radiation, and concluded that, if the assumed optical effect of benzpyrene were correct, then there must be some kind of light source in the cell, and very weak photon "signals" would be able to trigger drastic changes in the behavior of cells.

So, Popp and his collaborators started to construct a very sensitive light amplifier appropriate for measuring very weak photon emissions from cells. A schematic view of this machine is shown in Figure 3.

It is a certain irony that Popp, after he had presented his ideas to leading cancer scientists in Germany, was first denied any research money, because he said he wanted to find light inside cells. For these people, this was a completely absurd idea! Only when he pledged to establish that there is *no* light in cells, did he receive some funding.

With Popp's photomultiplier machine, it was possible to prove beyond any doubt that low-level light emissions are a common property of all living cells. It has different intensities for plant or animal cells, for different cell types, and it can vary from one moment to the next. It is not regular, but comes often as "photon explosion" (spikes), especially when the cells are irritated by outside means.

Much more interesting, and telling for the role of biophotons in real life, were experiments which show the interrelationship between two sets of living organisms. For this purpose, Popp developed a system with two independent photo multipliers, and a mechanism by which the two samples under investigation could be optically separated from each other. So, in the first round of the experiment with *gonyaulax polyedra,* a tiny dinoflagellate, the shutter was closed, and two completely different emission patterns resulted. However, when the shutter was opened, and the two samples came into optical contact, the situation changed dramatically: What had been random events before, became now a coordinated, tuned process of increased intensity. Simultaneous spikes of photon emissions occurred, as if they had been agreed upon (see Figure 4).



Source: Popp, *Biologie des Lichts*, 1984

Figure 3
SCHEMATIC OF POPP'S PHOTOMULTIPLIER
Popp and his colleagues built a high-sensitivity light amplifier, shown here schematically, which can reliably measure the extremely weak light emission of biological experiments. A quartz cuvette is located in the enclosed part of the apparatus before a concave mirror, which also directs the reflected rays to the light detector. A colored filter can select specific wavelengths, and the alternating light and dark ("chopper") plate allows a separation betwen actual signals from the probe and spurious light from the apparatus itself.

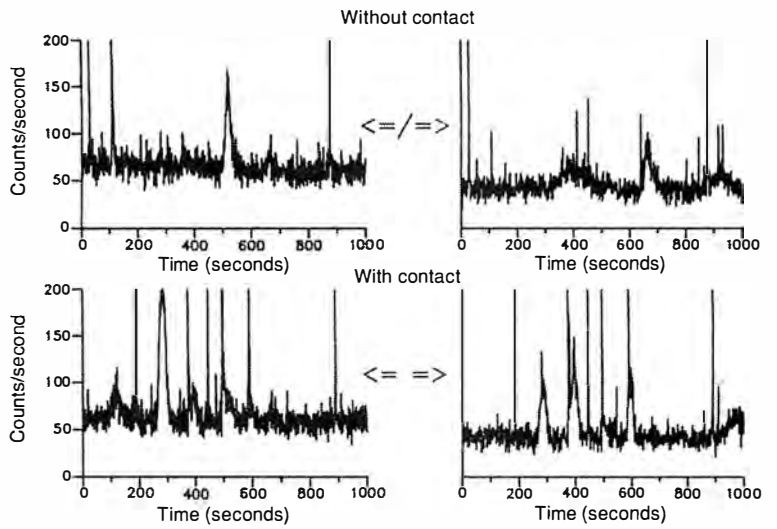


Figure 4
EMISSION PATTERNS OF TWO BIOLOGICAL SAMPLES, WITH AND WITHOUT CONTACT

Fritz Popp developed a system with two independent photo multipliers, and a mechanism by which the two samples under investigation could be optically separated from each other. Here, in an experiment with the tiny dinoflagellate gonyaulax polyedra, *the top part of the graph shows the pattern of emissions with the shutter closed; and the bottom graph shows the experiment with the shutter opened, so that the two samples are in optical contact. As can be seen, the random events on the top, become a coordinated, tuned process of increased intensity, with simultaneous spikes of photon emissions.*

The Harmony of Biophotons

In fact, one could draw an analogy to music and say, that a disharmonic process turns harmonic. Actually, as Johannes Kepler perceived the relations of the planets as a musical harmony of spheres, we can also, in the case of biophotons, make this harmony audible. Here is how Fritz Popp set the electromagnetic communication between cells to music! Please, don't expect these tones to be as beautiful as those in last night's concert, but creatures such as these dinoflagellates are not human, after all! First, we hear the dissonance of the separated samples, and then the harmony of interacting photon emission. [Note: an audio version of the biophoton tones will be made available on the *21st Century* website, www.21stcenturysciencetech.com.] You should note that the tones you will hear do not correspond directly to single photons emitted; they correspond to the degree of correlation of signals in both samples. So, the higher the tone, the better the correlation.

All these findings point to a specific form of electromagnetic coupling, indicating a specific kind of communication between living cells. Even if it is not yet known what the actual source of these photon emissions in cells is—and one should not fall into premature speculation on this point (there may even be outside, astrophysical influences involved)—they have a definite biological effectiveness. And Popp has also shown that this weak radiation must have the quality of a multimodal, multifrequency laser to be effective; that is, to be coherent in space and time.

Coming back to cancer research, it is not surprising that the use of photon emission is able to show a clear distinction between healthy cells and cancer cells.

The graph in Figure 5 shows how normal liver cells (lower curve) have a relatively stable or even falling level of photon counts at increasing cell density, while cancer cells of the same cell type show an increasing photon count at higher cell densities. It can be concluded from that, that populations of cancer cells have lost the harmony and coherence that is typical for healthy tissue.

I can only summarily report here on recent, impressive work by the Russian scientist A.B. Burlakov. He provided a striking example of the superiority of the biophoton approach over the molecular dogma.

Burlakov brought samples of fertilized fish eggs in different phases of development into optical contact with each other, and observed the mutual effects (see Figure 6). He reported the following results:

- Provided the age difference between the eggs or larvae

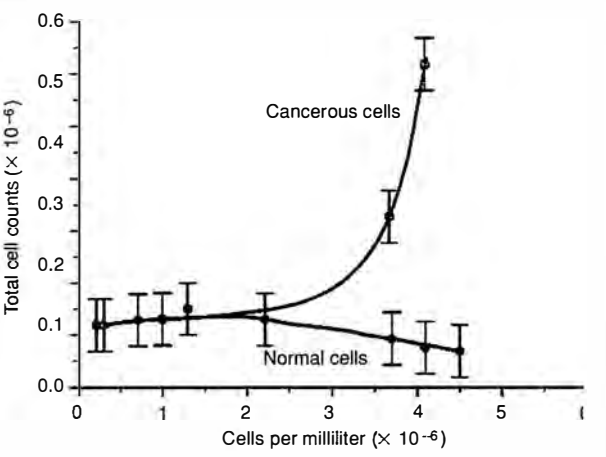


Figure 5
PHOTON COUNTS OF NORMAL LIVER CELLS VS. CANCEROUS CELLS

Normal liver cells (lower curve) have a relatively stable or even falling level of photon counts at increasing cell density, while cancer cells of the same cell type show an increasing photon count at higher cell densities. From this, it was concluded that populations of cancer cells have lost the harmony and coherence that is typical for healthy tissue.

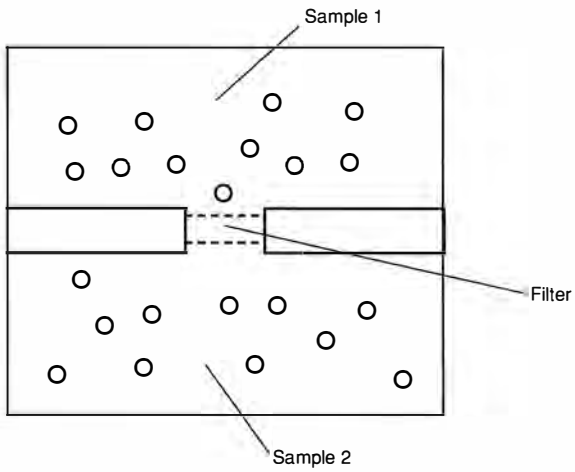


Figure 6
SCHEMATIC OF BURLAKOV'S EXPERIMENTS WITH FISH EGGS AND MITOGENETIC RADIATION

In these experiments, samples of fertilized fish eggs in different phases of development were brought into optical contact with each other. Burlakov found that if the age difference between the eggs or larvae was not too large, there was a significant acceleration in the development of the younger eggs relative to the older ones. However, if the age difference was large, the younger eggs showed a strong retardation in development; even deformities and higher death rates occurred. When Burlakov used normal window glass as a filter, all these effects disappeared, but with quartz filters, the effects could be observed.

was not too large, there was a significant acceleration in the development of the younger eggs relative to the older ones.

• However, if the age difference was large, the younger eggs showed a strong retardation in development; even deformities and higher death rates occurred. (This conforms, by the way, to observations in nature, that fish normally avoid laying their eggs in sites where other eggs have already been deposited.)

• When he used normal window glass as a filter, all these effects disappeared, but the effects could be observed by use of quartz filters, confirming clearly Gurwitsch's "mitogenetic effect."

• Using filters for different wavelengths and polarizers, Burlakov even succeeded in creating specific alterations intentionally, and subsequently undoing them. In this way, monster larvae with multiple heads, multiple hearts, and so forth, were generated, but could be corrected by the appropriate use of other optical coupling effects.

In fact, this latter case could be the beginning of an era of "biophoton technology," as Burlakov himself stated, with a potential far bigger than today's biotechnology, which has had a hard time keeping up with its far-flung promises. Obviously, in Burlakov's experiments, no changes were induced in the genome at all—the biophoton action works on the level of the living process itself.

Magneto-Biology

Finally, we should include in the list of technologies for the investigation of living processes, the potential of magneto-biology. Research of this type has a long tradition, especially in Russia. For example Alexander L. Chizhevsky [1897-1964] made intensive studies of the correlation between solar-induced changes in the Earth's magnetic field and the occurrence of physical events, such as epidemics, and other things. Also Simon Shnoll and his group in Moscow made extensive studies of the influence of cosmic phenomena on almost all physical processes on the planet. Professor Bruno Brandimarte of Italy has been a pioneer in the field of magneto-biology for many years. He has shown that oscillating magnetic fields of various forms can have striking effects on the healing of wounds and the increase of blood circulation.

In Figure 7, you see on the left a very bad case of diabetes gangrene, which would have been hopeless for traditional surgery. But, after treatment with magnetic fields (right), the foot was almost completely restored.

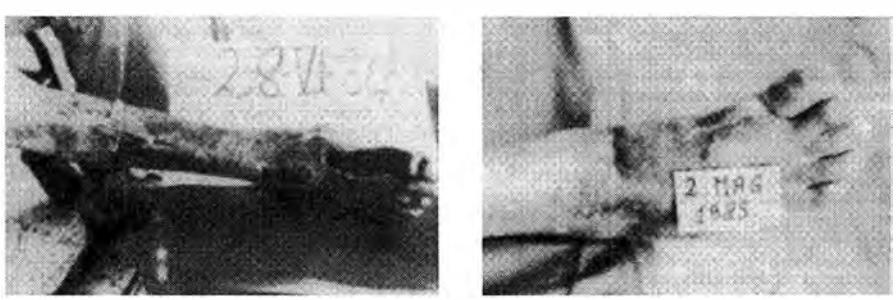
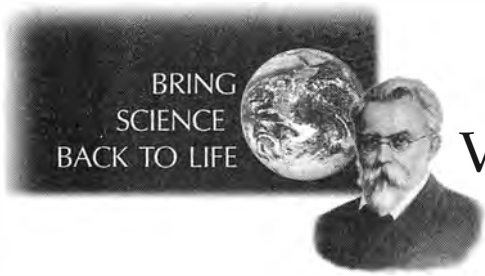


Figure 7
BRANDIMARTE'S OSCILLATING MAGNETIC FIELD TREATMENT

The Italian scientist Brandimarte has worked with oscillating magnetic fields to increase blood circulation and heal wounds. Here is one example of the positive effect of magnetic field treatment. On the left is a very bad case of diabetes gangrene for which the normal treatment would have been amputation. After treatment with magnetic fields (right), however, the foot was almost completely restored.

In conclusion, it must be stated, that we are only at the beginning of the era of "life technology." Many more approaches like the mitogenetic effect, the biophoton/laser principle, and magneto-biology must be developed. The aim is to develop methods, which allow us to study all those multiple levels, on which the characteristic actions of life occur.

Wolfgang Lillge, a physician, is the editor of the German-language Fusion *magazine.*



VERNADSKY'S METHOD

4. Is Mind a Mystery?

by Dino De Paoli

Vladimir Vernadsky developed the concept of the noosphere, and he defined it in the following way:

> Under the action of scientific thought and human labor, the biosphere goes over to a new state, to the noosphere. . . . In this way . . . a never-ending, growing set of new inert natural bodies and new great natural phenomena are created in the biosphere. . . . [This] is not an occasional phenomenon . . . but an elementary natural process whose roots are deep. . . .

Dean Andromidas/EIRNS

Dino De Paoli: "Thinking is for man as 'natural' as apple production is for fruit trees."

On another, later occasion, he expressed the following paradox concerning human thought:

> Here a new riddle has arisen before us. Thought is not a form of energy. How then can it change material processes? That question has not as yet been solved. . . . As for the coming of the noosphere, we see around us at every step the empirical results of that "incomprehensible" process.

Vernadsky recognized the effects of human scientific discovery, its necessity and naturalness, but he passed on to us the riddle of the nature and location of the human cognitive process. Some of the difficulties concerning the relation between energy and cognition derive from both a psychological and a methodological mistake.

Too often we get psychologically manipulated by the pleasure of trying to solve virtual or false dilemmas. For example, if someone were to ask you: "Why does that apple tree produce apples?" I imagine that you would quickly realize that the questioner was trying to fool you.

A more serious question would have been the following: "Why didn't that apple tree produce any apples this year?" The same line of reasoning should apply if someone were to ask you: "Why does that human being produce thoughts?" In this case too, the real question should have been: "Why the heck doesn't that idiot use his head?"

Thinking is for man as "natural" as apple production is for fruit trees! And in both cases, we should really only worry about how to improve on the quality of that production.

Methodologically this paradox touches upon a more difficult area, which I can develop only very schematically here. Vernadsky, as mentioned by Jonathan Tennenbaum, had hinted at a Riemannian solution to his riddle. To account for the undeniable specificity and "geological role" of living matter, he had stressed the importance of change in our simplistic and abstract conception of one homogeneous, infinite Cosmos, "which might satisfy the geometer, but which contradicts the entire empirical knowledge of the naturalists."

He pushes his posterity to elaborate, instead, the concept of "the simultaneous manifestation of spaces, characterized by different geometries, in different domains." That is, the supposition of:

> the geometrical inhomogeneity of reality. . . . In different cases and different manifestations of the Cosmos, different geometries may be manifested in phenomena under scientific studies.

Domains of Curvature

This is obviously the core of the anti-monistic (that is, anti-materialist) philosophy and revolutionary mathematics of Riemann, as far as Riemann himself adopted Leibniz's monadology. Riemann had developed the idea of an "inhomogeneous reality," in which we cannot linearly transpose the same type of meas-

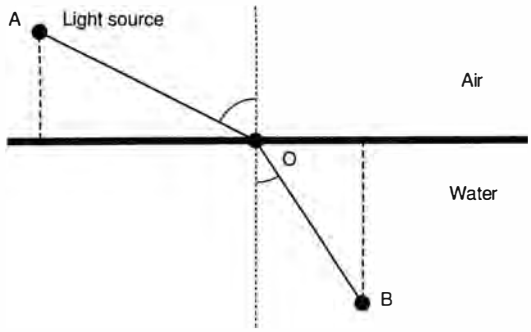


Figure 1
THE CURVATURE OF A LIGHT RAY PASSING FROM AIR INTO WATER
The light follows not a shortest path, but one that minimizes the total time of travel, a principle discovered by Fermat.

ure from one domain to another without changes; but where, nevertheless, there is a discoverable principle, a "curvature," which reveals the causal path that connects the different domains.

In Figure 1, you see only the simplest expression in nature of what I have just said. A source of light (*A*), which travels through an "inhomogeneous medium" (such as saltwater) will naturally travel along a "curved" path (*OB*).

When we move from light to the more complex inhomogeneous relationships among matter, life, and cognition, or even those inside such subdomains, we will not discover any more such simple and visible "curvature," but the principle nevertheless remains valid: We cannot linearly transport measurements from one domain to another, although a causal functionality connects all of them.

Despite empirical evidence to the contrary, there has always been an ideological attempt to ignore these different domains of curvature and, instead, to adopt the monistic (materialistic or idealistic) conception of "one homogeneous, undifferentiated space," where human specificity, human free will, and human cognition, either simply disappear into one of the sub-domains, or are moved to the virtual and arbitrary area of the "transcendental freedom" of Immanuel Kant, Johann Fichte, and their followers.

Specifically, when he posed that paradox, Vernadsky was obviously fighting against an argument which is usually formulated as: "The mind cannot be an efficient force in the physical world; otherwise the law of energy conservation would be false, and this is impossible!"

A positivist, when he observes nature through his instruments, sees and measures only mechanical, chemical, and other forces, which form a closed totality; he does not see or measure any "mental force." Therefore, according to him, a physically efficient mind cannot exist!

One wonders what kind of vegetable there must be behind the microscope or telescope mindlessly and objectively observing nature! The opposition to Vernadsky obviously forgot that the "law of energy conservation" is a physical principle discovered by a human mind. Indeed, the appropriate and original formulation of this law is the result of Leibniz and was derived from the idea that "sufficient reason" is governing the universe.

I cannot elaborate further on this issue here, but to help to find a place for cognition, I will use my favorite quotation from Blaise Pascal:

> It is not in space that I must seek my dignity, but from the ordering of my thinking. . . . As space, the universe grasps me and swallows me up like a point; by means of reason, I grasp the universe.

Therefore, the next time a mathematician goes to the blackboard to prove to you that his own mind does not exist, accept it as a fact. But as far as your own mind is concerned, try to adopt another method of proof. This could be called the crucial experiment to determine the conservation of existence.

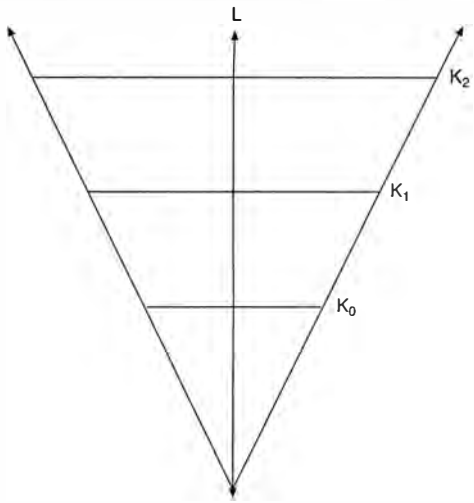


Figure 2
SCHEMATIC OF REPRODUCTIVE POTENTIAL OF LIFE
Contrary to the neo-Darwinists, Vernadsky defined a directionality in the evolutionary process—line L, in this simplified schematic, where each stage (K_0, K_1, . . .) is characterized by a function, today called the "carrying capacity." None of the stages is an absolute limit.

Vernadsky's 'Durable Colonization'

According to Vernadsky, the biosphere is characterized by a continuous transformation of biochemical energy, whose real source is the Sun, and whose chief manifestation is the multiplication of living matter. Living matter can be studied, then, by linking its rate of reproduction to the efficiency of the energy transformation, and this measurable process was named by Vernadsky "durable colonization."

Some of Vernadsky's ideas, associated with the work of Alfred Lotka and others, are today the standard way to study ecological systems; however, Vernadsky had stressed something, which is avoided today:

In Figure 2 you can see a simplification of Vernadsky's idea. Contrary to the neo-Darwinists, he defined a directionality in the evolutionary process (line *L*), where each stage (K_0, K_1, . . .) is characterized by a function, today called the "carrying capacity"; but none of the stages is an absolute limit. Life finds a way, through the formation of new species and other adaptations, to increase its rate of durable colonization. Such changes

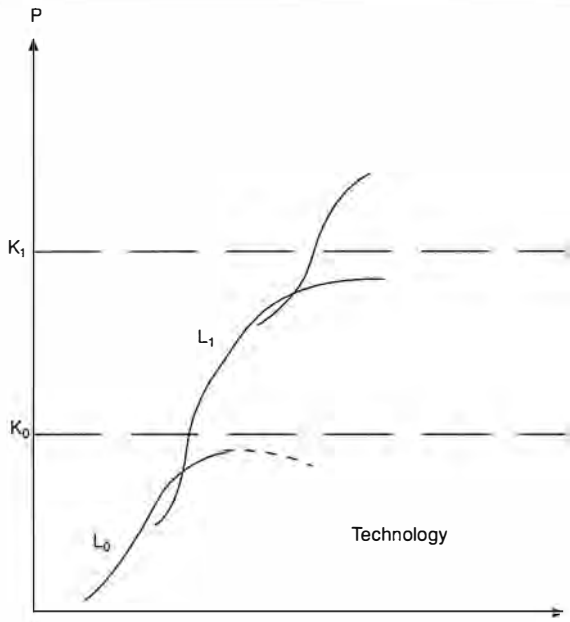


Figure 3
THE IMPACT OF SCIENCE AND TECHNOLOGY ON POTENTIAL POPULATION DENSITY
The ecological "carrying capacity," as represented by the K series, increases discontinuously, as a result of man's ability to discover new species of technology (the L series)—what Vernadsky called "durable colonization."

can therefore be ordered, and one can discover a curvature in such a higher, inhomogeneous, or Riemannian, space-time.

Sometimes Vernadsky adopted the hypothesis of the "growth and perfection of the central nervous system"—that is, the growth of the brain—as a metric for ordering the increase in the power of energy transformation.

But, if we now shift from the biosphere to the noosphere, we see that although Man is a continuation of this "natural trend" of increases in free energy formation, it would be a major mistake to add man simply as another higher stage in the series along the line *L*.

The noosphere changes the entire nature of the process itself; it operates in a different space-time and energy domain. Mankind's "durable colonization" of the Earth, cannot be compared with any of the geometries characterizing one of the single species in the biosphere. On the contrary, the noosphere becomes an intensified mirror of the biosphere in its totality. Therefore, we can represent the "noospheric," or physical economic, transformations with the same type of inhomogeneous space seen before for the biosphere (Figure 3). But now, the sub-manifolds (K_0, K_1, . . .) indicate the power of the physical economy to maintain a specific rate of reproduction, mediated by a characteristic species of technology, or of newly discovered physical principles.

We have evidence that for at least the last 2 million years, Man has been able to migrate all over Africa and Eurasia, and was therefore able to durably sustain his existence in very different environments. I want to focus on a more recent example of such "durable colonization," because it contains an interesting paradox.

Figure 4 shows the title page of an article, which appeared in *Scientific American* magazine in September 2000: "Who Were the First Americans? If your answer was fur-clad mammoth hunters, guess again. The first people to settle in the New World may have been fisherfolk and basket weavers."

What is the point of this debate?

Colonization of the Americas 40,000 Years Ago?

The officially accepted theory on the colonization of the American continent was, until recently, based on the so-called Bering Land-Bridge theory; the idea was that mammoth hunters, following their prey and not knowing where there were going, crossed the land-bridge between Siberia and North America, approximately 13,000 years ago, when the sea level was much lower and the ice sheets had melted just enough to open a land passage through Canada. Always following the animals, the theory goes, the hunters spread out over 1,000 years through North and South America.

But the contradictions to this simplistic view of human beings are beginning to force a change in thinking. It is now accepted that 15,000 year ago, there already was an established colony in Monte Verde, Chile, which is, at the moment, accepted as the oldest known site of human habitation anywhere in the Americas. To this must be added the other puzzle, of the presence of a cave painting which is probably 30,000 years old, in Pedra Furada, Brazil.

How could this be? How can we have in South America human colonization older than that in the North, and older than the assumed date of crossing of the Bering Land-Bridge? Reluctantly, as shown here, the idea that the migration to America took place much earlier, and therefore by sea, is beginning to be accepted. There are two main eastern routes by which the migration probably took place 40,000 years ago, followed later by others (Figure 5).

(a) The Pacific coastal route theory: The possibility is that the migrants followed the coastlines in small boats, and researchers are beginning to find other prehistoric artifacts under the water along the American coasts.

(b) The Pacific crossing theory: The same people who have


Who Were the First Americans?

If your answer was fur-clad mammoth hunters, guess again. The first people to settle the New World may have been fisherfolk and basket weavers

by Sasha Nemecek

SIDEBARS:
Early Sites in the Americas
Archaeology's Dating Game

RELATED LINKS

The leaf-shaped spearpoint I'm holding is surprisingly dainty—for a deadly weapon. I let my mind wander, trying to imagine life some 14,700 years ago in the marshes of southern Chile, where this relic was found. The 30 or so people who lived there then, at the creekside campsite now known as Monte Verde, were some of the earliest inhabitants of South America—most likely descendants of people who reached North America by crossing the Bering land bridge from Asia at least 15,000 years ago, perhaps more. Did this seeing crew realize they were such pioneers? Or are such musings reserved for people who don't have to worry about where to find their next meal?

My thoughts are interrupted by Tom Dillehay, professor of anthropology at the University of Kentucky and the man who in the 1970s uncovered Monte Verde, the oldest known site of human habitation in the Americas. In a basement classroom on the university's campus,

Figure 4
TITLE PAGE FROM *SCIENTIFIC AMERICAN* ARTICLE ON COLONIZATION OF AMERICAS
The debate over who the earliest settlers were and how early they arrived in the Americas was discussed in this September 2000 article in Scientific American.

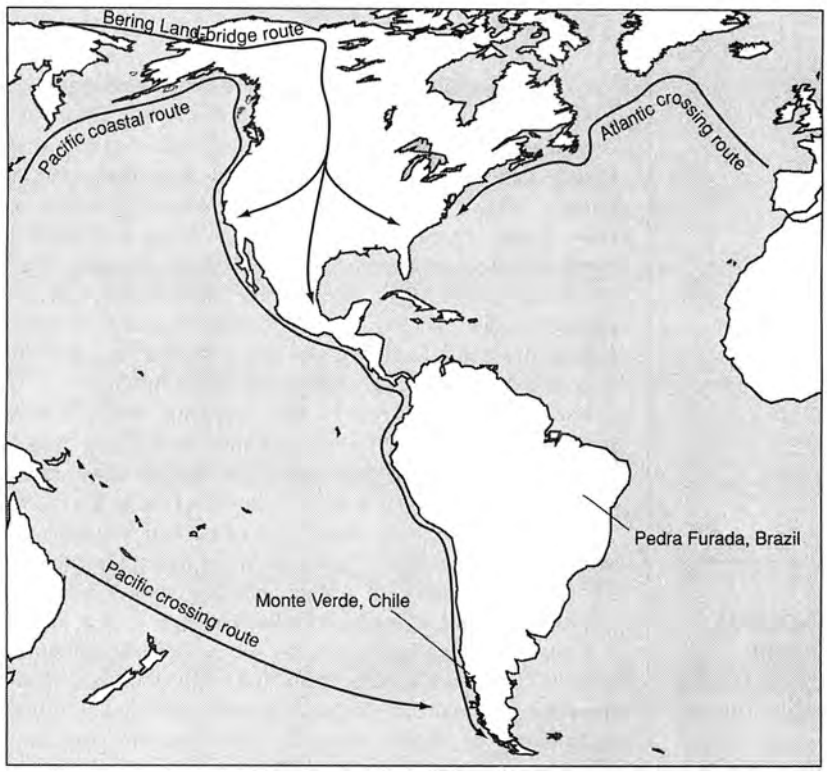


Figure 5
POTENTIAL MIGRATION ROUTES TO AMERICA 40,000 YEARS AGO
New discoveries, as well as some old but ignored discoveries, are forcing a new look at how America became inhabited, how long ago, and the level of culture required for making such sea journeys.

been shown to have moved by boats into Australia and the islands of the South Pacific, some 50,000, and possibly 100,000, years ago, might have continued travelling east, reaching other islands, and finally South America, although there is only scarce evidence for this at the moment. (There is also a possible western route, across the Atlantic, but let's concentrate here on the essentials).

Given the time, I have to leave it to you to extrapolate all the implications of what I just said. But for sure, if the above is true, we have to accept the fact that Man had mastered some form of rudimentary astronomy a long, long time ago.

We can also easily imagine the role of the discoverer, and his difficulty in convincing and educating his community. We can imagine the fear of many members of that society of recognizing the necessity of sailing towards the "unknown" islands. Therefore, such migrations must have needed a transformation of the cultural "space-time" of an entire society, or, as Lyndon LaRouche wrote:

> The productive potential of the individual lies not entirely within himself, but in the relationship of his development to the characteristic "curvature" of the society.

Because of this, we can easily imagine that such migrations were not accidental events, or aimless adventures. They were conceived as necessary great "missions," whose success, at the same time, achieved, and depended upon, a permanent shift in the power of the society.

From that time through to today, we have largely increased the rate of survival of our "permanent colony"; we have, therefore, also increased the power of the biosphere to sustain life. But, our brain has not increased one gram compared to the brain of those colonizers of 40,000 to 100,000 years ago. Therefore, we can no longer use the increase in brain size as an indicator of the right direction in the evolution of the noosphere—although a direction nevertheless exists, and it is coherent with the increased rate of "permanent colonization" indicated by Vernadsky, and further elaborated by LaRouche.

We have to shift the metric; the engine that guarantees self-conservation is no longer a biological, automatic process, although it is still a "natural" one. Because of this added degree of freedom, there is also the risk, with each new generation, that we may lose our right to govern the biosphere, if we do not find the moral will, and the spiritual resources, to make such discoveries as may uplift our society's ability to conserve the noosphere.

The present Pope wrote the following some time ago:

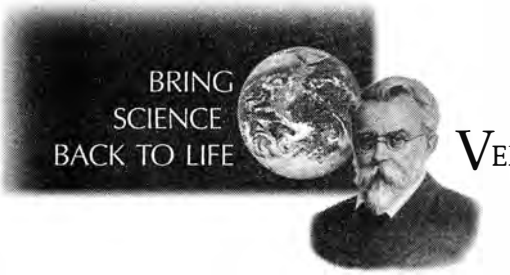
> A good culture must be able to help man to overcome the fear of his own scientific discoveries, the fear of the process of transformation of created things, to which he has been called by vocation. . . .
>
> And the Church should never tire of affirming the importance of man as man, of the fact that we have to love man because he is a man, because of his own singular dignity which he possesses. . . .

As Vernadsky had correctly assessed, the biosphere is fundamentally dependent on the Sun. Now, according to current stellar physics, one day the Sun will expand, causing an increase of temperature which will kill the Earth's biosphere.

Between now and then, hopefully, we will have been able to establish a permanent colony on Mars, and from there farther out towards the cooler outer planets, until we will again have to face the "unknown oceans" of the New World that is located outside our planetary system.

And, in case you do not like travelling, we could also study our Sun more deeply, and repair it, so that it can survive a bit longer.

Dino De Paoli, based in Hannover, Germany, has written widely on the history of science and has presented a series of Schiller Institute lectures to university audiences in Europe on the themes of this article.



VERNADSKY'S METHOD

5. Eurasian Development—The Next Step for The Biosphere

by Lyndon H. LaRouche, Jr.

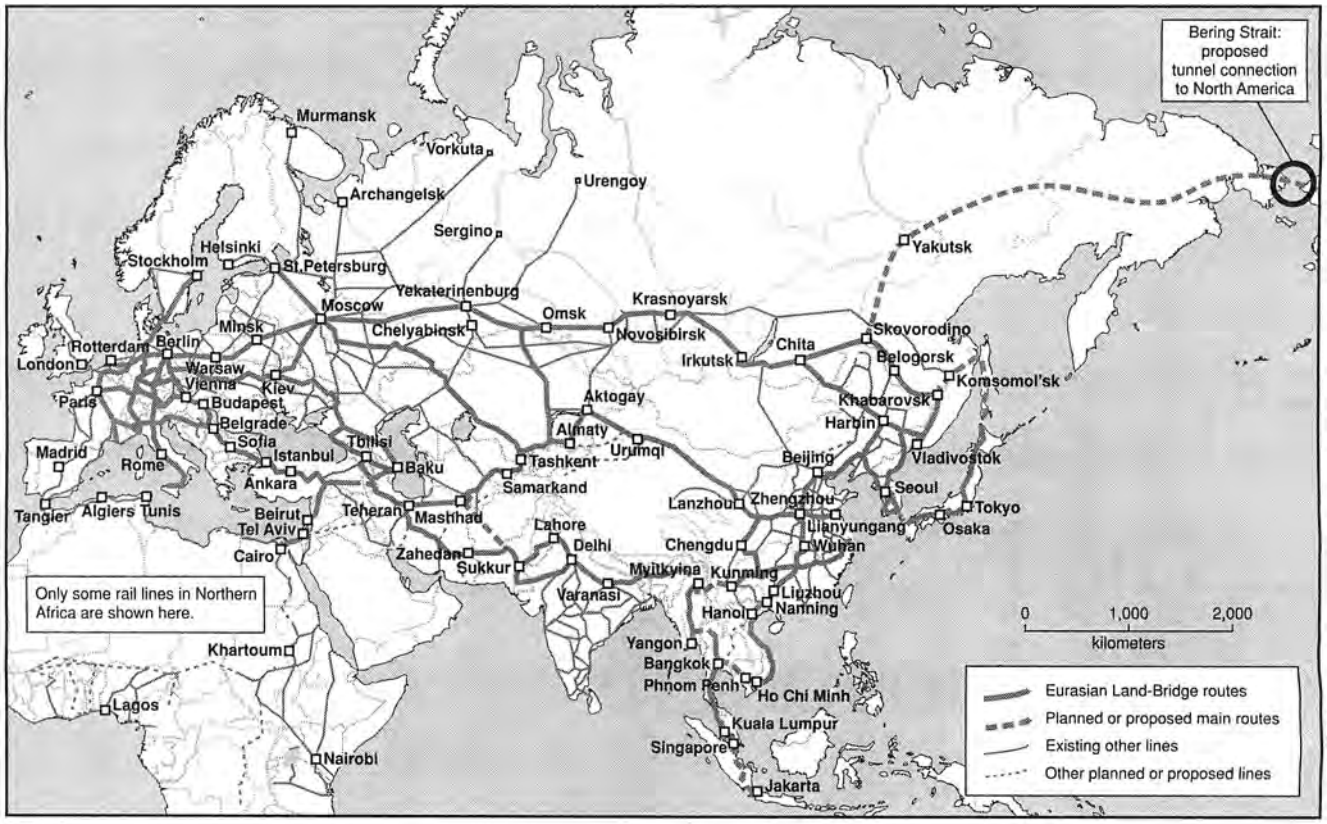
This is an excerpt from Lyndon H. LaRouche, Jr.'s keynote address to the Schiller Institute conference in Bad Schwalbach, Germany, on May 4, "Winning the Ecumenical Battle for the Common Good."

Maria Schmitz/EIRNS

Lyndon LaRouche: The Eurasian Land-Bridge project "means that we would be engaged in the greatest change in the environment in the history of mankind."

For as long as we know, mankind's economy has been dominated by the oceans. Contrary to all these theories that the British Biblical archaeologists tell you, civilization did not come from England and march down the rivers and the seas; it went the other way. What we know from, especially, information on the internal characteristics of ancient astronomical calendars, shows that they were predominantly calendars used by a trans-oceanic maritime culture, functioning over a long period of time, when most of North Eurasia was under a giant glacier, for about 100,000 years. During that period, most of what later became civilization, was running around the oceans. From the time that these maritime cultures came back into Eurasia, following the melting of the glacier about 20,000 years ago, when that began, they began to move inland. The first direction was to move along the great riverways inland, to move along the coastways, close to the seas and to maritime traffic. If you look at the map of the world, you find the characteristic of long development is the lack of the ability to utilize the inland areas, the land-locked areas, of the world, with the same degree of efficiency and productivity that was used in the coastal areas and chief riverways.

Look at Asia today: In China, you have the coastal areas which reflect this, they are more highly developed, relatively speaking, and the inland is poorly developed, the population has a poorer standard of living and poorer opportunities for development. This extends, then, into Central and North Asia as a whole. Therefore, if we conquer this area, what happens? Take transportation alone. People who don't think, think that ocean freight is the cheapest way to move freight. That is not true. The cheapest way is across land, but not by truck; trucks running up and down the highway tell you that the economy is being dismantled. It costs too much; it's intrinsically bad. Railways are



THE EURASIAN LANDBRIDGE: MANKIND'S GREATEST SINGLE OPPORTUNITY FOR DEVELOPMENT

The proposed Eurasian Land-Bridge stretches from the east coast of China, to Western Europe, with "fingers" extending across to North America and down through Africa. Development corridors, with new cities and industries—100 kilometers wide—are proposed for creation through the interior of Eurasia.

The strategic aim of the Land-Bridge is to improve and extend the entire Eurasian railway network for high-speed transport, to increase freight capacities many times over, and to combine this with energy, water, and communications systems, as well as with magnetically levitated rail transport. In short: to create the backbone of a Eurasian "economic miracle" in the early 21st Century.

Source: EIR News Service, Inc.

much better. Integrated transport systems, featuring railways, especially magnetic levitation systems, are excellent.

Magnetic levitation systems move passengers more rapidly, but those same systems for moving freight, that is really a wonder. That's where the payoff comes. If you can move freight from Rotterdam to Tokyo at an average rate of 300 kilometers per hour, without much stopping along the way, and if for every 100 km of motion across that route, you are generating the creation of wealth through production as a result of the existence of that corridor, then the cost of moving freight from Rotterdam to Tokyo is less than zero. What ocean freight can do that? Did you ever see a large supercargo ship producing wealth while travelling across the ocean? And at what speed?

A Turning Point in Technology

Therefore, we have come to a turning point in technology, where the development of the internal land-mass of the world, and the great typical frontier, is Central and North Asia. That is the greatest single opportunity before all mankind for development. This requires some revolutionary changes in the way we think about things. This means that we would be engaged in the greatest change in the environment in the history of mankind. This single project, say a 25-year or more development of Central and North Asia in this direction, including the conquest of the tundra—the Arctic tundra is one of the great frontiers to be mastered, and it can be done—that would be a great change in the environment. How are we going to decide what is good or bad about changing the environment?

What people think today about the environment is pretty stupid. It doesn't make any sense; people don't know what they're talking about, and when you see the kind of education they get, it's no wonder they believe that nonsense. Especially those with physics degrees.

The great theory of the environment was established by a Russian of Ukrainian credentials, Vladimir Vernadsky, with his concept of geobiochemistry. The problem is, that what you're taught in most universities about science is nonsense—it's a damn lie, to put it frankly. What you're taught as basic physics is mostly a lie. Because, as Vernadsky demonstrated this in his own way, and as others have shown, there are actually three principles involved in man's physical relationship to the Earth and the universe—three categories. One is what we call *non-living processes,* what most call physical processes. The second, which those in molecular biology refuse to understand, is

the *principle of life;* you will never get life out of a non-living process. Life is, as Pasteur insisted, a principle unto itself, a universal physical principle which, as Vernadsky demonstrated with his biogeochemistry, the oceans and the atmosphere were produced by living processes, down several kilometers below the Earth's surface. Most of the Earth that we are in touch with, as humanity was created, was a by-product of living processes, with what Vernadsky calls the "natural products of the biosphere." We can measure the power of the biosphere over the non-living processes—we can measure it!

Living processes are superior to non-living processes; they are more powerful, they are apparently weak, but their long-term effects are more powerful than the short-term effects of non-living processes.

The Need for Revolutionary Discoveries

There is a third thing, which Kant won't let you know—that's why they call him Kant, because he can't do anything. The essential nature of man is that we are capable of making discoveries of universal physical principle, discoveries we can validate in known experimental ways. By applying these principles, we increase our power in the universe, in ways that can be measured physically, per capita and per square kilometer. We can measure this in terms of the demographic effect of this kind of action. That is, does the human species improve its life expectancy, its power to exist in the universe, as a result of this? If it does, that is good. Mankind's primary mastery of nature has occurred in terms of his mastery and development of the biosphere. So actually, the biosphere, including what we call basic economic infrastructure, such as waterways, power systems, transportation systems, the development of good cities—these are natural products of cognition which are reflected as improvements in the biosphere.

The biosphere is weak, it is stupid, it does not know how to deal with the deserts it has, or the tundras, or other problems, but we, as human beings, can come to our poor, stupid slave, the biosphere, and say, "We will educate you, and we will make you stronger and better."

So, mankind intervenes in the biosphere to make it better. So, the principle of discovery applied to the environment creates natural products of cognition in the biosphere, which improves the biosphere, which increases the potential for human life. This is not a mysterious, arbitrary area; it is an area of science, of scientific precision. Which means the job to do is not to ask whether it is good or bad to tamper with the environment: It's very good to do so, if you know what you're doing. But you have to develop the science of water management, the science of transportation, the science of reforestation, the science of how to change and control the atmosphere and the climate. You can't make big mistakes; they will live with you for a quarter of a century or more. Therefore, you have to have competent groups of people determining how to do this. But by changing the biosphere of Central and North Asia, and changing the biosphere in the arid regions of China, and so forth, we will create the greatest boom for humanity on any part of this planet.

What we need is a mission-oriented task force to undertake the policy planning for precisely this. And it must be international.

The Pivotal Role of Russia

Now, the peculiar part of this is the case of Russia. Russia has gone from communism to liberalism, without passing "Go," and certainly without getting $200. It got nothing; it lost money on the deal. The problem in Russia is to define itself—once again, intention: This will work, if Russia adopts the intention of playing that role for itself in a Eurasian development program. That means, leading Russians must adopt such a perspective, and the Russian people must increasingly participate in that vision of the role of Russia in changing the situation in Eurasia and in Russia itself.

Under those conditions, the role of Russia as a pivot, with other parts of Eurasia, is crucial. How? First of all, there are conflicts of an historical and cultural nature along most of the nations of Asia. China and India, for example. China and Japan, Korea with China and Japan, and so forth. So that, on a bilateral basis, long-term agreements among these nations are very difficult to manage. However, if you have a common mission, with a common interest, which involves a number of these nations together, then you can bring them together in a system of cooperation. This is the natural role in which Russia can play a mediating part throughout Eurasia.

This is what came up when Primakov was Prime Minister, on the triangular cooperation, which we boosted very much, and pushed for, between China, Russia, and India. That is a viable idea. It has to be given more legs to walk on and a mind to direct it, in that sense. In Western Europe, we could potentially revive the kind of high-technology export potential which once existed here. But Western Europe has to adopt a mission, and Central Europe has to adopt a mission, of participating in this development of Eurasia, as a group of sovereign nation-states, through instrumentalities which they create among themselves, to facilitate this cooperation.

The object would be to bring the United States in to cooperate with that great venture.

And if you look at Africa, as we shall discuss here, it has no chance—it has been too looted—unless it has help. The help it requires is of the same nature. The primary needs from the outside for Africa are in the area of basic economic infrastructure, particularly large-scale extensible systems of infrastructure: transportation links, power grids, water management, the redistribution of water in Africa, could make a revolutionary difference. Africa needs assistance on *this.*

If Africa is allowed to have the room to undertake its own development, with that kind of assistance, Africa can develop. This assistance must come from viable other parts of the world. A prime case is Eurasia: If Eurasia is developing prosperously, then it will help Africa. But, if the Americas and Eurasia are not developing, there will be no help for Africa. And the penalty of what has been done to Africa, like an infectious disease, will continue to destroy Africa, internally and otherwise.

Therefore, we should see this connection in this world: Eurasia is the great center of human population. The conquest of the inner space of Eurasia is a great focal point for a mission out of this process. When we then turn to Eurasian development to look to Africa, and see the misery there, then we see a larger mission which exemplifies humanity as a whole. That is our chance. . . .

BIOGRAPHY OF A RENAISSANCE MAN

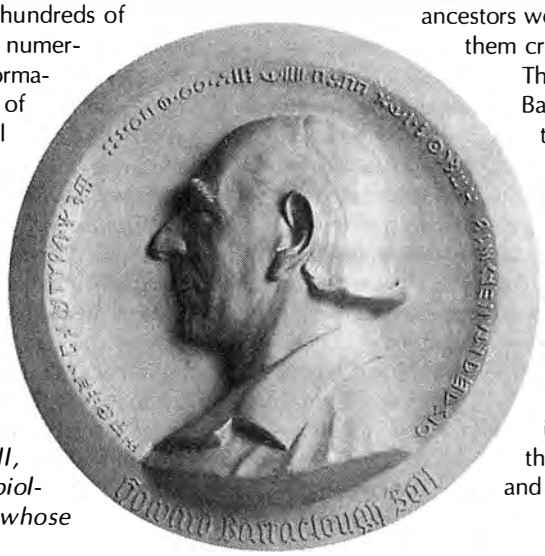
Part 2: Barry Fell's Revolution in Deciphering Old World Scripts

by Julian Fell

A son's memoir of a remarkable father, who deciphered many previously unknown scripts and overturned a multitude of establishment views in epigraphy, archaeology, history, and anthropology.

1. Introduction

An epigraphic revolution has occurred in the last 25 years. The use of decipherment techniques that dispense with the need for bilingual matching has made possible the decipherment of hundreds of seemingly disparate inscriptions from numerous locations. This has yielded information about the technical capabilities of old civilizations and of their global travels on a massive scale—previously unrecognized and unsuspected, because of historical amnesia and archaeological blinders. Barry Fell, the subject of this biography, is a prime catalyst and principal epigrapher of this diffusionist revolution. This account is an attempt to outline his works and their significance. The assumptions and conclusions presented here will appear to some to be entirely different from what they have been told during their schooling. Keep an open mind. Our ancestors were much smarter than we have given them credit for.



Howard Barraclough (Barry) Fell, 1917-1994, epigrapher and marine biologist. Above is the Phaistos Disk, whose script Fell deciphered in 1973.

The first part of this biography [1] covered Barry Fell's early years and those works that led to the discovery of the connection between Maori and Numidian script. His early and broad foundation with a wide range of languages, and his life-long study of languages (in parallel to his career in biology), along with a series of fortuitous events in his life, enabled Barry to recognize and decipher a series of key inscriptions in the Mediterranean, Indonesia, and the Pacific that revealed the linguistic and historical source of the Polynesian

language. This lay in the Mauri language and Numidian script of the Mediterranean shore of Africa, just east of Egypt.

A long-standing multicultural mix centered on Java (not Malaya) had occurred in the last half of the first millennium B.C., and datable inscriptions confirmed entries into the Pacific spanning 232 B.C. to 385 A.D. A separate series of linguistic and ethnological determinations provided a decipherment of the script of the Easter Island tablets which was consistent with Polynesian culture and mythology. It is the only decipherment accepted by the Rapa Nui people themselves as correct and, in recognition of this, they bestowed upon Barry an honorary chieftainship.

In Part 1 of this biography, it was reported that a Taranaki (New Zealand) inscription had appeared to be the last use of Numidian (about 1450 A.D.). Artifacts and inscriptions recently discovered now indicate that the use of Numidian script (as also with the case of Easter Island script) extended into the last 100 years in New Zealand and other Pacific locations. It had also been used in Sumatra, but with entirely different sounds for each letter.

Barry's Numidian-Egyptian-Polynesian studies established the multiple origins of the Polynesian vocabulary and its writing system, as well as the role of Java in its dissemination. Barry came to this from his recognition of Mediterranean (and Indian) roots in Maori, and his decipherment of the Javan steles. Curiously, as I have since learned, Edward Tregear (1846-1931), a classically trained philologist with Oxford connections, had similarly detected numerous Sanskrit roots and about a dozen Greek roots in Maori. This occurred almost 100 years before Barry's discoveries. The parallels between these two investigators are remarkable.

Tregear settled in New Zealand and studied the Polynesian language. He produced a major reference text comparing all the dialects in Polynesia in 1892,[2] which remains a standard today. He developed a profound respect for the Maoris and their culture. On the basis of word roots, mostly Sanskrit, he concluded that Maoris (and all Polynesians) were Indo-European, rather than Malayan, as popularly alleged. He also concluded (as did other students) that the tribal, physiognomical, and linguistic diversity of Maoris, as well as the population levels and material conditions attendant to relict villages and middens in New Zealand, contradicted the popular and traditional accounts of how the Maoris voyaged to New Zealand. Tregear believed that a far older and longer period of immigration had occurred.

Tregear also believed that the Maoris had a past far more sophisticated and technologically advanced than was popularly believed. Tregear published these conclusions in 1885,[3] separately from his reference text. His views were immediately trashed, suppressed, and forgotten. Tregear also noted the use of nonsense rhyming by the elite Tohungas of New Zealand, and the existence of an elite, secretive sect of priests in Tahiti who preserved (with mysterious recitations) the oral history of their peoples.

Although we now know, by hindsight, that much of Tregear's speculation was wrong as to how this came about, his observations of fact, and a significant part of his guesses, were entirely consistent with the discoveries of Barry, 90 years later. So completely had Tregear's non-reference works

A Personal Note

It has been pointed out that my account (in Part 1) of Barry's early intellectual disagreements with his stepfather, Michael Thomas Ryan, created the impression that a rift existed between them, and that Barry's stepfather was narrow-minded. This, most emphatically, was not the case. Although there was some conflict between them, which reflected significant intellectual differences in some of Barry's schooling and religious views, it must be emphasized that this was brief and confined only to the initial years of their contact, when Barry was in his early teenage years. It may have been largely a manifestation of the period of "distancing" that comes with the start of teenage years.

By Barry's late teenage years a mutual respect had begun between them, and Barry's respect for his stepfather grew ever stronger through time.

Michael Ryan, was an extraordinary man in his own right. Born in humble and poor circumstances, he sought to rise by a military career, which was frustrated by the loss of an arm in battle. (He was the first New Zealander to enter battle and be wounded in World War I.) After the war, he worked for, and later ran, a company that made technologically advanced prosthetic limbs for his fellow war amputees.

After 25 years, he was put out of business by a socialist government takeover. Then he and two sons took over a derelict sheep ranch, which was conventionally considered to be beyond recovery in a commercial environment. In 30 years of hard work they developed a viable unit beyond all imagined potential.

Michael Ryan was "Grandpa" to me, and my siblings, and our contact was all too brief because of time and geography. I recall him as very modest in persona and lifestyle, yet there was an aura of innate greatness about him. He was scrupulously honest and moral. He acquired an army of friends over his life. He was a natural leader, but he did not lecture, command, or berate; he led by example. He was always the first to volunteer, whether to grab a shovel or write a check.

He assumed work loads far beyond his fair share, working tirelessly for his fellow war amputees, for his church, and for his political beliefs. He out-worked everyone else, and despite his frustration at missing an arm, carried himself in such manner that one was seldom aware of his handicap.

Never satisfied with the status quo, he always sought to improve things, whether mechanically, socially, or financially, in quantity or quality. He had the courage to risk his material circumstances and his public standing to achieve his goals. Barry (and his half-brothers) all developed a lifestyle and work habits that largely mimicked those of Michael Ryan. In particular, Barry's courage to publish his findings, no matter the consequences or controversy, reflects the influence of his stepfather.

—Julian Fell

been deleted from public record, that Barry was apparently entirely unaware of them. As a final credit to Tregear's foresight, we should note that he predicted that a solution to the mystery of Polynesian origin could lie in the extensive stone ruins of Java.

Part 2 of this biography herein continues the history of Barry's decipherments and ancient language researches covering those of the Old World. Although some of the discoveries concerning Mediterranean and European languages actually derived from New World inscriptions, I have chosen to report upon them geographically, rather than in the temporal sequence of their respective elucidations. I wish to have the reader grounded in the scope of the languages "at home" in the Old World before entering the controversies of the New World.

More Linguistic Background.

Before reporting the specifics of Barry's works, we should continue in our review of languages and scripts. Part 1 of this series (pp. 49-51 of the Winter 2000-2001 *21st Century*) outlined the different types of scripts (methods of writing a language) and discussed the significance and implications of shared vocabularies (the "DNA" of cultural contact). Serious students should review these before continuing.

In modern languages, we have the circumstance where each language has a specific written form. The writing components (letters, signs, syllables, or characters) can be specific (unique) to the language and thereby carry the same name as the language; for example, as in Thai, Greek, Korean, Japanese, and so on. Or, a language can use a phonetic lettering system, which can also be used by other languages. The most widely used phonetic script is the Roman (or Latin) alphabet, which is now used to write most of the world's languages. About 60 percent of the world's population uses the Roman alphabet. Other major scripts include Chinese (logographic characters); a group of Indian languages descendant from Sanskrit using derivatives of the Devanagari script (alphabetical); Arabic Naskhi (consonantal alphabet), which is used also for Urdu and Iranian, and was formerly used for Turkish and Malayan; and the Cyrillic alphabet of Russia, Ukraine, Serbia, and Bulgaria.

These modern examples show that many languages can use a common script, and that an alphabetical script is well suited to write multiple languages. Most of the languages that do not use Roman script have formally designated Roman equivalents, so that foreigners (and internal minorities) may more easily learn to speak these languages. The official Roman alphabet of China, for example, is called *pinyin,* and its recent adoption turned the word Peking into Beijing.

Once a satisfactory script has been developed by a culture, it tends to become standardized, and thereafter no new scripts appear in that culture, unless there is a technological change that requires it. Cuneiform, perfectly suited for impressment onto clay tablets, was abandoned in the Middle East when there was a shift to writing on paper, for which a cursive pen-and-ink script was required. The Roman alphabet was adequate for Western European languages, and has been the standard for more than 2,000 years. Scripts that were contemporaries of Latin also continued, but the only new "scripts" that have appeared since for Western European languages are for specialized technical uses—Braille, Morse code, semaphore, and so on. Of about 15 scripts in use around the Mediterranean in Roman times, today only 6 remain. The number of languages, however, has not decreased.

The idea that a single script can write many languages is obvious, but it is equally true that several scripts can be used alternatively to write a single language. Chinese and Japanese words are routinely written in Roman letters, outside and within their respective countries. Japanese is actually written in a combination of three scripts: two syllabaries and a set of characters derived from Chinese. In pre-Biblical times, there was no standard script in the Mediterranean-European area, and it was normal that several scripts were used to write a single language. This circumstance occurs constantly in the reading of early inscriptions, as will be seen later.

Indo-European Languages.

In considering the European-Mediterranean languages, it is useful to be aware of two major language groupings: Indo-European (or Aryan) and Semitic. It must be emphasized here that this terminology is strictly linguistic, not ethnic or racial. The name "Aryan" comes from a Sanskrit word *Arya* (root *Ar-*) meaning noble or nobility. Linguistically, it was used to designate the Indo-Iranian subgroup of Indo-European languages, and the words Iran (Persia) and Eiran (Ireland) are derived from it. Sadly, in the 20th Century this word, along with a Celtic and Buddhist spiritual symbol, were hijacked by ideologues and given political implications that have rendered it almost useless as a linguistic or archaeological term.

The Indo-European language group is large and diverse. Fifty percent of the world's population speaks an Indo-European language. Members of this group originally ranged throughout Europe, from the Atlantic and Arctic coasts to the Mediterranean and Black Seas, and in a wide swath through Persia to the Bay of Bengal. Within the original Indo-European range there are pockets of non-Indo-European languages, including Basque, Hungarian, Finnish-Estonian, and Turkish. The last-mentioned is a recent arrival (11th Century A.D.), displacing Armenian and Greek from Anatolia (Asia Minor). Between the Urals and Portugal there are 64 Indo-European languages, or major regional dialects, in 9 major groupings. Similar numbers occur in the Indo-Iranian sector.

The Indo-European languages are usually written from left to right, except for some that use Semitic scripts (Urdu, Iranian, and Etruscan). In most instances, they are written, and have been written with alphabetic scripts. Indo-European languages have the peculiarity that they arbitrarily assign a gender to their nouns. Their principle distinction is that they are grammatically inflected and, in older languages, they are highly inflected. Inflections are modifications to the spelling (and pronunciation) of a word in accordance with its grammatical usage. Most changes involve the endings on stems. The stems do not change. Nouns are modified according to case, gender, and number. Adjectives have to match their nouns. Verbs change according to tense, number, person,

Fell's encyclopedic historical and scientific knowledge, and proficiency in the Classics and in several modern languages, enabled him to solve the mystery of many ancient scripts of the Mediterranean area.

mood, voice, participle, gerund, and so on. In the earlier known Indo-European languages, the diagnostic characters are most strongly present. In these (for example, Latin) the word order is not important, because the sentence meaning is essentially determined by the grammatical inflections of the words.

Having belabored the grammatically complex nature of inflected Indo-European languages, we must now observe that English, the most widespread modern daughter language of the Indo-European group, has lost nearly all of its inflections, and is considered to be non-inflected. There are no arbitrary gender assignments in English, except where an inanimate object is given a humanoid (pet) identity. Only a few remnant gender inflections remain (for example, actor and actress). Number inflections remain (for example, goose, geese; ox, oxen), but most plurals simply take the form of adding an "s," and in some (for example, sheep) there is no plural inflections (a condition common in non-Indo-European languages). The only case inflexion remaining on nouns is the addition of apostrophe-"s" ('s) for the possessive (genitive) case. In pronouns there still exist objective (accusative) case pronouns (me, him, her, us, them) and possessive pronouns (my, your, his, her, its, our, their). Adjectives do not match their nouns, and therefore must be placed next to (usually before) the noun they modify. The only inflexion remaining for English verbs is the use of a terminal "s" on third person singular, and the participles required for creating past tenses, and here there are already verbs with no participle inflexion at all (for example, shut, burst). Almost all meanings are now endowed by pronouns, prepositions, ancillary verbs, compound tenses, and word order. In English, word order is all-important.

This massive simplification of grammar in English makes English a relatively easy language to learn to read. As a result of its multiple parentage however, English has no consistent pronunciation and is therefore a nightmare to learn to speak. A recent study showed that English has more than 1,100 different spellings for the 46-odd phonemes that it contains. In contrast, Italian (a non-hybrid language) has only 33 spellings for its 25 sounds. English has lost every grammatical quality that characterizes an Indo-European language, but it retains its huge Indo-European root base and its syntax.

The three most famous classic Indo-European languages are Sanskrit, Greek, and Latin. They were not the first—far from it—but, circumstantially, they evolved and became stabilized and standardized into their respective classical forms, and then descended unchanged as the stable "anchor" languages in their respective localities. Of these, Sanskrit is both the oldest and the most sophisticated. Sanskrit developed and emerged as the definitive language of Northern India, by 800 B.C. Like Latin, half a millennium later, it was spoken and read in its orthodox form only by an educated elite, but it was used to stabilize the culture and religions that existed around it. A defining grammar (by Panini) was finalized by 500 B.C., at which time Greece had barely emerged from a dark age (1100 to 750 B.C.) and Rome was barely beyond a bunch of huts on the Tiber. No writing of Sanskrit in its original form from 1000

to 300 B.C. exists, and its written format during this time is essentially unknown, although use of Semitic scripts is suspected. Surviving texts of Sanskrit are known from about 270 B.C. in two scripts (Kharosthi and Brahmi) of this period. For the last 1,800 years, Sanskrit has been written in Devanagari alphabet, which is the most widespread of the several major Brahmi-derived scripts.

European language scholars who went to India in the mid-18th century, "to study the language of the primitive societies," found themselves in for a major surprise. They found a language more refined, elegant, and sophisticated than Latin—and a thousand years older. Surprise quickly turned to enthusiasm. The striking features of Sanskrit to European eyes were the close similarity of its grammatical structure to that of Latin, and the correspondence of its word roots to vocabularies of Celtic and Teutonic languages, as well as Greek and Latin. This, and subsequent determinations that Persian and some of the Caucasian region languages all followed these patterns and shared fundamental roots, led to the recognition and definition of the Indo-European language group.

"Indo" comes first, as the Indians did it first, and they did it best. The degree of Sanskrit's shared language features far exceeded what could come from loaning, and a shared or related ancestry was indicated. The reasoning for this is given in Part 1 (pp. 50-51) of this biography. The defining Panini grammar text for Sanskrit was a masterpiece. It was superior, by far, to anything that existed at the time for any other language. It became the model for all modern grammars, and effectively caused the science of Linguistics.

The studies of Sanskrit and Persian by 18th and 19th century linguists marked the realization (in linguistic circles) that languages are far more related and interrelated, and have deep ancestral interconnections. From this evolved Philology, the comparative study of languages. Sanskrit was an integral part of the studies of any serious student of languages in the 19th century. Colonial expansion by Indians, and trading connections took Sanskrit into Cambodia, Malaya, and Indonesia in the first millennium A.D., as was noted in Part 1 of this biography.

The geographical source of Indo-European languages is not established. Sanskrit is the "refined" language of a complex of vernacular dialects known as *prakrits*. *Arya* (our Aryan) is the Sanskrit word for noble or nobility; in other words, the rulers of Northwest India during the time that Sanskrit was evolving. These had invaded from Iran. Before 1973, no relationship had been determined between Sanskrit and the script of the Indus Valley (Mohenjo Daro-Harappan) civilization (2500 to 1500 B.C.), which was found on small seals.

There has been an assumption that there was a connection between the Aryan rulers, who came after the Indus Valley civilization, and the emplacement of Sanskrit. One of Barry's decipherments was able to answer these questions.

Semitic Languages.

The Semitic language group originally spanned from Egypt and the Red Sea, through Palestine, and into Mesopotamia and Arabia. Contact and immigration spread Semitic languages, and influences, along the Mediterranean coast of Africa and into North Africa. Phoenicians and, much later, Islamic Moors, carried Semitic languages into Spain. A large number of Semitic languages once existed, but almost all have been replaced by Arabic. Other Semitic languages exist in pockets (Maltese, Coptic, Hebrew, and Rhaetic) and languages containing large Semitic vocabularies include Berber, Malayo-Indonesian, Polynesian, Yiddish, and possibly Madagascan. (New World occurrences are omitted for now.) The earliest recorded (that is, where writing is known) is Akkadian from 2500 B.C. Babylonian, Assyrian, Phoenician (Carthaginian), Aramaic, Nabatean, Hebrew, and Arabic are among the better known Semitic languages. Tyrolean Rhaetic is a recent addition to the list. The earliest writings of these Semitic languages were syllabic, in cuneiform on clay tablets. Cuneiform was replaced by cursive scripts, for writing on paper. Arabic (Naskhi) script is now predominantly used outside of Israel and Ethiopia, as well as for Indo-European languages in Iran (Farsi) and Pakistan (Urdu).

Semitic languages are written from right to left. Originally tending to be syllabic in structure, the later Semitic scripts are consonantal, although both Arabic and Hebrew have optional vowel-pointing. Semitic languages are inflected, but in a manner quite different from Indo-European languages. Words are written with consonants only (usually three), and these do not vary. The vowels separating the consonants are varied according to the grammatical condition. Different grammatical conditions are assumed, or implied, from context when read or written, and by varying the vowels when spoken. Semitic languages have "open" syllables; that is, every consonant is followed by a vowel, and consonants do not occur together. This pattern makes it unnecessary to write the vowels; it is known that they are there, and experienced readers know what they are with more no difficulty than an anglophone has in knowing the specific pronunciation of every vowel.

Semitic languages appear to have been either the source of, or the inspiration for, most of the scripts used for Indo-European languages. A problem arose, in that Indo-European languages do not consistently have open syllables, and consonants occur together. This problem was ultimately solved for Indo-European languages by writing in all the vowels where they occur (full alphabet); but other methods have been used and confusions abound.

2. Former Decipherment Methods

Epigraphy is the decipherment of ancient scripts. Conventionally, this has meant first, the determination of the sounds of the script and then, the reading of the language(s) that the scripts write. These are actually separate steps, but mutually dependent. Some scripts had been approximately deciphered to sounds for some time before they could be read (for example, Etruscan and Numidian). In many respects, the first stage mimics the work of cryptanalysts ("code-breakers"), although the unknown writing has not been written so as to conceal the meaning. (Two notable exceptions to this are the key-word scripts found on the Easter Island Tablets and the

Phaistos Disk.) In most cases, we are simply seeking the phonetic equivalence between an unknown script and our own alphabet.

Over time, epigraphers have developed a methodical system for their work. When confronted with an unknown script, the first step is to determine its orientation. Some inscriptions that are not fixed to a structure can be hard to orient. What is up or down, left or right? Is the script-bearing substrate a positive or a negative? (A negative is a mold or stamp that creates a positive.) Many a would-be epigrapher has been confounded by getting these wrong. It is also important to know the context of the inscription's location, as this is a guide to its age, possible subject matter, and probable language of the script. The script is examined qualitatively for familiar letters and the presence of word groupings (most early scripts do not separate the words), as these can provide clues as to origin. The script is also screened for any punctuation signs, vowel indicators, and so forth.

The next step is to determine the basic type of writing system used. Is it a character (logographic/ideographic) script, or a phonetic script? If it is a phonetic script, then is it alphabetic, syllabic, or consonantal? Until this quality is established, the decipherment cannot continue. This may sound simple but it took almost 350 years before Yuri Knorosov, in what is now St. Petersburg, established that the Mayan inscriptions were hieroglyphic before any real progress could be made in their decipherment. Similarly, J.F. Champollion had to establish that Egyptian writing was hieroglyphic (phonetic), before he could progress. (This may sound a bit odd, but the hieroglyphic method of writing was named for, and after, the pre-existing name given to the Egyptian inscriptions.) Hieroglyphic writing is a kind of picture writing that is actually a complex syllabic script. Whereas most scripts employ abstract, but relatively simple, patterns of curves and strokes to represent sounds, hieroglyphs use images of real objects. Fortunately, hieroglyphic scripts are few in number. (I refer the reader to the account of Champollion's decipherments in Note 4 for details of an hieroglyphic decipherment.)

Outside of hieroglyphics and key-word scripting, the determination of a script type is not difficult, if there is an adequate sample. All the different types of letters/signs are identified. These are counted in both the number of types, and how many there are of each type. Multiple inscriptions can be combined for this. The number of different signs (letters) will indicate the method of the writing system. Most languages have 15 to 30 consonant sounds and 5 to 20 vowel sounds. The totals for English, German, and Sanskrit are all in the low- to mid-40s, but most languages have fewer.

It is normal for vowels, when written, to represent more than one sound (for example, the letter "a" in far, fat, fate, and fall). Similarly, extra consonant values can be written by pairing consonant letters like *cr, bl, sh, ph*, and so on. As a result, alphabetic languages need only 18 to 32 letters. Syllabic scripts require 45 to 100 different letters, and consonantal scripts usually require fewer than 25 letters. There can be other indicators also. Some consonantal scripts use vowel pointing, which makes them incipiently alphabetic. Scripts that separate words give guidance as to word length. The words written in consonantal and syllabic scripts are only half as long as those in alphabetic scripts. Certain languages always place vowels after consonants; others do not.

Having determined the type of script, the next step is to discover the represented phonetic values. Conventionally, at this point, the epigrapher looks for combinations of signs that could spell the name of a God, a monarch, or a city. These types of proper names are usually known from the historical records of other civilizations, and the names are consistent among languages. These are the bilingual keys that are used to make the first phonetic assignments. Most decipherments have been enabled by paired bilingual inscriptions (such as the Rosetta Stone), or matchable proper names in different scripts related to the same subject. If the location is Old World, the context will indicate the approximate civilization involved and, very likely, the subject matter of the inscription. This helps in the hunt for proper names.

The context of the location and script type also provides a guide to the type of language written and, therefore, other languages that may bear a close ancestral, fraternal, or descendant relationship to it, including languages still spoken in the vicinity.

Historically, between the time of Champollion and 1940, every epigraphic decipherment has derived from some type of bilingual matching. In about 1940, epigraphy ground to a halt, because all the remaining, undeciphered writings either lacked a bilingual key, or were so unrecognizable that no bilingual component (if, indeed, there were one) could be detected. It was believed, at that time, that no decipherment was possible without a bilingual key. There have been three major decipherment events since, and all were achieved without the use of bilinguals. These are Minoan Linear B, the Mayan hieroglyphs, and the decipherments by Barry Fell.

It was a remarkable individual who first attempted a major decipherment without any known bilingual component. Michael Ventris, a young British architect, solved Minoan Linear B by using an analysis of grammar. At first, Linear B of Crete was known from more than 5,000 "sentences" on excavated clay tablets, from a site that was dated to about 1200 B.C. The signs seemed to be Anatolian (Hittite). An American, Alice Kober, pointed out during the 1940s, that this script appeared to contain repeating patterns on the ends of sign strings which was evidence of terminal inflections, and that the language was probably inflected in the Indo-European pattern. She postulated that if the inflection patterns could all be detected, they would provide a clue as to their phonetic values, or they could identify the language if it were otherwise known by a different script.

In 1950, Ventris took up the challenge. There were about 70 different signs which pointed to a syllabic script. Like most ancient scripts, the signs were in strings, with no separation of words. Ventris thus began the task of systematically screening 5,000 strings for every possible repeating combination of signs.

To a speaker of English, an almost non-inflected language, the significance of this task is not apparent. By way of example it would be equivalent to an extraterrestrial, coming to

Mel Kermanham

Barry Fell and his wife, Rene, in 1994. Barry died suddenly from cardiac arrhythmia later that year.

Earth and trying to figure out Latin, knowing neither the letters nor the language. Where most English nouns have 4 almost identical forms (for example, person, persons, person's, persons'), a Latin noun has potentially 12 out of 60 (theoretically) possible endings. Many endings are repeated, so there are fewer spellings, but the sharing is inconsistent and this actually makes analysis more complicated. Similar complications are found in adjectives and pronouns, and verbs can have more than 120 different spellings each.

The complexity of Ventris's undertaking is utterly mind-boggling to consider; yet, 18 months after he began, Ventris produced a solution which, as later work established, represented about a 75 percent correlation. It had become evident that the emergent inflection patterns resembled those of Greek, and several other possibilities were eliminated for various reasons. Near the end of the study, an inscribed tablet suspected of listing local place names was tested against the proposed phonetic values for the syllables, and a match was achieved, providing at last the confirming bilingual. Shortly after that, tablets with place names and names of illustrated objects were excavated, and these confirmed the decipherment. Linear B, with a very restricted occurrence on Crete, and found also in the Mycenean-age ruins of Greece, was proven to be ancient Greek, written in a syllabic script which was unrelated to the later, distinct Greek alphabet.

Ventris's work represented the most complex and challenging decipherment undertaken to date—and probably ever—by a single individual. (The Mayan decipherment is more complex, but it has been a long-term effort by many persons.) Ventris had to experiment and venture into original, unorthodox, and daring hypotheses. One of Ventris's most avid followers was Barry Fell, who credited much of his own techniques and innovations to the insight and thought lines of Ventris. Barry often expressed the opinion that Ventris would have solved all the Mediterranean scripts that Barry himself later solved, had Ventris not perished in an auto accident in 1956.

3. Barry's Decipherment Methods: Theoretical Considerations

Like Ventris, Barry developed unique techniques to decipher unknown scripts that lacked a bilingual key. Curiously, although Barry gave huge credit to Ventris as the originator of the concepts upon which he based his methods, Barry's methods were very different from those used by Ventris.

Personal Factors

It has been observed that epigraphers are born to this work. Champollion, Rawlinson, Ventris, and Knorosov all had innate linguistic talents, as well as a widespread knowledge, largely self-learned.

Barry brought his own set of talents to his epigraphy. First, Barry had an eye for calligraphy. In any complex of strokes and curves, he could detect the underlying order and sequences of the original inscriber—no matter how stylized, personally customized, or distorted. In his mind, he could break a complex into separate components. Where others saw a picture, Barry could detect a rebus. He could detect letters, whether sideways, upside down, back to front, or partially erased.

Second, Barry had an encyclopedic mind and stored a seeming infinity of letters, symbols, and variants, which he could recall and cross correlate with seeming ease. These two qualities enabled almost lightning-fast assessments of an inscription in a variety of qualities. His encyclopedic knowledge was coupled with a well-prepared mind. He enjoyed an unusual facility with languages, and he learned the basics of a large number of languages with ease. We know that, at various times, he could speak five modern languages and read several more. With suitable dictionaries, he could fundamentally read other modern languages of the Indo-European and Semitic types. His knowledge of past (dead) languages was remarkable in its breadth. Where some knowledge of languages alerts one to the diversity of languages, a broad enough knowledge also enables the perception and qualification of the consistencies and similarities of languages.

Third, Barry had the mind of a biological systematist and mathematician. Many of his early analyses were accompanied by mathematical treatments. Just as functions can be rendered graphically in a Cartesian system, numerical data can also (and equally) be mathematically qualified by averages, deviations, regressions, least squares, chi squares, coefficients of correlation, and so forth. So too, analyses of frequency and probability. Barry used such treatments initially, but in the end, he realized that although statistical treatments qualified and confirmed his assessments, they did not speed up or provide any analytical advantage over his subjective assessments; in his later researches, therefore, he largely abandoned the use of routine mathematics.

Fourth, of course, Barry had the advantage of hindsight. The sum of the experience of all preceding epigraphers was available to him, and he put it to good use. Barry's methods would not be possible without the huge amount of work done previously, much of it derived from key bilingual decipherments.

Lastly, and more so than perhaps any previous epigrapher, Barry became aware of the descent and consistency of root words through time, and this became the core of his own decipherment methods, whereby he could solve an unknown script without a bilingual key. Barry's method was to solve the script by first solving the language. Previous epigraphic efforts, using bilingual keys, always sought to solve the script and then the language.

Any unknown language will have related languages, because all languages have ancestral forms, just as people have ancestors and relatives. No person or language appears out of nothing. Prior to the age of global immigration, the related languages generally occur geographically nearby. The nearby, related language will, more often than not, have a different script, but this is of little importance. The word roots in both the unknown language and any known related language will be the same, or will be close, differing in predictable ways. The word roots behave like DNA in living organisms; there is no requirement that the related known language be a contemporary of the unknown language. Each language has a frequency of usage for different letters. Frequency spectra for each language provide a characteristic signature of that language. They can provide a fast indicator of the language involved when several languages use a common script, and are used in probability treatments.

Practical Considerations

Decipherments using paired inscriptions of common statements, or included bilingual key words, are working between essentially contemporary languages. Barry's studies on word roots between languages and within any language, but at different times, showed that word roots are remarkably stable, and when they do change or differ, they do so in consistent patterns that can be anticipated.

An extreme example of this is the Egyptian word for the Sun, or Sun God. It arose in prehistoric times before 3200 B.C., and possibly millennia before that. The sign is a plain circle (our letter "O") and is pronounced "Ra." It passed unchanged, in spelling and pronunciation, down to the Ptolemaic period. Along the way, it passed into the Numidian/Mauri language, and passed unchanged within Maori, right up to the present.

English has many Greek and Latin words that retain both their original spelling and meaning. Champollion showed that ancient Egyptian words had the same pronunciation as the same words in Coptic. Grammar changes over time; word pronunciations (and therefore spellings) change over time, but very conservatively. Non-alphabetic scripts are more likely to change than remain constant. However phonemes (the actual sounds represented by letters) tend to remain unchanged for millennia.

This circumstance means that when comparing and testing word roots between related languages, there can safely be a substantial difference in age between them. Barry realized that dictionaries of descendant languages can be used as decipherment aids, and are as valid a tool as vocabularies of contemporary or antecedent languages. Social continuity through time preserves languages, and yields details of former times far more than an examination of other languages that are contemporary to the studied language. Modern Greek is a much better aid to studying ancient Greek than are Etruscan, Persian, or Latin. Linguistic proximity is not tied to geographic or temporal proximity.

Many academic spectators recoiled in horror when Barry used modern dictionaries. In Barry's view, a failure to use a modern dictionary is simply to deny oneself a useful tool. Curiously, some of Barry's severest critics (or deniers) rejected this method when used by him, but praised the epigraphers who later solved Mayan by resorting to the use of present-day Mayan language as an aid.

Barry researched word roots incessantly, and he studied the shifts in pronunciation, as first demonstrated in Grimm's Laws.

Barry Fell, *Saga America* (New York: N.Y. Times Books, 1980)

Fell (left) at a 1977 meeting with Arab scholars in Libya, where his decipherments were enthusiastically received. Mrs. Fell is at right.

He acquired hundreds of dictionaries over time. He observed that German-sourced books were the best; they were more thorough in their etymologies. There was something in the German character, and the high value placed on multi-lingual capability in the German culture, that produced a superior product.

4. The Actual Decipherment Process

Barry first followed the basic, initial decipherment steps, described earlier in this article. In almost all his decipherments, there was no bilingual key, and it was from this point, that Barry innovated his own methods. Before commencing the actual decipherment, Barry would identify the languages most likely to be related to that of the unknown script and would round up all the available dictionaries and vocabularies. In several instances, these were the vocabularies that he himself had produced as a result of prior decipherments.

All the signs (letters) were identified, and the relative numbers of each determined, thus providing the frequency spectrum of the language and its "signature" letters. These were then methodically tested for phonetic equivalency. For each potential language, or related language, the most probable phonetic equivalents in Roman letters were assigned, and the resultant text tested for recognizable word roots. Barry's initial interest was in the core stem of each word, not the inflective endings.

This process is guess and test. It is very tedious, but also very simple. Wrong letter assignments quickly become apparent. The majority of consonants in Indo-European languages do not go together, and in Semitic languages almost all are separated by vowels. Wrong assignments produce text that is nonsense, gibberish, and usually unpronounceable. When you get letter sequences like ucrpiizcb or kllbpobl you know immediately that you have a wrong match (unless it is perhaps Welsh). As Barry hit the correct matches, the resultant text produced recognizable roots among the words that emerged.

The process he used is self-correcting. Every "hit" phonetically reinforced the others. Every "miss" eventually cancelled itself. In a way, it parallels the process of completing a crossword puzzle. The more the hits accumulate, the better is the text being produced, and the more the process accelerates. Each potential related language is tested, until either it is eliminated or a match is established. Only related languages produced word roots in significant quantity. A mismatch might produce 2 percent matching roots; a valid match would produce 50 to 85 percent matching roots. As the revealed words emerge, an approximation of the meaning of the text can be deduced.

Those readers familiar with cryptography will recognize that this is essentially the test method used by cryptanalysts to solve for simple substitution ciphers, that is, where each letter is consistently replaced by one other, always the same one. In these, the frequency of usage spectrum is used first to identify the language involved, and then the translation of the text. The correct letter matchings provide both solutions.

The process is nowhere as simple and tidy as it sounds. When dealing with matches through large blocks of time, one has to be aware of, and familiar with, the "shifts" in pronunciations and relationships between enunciations of letters. The matched stems seldom have identical spellings, so one is dealing with degrees of similarity. This is definitely a technique for an etymologically experienced mind. It is a highly subjective process, and languages are notoriously inconsistent and filled with irregularities. The meanings of the identified roots can be approximated only to the certainty of Roget numbers. This is why most of Barry's decipherments were read slightly differently by subsequent workers.

The absence of bilinguals is unfortunate, because they provide the objective test that outsiders can see and verify. But the bilinguals are simply not there at present. Barry's work would probably be more widely accepted (which is to say that others would feel "safe" in going along with his results), if a bilingual could be found. A bilingual match produces a crisp, unambiguous phonetic match, but it only works between the two scripts being matched, and these are invariably contemporary. Barry's method is etymologically based and gives degrees of probability, rather than the clear match of a bilingual. The etymological method enables a wider degree of matching in time and geography, and the identification of ancestry, which the simple bilingual method cannot. The etymological method has to be used where there is no bilingual, but it can also be used where there is a bilingual. The etymological method has been used as far back as 1850, but was never popular. Initially, it is not as clear as a bilingual method, and also the etymological method is largely a tool restricted to those with a very broad and sophisticated knowledge of languages.

The method outlined here is a generic pattern. In reality, each decipherment had specific and unique qualities that differed from this outline in various ways. After each decipherment is made, the grammar, syntax, etymology, orthography, and vocabulary are identified and defined.

Employing this system of decipherment, Barry was able to solve the remaining Mediterranean scripts in a relatively short time. The most noticeable feature of Barry's decipherment process, when employed on these scripts, was its speed: His was a hundred times faster than methods used previously. This, I believe, was also a factor in the general silence that met Barry's work. No one could believe that decipherments could be achieved so quickly.

Ventris excepted, previous decipherments always began with a key bilingual component (a proper noun, for example) that revealed three or four basic sounds. These were then found in other words, and, one by one, additional sounds could be guessed; in turn, these sounds would be substituted into new words, and so on. Slowly, a list of solved letters would be built up. Ventris multiplied the complexity by his massive, simultaneous assessment of all the letters at once. Either way, the process was slow. Previous decipherments all involved solving the phonetics, before solving the language—and always one letter at a time.

Barry turned the whole process on its head. He sought to detect the language first, and he assigned phonetic equivalents

based on statistics and probability. Barry's method teased each unknown script into "confessing" its own solution. His method could be applied to short inscriptions, and in instances where there was very little material.

Speaking metaphorically, we could equate a decipherment to getting into a fortress. The earlier methods (which were dependent on an included proper noun) gained entry by a Trojan Horse (the noun): No horse, no entry. Ventris gained entry after a massive frontal assault, punching through in many small openings. Barry got in by walking up to the back door, and trying a series of keys until one of them opened it.

After the complexity and length of time required for a conventional epigraphic solution, Barry's method seemed like an anticlimax—it was almost as if he had cheated. It was simple and it was fast. Reaction from other linguists was one of non-acknowledgment. Barry's solution to the Polynesian scripts indicated historical circumstances that differed so much from the status quo assumptions, that no one dared to accept or remark upon it. Barry's New World findings were upsetting so many archaeological apple carts that most linguists would not admit to any possibility that Barry was onto something. His encyclopedic grasp of multiple languages was beyond their conception and belief. It also became apparent that most linguists did not understand the mathematical probability theory that underlay Barry's results. They remained mentally fixated on the need for a bilingual inscription. They were not prepared to take the trouble to learn, or to try anything outside their traditional ways.

There was one conspicuous exception to this: the etymologists. These are the linguists who study the origins and meanings of words, and who trace words back through their lineage of descent from an ancestor. These specialists know the consistency of word roots and the evolutionary shifts in pronunciation. Etymologists study vocabularies, and it is they who can detect and qualify former inter-cultural contacts by the exchange of loan words. Etymologists produce the dictionaries of ancient languages, and etymology depends upon epigraphy to provide the raw materials for study. Barry's decipherment methods were based on the principles of etymology and on etymological data. This the etymologists understood, and in their eyes, Barry's work was completely valid. Etymologists can rapidly detect erroneous decipherments and confirm correct ones. They are thus the natural partners of epigraphers, and Barry existed in a state of mutual respect with them.

Each valid decipherment opens a Pandora's box of new etymological research opportunities. By 1973, after more than 20 years had elapsed since the decipherment of Ventris, etymology was experiencing a drought of new material. A small group of etymologists (mostly European) realized that Barry was "hot" and scoring seriously in the epigraphic arena. They followed Barry like figurative remorae, to ensure a presence at each new epigraphic solution and a seat at the resultant etymological banquet. Barry's decipherments of European and Mediterranean scripts in the 1970s were followed by an etymological feeding frenzy.

These were the only mainstream/establishment language researchers to acknowledge Barry's work early on, and they were embarrassingly generous in their praise. Reuel Lochore, for example, a specialist in Anatolian languages, wrote in a popular journal in 1977:

> Why do I call Barry Fell the epigraphist of the Century? Because epigraphic method was unsystematic guesswork until in 1952 Michael Ventris, an amateur epigraphist, showed that in easy (sic) conditions two language systems can be compared in detail and the relationship between them defined in detail. . . .
>
> In 1973 Fell showed that with computer help the methodical comparison of a single feature which best withstood the ravages of time (the phonetic system), enables an ancient unknown script to be validly compared over a time gap of millennia with a modern derived script to produce a solution. That I believe is his secret: The rest is due to toil and an enormous curiosity.

5. Indus Valley Script

The origin of Sanskrit has been uncertain, because no writing from its formative period (1000 to 400 B.C.) has survived. Since the 3rd Century B.C., Sanskrit has been written in several scripts, but mostly in Brahmi and its most important derivative, Devanagari. The earliest surviving Sanskrit writings used a Semitic script, Kharosthi. Northwest India had experienced invasions of "Aryans" from Persia who were the rulers in the period (1800 to 500 B.C.), between the apparent demise of the Indus Valley civilization and the time when writing is confirmed to have been present (about 400 B.C.). What role did the Aryans have in the development of Sanskrit? Where did Sanskrit originate? India or Iran? And when?

It is believed now that an ongoing trading relationship existed among Mesopotamia, Egypt, and India, more or less steadily from the Sumerian Era (3000 B.C.) onwards. The Indians themselves traded, and later conquered and colonized, throughout Southeast Asia and western Indonesia. It is only to be expected that Middle Eastern linguistic elements would be found in northwestern India, and, in turn, that Indian language and scripts (and religions) would be found all the way east to Bali and beyond. Sanskrit in a local creole called Kawi existed in Java by Roman times.

As related in Part 1 of this biography, it was a series of inscriptions on steles in Java that demonstrated the multicultural complex that had existed there around the Ptolemaic Era, and in the three centuries following. Egyptian, Greek, Phoenician, Indian, and Numidian-Libyan writings were all present in Java. It was this complex that had produced the ancestral Polynesians. In studying these inscriptions, Barry had noted distinctive orthographic (orthographic refers to the actual writing and shaping of script elements) and grammatical features present in some of the inscriptions. Some of these had arisen as a result of script hybridization, and others were conventions that had been discarded in the places where the scripts had originated (and were lost to present knowledge), but which had persisted in the Javan "colonies."

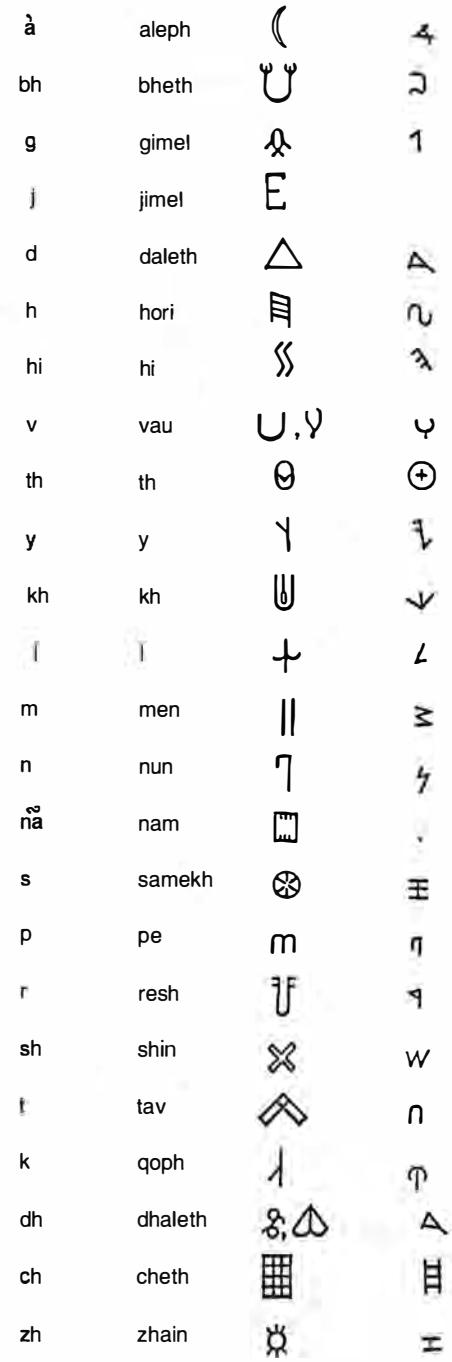


Figure 1
CONSONANT ALPHABET OF THE INDUS VALLEY SEALS

The basic letters appear mostly to have been derived from Egyptian hieroglyphs and Mesopotamian letters. The letters are named for their Semitic (essentially Phoenician) equivalents. The actual Indus Valley names are unknown.

Source: *Epigraphic Society Occasional Publications*, Vol. 2, No. 39 (1975)

In studying the script of the Indus Valley seals (the Mohenjo Daro/Harappan civilization) Barry recognized orthographic conventions that were unknown from Sanskrit writings in India, but which had survived in Java. He also recognized letter substitutions used in Java. From these, he was able to determine the letters of the Indus script.

The Indus Valley is one of the world's oldest city-civilizations, dating from 2500 to 1500 B.C. (The point at which a tribe or village can be acknowledged as having the attributes of a city-based state are highly arbitrary and imprecise. It is more a matter of power and economy, and we have to guess at this from the physical remains.) The quality of the construction, the city layout, and the public utilities in the Indus Valley are superior and more sophisticated than their Egyptian and Mesopotamian equivalents. Almost nothing is known of the inhabitants.

A number of small tiles have been found, and these bear the only writing known from this civilization. The tiles appear to be commercial or government trading stamps used to make seals. Each tile contains barely a phrase. Despite this minuscule amount of material, more than 100 possible letters have been proposed. This number of signs would indicate at least a syllabic writing system (possibly hieroglyphic), or possibly a character-based one. There was too little material to go further.

The Ptolemaic-Roman age inscriptions in Java are mostly in Semitic scripts, although many are writing Indo-European languages. A strongly Semitic character was present in the writing. The syllables were open (that is, they ended in vowels), and Phoenician-pattern vowel pointing was being used. Indo-European languages normally have many side-by-side consonants, and Sanskrit is no exception. This causes a conflict between the Semitic writing custom, which separates the consonants by a vowel, and the Sanskrit language, which puts many consonants together.

The usual practice in Indo-European languages is simply to place conjunct consonants together in sequence (for example, *th, tt, cr,* or *scr, sch*). In full alphabet usage, all vowels are written, and the absence of a vowel means that there is no vowel. In consonantal and partially consonantal alphabets, this practice is not established; there could be a vowel or not, depending on the language. The writers of the Javan scripts had solved the Indo-European language/Semitic script conflict by placing all side-by-side consonants at the start of each syllable; then, to eliminate the expectation of a vowel between them, these conjunct consonants were combined by an overwrite into a single new "letter." This eliminated the vowel question. Unfortunately, this also created a question as to which consonant came first.

There was no consistency to the overwrite orthography. In each case, the overwrite was configured differently, so as to best accommodate the shapes of the different letters. The result was that each conjunct looked quite different from its separate letters—indeed, appearing as a third letter. This created an abundance of extra "letters."

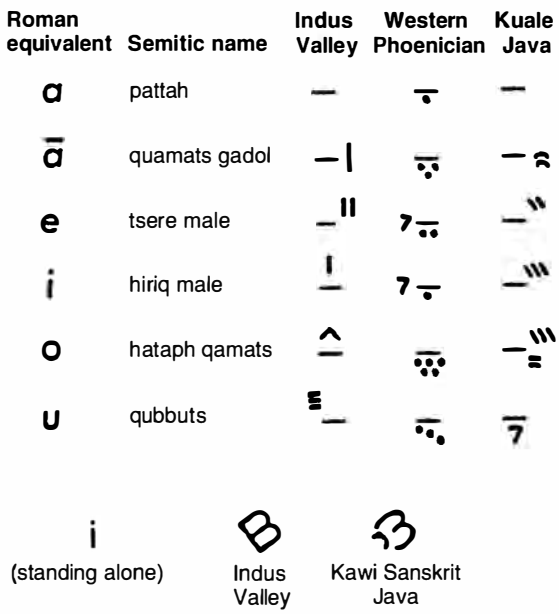
When Barry studied the youngest Indus Valley seals (ca. 1800 B.C.), he realized that he was looking at the same phenomenon that he had identified in the Javan inscriptions: Most of the "letters" were the result of the merging and overwrite of

side-by-side consonants. Furthermore, he was recognizing many of the same letters. When Barry had identified and separated all the conjunct combination letters, he was left with an alphabet: 6 vowels and 24 consonants, plus several special-use symbols (essentially characters). Two thirds of the letters could be matched to a Semitic equivalent, and this was used to assign a phonetic value. The remainder of the letters were phonetically identified by a guess-and-test method. Phonetically, this alphabet contained all the Sanskrit letters. The vowels were actually pointed, with the short "a" defaulted in the Sanskrit fashion. From this alphabet, Barry could derive all the words on the seals (about 100). The words were almost all relatable to the known Sanskrit vocabulary, and a few to Greek, but none to Persian. The proper nouns matched known Indian Gods.

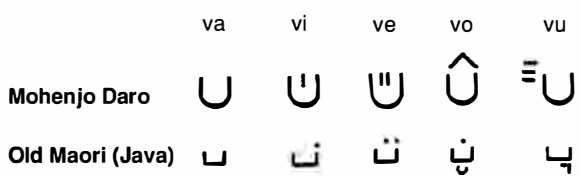
Epigraphically, this showed that the language and culture of the Indus Valley were direct ancestors of the later Indian civilization that was to formalize Sanskrit. *The Aryan invasion did not bring Sanskrit to India.* The Indus Valley vocabulary was

Figure 2
VOWELS OF THE INDUS VALLEY SCRIPT

(a) Medial vowels (those occurring within a word) are "pointed" by accent signs applied to the consonant that precedes the vowel. This method of indicating vowels requires far fewer letters than the syllabic system of writing, and is essentially alphabetic. Credit for developing vowel pointing has been given to, and named for, the Phoenicians. It is also used in the Indus Valley writings, which substantially ante-date the Phoenicians. Similar vowel pointing is found also in Java and in Old Maori inscriptions in the Pacific. The short a *is defaulted, as in Devanagari script since that time. Its presence is inherent when a vowel pointer is absent.*



*(b) Vowel pointing for the letter V (**vau**), as found in the Indus Valley (ca. 2000 B.C.) and Old Maori at the Suku Pyramid, Eastern Java (4th Century A.D.). The latter differs from the accent patterns used contemporarily at Kuale, Central Java.*



Source: *Epigraphic Society Occasional Publications*, Vol. 2, No. 39 (1975)

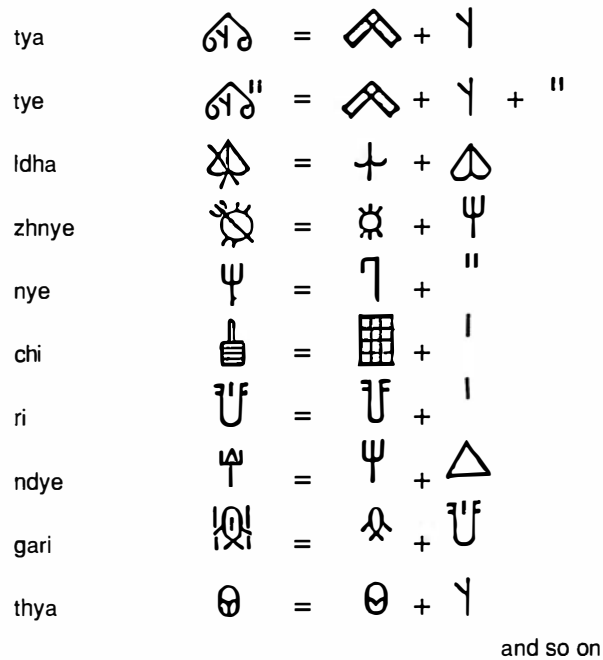


Figure 3
EXAMPLES OF COMBINED AND CONJUNCT LETTERS IN INDUS VALLEY SCRIPT

The simplest combinations are the inclusion of a vowel pointing accent. Adjacent consonants (with no vowel between them) is a normal condition in Indo-European languages, but a rarity in Semitic languages. The mismatch of Semitic writing conventions and Indo-European speech patterns was solved by combining adjacent consonants into a single, new letter. About a hundred such combinations have been identified. The resultant abundance of "letters" had frustrated previous attempts of decipherment, because their nature had not been realized.

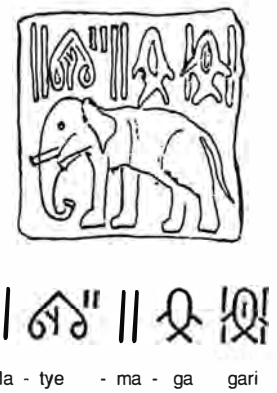
Source: *Epigraphic Society Occasional Publications*, Vol. 2, No. 39 (1975)

Figure 4
AN INDUS SEAL OF THE LATER PATTERN

This seal is strictly alphabetic and includes usage of conjunct consonants. Vowels in parentheses are by default (that is, not indicated).

The transcription reads: M(a)-Tye-M(a) G(a) = Sanskrit matamga, elephant.

The translation is: Willful roving trumpeter, the elephant.



Source: *Epigraphic Society Occasional Publications*, Vol. 2, No. 39, 32 pp. (1975)

clearly Indo-European, and the writing showed a strong Middle Eastern influence. In the vocabulary, Barry perceived a direct relationship to Mediterranean languages, but European etymological colleagues saw a closer connection to more northern European languages.

The Indus Valley script is notable for its being alphabetical in character and, therefore, more sophisticated than the cuneiform/hieroglyphic syllabaries of its contemporaries. It is apparently the first language in the world to be written alphabetically. The presence of Semitic-style vowel pointing in the Indus Valley script, raises the question as to where this custom originated, because it vastly pre-dates the occurrence of this practice with Semitic scripts in their respective homelands. The availability of vowel designation would technically eliminate the need for overwriting the conjunct consonants, yet this was not done. The usage of Semitic writing and conventions, which prevailed at the time, was to continue for most of the next 2,000 years, to judge by the descendant Javan inscriptions.

6. Numidian Considerations.

As related in Part 1, Barry had deciphered the Numidian script from bilingual inscriptions. The decipherment became possible after he had recognized that the same script occurred widely over Polynesia, a fact that identified the language written as ancient Maori. To assess the impact of these Numidian/Libyan studies on the state of knowledge of North African history and languages, it is best to consider the area as a whole. Our current knowledge of historical times places a number of civilizations in the area lying between Egypt and the Atlantic, along the Mediterranean shore.

The oldest group is the Berbers, who span geographically from Mauritania to Ethiopia, existing in a number of tribes. Their origin is undetermined, and they apparently pre-date any historical record. The language is fundamentally Semitic. Almost all Berbers today write with Arabic script and follow Islam, although one of the tribes, the Touaregs of Algeria, did not take up Islam, or Arabic script, until the 18th Century. Before then, the Touaregs wrote in a script called Tifinag. The Touaregs are also noted for the occasional anomalous occurrence within their society of European characteristics like blond hair, blue eyes, tallness, and light skin color.

Tifinag, a consonantal alphabet, shares about half of its letters with the Numidian alphabet, which is also consonantal. It was originally assumed that the Tifinag was simply a derivative of Numidian, but, as shown below, this may not be quite the case. All Berber writing since Roman times, and up to the use of Arabic letters, has been in Tifinag. There are many inscriptions in Numidian script along the African Mediterranean coast, and it has been naturally assumed that they were writing Berber. Barry showed that this was not the case, and as it stands now, it appears that there were no Berber writings (or none existing) prior to Roman times, and that conventional Numidian was not used by the Berbers.

The next identifiable inhabitants of Mediterranean Africa would appear to be the group that we now call the eastern Libyans, Libyans, or Eastern Mauri. These are the peoples that lived in the lands just west of Egypt. They are an important group, but much of their significance was unrecognized until Barry had deciphered the Numidian script, as related in the first part of this biography. There is no language evidence prior to the Numidian script. The origin of the early Libyans is unknown historically, because it appears that the area has always been inhabited, but very little evidence of their existence remains in this homeland. It is known that these early Libyans provided 9 of Egypt's 16, gods as well as Poseidon and Athena to the Greeks. Also, Hetphras, the wife of Khufu (also known as Cheops), who built the giant pyramid, was Libyan, and she is depicted as being white-skinned, blue-eyed, and yellow-haired on a tomb fresco. We should note, however, that Egyptians routinely showed female nobility as white-skinned, although usually with red hair.

Linguistic analysis and interpolation, and the discovery of the (literally) global dispersion of inscriptions in their Numidian script; and the accounts related within these inscriptions, enable us to reconstruct the history of the early Libyans from about 1500 B.C. forward.

These Libyans (or Mauri/Maori as they called themselves) turn out to have been the world's greatest navigators (explorers), and their descendants and language exist to this day in Polynesia. Through the script, vocabulary, and syntax, the language has been traced etymologically to the Uru, a Hittite-related tribe that lived in the second millennium B.C. in the region where Iraq, Turkey, and Syria converge today. The structure and core vocabulary is Indo-European. A large number of words were acquired from contact with the Amorites, a Semitic tribe of northern Mesopotamia.

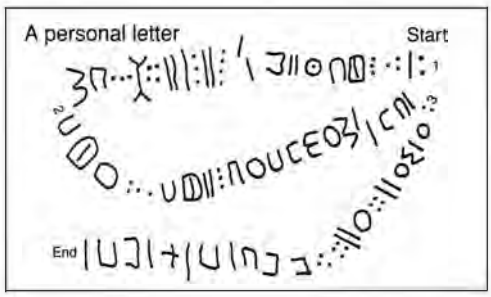
During Minoan times, under circumstances unknown, the use of this Numidian language appeared in the lands east of Egypt, which would require a significant migration. It is presumed that a large maritime trading complex existed in the Minoan period. It is also assumed that the Numidian script, which came into use in Libya, would have done so at the same time. It is in part a derivative of the Minoan group of syl-

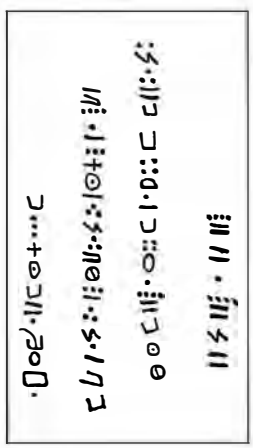
Figure 5
NORTH AFRICAN SCRIPTS

Numidian was the script of Libya. Its use in the eastern Mediterranean spanned from about 250 B.C. to 400 A.D., but was rare after 100 A.D., although it continued in use until the 19th century in Polynesia. Tifinag shares many of the same letters. Numidian was used in the western Mediterranean from about 150 B.C. to 500 A.D., mostly to write Maghrib Arabic. Tifinag was previously used in northern Europe during the Bronze Age, and into the Middle Ages. Tifinag continued in use in North Africa until the late 18th Century, to write Berber. With the coming of Islam, speakers of Arabic adopted Kufi, and later Naskhi, script.

(a) Table of consonants used in North Africa

Phonetic	Punic	Numidian	Tifinag
'	𐤀	𐎀	ⵄ
b	𐤁	𐎁	ⴱ
g	𐤂	𐎂	ⴳ
d	𐤃	𐎃	ⴷ
h	𐤄	𐎄	ⵀ
w	𐤅	𐎅	ⵡ
z	𐤆	𐎆	ⵣ
ḥ	𐤇	𐎇	ⵃ
ṭ	𐤈	𐎈	ⵟ
y	𐤉	𐎉	ⵉ
k	𐤊	𐎊	ⴽ
l	𐤋	𐎋	ⵍ
m	𐤌	𐎌	ⵎ
n	𐤍	𐎍	ⵏ
s	𐤎	𐎎	ⵙ
'	𐤏	𐎏	ⵄ
p	𐤐	𐎐	ⴼ
ṣ (z)	𐤑	𐎑	ⵚ
q	𐤒	𐎒	ⵇ
r	𐤓	𐎓	ⵔ
š	𐤔	𐎔	ⵛ
t	𐤕	𐎕	ⵜ





(b) Samples of usage of Tifinag in the 18th century. A personal letter (above) and religious inscription (right). North American archaeologists were highly suspicious of Tifinag letters, considering them to be modern mathematical signs and thereby evidence of fakery.

The inscription (right) was collected by Victor Reboud and published in 1870. The Libyan (Tifinag) script reads upwards from below, starting at the right hand corner.

Line 1: LY-L-H'-K-L-H
Line 2: B-S-M L-H-' R-H-M-N-'.M-L-K Y-w-
Line 3: -M D-N. '-Y-K N-' B-D W-'-Y-K, N-S-T-'-N. '-H-D-N
Line 4: (S)-'-R-R-T'-L-M-S-T-Q-M.

When the appropriate vowels are supplied, this text reads:

la ilaha illa Allahu. Bismi-llahi r-Rahmani r-rahim. Maliki yomi d-din. 'Iyakka na'budu wa-iyyaka nast'in. 'hdina s-s'rata l-mustaqim.

This is Arabic-Libyan, a Semitic language, and the text reads in English:

There is no god but God. In the name of God, the Compassionate, the Merciful. King of the Day of Judgment. Thee do we worship, and of Thee we ask help. Guide us in the way of the upright.

This passage is the opening sura of the Koran.

(c) A comparison of dated Moroccan inscriptions. These are some of the earliest Arabic renderings of these respective scripts.

Phonetic	Pre-Islamic Numidian, 250 B.C.	Pre-Islamic El-Hadj-Mimoun, 450 A.D.	Post-Islamic El-Hadj-Mimoun, after 700 A.D.	Kufic, after 700 A.D.	Modern Naskhi
y	𐎉	𐎉, 𐎉	𐎉	𐎉	ى
l	𐎋	𐎋	𐎋	𐎋	ل
w	𐎅	𐎅, 𐎅	𐎅	𐎅	و
k	𐎊	𐎊, 𐎊	𐎊, 𐎊	𐎊	ك
š	𐎔	𐎔	𐎔	𐎔	ش
b	𐎁	𐎁	𐎁	𐎁	ب
m	𐎌, 𐎌	𐎌, 𐎌	𐎌	𐎌	م
r	𐎓	𐎓	𐎓	𐎓	ر

labaries that Barry also identified (see below). It is not known what language the Libyans spoke prior to the arrival of Mauri/Numidian.

The Egyptians recorded that Pharaoh Merneptah repulsed an invasion of Egypt by the "Sea Peoples," in about 1218 B.C., and the Egyptian account records that the Libyans were allied with the Sea Peoples (or Peoples of the Sea). In 1182 B.C., at the time of Ramses III, the Sea Peoples again attempted to invade Egypt, advancing through Syria and Palestine, and they were defeated on the Egyptian border. This time, the Libyans had fought as allies with the Egyptians. The defeated throng was settled in southern Palestine, and became the Philistines. Egyptian records show that the Libyans were constantly attempting to encroach and squat in the Nile delta at this time. In 945 B.C., the Libyans conquered Egypt (actually, it was a palace coup), and they ruled until they were overthrown in 730 B.C. During this period, the Libyan language became thoroughly Egyptianized; it absorbed a huge Egyptian vocabulary, to the point of becoming a dialect of Egyptian, but retained the Numidian script and syntax, and its core Anatolian roots.

The Libyans had their own Pharaohs in parallel with Egypt. A gold plaque discovered in Cuenca, Peru, and dating from 148 B.C., shows some Libyan Pharaohs, but is written in Egyptian format with Egyptian hieroglyphs and the Libyan rulers named in cartouches. No equivalent artifact has been found in Libya itself.

The "Sea Peoples" left no known literature, and so they are known only from accounts by others. They appear to have been a confederation of maritime societies that engaged in opportunistic raiding and piracy in the Mediterranean, after the fashion of the Vikings 2,000 years later. They were thought to be of Aegean origin, but included refugees from a series of conquests that had ended the confederation of Hittite tribes and culminated in the destruction of Troy (Ilion). There was a mass of displaced persons at the time. As a result of Barry's researches, there is a possibility that the Sea Peoples also included a component of Norse peoples, which is explained in the Tifinag section below.

The Libyans were sailors, and provided the navy for Egypt during the first millennium B.C. The extent of their travels in the service of Egypt, which resulted in the settlement of Polynesia, has been discussed in Part 1 of this biography, and the New World presence of the Libyans will be told in Part 3. A Libyan Pharaoh, Necho, who ruled Egypt in about 650 B.C., had a canal built to join the Nile to the Red Sea. He also commissioned an expedition to circumnavigate Africa, crewed by Libyans and Phoenicians. According to Herodotus, this expedition departed from the Red Sea and returned, via Gibraltar, three years later.

The Libyan administration of the Mediterranean African coast apparently extended all the way to the Atlantic, but excluded the city-states of the Greeks and the Phoenicians. The Phoenicians who originated in what is present-day Lebanon, were arguably the greatest maritime traders of their time, which spanned roughly from 1200 B.C. to around the time of Republican Rome. They established trading cities all around the Mediterranean, to present-day Cadiz and Atlantic Morocco. Their most important daughter city was Carthage (in today's Tunisia) which existed from 814 B.C. until it was sacked by Rome in 146 B.C. The Libyan Pharaoh Masinissa helped the Romans destroy Carthage.

It was the Phoenician (consonantal) alphabet which provided the letters for the Greek alphabet, which, in turn, was the basis of the Russian (Cyrillic) alphabet. Phoenician also provided the letters for the Etruscan alphabet, which (through reversal) became the basis of the Roman alphabet.

Around 630 B.C., refugee Greeks from Thera or Sparta (accounts differ) founded a colony, Cyrene, on the African Coast. This became the state of Cyrenacea, an important trading center, which provided a steady stream of skilled technicians to Egypt. Its most famous scientist was Eratosthenes, who was able to calculate the (meridional) circumference of the planet, which inspired the expedition of Rata and Maui to circumnavigate the globe—the first recorded navigation into the Eastern Pacific. Cyrene provided the significant Greek vocabulary that entered the Libyan language, and was carried to Java.

One of the last immigrant waves into Mediterranean Africa before Roman times, was apparently composed of Arabic speakers. These became subjects of the Libyan Pharaohs, and they adopted the Numidian script. Their immigration is unrecorded. Barry's decipherment of Numidian script revealed the use of Mauri language in Libya, and also revealed that almost all the Numidian inscriptions found in the western part of North Africa (Tunisia, Algeria, and Morocco), are written in an early form of Arabic language, called Maghrib. Prior to Barry's decipherment, it had been believed that the western Numidian inscriptions were writing Berber language, although no one could decipher them despite a knowledge of Berber. Whereas the eastern Libyan users of Numidian script spanned more than a millennium B.C., the western (Maghrib) inscriptions are dated (by included historical context) from 139 B.C. in Tunisia to almost 500 A.D. in Morocco.

This discovery represented the first modern confirmation that speakers of Arabic had been present west of Egypt prior to the coming of Islam. The Roman historian Sallust, who lived in the 1st Century B.C., stated that the Libyans (that is, Numidians) were descended from a people from Anatolia whose language was similar to Phoenician. Greek, and later Arabic sources, record variants of this, giving Canaan (Palestine) or Philistine (today's Gaza) as the origin. It seems that the Arabic character ultimately prevailed. Whereas the Javan settlements and Polynesian descendants, having originated in earlier centuries from eastern stock, have a mixed Egyptian-Indo-European character; the Libyans of Roman and post-Roman age are decidedly Arabic, especially in the west. These western Numidians have a presence in the New World, which is related in a future part of this biography.

7. The Minoan Syllabaries

The Anatolian core of Numidian/Maori led Barry to investigate the likely source of this language in 1972. By then, Barry had synthesized the decipherment method, using statistical analysis and phonetic value assignment based on a related language group, as described earlier in this account. This

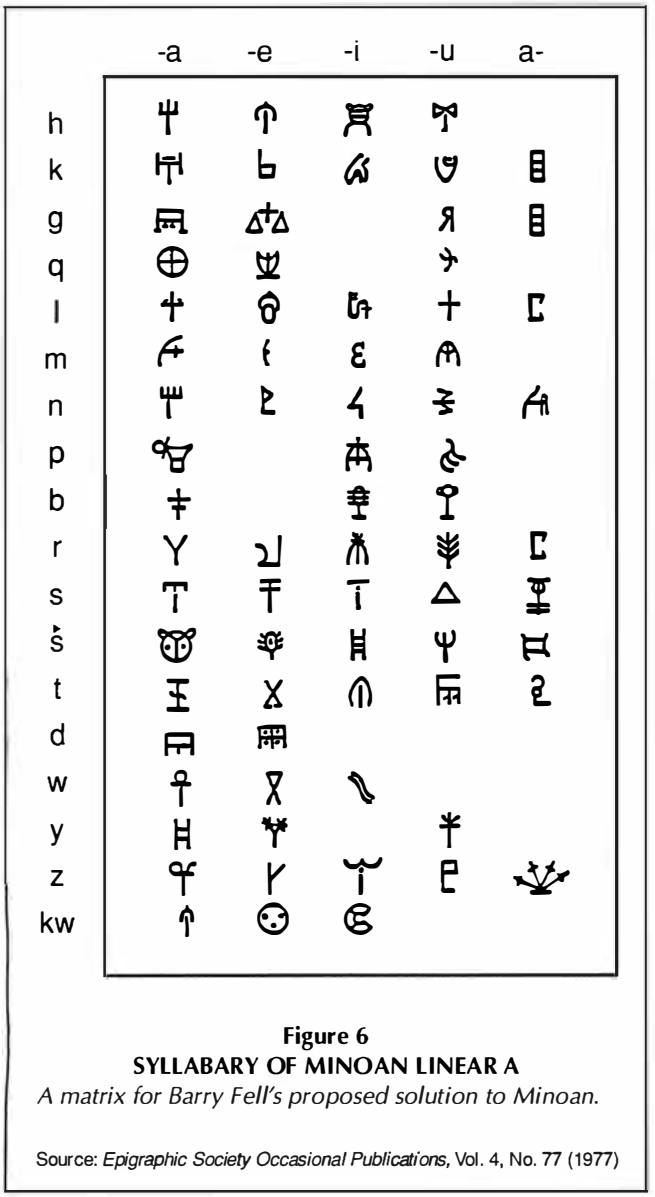


Figure 6
SYLLABARY OF MINOAN LINEAR A
A matrix for Barry Fell's proposed solution to Minoan.

Source: *Epigraphic Society Occasional Publications*, Vol. 4, No. 77 (1977)

method was used here. Barry suspected that Cyprus would be a key location, and the most likely node of maritime contact between eastern Anatolia (which is known as Asia Minor or today's Turkey) and Libya. The undeciphered inscriptions from Cyprus appeared to have a similarity to the letters in both hieroglyphic Hittite and Minoan Linear A from Crete. All are syllabic scripts. The Hittite had been deciphered and was assessed as the most likely language group to be related. It should be noted that "Hittite" is really more an adjective than a noun. The Hittite Empire of central and eastern Anatolia (that is, Turkey) which spanned most of the second millennium, was a group of diverse tribes under a central king. A number of similar Indo-European languages were involved. The administrative script was cuneiform, derived from Mesopotamia, and long known to epigraphers. The cuneiform was used to decipher the hieroglyphic-like syllabic script used by the Hittites, which apparently came from a distinct, associated tribe, the Luvians (or Luwians).

Minoan (Linear A)

Linear A is the name given to a script found widely throughout pre-Grecian Crete by a prosperous trading civilization, called the Minoans. At first using only the signs that matched closely in shape (orthography), and apparent sound usage (isophonism), Barry looked for "words" in the Linear A script that matched known words in Hittite. As matches were found, he was able to assign probable phonic equivalencies to other letters, and adjust some letters to produce better approximations to known Hittite inflections. In time, Barry had enough matches to extract readable phrases and contextually appropriate vocabulary. Eventually, 72 letters were phonetically defined in Linear A, and a vocabulary of more than 300 words was established. Grammatically, 8 cases were recognized, each with gender and number inflexions; 30 percent of the signs were matched directly to Hittite, 20 percent to Indic letters, and about 10 percent, in total, to several contemporary Semitic scripts. About 40 percent of the signs are unique to Linear A. By descent, about 20 percent each of the letters passed to Cypriot and to Linear B.

The Linear B inscriptions from Crete are almost all accountants' records. In contrast, the Linear A inscriptions cover a wide range of subjects: labels of produce, address labels, government seals, numerous agricultural reports, statements about food and drink (on various dishes), food labels, religious omens, festivals, graffiti, signatures, proverbs, inventories, and accountings.

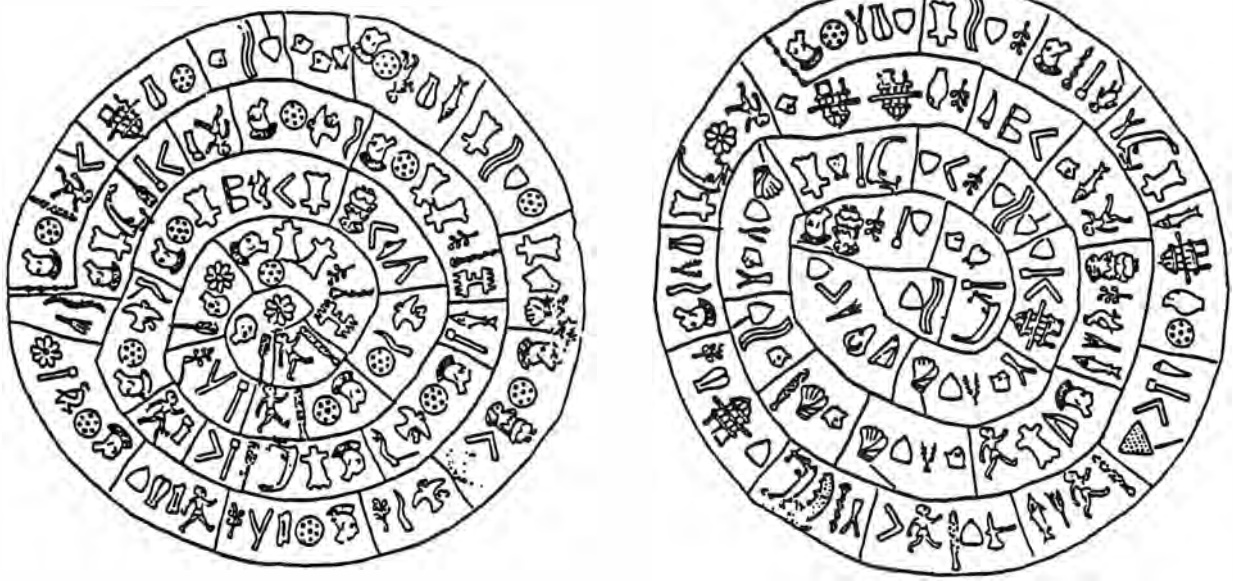
Barry's Linear A decipherment aroused little interest or excitement outside of etymology. In 1979, an etymologist's report confirmed the decipherment and the surprisingly close relationship to Hittite, and offered a number of alternative word roots. The decipherment has otherwise passed quietly into history. But Barry's decipherment of the Phaistos Disk aroused more interest.

The Phaistos Disk

The Phaistos disk is a small (15- to 17-cm diameter), circular clay tablet that has been fired to brick. It was found in the palace at Phaistos on Crete, and contextually dated to about 1600 B.C. It carries an inscription on each side, consisting of 123 and 118 signs respectively, each arranged in a spiral. There are 45 distinct signs. We say "signs," for each is a small picture, most being of recognizable objects. What the disk was for, what language it wrote—if indeed it wrote any language—had not been established. The signs/pictures are made by impressed stamps, a first in history for the use of movable type. The same signs appear on each side, but the dies/stamps used are different. The nature of its manufacture pointed to an intent to create multiple copies and permanence. Analysis of the clay used showed that the disk had not come from Crete.

This almost insignificant object had, over time, acquired the status of a cult icon.

Barry followed the same procedures he had used for Linear A. The text was assumed to be syllabic. An examination of the signs/pictures showed that most had a vague similarity to the letters of Minoan (Linear A). In each instance, the phonetic value of the letter was assigned to the matched sign of the disk. This immediately revealed recognizable words, or word roots, which could be found in Hittite, Minoan (that is, Linear A),



Face 1 Face 2

Figure 7
THE PHAISTOS DISK FROM CRETE

The disk is made of fired clay, 15 to 17 cm in diameter, with impressions "printed" by movable dies. The language is a stripped (stems only) Indo-European vocabulary of principally Hittite and Minoan origin. It carries generic instructions for divination.

Source: *Epigraphic Society Occasional Publications*, Vol. 4, No. 82 (1977)

Maori (adjusted for shifts per Grimm's Laws), and miscellaneous words from ancient Mesopotamian languages like Akkadian and even Sumerian. Many of the words were near guesses. The resultant text that was produced could be translated to the accuracy of Roget numbers. The text reads from the center outwards, a fact that was opposite to the prevailing opinion. This spiral pattern also occurs in Polynesian inscriptions in the Pacific.

The Phaistos Disk turns out be a divination device. One side is an alliterative feminine verse, and praises the disk as an oracular aid in the interpretation of omens. The other side gives instructions as to how a priest should advise a client in setting food out to attract birds, through which the gods will send omens regarding the fate of the client. In attempting to refine the decipherment, Barry and a colleague tried a variety of recitations to determine appropriate rhyming and scan.

The decipherment was mostly done in 1973, and revisited several times as new discoveries altered old views. In 1978, Reuel Lochore, an etymologist with Anatolian specialization, published his assessment of the decipherment, addressing it in meticulous detail. Although he listed numerous technical adjustments, Lochore strongly endorsed Barry's decipherment as correct.

Lochore preferred some alternative phonetic assignments, provided linguistic reasons to discount some of the "words" that had been selected as equivalent in related languages, and offered substitutions and new words. He noted peculiar Polynesian traits (open syllables), not used in Minoan or Hittite but found in Cypriot, as well as an apparent avoidance of pictographs, which he suspected was intended to prevent "outsiders" from using the disk. Lochore also noted a high level of non-inflexion; it seemed that the disk's authors had deliberately avoided these grammatical components. He speculated that this gave the disc a cross-cultural, or more universal usage. It seemed in each case, that the omission did not affect the meaning of the text; the narrow sense of the text prevented ambiguous readings. The verbs were similarly stripped, being bare-stemmed. Much of the rendering of the text was left to the discretion of the party reciting the text. To a degree, the text is a key word text, so that the respective priests can "customize" the grammar to the specific language of the clients.

Lochore's analysis revealed vocabulary sourced as 48 percent ancient Indo-European, through Hittite; 12 percent original from Hittite; 28 percent traceable to Sumerian, through intermediate Indo-European transmission; 8 percent from Akkadian; 6 percent from Uru (Polynesian ancestor); and 1 percent unknown. It appears the disk is not aimed at a Semitic clientele. Lochore also noted that bird omens were a peculiarity of the Hittites; other societies used other methods, such as the entrails of sacrificed animals. (Of course, we don't do this sort of thing today—notwithstanding tea leaves, psychics, tarots, horoscopes, and some rodents of the groundhog species in Punxsutawney, Pennsylvania.)

Why were signs used in place of Minoan letters? Was it to

conceal, or was it to guide? Priesthoods are noted for concealing their knowledge. The similarity of the signs to the letters they substitute for would rule out serious concealment, although it might act as a casual disguise. Were the signs actually historical precursors of the letters? Distinctly possible and quite unprovable. Were the signs key word script, intended to guide an illiterate to select the appropriate sound for each sign? In 1980, an attempt was made by another linguist to see if an hieroglyphic basis could be established for the script of the Phaistos Disk. A contemporary word was sought for each sign, which would name or describe the sign and where the first syllable of the word would also be the syllable that the sign represented. He found 29 possible fits for the 45 required, but fewer than 10 came from the Hittite-Minoan vocabularies.

Cypriot

Inscriptions from Cyprus are few and are in a script that is very similar to the signs of Minoan, so that a connection has always been assumed. The context of the inscriptions indicated a time range of the 7th to 2nd Century B.C. Some Cypriot inscriptions in this script had been deciphered in the 1870s, using a Phoenician bilingual, to reveal that the Cypriot inscriptions were written in classical Greek language, as was Linear B, much earlier. However, it was evident that the peoples of Cyprus also wrote another language, which was suspected to be a descendant of Minoan. An inscription in this language from Paphos in southwest Cyprus was deciphered by Barry in 1977, based on word roots from Hittite, Minoan, Mauri, and Etruscan. Yes, Etruscan, for it turns out that Etruscan was also a member of the Minoan language group. Barry produced a syllabary for the Paphian script, but a shortage of further good material from Cyprus, and of time, kept Barry away from further Mediterranean Cypriot inscriptions. As it turned out, however, the Cypriot syllabary had a significant presence in the New World, as will be shown in Part 3 of this biography.

Etruscan

The Etruscans were a group of tribes that formed a loose confederacy living in the region immediately to the north of Rome. They were a significant, advanced culture and local power during the period 800 to 500 B.C., but were eclipsed and subjugated by upstart rival Rome, which is regarded as the heir and perpetuator of the Etruscan civil structure and power, and its cultural and economic roles. The Etruscan language has been a mystery, as has been the origin of the Etruscan peoples. One ancient account has them endemic—*in situ*—and another describes the Etruscans as derivatives of the Lydians of second millennium B.C. Anatolia.

The Etruscan script is well known from numerous inscriptions. The Greeks had many regional dialects, of which only that of Athens (Attic) came to be considered as the classic standard. Etruscan script is derived from the alphabet of the western (Chalcidic) Greek dialect. Like Greek, Estruscan writing is an alphabet, but unlike Greek, it follows the Semitic pattern of being written from right to left, showing features of both its ancestors. The Etruscan alphabet is historically important, as it is the parent of the Roman (Latin) alphabet. When Etruscan writing is regarded by someone accustomed to reading languages written in Roman alphabet, it looks vaguely

Figure 8
MATCHING OF PHAISTOS DISK SIGNS TO LETTERS OF LINEAR A

In the deciphering process of the Phaistos Disk, Fell noticed the similarity of the signs to the letters of Linear A (Minoan), and assigned the phonetic value of those letters to each sign. This enabled him to recognize enough words or word roots to produce a translation. Why signs were used instead of Minoan letters is not known.

Source: *Epigraphic Society Occasional Publications*, Vol. 4, No. 77 (1977)

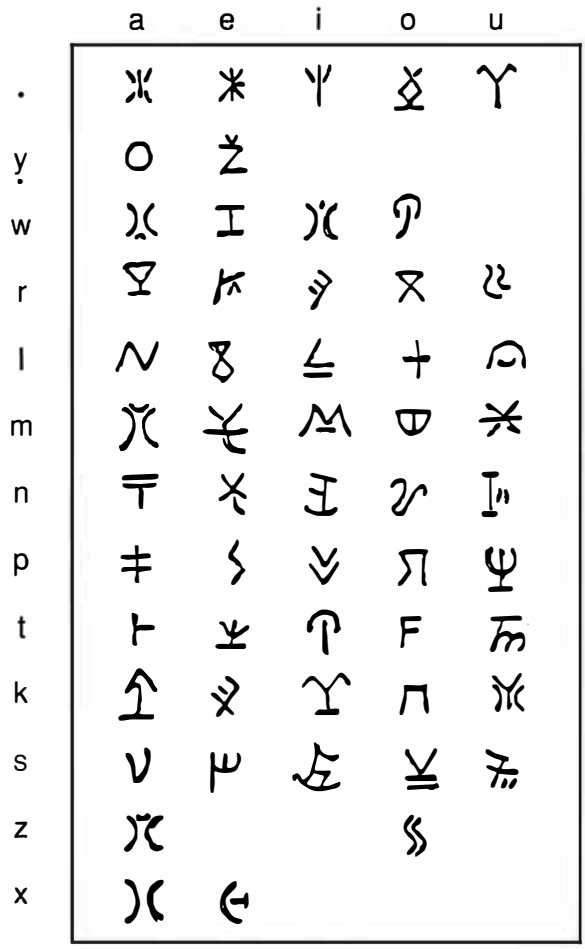


Figure 9
THE PAPHIAN SYLLABARY OF CYPRUS

This syllabary descended in part from Linear A and continued in use into late classical times. It was used to write Greek (in syllabic form) and to write the last relics of the Minoan language in the Paphian dialect.

Source: *Epigraphic Society Occasional Publications*, Vol. 4, No. 80 (1977)

Transliteration
VELTHINAS
ATENA.ZUK
I.ENESKI.IP
A.SPELANE
THI.PHULUMKH
VA.SPELTHI
RENETHI.EST
AK.VELTHINA
AKILUNE.
TURUNE.SK
UNE.ZEA.ZUK
I.ENESKI.ATH
UMIKS.APHU
NAS.PENTHEI
A.AMA.VELTH
INA.APHUNA
THURUNI.EIN
ZERI.UNAKKH
A.THIL.THUNKH
ULTHL.IKH.KA
KEKHA.ZIKHUKH
E

Translation
If a robber be taken, on deposed evidence, in a reputable citizen's household containing valuable property, sworn testimony to this effect is to be heard in the criminal court by the magistrates. If they determine as proven the evidence deposed, the prisoner is to pay restitution to the injured family. The prisoner is to be sentenced to compulsory hard labor and thenceforward bound with fetters to be worn at all times.

Figure 10
SAMPLE OF ETRUSCAN WRITING WITH TRANSLITERATION AND TRANSLATION

This is the Etruscan Law of Housebreaking, deciphered from Face 2 of the stele of the laws, CIE No. 4538, ex lapide tiburtino, *illustrated by Olaf August Danielson in* Corpus Inscriptionum Etruscarum *(Leipzig, 1902).*

Source: *Epigraphic Society Occasional Publications*, Vol. 5, No. 100 (1978)

familiar, yet somehow odd. When held up to a mirror and viewed in reverse, it looks far more familiar, as the Romans reversed not only the direction of writing (to follow the Indo-European left-to-right format) but also the letters. To us, Etruscan looks backwards.

The phonetic equivalence of the Etruscan letters to the Roman alphabet has long been established. The mixture of Roman, Greek, and Phoenician letters offered alternative pronunciations, but Italian researchers were able to identify the actual usages through a number of names of places and Etruscan despots known from Roman historical accounts. The language that the Etruscans wrote, however, defied identification and readability.

If there is a Guinness Record for the fastest decipherment, it could be awarded for Etruscan. Barry had not intended to work on Etruscan, because it was not in the mainstream line of his investigations at the time (1975), but one day, a colleague pointed out to him that Barry had solved every other outstanding Mediterranean script, so why not this one? Barry took up the challenge and had the answer in less than an hour. It should be noted that this was really only half of a normal decipherment, because the first stage of qualifying the script phonetically had already been done by others; he had only to identify and read the language written.

Etruscans lived in proximity to Greeks, Phoenicians, pre-Roman Latins, and Celts. Therefore, loan words in Etruscan from these languages could be anticipated, but if one of these has an ancestral relationship to Etruscan, then a substantial root sharing can be anticipated. None was found.

Accordingly, Barry looked further and took his clue from the Etruscans' own traditional account of their Lydian (southwest Anatolian) origin. There is no Lydian vocabulary available, but there were two other close vocabularies available for this comparison: Hittite and Barry's own Minoan one.

Fortunately, there are a number of Etruscan inscriptions that include Latin words, and these provided clues as to the context of the Etruscan words. Another important clue lay in a pair of documents on metal lamina in Etruscan and Phoenician. They are not identical statements, as occurred on the Rosetta Stone, but they are contemporary and cover the same subject: a letter from King Hiram of Tyre (553 to 533 B.C.) to an Etruscan contemporary. Between these inscriptions and the Italian phonetic determinations, Barry was able to find the necessary root matches in Hittite and Minoan to produce readable text. These confirmed the Anatolian-Minoan ancestry of Etruscan.

Building off the Anatolian-Minoan vocabularies, Barry was able to translate a number of Etruscan documents, although the small vocabulary in Minoan (approximately 500 words) was a frustration. Ultimately Barry was able to establish an Etruscan vocabulary of about 200 words, mostly based on Hittite stems. The nouns showed a clearly Indo-European pattern of inflection, with most following the Hittite pattern and seven cases identified. The verbs, however, were almost all stems with short terminations, perhaps recalling the condition on the Phaistos Disk. The complex conjugations found in Latin were missing and, as in English, there was a reliance on pronouns. Like Hittite, Etruscan lacks the letters *B, D* and *G*. Most of the texts available for translation were not of the same subject matter as those for Minoan (Linear A), so a close cross study of the two was not possible. The most important document was a legal code specifying crimes, trial procedures, and punishments.

Barry concluded that the ancestral Etruscans were a part of the Sea Peoples exodus of about 1250 to 1100 B.C. Bronze Age lettering found in petroglyph sites in Northern Italy, and in the Balkans, show words found in Albanian dialects and affinity to an original Anatolian source. Some of the names show Etruscan religious beliefs and agricultural influences. Albanian (the modern term for Illyrian) is the surviving language of the Anatolian-Minoan (Etruscan) complex, with kernels of loan vocabulary also found in Serbo-Croatian, Romanian, and Bulgarian. Current investigators are now looking to Albanian as a modern language guide to Etruscan, something that Barry seems to have missed. Albanian appears to be perhaps the oldest surviving European language, after Basque.

8. Runic Script

The Rune alphabet was used in Germany and Scandinavia, prior to the modern use of Roman letters, and Anglo-Saxons used it in England. It was used by, and carried widely around Europe, by the various looting groups known to us as Vikings (about 700 to 1100 A.D.). It remained in use in parts of Scandinavia until relatively recently. Most surviving inscriptions are of Anglo-Saxon and Viking age. They are not known in western Germany, Britain, and Scandinavia

Figure 11
THE RUNIC ALPHABET
The runic alphabet (futhark) of the Teutonic cultures had a lengthy span of usage. "Futhark" derives from the first 6 letters, in similar manner to Greco-Roman "alphabet." Runes took many local forms, the most complex used by the Anglo-Saxons with 28 and 33 letters. This is the 28-letter version used until 600 A.D. in England.

Source: *Epigraphic Society Occasional Publications*, Vol. 16, p. 124 (1987)

before the 3rd Century A.D., but older (250 B.C.) and unreadable versions have been found along the Black Sea and the middle and lower Danube. They were thought to be derived from the western Greek (Chalcidic) alphabet, which also gave rise to the Etruscan and Iberic scripts. Barry's sabbatical in Denmark and Sweden left him well acquainted with Runic inscriptions.

Barry had little direct involvement with Runic inscriptions, because there were many qualified epigraphers for this. He did show, however, that a set of inscribed burial artifacts from the southern Baltic, bearing Runic inscriptions, were of Bronze Age—by manufacture, by historical context, and by the actu-

Figure 12
RUNIC INSCRIPTION OF 14TH CENTURY
Found in the Baffin Bay area of western Greenland, this inscription (top) is now in the Copenhagen Museum. The Roman transliteration of the three lines appears below.

Source: Barry Fell, *Saga America* (New York: N.Y. Times Books, 1980)

al letters used, which matched those in use in the pre-classical Greek period. This substantially pre-dated conventional accounts. Another researcher had shown that Mycenean age Greek objects had been traded widely to northern Europe, but that this distant trade had been cut off during the Grecian dark age (1100 to 750 B.C.) and with the appearance of the Hallstatt (early Celtic) culture across central Europe, which may have intercepted the Mediterranean trade. These two circumstances, and Barry's decipherment of Minoan, led another researcher to re-examine the whole Runic picture with interesting conclusions. It now appears that the signs of the Minoan syllabaries were carried widely over Europe (as Linear B) by Mycenean traders, and that the German tribes picked from this set of signs the letters they required for their own writings, rather than from the later Chalcidic Greek. The phonetic values that they assigned to each letter were independent of the values used by the Myceneans. The letter by letter orthographic match up between Minoan letters and the early Runic letters was remarkable, certainly well beyond any possibility of simple coincidence. It would seem that the early Rune usage, like that of Sanskrit, lacks any surviving inscriptions from the time that it came into use and that it is much older than previously suspected.

9. Celtic Ogam

It has long been a standard principle that when a functional writing system is in place, (meeting both the requirements of the language and the substrate, upon which it is written), there is no need for a different or new script, and they do not arise. It has also been standard that once a flexible alphabetic system has been widely accepted, it will be universally adopted to write all the languages that, to date, have not had a writing system of their own. The Roman alphabet has met these standards for the last 2,000 years, and no new writing system has been needed where the Roman alphabet has come into use. What survives (and often continues side by side with the alphabet for a considerable time), are all the writing systems that existed prior to the adoption and usage of the newer alphabet. Many cultures use an alphabet (usually Roman) as a practical matter, but take a national or cultural pride in also retaining their former (and less practical) systems.

Despite the self-evidence of this, many writers of history have promoted accounts of new and impractical scripts being invented, despite the long-standing presence of an alphabet, in order to account for the existence of inconvenient writing systems. Such systems are inconvenient, because their existence contradicts religious or historical dogmas, or social prejudices of the day. The reasons provided for the "invention" of these anomalous scripts include: secret rites, religious hocus pocus, and a patronizing/condescending need to provide a "better" way of teaching the word of God. In most cases, the script so labeled is actually more cumbersome than an alphabet. As part of this phenomenon, a "not before" date is established for each anomalous script, and thereafter any finding that pre-dates this point is declared to be in error, or fraudulent. Many inscriptions in these anomalous scripts are automatically dated to the "not before" date without serious examination of the actual contextual circumstances.

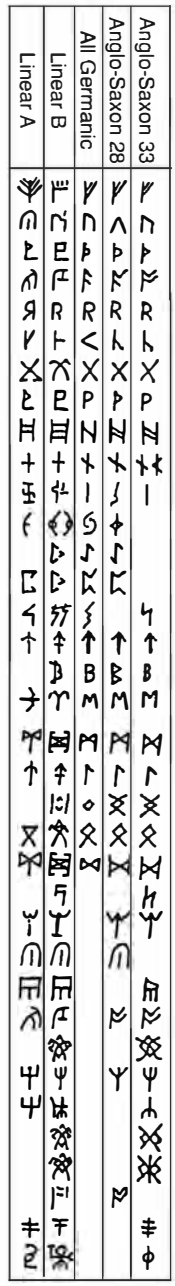


Figure 13
COMPARISON OF MINOAN AND RUNIC LETTER FORMS

There is considerable uncertainty as to the age of the Runic alphabet. After the decipherment of Linear A, L. Lyle Underwood undertook a study of the orthography (shape and form) of the Minoan syllabaries and Runic alphabets. His matchings are shown in this table, and they are for orthography only. The phonetics are quite different. There have been several instances in history where an alphabet has been adopted ("loaned"), and the recipient has assigned its own separate phonetic values. If this is the case here, then the period of Runic usage should be moved back 1,000 years.

Source: *Epigraphic Society Occasional Publications*, Vol. 8, No. 189 (1979)

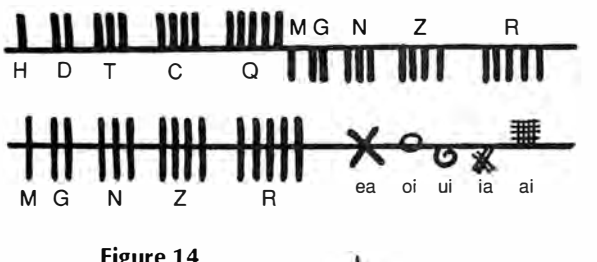
In North America, several scripts have had accounts of recent invention created for them. In Europe, the Celtic Ogam scripts have been so pigeonholed. Barry never accepted these "not before" dates, nor the accounts provided for the recent invention of the scripts. He always looked anew at the context of a script, and at the linguistic attributes it contained. This did not make him any friends in conventional, mainstream linguistic and archaeological circles.

The official, archaeologists' account of Celtic Ogam is that it was invented in Britain in late or post-Roman times, and that it was derived from Latin. This account also declares Ogam to be fully alphabetic only, with a distribution restricted to the

British Isles. This account is now utterly contradicted by the epigraphic evidence.

The culture (or civilization) known, or definable, as the Celts is currently thought (in archaeological circles) to have first appeared in the foothills on the north side of the Alps around 1000 B.C. From here, Celts subsequently appeared widely through most of Europe, ranging from Portugal and Spain, through France, the British Isles, Bavaria, and down the Danube to the Black Sea. The Celtic culture is thought to have entered Britain in about 600 B.C. The Celts penetrated south to Northern Italy, and a group settled in Anatolia (Galatia). Celts were often used as mercenaries by Mediterranean cultures. The Romans suffered a humiliating defeat with Celts in 390 B.C., and remained in conflict with Celts for the next 450 years. The Romans demonized the Celts, and were particularly ruthless when victorious over Celts.

The Celts were usually portrayed by Romans as being barbarians, but they had the same technological skills as the Romans and traded widely. In addition to being formidable warriors, the maritime tribes among them were also exceptional mariners and shipbuilders. We are only now beginning to realize the full extent of Celtic influence in time and geography, and it is much greater than conventionally assumed.



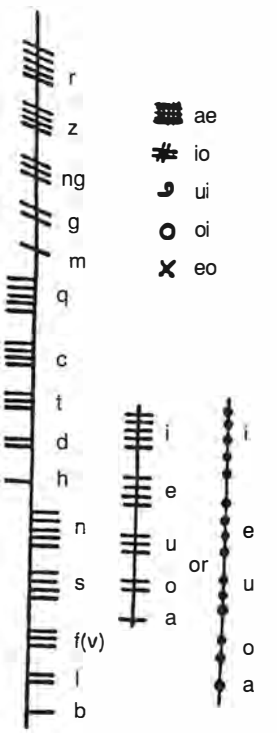


Figure 14
OGAM SCRIPT

Ogam, mostly associated with the Gaelic Celts of the British Isles, has now been found to occur widely outside Britain. The letters consist of a series of strokes arranged along a stem line. They are grouped in numbers of one to five, and lie above, below, or across the stem line, which can be horizontal or vertical. Frequently, a crack, or a ridge or a corner on a stone is used as the stem line.

The post-Roman version in Britain includes vowels. The earlier and widespread version is vowel-less. S *and* Z, F *and* V, C *and* K, J *and* G *are mutual substitutions.*

Linguistically, two categories of Celtic languages are recognized in Britain. The degree that these types occur outside Britain is uncertain. These are the "Q," or Gaelic Group (later redundantly called Goidelic) of Scotland, Ireland, and Manx; and the "P," or Brythonic Group of Brittany, Wales, and Cornwall. It is inferred from epigraphic evidence that the Celts of Iberia were of the Q group and the Gauls (of France), and the Eastern Celts were of the P group. The Celts were notoriously secretive about writing of themselves in the pre-Christian era, and although it is widely believed that they had no endemic script of their own during this time, this is incorrect. The Celts tended to use the script of their trading partners or masters in Roman times and later; nevertheless, they did have their own script: Ogam. Almost all the Ogam inscriptions known come from the Q group. In Britain, only the P-Celtic areas were occupied by Rome. This leads to the oddity in the "official" archaeological account (in which Ogam is derived from Latin), where it is only the Celts who were not overrun by Rome who derived a new script from Latin.

Ogam (or Ogham) is a writing system using very simple lettering—essentially parallel strokes arranged along a guide line. The guide line (called the stem line) can be horizontal or vertical. It can be a groove on a rock face, or an edge or corner of the rock. There are 15 consonants consisting of clusters of one to five strokes arranged above, or below, or crossing the medial "stem" line. In the post-Roman forms, there are also vowels, which are similar but have shorter strokes, and other modifications for conjuncts and diphthongs.

A large amount of the early Ogam was erased later by Christian monks, because it contained pagan subject matter. In the British Isles, there are about 370 Ogam inscriptions remaining. Most are from the 5th and 6th centuries A.D. and are of the alphabetic (voweled) type. These inscriptions were studied intensely in the 19th century, but lack of new material has resulted in a loss of interest since then.

The history of the decipherment of Ogam is usually overlooked, as Champollion's decipherment of Egyptian hieroglyphics gets all the attention and credit. In fact, Ogam was the first script to be deciphered in the modern age—in 1784. Ogam first came to the attention of modern learned academicians in 1712, when Edward Lhyd, travelling in County Kerry, Ireland, reported the strange engravings on a rock to the Royal Society. Later, Charles Vallancey, an Englishman turned Irish, who was a student of Gaelic literature and mythology, found an old poem (in Gaelic) concerning a famous warrior, which included a description of his burial at a specific location in 283 A.D. Vallancey had this location explored, and a tomb was found. The name of the warrior was within an Ogam inscription on the tomb. This was the first use of a proper name bilingual match. But how did Vallancey know the phonetic equivalents? For this we have to track the history of the Irish.

When the Romans withdrew from Britain (essentially today's England and Wales) in 410 A.D., the romanized Celtic populus had adopted Latin script. Britain then underwent a series of invasions by Anglo-Saxons and Jutes, then Vikings, and then Normans. Centuries of barbarism followed. The Teutonic invaders brought in Runic script, which was used for a while.

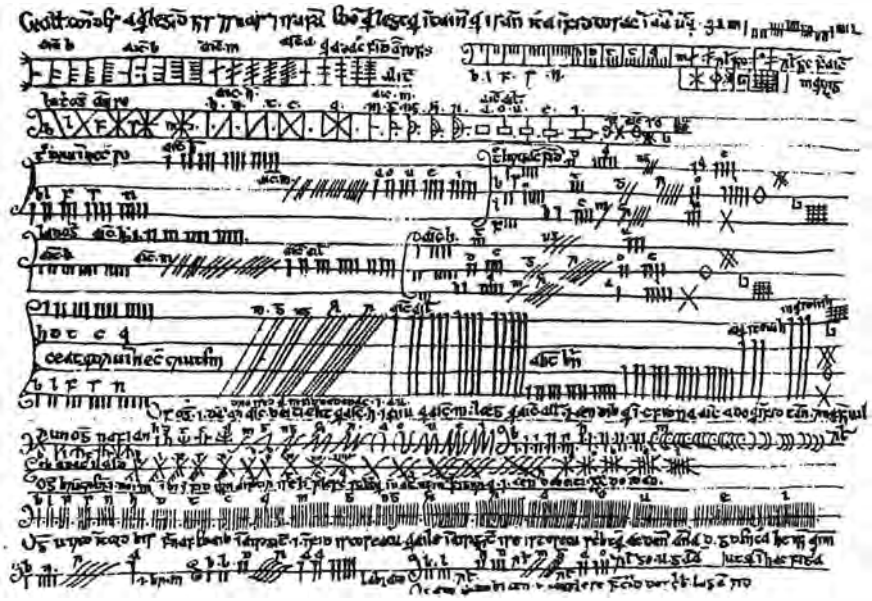


Figure 15
THE BOOK OF BALLYMOTE
There are potentially more than 100 different ways of writing Ogam. The Irish Book of Ballymote *lists more than 90, although only a few have been found in actual use. This figure shows a small part of the* Book of Ballymote.

The Celts of eastern and central Britain were variously eliminated or absorbed by the invaders, but Celtic languages persisted in the north and western extremities. Ireland was not conquered by the Romans, nor by any of the subsequent raiders, and it was in Ireland that Gaelic, Christianity, Ogam and Roman scripts, and many other elements of knowledge were continued.

Around 1200 A.D., some Irish monks gathered together a host of velum manuscripts and bound them into a book called the *Book of Ballymote,* which still exists today. This book included a catalogue of more than 90 styles of writing Ogam, all matched to the equivalent Roman letters. In this book, Vallancey was able to find the appropriate match, and thereby had his transliteration from Ogam to Roman. The language was Gaelic, which of course he knew well. But Vallancey's decipherment was rejected and condemned for quite a while before it was eventually accepted. The English, it seems, could not accept the possibility that the native Celts had been literate in a script of their own. It is curious that a variant of this theme persists today in North America.

All the post-Roman Ogam is the alphabetic type. British Celtic academicians term this "True Ogam," implying that all else is somehow otherwise. All the *Book of Ballymote* "scales" are alphabetic, but all the vowels are tacked on the ends, as if an afterthought. These "add-on" vowels are ordered *a, o, u, e,* and *i.*

The monk that compiled the book commented that he knew of 150 varieties of Ogam. (In 1993, Barry updated and republished these tracts.) There are no existing inscriptions in most of these varieties. Not included is an older, vowel-less (consonantal) type. There are 17 examples of vowel-less Ogam from northern Ireland and Scotland reported in the technical literature. The term Ogam Consaine was given to it by an Irish poet in the 18th Century. At that time, Ogam was no longer read by the Irish but they knew of it and they could distinguish the vowel-less texts, which were considered to be archaic. The Ballymote scribe had also matched Aramaic and Numidian letters to Roman, but this went unrealized until after these particular scripts had been deciphered. Clearly, the Irish had extraordinary knowledge and there has been a failure to recognize this, to our disadvantage.

During his university and early military service years in Scotland, Barry became well acquainted with the Celtic ruins, and he had taken formal and informal instruction in Gaelic. He was, therefore, particularly well suited to recognize Ogam inscriptions in North America, where they occur in large numbers—but this is for a later part of this biography. Barry's studies of Ogam in the Old World showed that artifacts bearing consonantal Ogam occurred widely outside the British Isles: from Iberia, on coins from Gaul (200 B.C.), in Egypt (1146 B.C.), from Troy, from Galatia (Turkey), from Tuscany (Etruscan), and from Southern Africa. The last group included a table matching Ogam to Kufi (Arabic) engraved on stone.

Ogam is a script, not a language, and has been used to write other languages. The southern African writings were Consaine type and wrote Arabic. In 856 A.D., a Nabatean scholar wrote a book listing 80 ancient scripts known to him, including two varieties of tree Ogam which are of the Consaine type. This manuscript was reprinted early in the 19th century by European scholars. These all indicate that Ogam has a huge range in time and geography, with the voweled type restricted to post-Roman Iberia and the British Isles.

The age of some of these inscriptions is of great significance. The last invasion of Ireland (before the English) was by the so-called Beaker People. From this, R.A.S. Macalister and Richard Brash, Irish historians, concluded that the Beaker people had to be Celtic and speak proto-Gaelic. This was one of the civilizations thought to be involved in the construction of Stonehenge. The later date of 600 B.C. for Celtic arrival in Britain, favored by archaeologists, would date the builders of Stonehenge to a pre-Celtic civilization, and leaves the saturation of Ireland with Celtic culture unexplained. Barry favored the earlier presence of Celts, because artifacts from Windmill Hill (near Avebury, England) had

Ogam Consaine upon them, and this dated well to the start of the second millennium B.C., when Stonehenge was started. Barry also noted that one of the Ogam stroke series (those above the line) goes *H* (single stroke), *D* (two strokes), *T* (3 strokes), *C* (4 strokes), and *Q* (5 strokes). These letters happen to be the first letters of *Haon, Da, Tri, Cethir, Qoic* (or *Coic*) which are Gaelic for one, two, three, four, and five. This points to a Celtic origin for Ogam.

Also, other Ogam letters phonetically match Hittite cuneiform letters, which are written a similar way. Barry concluded that Celtic language and culture (and writing) are much older than currently believed. Celtic civilization had experienced waves of technological and cultural changes, which passed through the Celts, who were already in place and had been for some time. The British Isles probably had had separate incursions of Q-Celts and later P-Celts, and this is likely a gross simplification.

British Celtic scholars have declared all extra-Britannic Ogam to be "not true Ogam." Barry obtained photos of Consaine Ogam inscriptions from Ireland, and arranged to have them submitted to British scholars through intermediaries, in a manner that implied the inscriptions were from North America. The British scholars replied that in their opinion the inscriptions could not be "true Ogam."

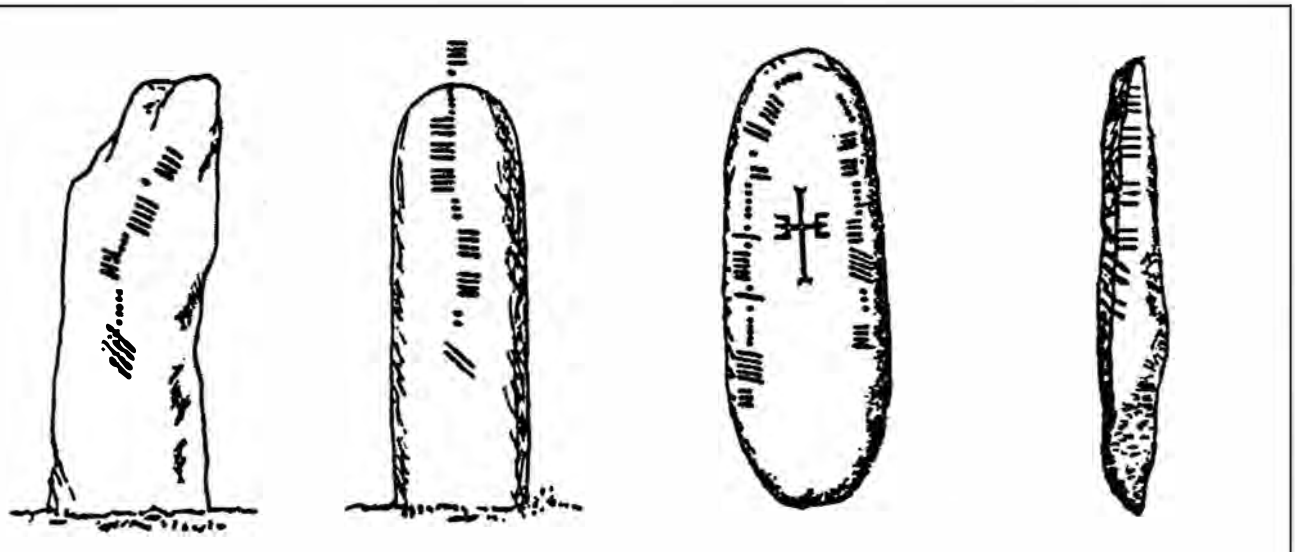
The Picts

Who were the Picts? Historically, they are known only from post-Roman remnants in Scotland. They were eventually (apparently) absorbed into Scottish society. They had adopted Ogam script, which they used on their tombs, but their language is unknown. In 1989, an acquaintance of Barry, Jean Hunt, was able to make a correlation between two Irish texts, which may provide the answer.

A private study from early 20th century, reported upon in the 1930s, had compiled a vocabulary of a peculiar and very secretive underclass of Irish origin, commonly called "Tinkers," noted for their clannishness and traditions of marrying only within the clan, for hiding their language, and for indulging in certain trades and practices (sometimes disreputable). In many ways, the Tinkers paralleled Gypsies, although there is no connection to them. These people called their private language Shelta, and its unique vocabulary was not Indo-European.

Another study, (by O'Rahilly in 1957), in ignorance of the previous study, had been able to extract from old Gaelic history (essentially mythology) that the Gaels, when they occupied Ireland, had conquered the Fir Bolg people. The Fir Bolg called themselves Priteni but were known to the Irish as the Erainn. The Priteni had been banished to the least desirable lands and bottom social strata. O'Rahilly noted the appearance in Gaelic of linguistically non-Gaelic loan words that came from the Priteni, and reflected their underclass roles and status. This loaning continued to at least the 7th Century A.D.. The language of the Erainn was called Ernbelre, and it has been historically and sociologically assumed that the "Tinkers" were the descendants of the banished Priteni. Jean Hunt deduced then that recent Shelta and historic Ernbelre were the same, which is by no means improbable, now that we know how tenaciously languages can descend through long periods of time.

The question is, can we correlate the Priteni people and Ernbelre, and/or Shelta languages, to an inscription on a relict structure? To date, no megalithic site has produced Ogam, although there are Pictish burial monuments with Ogam. Barry transliterated one such inscription, and the words produced were not known in Gaelic, but a contextually appropri-



Lugnagapul No. 2 (After Brash) | *Lugnagapul No. 1 (After Brash)* | *Aghadoe No. 1 (After Macalister)* | *Sleive Na Calliagh (After Brash)*

Figure 16
SAMPLES OF MEGALITHS BEARING OGAM FROM THE BRITISH ISLES

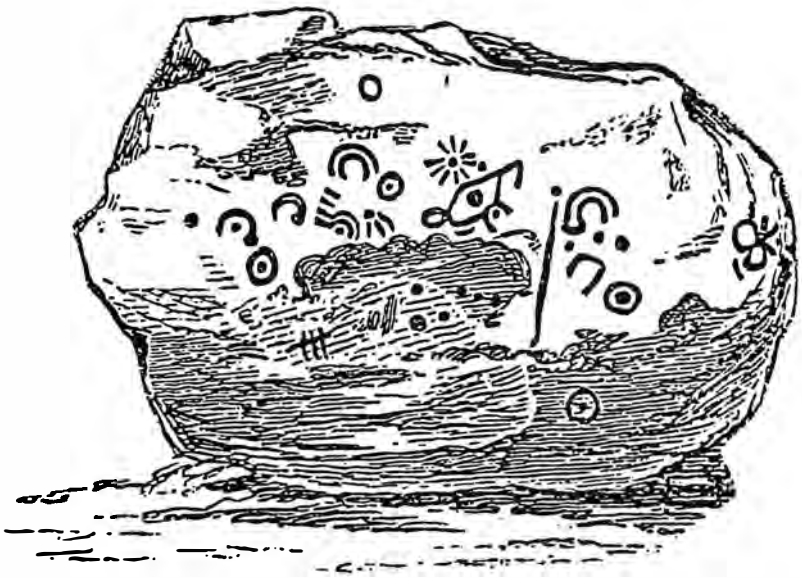


Figure 17
STONE FROM THE TOMB OF OLLAMH FODHLA, IRELAND
This stone no. 8 is from Lough (Loch) Crew, County Meath, Ireland, a Celtic tomb site, originally buried in a tumulus. Although Ogam is present, the site is remarkable in that it is built of stones salvaged from a pre-existing structure of much greater age. These rocks were pre-inscribed with Tifinag script, which includes Gaelic roots. The readings of the Tifinag indicate an astronomical/calendar use of the site.

Source: *Epigraphic Society Occasional Publications*, Vol. 11, No. 276 (1983)

ate word was found in the Shelta vocabulary. This alone, of course, is insufficient to provide absolute proof but it does point to Pictish having an ancestral connection to Shelta—and, therefore, to the "tinkers" as being descendants of the Picts. An etymological comparison of Shelta to O'Rahilly's Priteni loan words could establish this connection, but this has not yet been done.

10. Iberian Soup

The languages and scripts of Iberia (present day Portugal and Spain) that occurred before the use of Roman letters have presented epigraphers with a unique complexity. Until the early 1970s, the languages that were believed to be written down were identified and well known, yet their apparent inscriptions seemed to defy decipherment. Most of the inscriptions just did not make sense, and even the Latin was hard to comprehend. The overwhelming majority of the inscriptions were in the script termed "Iberic," which is derived from Chalcidic Greek. Chalcidic is a variety of Greek script used in the north and west of Greece, and in the southern Italian and Sicilian colonies. Greek colonists carried it to eastern (Mediterranean) Spain. The Chalcidic Greek script has a decided similarity to Phoenician, from which it was derived, and also to Etruscan script, which also came from Phoenician. By the 1930s, Spanish epigraphers had determined the majority of the Iberic script phonetics. The problem was, that most of the time, the transliterations of Iberic did not produce recognizable Greek, or Latin, or Spanish words. An additional complication was that there was no consistency in the direction of writing; it seemed that left to right, or right to left, were optional.

Barry brought some order to this complex by identifying the underlying problem, based on his New World discoveries, which were traced back to Iberia. Having achieved a few key decipherments, Barry left the Iberic investigations to another epigrapher, Donal Buchanan, who has continued to sort out the complex. This was one instance where bilingual inscriptions would have been of little help. Theoretically, more than 40 would have been required. The problem did not lie with unknown scripts, but with unknown languages being written in known scripts. This problem can only be solved by the etymological method of decipherment.

The problem was that pre-Roman Iberia contained at least eight potential languages. Each had its own script but the Iberic script was also being used to write five of these, and, later, Latin was also used to write some of them. These scripts all varied orthographically with location and writer, after the manner of ancient writings. The Phoenician present looked superficially like Chalcidic Greek and Iberic, as did later Carthaginian. It would be as if a speaker of Chinese were to be handed an English dictionary and then be confronted with a number of short writings in German, English, Spanish, Hungarian, Romanian, and Polish. They all use the same letters and would look superficially alike, but the English dictionary is not going to take him very far.

The simple transliteration of Iberic to Roman yielded text that then had to be identified as to its language, and only then after the direction of the writing had been established. The cross-mixing of Semitic and Indo-European scripts and languages led to confusions over whether a text was consonantal or alphabetic. Before Barry, three of the languages involved were not known to be present. Another complication was a local custom of abbreviating common words to a single letter. This was what was confusing the texts that were otherwise in straight Latin.

The Iberian Participants: By Language

Basques. Basques have been present in Iberia and southwest France from prehistoric times. The language does not fit any known group, although some words are recognized by speakers of Armenian. Basques were once more widely spread throughout Iberia than in their current northern pocket. Basque language was written in a syllabic script from the Bronze Age to about 1200 A.D., when the Roman alphabet

began to be used. The Basque syllabary was unreadable—until 1979, when Barry solved it, using a solution that came from the New World. The letter by letter correlation was close to absolute, and all parties have accepted it without question, but with a great deal of initial astonishment all around. It was not, in fact, deciphered. The syllabary was already in use elsewhere: The answer lay under everyone's nose but was unrecognized for 130 years! It was the calligraphic prowess and the encyclopedic mind that made the connection. (This will all be explained in the New World part of this biography, to come later.) Basque language is found in inscriptions in eastern North America.

Celts or Celtiberians. Most of Iberia was occupied by Celtic peoples who appeared after the Basques. Current archaeological opinion places recognizable Celtic culture in Iberia by 900 B.C., although we may suspect that proto-Celts may have been present much longer. We know now from epigraphic evidence that these Iberian Celts, whom we call Celtiberians, wrote their language (Q-Celtic or Gadelic) in Ogam, and later in other scripts, including Latin and Iberic. They were master mariners and they appear to have had a strong tie to Irish Celts (they called Ireland "Ierne" or "Ibheriu", that is, Hibernia) and they had a significant presence in the New World.

It was Julius Caesar himself who documented the nautical capabilities and superiority of Celtic mariners and ships. These are skills and technology that do not arise quickly, and were probably acquired from the Phoenicians. Ogam inscriptions are concentrated in northern Portugal and northwestern Spain. These are mostly consonantal, but there is also alphabetic Ogam present. One artifact is bilingual Ogam and Latin, showing Ogam persisting to the Roman era. Iberic inscriptions from southern Portugal turned out to have been writing the Celtic language. There is a hybrid Ogam-Iberic inscription where the simpler Ogam letters are used, but Iberic letters are substituted for the complex Ogam letters.

Phoenicians/Carthaginians. Phoenician traders were present in southernmost Spain during the 9th and 8th centuries B.C. and had Atlantic trading ports in southern Spain and Morocco. "Iberia" is thought by some to be a Phoenician word for Spain, adopted into Greek. The initial Phoenician presence was replaced by that of its daughter state, Carthage. Carthage was "officially" founded in 814 B.C., and quickly inherited the trading domain of its parent. A Phoenician trading port in southern Spain, called Tarshish (Greek Tartessos), was famous for both its wealth from metal trading and for the size and oceanic capabilities of its ships. The location of this port is unknown, but is suspected to be Gades (Cadiz) or Huelva. Spanish archaeologists have established that the Phoenician

Figure 18
IBERIAN ALPHABETS

Decipherments and translations of ancient inscriptions from Spain and Portugal have been difficult and confusing, because multiple languages were being written interchangeably in multiple scripts. Each location also had unique conventions for various letters. The basic Iberic script evolved from Chalcidic Greek, brought to Catalonia by Greek colonists.

A	Α Α	alpha
B	Θ	beta
BH	Φ	bh/v
Γ	Γ	gamma
Δ	Δ	delta
E	Ε	epsilon
Z	Ζ	zeta
H	Η	heta
Θ	⊕	theta
ΔH	Φ	dhelta
I	Ι	iota
K	Κ	kappa
Λ	Γ	lambda
M	Μ	mu
N	Ν	nu
Ξ	Ξ	xi
O	Ο	omicron
Π		(lacking)
P	Ρ	rho
Σ	Σ,C	sigma
T	Ψ	tau
TΣ	Ϡ	ts
Y	Υ	upsilon
Φ	Φ	phi
X	Χ	chi
Ψ	Ψ	psi
Ω	Ω	omega
OY	Υ	ou, w
XI	Χ *	chi + iota
TI	Ψ	tau + iota

(a) Match of Chalcidic Greek letters of Catalonia to classical (Attic) Greek alphabet.

Source: *Epigraphic Society Occasional Publications*, Vol. 3, No. 56 (1976)

		Iberian		
Phonetic	**Punic**	North	South	Turdetian
'				
b				
g				
d				
h				
w				
z				
ḥ				
ṭ				
y				
k				
l				
m				
n				
s				
'				
p				
ṣ				
q				
r				
š				
t				

(b) Table of Iberic Letters

Source: H.B. Fell, proprietary

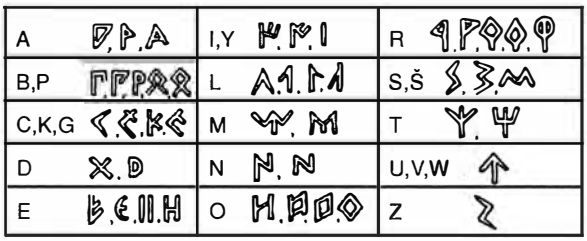


Figure 19
TABLE OF IBERIC LETTER PHONEMES

The phonetic values of the Iberic letters were determined from geographical place names, especially on coins. This grid shows the sound values determined by French numismatist, A. Heiss, in 1870.

Source: Barry Fell, *Bronze Age America* (New York: Little, Brown & Co., 1982)

culture predominated over the local Basque and Celtic cultures in the Cadiz area. We know now, from epigraphic evidence, that the Tartessians traded far and wide, both to the south and to the north, and that they reached the New World regularly. Curiously (and conveniently for epigraphers), the Tartessians wrote their Phoenician language in Iberic script, rather than standard Phoenician, thereby revealing their origin. Their crews included Celtiberians and Basques.

Although Phoenicians brought Semitic writing to southernmost Spain, the bulk of the Semitic language inscriptions in southern Spain are Carthaginian or ancient Arabic, and the bulk of the Iberic inscriptions from southern Spain are writing a Semitic language. When the script is Phoenician, Punic (Carthaginian), Numidian (Maghrib) or Tifinag, the language can be identified as such. When the script is Iberic writing one of the above languages, the convention is to use the term Semitic whenever local Iberian dialects make them difficult to distinguish. Buchanan has determined that the Glozel inscriptions of southern France are of a southern Iberic Semitic language, written in Iberian Punic.

Greeks: Greek colonies were established on the Mediterranean coast of Spain at its most eastern extremity (the Barcelona vicinity) and then southwestward, past Valencia. We might note that the River Ebro of this area used to be called the Iberus. These colonies are dated from the 7th Century onwards. They brought the Chalcidic script which was to become, and remain, the predominant writing system of Iberia until long after the Roman conquest. The Iberian Greeks were also major traders, as shown by the ships featured on their coinage. A grain silo in ancient Ullastret (north of Barcelona), was found to contain maize, a crop which originated in the New World. The Chalcidic-Iberic script introduced by these Greek colonies was also being used to write Gadelic (Celtic), Phoenician, Punic, Latin, Basque, Maghrib, and proto-Spanish. Scarce wonder that the epigraphers were having a little difficulty.

Numidians. Numidian is a term for the North Africans who used the Numidian alphabet. The eastern Numidians, which is to say the Libyans, did not have a recognizable presence in Iberia. The western Numidians, who spoke Maghrib Arabic, left inscriptions in southern Spain in Numidian, but mostly in Iberic script. These western Numidians had a strong presence in the New World.

Romans. After the Second Punic War ended at the start of the 2nd Century B.C., the Celtic tribes of Spain, who had fought with the Carthaginians against Rome, were defeated by a series of invading Roman Armies, and Spain became a Province of the Roman Empire (Hispania). Latin script and language was introduced, but did not become predominant for several hundred more years, because the locals continued to use the Iberic script.

Roman conquests steadily eliminated all the Mediterranean and European powers that had significant maritime capabilities. Carthage was eliminated by 146 B.C., the Celtiberians by 133 B.C., the Gauls by 50 B.C., and the Britannic tribes by 50 A.D.. This apparently shut down transatlantic voyaging, except possibly for the Numidians and Irish, who were as much refugees and missionaries as traders. After the Romans, Spain was invaded (406 A.D.) by Vandals (from whom comes V-Andalusia), who passed through and took up residence in Tunisia, and Visigoths, who moved into north and central parts. With the advent of Islam, the Maghrib Arabs (Moors) invaded (711 A.D.) from the south, and were not expelled until 1492. It is believed that it was the Moors who kept the knowledge of past transatlantic travel. The last city to fall (or return) to the Spanish was Granada, and shortly after this, the Spanish throne had a sudden change of attitude. After years of disinterest, it developed an intense interest in Atlantic exploration. Did they learn something in Granada?

11. Tifinag

Tifinag is the name of the writing used by the Berbers of northwestern Africa. It has a consonantal alphabet and shares about half of its letters with Numidian. As discussed earlier in this paper, Tifinag was thought to be a derivative of Numidian, but after Barry deciphered Numidian, it became apparent that the Berbers never used Numidian. It is now possible that the Libyans and Maghrib Arabs obtained Numidian in part from the Berbers, but there are no inscriptions to answer this question either way.

When Barry studied the major petroglyph site at Peterborough, Ontario, he realized that it was Bronze Age Norse, and contemporary to the Bohuslan petroglyphs of Sweden, which is to say, equivalent to Minoan age. Barry also recognized from his Numidian studies that the Peterborough site contained phrases written in Tifinag script that were contextually appropriate. This prompted a re-examination of the Bohuslan site, and it became immediately apparent that it also contained Tifinag statements.

Because many Tifinag letters are composed of dots (like braille) they are easily overlooked as rock spawls and surface imperfections, unless they are being specifically sought. Because there was no expectation that a Mediterranean nomad script would appear in a Norse context 1,500 years before the Mediterranean usage, it was overlooked. It is conventionally believed that the Norse had no writing system at

all until they acquired Runes in the Roman era. The implications of the Peterborough site are revolutionary in several areas, which are outside the scope of this article. Suffice to say that Norse experts have verified the Norse ethnicity of the site. The epigraphic implications are that Tifinag originated with the Norse and was acquired by the Berbers much later.

Norse and German Bronze Age sites are now being re-examined, and Tifinag is being found in them. Tifinag has now been found on a Bronze Age Irish calendar site, and in the Lascaux Cavern in France, spelling a Celtic word. Tifinag has been found on Roman Age and medieval coins of Britain and on Viking age coins of Denmark, and it has remained in use with some Berbers almost to the present.

The question arises, how did a northern European script end up being used by the Berbers? Barry postulated that Norse mariners were a part of the marauding "Sea Peoples" of late Minoan age. They ended up settling in Libya, and became a part of the Berbers or Libyans, and their script went with them. Barry saw the Norse being a major part of the Sea Peoples, but subsequent research has reduced their role to a small one, if they were participants at all.[5]

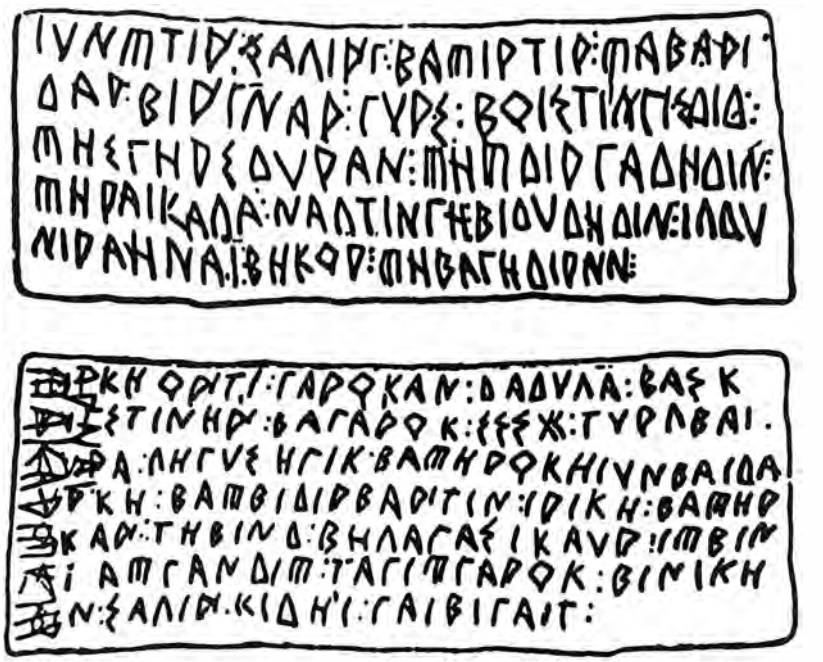


Figure 20
WRITING IN IBERIC

This inscription is from about 500 B.C. It was written on a lead lamina, and was discovered south of Valencia. The language was read as Punic. It is notable for the use of abbreviations, a common custom in Iberia, and for the occasional insertion of vowels, which are normally absent in a Semitic text.

Source: Barry Fell, *America B.C.* (New York: N.Y. Times Books, 1976)

End Thoughts

Linguistic evidence created by epigraphy clearly adds a large and new dimension to our knowledge of the past. Yet, oddly, there is a huge resistance by conventional artifact or "dirt" archaeologists to recognize and use such information. In Barry's case, archaeologists not only failed to use it, but mainstream archaeologists have rejected it outright, and, in some instances, with extraordinary and unprofessional vehemence. English and American academicians are the main objectors. Their arguments are mostly emotional, rather than addressing any specifics. Conversely, parties familiar with the data, or with a narrow, related historical area, have strongly accepted Barry's findings. Arab scholars, for example, have endorsed his North African conclusions with enthusiasm, finding them entirely consistent with their linguistics. Easter Island Polynesians awarded Barry an honorary chieftainship for his decipherment of their tablets. Basques, Arabs, Italians, Irish, Germans, and Danes are today conducting epigraphic work in Basque, Iberic, Etruscan, Gaelic, and other languages and scripts, pursuant to Barry's findings.

Meanwhile, English and American archaeologists are still declaring that Estruscan, Linear A, Phaistos Disk, and Cypriot and Indus seals are still undeciphered. More and more, these archaeologists are looking like the King and his courtiers in Hans Christian Andersen's tale of "The Emperor's New Clothes."

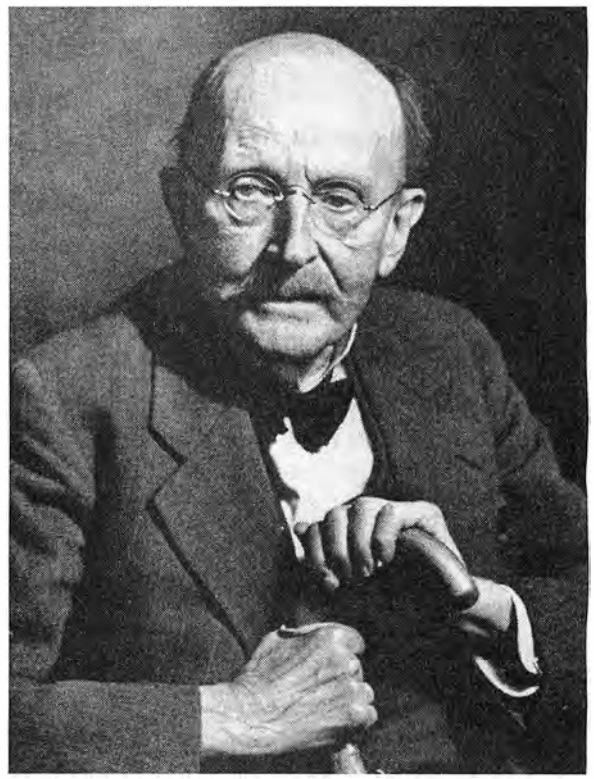
Having outlined Barry's impact on the epigraphic status of pre-Roman European and Mediterranean cultures, the next step will be to extend this review to the inscriptions found in the New World. This is to be the subject of Part 3 of this biography.

Julian Fell is a zoologist with a specialty in systematics, evolution, and ecology. He has had a lifelong involvement with museums, in a range of roles from technician to administrator. He has also worked as a technologist in several fields, including mining. Although not an epigrapher himself, he has enjoyed a unique, front-row seat during the epigraphic "explosion" of the last three decades.

References

1. Julian Fell, 1999. "Barry Fell, Epigrapher: Biography of a Renaissance Man," *21st Century* (Winter), pp. 40-63.
2. Edward Tregear, 1892. *The Maori-Polynesian Comparative Dictionary*. Reprinted 1969. (Oosterhout N.B., Netherlands: Anthropological Publications) North American Distributor, Humanities Press, New York.
3. _____, 1885. *The Aryan Maori*. (New Zealand: Government Printer), Reprinted 1984 by R. McMillan, Papakura, New Zealand, and 1995, by Kiwi Publishers, Christchurch, New Zealand.
4. Muriel Mirak, 1999. "Jean Francois Champollion and the True Story of Egypt," *21st Century* (Winter), pp. 26-39.
5. Cyclone Covey, 1987. *Homeric Troy and the Sea Peoples*, (Lakemont, Georgia: Copple House Books), 216 pp.

Max Planck's Unanswered Challenge



Presse und Informationsamt der Bundesregierung

Max Planck (1858-1947)

by Caroline Hartmann

The accepted quantum theory still leaves unanswered the fundamental questions raised by Planck's discovery of a century ago. What is the structure of the atom, and how does it produce the results measured by Planck's constant?

One hundred years ago, on December 14, 1900, the physicist Max Planck (1858-1947) announced in a speech before the Kaiser Wilhelm Society of Berlin, his discovery of a new formula for radiation, which could describe all the regularities observed when matter was heated and began to radiate heat of various colors. His new formula, however, rested on an important assumption: that the energy of this radiation is not continuous, but occurs only in packets of a certain size. The difficulty was in how to make the assumption behind this formula physically intelligible. For, what is meant by "energy packets," which are not even constant, but vary proportionally with the frequency of oscillation (Wien's Displacement Law)?

In his famous, and very informative, biography of Max Planck, John Heilbron[1] describes the dichotomy between the two world-views, which, from then on, would shape scientific discussion on this question: On the one side, was the assumption that Nature is governed by a principle of the highest reason and lawful causality; and this was also the standpoint of Planck, who was a great admirer of Leibniz. On the other side, there emerged an almost pagan belief in the "eternal rule of probability."

At first, attempts at interpretations of Planck's discovery fell like a spring rain, watering the flowers of fantasy and imagination: Is radiation more like a wave, or does it consist of single particles, which carry distinct portions of energy? Apparently, the experiments proved both. Many examples argued for the wave. In the famous "double-slit" experiment, for example, light or microwaves passing through two closely placed slits, produced patterns on a screen behind them, which showed all the phenomena of waves: diffraction, reflection, and interference. But, in other experiments, one could observe a real track or pathway, as if of a single particle, as in a bubble chamber. This posed a real paradox!

Ever since Planck's work, physicists have been trying to find a cogent explanation for this apparently unresolvable dichotomy. Erwin Schrödinger achieved one possible solution by assuming the existence of a kind of matter wave, first proposed by de Broglie. The practical development of laser physics is based on this theory, which assumes that each particle is a center of wave-emission.

The Copenhagen School

The other "line," that of the so-called Copenhagen School, centered on Niels Bohr. This school tried simply to explain away the paradox as a statistical result of random events—viewing nature as a large accumulation of chance occurrences, which was also the basis for the statistical gas-theory of Robert Clausius and the thermodynamics of Ludwig Boltzmann. The mathematical representation of the Copenhagen approach was worked out for Bohr by the young mathematical genius Werner Heisenberg. Yet, Heisenberg had almost failed the course in experimental physics, because his professor, Wilhelm Wien, saw that Heisenberg did not know

very much about the experimental side of nature!

The result of the Copenhagen approach became the now famous quantum theory, which Planck always referred to by the derogatory name *matrix mechanics.* For, who seriously believes that all the geometric structures of Nature, and the high art one sees in living structures, are ultimately based only on random motions of atoms or smaller particles?

The reasons that the quantum theory became the accepted explanation were many, and tragic. The First World War, and, even more, the Second World War, destroyed a great part of the experimental physics capability in Europe, and particularly in Germany, where students and professors were drafted into the army. Many physicists left Germany, either because they were Jewish, or they were fed up with the political situation. Then, after the war, the division between experimental and theoretical science became very sharp.

Chance Is Not a Cause

But how can somebody ask a question of nature, when his underlying belief is that events are governed only by the laws of probability? Yet, today, this is the underlying assumption—whether the subject is so-called "black holes," the mythical "Big Bang," or "global warming." The description of nature merely by *models,* can never explain the real phenomena; it can never tell the truth---even if the ignorant commentators of the mass media never stop talking about it. In all these cases, real experimental results which contradict the accepted "model" of the well-paid scientists, are swept under the rug.

Max Planck, a true man of wisdom and thus a true scientist, recognized the necessity of identifying the truly important problems to be solved, and separating them from the many "pseudo-problems" (*Scheinprobleme*) which arise in science, as in all areas of inquiry. Planck himself never found a solution to the paradox, but he was too much a thinker and philosopher to give up, and settle for a cheap compromise. He knew, that whenever you come upon an apparently insoluble problem in Nature, a higher, more complex lawfulness must lie behind it; or, in other words, there must be a different "geometry of the universe" than one had assumed before. Planck always insisted, for example, that the validity of Maxwell's equations had to be re-established, because physics had reached a point where the so-called "classical" laws were not universally valid.

He devoted his whole life to showing physicists how to find the decisive, or meaningful, problems to be sought after in nature. He often remarked that finding the reason for the existence of the so-called universal natural constants was the main aim of all physical or chemical research. He himself had discovered a totally new natural constant, which today is called the *Planck constant,* or *quantum of action,* and appears as the letter h in the equation for the energy of radiating matter;

$$E = h\nu,$$

(where E is the energy, ν the frequency of the radiation, and h Planck's constant).

When a deeper inquiry is made, a whole world of Nature's secrets always lies behind these fundamental constants, such as those associated with gravitation, with elementary electrical charge, and so on. Planck had discovered this truth, already as a young man, when he wrote, that these relations retain their importance, independent of any particular matter or substance, and are necessary for all times, and even for extraterrestrial or extrahuman cultures.

The Ideas Are Determining

What is the importance of Planck's *quantum of action;* what lies behind this natural constant? What meaning does it have for the construction of matter, for atoms and molecules? To examine this question, we shall now take a deeper look into the history of research in radiation before Planck's great discovery.

Until 1832, physicists had a strange idea of radiation. The English physicist David Brewster was the leading proponent of the view that there are three types of radiation, each differing from the other in respect to its reflectability and fundamental nature: First, there was the light which one could *see* in sunlight, or from a glowing material; second, heat, or thermal radiation, which one could feel, for example, when close to heated iron, and; third, the radiation which takes place in chemical processes.

The French physicist, André-Marie Ampère, injected more reason into the discussion. Ampère asserted that light is nothing other than visible heat radiation, and that many types of radiation could originate in the *same* process. Our eyes see only the radiation in a certain spectrum as light, and it is simply not possible for the human eye to see the radiation of other frequencies.

Gradually, Ampère's hypothesis was seen to be correct. And here we see an example of the enormous importance of the *idea,* or hypothesis, in scientific research, because without Ampère's idea, scientists would have been barking up the

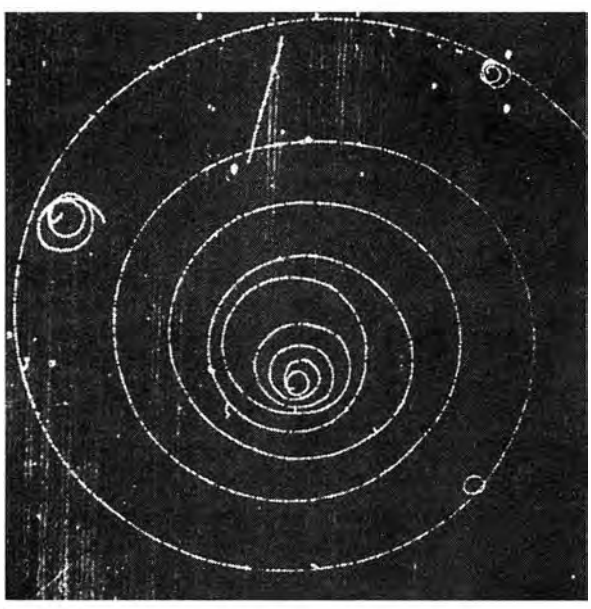


Figure 1
ELECTRONS BEHAVING LIKE PARTICLES
The tracks formed when electrons pass through a bubble chamber suggest that the electron is a particle. But other evidence indicates that it is a wave.

Planck on 'Pseudo-problems in Science'

In a 1946, speech at Göttingen University,[1] Max Planck raised the issue of what he calls "Scheinprobleme" (Pseudo-problems). We excerpt here some key passages of the speech, translated by Alexander Hartmann. Interpolated commentary in brackets is by Caroline Hartmann.

"The world is full of problems [or paradoxes]. They crop up everywhere—at home and on the job, in economy and in technology, in art and in science. And many such problems have a very stubborn side to them; they won't let us go, but keep nagging us from day into sleepless night. When once we find a solution, we experience a sense of freedom, and rejoice in the enrichment of our knowledge. It is totally different, however, when we discover, after a long and exhausting battle, that no solution can be found, either, because there is no error-free method of solution, or because, when seen in the right light, the problem makes no sense at all—it is a pseudo-problem [*Scheinproblem*], and we wasted our mental energy in vain. There are many such pseudo-problems—and, in my opinion, more than we usually think, even in science. The best way to avoid such unpleasant experiences is to always clarify for ourselves, whether the problem we are struggling with is a true one, that is, whether it makes sense, and if we could expect to find an actual solution for it. For that reason, my dear Ladies and Gentlemen, I want to present a series of problems to you, and let us work together to determine whether they are possibly only pseudo-problems. Maybe in this way, I can help some of you in some way or another. The selection of the problems is neither systematic, nor does it claim any completeness. Mostly, they are taken from the realm of science, because here, we have the best overview of the relationships. But that will not prevent me from reaching into other realms, where I can assume you may have an interest.

"To decide the question whether a problem under consideration really makes sense, we must first examine all the assumtions which are embedded in the formulation of the problem. . . . A simple example is the famous problem of constructing a *perpetuum mobile*, a perpetual motion machine—that is, a periodically acting machine, which does work continuously without producing any other change in Nature. Because the existence of such a machine would contradict the theorem of conservation of energy, something like this is not possible in Nature, and the problem is rather a pseudo-problem. Granted, one could argue that the energy principle is, in the last analysis, a theorem based on experience. If, at some point, its validity would have to be restricted, as has actually been mooted in atomic physics, the problem of the *perpetuum mobile* could turn into a real one; in this respect, its meaninglessness is not absolute. . . .

"There are also pseudo-problems, which will certainly remain so for all time. Among these also is a question which has occupied many famous physicists for many years: to determine the mechanical properties of the luminiferous ether. The meaninglessness of the problem follows directly from the assumption that light waves have a mechanical nature; for, this assumption is erroneous, and will always remain so. . . .

"I now want to present an example of a pseudo-problem, and I have to beg your pardon, ladies and gentlemen, for its triviality. This hall, where we find ourselves, has two sides, a right, and a left. For you, *this* is the right side; for me, sitting in front of you, *that* is the right side. The problem is: Which side is now really the *right* one? The question may sound ridiculous, but I dare to claim here that it is typical of a whole series of problems, over which much earnest and ingenious debate has taken place, the only difference being that the circumstances are not always so clear as in our example. You see that the word "real" should be used with great care. In many cases, it actually only makes sense when one has first established the standpoint from which it is being considered. Otherwise this word is often meaningless and misleading. . . .

"Another example comes from modern physics: If we observe a moving electron through an electron microscope, it appears to be a particle, moving on a determined pathway. But, if we send the electron through a crystal, the image appearing on a screen on the other side shows all the characteristics of diffracted light waves. The question, whether the electron is in reality a particle occupying a given position in space at a given time; or, if it is really wave, which fills up all of infinite space, will therefore reaim a pseudo-problem, so long as it is not stated which of the two methods has been used to study the electron. . . .

"Now, we want to move on to discuss a problem, which, because of its importance for man's life, has always played an exceptional role. It is the famous problem of mind and body, the so-called mind-body paradox. First of all, we have to ask if this question has a real meaning. For, there are philosophers who claim that mental processes need not be accompanied by any bodily ones, but can proceed totally independent of them. If this assertion is true, then a completely different set of laws governs the two processes. And in that case, the mind-body paradox divides into two separate questions—that of mind and that of body; it thus loses its meaning, and become only a pseudo-problem. Then we can consider the case closed, and need only look at the interaction between processes of mind and body. Experientially, these are very closely related. When somebody poses a question to us, it begins with a bodily process, the acoustical waves of the spoken word, which, proceeding from the questioner, meet our ear, and proceed through the sensory nerves into our brain. There, mental processes occur, that is, thoughts about the meaning of the words, and our decision over how to respond. . . .

"Are the processes in the mind caused by the bodily ones? And if so, according to what laws? How could something material actually have an effect on something immaterial, and vice versa? All these questions are very difficult to answer. . . ."

[Here, Planck goes into a lengthy discussion of the basis of this problem, and examines the theory of "parallelism." This is the

assumption that mind and body are independent of each other, each obeying their own laws, and that the connection between them acts by a "pre-established harmony," which is actually the theory of Gottfried Wilhelm Leibniz. This "pre-established harmony" governs practically all reasonable minds, in the highest domain of ideas, reason, and spirit—somewhat reminiscent of what Kepler calls the "mind" of the universe.

Planck notes that we have experience of how mental processes can have an enormous impact on the physical world, "as a gentle breath of wind can induce a powerful avalanche, or a tiny spark can blow up a gigantic barrel of powder." We could try to investigate these forces, but we can only do this with reliance on our conscious states of mind, since we don't possess sufficiently exact knowledge of the *unconscious* to investigate it scientifically. To do so would be a *contradictio in adjecto,* a contradiction in itself. Therefore, he concludes, all problems which deal with the subconscious are pseudo-problems. "You cannot know, what is unconscious."]

Planck continues:

". . . The situation becomes very different, and much more problematic, when, in addition to the feelings of the mind, and the bodily processes, we add the will. Because here, the ancient problem arises of the contradiction between the freedom of the will and the laws of causality. . . . Is the will really free, or is it determined by causality?"

[At this point, the confusion into which Planck led the audience could only have been disentangled by considering the problem from a higher standpoint. But he goes on to examine the question only from an objective and formal standpoint, that accepted as the "scientific" one. He examines the question whether one can investigate one's own decisions, whether they can be called "free." He notes that it would therefore only be possible to investigate decisions from the past, and so on.

In a certain sense, this is all true, but doesn't get to the point. Planck's failure to take a higher standpoint leaves us with only a liberal conception of freedom. Dwelling further on the proper definition of "free," he takes up the different cases, of decisions made only after long and reasonable deliberation, with good intentions, or, in the worst case, only out of rage. Like most of today's scientists, and also most other people, he doesn't consider the idea that human beings have the capability to be free in a much higher sense: by continually seeking and discovering the laws of the universe, and trying to "synchronize" their will with that "curvature." This has nothing to do with determination or causality, because, just as a planet always "knows" where to go, even though its pathway is actually different and nonlinear in every moment, a human being only becomes truly free when engaged in this ongoing process of investigation and discovery.

But, Planck finally returns to the main theme, and offers a solution to the problem of how to discover which problems are really meaningful, and which are pseudo-problems. These beautiful sentences are those quoted at the conclusion of the accompanying article.]

Notes

1. Max Planck, *Scheinprobleme der Wissenschaft: Vortrag Gehalten in Göttingen am 17. Juni 1946* (Leipzig: Johann Ambrosius Barth Verlag, 1947).

wrong tree for a long time, as so often happens today with the formation of mere "models" of the phenomena.

Ampère's hypothesis opened a totally new road for experimental physics. Names such as Heinrich Hertz, Philipp Lenard, Otto Lummer, Ernst Pringsheim, Marie Curie, Lise Meitner, and Otto Hahn are only some examples of the long tradition which arose out of it. To understand the developments leading to Planck's revolutionary hypothesis, we must briefly examine the seminal breakthroughs of Robert Wilhelm Bunsen and Gustav Kirchoff. After Ampère's discovery, Bunsen and Kirchoff experimented with a variety of elements, in order to investigate their spectra—that is, the characteristic colors which each element emits on heating. They used a simple apparatus, devised by Bunsen, which regulates the quantity of oxygen delivered to a gas flame, in order to control the temperature of combustion—today, we know this as the Bunsen burner. As a result of their experiments, it was possible to deduce the elements present in the Sun, by analyzing the spectral lines found in sunlight; these are called the "Fraunhofer diffraction lines," after their discoverer, Joseph von Fraunhofer. Bunsen and Kirchoff also uncovered a new, and strange phenomenon, which is not yet understood. Kirchhoff wrote a description of the discovery in the essay, *"Uber das Verhältnis zwischen dem Emissions—und Absorptionsvermögen der Koerper für Wärme und Licht" (On the Relation between the Emission and Absorption Capability of Bodies, with Respect to Heat and Light), Leipzig, 1859-1862):*

> When a given body, a platinum wire, for example, is heated slowly, at a certain temperature it begins to give off radiation of a wavelength greater than visible light. At a certain temperature, rays in the infrared range are emitted. Then, as the temperature rises, rays of a shorter wavelength begin to appear, in such a way, that, at each temperature, rays of a certain wavelength are added, while the intensity of the beams of longer wavelength rises. . . . From this it follows . . . that *all* bodies, when their temperature rises slowly, start radiating beams of the same wavelength. That means that, at the same temperature, the bodies glow red, then when all parts have achieved a higher temperature, they send out yellow beams, and so forth. But the intensity of the beams of a certain wavelength, which the bodies of the same temperature emit, can be very different. . . .

Black Body Radiation

Now, what did all that mean? Seeking a way to better explain these phenomena, Kirchhoff conceived of a somewhat idealized form, which we call today *black body radiation* or *Hohlraumstrahler.* He described it in the following way:

> When a room is enclosed by walls of the same temperature, and, at the same time, no radiation can get into the room, then every bundle of energy within the room will have the same quality and intensity, as if it had originated from a black body of the same temperature, and its energy is therefore independent of the condition and shape of the body, and depends only on its

temperature. The truth of this statement can be seen when one considers that a bundle of rays of the same shape, but the opposite direction, will be fully absorbed by the infinite reflections within the black body. In the interior of an opaque and glowing hollow body of a certain temperature, we therefore always find the same brightness, whatever the other condition of that body might be.

In considering such regular phenomena in nature, one must become a little uneasy, for the results seem to contradict our usual experience. Just imagine, if your car had a fuel tank capacity of 15 gallons, and always stopped after exactly 100 miles, regardless of how much gas you put in. At first you might think there was a leak in the tank. But if your mechanic, after a thorough investigation, told you that everything is okay, you would start becoming queasy over that constant. "Things are not normal here . . . the tank doesn't have a brain. . .!?" And, as a matter of fact, these universal constants in nature show us, that there do exist a sort of "thoughts" behind the construction of the universe, that the universe is built with a certain "intention," a kind of fundamental geometry.

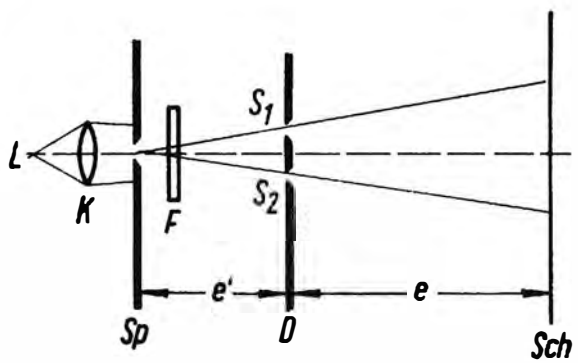
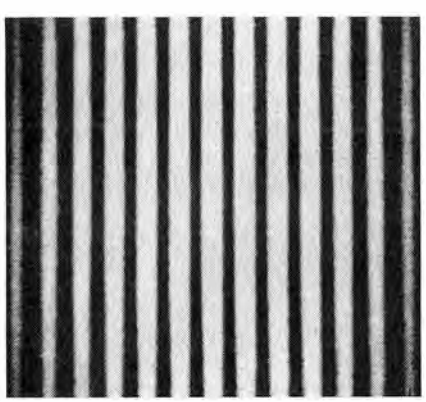


Figure 2
ELECTRONS BEHAVING LIKE WAVES

Electrons show their wave-like character, behaving just like light rays, when a beam of electrons is passed through two narrow slits. The diagram (above) shows how a focussed beam of light, passing through the two narrow slits, S_1 and S_2, projects an image on the screen at right which shows the property of interference. The image is alternately bright and dark (below). The interpretation is that the light consists of waves, which alternately reinforce and cancel each other, like waves on the sea surface.



Before Planck, Wilhelm Wien was gripped with solving the paradox posed by the observations of Bunsen and Kirchhoff. In the "Theory of Heat Radiation," Wien wrote:

> Therefore, the theory of radiation is one of the most important physical theories, because it deals with the laws which govern the creation of rays of light and heat, and also because these observations lead us more deeply into the inner construction of matter than do all other theories. . . . One of the most important tasks of the theory of radiation is, now, to describe the emission as a function of temperature and wavelength. ["Theory of Heat Radiation," in *Kultur und Gegenwart,* 1915]

The Atomic Structure

Wien thus touched on the fundamental question of the construction of matter, and pointed to the meager understanding we possess about the atomic structure—the motion of the electrons in the atoms, for example. Wien later described the problem:

> To find such a law, we must understand more clearly what occurs when light is emitted, because this apparently takes place within the molecules or atoms of bodies. Based on the electromagnetic theory of light, it had to be the electrical charge, which was in some way connected with the molecules and atoms, that was causing the light emission. This assumption found important support in the phenomenon discovered by Zeeman. This was the shift in position of a spectral line, observable when a radiating body is put into a magnetic field. On the assumption, that the color of the emitted light is determined by the velocity of the electrons moving in circular orbits, the change in this orbital velocity, and with it the change in color, could easily be calculated. From the shift in the spectral lines and the magnitude of the magnetic field, one could even determine the charge-to-mass ratio of the electron—the so-called specific charge. . . . But, even though something could be known about the mechanism of light production, one still did not know the cause for the motion of the electrons which produce the light. ["Theory of Heat Radiation," in *Kultur und Gegenwart,* 1915]

Wilhelm Wien had found the first law that could describe the phenomena. But it was valid only for low temperatures. Only later, at the end of the year 1900, did Max Planck find the law which was valid for all temperatures, as was firmly established by much additional experimental work, especially that by Otto Lummer, Ernst Pringsheim, and Friedrich Kurlbaum. But the crucial question raised by Wilhelm Wien

still remained unsolved. Planck's discovery of energy "packets" only made its solution more urgent. Now, new ideas about the structure of matter would be needed to understand the truth behind the phenomena. Some theorists, however, especially Niels Bohr and his school, introduced the nonsense of explaining everything by the laws of probability. Wien was very much disturbed by this direction in the debate:

> One must now seek even more deeply to explain why such a partition of energy must occur. The reason must be found in the atomic characteristics of matter, and one must conclude that the usual theorems of probability theory must not be used. It is possible, that we are dealing here with certain constraints on the freedom of motion of the electrons inside the atoms. . . . Something still not understood in the molecular processes must be involved, which prevents the energy from being allocated by the usual laws of probability. We will also see that the behavior of the specific heat of bodies actually leads to the same result. But where this behavior has its origin is not yet known. It is possible that the collisions of molecules, which have, so far, been interpreted as ordinary mechanical collisions, bring something still unknown with them.

Today we are indebted to the continuing research of scientists like the Curies, Lise Meitner, and Otto Hahn for a deeper insight into atomic structure. But the fundamental questions: what *causes* the motion of the electrons, is that motion is constrained by certain geometrical laws, and *why* certain elements are more stable than others, are still not clear, and await new pioneering hypotheses and ideas.

Planck on *'Scheinprobleme'*

Even in the face of the collapse of whole areas of physics, and the impoverishment of intellectual work in Germany after the war, Max Planck laid out (in one of his very last speeches, on June 17, 1946, in Göttingen), what the basis of scientific research must be, and what high ethical demand is placed on it:

> In this situation, a fundamental and grave question is forced upon us. When, as so often happens, we discover, after long investigation, that even great and important problems turn out to be only *pseudo-problems* (*Scheinprobleme*)—yes, that the word "reality," or "truth" may have a totally different meaning, depending on the standpoint we have chosen from which to view a problem—must we conclude that all scientific knowledge leads simply to a plain, or shallow relativism? Ultimately, does there not exist any absolutely valid judgment, any absolutely valid truth, independent of any particular standpoint?
>
> It would be unfortunate, were this to be the case. No, there are absolute, true, and definitive theorems in science, as we also have absolute values in ethics, and the most important thing is that it is precisely these theorems and values which are the most desirable and important of all. In the exact sciences, we must name here the so-called absolute constants, such as the elementary unit of *electrical charge,* the elementary *quantum of action* [today called *Planck's constant*], and many others. These constants always remain the same, by whatever method we employ to measure them. The discovery of these constants and the endeavor to subsume all physical and chemical problems under them, can be defined as the final aim of all scientific research.
>
> And, it is not different in the world of religion and ethics. Here also, the standpoint from which something is observed, is often determined by various circumstances, and this fact, indeed, may play a crucial role. For example, the ethical demand for truthfulness can very rarely be removed or weakened in any fundamental way. I don't want to mention here, the convenient lies, which are made in the interest of politeness—for with those you cannot really deceive anybody. But when it comes to truthfulness, the noblest of all virtues, there is a well-defined domain where this ethic is of absolute importance, independent of any particular point of view. And that is the truthfulness towards oneself, towards one's own conscience. Here, under all conditions, not even the slightest compromise or deviation may be justified. Whoever violates this demand, by closing his eyes to the search for the correct assessment of the situation— perhaps to gain a momentary advantage—is like a spendthrift, who mindlessly squanders his possessions, and one day will surely have to suffer for his carelessness.
>
> It is the duty of all men of open and inquiring minds to seek after these absolute values in science and ethics; this is an obligation which will always be with us, in one form or another, depending on the demands of the day. And this obligation will never go away, because the never-ceasing process of life is forever generating both real and pseudo-paradoxes (*Scheinprobleme*), and our work always leads us to new challenges. It is only by work that we find our way on the path of life, and there is an old and unfailing standard for evaluating that work, one which will remain forever the last word on the subject:
>
> "By their fruits ye shall know them!"
>
> [Max Planck: "Scheinprobleme der Wissenschaft," Göttingen 1946]

Caroline Hartmann is a collaborator of Lyndon and Helga LaRouche, and a leader of the Schiller Institute in Germany. *This study of Planck first appeared in the German-language magazine* Fusion, *in the Jan.-March 2001 issue. It was translated into English by Alexander Hartmann. The author's biography of Planck, "A Tragedy of Science: The Life of Max Planck," appeared in the Summer 1995 issue of* 21st Century.

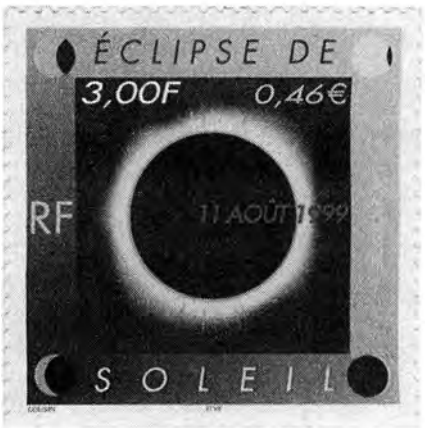
Notes

1. John L. Heilbron, 2000. *The Dilemmas of an Upright Man—Max Planck and the Fortunes of German Science*, Second edition, with a new afterword (Cambridge, Mass.: Harvard University Press).

AUGUST '99 ECLIPSE STUDIES SHOW

The 'Allais Effect' Is Real!

by Henry Aujard



French stamp commemorating the total solar eclipse of August 11, 1999.

EDITOR'S NOTE

Through experiments in the 1950s with a paraconical pendulum, and other devices, as well as later analysis of Dayton C. Miller's 1920s observations with a Michelson-Morley interferometer, Maurice Allais, the French Nobel Prize economist, and physicist, established evidence for what he calls the *anisotropy of space.*

Allais believes that the *ether,* the medium of space through which light, radio, and all electromagnetic radiation must pass, is not uniform in all directions; rather, the state of the ether constantly varies. The experimental evidence leads him to conclude that within the vicinity of the Earth, the variations in the ether are of a periodic character, coinciding with astronomical periods, including the sidereal day and year.

Henry Aujard, an engineer and collaborator of Professor Allais, here presents an historical overview of the subject, and reviews the attempts to verify the Allais hypothesis, in connection with the solar eclipse of Aug. 11, 1999.

1. Historical Background Of the Problem

At the beginning of the 17th Century, Kepler established three fundamental laws for the motion of the planets in the solar system. Making use of these laws a half century later, Newton established the "law" of attraction of two bodies as a function of the inverse square of the distance which separates them. Albert Einstein, first in his Theory of Special Relativity in 1905, and then in his Theory of General Relativity, presented totally new views on gravitation.

The problem of gravitation subsumes that of demonstrating the rotation of the Earth and its orbital motion around the Sun by purely terrestrial experiments. At the beginning of the 20th Century, Henri Poincaré wrote: "Even if the sky were covered with clouds, and no stars were visible, it would be perfectly possible for some Copernicus to prove that the Earth moves in its orbit, and to establish its position by purely terrestrial experiments."

Already in 1851, Leon Foucault had demonstrated the rotation of the Earth, using a pendulum, mounted so as to be free to swing in any vertical plane. Foucault determined that the plane of oscillation of the pendulum's swing rotated with a period of 32 hours. This was exactly the effect calculated by the Coriolis force, corresponding to the action of the rotation of the Earth on the pendulum. A proof of the motion of the Earth in its orbit was still wanting.

Michelson-Morley-Miller

It had been suggested that the Earth's motion might be demonstrated by means of the superposition of velocities, by analogy with the experiments of Christian Doppler (1850), demonstrating that sound propagates differently when the source and the observer are in relative motion.

In 1881, A.A. Michelson carried out an experiment in Cleveland, using a large interferometer, which separated a light beam into two parts—one in the direction of the movement of the Earth and the other perpendicular to it—and then reunited them (Figure 1). He established a difference in the velocity of the two parts of the beam, on the order of 8 km/s, which was interpreted as the result of observational error, or of variations in temperature.

In 1905, proceeding from the assumption that the velocity of light is constant for uniform rectilinear motion, and

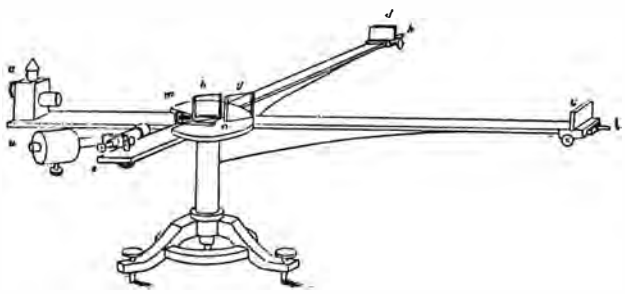


Figure 1
FIRST MICHELSON INTERFEROMETER (1881)

A.A. Michelson's instrument for detecting the relative motion of the Earth through the ether used the principle of wave interference developed by Augustin Fresnel. A beam of light is divided by a half-silvered mirror into two perpendicular paths, which are then reunited by reflection. If the times of travel of the light beams along the two equal, but perpendicular, arms are different, it will show up in the sighting glass as an interference pattern.

rejecting, at the outset, any notion of a medium of propagation (the ether), Albert Einstein presented his famous paper on the Theory of Special Relativity, which notably contained the well-known formulation of the equivalence of mass and energy ($E = mc^2$).

Some other experiments, very similar to those of Michelson, were carried out, which produced differences in velocity of the two perpendicular beams of from 6 to 10 km/s, again attributed to observational errors or to the effects of temperature. Meanwhile, a number of scientists were expressing doubts about the fundamental soundness of Einstein's Relativity Theory. Among them was the Frenchman Ernest Esclangon, director of the Strasbourg observatory, who carried out a series of optical experiments during 1927-1928, showing an optical dissymmetry of space.

In 1925-1926, the physicist Dayton C. Miller, an associate and friend of Michelson's collaborator at the Case Institute, Albert Morley, used a steel interferometer, completed in 1904 by him and Morley (Figure 2), to carry out several long series of continuous observations. These were conducted during four periods, each about a week in duration, on the steel interferometer which had been transported to Mount Wilson in California. These were then compared with similar observational series made in Cleveland, and these observations demonstrated that the speed of light varied according to its direction.

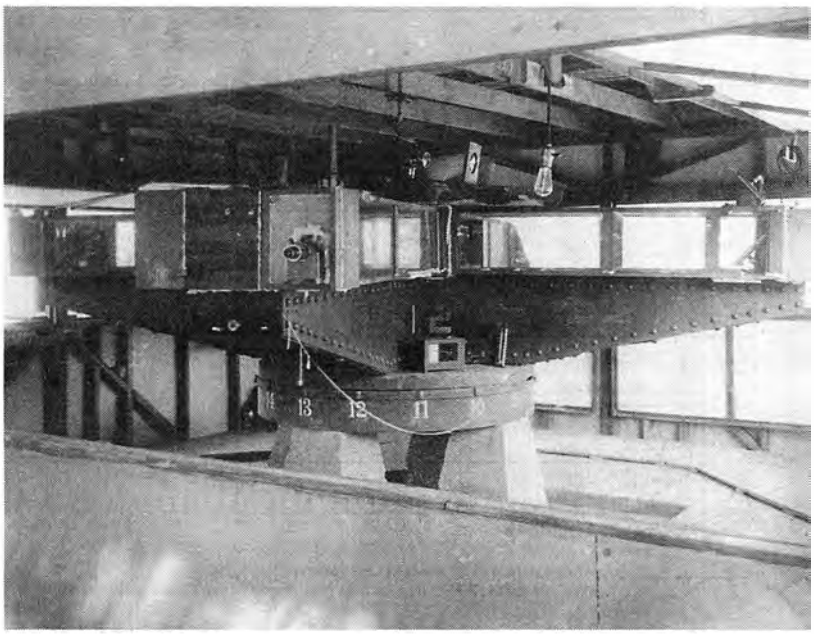


Figure 2
MORLEY-MILLER INTERFEROMETER ON MT. WILSON
This ether-drift apparatus (interferometer), built by Dayton Miller and Edward Morley in 1904, was transported to Mt. Wilson Observatory in California, and used there between 1924 and 1926. A positive ether drift was detected.

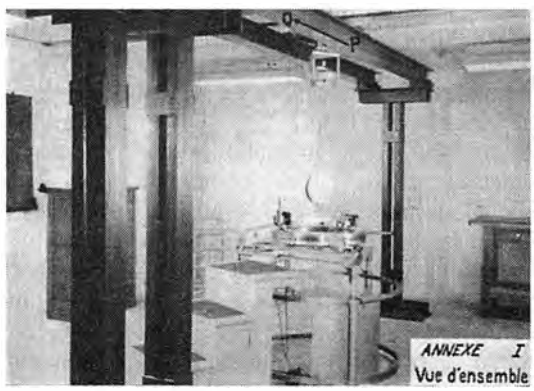
Source: Courtesy of Case Western Reserve University Archives

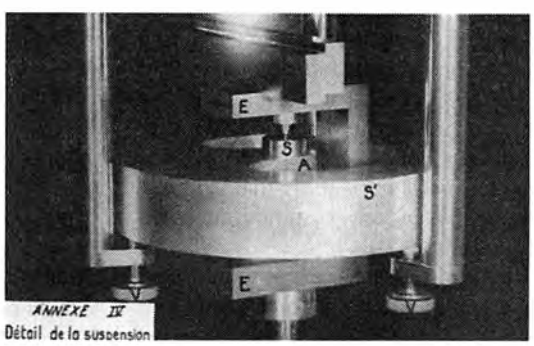
2. Experiments of Maurice Allais

Some years later, in 1950, Professor Maurice Allais, a graduate of the French Ecole Polytechnique, began his own experiments with a paraconical pendulum. He was convinced that the propagation of gravitational and electromagnetic actions must occur in the same way, and that this implies the existence of a medium of propagation (the ether of Fresnel).

Allais began with the idea that it would be possible to establish a link between magnetism and gravitation, by observing the effect of magnetism on the movement of a pendulum. In 1953, he began observing the movements of a paraconical pendulum (Figure 3). The

Figure 3
PARACONICAL PENDULUM OF MAURICE ALLAIS
Allais's 1954 to 1960 experiments with the paraconical pendulum demonstrated the anisotropy of space. Above, the pendulum suspended from beams. Below, a closeup of the suspension system. A ball bearing, resting on the platform at S, *supports the weight of the U-shaped pendulum arm,* E. *The peninsular-like shape of the platform,* A, *permits the pendulum to swing through a wide range of azimuths.*





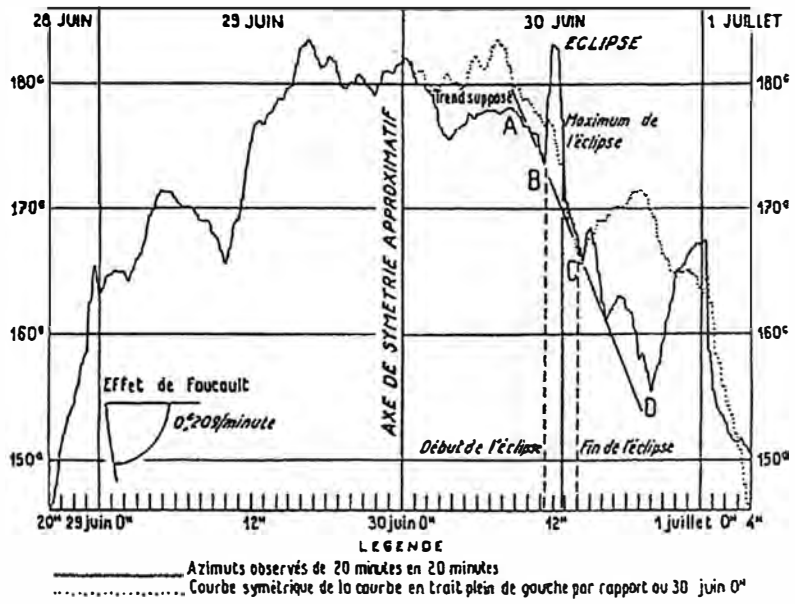


Figure 4
PARACONICAL PENDULUM OBSERVATIONS DURING SOLAR ECLIPSE
A total eclipse of the Sun occurred on June 30, 1954. The graph shows observed azimuths of Allais's paraconic pendulum from June 28 at 20 hours to July 1 at 4 hours.

pendulum was originally 2 meters long (this was reduced to 83 cm in 1954), and was isolated from any magnetic field other than that of the Earth. To his great surprise, Allais observed that, in addition to the Foucault effect, some important anomalies appeared which were variable with time.

To analyze these anomalies, Allais decided to carry out a series of monthly observations from 1954 to 1960. The essential result of these experiments was to establish a luni-solar periodic component of 24 hours, 50 minutes in the movement of a paraconic pendulum, with an amplitude 100 million times larger than that calculated by the theory of gravitation, modified or not by the Theory of Relativity. Moreover, during observations conducted at the time of the June 30, 1954, total eclipse of the Sun, a sharp deviation in the plane of oscillation of the pendulum was observed—a phenomenon that is totally inexplicable by any currently accepted theories (Figure 4).

The results of these experiments were written up in 10 public communications from 1957 to 1959, in the *Comptes Rendues de l'Academie des Sciences,* and in a series of articles in the U.S. journal *Aerospace Engineering* of Sept.-Oct. 1959, titled "Should the Laws of Gravitation Be Reconsidered?"

Allais's Experiments in Optics

While carrying out these experiments on the paraconic pendulum, Allais asked himself if experiments in optics—for example, of telescopic sightings on a surveyor's rod—could not confirm the results found with the pendulum, and thus also help to establish the nature of the ether.

In June-July 1958, at the French research institute PIRSID, and then in February-March 1959, at the National Geographic Institute, Allais established the indubitable presence of optical anomalies, with a periodic structure that was in phase with the anomalies of the paraconic pendulum, which thus also served as confirmation of the results obtained with the pendulum.

Analysis of the Miller Data

In 1995, Allais made a detailed analysis of the 1925-1926 interferometry observations of Dayton C. Miller. He was pleasantly surprised to discover that the observations of Miller were much more significant than Miller himself had supposed. In fact, in the period after 1926, Miller, doubtless discouraged by the attacks on him, had ceased his interferometer experiments.

In March 1997, Allais presented a profound analysis of Miller's observations in his book *L'Anisotropie de l'espace* (The Anisotropy of Space), particularly emphasizing the experimental regimen, in which readings were taken through all azimuths in a continuous manner, day and night, over four sessions, each of about one week's duration. Allais concluded that these experiments of Miller were much more significant than all the previous ones, which had been of shorter duration, yet on which everyone had been relying as proof of the isotropy of the propagation of light, and of the validity of the axioms of Einstein's Special Relativity Theory.

Finally, in 1997, after some new analyses of the observations of Miller, Allais could conclude, with complete certainty, that these observations demonstrated the existence of a very remarkable underlying coherence, independent of all distorting effects, most particularly of temperature. It follows from this, that the speed of light is not the same in all directions. Maurice Allais presented his conclusions in two Notes to the French Academy of Science. It took more than two years for the first Note to be accepted for publication in the official journal, *Comptes Rendues.*

3. Experiments Sponsored by NASA

In June 1999, Dr. David Noever of the U.S. National Aeronautics and Space Administration was researching the different causes of the flight anomalies of three probes—Pioneer 10, Pioneer 11, and Ulysses—that did not follow the exact trajectories and velocities predicted by calculations based on the classical laws of gravitation.

Noever happened to consult Maurice Allais's 1958 study, which had been published in English in the U.S. journal *Aerospace Engineering* (cited above), at the request of the then-director of the U.S. space program, Wernher von Braun.

Additionally, Noever took note of a

large number of other studies on experiments with pendulums and with optical sightings, which seemed to demonstrate clearly that the Newtonian laws of gravitation, corrected or not by the Theory of Relativity, obviously posed some problems.

Noever thus decided to launch a large investigation, through specialized laboratories and universities, in order to verify what they came to call the *Allais effect.* Research centers at many locations planned experiments in connection with the Aug. 11, 1999 eclipse, including:

Austria: Austrian National Meteorological Institute, Central Institute for Meteorology and Geodynamics; University of Vienna, Experimental Physics Department.

Italy: Department of Physics, University of Trento, University of Trieste, Marigliano.

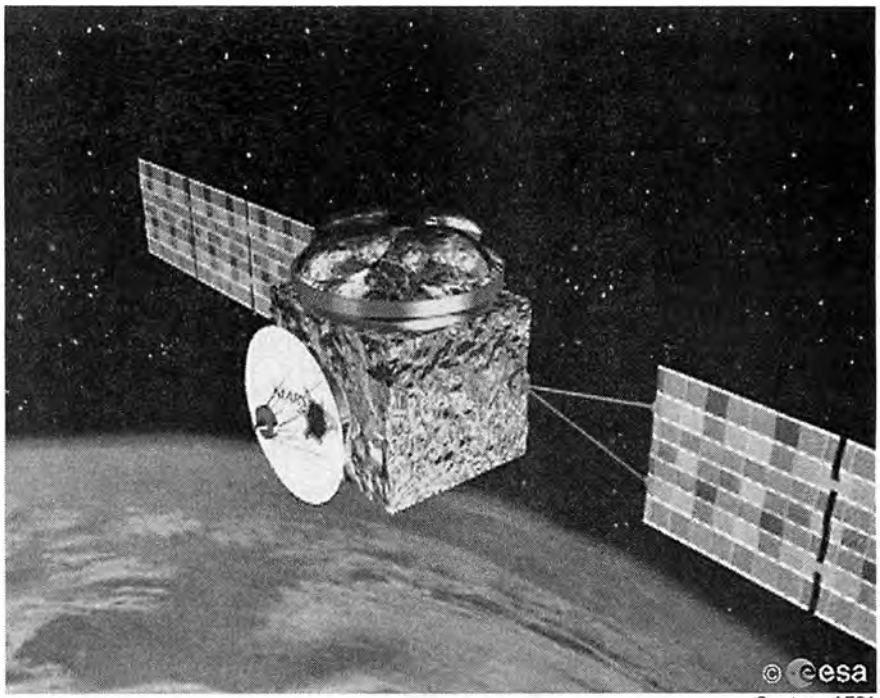
France: Scintrex LDS Europe, Saint-Jean-de-Braye.

Germany: Department of Physics, Ernst-Moritz-Arndt-University; Greifswald University Observatory.

Persian Gulf: Seven stations in the Persian Gulf, co-ordinated by Edcon Inc., Denver, Colo..

Turkey: Meteorology Institute, Kocaell, Turkey.

United States: Seven stations in the U.S.A.: NASA-MSFC, Huntsville, Ala.; Department of Geological Sciences, Virginia Tech, Blacksburg, Va.; Department of Physics, University of Louisville, Louisville, Ky.; Ball Aerospace & Technologies Corporation, Boulder, Colo.; Edcon, Inc., Denver, Colo.; Micro-G Solutions Inc., Boulder, Colo.; and Lacoste & Romberg, LLC, Austin, Tex.



Courtesy of ESA

A radio signal takes 11 minutes to travel to or from Mars. A spacecraft will have moved 6,000 kilometers before Earth-based controllers can correct its speed or trajectory. A very slight variation in the assumed law of gravity can thus have great consequences. Pictured, an artist's illustration of the Mars Express Orbiter.

Chronology of Work on Gravitation and Relativity

1881—A.A. Michelson's experiments with the interferometer.

1895—H.A. Lorentz's memoir on the theory of the electron and the electromagnetic field.

1899—Henri Poincaré writes that "optical phenomena depend only on the relative motions of the material bodies which are present."

1900—Poincaré demonstrates in his memoir on the theory of Lorentz, that electromagnetic energy propagating in space is endowed with inertia, and that its inertia, m, is equal to E/c^2 (where c is the speed of light), and therefore $E = mc^2$.

1904 (March)—Lorentz publishes his memoir on electromagnetic phenomena in a system in motion.

1904 (September)—Poincaré enunciates the principle of relativity at the Conference of St. Louis (U.S.A.).

1905 (June)—Gustave Lebon uses the example of the Sun to illustrate the property of material susceptible to transforming itself into energy.

Poincaré sends a Note to the French Academy of Sciences laying out the principles of Special Relativity.

1905 (September)—Albert Einstein publishes a fundamental article on the Theory of Relativity.

1905 (November)—Albert Einstein mentions $E = mc^2$.

1925—Experiments of Dayton C. Miller on the interferometer at Mount Wilson, Calif.

Einstein declares that "if the observations of Miller were confirmed, the theory of relativity would be overthrown."

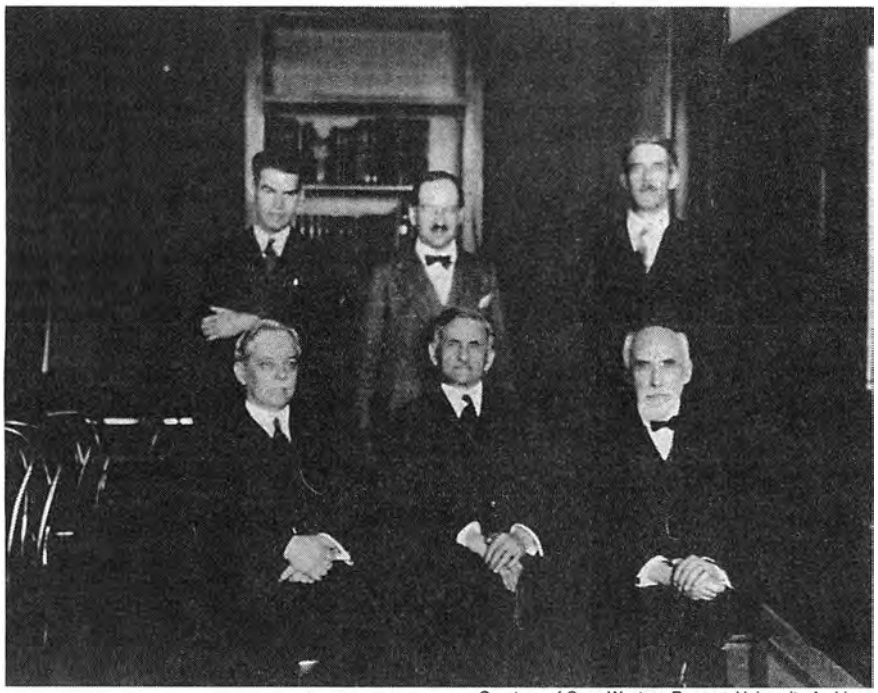
1928—Ernest Esclangon conducts optical experiments leading to the conclusion that space is anisotropic.

1954-1960—Maurice Allais conducts experiments with the paraconic pendulum at the IRSID lab in France, and on the deviations in optical sightings on the surveyor's rod at the IRSID, repeated at the IGN in 1959. All of the reported anomalies lead to the anisotropy of space.

1958-1959—Allais publishes reports of his experiments on gravitation in France and the United States.

1997—Allais publishes **L'anisotropie de l'espace,** a fundamental work that is highly recommended.

—Henry Aujard



Courtesy of Case Western Reserve University Archives

Front row, from left: Dayton Miller, Albert Michelson, and H.A. Lorentz. Their pioneering work later led to the conclusion of the anisotropy of space.

Experimental Results

In Bucharest, Romania, Professor Ieronim Mihaila, with a team of other professors, decided to execute a new series of experiments during the August 1999 eclipse. These new experiments confirmed perfectly the results of similar earlier experiments, conducted from 1960 to 1981. The Mihaila group thus decided to present these results in a communication to the Academy of Sciences of France "in honor of Professor Allais." As a result of these positive results, Professor Mihaila and other Romanian universities recently decided to perform new series of tests with pendulums.

Working in Italy, Antonio Iovane carried out tests in Margiano, using a 5.5 meter pendulum with no initial motion. During the eclipse, the pendulum showed spontaneous motion more severe than was observed at any other time, and thought to be the result of the Allais effect.

In his extensive tests, Iovane observed that the detection of anomalies (at least the higher-frequency components) is affected by the length of the pendulum, and therefore the period of its oscillation: The short pendulum shows more observable deviations than a longer one.

Weakness of Gravimeter Data

Iovane, who examined some of the experiments with gravimeters, suggested that the same consideration may exist in experiments with spring-mass gravimeters, leading to the mixed results recorded with such devices. He also observed that superconducting gravimeters, which seem to present null results (at least for short time periods), may be insensitive to the Allais effect, because of the usual low-pass filtering of raw data. Iovane concluded that "the available gravimeter data are not sufficient to put into doubt the Allais effect, which is clearly present in experiments employing other devices."

Earlier, Professor Shu-Wen Zhou of the University of Houazhon in China, had published an article confirming the anomalies of eclipses with a device specially designed for this effect. The very positive results reported are analogous to those corresponding to the pendulum of Allais.

On the Types of Pendulums

In fact, the eclipse effect is only a particular case of a much more general phenomenon, an anisotropy in space. At the time of a solar eclipse, the direction of anisotropy of space combines with the common direction of the Sun and the Moon.

The effects of the eclipse on the motion of the pendulum are particularly spectacular, and are manifestly inexplicable by currently accepted theories. However, these effects can only be demonstrated through observations of very long duration.

Maurice Allais, like other experimenters of the past, made his experiments with short pendulums, whereas the Foucault-type pendulums are many dozens of meters long.

It appears that with the hypothesis of the anisotropy of space, the effect of the influence of a star is proportional to the square of the amplitude of the pendulum, *and* inversely proportional to its length, whereas, according to the the current theory of gravitation, the effect is proportional to the square of the amplitude of the pendulum, but is independent of its length.

Conclusion

As indicated here, some very positive results have already been achieved, and are in the process of being analyzed, and comparisons made with previous experiments during other eclipses, and especially with the numerous experiments carried out previously with pendulums of often very different lengths (in France, England, Italy, and Romania, for example).

It must be remembered that the analyses of the eclipses and, most particularly, of the tides, have taken a very long time to complete, and that even if today we can use more powerful tools than in the past, there is still a long program of observations to carried out here. Nevertheless, it is certain that the experiments cited above, not to mention many others that have given comparable results, have already provided quite a few stones and timbers for the edifice of the anisotropy of space.

It may take years, even centuries, for the "established truths" (which are, in fact, only the theories of the day) to finally be called into question. A theory is only as strong as its premises. If the premises are erroneous, or too obviously incomplete and disputable, a theory has no real scientific value. The only sci-

entific criterion for judging the scientific validity of a theory is, in fact, its conformity with the results of experiment. After Léon Foucault, now universally recognized, we have today, finally, Maurice Allais. In fact, it is now well established that the commonly accepted "laws" of gravitation do not account for physical reality.

Bravo, and thank you to NASA, and to all of the other researchers of the international scientific community for having been able to show us that the Allais Effect is real.

A French version of this article first appeared in Centraliens, *No. 517, June 2000.* Mines, La Revue des Ingénieurs, *No. 388, Sept.-Oct. 2000, and subsequently in* Fusion, *No. 86, May-June 2001. The version here has been updated. It was translated into English by Elizabeth Pascali.*

Works of Maurice Allais

Maurice Allais, 1997. *L'anisotropie de l'éspace,* 760 pages, (Editions Clément Juglar, 67 avenue de Suffren, 75015 Paris, Tel. 01 45 66 55 70.

_____, 1998. "The Experiments of Dayton C. Miller (1925-1926), and the Theory of Relativity," *21st Century,* Spring, pp. 26-31. (Originally published as "Les experiences de Dayton C. Miller 1925-1926 et la theorie de la relativité," *La Jaune et la Rouge,* Aug.-Sept. 1996)

_____, 1998. "Should the Laws of Gravitation Be Reconsidered?", *21st Century,* Fall, pp. 21-33. (Previously published in English in *Aerospace Engineering,* September 1959, and originally published in 1958 as "Doit-on renconsidérer les lois de la gravitation?" *Perspectives* (Ecole Polytechnique).

_____, 1989. "My Life Philosophy", *The American Economist,* Vol. 33, No. 2, Fall. Excerpts of this were published as "On My Experiments in Physics, 1952-1960," *21st Century,* Spring 1998, pp. 32-34.

_____, 1999. Two notes on the observations of Dayton C. Miller from 1925-1926, in *Comptes Rendus de l'Academie des Science,* Vol. 527, Series 2b, pp. 1405-1418, December.

_____, Ten different notes on the anomalies of the paraconic pendulum in *Comptes Rendues de l'Academie des sciences,* 1957-1959.

Further Reading on the Subject

Laurence Hecht, 1998. "Optical Theory in the 19th Century, and the Truth about Michelson-Morley-Miller," *21st Century,* Spring, pp. 35-50.

Patrice Lanoy, 1998. "Soupçons d'imperfection sur la gravitation," *Le Figaro,* Sept. 27.

Jules Laveugle, 1994. *La Jaune et la Rouge,* April.

Dayton C. Miller, 1933. "The Ether-Drift Experiments and the Determination of Absolute Motion of the Earth," *Review of Modern Physics,* Vol. 5, No. 3 (July), pp. 203-242.

Fabrice Node-Langlois, 1999. "La NASA étudie les observations de Maurice Allais, contraires aux postulats sur la gravitation universelle," *Le Figaro,* Aug. 12.

Rémi Saumont, 1998. "Undermining the Foundations of Relativity," *21st Century,* Summer, pp. 83-87. (Originally published as "Autour du livre de Maurice Allais: L'anisotropie de l'éspace," *Fusion,* No. 69, Jan.-Feb. 1998)

Shu-Wen Zhou, 1999. "Abnormal Physical Phenomena Observed When the Sun, Moon, and Earth Are Aligned," *21st Century,* Fall, pp. 55-61.

University of Bucharest and Jassy (Romania), 1999. Note of Professors Mihaila, Marcov, Pambuccican, and Agop, "Observations de l'effect Allais lors de l'éclipse de Soleil du 11 août 1999," presented to the French Academy of Sciences.

Benedetto Soldano, 1999. "Space Probe Acceleration Anomalies Suggest Nonequivalence," *21st Century,* Summer 1999, p. 66. (This presents another view on the anomalies found in the paths of Pioneer 10, Pioneer 11 and Ulysses.)

Websites

On Allais' work:

http://allais.maurice.free.fr

NASA research:

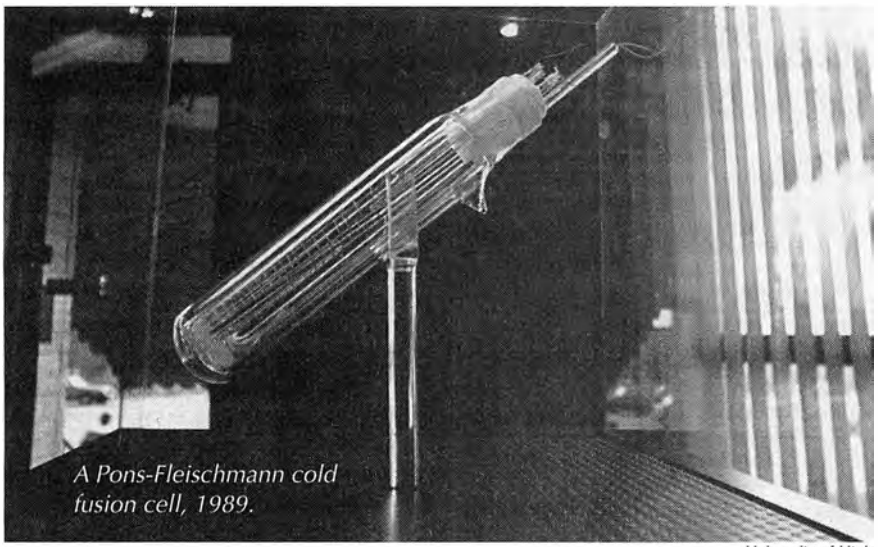
http://www.ssl.msfc.nasa.gov/newhome/headlines/ast06aug99_1.htm

To order back issues of 21st Century online:

http://www.21stcenturysciencetech.com

Where Do We Stand on Cold Fusion?

by Edmund Storms



A Pons-Fleischmann cold fusion cell, 1989.

University of Utah

Just what has been accomplished so far in the field of cold fusion? (Since the term "cold fusion" has become unfashionable, the general process is now called either *Chemically Assisted Nuclear Reactions,* CANR, or *Low Energy Nuclear Reactions,* LENR.) Unfortunately, the few scientists who remain in this field have been so distracted trying to convince their fellow scientists that the effect is real, that they have not made much progress toward producing a useful device. Nonetheless there are substantial results to report.

First, a dozen techniques have been found to produce anomalous energy and benign nuclear products in certain solids.

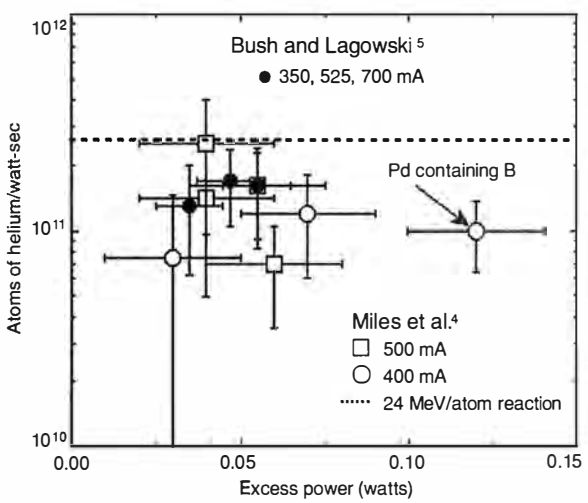


Figure 1
HELIUM AND ANOMALOUS POWER GENERATED BY A PONS-FLEISCHMANN CELL

Shown are two independent measurements of the relationship between atoms of helium per watt/second of energy and anomalous power generated by a Pons-Fleischmann type cell. The helium measured in the generated gas does not include helium retained by the palladium cathode. This work was done at the Naval Weapons Laboratory at China Lake (Miles et al.) and at SRI in Stanford (Bush and Lagowski).

METHODS CLAIMED TO PRODUCE CANR OR LENR (COLD FUSION)

Note: AE = anomalous energy, NP = nuclear products.

1. **Electrolysis of D_2O** (H_2O)-based electrolyte using Pd, Pt, Ti, or Ni cathodes. (This is the orginal Pons-Fleischmann method, which has been replicated hundreds of times to produce claimed AE and NP in every country where the method was used.)
2. **Electrolysis of KCL-LiCL-Lid** (fused salt) electrolyte using a Pd anode. (Several attempts at duplication have failed.)
3. **Electrolysis of various solid compounds in D_2** (proton conduction). (This method has been duplicated in the United States, Japan, and France to produce AE.)
4. **Gas discharge** (low energy ions) using Pd electrodes in D_2 (H_2). (Variations on this method have reported AE and NP in the United States, Russia, and Japan.)
5. **Ion bombardment** (high energy ions) of various metals by D+. (Variations on this method have reported NP in Russia and Japan.)
6. **Gas reaction** (H_2) with Ni under special conditons. (Replicated independently several times in Italy to produce NP and AE.)
7. **Cavitation reaction involving D_2O** and various metals using an acoustic field. (This method has been replicated in the United States to produce NP and AE.)
8. **Cavition reaction in H_2O using microbubble formation.** (Several attempts to duplicate variations on the method have failed.)
9. **Reaction of finely divided palladium** with pressurized deuterium gas. (Variations on this method have produced AP and NP in the United States and Japan.)
10. **Plasma discharge under D_2O or H_2O.** (Variations on this method have produced AP and NP in the United States, Italy, and Japan.)
11. **Phase change or a chemical reaction, both involving deuterium.** (NP production has been reported in the United States and in Russia.)
12. **Biological systems.** (This method has produced NP in Japan, Russia, and France.)

These are listed in the table (p. 76). Most of these methods have been duplicated at independent laboratories, and several can be made to work by anyone who would take the time to learn how. In spite of this fact, a spokesman for the American Physical Society,[1] in his recent book *Voodoo Science,* refuses to acknowledge any progress at all. Such is the reason that this discovery is not yet solving our energy problems. A more accurate description of the situation can be found in a book by Charles Beaudette.[2] Readers interested in the scientific details can find much information at http://home.netcom.com/~storms2/index.html.

What is this pariah subject all about?

When the CANR effect occurs, energy is produced from a collection of nuclear reactions, all taking place in special solid environments. The most easily initiated is fusion between two deuterons, resulting in helium. No harmful radiation accompanies this reaction, in contrast to the "hot" fusion method. The relationship between helium production and power production has now been measured using the Pons-Fleischmann[3] method (No. 1 in the table),[4, 5] as well as the gas loading method (No. 9 in Table).[6]

Figure 1 compares two completely independent measurements of helium released to the gas, while anomalous power is being produced by a palladium cathode in a deuterium-oxide-based electrolyte. While the amounts of heat and helium are small, agreement within the data sets, and between the two studies, is well within the expected error. However, the values for helium do not include helium retained by the palladium cathode. Helium was found to be absent on a number of occasions when no excess energy was detected.

The gas-loading method gives a much larger effect, as shown in Figure 2. Here, deuterium gas was placed in contact with finely divided palladium deposited on a carbon-based catalyst.[7] As anomalous energy is generated, the amount of helium in the gas increases, eventually exceeding the concentration within the surrounding air. Some samples are found to produce helium and heat, and some do not, even though they are from the same batch of catalyst. Studies were done to eliminate the possibility that helium was being desorbed from the catalyst.

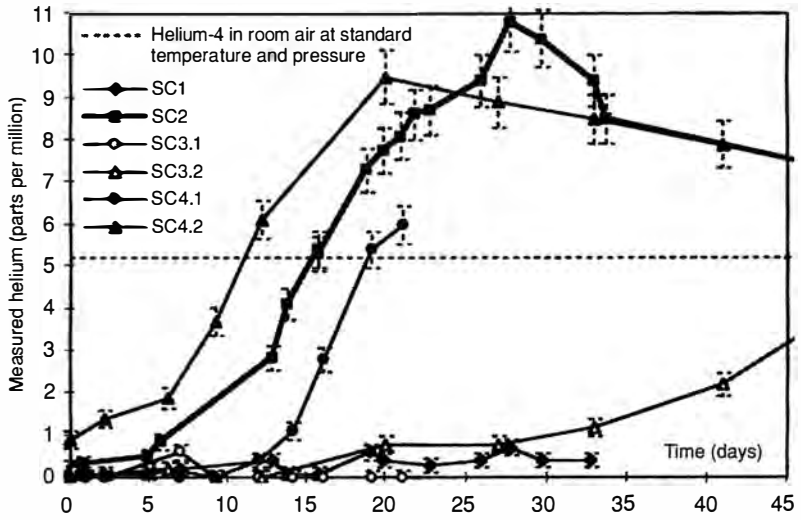


Figure 2
HELIUM CONCENTRATIONS IN DEUTERIUM OVER TIME
Shown is the increase of helium concentrations in a gas-loaded cell, which contains D_2 surrounding a palladium and carbon catalyst, studied over time. Some samples were found to produce higher concentrations of helium, eventually exceeding the concentration within the surrounding air, while other samples did not produce helium, although they were from the same batch of catalyst.

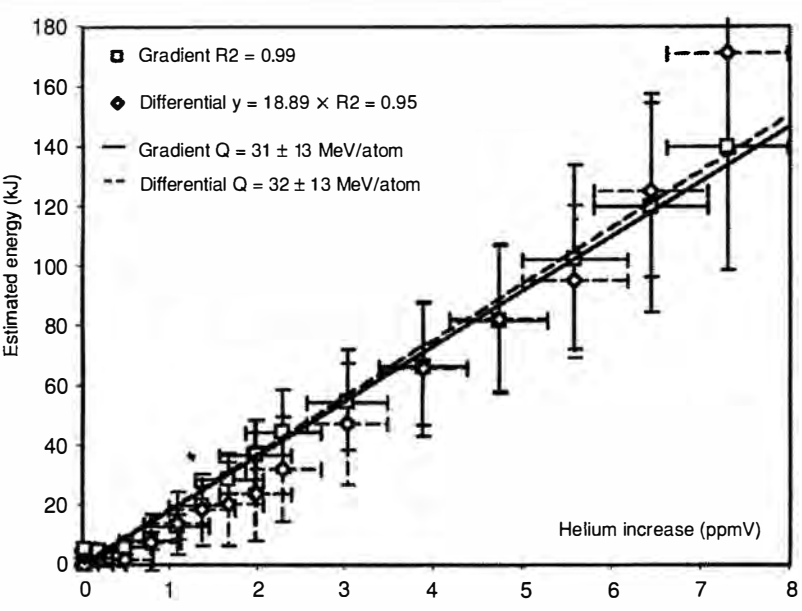


Figure 3
ANOMALOUS ENERGY AND HELIUM PRODUCED IN A GAS-LOADED CELL
Shown is the relationship between the amount of anomalous energy and the amount of helium produced in a cell containing palladium on charcoal surrounded by deuterium gas. As anomalous energy is generated, the amount of helium increases. This study was done at SRI at Stanford with the help of Drs. Case and George.

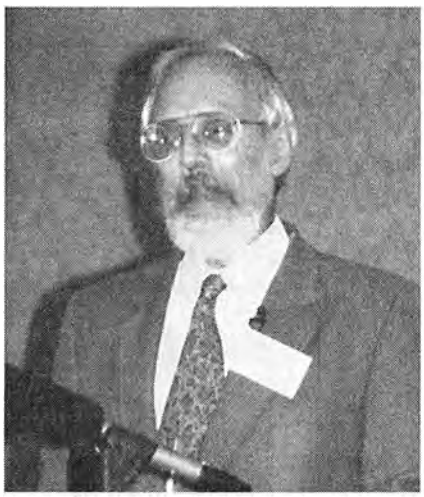
Figure 3 compares the anomalous energy and the amount of helium produced. The slope is somewhat greater than the expected value of 24 MeV/atom because some helium is retained by the catalyst. Workers in Japan have seen the same effect using palladium-black.[8] Finely divided palladium, plated on a platinum surface, will also make anomalous energy very easily when placed in a Pons-Fleischmann cell, in contrast to the normally used palladium wire or sheet.[9]

Independent laboratories have duplicated all of these methods, and the reasons for failure when using commercial palladium metal are now understood. The reason for the failure while using commercial palladium is that the required properties of the palladium are neither uniform, nor easily duplicated. Only rare pieces of palladium, which do not crack when reacted with high concentrations of deuterium, are suitable. Apparently, having very fine particles of a suitable material is another essential condition for this phenomenon to work.

Transmutation of Elements

Occasionally, evidence for a whole spectrum of nuclear reactions, called transmutation, is seen when the surfaces of electrodes are examined.[10, 28] These reactions are found when either ordinary hydrogen or deuterium is present, as gas or as water. Of course, some of this material—but not all—results because ordinary impurities within the environment are concentrated on the surface. In some cases, great care was taken to purify the system. In addition, some of the anomalous elements are many orders of magnitude more than can be attributed to contamination, and some have an abnormal isotopic ratio.

In general, a special solid environment needs to be created, and the effect can be enhanced by electrical discharge. This aspect of the phenomena is proposed as a way to reduce the radioactivity of nuclear waste, by releasing energy stored in the unstable nucleus more rapidly. In other words, either the half-life is shortened, or the nucleus is converted to a stable isotope. In this manner, the nuclear waste poisons produced by fission power might be removed while making useful energy, all without making more poison. In this sense, cold fusion is higher up the evolutionary ladder to a more perfect energy source.



Courtesy of *Infinite Energy*

The author at the Cold Fusion and New Energy Symposium in October 1998.

Where to Now?

Where do we go from here?

First, the special environments in which these nuclear reactions occur need to be identified and investigated. The common assumption that the active material is β-PdD has wasted much effort. Actually, the structures are very small regions within an inert material, and can be any one of many kinds of materials able to acquire a high concentration of deuterium or hydrogen. Although palladium is one of these materials, the compound β-PdD is not the structure in which the nuclear reactions occur. This realization shifts attention away from bulk material, which can be easily studied, to very small regions within a larger structure, which are not so easy to study.

In other words, the cost of tools needed to understand this effect has just gone up. This creates a Catch-22. The present, rejecting attitude restricts investigators to using simple tools, which are incapable of answering the questions skeptics demand be answered. Without these answers, no money will be spent on the required tools.

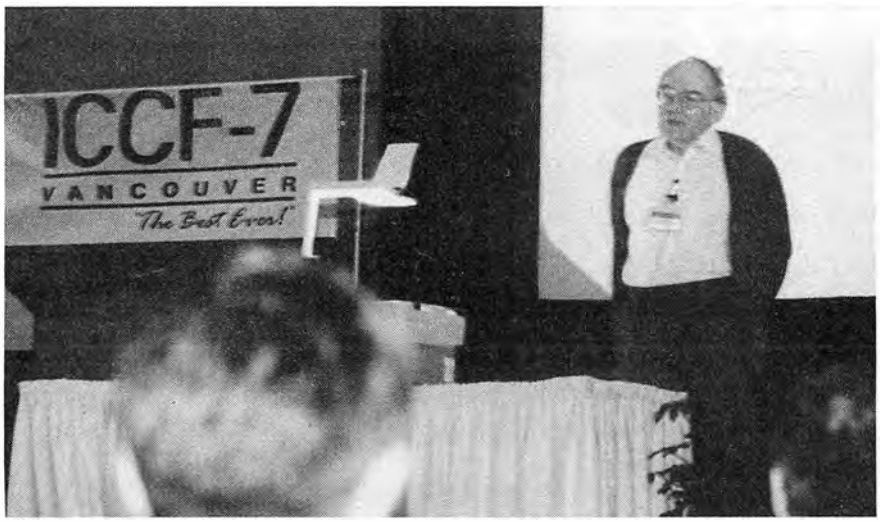
The literature now consists of more than 3,000 papers having some relationship to the effect, with about 1,000 of these useful for an understanding. Many are published in peer-reviewed journals. More than 500 variations on various themes have been proposed as explanations, with about a dozen being useful. Work is being done in six countries with official government support in most.

Of this group, only the United States has resisted supporting any but a small effort. In fact, the U.S. Patent Office is unique in refusing to issue patents on the subject. The United States is now the largest user of polluting energy, yet resists any change in this situation, even to the point of completely ignoring a method to make safe nuclear energy. How much worse must the situation become before our leaders come to their senses?

Dr. Edmund Storms retired in October 1991 from Los Alamos National Laboratory in New Mexico, where he had worked for 32 years. His research there was on the SP-100 space nuclear program, and space nuclear propulsion systems. He continues to conduct his own research in "cold fusion," and has published many articles on the subject.

References

1. R. Park, 2000. *Voodoo Science.* (New York: Oxford University Press) 211 pages.
2. C.G. Beaudette, 2000. *Excess Heat. Why Cold Fusion Research Prevailed.* (Concord, N.H.: Oak Grove Press, *Infinite Energy,* Distributor) 365 pages. Reviewed in *21st Century* by Dr. Thomas E. Phipps, Fall 2000, p. 74.
3. S. Pons, and M. Fleischmann, 1990. "Calorimetric measurements of the palladium/deuterium system: Fact and fiction." *Fusion Technol.,* Vol. 17, p. 669.
4. M.H. Miles, and B.F. Bush, 1994. "Heat and Helium Measurements in Deuterated Palladium." *Trans. Fusion Technol.,* Vol. 26(4T), p. 156.
5. B. Bush, and J.J. Lagowski, 1998."Methods of Generating Excess Heat with the Pons and Fleischmann Effect: Rigorous and Cost Effective Calorimetry, Nuclear Products Analysis of the Cathode and Helium Analysis," in *Seventh International Conference on Cold Fusion.* Vancouver, Canada: ENECO, Inc., Salt Lake City, Utah.
6. M.C.H. McKubre, et al., 2000. "The Emergence of a Coherent Explanation for Anomalies Observed in D/Pd and H/Pd System: Evidence for He-4 and He-3 Production," in *Eighth International Conference on Cold Fusion.* Lerici (La Spezia), Italy: Italian Physical Society, Bologna, Italy.
7. L.C. Case, 1998. 'Catalytic Fusion of Deuterium into Helium-4," in *Seventh International Conference on Cold Fusion.* 1998. Vancouver, Canada: ENECO, Inc., Salt Lake City, Utah.
8. Y. Arata, and Y.-C.Zhang, 1997. "Helium (He-4, He-3) within deuterated Pd-black." *Proc. Japan Acad. B,* Vol. 73, p. 1.
9. E. Storms, 2000. "Excess Power Production from Platinum Cathodes Using the Pons-Fleischmann Effect," in *Eighth International*

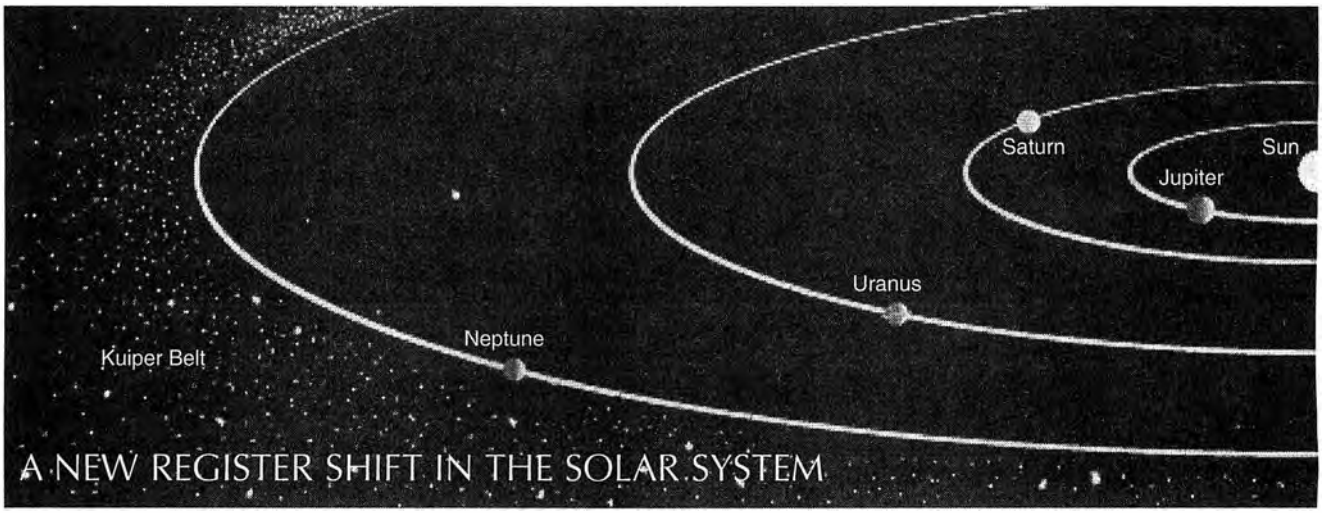


Edmund Storms

"The original Pons-Fleischmann method of cold fusion has been replicated hundreds of times, producing anomalous energy in every country where the method was used." Here, electrochemist Martin Fleischmann addressing the 7th International Conference on Cold Fusion, held in Vancouver in 1999.

Conference on Cold Fusion. 2000 Lerici (La Spezia), Italy: Italian Physical Society, Bologna,Italy.

10. G. Miley, et al., 2000. "Advances in Thin-Film Electrode Experiments," in *Eighth International Conference on Cold Fusion.* Lerici (La Spezia), Italy: Italian Physical Society, Bologna, Italy.
11. J. Divisek, L. Fuerst, and J. Balej, 1989. "Energy balance of D_2O electrolysis with a palladium cathode. Part II. Experimental results." *J. Electroanal. Chem.,* Vol. 278, p. 99.
12. C.T. Dillon, and B.J. Kennedy, 1993. "The electrochemically formed palladium-deuterium system. I. Surface composition and morphology." *Aust. J. Chem.,* Vol. 46, p. 663.
13. D.S. Silver, J. Dash, and P.S. Keefe, 1993. "Surface topography of a palladium cathode after electrolysis in heavy water." *Fusion Technol.,* Vol. 24, p. 423.
14. J. Dash, G. Noble, and D. Diman, 1994. "Surface Morphology and Microcomposition of Palladium Cathodes After Electrolysis in Acified Light and Heavy Water: Correlation With Excess Heat." *Trans. Fusion Technol.* Vol. 26 (4T), p. 299.
15. J.O.M. Bockris, and Z. Minevski, 1996. "Two zones of "Impurities" observed after prolonged electrolysis of deuterium on palladium." *Infinite Energy,* Vol. 1 Nos. 5/6, p. 67.
16. T. Ohmori, et al., 1997. "Transmutation in the electrolysis of light water-excess energy and iron production in a gold electrode." *Fusion Technol.,* Vol. 31, p. 210.
17. T. Ohmori, et al., 1997. "Low temperature nuclear transmutation forming iron on/in gold electrode during light water electrolysis." *J. Hydrogen Energy,* Vol. 22, p. 459.
18. Y. Iwamura, et al., 1998. "Detection of anomalous elements, X-ray, and excess heat in a D_2-Pd system and its interpretation by the electron-induced nuclear reaction model." *Fusion Technol.,* Vol. 33, p. 476.
19. T. Mizuno, et al., 1998. "Confirmation of the changes of isotopic distribution. for the elements on palladium cathode after strong electrolysis in D_2O solutions." *Int. J. Soc. Mat. Eng. Resources,* Vol. 6, No. 1, p. 45.
20. V. Nassisi, 1998. "Transmutation of elements in saturated palladium hydrides by an XeCl excimer laser." *Fusion Technol.,* Vol. 33, p. 468.
21. T. Ohmori, et al., 1998. "Nuclear transmutation reaction occurring during the light water electrolysis on Pd electrode." *Int. J. Soc. Mat. Eng. Resources,* Vol. 6, No. 1, p. 35.
22. T. Ohmori, et al., 1998. "Transmutation in a gold-light water electrolysis system." *Fusion Technol.,* Vol. 33, p. 367.
23. I. Savvatimova, 1998. "Transmutation Effects in the Cathode Exposed Glow Discharge, Nuclear Phenomena or Ion Irradiation Results?" in *Seventh International Conference on Cold Fusion.* 1998. Vancouver, Canada: ENECO, Inc., Salt Lake City, Utah.
24. Y. Iwamura, et al., 1998. "Detection of Anomalous Elements, X-ray and Excess Heat Induced by Continuous Diffusion of Deuterium Through Multi-layer Cathode (Pd/CaO/Pd)," in *Seventh International Conference on Cold Fusion.* 1998. Vancouver, Canada: ENECO, Inc., Salt Lake City, Utah.
25. V. Nassisi, and M.L. Longo, 2000. "Experimental results of transmutation of elements observed in etched palladium samples by an excimer laser." *Fusion Technol.,* Vol. 37, p. 247.
26. X.Z. Li, et al., 2000. "Nuclear Transmutation in Pd Deuteride," in *Eighth International Conference on Cold Fusion.* Lerici (La Spezia), Italy: Italian Physical Society, Bologna, Italy.
27. Y. Iwamura, T. Itoh, and M. Sakano, 2000. "Nuclear Products and Their Time Dependence Induced by Continuous Diffusion of Deuterium Through Multi-layer Palladium Containing Low Work Function Material." in *Eighth International Conference on Cold Fusion.* Lerici (La Spezia), Italy: Italian Physical Society, Bologna, Italy.
28. J. Warner, and J. Dash, 2000."Heat Produced During the Electrolysis of D_2O with Titanium Cathodes." in *Eighth International Conference on Cold Fusion.* Lerici (La Spezia), Italy: Italian Physical Society, Bologna, Italy.



How I Know Pluto Is a Kuiper Object

by Jeremy Batterson

In 1986, when I first heard of the discovery of the asteroid Chiron (discovered in 1970), and, soon after, another such asteroid, in an orbit between Jupiter and Neptune, I thought to myself, "Aha! Another asteroid belt is being discovered." Although not then familiar with the conception of Lyndon LaRouche and his associate Jonathan Tennenbaum of the idea of "register shifts" in the solar system,[1] I did know of "Bode's Law," and of the Kepler model of approximate planetary distances, using nested Platonic solids. Although these models were crude approximations, nonetheless, they gave a tantalizing taste of some ordering principle which had not yet been found.

In this report, I reflect on an exciting discovery that is gradually coming to be accepted by more and more people within the astronomical community. Although, since its discovery in 1930, Pluto has been thought of as the ninth planet, the evidence now shows it to be the largest of a newly discovered grouping of asteroids, which take up a position in the solar system known as the Kuiper Belt. Like most discoveries, it is disturbing but also elating, when we realize that the new and true system is more worthy than the false system it replaces, but which we may be attached to emotionally.

Bode's Law

In 1772, Johann Bode, the director of the Berlin Observatory, publicized the discovery of Titius of Wittenberg, a discovery today called the "Titius-Bode Law" of planetary distances. Starting with the number 0, and jumping to 3, Titius produced a series, where each successive term after 3 was the previous term doubled. Next, he added 4 to each term. (See Table 1) This fit very closely with the known planets of the time. (This was before the discovery of Uranus and Neptune.)

Most striking in this pattern, is the glaring gap between Mars and Jupiter, which led to the hypothesis that an unknown planet must exist in the gap. Based on his work with musical intervals, Kepler hypothesized that there was either a planet, or a region of instability; and that a common characteristic geometry (a "curvature" as we say now) underlay both the geometry of music, and the geometry of the universe at large.

In 1801, the Italian Giuseppe Piazzi discovered an object that was at first considered to be the missing planet; it was named Ceres. A year later, a German amateur astronomer, who ran a search from the roof-top observatory of his house, discovered Pallas. He suggested that the two known bodies could be part of an exploded planet, and that other pieces of this former planet might exist. Today, we know of thousands of such "asteroids."

Table 1
BODE'S LAW FOR THE FIRST 6 PLANETS

	Base	Plus 4	Real Distance (Earth = 10)
Mercury	0	4	3.9
Venus	3	7	7.2
Earth	6	10	10
Mars	12	16	15.2
[**?**	24	28	28]
Jupiter	48	52	52
Saturn	96	100	95.4

The "Asteroid Belt" would seem to be a region of instability, where the matter that normally would coalesce into a planet, was prevented from doing so, and, instead, formed countless small planetoids. However, this belt fit neatly into the gap that had been hypothesized as the location of a missing world.

When Uranus was discovered in 1781, it was noticed with delight that it

also fit very neatly into the "Bode's law" scenario, and it was assumed that further planets would also fall into this pattern. However, notice that the pattern breaks down with Neptune and Pluto. Pluto occupies a position which one would expect to be occupied by Neptune, while Neptune is far closer to the Sun than the rule would allow.

See the continuation of the earlier pattern in Table 2:

In 1988, LaRouche associate Jonathan Tennenbaum hypothesized that the asteroid belt existed at a region in the solar system's ordering which played the same role as that of a "register shift" in the geometry of the human singing voice; that is, the region in voice registration where the increase of pitch meets a roadblock, and a change of method of singing must be employed in order to break through the barrier. Although most modern music teachers try to smooth over these shifts, they are a physical fact of the geometry of the voice. Register shifts are a region of instability of the voice, where the singer must "change gears," or risk damaging his or her voice permanently. (One reason that most opera singers don't last very long any more, is because they are taught to ignore this fact by our modern Cartesian theory of music. Thus, they often lose their voices at a very young age.)

Table 2
BODE'S LAW FOR THE OUTER PLANETS

	Base	Plus 4	Real Distance (Earth = 10)
Uranus	192	196	191.8
Neptune	384	388	300
Pluto	768	772	390

After our solar system's "register shift," the nature of the planets changes very dramatically: Before the asteroid belt, planets are rocky and dense, like the Earth. However, beyond the belt, planets take the form of the "gas giants" such as Jupiter—large and gaseous. The largest "terrestrial planet, Earth, has a diameter of 12,756 km. The smallest of the "gas giants," Uranus and Neptune, are four times that large. Beyond the belt, there is a jump in scale for the planets. Thus, the asteroid belt is like a "register shift" between the two types of planets. Planetary satellites beyond the register shift are characteristically different from those planets inside it.

When I heard of this idea, I immediately remembered Chiron and the second asteroid belt hypothesis. "Oh!" I thought. "Could this second asteroid belt be a second register shift between Neptune and Pluto?" This would explain the shift from the gas giant planets, back to "ice midget" Pluto. Although Chiron was not in an orbit between Neptune and Pluto (it orbits between Jupiter and Neptune), I figured that, as more of these new asteroids were found, they would average out into an orbit that did lie between Neptune and Pluto. The first actual body in what is now called the "Kuiper Belt," was found in 1992.

Now, a decade later, about 300 of these "Kuiper Belt" asteroids have been found, and most of them have orbits similar to Pluto's. They never pass farther from the Sun than about 55 AU. Many are highly elliptical, such that they pass near, or within, the orbit of Neptune at their closest points to the Sun, like Pluto.

About 35 percent of them have a 3:2 resonance with Neptune, as does Pluto, and have been given the name "Plutinos," because of this. This means that for every three Neptune revolutions around the Sun, these bodies orbit twice around the Sun. This prevents them from interacting with Neptune's gravity field, or, in some cases, even crashing into Neptune. If they did not have such a resonance, or some other resonance, they would have unstable orbits. Close encounters with Neptune would disrupt both their own and Neptune's orbits.

The bulk of the rest of these bodies are called "Classical Kuiper Belt Objects." They have far less elliptical orbits, and, thus, do not need resonances with Neptune, because they never get too near to it. Objects such as Chiron have unstable orbits, and are believed to be originally from the Kuiper Belt.

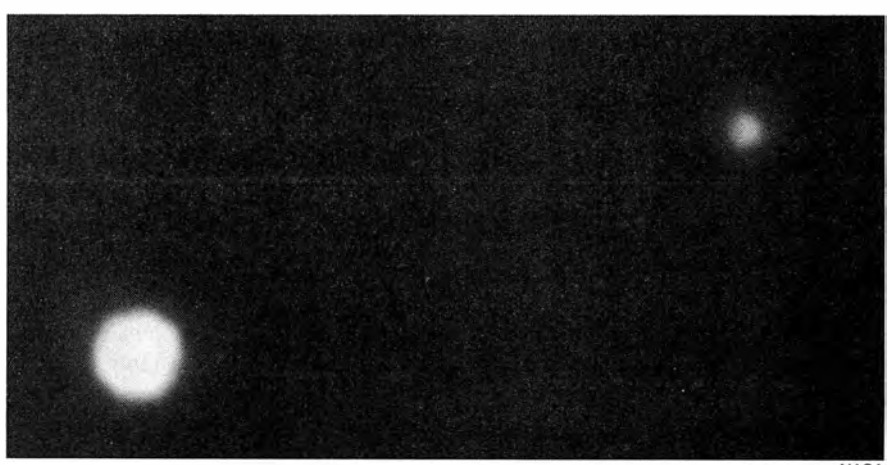
In 2000, astronomers at the Inter-American Observatory in Chile searched six areas of the sky, about equal in area to a full moon, and discovered 24 new such objects, 9 of which were larger than 160 km in diameter. By extrapolating these data to the remaining uncharted area of the ecliptic plane, it was estimated that there are 35,000 of these objects larger than 100 km in diameter. Several of the most recent Kuiper objects found are similar in size to the giant asteroid Ceres. It is probably only a matter of time before even larger ones are found.

It may even be the case that one, or several, larger than Pluto itself, will be found. For comparison, the asteroid belt has only a relative handful of asteroids larger than 100 km in diameter Thus, this belt is far more extensive and massive than the first asteroid belt.

Pluto Is Not a Planet!

The evidence against Pluto's being a planet is now massive and overwhelming. Pluto has always seemed a strange planet. Its tiny size of 2,274 km, makes it smaller than our own Moon, with a mass that is only one-sixth that of our Moon. For comparison, Mercury, the smallest planet other than Pluto, has a mass 26 times greater than Pluto. In fact, because of its

Continued on page 85



NASA

Pluto and its moon, Charon, as seen by the Hubble Space Telescope, Feb. 21, 1994, when Pluto was 2.7 billion miles from the Earth.

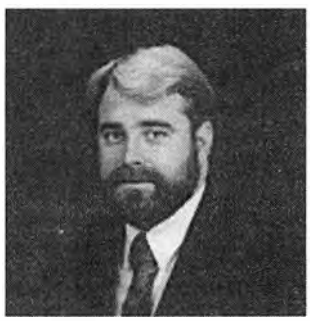
A Biochemical Approach for Treating Degenerative Diseases of Aging

by Marjorie Mazel Hecht

What if you could provide the human body with the biochemicals—amino acids, enzymes, and so on—which are critical for optimal cell functioning, but which naturally decline 2 percent per year, after the age of 20, as the body ages? Could you then prolong healthy human life, and slow down or even stop the process of degenerative diseases? This is the question that fascinated biochemist Timothy Cochran as an 18-year-old student, sitting in a college biology class about the cell. Although the teacher and his fellow students laughed at the idea, Cochran pursued it with passion, making it his mission in life.

Many years later, established as a therapeutic biochemist, he succeeded in developing what is called the Cochran Regimen, a patented mixture of 76 essential amino acids, enzymes, hormones, minerals, vitamins, and essential fatty acids, to keep cells optimally functional. It is the product of nearly 30 years of his research work, which he has supported with his own funds from a family business. A few years ago, he set up a nonprofit research foundation (the Cochran Foundation of Medical Research[1]) to further his research.

Clinical trials over the past five years, with cardiovascular and Parkinson's patients, have shown positive and often remarkable results. The Cochran Regimen relieves many symptoms of Parkinson's (especially with those who are not in an advanced stage of the disease), and has enabled some people to leave their wheelchairs, to walk without difficulty, to take care of their basic needs (such as using the toilet or getting dressed without assistance), and to have less severe tremors. Although patients at an earlier stage of the disease had considerable relief of symptoms, some improvement was seen even in those people in later stages of the disease.



Biochemist Timothy Cochran: A passion for stopping degenerative disease.

For heart patients, the Cochran Regimen lowers blood pressure, cholesterol, pulse rate, and blood sugar and improves cardiac output and energy levels. It enables patients to progressively lower the doses of the prescribed drugs they are taking, many of which have known detrimental side effects. Almost all the patients in the cardiovascular clinical trial showed improvement (93 percent), and some showed considerable improvement. (See box and table pp. 84-85.)

More recent treatment of patients with various ailments, including chronic fatigue syndrome, fibromyalgia, and ALS (Lou Gehrig's disease), have shown that the Cochran Regimen relieves symptoms. The effect on ALS in one recent case is remarkable; the patient's symptoms abated, and he was able to work normally. No other treatment has been available for this killer disease.

The Cochran Regimen is relatively inexpensive and simple to use. It is not toxic. It comes in powdered form, which is mixed with water or juice and ingested three times a day, before meals. It requires a doctor's prescription, and is adjusted to the biochemical needs of each patient, based on information from blood tests and case histories. The formulation is prepared and supplied by an FDA-approved pharmaceutical laboratory in central California.

As Cochran stresses, this is not "alternative" medicine; it is just "good science."

For an objective observer, looking at the results of the clinical trials and individual cases so far, the question is, why aren't there more and larger trials going on with cardiovascular and Parkinson's patients? Why isn't there major funding to test the efficacy of the Cochran Regimen with a host of degenerative diseases, including cancers? Why aren't we funding pilot projects to see if the use of this regimen should be *routine* for all aging human beings, to prevent the onset of degenerative diseases? Why don't we have a Manhattan Project approach for basic research to extend healthy human life?

The Biochemical Formula

Cochran's attack on the problem of degenerative diseases and aging starts with very traditional molecular biological assumptions. He looked at the body's cells, how they function, and what they optimally need. As he put it: "All of your cells have a language, linguistic structure, and command system. All cells obey the laws of physics and chemistry. The only language that they know and understand is one of hormones, amino acids, enzymes, minerals, and fatty acids. If you give them biochemically what they require and are asking for, the cells respond in a positive fashion, as they were designed to do."

Cochran looked at all major cell groups, and what was required to keep them functioning, rebuilding and

Note

1. The Cochran Foundation of Medical Research, specializing in cardiovascular and neurological diseases, is a 501 (3)C nonprofit foundation, P.O. Box 9060 Cedarpines Park, Calif. 92322. Phone: (909) 338-7012; Fax: (909) 338-4010; e mail: Cochran-Foundation@worldnet.att.net.

Stuart Lewis/EIRNS

Although the average lifespan has increased, there is little basic research into the degenerative diseases of aging.

repairing themselves when necessary, and the "command" formats that control the cycles for tissue regeneration. Then he set about to return to the body the natural substances that are designed to give and receive those commands.

"Cells talk," Cochran says. "Think of your cells as you would a hungry child. If a child is hungry, you don't give him a dirt clod. . . . If your body is screaming for help, and you don't understand the language it is speaking, the result will be only physical degeneration and, eventually, death."

Many of the biochemicals in Cochran's formulation have been well studied individually, and their effects on some diseases are known. For example, co-enzyme Q-10, melatonin, and DHEA have been found to have some partial effects on cardiovascular disease. But, Cochran points out, there have been "no concerted efforts to combine various biochemical compounds as a regimen, and to observe the effects when given in a therapeutic dose that aims to match the levels of early adulthood."

It is important to understand, Cochran stresses, that the natural compounds have to be administered in the proper quantities. It's not simply a case of throwing in one of this for the heart, two of that for the liver, and so on. He has devised specific ratios of the compounds to ensure that they work together to improve the cells of the body as a whole.

The first goal of the treatment, according to Cochran, is to activate dormant neurons, so that they can begin "communicating" again. Next, the objective is to re-activate the damaged neuron tracks, by fostering sprouting and growth of the neurons, so that they can spread out and connect with other neurons, bypassing the damaged areas of the neuron track and thus restoring normal functioning.

The key, Cochran says, is to get back into the body those particular biochemicals that will properly interface with the cellular membranes and gain transport to the neural cells, and, at the same time, to get other biochemicals to the right cellular place for repair work. He has studied the intricacies of the workings of each biochemical in such detail, that he refers to them as his "friends and buddies," as he explains what each component can and cannot do.

Cochran chose to begin the therapeutic application of his theory to cardiovascular disease, because it is so prevalent as a disease of aging—up to 60 million people in the United States, he estimates, have some form of cardiovascular disease—hypertension or elevated pulse, for example. He enjoys working in cardiology, he says, because it involves a host of different physiological systems, and the benchmark physiology is well known.

He was encouraged to take on Parkinson's Disease by a Columbia University-trained neurologist from India, who saw the data for a cardiology patient from Stanford University Hospital who had been treated with the Cochran Regimen. The neurologist, who heads the largest neurology hospital in Asia, then convinced Cochran to apply his Regimen to Parkinson's Disease. The first Parkinson's patient Cochran treated was a pharmacologist who had early-stage Parkinson's and who had retired to India from a career at the U.S. National Institutes of Health.

Initially, Cochran tackled the problem of Parkinson's by studying the biomarkers for the disease, and evaluating what particular biochemicals might affect these biomarkers. For example, he was the first to see the association of Parkinson's with injury to the respiration mechanism in the mitochondria of neural cells, and he tried using coenzyme Q-10 and taurine to help overcome this. He also noticed a reduced level of glutathion in Parkinson's neural cells, and was the first to try glutathion-building nutrients, such as lipoic acid, as a remedy.

Another of his ideas was to increase the amount of taurine, which influences the movement of calcium ions in the brain, and helps stabilize the neural cell membranes. By increasing taurine levels over those normally produced by the liver, he hypothesized, two other amino acids, methionine and cysteine, would be freed up for better use in other biochemical pathways.

About 50 percent of the Parkinson's patients treated with the Cochran Regimen show dramatic improvement, and another 25 percent show moderate improvement, while the remaining 25 percent show little or no improvement. Cochran is continuing to work on the Parkinson's problem, trying to determine why patients with the same level of symptoms have such different responses to the Regimen, some recovering substantially, and others partially or not at all.

The Biochemical Formula

In shorthand, Cochran's biochemistry formula is:

$$H \times 2A + 3E + 3M = DNA - RNAr \geqq TR$$

Total Human Physiological Systems.

SELECTED RESULTS OF CARDIOVASCULAR CLINICAL TRIAL (1997-1998)

23 patients

	Pulse				Blood pressure/systolic				Blood pressure/diastolic			
Patient no.	Starting pulse	1-month pulse	3-month pulse	End pulse	Starting systolic	1-month systolic	3-month systolic	End systolic	Starting diastolic	1-month diastolic	3-month diastolic	End diastolic
1	90	90	80	75	130	120	110	110	90	84	70	60
2	112	100	90	84	130	110	110	110	70	70	64	64
3	98	90	90	80	140	120	110	100	100	90	70	60
4	100	80	70	70	146	120	118	110	110	90	80	70
5	90	—	90	84	138	—	110	100	86	—	80	64
6	96	90	74	68	140	118	110	110	90	80	80	80
7	100	82	80	64	168	130	110	100	110	90	80	70
8	108	—	—	70	150	—	—	110	100	—	—	60
9	96	90	80	70	168	150	150	134	116	100	90	90
10	115	112	110	110	148	130	120	112	100	90	84	72
11	100	—	—	70	162	—	—	110	100	—	—	64
12	110	90	80	66	170	140	130	120	110	90	80	60
13	90	90	90	80	140	130	130	130	90	90	90	90
14	118	100	90	80	160	130	120	110	126	90	80	70
15	130	110	94	64	142	130	120	120	100	100	90	70
16	88	80	70	60	130	120	110	108	88	80	74	60
17	124	100	80	70	190	140	120	112	126	90	90	68
18	94	90	80	74	140	130	120	120	100	90	70	70
19	110	80	80	80	180	118	110	108	110	80	70	60
20	84	80	77	60	164	130	110	110	90	90	70	68
21	90	84	80	70	150	130	118	112	100	80	70	60
22	140	130	130	120	190	150	150	150	112	110	110	110
23	110	90	90	80	160	110	110	110	110	80	70	60

Source: Cochran Foundation of Medical Research

Here is how Cochran describes the formulation:

(1) The first ingredient is hormones, (H). When processed and secreted into the body fluids by a hormone production cell or groups of cells, hormones exercise massive physiological control, activating a wide range of physiological processes. Cochran aimed to keep the hormone level at that which it is when the body is at its biological prime.

(2) The second ingredient is amino acids (A). These are doubled. The formula includes both the essential and non-essential amino acids, which the body requires for proper synthesis of proteins in cells.

(3) The third ingredient is enzymes (E). These are enhanced three times, in order to offset the degeneration that naturally comes with age. Inside the cell, enzymes initiate and increase the rate of required biochemical reactions.

(4) The fourth ingredient is mineral ions (M), naturally occurring inorganic chemical compounds, which are required for proper cellular operations. These maintain a state of dynamic equilibrium, not only at the molecular and cellular levels, but for the entire physiological mechanism.

(5) The fifth ingredient is the essential fatty acids.

(6) DNA – RNAr refers to the regulation and control of the transcription and translation processes in the production of new and improved cellular protein. According to Cochran, even aged cells retain their blueprint for functioning, but they no longer are being given the "instructions or resources to perform the required task of normal cellular function."

(7) The point of the Regimen is to lead to a situation where the above ingredients, and the reactivated DNA/RNA functioning, enable tissue regeneration. By allowing the rebuilding and repair cycles to continue, along with protection of the cellular structure, the cells can follow the same patterns of functioning that they did when the body was 23 years old.

By biochemically invoking the "laws" of the body's cellular functioning, Cochran reasons, not only do you reach the "control cycles for tissue regeneration," but also you destroy "the biochemical deterioration state or medium that allows the disease to exist and grow." Thus, you "take away the medium that the disease must have to exist, and by doing so, you therefore destroy the disease's ability to survive."

The Future

The next step, according to Cochran, is to test the formulation in much wider clinical trials, with a variety of patients, which would provide a broader basis on which to assess when the Cochran Regimen works best, and perhaps gain some insight into exactly why it has been successful. But this requires large-scale clinical trials, and large-scale clinical trials require major funding, which right now, is not there.

Cochran's foundation has had some funding offers, but with strings attached

that were unacceptable. And so, he is continuing to use his own funds to pursue the research. He recalls the words of one of his professors: " 'If those are your ideas and you have the money to prove it, then that's fine, but you aren't going to get that kind of grant money from somebody else to prove it.' "So," he says, "I put my money where my thoughts were."

Besides, he says, sometimes grant money can limit your research, and "we wanted to have the intellectual freedom to be able to pursue whatever lead comes up."

The word, however, is getting out on how the Cochran Regimen has helped many individuals with a variety of incurable diseases, and some major institutions are beginning to take notice. A cardiovascular study with 100 to 200 patients in southern California is in the works.

Cochran also works regularly with hospitals in California and physicians around the country. His outlook for the future is a philosophical one: "The Cochran Regimen is more effective, nontoxic, and relatively cheap, and it is an idea whose time will come," he says, "and the sooner the better for millions of people whose lives could be improved."

How has the medical community responded? In some individual cases, with enthusiasm. William Regelson, M.D., for example, a professor emeritus at the Medical College of Virginia, who specializes in aging (and who alerted this writer to Cochran's work), sees the regimen as having great promise—and the medical community as being too narrow-minded to understand something new. Richard Passwater, Ph.D., a researcher who works on nutrition, has investigated and publicized the Cochran Regimen in his monthly newsletter, urging cardiovascular and Parkinson's patients to have their physicians enroll them in the regimen.

Again Cochran takes a philosophical approach. He has seen the amazement of many physicians when their supposedly incurably ill patients improve, and yet, he says, those same physicians remain unwilling to expand the use of the treatment to other patients. "They just don't want to rock the professional boat," he says. "Medicine is a self-serving business. And, many physicians don't want to understand that biochemicals—instead of costly drugs—can be a solution."

Ultimately, however, Cochran is certain that the proven success of his treatment will prevail, and that someday, its use in fighting and curing degenerative diseases, including ordinary aging, will be commonplace.

Cardiovascular Disease Clinical Study

In a clinical trial, conducted in 1997-1998 in India, there were 23 cardiovascular patients, 21 male and 2 female, with a mean age of 64.5. The patients took no medication—for blood pressure, cholesterol, and so on—during the trial, only the Cochran Regimen.

Here are some of the results (see table):

Pulse rate. Pulse decreased promptly and then stabilized.

Blood pressure. Blood pressure fell quickly, going from an average of 154/104 to an average of 128/88 after one month, and an average of 111/79 after three months.

Cholesterol. There was an average 17 percent reduction in cholesterol.

Quality of life. After six months, only one patient was nonresponsive, while the average patient went from "a severely restricted life to one in which normal activities are now possible with minimum fatigue."

This study was undertaken by U.S.-trained physicians, who worked in India, after they saw the results of a "pilot patient" at Stanford University Hospital. This patient, who had been near death, showed dramatic improvement after taking the Cochran Regimen. The patient had been treated for heart disease for 10 years at the Stanford hospital.

Pluto a Kuiper Body

Continued from page 81

low density, Pluto's mass is even less than that of the largest asteroid, Ceres.

Far more devastating than its size and mass, to Pluto's status as a planet—at least from a Keplerian standpoint—is its orbital characteristic. Pluto is the only planet whose perihelion (point closest to the Sun) lies inside the orbit of another planet. For 20 years out of the 247.7 years that it takes to revolve around the Sun, Pluto lies closer to the Sun than Neptune. The last 20 year period like this occurred from 1979 to 1999. At this writing, Pluto is about 30 AU (astronomical units) from the Sun. At aphelion (the point in its elliptical orbit farthest from the Sun), Pluto is about 50 AU from the Sun! But, this is typical for Kuiper Belt objects.

Most devastating of all to Pluto's status as a planet, is the fact that tens of thousands of other similar bodies, smaller than Pluto, have a similar characteristic orbit. It seems, thus, that Pluto plays a role within this Kuiper Belt similar to that which Ceres plays in the inner asteroid belt. It may even be the case that other bodies similar in size to Pluto exist in this same belt. Currently, the largest known bodies in the belt, are Pluto (2,274 km in diameter) and its satellite Charon (1,172 km in diameter).

In December 2000, a Kuiper belt body was discovered which may measure 1,200 km. In April 2000, a pair of bodies similar to the Pluto-Charon system, with diameters similar to that of Ceres, was discovered in the Kuiper belt.

If Kepler thought that the zone of the inner asteroids was an area of instability, let us ask: what is the geometry causing this outer area to be unstable? Why was all the matter in this disk not able to coalesce into a single planet? One argument now is that the matter was too far apart and too disperse to do so.

What would we say from a Keplerian standpoint? What is the change in the order of matter, beyond this second register shift in the solar system? What form would any planets beyond this belt take? Are there other register shifts farther out than this?

Notes

1. Jonathan Tennenbaum, 1988. "New Discoveries on the Curvature of Space," *21st Century* (Sept.-Oct.), pp. 20-36.

America's Ancient Forests Were Managed

by Richard S. Bennett

America's Ancient Forests: From the Ice Age to the Age of Discovery
Dr. Thomas M. Bonnicksen
New York: John Wiley & Sons, 2000
Hardcover, 594 pp., $80.00

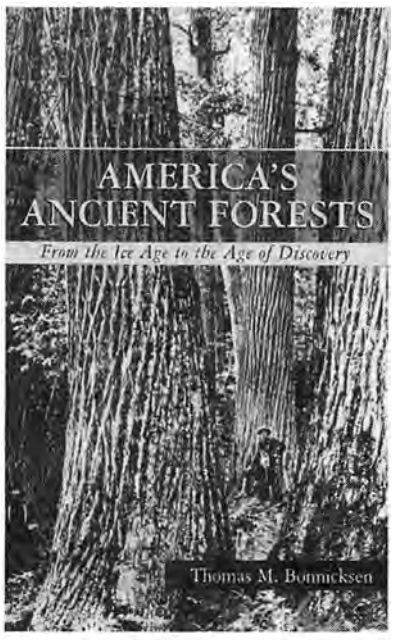
Many years ago, when the use of glass in houses began to increase, an old contractor remarked about a house he had just built, "I won't say that house has too many windows, but if any house has too many windows, this one does."

So it is with this book. There are 2,125 notes and citations, plus a bibliography of 75 pages; the text covers only slightly more than half of the book. It is an enormously detailed look at the development of America's forests from prehistoric times up to the 19th Century, when trappers roamed over the West, and it reflects the 30 years of work on the part of the author, a professor of Forest Science at Texas A & M University, that went into the writing of the book.

The book is divided into two parts. The origins of the forests and the native people who influenced their development comprise the first part. The second part describes the appearance of the forests and how they functioned when they were first seen by Europeans.

In the first chapter, there is an excellent explanation of the forces that influence climate change, with emphasis on the impact of changing orbits, tilt, and wobble as the Earth revolves around the Sun and turns on its axis. (This should be required reading for all the alarmists who fear global warming.) The book starts with the last Ice Age, when glaciers covered much of what is now the United States (and will return one day), and it describes the forests that developed as the glaciers retreated, and the animals that inhabited them.

The author gives the traditional anthropological explanation of a people he calls "Paleoindians," who came to North America from Asia over the land bridge that is now under the waters of the Bering Straits. These peoples arrived approximately 15,000 years ago, he says, and immediately began to have an



impact on the land, the animal life, the forests, and their environment. When the ice sheets had retreated enough to allow passage south, the Paleoindians expanded their range, and their descendants finally populated the entire continent, long before the arrival of the first Europeans. This book traces their impact on the range and forest resources.

America Was Not Uninhabited

Contrary to popular belief, America was not a wild and uninhabited place. The author estimates that there were several million Indians in what is now the United States and Canada. But, with a few major exceptions, they were hunters—not gatherers—and they depended on wildlife for their existence. To encourage the growth of vegetation for the larger ungulates—deer, elk, moose, and bison—the Indians regularly burned both the open prairie land and the forests. This resulted in forests with a park-like character with the disappearance of undergrowth and younger, smaller trees so necessary for forest maintenance.

Some of the more advanced tribes did grow crops, but, often the practice was to plant in the spring, move on to another place for summer hunting, and return in the late summer or early fall to harvest their meager crops of maize or beans.

With the advent of the white man, and the diseases he brought with him—smallpox being one of the more virulent—the Indian population was decimated. As a result, the use of fire decreased, and the forests regained a more natural state, composed of trees of different species, sizes, and ages.

Dr. Bonnicksen postulates that the Indians had a beneficial effect on the ancient forests, primarily through the use of fire. There are many who will disagree. Fire certainly has a place in maintaining prairie grasses, but those benefits do not necessarily extend to forested areas.

The Indians, as the author admits, were indiscriminate in their burning and often destroyed, or severely damaged, large areas of what could have been magnificent forests. Of greater negative consequence, is the lack of smaller trees and seedlings so vital to forest continuance. More than 70 pages are used to describe how the Indians—called "Fire Masters"—carried out their burning practices. These included what we would consider barbarous practices, such as making a fire circle to drive deer out of the forest so that they could be slaughtered by the waiting Indians, or drive the deer over cliffs, so that they would be killed in the fall. Game was more important than trees.

Forest species succession is well depicted. Dr. Bonnicksen sorts trees into two classes: "pioneer" trees and "settler" trees. As the ice sheets receded, or after a fire, the pioneer trees (which are not tolerant of shade) are the first to arrive and are followed by the settler trees, which start in the understory and are more shade tolerant.

A considerable number of pages is devoted to the character of most forests, in that they are composed of a mosaic of "patches" as a result of fire, natural succession of species, and tree harvesting by the Indians. Much to his credit, the author does not mention that horrible word "ecosystem," which is only used once—in the blurb on the back jacket.

'Natural' Vs. Classical

There are many in academia who take the position that the best forest management technique is to return forests to their "natural" state, and more or less let nature take its course. This promotes "biodiversity"—whatever that is. In practice, this means that the forests should be subjected to periodic burning, and that only mature trees should be harvested.

Such a viewpoint has its limitations. As a careful reading of this book illustrates, there are really no "natural" American forests, because they have all been affected by their inhabitants for many thousands of years.

If followed to its logical conclusion, the "natural" approach would also mean no tree planting, no thinning of young or intermediate stands, and no need for the science of forest genetics or fire-control activities. It would be very difficult to manage a forest for certain objectives, such as pulpwood or timber production. Soil erosion control, for example, would not be a major objective of management.

There is an opposite school of thought, which can be termed the "classical" school. This view holds that forests should be carefully managed in the European tradition, a belief that was the cornerstone of the fledgling U.S. Forest Service when it was first conceived. According to the classical philosophy, a forest should be managed for maximum benefits: "The greatest good to the greatest number of people in the long run."

America's Ancient Forests: From the Ice Age to the Age of Discovery

This 1585 woodcut by John White depicts Virginia Indians using fire to cut trees and build a dugout canoe.

Forests can be improved through management techniques that provide for wildlife and recreation, prevent soil erosion, and protect watersheds as well as timber growth and production. This is known as the "multiple use" concept. Fire has little place in such a system, because it is indiscriminate, it is often difficult to control, it destroys young seedlings and small trees, it promotes soil erosion, it contributes to air pollution, and it may destroy streams and fish life.

Also, controlled burns are extremely expensive to conduct, and the negative impacts far outweigh any positive effects it may have. Controlled burning has little or no place in European forest management, which has produced beautiful forests with wildlife and other values intact. In this classical approach, the forest is continually improved, using genetics to produce superior trees with desirable qualities, and managing the forest for specific purposes depending on its location, tree species mix, and market forces. Yet, there are some who still advocate the use of fire.

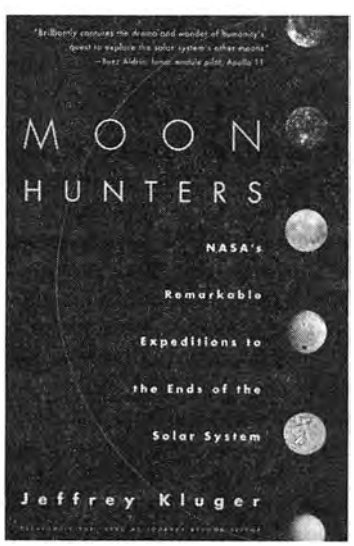
This is a well-written book, which suffers only from almost over-painstaking attention to detail, and poor binding from the publishers. It will be of value to forest researchers and managers alike.

Richard S. Bennett has taught forestry courses at the University of Wisconsin and Virginia Tech, and was a forestry advisor to the Libyan government. He was executive director of the Society for Environmental Truth (SET) for eight years, and is now its president.

Exploring the Solar System's Magnificent Moons

by Marsha Freeman

Moon Hunters: NASA's Remarkable Expeditions to the Ends Of the Solar System
Jeffrey Kluger
New York: Touchstone, 2001
Paperback, 314 pp., $14.00



Anyone who has followed the space program, and watched the launches that have taken man into space, is aware of the risks involved. The nation was in shock when the first three Apollo astronauts died in a fire on the launch pad in 1967. The entire world watched in awe, and prayed, as NASA struggled to bring the three Apollo 13 astronauts back to Earth, after their ship suffered a catastrophic explosion in an oxygen tank on its way to the Moon. And nearly 20 years after the Apollo fire, the Space Shuttle Challenger exploded in 1986, killing all seven astronauts on board.

But not often do we think about the risks, failures, and drama of sending relatively tiny spacecraft off on their own, for years at a time, to probe the small worlds of planetary moons that adorn not only the Earth, but the entire Solar System.

Jeffrey Kluger is well placed to relate not only the science, but the stories, of these missions that are the precursors for human flights, as he is the co-author, with Apollo 13 astronaut Jim Lovell, of the book *The Perilous Voyage of Apollo 13,* which was the basis for the movie "Apollo 13."

In his new book, Kluger brings the reader inside the drama of preparing,

launching, and guiding the unmanned spacecraft that have made it possible for men to go to the Moon, travelling billions of miles, opening up the rest of the Solar System for exploration.

Lunar Drama

Kluger begins his story for the hunt and exploration of moons with the nearest and most familiar, Earth's own. Before sending people to the Moon, unmanned explorers first had to chart the way. Earth-bound telescopes had, for centuries, provided a fairly detailed picture of the surface of the Moon, but finding landing targets for the Apollo astronauts required more detailed topographic maps of the lunar surface, which could be done only from lunar orbit.

Although studies of unmanned missions to photograph the Moon close up began before President Kennedy announced the Apollo program on May 25, 1961, that initiative lent a new urgency to the program. NASA's Jet Propulsion Laboratory in California was given the responsibility to design, construct, and launch the Ranger, Orbiter, and Surveyor lunar missions, to pave the way for men.

But urgency did not ensure success.

The first two Ranger missions, in 1961, were stranded in Earth orbit, because of the failure of the launch vehicles that carried them. In 1962, Rangers 3 and 4 made it to the Moon, but their communications systems failed before they were able to transmit data back to Earth. Ranger 5, launched later that same year, did not impact the Moon, which it was designed to do. Ranger 6 was launched in 1964, but failed to return data before impact.

The program, by that time behind schedule and significantly over budget, was an embarrassment to the Laboratory, to NASA, to the Congress, and to the nation. After the Ranger 6 failure, Congress investigated Project Ranger, while JPL itself, and an independent review committee, did the same.

Program management was changed by NASA, as were technical systems, and after years of failures, Ranger 7 completed a successful mission to the Moon in 1964. In a gripping description, the author recounts the vagaries of the effort, and most important, the drama of failure, and the commitment to meet the objectives.

Discovering New Moons

Kluger describes in fascinating detail, the two 1970s Voyager missions to the outer planets, without question, one of NASA's greatest triumphs.

In the 1960s, scientists at the Jet Propulsion Laboratory had noted that in the late 1970s, planetary geometry would align the four gas-giant planets—Jupiter, Saturn, Uranus, and Neptune—in such a way that one spacecraft would be able to visit all four, using a gravity-assist from each encounter to get to the next rendezvous.

The scientists were told by Congress that NASA could not afford such a 12-year "Grand Tour of the Solar System," and that only a less capable spacecraft headed just to Jupiter and Saturn, would be authorized. But the scientists and engineers at JPL had no intention of giving up on a mission that can be carried out only once every 176 years.

The engineers took a gamble that a much less expensive set of spacecraft than that originally planned for the Grand Tour, could be built, with enough robustness and redundancy, and within budget, to visit all four giant planets. And once Voyager was just a celestial stone's throw from Uranus, and then Neptune, who could really object to going there?

Breathtaking photographs, and decades' worth of data, were returned from the Voyager spacecraft. Entire miniature solar systems were discovered at Jupiter and Saturn; a tenuous ring around lopsided Uranus; and unexpected turbulence at Neptune, more than 2.5 billion miles from the Earth.

But most magnificent are the moons. Some, such as Europa and Callisto, appear to harbor liquid oceans beneath their icy surfaces, and hence the possibility of life. Each one of the Solar System's 63 known moons is unique.

Kluger discusses the recent, and ongoing, returns from the Galileo Jupiter mission, and provides a glance at the upcoming Cassini-Huygens mission to Saturn, which will release a probe into the atmosphere of its moon, Titan.

A subject which could be dry and full of too many details is made interesting, engaging, and exciting in this well-written book.

Associate Editor Marsha Freeman's most recent book, Challenges of Human Space Exploration, *was published by Springer Praxis earlier this year.*

China plans 10,000 major infrastructure projects in the next decade. Will the United States adopt this approach to make its way out of the new Great Depression?

THE EURASIAN LAND-BRIDGE

The "New Silk Road" —locomotive for worldwide economic development

A special report from *Executive Intelligence Review* including studies of:

- High-technology infrastructure development corridors
- China and Europe as Eurasia's development poles
- Crucial infrastructure projects in China
- The Eurasian Land-Bridge and development around the great ocean basins
- Financing an economic miracle: Hamiltonian credit generation
- The Eurasian Land-Bridge and the economic reconstruction of the United States

290 pages
$200

Available from:
EIR News Service
Dept. T, P.O. Box 17390
Washington, D.C. 20041-0390

Paid Advertisement

In This Issue

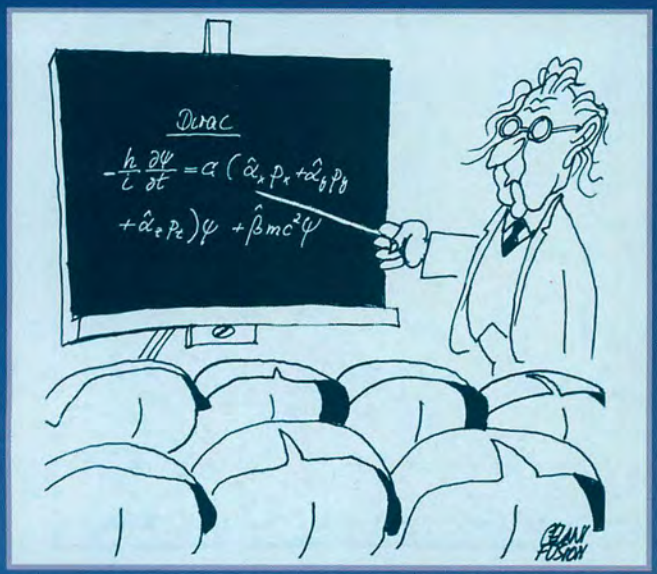


Illustration by Claudio Celani

Science, conducted according to the accepted rules of classroom mathematics, becomes a cult, ruled by an academic priesthood.

BRING SCIENCE BACK TO LIFE!

Ask a modern scientist "how do you know that you are alive?" and he is hardpressed, within the accepted rules of classroom mathematics, to give an answer. To help break out of this straitjacket, this issue's feature on Vernadsky's method presents the proceedings of a panel discussion at a recent Schiller Institute conference, which examines Vernadsky's approach to the basic questions of life, mind, and scientific discovery.

Excerpts from the conference keynote address of Lyndon H. LaRouche, Jr. situate the importance of revitalizing science and technology in order to undertake mankind's next great mission: Eurasian development.

© Warren W. Dexter

BARRY FELL AND THE EPIGRAPHIC REVOLUTION

Part 2 of the biography of Barry Fell, by his son Julian, covers the central role played by Fell in the epigraphic revolution of the last 25 years, focussing on Fell's decipherment of many Old World scripts, including the Indus Valley script, Numidian, Minoan (Linear A), the Phaistos Disk, Cypriot, Etruscan, Runic, Celtic Ogam, Iberian, and others. Fell's classical education, Renaissance outlook, and passion for truth, enabled him to succeed where others had failed, and left scores of fatally wounded establishment assumptions along the way.

© Warren W. Dexter

The Tomb of Ollamh Fodhla, ca. 1,000 B.C. This tumula is in central Ireland, at Loughcrew, County Meath, southeast of the town of Oldcastle, and at the head of the tributaries that form the Born Valley River, where a series of other ancient tombs are located. Inset is an interior view of the entrance. The inscription on the front cover is from this site.