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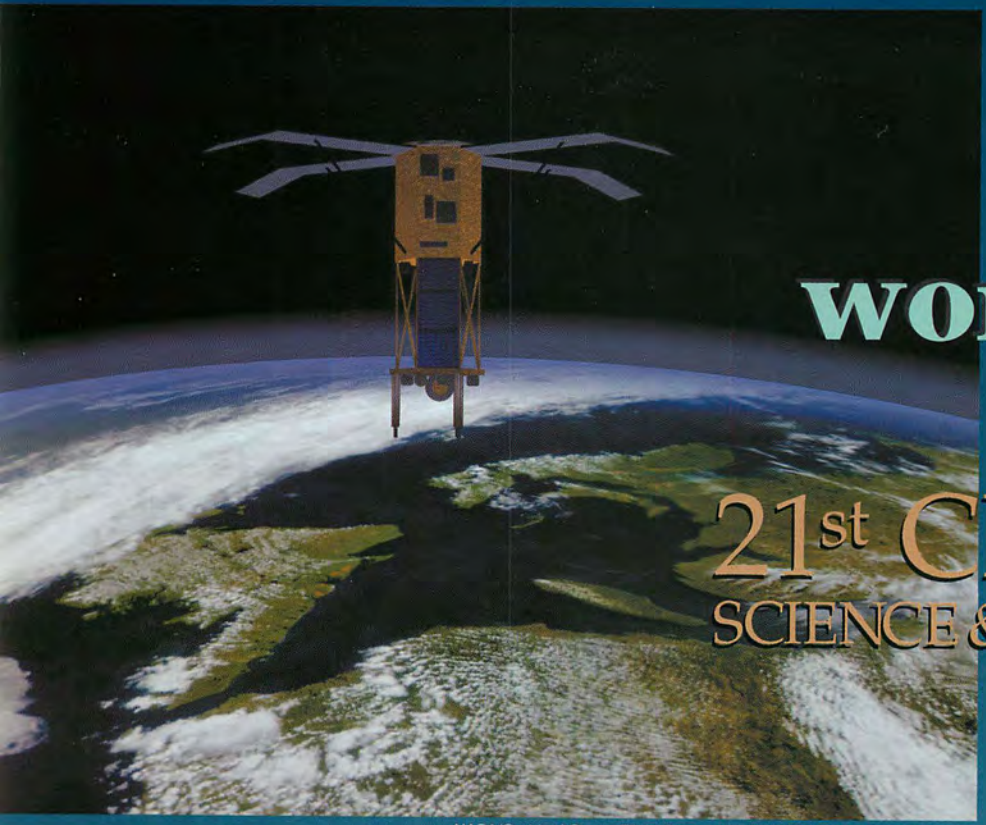

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21st CENTURY SCIENCE & TECHNOLOGY

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21st Century Science & Technology (ISSN 0895-6820) is published 4 times a year by 21st Century Science Associates, 60 Sycolin Road, Suite 203, Leesburg, Va. 20175. Tel. (703) 777-6943.

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

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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 ($8 foreign). Payments must be in U.S. currency.

Printed in the USA ISSN 0895-682

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To Stop the Pandemic, Change Your Axioms!

Never in most of our lifetimes has an existential threat to the whole of humanity been so immediate and so widely acknowledged, as the threat posed by the probable imminent emergence of a human-transmissible form of the avian influenza type A/H5N1.

Since our decision several months ago to devote our Fall issue to this topic, the level of public awareness of the danger has been raised by the devoted efforts of a number of leading figures, prominent among them the infectious disease specialist Dr. Michael Osterholm. Many media outlets have not hesitated to present the danger.

Yet, the level of government response remains vastly, obscenely, inadequate to the need. Listen to even the best-informed public figures, such as the National Institutes of Health's Dr. Anthony Fauci, as they describe the looming catastrophe with considerable precision. Then hear their proposed responses. Anyone who has truly internalized the magnitude of the threat, cannot but feel like one of the thirsty and starving citizens of New Orleans in the first week of September, as they listened to government posturing and promises of help on the way.

The failure to act adequately in face of a perceived threat of this magnitude can only be explained as a form of mass insanity. So future generations—the post "great-influenza outbreak" generations—would see it. And so must we, who wish to be history's active instruments in averting such a disaster.

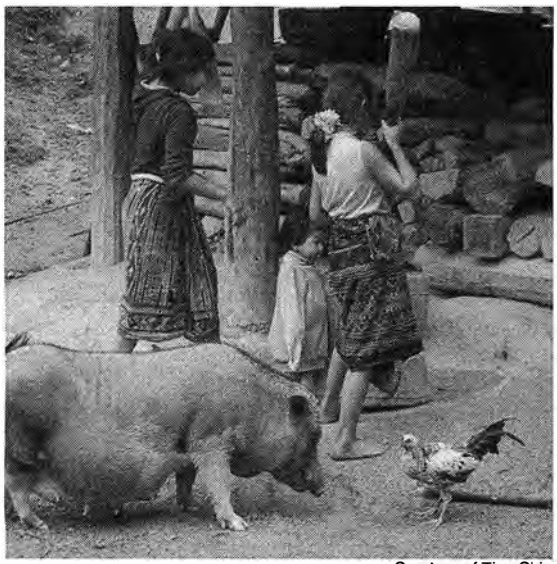
The specific insanity is a cultural problem with roots in the mid-1960s. It is the shift which took place in America and Western Europe in the period following the John F. Kennedy assassination and the buildup of the Vietnam War. The dominant theme of that cultural paradigm shift, defined by figures such as Lord Bertrand Russell, was the abandonment of a commitment to the scientific outlook as a means of solving the problems facing mankind. Russell, who had just a few years earlier argued for preemptive nuclear strikes against Russia, changed the argument: Science made war. Give up your brain, and get in touch with your feelings. If you found the taste bitter, the favorite poets and authors of the Congress of Cultural Freedom's menagerie of pessimism were there to make you feel good about feeling bad. And there were always drugs and sex.

Symptomatic was the dismemberment of the U.S. space program, even before the first astronauts set foot on the Moon. In place of the manned mission to Mars, we got the Star Trek television serial, whose principal spinoff, the "Trekkies," were the living embodiment of the shift in popular axioms from science to intellectual mass suicide.

Where Katrina Came From

Take the case of Katrina, as exemplifying the kind of mass cultural insanity we address. Following Hurricane Betsy in 1965, the Johnson Administration got Congress to authorize a project to be completed in 10 years, which included protecting the city of New Orleans with 16-foot levees. But before the 10 years was up, the decision was made not to spend the money. The cultural paradigm shift of the '68-er generation had already set in. Science was out. Infrastructure was too expensive. "Get it now while you can, and let someone else worry about the future." The process set in the economy as a whole, as the essential costs of maintaining a modern agro-industrial economy were abandoned.

Some wise guys figured out that we didn't have to produce anything at home any more. It was a lot cheaper to shop it out to cheap-labor markets in South America and Asia. Those things



Courtesy of Tien Chiu

Vietnamese peasant farming: Traditional practices provide an opening for flu virus mutation under conditions of globalized agriculture

that couldn't be imported, like health care for the poor and elderly, we'd just cut. First, it was called the Jimmy Carter Administration, a receivership under control of such Trilateral Commission and Council of Foreign Relations figures as James "Rodney the Robot" Schlesinger and Zbigniew Brzezinski. Then it was re-invented as Newt Gingrich's Conservative Revolution. The premise is the same: You don't have to actually work to make a living (unless you're poor), and government can persist forever cutting taxes for the rich.

Flu Threat Has Same Origin

Our dangerously weakened ability to respond to the now-threatening avian flu pandemic is provably a result of those same policies implemented on a global scale. Among the consequences:

- The conditions for reassortment and spread of the viral organism are provably fostered by the patterns of globablized agriculture which have developed, particularly in Asia.
- The present weakness of our public health infrastructure, has the same ideological origin.
- The same causes are behind such economic vulnerabilities as the prevalence of just-in-time inventory systems—which will mean immediate shortages in production in the event of a pandemic-induced shutdown of transportation)—a point recently emphasized by Dr. Osterholm—has the same origin.

Worse, under globalized agriculture we have developed a vulnerability in our food supply chain which will exacerbate the effects of any pandemic, and poses a catastrophic problem in its own right—the threat of worldwide famine. As elaborated in the article featured on page 34, the alarming worldwide reduction of variety in plant and animal stocks used for food production leaves us wide open to attacks by zoonotics and botanicals that could eliminate much of the world's food supply overnight.

Global Biological Holocaust

Our record on this matter goes back to physical economist Lyndon LaRouche's 1973 warning of the inevitable onset of a global biological holocaust resulting from the effects in Third World nations of the early phases of that mid-1960s cultural paradigm shift. Policies such as the replacement of village-scale agriculture with exportable mono-crop production in impoverished regions of Africa, temporarily supporting displaced populations with a flood of PL-480 food aid, were the sort of thing to be noted. Behind this came a crushing burden of debt service requirements, and the inevitable International Monetary Fund austerity programs. In the effects of those conditions on already impoverished and often deeply demoralized populations, could be found the conditions for the outbreak of old and new forms of pandemic disease.

LaRouche's associates sounded the warning in 1974 through the formation of the Fusion Energy Foundation's global Biological Holocaust Task Force. The appalling 1973 famine in the African Sahel, when this once self-sufficient region was struck by one of

Continued on page 5

Senate Proposes $3.9 Billion To Fight Avian Flu

The proposal by Senate leaders Democrat Harry Reid and Republican Bill Frist, to appropriate $3.9 billion to fight avian flu, is a move in the right direction. But don't get too excited yet: Some $3.1 billion of it is reported to be allocated to build U.S. stocks of the antiviral Tamiflu, in order to have enough for 50 percent of the U.S. population. That comes to $22 per person for 140 million Americans for a drug that is not certain to protect against the coming flu. How far is the other $0.8 billion going to go in face of a pandemic that could be more severe than the 1918 Spanish flu, which killed 40 to 50 million?

The proposal was announced on Sept. 29 by Democrat Tom Harkin of Iowa and backed by Senators Harry Reid, Barack Obama, Ted Kennedy, and Evan Bayh, as an amendment to a $50 billion-plus emergency Defense Appropriation for Iraq, about to come before the Senate. Republican Majority leader Frist endorsed the effort in a joint appearance with Democratic Senate leader Harry Reid on ABC-TV's "Nightline," Sept. 29. Key points include:

- Double global surveillance of avian flu;
- Restore Bush's $122 million budget cuts to local and state public health departments and emergency preparedness activities;
- Increase stockpiles of the Tamiflu antiviral to provide for 50 percent of the population;
- Build up and strengthen vaccine infrastructure;
- Provide new resources for outreach and education.

All the points are necessary, but they don't even begin to face the requirements of a global pandemic that could strike as early as this flu season.

There's No Global Warming, Because There's No Global Climate

We publish here an exchange on this subject which took place in the French-language science magazine Fusion. *A French farmer takes issue with an article by climatologist Marcel Leroux, "Global Warming: a Scientific Fraud"* (Fusion *No. 95, March-April 2003), and Dr. Leroux replies in the Feb.-March 2005 issue of* Fusion *(No. 103).*

Leroux is Professor of Climatology at Jean Moulin University in France, and the director of the Laboratory of Climatology, Risk, and Environment. His book, Global Warming: Myth or Reality? The Erring Ways of Climatology, *was published this year by Springer-Praxis (Springeronline.com).*

Translated by Christine Craig.

The Farmer's Objection

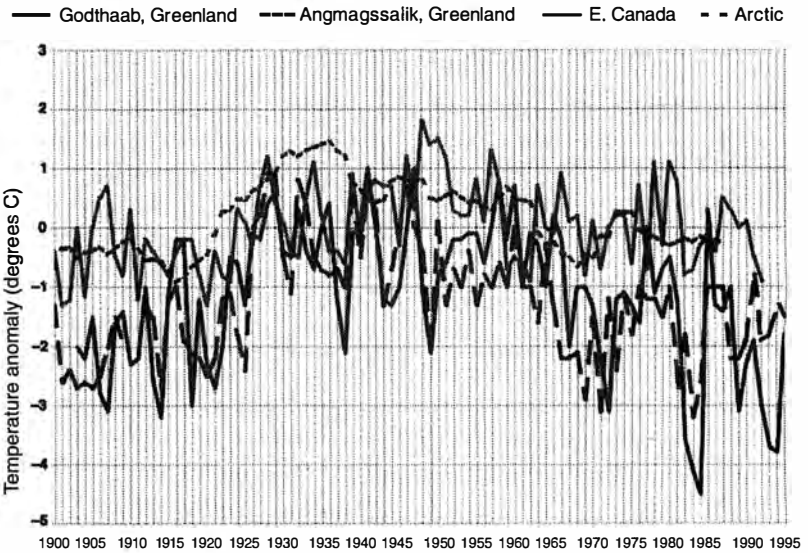
Allow me to express my reservations about the thesis of Marcel Leroux, which challenges global warming. Numerous observations of the changes in flowering habits of certain plants, and in reproduction in certain animals, indicate clearly that the climate is getting warmer. I refer you to the report of the Pew Center on Global Climate Change, which is about to be published on this subject, and which proves that the temperature of the tundra in Alaska has increased an average of 2°C to 4°C in the last five years.

—OM
(farmer from l'Aube)

Marcel Leroux Responds

One perverse aspect of the scenario put forth by the International Panel on Climate Change (IPCC) and their media hitmen, is to make believe that climate behaves in the same fashion everywhere, over the whole surface of the Earth, and especially, that it is largely warming throughout, their mantra being: *the climate is heating up.* Yet, they know very well that there is not one "global" climate, but a large variety of climates, depending on latitude, geographic conditions, and atmospheric dynamics. Therefore, the climatic differences are considerable between Montreal and Lyon, situated about 45 degrees North Latitude, and between New York and Naples at around 40 degrees N.

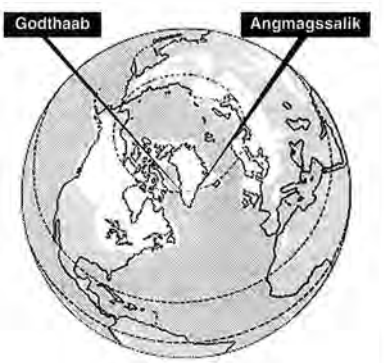
For similar reasons, it is foolish to say—or believe—that the climate is heating up everywhere: Some regions are getting warmer, but others are just as



MEAN TEMPERATURES IN GREENLAND AND NORTHEAST CANADA HAVE BEEN FALLING DRASTICALLY FOR 50 YEARS

While some parts of the globe have warmed, northeastern Canada and western Greenland (where the North American Ice Age glaciation originated) have been cooling considerably since 1960.

The figure shows the evolution of temperatures in four regions: the mean temperature anomaly in the Arctic Atlantic from 1900 to 1987 (Arctic); the Eastern Canada mean (E. Canada) from 1900 to 1992; at Godthaab (64.26° N, 51.7° W, alt. 20 meters) and at Angmagssalik (65.6° N, 37.6° W, alt. 35 meters) in Greenland, from 1900 to 1995.



In the last glaciation, which ended only about 10,000 years ago, the Greenland ice sheet extended as far south as New York and Chicago. A new glaciation is expected sometime soon.

Sources for data: Arctic, after J.C. Rogers, 1989, "Seasonal Temperature Variability over the North Atlantic Arctic," *Proc. 13th Annual Climate Diagnostics Workshop*, NOAA-NWS, pp. 170-78; Eastern Canada, after M.R. Morgan, et al., 1993, "Temperature Trends at Coastal Stations in Eastern Canada," *Clim. Bull.*, Vol. 27, No. 3, Envi. Canada, pp. 135-53; Greenland, after John Daly, 2000, "Still Waiting for Greenhouse: What the Stations Say," www.vision.net.au/daly.

surely cooling down. For example, in the vast atmospheric domain of the North Atlantic, in which we include the area lying between the Rocky Mountains and Western Europe, the American Northeast is getting colder, at the same time that the northwestern Atlantic is heating up.

The explanation is very simple, but requires a little effort to understand.

Cold and hot don't come out of nowhere. Without getting into radiative effects, we hold to the model that cold comes from the poles, while warm air comes from the subtropical and even tropical regions. Each day, to some extent, a mass of cold air (more so in winter than summer, and with greater force) leaves the Arctic, thrown out by centrifugal force. This mobile mass of cold air is called a Mobile Polar Anticyclone (MPA).

Above the area affected by this, the MPA preferentially passes first over Canada, then over the United States, and spreads finally into the North Atlantic. In the course of its progress toward the east, and toward the south, the MPA encounters and lifts the less-cold, or warmer air (because it is lighter), and forces it to flow back toward the north (to fill the void left by its passing), forming an unstable cyclonic circulation which generates our precipitation.

This air, which moves back toward the pole, brings warmth with it. Its most usual trajectory is found to be toward the east of the Atlantic, that is to say, Western Europe (*cf.* M. Leroux, 2001, Dunod). The results are simple: To the west (Canada, USA) it is cold; to the east (Western Europe), it is warm, relatively speaking.

Canada Cools, Norway Warms

Thirty years ago (that is to say, after the climatic cycle of 1970), the area west of Arctic-Greenland began to cool down, according to the clear evidence of the Arctic Climate Impact Assessment (ACIA) of Nov. 8, 2004. The MPA, which forms precisely above that part of the Arctic, thus leaves there both colder and with more power: Winter after winter, Canada hits new records of cold and ice storms.

Between the Rockies and the Appalachians (in the Great Plains) the MPA blows strongly in the direction of the Gulf of Mexico. At the same time, the borders of the northern seas, around Norway and the Barents, heat up. Here we see increased precipitation (from the transport of the collected water vapor), and a greater number of storms. The amount of warming is directly related to the amount of initial cooling, because it is that which puts the warm air into motion.

Why Alaska Is Warmer

These changes are observable in each of the six systems of atmospheric circulation.

For example, in Alaska, where the situation is comparable to that of the Norwegian Sea, the cooling is observed over Eastern Siberia (*cf.* ACIA), and the MPA that empties into the North Pacific stimulates powerful warm air uplift in the area of North America west of the Rockies. Here the powerfully uplifted land strongly channels the force of the warm air from the south, northward toward Alaska and the Bering Sea. The warming is significant, and it is the southern coast of Alaska, at the foot of the strong continental uplift, which receives the strongest increase, because of the concentrating effect from the land relief, of temperature and latent heat.

But let me reiterate: Without initial cooling, regional warming would not be possible.

Over Eurasia, one can observe the same dichotomy. From Scandinavia to Central Europe, and reaching even to the eastern Mediterranean, the temperature falls because of the passage of the reinforced MPA. In return, the Ukraine and southern Russia heat up because of the intensification of the warm air uplift. France, situated on the eastern side of the North Atlantic atmospheric system, exhibits net warming near the Atlantic coast, with increased rainfall. But this tendency is distinctly less as one moves east (a changing of the circulation system), and ends by showing a small cooling in the east of the country.

In conclusion, it does not suffice to get worked up over the "good" information of the IPCC. The tundra of Alaska experiences warming; that is well known. But one cannot forget to take into account that the region north of Florida is losing, little by little, its tropical flora, because of more and more frequent and severe storms which strike from the Gulf of Mexico. One must consider how all the parts of the climate fit together and interact, because the climate evolves steadily, but with diverse manifestations.

Editorial

Continued from page 3

its periodic droughts, was a harbinger of worse to come.

The appearance of HIV/AIDS in epidemic form in parts of Africa in the mid-1980s, became the occasion for LaRouche's call for a crash mobilization of scientific resources to defeat this deadly threat to the whole human race. LaRouche called for a Manhattan Project-style mobilization of both existing and frontier resources of biomedical research, with a special emphasis on pursuing unexplored pathways, such as some promising results in optical biophysics applications spun off from military-related research. The response of then Surgeon General C. Everett Koop was to argue that we could not afford it.

In 1986-1987, the Fusion Energy Foundation conducted a proof-of-principle experiment in the efficacy of eliminating flying locusts by use of appropriately tuned directed-energy beams. That approach to solving the locust crisis then devastating West Africa and surrounding locations was added to LaRouche's call for mobilization against biological holocaust.

The trend of culturally dictated negligence of the need for scientific mobilization for defense of human life, from the failure to implement the response to Hurricane Betsy launched under President Johnson, through disregard for our own and others' validated warnings of a pending Sahel crisis, through our warnings on the subject of the global "AIDS " pandemic during the early 1980s, and the horrifying negligence of the Cheney-Bush administration in failing to prepare for the clear threat from "Katrina" are now expressed in the most terrifying of all such threats of pandemics, pestilences, and related categories of "New Dark Age"-like calamities today.

The mid-1960s paradigm shift, away from science-driven approaches to serving the common aims of mankind, is the problem. It's time to face this deeply embedded error in our cultural outlook, to change it, and to have the courage to tell others to do the same.

—Laurence Hecht
Oct. 1, 2005

On Solar Radiation and Immune Deficiency, Man and the Biosphere, and Climate

by Dr. Kirill Ya. Kondratyev
Academician, Counsellor
Russian Academy of Sciences

This is excerpted from the Annual Report for the Nansen Scholarship, *prepared by Prof. K. Ya. Kondratyev for the year November 2003-November 2004.*

This year has been marked by some progress in a number of directions.

1. Solar Radiation Spectra and the Problem of Immunodeficiency.

It seems to me that in co-operation with Prof. P.P. Fedchenko (my former post-graduate student), we've managed to achieve a certain breakthrough in our studies of the impact of the fine spectral distribution of solar radiation within a number of Fraunhofer lines [dark lines in the solar spectrum—ed.], on the evolution of the biosphere. We've conducted these studies for almost 20 years (first relevant papers were published during the second half of the 1980s) to substantiate a new concept based on consideration of the special role of Fraunhofer lines in biospheric evolution.

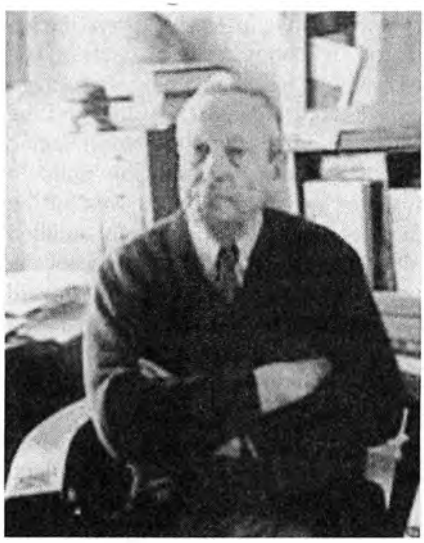
During the recent few years, this concept has been applied to examine a possibility to use laser light illumination (including Mg and Fe lines) for the suppression of the development of immunodeficiency. The first tests with AIDS patients in the Institute of Immunology in Moscow, and then in a number of clinics in Minsk (Belarus), have been 100 percent successful. The same is true for a few cases of hepatitis-B,C, and leukemia (blood cancer).

The results achieved in the substantiation of the concept and preliminary tests have been discussed in two papers submitted for publication in *Il Nuovo Cimento C:*

1.1. K.Ya. Kondratyev, P.P. Fedchenko. "Solar Radiation Spectrum and Evolution of the Biosphere."

1.2. K.Ya. Kondratyev, P.P. Fedchenko, "Fraunhofer Lines in the Solar Spectrum and Immunodeficiency Development."

Relevant versions of the papers in Russian have been submitted for publication in the Journal of the Institute of Scientific Information. Now, Prof. P.P. Fedchenko and myself have worked out suggestions for an international co-operation.



Prof. Kirill Yakovlevich Kondratyev, a member of the Russian Academy of Sciences, is editor-in-chief of the journal Studying the Earth from Space, *and has published more than 1,000 scientific papers. He has been involved throughout his career in research on atmospheric radiation problems relevent to the physical basis of climate.*

2. Global Change Problems

An important result of the last year's efforts has been the publication of the following two monographs:

2.1. K.Ya. Kondratyev, V.F. Krapivin, V.B. Savinykh, C.A. Varotsos, *Global Ecodynamics: A Multidimensional Analysis* (Chichester, U.K.: Springer/Praxis, 2004), 687 pp.

2.2. K.Ya. Kondratyev, K.S. Losev, M.D. Ananicheva, I.D. Chesnokova, *Stability of Life on Earth* (Chichester, U.K.: Springer/Praxis, 2004), 162 pp.

Both monographs are of a conceptual nature. The principal purpose of the first book has been to discuss general information concerning the interaction between society and nature on a global scale (i.e., key issues of global change) with special emphasis on multidimensional analysis of global ecodynamics with the use of a global numerical simulation model of the Nature-Society System (NSS). A special role of various kinds of parameterizations has been emphasized in this context.

The basic aim of the second monograph has been to substantiate a concept of "biotic regulation of the environment" to demonstrate the key importance of biospheric dynamics for global environmental safety. Now, a subsequent, more detailed publication is being prepared. Important additional publications are:

2.3. K.Ya. Kondratyev, V.F. Krapivin *Global Carbon Cycle Modelling* (Moscow: Fizmatgis Publ., 2004) (in Russian).

2.4. K.Ya. Kondratyev, I. Galindo, "Key Issues of Global Change at the End of The Second Millennium." (Colima, Mexico: Universidad de Colima, 2004), 63 pp. (in English and Spanish).

The last publication is the fifth issue of booklets with Dr. I. Galindo devoted to various problems of global change.

3. Global Climate Change Problems

After the completion of the World Climate Change Conference held in Moscow last autumn, I've been involved in preparations and publication of a number of survey papers discussing key issues of the problem:

3.1. K.Ya. Kondratyev, "Priorities of Global Climatology," *Proc. Russian Geographical Society,* 2004, Vol. 136, No. 2, pp. 1-25 (in Russian).

3.2. K.Ya. Kondratyev, "Global Climate Change: Observation Data and Numerical Modelling Results," *Studying the Earth from Space,* 2004, No. 2, pp. 61-96 (in Russian).

3.3. K.Ya. Kondratyev, "Uncertainties of

Observation Data and Climate Modelling Results," *Meteorol. and Hydrol.,* 2004, No. 2, pp. 93-119 (in Russian).

3.4. K.Ya. Kondratyev, "Key Aspects of Global Climate Change," *Energy & Environment,* 2004, Vol. 15, No. 3, pp. 467-501.

An important relevant step is also:

3.5. K.Ya. Kondratyev, "Observation Data and Numerical Climate Modelling Results: Conceptual Aspects," *Proc. of the Conf. on Remote Sensing,* St. Petersburg, 2004, Vol. 1, pp. 12-18 (in Russian).

3.6. K.Ya. Kondratyev, "Review of the Book by C. Essex and R. McCormick *Taken by Storm," Energy & Environment,* 2003, Vol. 14, No. 6, pp. 905-913; as well as its version in Russian.

3.7. K.Ya. Kondratyev, "Global Climate Change: Unsolved Problems," *Meteorol. and Hydrol.,* 2004, No. 6, pp. 118-128 (in Russian).

Important conclusions are as follows:

(a) There are no adequate data for reliable enough assessments of global averages even in the case of surface air temperature;

(b) There is a serious disagreement on long-term temperature trends due to surface and satellite observations;

(c) Simulation modelling is still lacking a complete enough consideration of all the important mechanisms and factors of climate change.

These and other circumstances demonstrate the absence of scientific substantiation for the Kyoto Protocol recommendations, which has been discussed in the papers mentioned above as well as in a number of other publications:

3.8. K.Ya. Kondratyev, K.S. Demirchian, "Global Carbon Cycle and Climate," *Proc. Russ. Geograph. Soc.,* 2004, Vol. 135, No. 1, pp. 16-25 (in Russian).

3.9. K.S. Demirchian, K.Ya. Kondratyev, K.S. Danilevich, K.K. Demirchian, "Scenarios of Dangerous Climate Changes Due to IPCC Are Based on Non-realistic Assumptions," *Proc. Russ. Acad. Sci., Energetics,* 2003, No. 4, pp. 89-121 (in Russian).

3.10. K.Ya. Kondratyev, V.F. Krapivin, "Global Carbon Cycle: The Present State, Unsolved Problems and Perspectives," *Studying the Earth from Space,* 2004, No. 3, pp. 12-21 (in Russian).

3.11. K.Ya. Kondratyev, V.F. Krapivin, "Global Carbon Cycle: New Results," *Studying the Earth from Space,* 2005 (in Russian, in print).

I can't avoid a reference to a dangerous intervention of politics into science which has happened during the Russian-U.K. seminar on climate problems with emphasis on the Kyoto Protocol, held in Moscow (July 7-8, 2004). Sir David King, chief scientific advisor of the U.K. Government, and his colleagues undertook strong efforts to introduce censorship during the holding of the seminar and to limit opportunities for participants with differing views to speak. This and other attempts to disrupt the seminar undertaken by the U.K. side forced Prof. A.N. Illarionov, economic advisor of the Russian President, to say: ". . . [T]his is a war against the whole world. . . . [T]he main prize in this war, for those who have started it and who are waging it, is the ratification by Russian authorities of the Kyoto Protocol."

British Embassy in Berlin

Sir David King, left, chief scientific advisor of the British Government, attempted to stop Russian scientists with other views from speaking at a climate forum in Moscow. Here he accompanies Queen Elizabeth at the Climate Change conference in Berlin, Nov. 3, 2004. King has stated that "global warming is a far greater threat to the world than international terrorism."

I agree with the assessments made by Prof. A. N. Illarionov and believe that the seminar mentioned is a very dangerous demonstration of limiting discussions and avoiding scientific truth for the sake of certain political aims.

As far as climate problems are concerned, one of the important illustrations of the scale of uncertainties is an atmospheric aerosol climatic impact. To discuss the situation, I've written and partly published a number of papers in *Optics of the Atmosphere and Ocean.* (This journal is being published both in Russian and in English):

3.12. K.Ya. Kondratyev, "Atmospheric Aerosol as a Climate-forming Component of the Atmosphere. 1. Aerosol Properties," *Optics of the Atmosphere and Ocean,* 2004, Vol. 17, No. 1, pp. 1-20.

3.13. K.Ya. Kondratyev, "Atmospheric Aerosol as a Climate-forming Component of the Atmosphere. 2. Remote Sensing of Atmospheric Aerosol Properties and its Climatic Impact," *Optics of the Atmosphere and Ocean,* 2004, Vol. 17, No. 1, pp. 23-34.

3.14. K.Ya. Kondratyev, "From Nano- to Global Scales: Aerosol Properties Formation Processes and Climatic Impacts. 1. Field Observational Experiments. Africa and Asia," *Optics of the Atmosphere and Ocean,* 2004, Vol. 17, No. 9, pp. 1-16.

3.15. K.Ya. Kondratyev, "From Nano- to Global Scales: Aerosol Properties Formation Processes and Climatic Impacts. 2. America, Western Europe and High Latitudes," *Optics of the Atmosphere and Ocean,* 2004, Vol. 17, No. 9, pp. 17-43. . . .

3.21. K.Ya. Kondratyev, *Atmospheric Aerosol Formation Processes, Properties and Climatic Impacts,* (St. Petersburg: Chem. Publ., 2004), 211 pp.

A similar book of a broader information content for Springer/Praxis is at the stage of preparations with the participation of a number of my colleagues.

The information on atmospheric aerosol obviously demonstrates the high complexity of aerosol parameterization in case of climate modelling (especially if coupled aerosol properties are to be taken into account) because of strong variability of aerosol properties and complexity of their interaction with clouds. An important fact is that the aerosol radiative forcing (ARF) either is comparable [to] or exceeds the greenhouse RF. . . .

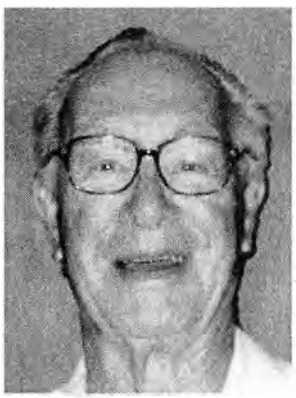
VIEWPOINT

The Real Cost of Killing the FFTF

Ralph Johnson, a retired nuclear engineer, was part of a team of community supporters of the Fast Flux Test Facility in Richland, Wash., who worked for several years to reverse the government's decision to destroy the reactor and turn its multibillion-dollar research complex into a waste dump, requiring $2 billion in decommissioning and cleanup. The story of the FFTF appears in the Spring 2005 21st Century.

This estimate of loss and liability—condensed here for publication—was written on April 28, 2005, before a hole was drilled in the FFTF reactor vessel to drain the sodium coolant; the hole made the reactor unusable.

* * *



by Ralph Johnson

My assignment as a registered professional nuclear engineer is to develop a quick draft estimate of the total liability scope and costs should the FFTF and FMEF [the adjacent Fuel and Materials Examination Facility] be destroyed. The draft estimates have been made very quickly to derive what is often called "a ball park number," of use before litigation planning can begin. The scope and estimates rely on my professional judgment and have not been verified or validated in any way as yet by the other professionals on our team. A final report will, of course, be reviewed by those most qualified, and clearly explain the assumptions and details necessary to obtain a scope and cost number for total liability.

Deprivation of Life Extension

The FFTF is the world's largest potential producer of medical isotopes that can only be replaced over a 10-year period at a roughly estimated cost up to $10 billion. Note that the cancer assistance of medical isotopes is considered therapeutic (only 10 to 20 percent of today's use) whereas diagnostic use of medical isotopes is 4 to 10 times more than that, and is not included here.

Domestically, there are now estimated to be 1.37 million patients per year whose lives could be extended, and whose pain and suffering could be reduced, by the availability of medical isotopes that FFTF has the capability to produce. The estimated number of people who will contract cancer over the next 10 years is approximately 14 million (based upon extending the U.S. 2004 Cancer Statistics). If one uses the cancer treatment costs as quoted by the National Institutes for Health for 2004 ($190 billion), divided by the number of patients (1.37 million of them), the cost per patient is about $140,000.

Worldwide, there are now multimillions of persons living with cancer. FFTF has the production capability to provide medical isotopes for the international community for treatment of cancer. Within the next 10 years, it is estimated that this international need could exceed 5 million people.

Costs for year 2004 for cancer have been estimated to be $190 billion. Cancer incidence is going upwards, so a 10-year average of $220 billion/year may be assumed. If just 30 percent were attributable to a lack of medical isotopes, $66 billion could be considered as an annual liability (this excludes pain and suffering, which could amount to at least twice the medical costs).

SUMMARY OF ROUGH ESTIMATES

Loss of life extension (first year only)	$66 billion
Loss of FFTF capital facility	$ 2 billion
Loss from NEPA violations	$20 million
Loss from procurement violations	$10 million
Loss from potential uses of FMEF	$ 3 billion
Loss from use of advanced power concepts (half of potential)	$70 billion
Loss of jobs (one year)	$14 million
Loss from inadequate planning	Unlimited
	Total $140 billion

Destruction of a $2 Billion Asset

The destruction of the FFTF is apparently being accomplished without using the design procedure that allows the sodium coolant to be replaced (or any other nondestructive procedures). The technique being used by the Contractor/Department of Energy causes irreparable damage. The party responsible for the adherence (the Regulator) is not clearly defined and has no workable implementation.

The *deactivation,* which was authorized by court decision, is not intended to cause irreversible permanent damage to the future usefulness of the FFTF, or it could be construed as a *decommissioning* act. . . .

Rampant confusion exists about distinguishing the difference between deactivation and decommissioning. No NEPA [National Environmental Protection Act] Record of Decision exists to authorize decommissioning. News releases as recent as April 26 [2005] show gross errors in categorizing the destructive actions being taken.

The amount of basic liability could be the capital costs required to construct and improve the facility—$2 to $3 billion.

Apparent Violation of NEPA Law

Program planning neglected NEPA until Benton County [Wash.] brought a lawsuit. The initial DOE contracting and planning documents

neglected adherence to NEPA. Consideration of compliance began much after the fact. Public involvement was once again defied. Damages exist to the citizens of Benton County, the FFTF complex employees, and the State of Washington. Contracting costs may well have been wasted, since the wrong public law had been followed for a period of time. To attach a liability sum to this is difficult and is likely in the tens of millions. . . .

Loss of Use of Potential

Destruction of the FFTF will severely degrade any possible use of the FMEF, an accompanying facility specifically designed to handle and process nuclear fuels and radioactive materials. The facility has numerous functions that could be marketable. Without the FFTF, the facility likely has only scrap value even though it contains much equipment and materials that have never been used. Liability to the facility is assumed to be $3 billion.

Delay to Advanced Power Production

Without a test reactor the progress of advanced nuclear power concepts will be delayed until a replacement (or its functions) can be found. If a single new test reactor is selected, a delay of about 10 years is expected. Power costs via oil and gas are expected to jump drastically.

Ten years of incremental costs related to the rise in oil costs could reach $20/barrel of oil ($50 − $30) times millions of barrels of oil used daily—at 10 years × 365 days × 2 million barrels/day × $20/barrel would approximate 140 billion dollars. This assumes that the use of the FFTF would reduce the time to reach new advanced energy concepts by 10 years. Assuming a 50 percent probability, this would reduce the liability to $70 billion.

Loss of Washington State Jobs

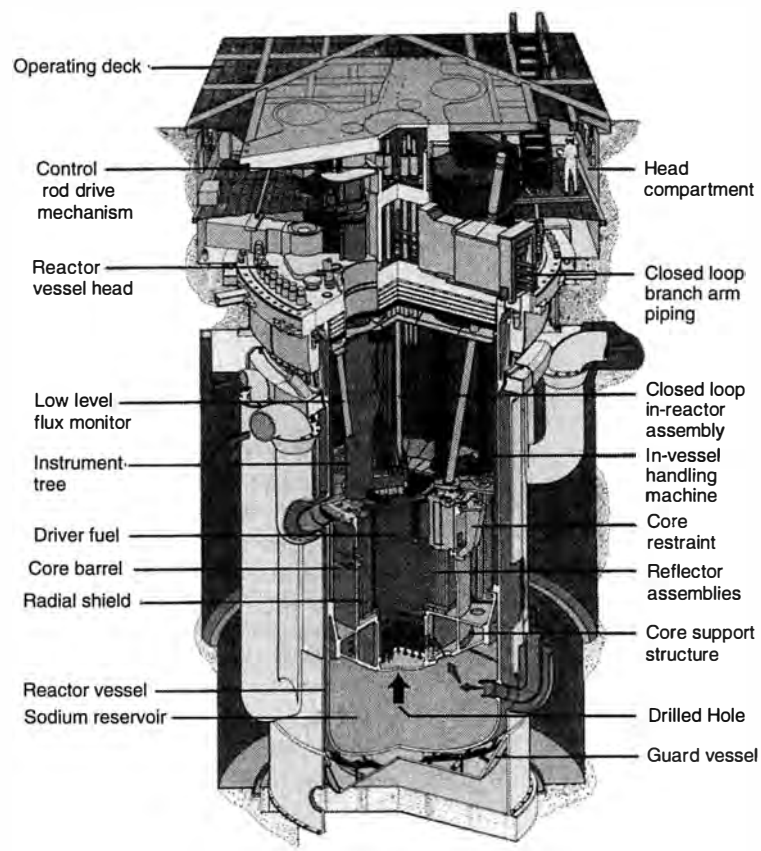
Job losses fall into two categories: Loss of jobs to those now employed to operate and maintain the FFTF/FMEF, and those who would do the same if the units were once again placed in operation. . . . A net loss of 400 jobs at $35,000/year = $14 million loss of income.

Liability could be perhaps one year of lost income even though the total time span considered is 10 years, at a liability of $14 million.

Once restart is accomplished, the prospect of advanced medical facilities is highly likely. Fuel preparation activities for the FFTF would once again be implemented. In contrast, the non-productive jobs of decommissioning and cleanup would not cover those jobs lost, when compared to a resumption of productive operations. . . .

Summary

In summary: What this tells us is that we (the Nation) have not given appropriate balance to the importance of energy/power and nuclear in its impact on our daily lives, both economically and in terms of health. It is a shame that it takes a multitude of mistakes and a crude economic study, to bring attention to the truths and priorities that need to be exercised within our governmental processes.



CUTAWAY VIEW OF THE FAST FLUX TEST FACILITY

The FFTF is a 400-megawatt liquid-sodium-cooled reactor with a fuel of mixed uranium oxide and plutonium oxide. Fast flux refers to the speed of neutrons produced in the reactor core during the fission process.

The Department of Energy chose to disable the $2 billion reactor using an invasive method: drilling a hole at the bottom of the reactor vessel (see large arrow) in order to drain the sodium coolant that surrounds it. The metal shavings from the reaming and drilling make the system unusable. The DOE began reaming and drilling in early May 2005. Drainage of the 16,000 gallons of sodium coolant is now completed, and the DOE is washing out the residual sodium.

www.keringhuis.nl

An example of protective infrastructure, built to withstand a 10,000-year event, is the Maeslant Barrier, a movable storm surge barrier that protects the Netherlands port of Rotterdam. The 689-foot arched gates are hollow. As a storm approaches, the gates swing out into the waterway, fill with water, and sink to the bottom, sealing off the waterway opening. The gates rise 16.4 feet above water level to block the storm surge.

TO PROTECT AGAINST MOTHER NATURE, BUILD INFRASTRUCTURE!

"What we're receiving, is 40 years of total disregard for the future—and we're paying the price." This is how Michael Parker, chief of the U.S. Army Corps of Engineers from October 2001 to March 2002, summed up the devastation in the wake of Hurricane Katrina, in an interview published in the Sept. 30 *Executive Intelligence Review*. Parker was asked by President Bush to resign in 2002 because of his criticism of the Administration cuts to the Army Corps' infrastructure program.

Parker told *EIR:* "For the first time, people are learning some things. I mean, our parents and grandparents knew it. But all of a sudden, this generation is learning some things that it has never known before, and that is, that there's a direct correlation between standard of living and infrastructure. And one of the things that the government is charged with—we've become such a short-term, instant gratification society—[is] the responsibility of looking to the future and providing for the security of the nation. And one of the ways you do that, is, to put in place things that are not for your generation, but for future generations. The infrastructure that we have in place today, is a gift that we've been given from our parents and grandparents. The infrastructure that we build and maintain—it's not for us; it's for our children and grandchildren."

DANISH SCIENTISTS CLAIM NEW HYDROGEN FUEL STORAGE METHOD

Scientists at the Technical University of Denmark have developed a novel way to store and deliver hydrogen, which they claim fulfills all requirements of the U.S. Department of Energy Hydrogen Fuel Initiative goals for 2015. Their technology, according to Clause Hviid Christensen, one of the developers, can store enough hydrogen fuel in a 50-liter tank to power a vehicle for 500 km. Instead of storing the hydrogen in bulky compressed gas tanks, the researchers have invented a way to adsorb ammonia reversibly into magnesium chloride tablets. Catalysis is used to release the hydrogen for fuel-cell vehicles. Details on the mechanism of storage and delivery of the hydrogen are being kept under wraps, as the researchers patent the technology for their new company, Amminex, but they have published their claims in the September issue of *Journal of Materials Chemistry*.

www.public-health.uiowa.edu

Dr. Michael Osterholm: Avian flu will collapse the global economy—"the levees will break if we don't act now."

EXPERTS WARN OF FLU PANDEMIC AND ECONOMIC COLLAPSE

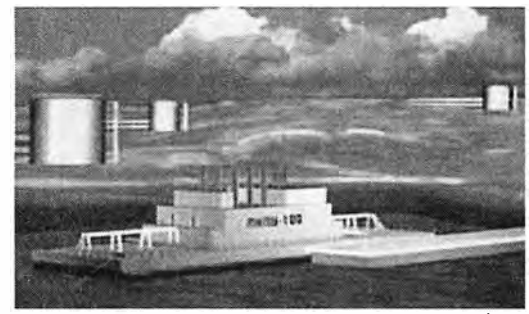
Representatives from dozens of national and international organizations packed an auditorium at the Woodrow Wilson International Center for Scholars in Washington, D.C., Sept. 19, to hear the dire warnings of two experts about the certainty of an avian flu pandemic. Dr. Michael Osterholm, director of the Center for Infectious Disease Research and Policy, and Helen Branswell, medical writer for the Canadian Press Agency, presented the alarming statistics about the circumstances that will lead to a global pandemic—and a global economic meltdown.

The nature of the flu virus and its hosts, Osterholm said, means a natural disaster is inevitable; but unlike Hurricane Katrina, it need *not* be massively catastrophic. However, even with a focussed international effort, he said, there is not time to make the changes and develop the infrastructure and technology to avert this pandemic. The major blame, said Osterholm, is the global, "just-in-time" economic system, which has rendered nations unable to amass even the bare necessities to avert catastrophe—vaccines, surgical masks, food, clean water, and so on. When the flu strikes, countries will close borders and horde medical resources, but almost no countries have all the necessary resources within their borders. Panicked about catching the flu, people will hunker down, refusing to go to work, leaving national economies in a shambles, he said. Osterholm emphasized, it's not about money any more—building infrastructure takes time.

RUSSIA AND CHINA JOIN TO BUILD FLOATING NUCLEAR PLANT

Russia's nuclear energy agency signed an $86.5 million contract with China July 28, to build the world's first commercial floating nuclear power plant, in Severodvinsk. The 10-story, 70-MW reactor will cost $208 million, and will supply heat and electricity to defense enterprises in the far north. Russia has been trying for years to find a partner to invest in the project. China will build the reactor housing, and Russia will build the nuclear power block. The floating reactor has great potential for export to non-nuclear, developing nations. Indonesia, for example, has expressed interest in buying these small reactors, which can be put on line quickly, requiring little pre-construction infrastructure.

The first-ever floating nuclear power plant was the MH-1A *Sturgis,* built by the U.S. Army in the early 1960s from a surplus Liberty Ship, and stationed to supply power to the Panama Canal during the the Vietnam War era.



www.bz.ru

Top: An artist's drawing of the Russian design for the first commercial floating nuclear power plant. Below: The USS Sturgis, providing nuclear electricity in the 1960s.

www.armed-guard.com

PURDUE SCIENTISTS SCULPT ANTI-CANCER TOOL FROM RNA

Peixuan Guo and his team of scientists at Purdue University have developed a remarkable system to deliver therapeutic agents to cancer cells in tissues and in live mice. Guo has been studying a tiny DNA virus, phi29, for years to understand how it delivers its DNA into the pre-assembled viral envelope. He discovered that the virus used a nano-sized "motor"—an ATP-driven screw, twisting the DNA spiral through the envelope. The "head" of the screw is a hexagonal ring of RNA attached to the icosahedral shell of the virus.

Guo's team has emulated and perfected a similar triangular RNA array with three "arms," carrying three different agents to cancer cells. The first moiety binds to cell receptors, allowing entry. Once in the cell, one of the agents, another RNA, goes to work turning off certain cellular processes necessary to cancer growth.

The nano-sized cancer fighters have stopped cancer in its tracks in mice developing cancers, but much work remains to make sure the molecules target only cancer cells, and to keep them from being degraded by cellular processes. This study appears in both the Sept. 9 issue of *Nano Letters* and the September issue of *Human Gene Therapy.*

SEA-VIEWING SATELLITE YIELDS IMAGES OF OCEAN CYCLES

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) on the Seastar satellite has enabled scientists to superimpose changes in the greening of the oceans (a measure of phytoplankton photosynthetic activity) with data on the fluctuating El Niño to La Niña transition in the Pacific during 1998. One research team found a strong greening of the ocean, caused by phytoplankton "blooms," as La Niña took over—a 500 percent increase over that during the height of El Niño. (El Niño is characterized by warmer surface waters spreading from the west, and a subsidence in the eastern Pacific of up-welling of the cool, nutrient-laden waters beneath. During La Niña, the surface waters cool and upwelling intensifies.)

The fluctuation in phytoplankton leads to fluctuations of all organisms higher on the food chain, so the productivity of the ocean is profoundly affected by the amount of oceanic up-welling. A further marked effect is the amount of CO_2 sequestered by the bodies of the dying phytoplankton as they sink into the deep. During the phytoplankton blooms, up to eight times the carbon is sequestered and moved to the ocean bottom as during relatively lifeless El Niño ocean condition—a potent force in regulating atmospheric levels of CO_2.

This study, by Wendy Wang and a team of scientists from the University of Maryland, appeared in the January 2004 issue of *Geophysical Research Letters.*

NASA/Goddard Space Flight Center, the SeaWiFS Project, and Orbimage

The Seastar satellite launched via Pegasus rocket on Aug. 1, 1997, carried this state-of-the-art imaging system, SeaWiFS, designed to monitor the color of the Earth's oceans.

Gottfried Wilhelm Leibniz (1646-1716)

SCIENTIFIC CLASSICS

On the Expression in Rational Numbers of The Exact Relationship Of a Circle to Its Circumscribed Square

by Gottfried W. Leibniz

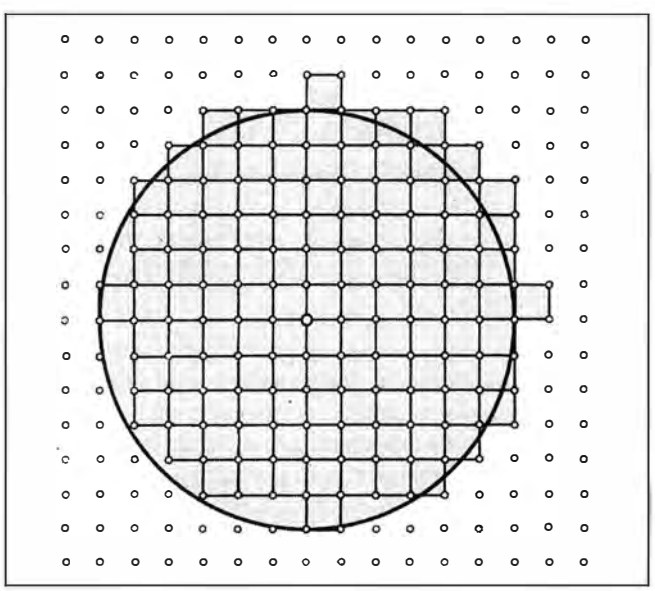
Translator's Note

This essay originally appeared in Latin in February 1682 in Leibniz's philosophical journal *Acta Eruditorum* (M.S. V, pp. 118-122), under the title "De Vera Proportione Circuli ad Quadratum Circumscriptum in Numeris Rationalibus Expressa." A French translation by Marc Parmentier appears in the book *La Naissance du Calculus Differential* (Paris: Libraire Philosophique J. Vrin, 1989). This English translation by Laurence Hecht is from Parmentier's French.

The essay describes Leibniz's discovery of the infinite series $1 - 1/3 + 1/5 - 1/7 + 1/9 \ldots$ whose sum is equal to the area of a circle of diameter 1, that is to $\pi/4$. The essay is notable for its rigorous distinction between methods of *approximation,* such as Archimedes' quadrature by inscribed and circumscribed polygons, and what Leibniz calls a *rigorous* quadrature, which can be either *geometric* (obtained by rigorous construction), or *analytic* (resulting from a rigorous calculation).

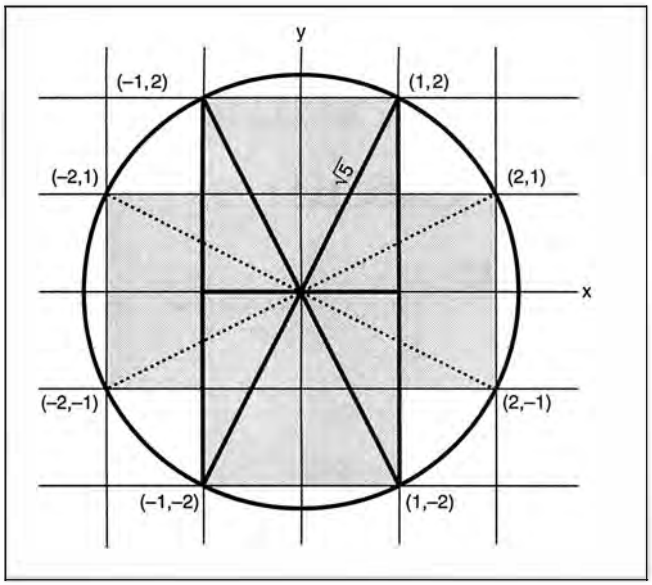
Included under the concept of *rigorous quadrature* is a precise definition of the notion of "limit," which Cauchy and all subsequent academic "experts" have failed to grasp. Also in this essay, Leibniz, apparently for the first time, uses the term *transcendental* to distinguish a category of curves, including the circle, from other so-called mechanical curves.

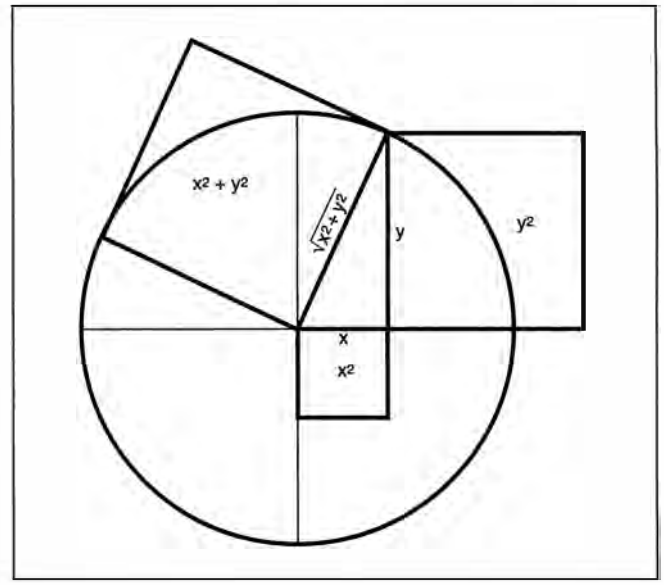
My interest in Leibniz's discovery of the $\pi/4$ series was piqued by reading a description of the beautiful geometric derivation, attributed to Gauss, for the series. Gauss's method involves a literal "squaring" of the circle by superimposing upon it an ever shrinking rectilinear grid system,



and simply counting the number of whole squares contained within the circle. As some of the squares will always fall partially within and partially without the circle, and the count can only be exact when all of the squares are fully within the circle, it is necessary to use Leibniz's method to carry the process to the infinite.

The great beauty of Gauss's derivation is that he is able to accomplish this by recognizing the equivalence of the geometric construction of a square grid upon a circle to the number-





theoretic problem posed by Fermat of how many ways a number can be represented as the sum of two squares. The connection between this problem and Leibniz's series for π is both simple and profound.

The essence of Gauss's derivation is this: If one locates the center of a circle at the origin of coordinates of a rectilinear grid, the equation of the circle will be $x^2 + y^2 = r^2$. If x and y are restricted to whole numbers (that is, the points where the circle passes through intersection points of the grid), the equation of the circle is seen to be the same as the Pythagorean Theorem. So, for example, for a circle whose radius is the square root of 5, the coordinate point (1, 2), that is $x = 1$, $y = 2$, will lie on the circumference of the circle, and so will the three other points (1, –2), (–1, 2), and (–1, –2). Each forms a Pythagorean triangle in which the radius (hypotenuse) is square root of 5. This is just another way of saying that $1^2 + 2^2 = 5$, and also that $(-1)^2 + 2^2 = 5$, and so forth. The coordinate points (2, 1) (2, –1) (–2, 1), and (–2, –1) will also fall on the circumference of the circle.

Thus, for any whole number which can be expressed as the sum of two squares, there are 8 representations; and for any circle the square of whose radius is a whole number, the number of ways in which that whole number can be expressed as a sum of two squares gives the number of points of intersection of the circle with the coordinate grid. This then tells how many squares are contained within the circle, and how many are partly excluded. As one considers circles of larger radius, that is, increases the density of the grid covering the circle, the quadrature becomes ever more accurate, and corresponds to an infinite series.

The problem of counting the squares wholly or partially contained within the circle thus becomes one of knowing what whole numbers are the sum of two squares and in how many ways. (A number can be the sum of two squares in more than one way—65, for example, is both $8^2 + 1^2$, and $4^2 + 7^2$.) And here it turns out, that Fermat had discovered, although not proven, a general rule for determining when and in how many ways, a number is a sum of two squares. Essentially, one takes the prime factors other than 1, and counts how many are of the form $4k + 1$ and how many of the form $4k + 3$. The difference of the two corresponds to the number of ways the number under investigation is a sum of two squares. Thus, for 65, the prime factors other than 1 are 5 and 13. Both primes are of the form $4k + 1$ (divisible by 4 with 1 as remainder). Thus there are two ways ($8^2 + 1^2$ and $4^2 + 7^2$) to make 65 by summing two squares, and, as noted above, each way represents 8 points of intersection of the circle with the square grid.

To move from these two concepts—Fermat's general rule for the sum of squares, and Gauss's lattice construction—to the Leibniz series for π is then a relatively easy matter. (An intelligible summary presentation is given in Hilbert and Cohn-Vossen, *Geometry and the Imagination* [New York: Chelsea, 1952], pp. 32-34, 37-39.)

Gauss's interest in this quadrature is closely connected to his work of the *Disquisitiones Arithmeticae*. The solution to the array of number-theoretic problems associated with Fermat's theorem on the sum of two squares is found in the complex domain, as is the higher approach to the circle, and the transcendance of the value of π.

This essay, which clearly also forms a decisive step on Leibniz's path to the formulation of the calculus, is thus a crucial link in the chain from Archimedes to Nicholas of Cusa, Leibniz, Gauss, Riemann, and Cantor. (Leibniz's inclusion of Cusa in his list of those claiming the "perfect quadrature" indicates his lack of familiarity with Cusa's *De Quadrature Circuli* (On the Squaring of the Circle). There Cusa makes clear that his proposed construction for a circle isoperimetric to an equilateral triangle is not a perfect one, adding this as evidence for his correct assertion that the circle and polygon are of different species, a point on which Cusa and Leibniz clearly agree.)

In a few locations I have interjected some points of clarification. These are indicated by square brackets. The two footnotes are by the French translator.

—Laurence Hecht
March 24, 1994

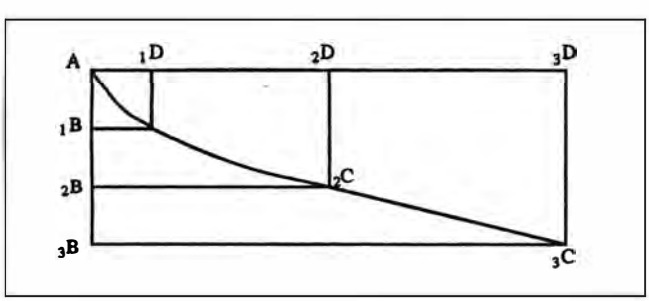
On the Expression in Rational Numbers of The Exact Relationship of a Circle To Its Circumscribed Square

by Gottfried W. Leibniz

Geometers have always worked to establish the relationship between curved and straight lines; yet even now that we have the help of algebra, we have still not gained a good mastery of this question, at least not by applying the methods in use today. For it is impossible to reduce these problems to algebraic equations; yet it is still wonderfully useful to apply geometric formulas in engineering, as some of the most eminent mathematicians who have investigated the problem have not failed to observe.

It was Archimedes who, to all appearances, first found the relationship among the cone, sphere, and cylinder having the same height and base to be that of the numbers 1, 2, 3—the cylinder being three times the cone and one-and-a-half times the sphere—which gave him the idea of having a sphere and cylinder engraved on his tomb; he also discovered the quadrature of the parabola. In the course of this century, means have been found to measure a number of curvilinear figures, notably when the ordinates *BC* stand in multiple or submultiple [fractional] proportion of any given degree, direct or reciprocal, to the abscissas *AB* or *DC*. [As we would say, when $Y = X^m$ where m is any integer or rational fraction other than –1.—LH] The relationship of the figure *ABCA* to the circumscribed rectangle *ABCD* will be that of unity to the number expressing the multiplicity [power] of the ratio, plus 1.

In a parabola, for example, the ordinates *BC* corresponding to the abscissas *AB* or *DC* proportional to



the natural numbers 1, 2, 3, etc., are proportional to their squares 1, 4, 9, etc., that is to say in double ratio [2nd power] of the numbers; the number representing the multiplicity of the ratio will thus be 2; consequently the figure *ABCA* will be to the circumscribed rectangle *ABCD* as 1 is to (2 + 1), or 1 to 3, and will represent one-third of the rectangle. Leaving *AB* or *CD* equal to the natural numbers, if the values of *BC* are their cubes (as in a cubic parabola), the ratio between the ordinates will be triple the ratio between the abscissas; the figure would be thus, in respect to the rectangle, as 1 is to (3 + 1), that is 4, and would represent a fourth of the rectangle. Contrarily, if *DC* is the square and *BC* the cube, that is to say the ratio of *BC* is 3/2 that of *DC,* the figure *ABCA* (a 3/2 power parabola) will stand in respect to the rectangle *ABCD* as 1 to (3/2 + 1), that is to say it will cover two-fifths of it. For the reciprocal ratios, the number of multiplicity is preceded by the minus sign −.

As to the circle, although geometers of all times have tried their hands at it, they have still not succeeded in placing it under similar laws. One still cannot discover any number expressing the relationship of a circle *A* to the circumscribed square *BC* having for its side the diameter DE.

The same goes for the relationship of the circumference to the diameter, equal to four times that of the circle to the square. Archimedes, in going from the inscribed and circumscribed polygons (the circle is greater than the first and smaller than the second), indeed demonstrated how to find the limits between which the circular area must fall, that is to say he gave a method of making approximations: The relationship of the circumference to the diameter is greater than 3 to 1, by about 1/7, and smaller than 22 to 7. Others have pushed this method further: Ptolemy, Viete, Metius, but above all Ludolph Van Ceulen, who showed that the relationship of the circumference to the diameter is 3.14159265358979232846 etc. to 1.00000000000000000000.

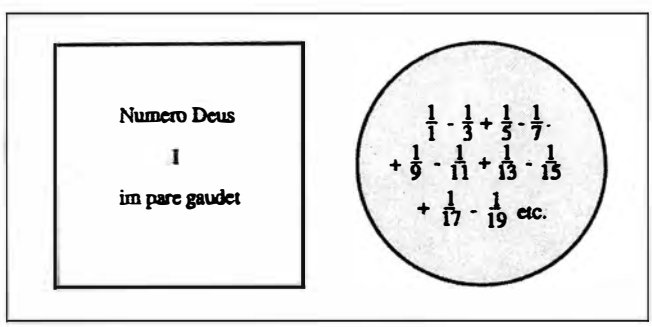
Although useful in practical geometry, in reality, approximations of this sort reveal nothing to satisfy a mind thirsty for truth, if one does not find how to extend such numbers to the infinite. There are many, be it understood, who have claimed to possess the perfect quadrature, like the Cardinal Cusa, Oronce Fine, Joseph Scaliger, Thomas Gephyrander, Thomas Hobbes, but all wrongly: The calculations of Archimedes, or today of Ludolph, refute them.

But as I realized that many have not grasped well what is really being sought, let us specify that one can consider four quadratures, that is to say four ways of converting a circle into an equal square, or into another rectilinear figure, depending on the relationship between the circle and the square constructed on its diameter: by calculation, by plotting lines, and in these two cases either rigorously or in an approximate manner. I call *analytic* the *quadrature* resulting from a rigorous cal-

culation and *geometric* the one obtained by a rigorous construction; the calculation by approximation provides an *approximation,* a construction by approximation a *mechanism.* Ludolph pushed the approximation very far; Viete and Huygens among others have produced admirable mechanisms.

One can obtain a rigorous geometric construction, allowing one to measure not only the entire circle but any sector or arc whatsoever, by means of an exact and ordered motion but which must be guided by the transcendental curves; it is wrong, moreover, to include these latter among the mechanical curves, for without being either algebraic or reducible to algebraic equations of determinate degree, they are just as geometric as the ordinary curves: They, in fact, possess specific equations, certainly not algebraic, but all the same analytic. But I cannot treat them here as they deserve. The *analytic quadrature,* corresponding to a rigorous calculus, can in turn be divided in three: the transcendental, the algebraic, and the arithmetic. The transcendental analytic quadrature is one of the results that can produce equations of indeterminate degree, that no one has yet studied. For example, if we have $X^x + X = 30$, and we want to know X, we will find that it is 3, since $3^3 + 3$ equals 27 + 3, or 30; I will give in due time the equations of this type for the circle. One gets an algebraic expression by means of ordinary numbers, possibly irrational; that is to say, by means of the roots of common equations, one naturally cannot find any expressing the general quadrature of a circle or of a circular sector. There remains the arithmetic quadrature, consisting in fact in a series, where the exact value of the circle appears through a series of terms, preferably rational; it is this type which I am now going to reveal.

I have then discovered that:



The square of the diameter being 1, the area of the circle will be: 1 −1/3 + 1/5 −1/7 + 1/9 −1/11 + 1/13 − 1/15 + 1/17,etc., or the square of the diameter less one-third (so that the result be not too large), plus another one-fifth (because we have deducted too much), less one-seventh (because we added too much to it), hence in succession, and consequently:

1 will be too large by an error less than 1/3

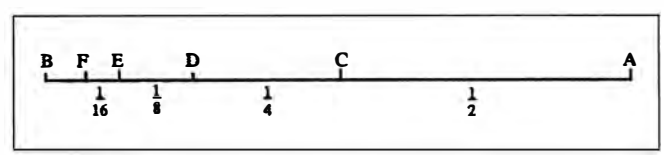
1-1/3 will be too small by an error less than 1/5

1-1/3 + 1/5 will be too large by an error less than 1/7

1-1/3 + 1/5 −1/7 will be too small by an error less than 1/9, etc.

Together the series thus contains all the approximations, that is, the values just greater than and less than; for to the degree that one considers the series further and further along, the error will be a smaller and smaller fraction, and consequently less than any given magnitude. Taken as a whole, the series thus expresses the exact value. Although one cannot write the sum in a single and unique number, and it continues out to infinity, to the degree that it is constituted only by a unique law of progression, the mind can suitably conceive it as a whole. Because from the moment that the square and circle are not commensurable, the latter can only be expressed in a unique number, but not appearing in rational terms, through series of the same type as the diagonal of the square, the section by mean and extreme ratio which some call divine [golden section], and many other irrational magnitudes. If Ludolph had been able to indicate a rule by which the numbers 3.14159 etc. could be continued to infinity, he would have very nicely furnished the exact arithmetic quadrature in whole numbers that I am going to give in fractions.

But lest anyone suppose, out of inexperience, that a series made up of an infinite number of terms cannot be equal to a circle, which is a finite quantity, I must specify that many series containing an infinity of terms are, when one takes their sum, of finite magnitude. To take a trivial example, consider the series which starts at 1 and decreases infinitely in a geometric progression of ratio 1/2: 1/2 + 1/4 + 1/8 + 1/16 + 1/32 + 1/64, etc. infinitely. Yet the sum does not exceed 1, for if one takes a segment *AB* equal to 1, *AC* will be 1/2; in dividing the remainder (*CB*) equally at *D,* we have *CD* = 1/4; dividing the remainder (*DB*) at *E,* we have *DE* = 1/8; while dividing the remainder (EB) at *F,* we have *EF* = 1/16; continuing in that way indefinitely,



we will never reach the end *B*. I have demonstrated elsewhere that the same thing is produced by the inverse of the numbers which constitute the harmonic triangle.*

One could make a number of remarks respecting this quadrature, but I have not the leisure now to undertake it. One point, however, deserves attention: the terms of my series 1, 1/3, 1/5, 1/7, 1/9, etc. are those of a harmonic progression or, put otherwise, they are in continued harmonic proportion; a simple check will allow you to convince yourself of it.** But the series obtained by jumping every other term: 1/1, 1/5, 1/9, 1/13, 1/17, etc. is equally in harmonic progression, and the same for: 1/3, 1/7, 1/11, 1/15, 1/19, a series of harmonically proportional terms. If one subtracts the second partial series from the first, the circle will have the value: 1 + 1/5 + 1/9 + 1/13 + 1/17 , etc. −1/3 −1/7 −1/11 −1/15 −1/19, etc., it will appear as the difference of two series in harmonic progression. Here then is a convenient method of making approximations (if there were need of it after that of Ludolph), since we can always regroup a finite number of terms of a harmonic progression into a single one.

If one wishes to eliminate from my series the terms affected by a minus sign, it suffices to add the successive terms two-at-a-time: + 1/1 −1/3, + 1/5 −1/7, + 1/9 − 1/11, + 1/13 −1/15, + 1/17 −1/19, and so forth; one will obtain a new series to express the circle, to wit 2/3 (or 1/1 −1/3) + 2/35 (or 1/5 −1/7) + 2/99 (or 1/9 −1/11), thus:

The inscribed square being 1/4, the area of the circle will be 1/3 + 1/35 + 1/99 + 1/195 + 1/323, etc.

Now the numbers 3, 35, 99, 195, 323 are derived, by jumping over certain terms, from the series of squares (4, 9, 16, 25, etc.) diminished by 1, which gives the series 3, 8, 15, 24, 35, 48, 63, 80, 99, 120, 143, 168, 195, 224, 255, 288, 323, 360, 399, etc., in which we must choose every fourth term after the first. But I observed equally (which is not surprising) that the infinite series 1/3 + 1/8 + 1/15 + 1/24 + 1/35 + 1/48 + 1/63 + 1/80 + 1/99, etc. has as its sum 3/4; while if we take every other term, or: 1/3 + 1/15 + 1/35 + 1/63 + 1/99, etc., the sum of this new infinite series gives 2/4, or 1/2. But in extracting every other term from this latter series one more time: 1/3 + 1/35 + 1/99, etc., the sum of the infinite series will be the semicircle whose diameter has 1 for its square.

Now, since without any additional work, one obtains an arithmetic quadrature of the hyperbola, I would like to admire this harmony in its totality:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

1 4 9 16 25 36 49 64 81 100 121 144 169 196 225 256 289 324 361 400

0 3 8 15 24 35 48 63 80 99 120 143 168 195 224 255 288 323 360 399

1/3 1/8 1/15 1/24 1/35 1/48 1/63 1/80 1/99 1/120 1/143 1/168 1/195 1/224 1/255 1/288 1/323 1/360 1/399,
etc. equals 3/4;

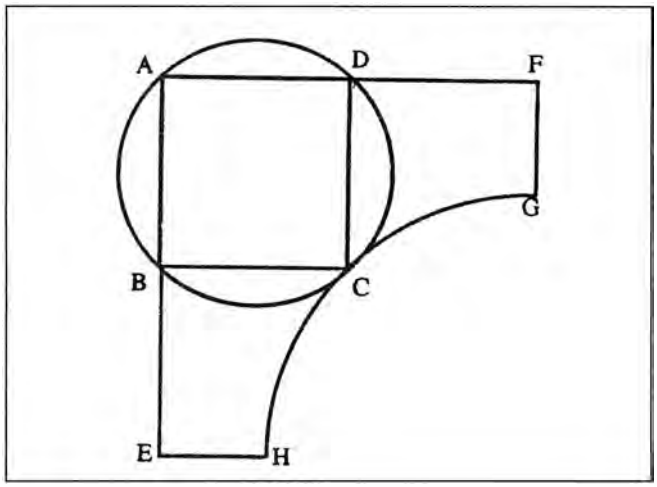
1/3 1/15 1/35 1/63 1/99 1/143 1/195 1/255 1/323 1/399
etc. equals 2/4;

1/8 1/24 1/48 1/80 1/120 1/168 1/224 1/288 1/360,
etc. equals 1/4;

1/3 1/35 1/99 1/195 1/323,
etc. is equal to the circle ABCD, whose inscribed power is 1/4;

1/8 1/48 1/120 1/224 1/360, etc.
is equal to the hyperbola *CBEHC*, whose square *ABCD* is 1/4.

Given in the figure the branch of the hyperbola *GCH* with vertex *C*, having for asymptotes the perpendicular lines *AF* and *AE*, and given *ABCD* its inscribed power, that is to say, the



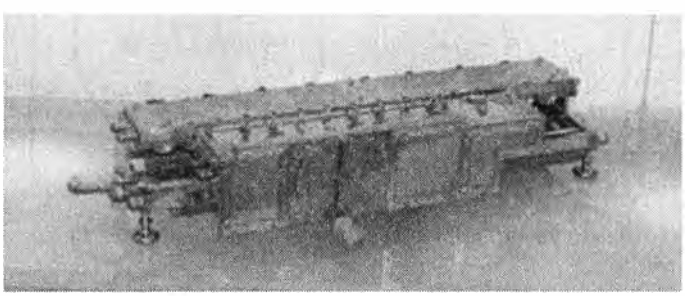
square constantly equal to the product of any ordinate whatsoever, *EH*, times the corresponding abscissa, *AE;* let us trace a circle enclosing this square, and suppose the hyperbola prolonged to the point *H*, such that *AE* is double *AB*. Then taking *AE* as unity, *AB* will be 1/2 and its square *ABCD* [He must mean the circle *ABCD*.—LH] will be 1/3 + 1/35 + 1/99, etc., but the portion of the hyperbola *CBEHC* (having for its inscribed power the same square 1/4), a portion which represents the logarithm of the ratio of *AE* to *AB* (that is to say of a double ratio), will be 1/8 + 1/48 + 1/120, etc.

Notes

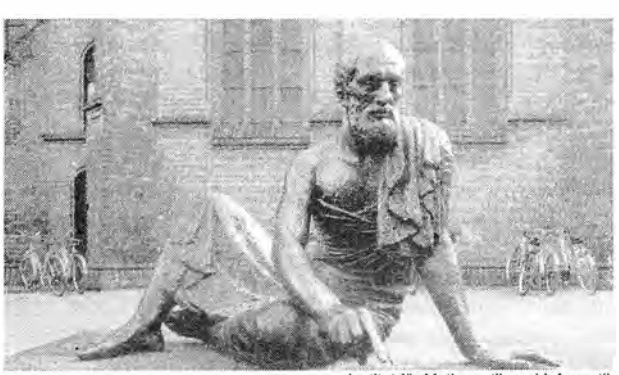
* Parmentier's note 49: In the harmonic triangle [such as the Pascal triangle—LH] the sum of a diagonal is given by a term of the preceding diagonal and has a finite value. For example: 1 + 1/3 + 1/6 + 1/10 + 1/15 + . . . = 2/1, 1 + 1/4 + 1/10 + 1/20 + 1/35 + 1/56 + . . . = 3/2 . . . .

** Parmentier's note 50: A harmonic progression is made of the inverse of the terms of an arithmetic progression. Here 1, 3, 5, 7, are naturally in an arithmetic progression of ratio 2.

Nicholas of Cusa (1401-1464), from a sculpture in St. Peter's Basilica, Rome. Cusa was the first to recognize the transcendental nature of the relationship of the circle to the square.



▲ *Leibniz built the first calculating machine capable of accurately carrying out multiplication. He showed it off to the Royal Society in London in 1672. The calculating machine is now in the Leibniz Library in Hannover, Germany.*



Institut für Mathematik und Informatik

Archimedes (287-212 B.C.) This statue by Gerhard Thieme of the great Hellenic mathematical physicist from Syracuse is in Güstrow, Germany.

Newton (right) and Leibniz (left) represent two irreconcilable epistemologies, as seen in their approaches to the calculus, politics, physical economy, and the nature of man and God. Leibniz's approach led to a flowering of mathematics and the sciences in Europe and the nascent republic of the United States, while Newton's led to their stultification in England.

Painting by Thornhill

LEIBNIZ OR NEWTON:

'What's the Difference?'

by Merv Fansler

When confronting college students and professors on the fraud and inferiority of Newton's "calculus" in contrast to Leibniz's original discovery of the infinitesimal calculus, most hurl back the mindless statement, "What's the difference? Don't they both do the same thing?" It is this type of horse sense that typifies the standards of thinking in a consumer culture. Follow this same professor as he walks into Wal-Mart, justifying his behavior to himself with, "Well, if they can make the same things in other countries more cheaply, doesn't that make it better?" Again, as he prepares his class, "If kids can accomplish the same results on tests without having to make discoveries, doesn't that make it better?" (Remember, this is the same professor who married a plastic dummy because her measurements outdid those of any real woman.)

Any student of Kepler would understand the absurdity of such attempts to "save appearances" (let alone marry them!). One who would seek to rigorously investigate such things would start with the intention to re-create in his own mind the idea that generated such footprints, just as the archaeologist attempts to envision the living, breathing creature whose fossils have been left for him. In order to know the utter ridiculousness of what most students believe to be "the calculus," we must embark on a journey to rediscover Leibniz's discovery.

Leibniz begins his *Historia et Origo Calculi Differentialis* (History and Origin of the Differential Calculus) with:

> It is an extremely useful thing to have knowledge of the true origins of memorable discoveries, especially those that have been found not by accident but by dint of meditation. It is not so much that thereby history may attribute to each man his own discoveries and that others should be encouraged to earn like commendation, as that the art of making discoveries should be extended by considering noteworthy examples of it.

The Limits of Empiricism

The first lobotomy one undergoes in any fraudulent presentation of the calculus is an indoctrination with the mind-bounding procedure of limits. Although established as the reductionist's formalization of Newton's fraud by Cauchy in the 19th Century, limits may be better recognized as a degenerate algebraicist's use of the (fittingly titled) method of exhaustion.

Sharon Stevens/EIRNS

Playing with constructive geometry at a June 2005 Detroit cadre school of the LaRouche Youth Movement. The author is at center.

One need look only so far as Cusa's reworking of Archimedes' quadrature of the circle, to locate the inferiority of limits. Cusa says, in his "Quadrature of the Circle," that those who admit the quadrature of the circle do so on the admission that, "Where one can give a larger and a smaller, one can also give an equal." In the case of the circle, the syllogism follows that, since one can construct a square larger than a given circle (for example, that circumscribing the circle), and one can also construct a square smaller than the same circle (for example, that inscribing the circle), ergo—for those of limited mind—one can also construct the equal.

For Cusa, however, a student of the divine order of Nature would never assume *a priori* the ontological qualities of things. As he demonstrates for counter-example, "There can namely be given an incidental angle that is greater than a rectilinear, and another incidental angle smaller than the rectilinear, and nevertheless, never one equal to the rectilinear. Therefore with incommensurable magnitudes this conclusion does not hold."[1]

Another example of this is found in the ontological difference between doubling a line, a square, and a cube. The doubled line will hold a rational proportion to the original line, namely 2:1. The side of the doubled square, however, can never be expressed as a rational proportion of the side of the unit square. To generate the side of a doubled square, one must discover a power of a different nature than that which doubles the line. Leibniz explicated his developed conception of this in his "Preliminary Specimen" (1695), in opposition to the Cartesians, saying, "Furthermore, I have discovered that this law of nature holds instead, namely, that the whole effect has the same power as its full cause. . . ."[2] Therefore, to achieve an effect of a different nature (for example, doubling an area or volume rather than a length), one must search for a higher power.

The reductionist may attempt a solution as such: Begin with a square whose side we will call 1. Now extend this side to a length of 2. The area of this new square will be equal to 4 (oops, that didn't work). Well, since this is too large, reduce its size by half of what we just added to it (namely, 1/2). This will give us a side of length 3/2 and this square will have an area of 9/4. (Duh! That doesn't work either.) We're getting closer, right? We didn't subtract enough, so this time subtract half of what we had subtracted before, because the square has an area larger than 2. This will leave us with a square whose side is 5/4, which means its area will be 25/16 (Wrong again!). Now even though we've been wrong at each step before, if we keep reiterating this algorithm, we'll always be getting closer and closer to the length of the square root of 2. So, since this last square is smaller than that of the doubled one, we can add half of what we just subtracted back on, leaving us a length of 11/8 and an area of 121/64. Although this is wrong again, if we continue to do this *ad infinitum,* the limit of this process will give us the square root of 2.

In other words, this process has as its boundary the side

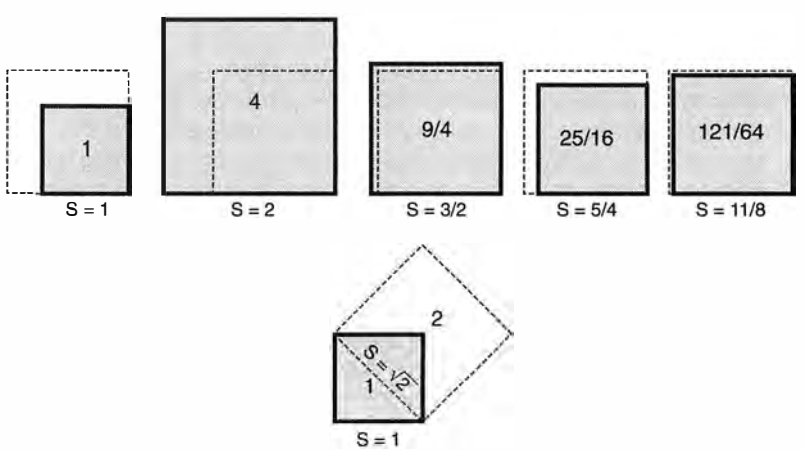


Figure 1
THE METHOD OF EXHAUSTION VS. THE CONCEPT OF POWERS
Using the method of exhaustion to find an area double that of the unit square is merely formalized trial and error. The actual solution to doubling the square lies in a lawful principle of rotation and extension, as is apparent in the lower figure.

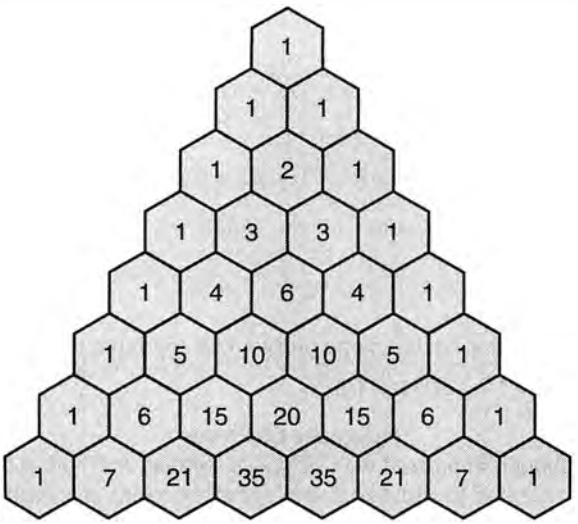


Figure 2
PASCAL'S TRIANGLE

As can be seen, numbers in lower rows are sums of the two numbers just above them. The columns represent various infinite series: 1, the rational numbers, the triangular numbers, the pyramidal numbers, and so on. If the figure is rotated 120 degrees, however, you can easily see that those infinite series form a hierarchy of "difference" series relative to later series, from 1 to as large as you wish.

of the square whose area is 2. The irony of the reductionist's behavior is the joke of E.A. Poe's "The Raven," where the character, despite the obvious situation that the raven will always answer with a negative (that is, "Nevermore"), insists on positing inquiries for which he only wants to hear an affirmation! In the case of the reductionist, despite his knowing that upon each iteration of his algorithm it will always produce the wrong square, he still insists on iterating it evermore! If there is never any qualitative change in this obsessive-compulsive behavior, how can one insist that such a procedure can validly generate an adequate solution? There is a word for that state of mind that does the exact same thing over and over again and expects a different result: insane. Like Poe's character, empiricists are bound by those self-imposed limits of shadows on the wall of Plato's Cave.

A similar case holds true for the doubling of the cube, which is of a higher power than both the line and the square. In each case, one must do as Archytas did, and hypothesize a higher power which is generating the paradoxes one encounters in investigating such problems. Of course, the empiricist will *a priori* exclude from his fishbowl any concept of a higher principle, especially as it demands of him the exercising of another power which he has also excluded from the universe: the creativity of the human mind.

Leibniz pointed out such fraudulent attacks on his calculus in his "Historia": "Moreover, they have changed the whole point of the issue, for in their screed, in which under title of 'Commercium Epistolicum D. Johannis Collinsii,' (1712) they have said very little about the calculus; instead, every other page is made up of what they call infinite series."

He goes on to tell of the fishbowl of Descartes that he smashed:

> . . . [M]oreover, the more advanced parts pertaining to Archimedean geometry, and to lines which were called "mechanical" by Descartes, were excluded by the latter in his calculus. But now by the calculus of Leibniz, the whole of geometry is subjected to analytical computation, and those transcendental lines that Descartes called mechanical are also reduced to equations chosen to suit them, by considering the differences *dx, ddx,* etc. and the sums that are the inverses of these differences, as functions of the *x*'s; and this, by merely introducing the calculus, whereas before this no other functions were admissible but *x, xx, xxx,* square root of *x,* etc., that is to say, powers and roots.

Then, commenting on the Newtonians, he adds:

> . . . [T]he new discoveries that were made by the help of the differential calculus were hidden from the followers of Newton's method, nor could they produce anything of real value nor even avoid inaccuracies until they learned the calculus of Leibniz, as is found in the investigation of the catenary as made by David Gregory.[3]

It is from the standpoint of such an understanding of higher powers and the inferiority of limits to resolve their incommensurability that Gauss later attacked D'Alembert's attempted foolery respecting the Fundamental Theorem of Algebra. Ironically, it is D'Alembert's use of a Newtonian method for extracting roots, extended to "imaginary numbers," that Gauss chose as his flank to prove that such limited methods are of absolutely imaginary worth in approaching the problem of hypergeometric series!

Art vs. Algorithm

Leibniz recounts that as a youth it wasn't until he met Christiaan Huygens in Paris in 1672 (where Huygens had been invited by Colbert to drive forward the Academy of Sciences in Paris, which Colbert established in 1666), that Leibniz, at the age of 26, was first introduced to higher geometry, in particular to Huygens's work on the tautochrone principle of his pendulum, as well as the work of Pascal, who also resided in Paris at the time. In fact, Leibniz recalls that he had little memory of geometry in school, reading through works such as Euclid as though he were reading a novel!

However, the principles he had unearthed through his work on his dissertation, entitled "The Art of Combinations," displayed enough talent to provoke Huygens to test Leibniz's power of discovery. In "The Art of Combinations," Leibniz presents his discovery that the sum of the differences of a

series is equal to the difference of the extreme terms in the series.

For example, take the square numbers and their differences (don't block on playing with blocks!):

0 1 4 9 16 25 36 . . .

1 3 5 7 9 11 . . .

The sum

1 + 3 + 5 + 7 + 9 = 25 − 0 = 25,

and also

7 + 9 + 11 = 36 − 9 = 27.

One should also play with the cubic and biquadratic numbers and their differences (as well as the differences of their differences).

Another type of progression is the geometrical series. For example, try doubling and its differences:

1 2 4 8 16 32 64 128 . . .

1 2 4 8 16 32 64 . . .

1 2 4 8 16 32 . . .

What's going on here that isn't occurring in the squares, cubes, and biquadratics? One should also try this with tripling and quadrupling. Despite this significant difference, one can still find that the same principle holds.

2 + 4 + 8 = 16 − 2 = 14,

and also

4 + 8 + 16 = 32 − 4 = 28.

In "The Art of Combinations," Leibniz also examines a series of series:

1 1 1 1 1 1 1 1 1 . . .

1 2 3 4 5 6 7 8 9 . . .

1 3 6 10 15 21 28 36 45. . .

1 4 10 20 35 56 84 120 165. . .

The principle of this table is that each element in the series is the sum of the number to the left of it and the number above it. Again, if one wants to unblock one's conception of this table, pull out the blocks! The first row is just a series of 1's. The second is the sequence of natural numbers. The Pythagoreans, as well as Leibniz, called the third row the triangular numbers. They also named the fourth row the pyramidal numbers. The next row (which isn't shown) would have been called the triangulo-triangular. Furthermore, some might also recognize the entire table as another very special triangle! (See Figure 2.)

What excited Leibniz and Huygens most, though, was Leibniz's insight into the application of his principle to infinite series. Take the geometrical progression of halving as a test case:

1 1/2 1/4 1/8 1/16 1/32 1/64 . . .

1/2 1/4 1/8 1/16 1/32 1/64 . . .

This should remind us of the geometrical progression of doubling, tripling, etc. In this case one can see that

1/2 + 1/4 + 1/8 = 1 − 1/8 = 7/8,

and also

1/4 + 1/8 + 1/16 + 1/32 = 1/2 − 1/32 = 15/32.

What then, would be the total for

1/2 + 1/4 + 1/8 + 1/16 + 1/32 + 1/64 + . . . = ?

Leibniz said it would be the difference of the extremes, namely:

1 – 0 = 1.

One should solve this same problem for the infinite series

1 + 1/3 + 1/9 + 1/27 + 1/81 + ...[4]

Huygens's Challenge

Although impressed with Leibniz's method, Huygens took it upon himself to provoke Leibniz into exploring the depth of his discovery. In a sequence of letters dated April and May 1673 to Oldenburg, whom Leibniz had met in England in 1672 before returning to Paris, Leibniz reports on Huygens's challenge. Leibniz says that Huygens pointed out to him that it had been shown before that the series

1 + 1/2 + 1/3 + 1/4 + 1/5 + 1/6 + . . .

(known to the Greeks as the Harmonic Sequence) had no definite sum, but that, although it had been assumed that the inverse triangular numbers,

1, 1/3, 1/6, 1/10, 1/15, . . . ,

for similar reasons, also had no sum, he did not recall anyone sufficiently demonstrating that to be the case. Huygens posed to Leibniz the problem: What is the sum of

1 + 1/3 + 1/6 + 1/10 + 1/15 + 1/21 + . . . ?

(Notice that the denominators are the triangular numbers.)

This sufficiently provoked Leibniz to elevate his conception. Instead of taking the route of the reductionist, who would attempt to extract a formula out of the series and run it to its limits, Leibniz asked himself, not what is the difference in each of these terms, but a question of a higher hypothesis: What is the higher function which is generating this one as its characteristic of change? What is the higher power generating this, as a foot does a footprint? What substance is generating this shadow?

Leibniz returned to Huygens with his solution: The differences of the harmonic series are as follows,

1 1/2 1/3 1/4 1/5 1/6 1/7 . . .

1/2 1/6 1/12 1/20 1/30 1/42 . . .

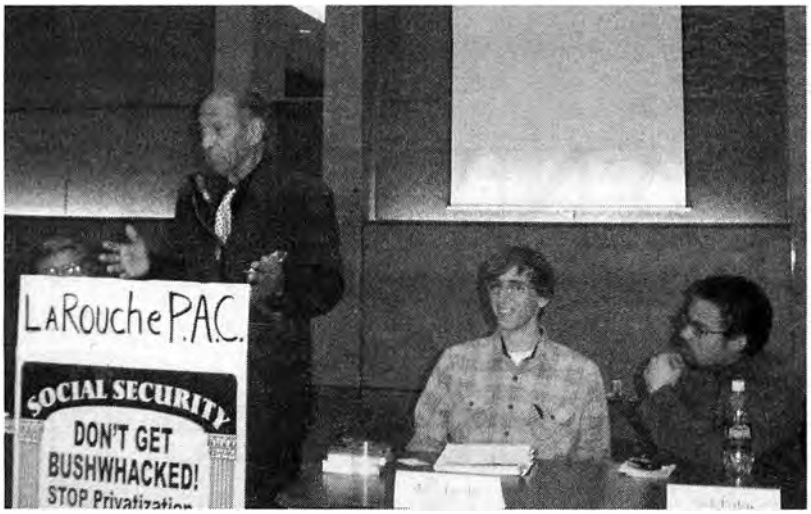
but,

1/2 1/6 1/12 1/20 1/30 1/42 . . . = (1/2) × (1 1/3 1/6 1/10 1/15 1/21 . . .)

Therefore,

2/1 2/2 2/3 2/4 2/5 2/6 2/7 . . .

1 1/3 1/6 1/10 1/15 1/21 . . .



Sharon Stevens/EIRNS

Author Merv Fansler (second from right) at a town meeting on saving Social Security, in Detroit, March 23, 2005, sponsored by LaRouche PAC. At the podium is Michigan Democrat Rep. John Conyers, one of the Congressmen leading the fight for Social Security.

Applying Leibniz's method then gives us:

$1 + 1/3 + 1/6 + 1/10 + 1/15 + 1/21 + \ldots$

$= 2 - 0 = 2$

Leibniz continues in his letter to Oldenburg,[5] that not only did his new invention bring him to resolve the question that Huygens posed to him, but that it also enabled him to solve the inverse pyramidal numbers and the triangulo-triangular numbers as well (we leave that to the reader to work out). (The reader might also experiment with the inverse squares, cubes, pentagonals, and so on.)

Gauss, Riemann, and LaRouche

The question yet remaining is, What is the nature of the series

$1 + 1/2 + 1/3 + 1/4 + 1/5 + \ldots ?$

At first glance, one might assume that, since each term in the sequence is less than the previous one, this series must have some boundary that it could never surpass. However, it is on exactly this fallacy that Gauss unveils the fishbowl surrounding D'Alembert's reductionist mindset. The inverse natural numbers and the inverse triangular numbers are both examples of what Gauss and Riemann called hypergeometric series. It was D'Alembert's exclusion of the potential for such a higher ordering that typifies the behavior of a reductionist.

Both Gauss and Riemann asked themselves: What is the higher power that generates the series of hypergeometric series? What is the principle of which what I see is merely the footprint? The answer to such questions lies outside the domain of an empiricist's limits.

Just the same, when asking what is the difference between Newton and Leibniz, one must adopt the Vernadsky approach to identifying the ontological difference in the generative principle of the two. The point is made very clearly by Lyndon LaRouche in his recent piece "Memo on the 'Pericles Syndrome' ":

> Begin with the principle of life. Just as Kepler defined gravitation as a universal effect lying outside the bounds of the reductionist method of Aristotle's follower Claudius Ptolemy, gravitation is a principle which does not exist as a systemically scientific conception within the bounds of simple phenomenology. So, the universal physical principle of life is defined experimentally by existing states of organization of non-living matter which are never generated by non-living processes. So, in other words, life is defined by its manifest, singular efficiency in generating accumulations of fossils which can not be attributed to non-living states. So, cognition is defined by the generation of accumulated fossils of a type which can not be attributed to the same processes which produce the fossils of the Biosphere.
>
> Creativity is therefore defined as the principled generation of increase of the power of generation of fossil products of the Noösphere. The mental action which accounts for this can not be attributed to living processes in general [or empiricists!—MMf], but is expressed in the form of a change in the power which the human individual is able to generate as a quality of upshift in the characteristic rate of qualitative, rather than merely quantitative, growth within a phase of the Noösphere.[6]

SCIENCE and the LaRouche Youth Movement

Therein lies the difference.

Merv Fansler is a LaRouche Youth Movement leader, organizing in Detroit.

Notes

1. See William F. Wertz, Jr., "Nicolaus of Cusa's 'On the Quadrature of the Circle,' " *Fidelio*, Summer 2001, p. 30.
2. G.W. Leibniz, "Preface to the Dynamics," *Philosophical Essays*, translated by Roger Ariew and Daniel Garber (Indianapolis: Hackett Publishing Co., 1989), pp.105-111.
3. Find out more about the catenary in the development of Leibniz's mathematical ideas at: http://wlym.com/antidummies/part10.html
4. Joseph E. Hofmann, *Leibniz in Paris: 1672-1676*, (Cambridge University Press, 1974).
   It was known at Leibniz's time that one could solve such geometric sequences geometrically. Take as an example the magnitude AB. Construct point *C* such that *AB:BC* = 2:1. One can continue such a construction where *AB:BC::BC:CD::CD:DE::* . . . = 2:1. Then what is the total length of such a series?
   If one can locate the point *K* such that *AK:BK::AB:BC*, then the magnitude *AK* will be the sought-for sum. Anyone skillful in geometry should be able to find a general construction for *K*, given any proportion for *AB:BC*. Have fun!
5. G.W. Leibniz, *Leibniz' Mathematische Schriften*, C. I. Gerhardt, ed. (Berlin, 1849), Volume I of VII, pp. 37-50. (Text in Latin.)
6. Lyndon H. LaRouche, Jr., "Memo on the 'Pericles Syndrome': The Case of a Vice President's Mass Insanity," *EIR*, July 29, 2005.

FLU PANDEMIC

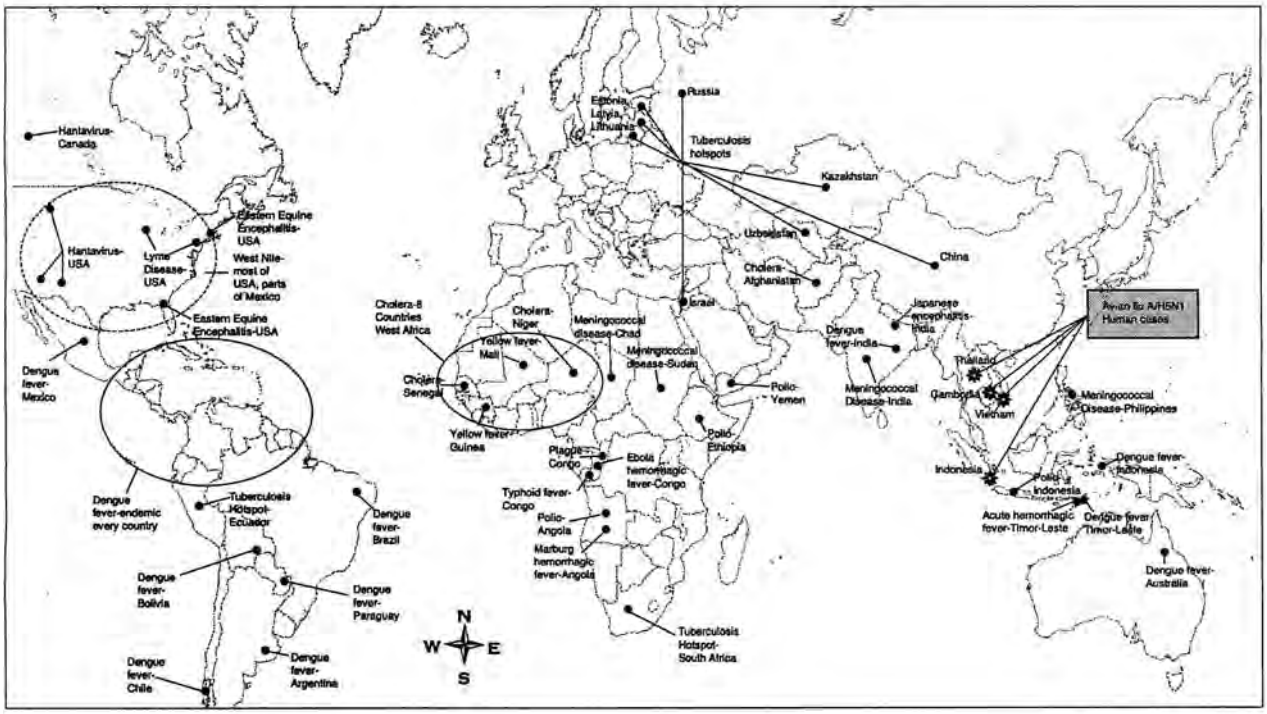
It's the Physical Economy, Stupid!

FAO

Declining world living standards, combined with globalized agriculture, have created ideal conditions for the development and spread of infectious diseases. Here a live fowl market in Asia, where the close proximity of human beings and animal and bird species provides a culture for avian flu to spread.

A global pandemic of the H5N1 avian influenza virus now threatens 50 million or more lives. The virulence of this new strain of Influenza A is established by the fact that, of the 118 confirmed cases so far among humans, 64 died in a short time. To date, *most* of those infected were in close proximity to infected animals. The remaining step in the evolution of the virus is a reassortment or mutation of the existing strain to a form capable of easy human-to-human transmission. There is no doubt among experts in the relevant fields of virology and veterinary medicine that this final step is coming some time soon. The question is not if, but when.

Emergency measures must be taken now, before it is too late. These must include: protection of front-line defenders; government action under emergency provisions to accelerate vaccine preparation, and to produce and stockpile antiviral medication; and gear-up of emergency capabilities for medical and public health response. No more hospital closings. No more takedown of



EMERGING INFECTIOUS DISEASE HOTSPOTS 2005

The map is a "snapshot" of the major infectious disease outbreaks for 2005 globally, including the emerging human breakout of avian influenza A/H5N1 in Asia this year. Not included are the ongoing HIV/AIDS pandemic now devastating Africa and moving into Asia and Russia, and malaria, one of the top three killer diseases worldwide.

Sources: WHO, CDC, PAHO

medical capability such as the decision to break up the research capability of Walter Reed Army Medical Center, in Washington, D.C.

There are two crucial and frequently overlooked points which relevant experts and layman alike need to know in the coming battle to defeat this deadly threat.

First, the avian flu threat is part of a general biological holocaust, which is the result of a decades-long collapse of world physical economic infrastructure. **Second,** the collapse of living standards and spread of disease is the intentional and willful policy of leading financial elites. We address these points consecutively below.

Pandemic and Physical Economic Breakdown

Despite mountains of propaganda, the average standard of living of each member of the human species has been significantly reduced since the 1965-1971 period. A county-by-county breakdown of the physical productivity of U.S. manufacturing regions, carried out by the *Executive Intelligence Review* economics staff, makes the point so dramatically as to be irrefutable, regarding the United States.

The declining condition of life in most Third World nations has become so severe that the rising rates of infectious disease, infant mortality, and malnutrition—not monetary economic measures—have become the most precise indicator.

Accompanying this physical economic breakdown, which dates to the 1965-1971 period of abandonment of the commitment to the development of an agro-industrial economy in the United States, has been the spread of a global biological holocaust, which includes the emergence of AIDS, and re-emergence of once-controlled tuberculosis, malaria, and a full spectrum of other infectious diseases, affecting the human, animal, and plant populations. These two features, physical economic collapse and biological collapse, interact in myriad interconnected ways, some understood and some yet to be discovered.

Primary among causative factors has been the proliferation of agricultural practices such as monoculture, which has so reduced the species diversity of crops as to threaten disaster with the onset of every new disease. A similar reduction in the diversity of species and varieties poses a dangerous threat to the sustainability of livestock in the event of infection.

In livestock management, a danger arises at both ends of the economic spectrum. The intermixing of migratory waterfowl (which carry influenza A virus in their intestinal tract), with farm populations of fowl and mammalian livestock, provides the breeding ground for emergence of a new strain of H5N1 capable of human-to-human transmission. At the low end of the economic spectrum, this species mixing occurs in traditional agricultural practices. On the other end of the econom-

LaRouche: Public Sanitation Is First Line of Defense

During the anthrax-letter episodes of Fall 2001, Lyndon H. LaRouche, Jr. released a policy document, "National Defense Against Germ Warfare," through his Presidential campaign, LaRouche in 2004. Some excerpts from this Oct. 28, 2001 statement follow. (The full text is at www.larouchein2004.com.)

The most important principles of national defense against bacteriological and related forms of warfare, were consolidated as knowledge in the experience of World War II and the war in Korea. Those lessons were featured in the adoption and implementation of the Hill-Burton legislation adopted shortly after the close of World War II.

From the related experience our nation, and others, have accumulated over the centuries, we must not limit the idea of defense against germ warfare and related attacks, to the role of medical practice. We must situate the role of the medical profession, both in care for the sick and in other ways, as an essential, subsumed feature of public sanitation.

I explain this extremely important distinction to be made at this point of our national defense requirements. It is to the degree that we have taken down much of the national-defense protection provided by public and related measures of sanitation, during the recent three decades, that our nation's vulnerabilities to the presently ongoing germ-warfare attacks were created as the opportunities they presently represent to the advantage of our enemies.

National biological defense means, chiefly, those measures of sanitation which are essential to improving and defending the life-expectancies and well-being of the population as a whole. . . . This includes not only safe water, but also improved supplies of energy, per capita and per square kilometer; it includes improved public transportation.

EIRNS

Lyndon LaRouche in 1974, testifying in Washington, D.C., before the House Judiciary Committee. In 1973, LaRouche commissioned a task force on biological holocaust, to study the emergence of new and old pandemic diseases that were likely to result from the shift to policies of austerity and deindustrialization.

The General Hospital

It also includes the practice of the medical professions generally. The pivotal feature of the medical profession's role is the general hospital, provided as a public institution which is not only a teaching institution, but which serves those sections of the population which are relatively indigent, and are therefore the most likely radiators of infectious diseases. The public teaching hospital of this type, which is also integrated with the teaching and research functions of a university, is among the most valuable such facilities.

The feature of medical practice to be emphasized in dealing with the actuality and threats of biological warfare, as now, is the ability of the medical profession to respond effectively by producing, rapidly, appropriate forms of non-standard treatment for diseases of a non-standard quality. In such circumstances, we must deal not merely with the apparent "ingenuity" of infectious organisms, but with an enemy, like H.G. Wells's fictional "Dr. Moreau," whose satanic impulses are employed to make infectious agents more deadly than such diseases could become by so-called natural means.

However, without lessening emphasis on the importance of medical counter-intelligence practice, *it is public sanitation which remains the first line of defense of the population against both normal epidemic disease, and also biological warfare attacks.* We require a coordinated, "crash program" sort of attack on both fronts, combined.

This means that we must move quickly, not only to restore the indispensable Washington, D.C. General Hospital, but to restore those medical and infrastructural defenses which were taken down, piece by piece, during the approximate quarter-century since the enactment of the [1974] HMO legislation.

ic spectrum, massive factory farming of chickens, pigs, and other animals provides a breeding ground for rapid spread of any infection and the human-animal interaction which can facilitate mutation and viral reassortment. Similarly for the large-scale poultry processing operations, animal feedlots, abbatoirs, and so on.

In all these cases, pressures for quick-return on financial investment, a key feature of the disastrously mismanaged global economic environment, lead to shortcutting of sanitary practices, and use of untrained labor, often under conditions of overwork and poor health. Even the most brilliant work of veterinary pathologists cannot always be expected to stem the tide of infection under such circumstances.

The level of health and immunological resistance of the human population is the final link in the chain of spread of pandemic disease. Here is where the low level of public health infrastructure in developing nations, and the takedown of once advanced capabilities in formerly industrialized nations such as the United States, really take their toll. First, resistance to most types of infection resides not in the individual, but in a population as a whole. The spread of HIV/AIDS in famine- and disease-wracked sub-Saharan Africa is a case in point, as is the resurgence of tuberculosis in such locations as the economically looted states of the former Soviet Union. Poor infrastructure for provision of clean water, sanitation, and basic public health are the hallmarks of a region marked for human ecological holocaust. Such populations are the breeding ground for new and more virulent forms of pandemic disease, which have no respect for political borders.

HHS/Images from the History of the Public Health Service

A U.S. public health nurse visits rural patients, around 1920. Today, the public health gains of the last century are in decline, as the physical economy disintegrates and health budgets are cut.

Precisely this interconnection of declining physical economy, public health, and the emergence of new and old forms of pandemic disease was the thesis of economist Lyndon LaRouche, in 1973, when he commissioned a task force on *biological holocaust*. LaRouche recognized at the time that the shift in U.S. policy from that of an agro-industrial producer society, committed to industrial development of the Third World, to a consumer society, increasingly dependent on imports from low-wage nations, meant a downward shift in the global economic productivity and a concomitant reduction in average per capita living standards for the entire world population. The monetary arrangements associated with that shift, the end of the Bretton Woods gold-reserve standard in 1971 and its replacement by a floating exchange rate, created the conditions for the looting of wealth out of developing nations by way of adjustment of currency values, so as to astronomically increase debt service payments.

LaRouche recognized in the austerity terms imposed on already poor, hard-pressed developing nations by the International Monetary Fund and related institutions, precisely the conditions for emergence and spread of pandemic. The appearance of the HIV/AIDS infection in Africa in the 1980s, and its spread into Southeast Asia, and other locations in the 1990s, was precisely the sort of thing to be expected.

The Intention Behind the Collapse

The second point that is often overlooked: The collapse of living standards and spread of disease is the intentional and willful policy of leading financial elites. Prince Philip's 1986 call to be reincarnated as a "deadly virus" in order to help reduce world population, was no idle fancy (see box). The Duke of Edinburgh was stating a personal commitment to a policy of the Anglo-Venetian financial elite, otherwise spelled out in the 1974 National Security Study Memorandum 200 directed by then National Security Advisor Henry A. Kissinger.

There, Kissinger developed the nakedly colonial policy that population growth in Less Developed Countries threatened our national security by denying U.S. access to strategic minerals. Thirteen key countries were specially targetted for population reduction: India, Bangladesh, Pakistan, Nigeria, Mexico, Indonesia, Brazil, the Philippines, Thailand, Egypt, Turkey, Ethiopia, and Colombia. That policy commitment continues to be a guiding principle in foreign policy objectives of the Cheney-run Bush Administration today.

Although many would wish to avoid facing this nasty side of the matter, recognition of the problem is a necessary part of dealing with the current reality. Failure to face it will cause much wasted effort by otherwise well-intentioned and qualified opponents of this new genocide in their dealings with government and policy-making institutions. Ultimately, the only solution to the global pandemic threat is to eliminate the

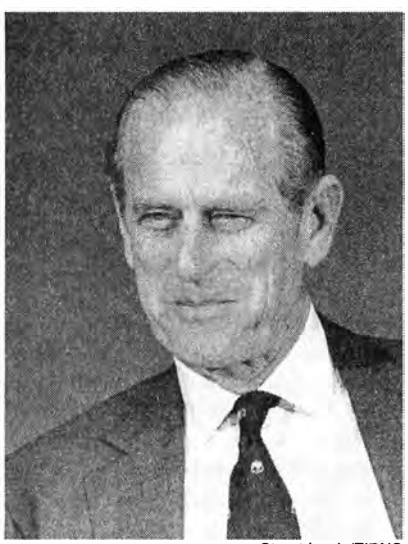
conditions of economic backwardness which allow them to spread.

In the following articles, we first provide the reader with an overview of the avian influenza H5N1—how it works, the immediate threat it poses, and the short-term emergency measures which must be taken to deal with it. Next, we address the question of the larger context of global pandemic, the physical economic breakdown, and what must be done to restore a functioning public health system. To this end, we include substantial excerpts from the testimony before Congress by the LaRouche Political Action Committee at the time of the November 2004 U.S. crisis in flu vaccine. Our intent is to offer a summary overview of the threat from new and re-emerging diseases, and the necessary approach to public health which must be implemented, pronto, if the human species is not to succumb to a global biological holocaust worse than any we have seen before. We make no exaggeration, as the reader who takes the trouble to find out for himself will soon learn.

—Laurence Hecht

Who Wants a Pandemic?

It's not just "natural causes." The destruction of public health infrastructure, and abandonment of populations to disease and famine have a willful component. Some people want genocide.



Stuart Lewis/EIRNS

Prince Philip: Deadly virus?

"In the event that I am reincarnated, I would like to return as a deadly virus, in order to contribute something to solve overpopulation."

—Prince Philip, Duke of Edinburgh and director of the World Wildlife Fund, as reported by Deutsche Press Agentur, August 1988

"I don't claim to have any special interest in natural history, but as a boy I was made aware of the annual fluctuations in the number of game animals and the need to adjust the 'cull' to the size of the surplus population."

—Prince Philip, Duke of Edinburgh, preface to Down to Earth, *1988*

"For example, the World Health Organization Project, designed to eradicate malaria from Sri Lanka in the post-war years, achieved its purpose. But the problem today is that Sri Lanka must feed three times as many mouths, find three times as many jobs, provide three times the housing, energy, schools, hospitals and land for settlement in order to maintain the same standards."

—Prince Philip, Address on Receiving Honorary Degree from the University of Western Ontario, Canada, July 1, 1983

"[T]here are only two possible ways in which a world of 10 billion people can be averted. Either the current birth rates must come down more quickly. Or the current death rates must go up. . . . Famine and disease are nature's ancient checks on population growth, and neither one has disappeared from the scene."

—Robert McNamara, then president of the World Bank, Oct. 2, 1979

"The Mexican population must be reduced by half. Seal the border and watch them scream." Asked how this population reduction would be accomplished, the speaker replied, "By the usual means: famine, war, and pestilence."

—William Paddock, U.S. State Department consultant, in a 1975 interview

Library of Congress

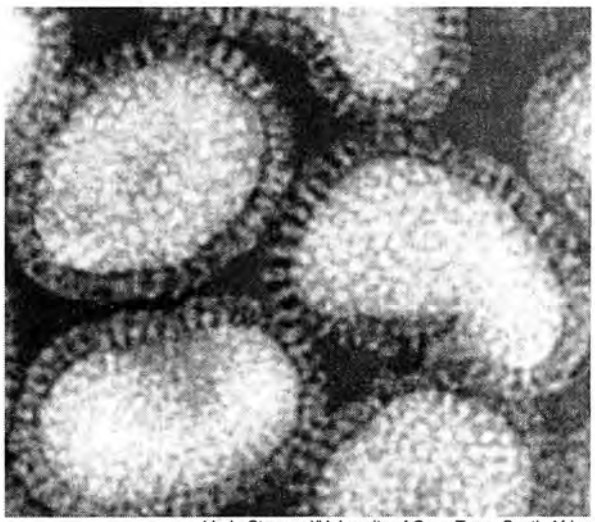
Bertrand Russell: Black Death advocate

"At present the population of the world is increasing at about 58,000 per diem. War, so far, has had no very great effect on this increase, which continued throughout each of the world wars. . . . War has hitherto been disappointing in this respect . . . but perhaps bacteriological war may prove effective. If a Black Death could spread throughout the world once in every generation, survivors could procreate freely without making the world too full. The state of affairs might be unpleasant, but what of it."

—Bertrand Russell, The Impact of Science on Society, *1952* (Routledge UK)

Last Chance to Stop Avian Flu Pandemic

by Colin Lowry



Linda Stannard/University of Cape Town, South Africa

The H5N1 avian flu virus up close. Actual size is about 200 nanometers diameter.

Events in Asia over the past few months have put the world on a short fuse toward the explosion of a global influenza pandemic. Avian influenza (H5N1) has broken out in several new places, and last Spring it infected another species, the pig, which could act as a carrier and mixing vessel for the recombination of a hybrid virus that can easily infect people.

This very lethal influenza virus has only to acquire the ability to spread easily from person to person to become the most deadly flu pandemic ever recorded. However, most of the world remains sorely unprepared to deal with the public health crisis that the new flu pandemic will bring. The United States itself is suffering a serious crisis in its public health response capability, as a result of years of willful neglect. The U.S. government has done nothing to address the lack of hospital and clinic capacity that would be required to deal with a pandemic, although a typical flu season already overwhelms the hospitals in many areas of the country. Antiviral production capacity is severely restricted, and vaccine production has not been geared up for the sort of crash program that is needed.

Center for Biologic Terrorism and Emerging Diseases

More than 140 million chickens were killed in Asia to try to stop the spread of the H5N1 strain of avian flu. But the avian flu has continued to spread, as wild birds carrying the infection fly out from their breeding areas. Here, domestic chickens are burned in Hanoi.

The Flu Spreads

Since Dec. 26, 2003, 118 cases of human infection with H5N1 have occurred in four Asian countries. There were 63 deaths, indicating more than a 50 percent mortality rate for this deadly virus. What will mark the transition to a global pandemic is the development of a viral strain which can easily move from human to

human. There is general agreement among virology and disease control experts that it is not a question of "if," but "when."

Indonesia reported its first human cases and fatalities from avian influenza type H5N1 on July 21, 2005, with the death of a father and two of his young daughters. The man died 10 days after the onset of symptoms, despite treatment in the hospital. Making the cases more mysterious, is the fact that the man lived in a city and had no known exposure risk to wild or domestic birds, which, so far, have been the primary vectors for spreading the disease to people.

The health authorities in Indonesia are coordinating with the World Health Organization (WHO) to track down all of the people who may have been exposed to the virus from the victims, or who had recent contact with them, to try to find the source of the infection.

In April in Indonesia, researchers reported that they had been testing for the presence of H5N1 influenza in domestic pigs, and found that in one area on the island of Java, there were many pigs that showed no symptoms but were infected with the virus. This finding is extremely serious, as pigs could now be vectors of the avian influenza virus, and because the pigs showed no symptoms of the disease, it makes detection even more difficult. In Asia, large-scale testing for the virus in domestic pigs is economically impossible under current conditions.

The fact that the pigs could now harbor the avian virus also makes them a dangerous new mixing vessel for the creation of a new form of the virus, if the pigs are also infected with a human influenza virus. Pigs routinely are susceptible to human influenza viruses, and can carry them asymptomatically as well. Influenza type A viruses can recombine and swap genes, creating a new and potentially more dangerous virus. A recombination event in the pig, with a human and avian influenza virus, could produce a virus that could easily spread from person to person—which is exactly what the experts fear will be the start of the next deadly pandemic.

Can a New Pandemic Be Prevented?

The Summer avian flu outbreak in Qinghai province in China showed that wild birds are an important vector in the spread of the disease, and their flight patterns mean that the disease is far from contained in Asia. As of early September, more than 140 million domestic chickens had been slaughtered in an attempt to contain the spread of the disease. Avian flu has spread to Kazakhstan and in the Russian region of Novosibirsk, probably from infected wild birds coming from the breeding area of Qinghai Lake in China.

Wild bird flyways during migration from this area go to Russia, Europe, India, and the Middle East. German farmers were advised to put all their poultry under cover as of Sept. 15; the Netherlands ordered this as of Aug. 22. In an outbreak of a less dangerous bird flu in the Netherlands, in 2003, many public health workers handling the birds took ill, and one veterinarian died.

Some Siberian species also fly over to Alaska, where they mix with North American species. Limited testing is now going on among some birds in Alaska.

WHO Strategy Review

In early July 2005, the United Nations World Health Organization (WHO), the U.N. Food and Agriculture Organization (FAO), and the World Organization for Animal Health (OIE) held an international meeting of health officials and scientists in Malaysia to review the strategy to combat the avian influenza epidemic in Asia. The meeting concluded by adopting a prevention plan with four main objectives. Although insufficient to meet the total threat, these could form an important part of a larger plan of flu prevention and public health measures to be taken:

- (1) Farming practices must be changed to segregate the species, so that chickens, ducks, and pigs are not kept together, allowing a flu virus to move from species to species, and recombine into a new form.
- (2) A large education program must be set up for small farmers and their families about risky livestock practices, and how to limit exposure of people to animal viruses.
- (3) The testing and reporting of suspected flu outbreaks must be improved, with incentives for farmers to report outbreaks in their flocks, so that the necessary control measures can be applied.
- (4) A better poultry influenza vaccine needs to be developed; large-scale vaccination of poultry in countries with endemic avian flu may be the only way to stop the epidemic from spreading.

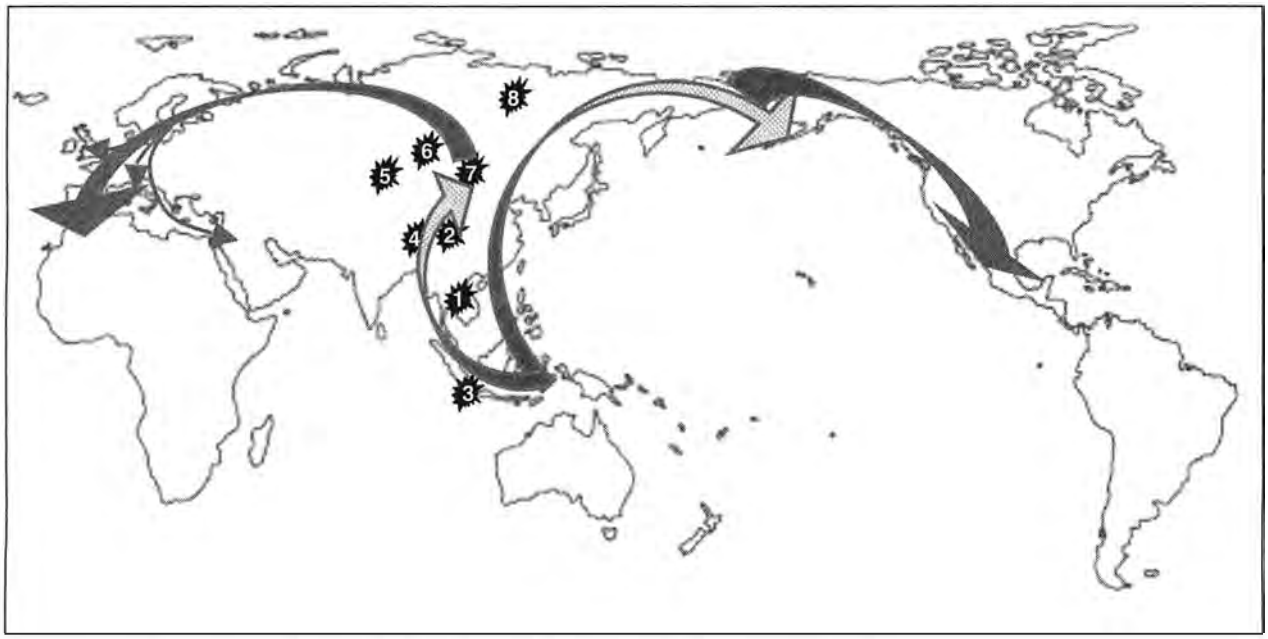
The implementation of the WHO plan would cost about $250 million, which would have to come mostly from the developed countries outside of Asia. The plan also calls for the buildup of public health infrastructure, including laboratories, clinics, disease surveillance, and the purchase of antiviral medicines, which would require much more funding than that included in the WHO budget.

The question of the effectiveness of an H5N1 vaccine based on the seed strains the WHO was using last year is still not resolved, as no one can say what the composition of a new variant virus would be, but so far, studies from Vietnam show that the virus has changed very little over the last year. The vaccines are still being developed, and if the H5N1 virus were to break out this year in Asia, spreading from person to person, the vaccines would not be ready for use. The only other treatment would be antiviral drugs, but the older class of drugs, such as Amantadine and Rimantadine have shown little effectiveness against H5N1 in human patients.

The newer drugs, Tamiflu and Relenza, are more effective, but are much more expensive, and are in short supply worldwide. Tamiflu is manufactured only by Roche Pharmaceuticals, and only in one plant in Switzerland. Orders from 14 countries for 40 million doses are still being fulfilled and at current capacity, the manufacturing process will take about one year to produce that amount. But this will be insufficient in the event of a global pandemic, where potentially a billion doses would be needed.

Are Antivirals Effective Enough?

A new study done by a research team at St. Jude Children's Hospital in Memphis, Tenn., has shown that the previous assumptions about how much Tamiflu is required, and how



WATERFOWL FLYWAYS AND H5N1 AVIAN FLU OUTBREAKS IN BIRDS

The known flyways of waterfowl indicate where the H5N1 avian flu is likely to move—and why we have a pandemic waiting in the wings. Indicated are the locations where major bird outbreaks have occurred: (1) Southeast Asia (Thailand, Cambodia, Vietnam); (2) China; (3) Indonesia; (4) Tibet (near Lhassa); (5) Kazakstan, Uzbekistan; (6) Russia; (7) Mongolia; (8) Siberia.

long a patient should be treated, may not work against the new variety of avian H5N1 in circulation now. Previous work using the original H5N1 virus, which was isolated from Hong Kong in 1997, showed that a five-day course of Tamiflu given to mice experimentally infected with the virus resulted in about an 80 percent survival rate. When this experiment was done using the H5N1 virus isolated from Vietnam in 2004, the same treatment was able to save only 50 percent of the infected mice.

Continuing the study with varying doses and time courses, it was found that to get 80 percent survival in the mice infected with the 2004 H5N1 virus required an eight-day treatment with Tamiflu. If this study is an indication of what the new variant virus might look like from a treatment perspective, it means that even more Tamiflu will be required, and that current stockpiles of the drug will be exhausted more quickly in the event of a pandemic.

Flu vaccine production in the United States depends on only two companies, neither of which could produce enough vaccine to protect the U.S. population. Antiviral medicines, which may be the only effective treatment in the absence of a vaccine, are in short supply, and WHO recommendations to increase the production of these medicines and to stockpile supplies have been mostly ignored here.

What Makes Avian H5N1 So Dangerous?

H5N1 avian flu infection can be deadly to people by causing respiratory failure. The clinical course of the infection produces high fever, and inflammation of the respiratory membranes. However, the overreaction of the immune system often leads to severe inflammation of the lungs, including flooding of the alveolae, and often massive internal bleeding in the lungs.

In many patients, the infection triggers a cytokine immune response that is not turned off by the body, leading to tissue damage. Patients have died of respiratory failure 7 to 10 days after the initial onset of symptoms.

An unusual feature of the H5N1 human cases was the presence of primary viral pneumonia; generally, pneumonias seen in flu cases result from secondary bacterial infections.

H5N1 influenza is a type A influenza virus, which is highly unstable, and prone to genetic mutation. In addition to mutation, the virus can reassort genetically, by combining with another influenza virus. In this way, the virus can pick up new genes from other viruses in a sort of swap of genetic material. The virus is further defined by the variety of surface antigens for Hemagglutinin (H) and Neuraminidase (N) it contains.

How It Started

Although avian influenza viruses usually cause disease only in birds, H5N1 jumped the species barrier in 1997, and caused the first documented human infections, with severe disease and deaths. This outbreak in Hong Kong in 1997, started with a highly pathogenic H5N1 on poultry farms and in live bird markets, which was then transmitted directly from birds to human beings, resulting in 18 cases and 6 deaths. A wider epidemic was averted by the decision to destroy the province's entire poultry population. The quick action of the

How Avian Flu Virus Takes Over a Cell

by Christine Craig

The avian influenza virus is a remarkably simple entity consisting of eight segments, or strands, of the genetic material RNA, bundled with a few proteins inside an outer envelope. Here we show the steps by which the virus invades and takes over the life process of a cell.

1. The flu virus particle (*virion*) must first invade a susceptible cell in order to reproduce and prosper. Without a host cell, a virus is merely a lifeless mote with interesting structural qualities. The surface of the virion is carefully crafted to accomplish this task. Borne by air or water into the host, it uses special molecules (the glycoproteins ***hemagglutinin*** and ***neuraminidase***) projecting from its surface envelope which have been derived from host cell material, to bind to complementary *receptor* molecules on the host cell membrane.

2. This "handshake" of recognition at the cell membrane sets into motion a process called *endocytosis,* the same which cells use to bring external substances into the cell for nutritional or other purposes. The cell membrane surrounds the virion and fuses around it.

3. Now the virus is ***within*** the cell, in a spherical vesicle surrounded by a membrane. But it does not yet have access to the rest of the cell.

4. Next, the aqueous environment within the vesicle acidifies, which sets into motion a cascade of events, resulting in the release *(decoating)* of the virus's RNA strands and related proteins into the cytoplasm of the cell. The virus now has free access to hijack the cellular "machinery" required for its replication and the eventual release of its progeny from the cell.

5. The viral RNA (v-RNA) is transported into the nucleus, along with the four viral proteins essential for processing of the viral RNA. Here are found the host cell's chromosomes and the required apparatus for DNA and RNA synthesis and processing. Using its own nuclear enzymes and those of the host cell, the viral RNA is transcribed into messenger RNA (m-RNA)—the code for protein translation—and complementary RNA (c-RNA). The c-RNA will eventually produce all the copies of the eight viral RNA strands necessary for the hundreds of infectious progeny which a single infected cell can produce.

6. Meanwhile, in the cell cytoplasm (the aqueous milieu outside the nucleus), the cell's protein-manufacturing equipment, its ribosomes, have been conscripted to produce the protein products necessary for the assembly of new virions.

7. The protein products destined for packaging within the viral envelope are now transported into the nucleus, where they are assembled in the proper proportions and configuration with a complete set of eight v-RNA strands. Then they are exported into the cytoplasm and migrate toward the inside of the outer cell membrane.

8. While this is occurring, two viral components take a different route. Hemagglutinin and neuraminidase, the two glycoproteins which will eventually stud the outside of the viral envelope, are transported to the outer cell membrane via the *endoplasmic reticulum* (ER) to *Golgi apparatus* (GA) route.

9. The viral glycoproteins are duly incorporated into the cell membrane,

Hong Kong authorities probably saved the world from an immediate pandemic then, but the virus itself simply retreated into the wild waterfowl population, and slowly began to mutate.

The 1997 Hong Kong outbreak put the world on notice that H5N1 avian flu had pandemic potential, and scientists began to track and study this virus. In southern China, samples of the virus were taken from wild ducks and geese over the years 1999-2002. The wild ducks themselves showed no signs of disease, but were found to excrete large amounts of virus. These viral isolates from the ducks were then experimentally introduced into chickens, which caused severe disease and often death. The H5N1 viral isolates were also tested on mice, to see if the virus was somehow acquiring the ability to infect mammals. Over the three-year period, the virus did indeed gain greater infectivity in the mice, and caused progressively severe disease with increasing mortality. This startling finding shows that the virus may be reassorting with other mammalian influenza viruses, picking up genes needed to infect mammals more easily.

Pigs are sometimes susceptible to avian influenza, and it may be that in areas where pigs and ducks are kept in close proximity, this type of viral mixing may have occurred. Because wild ducks are resistant to H5N1, they act as a large mobile reservoir for the virus, which is almost impossible to control or eliminate. Compounding the difficulties of control efforts, is H5N1's ability to survive in water for up to four days, and in contaminated manure for three months.

Pandemic Waiting in the Wings

In 1997, H5N1 initially caused only mild disease in chickens, but after months of mutation, it became a highly deadly virus that could kill a chicken in 48 hours, by causing internal bleeding and organ damage. As quickly as it hit bird flocks in 1997, it disappeared from view for almost six years. Then, in December 2003, a large poultry farm near Seoul, Korea, reported large numbers of chicken deaths, and avian influenza was the suspected cause. Days later, two more farms were hit by the same influenza. Laboratory tests of the samples revealed that it was H5N1 subtype, just like the Hong Kong outbreak in 1997.

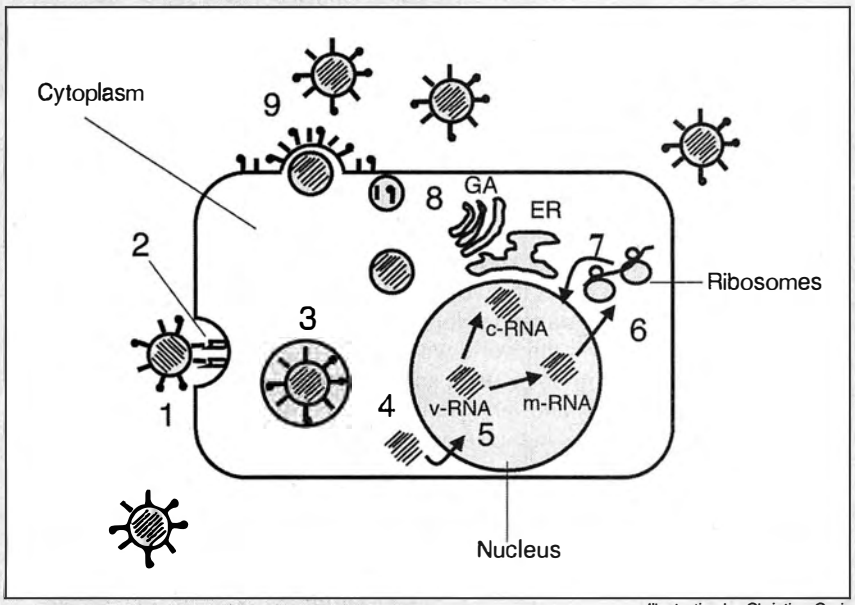


Illustration by Christine Craig

whereupon the virions exit the cell in a reverse of the process by which they entered—exocytosis. The viral parts next to the inside of the cell membrane are "blebbed off" as hundreds of new, fully assembled, infectious virions, complete with an envelope made up of the cell's membrane, studded with the hemagglutinin and neuraminidase glycoproteins on the outside.

How the Species Jump Occurs

The key to the ability of the avian flu to jump species and infect humans with virulent pandemics lies partly in the nature of its genome, and partly in its method of entry into the cell.

Because of the segmentation of the viral genetic code into eight strands, it becomes possible for a *reassortment* to occur within the host cell. If more than one flu virus strain has infected the cell, functionally similar (homologous) RNA strands from different virus strains can be swapped upon packaging, leading to a "hybrid" virion type. For example, since the hemagglutinin (H) and neuraminidase (N) glycoproteins are contained on different strands, the following might occur:

Two strains, H3N1 and H5N7 both infect a cell. Within the nucleus, every so often, H3 strands of RNA might get packaged with the other seven RNA strands of the N7 genotype, instead of its own cohort; while the H5 could be packaged with the N1 RNA group. This would produce four genotypes relative to the surface glycoproteins: H3N7, H5N1, H3N1, and H5N7. This reassortment can lead to different qualities of infectivity or virulence in new or old hosts. Once a population is infected, the virus keeps one step ahead of the host immune defenses by rapidly mutating its antigenic determinants (how the host immune system recognizes the virus as the enemy to be destroyed).

If one of these new "hybrids" can now efficiently infect a new type of animal host, like the bird flu infecting a human being, the seeds of a pandemic could be sown. The new host, having no immunity to the "hybrid," could suffer devastating infection, which could spread rapidly within the population—if there is not rapid and effective intervention.

In January 2004, Vietnamese health officials reported a cluster of cases of severe respiratory disease in 11 children, of whom 7 eventually died. A little later, large numbers of poultry died from H5N1 in southern provinces, but there was no evidence at the time that suggested a link between H5N1 and the respiratory disease in the children. However, several samples from the fatal cases were sent to the WHO reference laboratory for testing and identification, and in a week it was confirmed that the children had been infected by avian H5N1.

In early February 2004, H5N1 swept through poultry farms in Japan, and Vietnam's epidemic had already infected 3 million poultry. Thailand soon followed with announcements of large outbreaks, and its first human cases of H5N1 infection—two young boys. At this point, H5N1 epidemics in birds had spread to Cambodia, Laos, Indonesia, and China. By March 2004, 120 million birds died or were destroyed in Asia as a result of the H5N1 virus. Never before had avian influenza caused outbreaks in so many countries at once. Massive control efforts had an effect by April, and outbreaks declined sharply. But as can be expected from the history of influenza epidemics, a second wave of outbreaks can produce an even more tenacious flu virus.

This started to be seen in July and August of 2004, with fresh outbreaks in Cambodia, China, Indonesia, Thailand, Vietnam, and Malaysia, which had been untouched in the first wave. The second outbreaks infected about 1 million poultry, but they were also followed by new human infections, including some fatalities. In September 2004, Thailand reported its first probable case of person-to-person transmission in a family cluster. This was the event that prompted the WHO to sound the alarm that the world was on the brink of the next flu pandemic that could kill millions.

Other events in Thailand showed that H5N1 was expanding its mammalian host range, when 147 captive tigers became ill from eating infected chicken. Tigers and other cats were not considered susceptible to infection with other influenza A viruses, so this marked a disturbing trend. By October, migratory birds were discovered that were dying from H5N1 in Asia, signalling another change in the composition of the virus.

Emergency Measures in Brief

- Vaccinate first responders
- Government mandate to produce supply of antiviral drugs
- Crash program for vaccine production, including cell culture method
- Return to a real public health system, including adequate beds and personnel for emergencies (and prevention), return to Hill-Burton standards
- Protect the food supply: stop globalization and bring back crop and animal varieties

Pandemics of the Past

To get a picture of what a new influenza pandemic would look like, it is useful to look back at the three pandemics that have occurred in the last century. The most severe pandemic took place in 1918, and estimates are that 40 to 50 million people died from the flu worldwide in less than one year. The flu started out in the Spring in Europe and the United States, and travelled back and forth among the troops. It was not particularly deadly in this first wave. But by August, something had changed drastically, and young, previously healthy people were now dying in a matter of days in the United States, France, and Africa.

The second wave left no country untouched, and it caused symptoms so severe, including bleeding of the lungs, that influenza was not even considered as a cause when it first appeared. Unlike typical influenza epidemics that cause deaths in the very old and very young, this influenza caused the most deaths in the 15-35 age bracket. Primary viral pneumonia was common, and secondary bacterial pneumonia was very difficult to treat, as antibiotics were not available in 1918. It is estimated that 25 to 30 percent of the world's population fell ill from this influenza during 1918-1919. Recent analysis of samples of the virus from 1918 showed that it was of type H1N1, and that it may have adapted over time from an avian flu virus. It is still not known what made the virus so deadly.

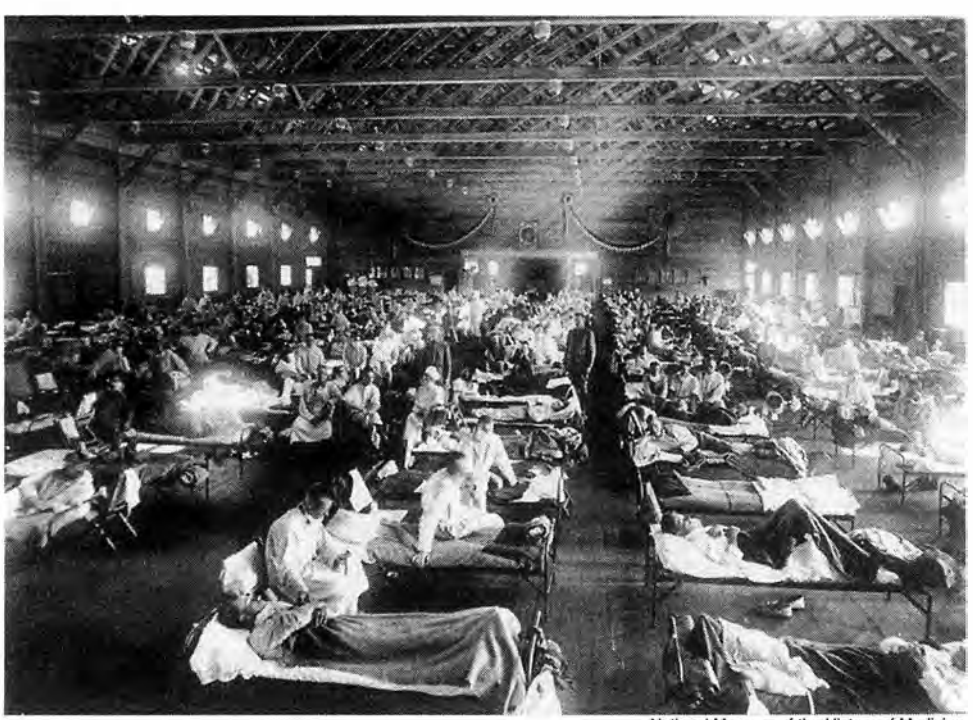
In 1957, the world was hit by what was called the Asian Flu, which started in Hong Kong and China in February and spread all over the world within six months. This was a much milder flu virus than 1918, and the pattern of deaths was mostly in the elderly and very young. Vaccines were being made against this flu virus in the United States, Britain, and Japan by the Fall of 1957, but limited production capacities made their introduction too late to do much to thwart the epidemic. As a result, about 70,000 people died of the flu in the United States in the 1957 pandemic.

Again, in 1968, the pandemic started in China, and rapidly spread to the rest of the world. However, this was an even milder flu virus than 1957, and it was of a similar subtype, so most of the population had some resistance to it. In the United States, about 34,000 deaths occurred from the flu that year, mostly in the elderly.

Window of Opportunity Closing

The evidence is increasingly clear that the world will face a new flu pandemic, possibly very soon, and so far we are unprepared to deal with it. Even the modest WHO plan will not be implemented unless the money and resources are put behind it very soon—and much more is needed. The window of opportunity for the world to prevent this catastrophe from happening may close very soon. Past flu epidemics have shown us that flu usually resurges in Asia in the Summer, and then sweeps through the rest of the world, hitting the United States in the early Winter.

Most health experts believe it is only a question of time before H5N1 becomes able to spread from person to person, kicking off the next deadly flu pandemic. The present form of the virus has shown near 50 percent lethality in people, but it is likely that the virus would lose some of this lethality as it acquires improved transmissibility. Still, it will be very dangerous, and the fact that no H5 subtype virus has ever circulated



National Museum of the History of Medicine

An emergency wing of a Kansas hospital in 1918, set up to care for flu victims.

in the population, means that potentially, the entire human race will be vulnerable to it. This provides even more incentive for the development of a vaccine to protect the population.

Technically, there are some problems to be overcome in vaccine development, as the current H5N1 virus is so deadly to chickens, that the standard method of growing the virus in chicken eggs may have to be changed. Cell culture methods could certainly work, but the majority of vaccine manufacturers lack cell culture facilities of the scale needed to mass produce an influenza vaccine.

The total vaccine production capacity globally today is only 300 million doses per year, but WHO experts say that more than 1 billion vaccine doses would be needed to control a new pandemic. In the United States, only two companies, Aventis Pasteur and Chiron, produce flu vaccine, and their production capacity is sufficient only to produce enough vaccine in six months to cover about 10 percent of the U.S. population.

Frank McFarlane Burnet/University of Melbourne

Inoculating eggs for the production of flu vaccine, 1944-1945. The H5N1 flu is so lethal to chickens, that other methods for producing vaccines, such as cell cultures, will be needed. But the production gear-up has to start immediately.

So far, the U.S. government has done nothing to address the lack of any plans to produce a vaccine against H5N1 influenza. Sen. Charles Schumer (D-N.Y.) proposed on March 6 that the Federal Government issue a guarantee of $200 million to ensure that vaccine manufacturers here produce the vaccine without the fear of losing money. He also called on the U.S. Centers for Disease Control to begin stockpiling antiviral medications that could be used to treat the flu in the event of a pandemic.

Emergency Measures Needed

The U.S. government needs to implement emergency measures before the flu pandemic hits, and to coordinate a response with other governments and the WHO. These measures can be carried out under declaration of a public health emergency:

Front-line Defense: When a pandemic first is detected, it is essential that all front-line medical personnel be treated with drugs such as Tamiflu that can prevent infection, and if a vaccine is available, these first responders must be vaccinated.

Government Mandate to Produce Antivirals: The U.S. government must order production of Tamiflu (oseltamivir) as a generic by issuing contracts to other drug manufacturers, and by producing it at government facilities if necessary. The government must buy and stockpile crucial antiviral medications that may provide the only way to curtail the spread of the avian influenza and save lives, should the pandemic erupt this Winter.

The World Health Organization plans to use a stockpile of antiviral drugs to be delivered anywhere in the world where an outbreak is detected, to try and stop the virus from spreading. Three million doses of Tamiflu have been ordered so far by the WHO, but it will take up to a year for the drugs to be manufactured, using presently limited capabilities.

Crash Program for Vaccine Development: The U.S. government should be issuing guaranteed contracts for the production and development of new flu vaccines.

The prototype for the human H5N1 flu vaccine has been tested, but the results show that double the standard amount of vaccine antigen will be needed to generate a protective response. The lack of vaccine production capacity will have to be solved by increased research to perfect cell culture vaccine methods, and the transformation of some national laboratories into vaccine production facilities.

Public Health in Depth: A health-care infrastructure rebuilding program must be launched, modelled on the Hill-Burton standard of adequate medical facilities based on the population of an area.

The nation is vulnerable in its lack of surge capacity in hospitals and clinics, to be able to handle the tremendous increase in hospitalizations required in a pandemic. To solve this, requires a long-term perspective of rebuilding our public health infrastructure, including new hospitals and public clinics. State and municipal public health systems must be revitalized with well-trained public health personnel who can contribute to an increased disease surveillance network.

No hospital shutdowns are to be tolerated. All Veterans Administration and Army medical centers are to remain open as crucial parts of the nation's defense against a pandemic. This includes the research capability of Walter Reed Army Medical Center, scheduled to be broken up by the recent decision of the Base Realignment and Closure Commission.

LAROUCHEPAC TESTIMONY

To Meet New Pandemic Threats, Bring Back Public Health

Excerpts from testimony by the Lyndon LaRouche Political Action Committee, placed in the record of the House Committee on Government Reform's hearings Nov. 17, 2004, on "The Nation's Flu Shot Shortage: Where Are We Today, and How Prepared Are We for Tomorrow?" A version of the same testimony was placed in the record of the Nov. 18 hearings of the House Energy and Commerce subcommittees on Health, and on Oversight and Investigations. Those hearings were titled "Flu Vaccine: Protecting High-Risk Individuals and Strengthening the Market."

The LaRouchePAC testimony was prepared by Executive Intelligence Review economics editor Marcia Merry Baker.

To Committee Chairman Rep. Tom Davis; Rep. Henry Waxman; and Committee Members:

In recent weeks, members of this Committee have rightly undertaken a necessary line of investigation into the current U.S. flu shot supply shortage, namely: How did it come about, that the U.S. 2004-2005 flu vaccine was to come from only two suppliers, including one company reliant on an offshore facility with a known history of risk?

Throwing a spotlight on this question is important. But in terms of government oversight, we want with this testimony to bring attention to the broadest context within which to judge government responsibility:

First, what is the full scope and nature of the disease threat faced today by this nation and internationally—going beyond even pandemic influenza?

Second, from that vantage point, what are the public health and other actions called for in the immediate situation, and what must be done to reverse the policies that created the crises in the first place?

The particulars of the various dramatic episodes in recent years, including the anthrax attack (2001), SARS (2003), Mad Cow Disease in North America, etc., illustrate the point that it is the takedown of public health infrastructure, along with globalization practices in agriculture and throughout the economy, that are themselves causing increased likelihood of harm.

Forewarning was given decades ago by American economist and Democratic Party leader Lyndon LaRouche, who in 1973, commissioned a task force on the prospects for a "biological holocaust," if policies of de-industrialization and free trade were to prevail, and to create "points of congruity and interaction of economic and biological processes," leading to the spread of disease. In July 1985, the task force published the EIR Special Report Economic Breakdown and the *Threat of Global Pandemics.*

Unfortunately, LaRouche's warnings have been borne out. We are now seeing dramatic, deadly proof of how new and re-emerging diseases are associated with practices of outsourcing, lack of sanitation and pest eradication, monoculture in agriculture, and all the other hallmarks of so-called "competitive global sourcing and markets."

Moreover, bad as this free-trade era was when it "worked," it is now simply breaking down.

Lyndon LaRouche, on July 30 of this year [2004], addressed the issue of the public health crisis, and the general collapse process in the economy, at a Boston press conference following the end of the Democratic Party Convention; there, he announced the formation of the political action committee Lyndon LaRouche PAC, to fight for emergency measures to restore a functioning *physical economy*. . . .

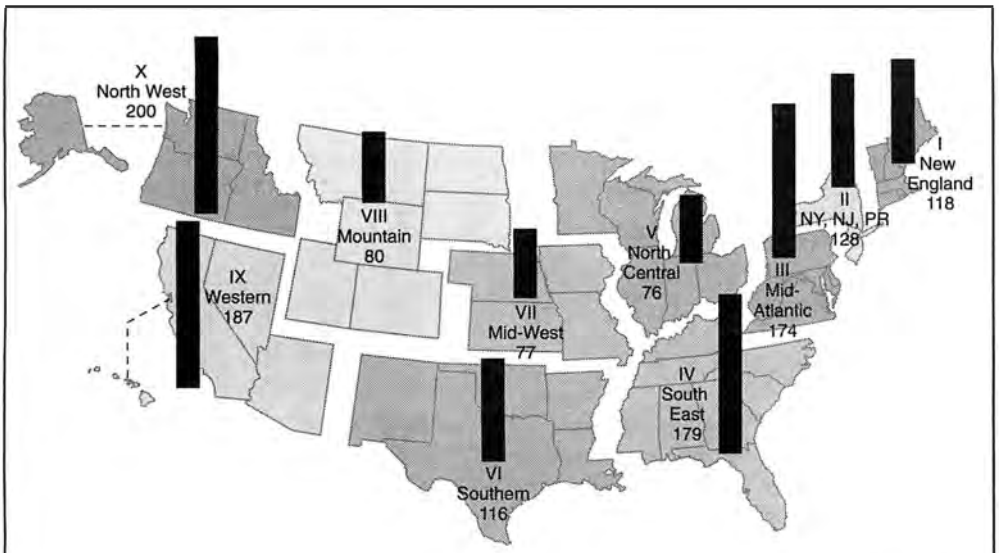
Threat of Flu Pandemic, Other Diseases

For years, epidemiologists and livestock and other experts have sounded alarms about growing disease threats. Three recent sources make the necessary points about the scale of danger today, beginning with influenza.

On Oct. 28, 2004, Dmitri Lvov, director of the Ivanovsky Virology Institute and Academician of the Russian Academy of Medical Sciences, held a press conference [reported by RIA-Novosti News Agency], warning of the threat of avian flu becoming transmissible from human to human. "Up to 1 billion people could die around the whole world in six months. We are half a step away from a worldwide pandemic catastrophe."

The World Health Organization, the Pan American Health Organization, the International Vaccine Institute based in Seoul, South Korea, and many other agencies, are likewise warning of flu pandemic.

On Sept. 25, 2004, a report given to the Pan American Health Organization conference warned of a potential "new influenza strain" saying that the "sudden and marked change in Influenza virus A [in Asia] should be considered one of the greatest public health concerns" in the Americas. The report said, "Recent episodes of animal strains causing disease in humans, support experts' views that a new pandemic is inevitable. . . . Epidemiological studies project that another pandemic is most likely to result in . . . 280,000 to 650,000 deaths in less than two years—in industrialized countries alone."



PUBLIC HEALTH WORKERS PER 100,000 POPULATION IN 10 FEDERAL HEALTH DISTRICTS, 1999

Public health infrastructure in the United States has been gutted in the past 25 years. In the early 1970s, there was an average of 219 public health workers per 100,000. Today, 3 out of 10 Federal Health Districts have fallen to less than half that number, and no district even matches the 1970 average.

Source: The Public Health Workforce Enumeration 2000, *EIR*

New and Re-Emerging Diseases

Apart from influenza, there are threats from other new and re-emerging infectious diseases. A September 2004 report by the U.S. Government Accountability Office (GAO), "Emerging Infectious Diseases," reviewed how well state and Federal surveillance systems are set up to monitor disease incidence. Provided at the request of Sen. Norm Coleman [R-Minn.], Chairman of the Permanent Subcommittee on Investigations of the Senate Committee on Governmental Affairs, the study took place over the past year, and the report includes a world map showing many of the "Selected Emerging Infectious Diseases, 1996-2004."

On the flu, the GAO report stressed: "The Centers for Disease Control and Prevention (CDC) estimates that if an influenza pandemic were to occur in the United States, it could cause an estimated 314,000 to 734,000 hospitalizations and 89,000 to 207,000 deaths, with associated costs ranging from $71 to $167 billion" (From the CDC, Fiscal Year 2005, Justification of Estimates for Appropriations Committees, p. 172).

On disease threats generally, the GAO report states, "More than 36 newly emerging infectious diseases were identified between 1973 and 2003, and new emerging infectious diseases continue to be identified."

Microbial Threats

The U.S. crude death rate from infectious diseases, declining for 80 years, is now on the rise! The National Institutes of Medicine, which surveys rates of infectious diseases every 10 years, released its 400-page report in 2003—Microbial Threats to Health; Emergence, Detection and Response—and stressed at the outset that in the United States, the crude death rate per 100,000 persons from infectious diseases has increased from 1980-1999, from under 40 deaths to over 50; and this is before the death toll from HIV/AIDS is added in. With that included, the U.S. death rate from infectious diseases has risen from 40 per 100,000 in 1980, to over 60 by the turn of the century!

Why? The Institutes of Medicine faults the head-in-the-sand policies of the past 20 years, in which the public and lawmakers discontinued base-line public health policies, perhaps under the delusion that disease threats had somehow come to an end! "As a result of this apparent reprieve from infectious diseases, the United States Government moved research funding away from infectious disease toward the 'new dimensions' of public health—noncommunicable disorders such as heart disease and lung cancer. The government closed 'virtually every tropical and infectious disease outpost run by the U.S. military and Public Health Service' [quote is from Laurie Garrett, Research Fellow, Council on Foreign Relations in a 1989 study]. Infectious disease surveillance and control activities were de-emphasized. Research, development, and production of new antibiotics and vaccines declined. The potentially devastating impact of infectious diseases was either relegated to the memory of previous generations or left to the imagination of science fiction enthusiasts."

All kinds of infectious diseases are on the rise—not simply recent and exotic varieties such as the West Nile virus, or Lyme Disease. Two cases in point: whooping cough and foodborne illnesses.

- Whooping cough, or pertussis. The seventh-ranked killer infection globally, this is making a comeback in the United States, because of lack of vaccination, poverty, immigration, and general neglect. Thirteen children died in 2003 as a result of pertussis, which can also cause pneumonia and inflammation of the brain. In 2004, the CDC reported that North Dakota has had one of the largest outbreaks, with 693 cases in 2004, up from just 6 in 2003.
- Hepatitis A. In October-November 2003, the largest-ever U.S. outbreak from a single source took place near Pittsburgh, in Beaver Valley, Penn. At least 650 got sick; 100 were hospitalized; and 3 died, two men (aged 38 and 46) and a 51-year-old woman. The source was contaminated scallions, imported from a cheap-labor farm operation in Mexico. Another incident may occur at any time. During the winter

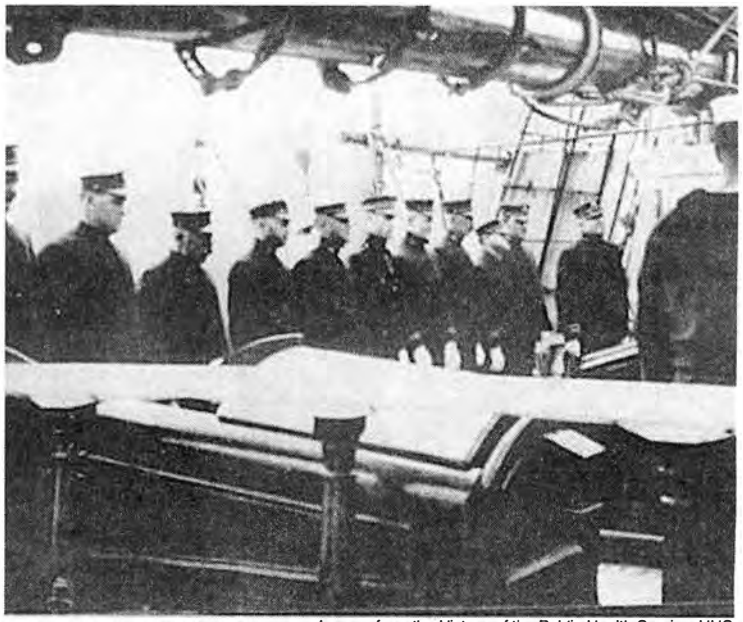
months, up to 70 percent of the fresh fruits and vegetables consumed in the United States are imported; the average annual rate is 25 to 35 percent and rising. Harmful pathogens are more than three times as likely from low-infrastructure sources in Mexico, Guatemala, the Philippines, and elsewhere; including *salmonella, E. coli,* and *shigella.*

Zoonotics and Botanicals

Beyond basic sanitation and pathogens, risks of disease are increasing, simply because of the common patterns of plant-life and livestock-raising under globalized agriculture, and lack of public health infrastructure under borderless "free trade" generally.

The threat comes from the fact that the last 40 years have been characterized by ever-increasing monoculture in crops and livestock; increasing reliance on a few varietals of plants and animals; and dangerous animal husbandry practices. Therefore, vulnerability and extent of damage are maximized, in the case of any mutation, outbreak, species-jump, and so on.

One recent case of plant disease, and magnified harm from monoculture, is the arrival this fall of soybean rust, a fungus, in the United States for the first time (confirmed Nov. 10 [2004] by the U.S. Department of Agriculture). The blight, of the species Phakopsora pachyrhizi, was identified in Louisiana. It can cut yields significantly. The same fungus—entrenched in Asia—arrived in South America in 2001, and has spread since, reaching Argentina in 2003.



Images from the History of the Public Health Service, HHS

Uniformed Public Health Service officers aboard the Coast Guard Cutter Bear. Since 1879, Public Health Service medical officers have served on Coast Guard vessels. Today we need to return to the concept of public health as national defense.

The salient point about this pest, is that food-cartel-imposed policies have led to a situation of such concentration, that only three countries of the Americas—the United States, Brazil, and Argentina—together account for 188 million metric tons, which is over 80 percent of all world annual soy production (229 million metric tons), and those three account for over 90 percent of all soybean exports. There is no redundancy and no reserves.

The cartel companies (ADM, Cargill, Monsanto, Smithfield, et al.) impose extreme concentrations of food processing, factory-farm-production monoculture, and trading, which has been extensively documented by Prof. William Heffernan, of the University of Missouri.

Animal sources of diseases are equally serious, both for risk of direct transmission, and as "mixing bowls" for mutations of pathogens that can then become human-to-human transmissible. The GAO September report summarized: "According to CDC, nearly 70 percent of emerging infectious disease episodes during the past 10 years have been zoonotic diseases, which are diseases transmitted from animals to humans. The West Nile virus, which was first diagnosed in the United States in 1999, is an example of a zoonotic disease. The West Nile virus can cause encephalitis, or inflammation of the brain. . . . Other zoonotic diseases include SARS, avian influenza, human monkeypox, and variant Creutzfeldt-Jakob diseases (vCJD), which scientists believe is linked to eating beef from cattle infected with bovine spongiform encephalopathy (BSE), and is often called mad cow disease."

Look at the record of the period of origins and spread of BSE in Britain, under Prime Minister Margaret Thatcher, the quintessential free-marketeer government (1980-1990).

After the 1970s, studies by the U.S. Department of Agriculture and others were finding risks of "transmissible dementias" between species; the strong recommendation was made in September 1979, that hygiene standards be tightened for animal feeds in Britain, where a large outbreak of sheep scrapie was under way (TSE, transmissible spongiform encephalopathy). The British Royal Commission on Environmental Pollution wanted tight licensing for processing animal proteins—especially sheep parts—back into the feed and food chain, especially the chain destined for cows.

Thatcher and her Agriculture Minister, Lord Peter Walker, refused, on grounds that this violated the privatization principle of "self-regulation" of farm and health industries; they loosened rules on cycling animal wastes back into feed; and on exporting animals. By 1986, BSE was identified; by 1996, some 162,000 cases of BSE cows were officially reported in the United Kingdom, and the epidemic had been exported.

Government Responsibility

These kinds of ideologies must be stopped cold, and public health principles re-established as the basis for government action. The current U.S. flu shot debacle underscores that very point.

What needs to be done in the short term is straightforward, generally falling into two categories: vaccines, and medical treatment contingencies.

Vaccines: Both for the 2005-2006 "normal" flu season, and for the threat of a killer flu pandemic, the U.S. government must take domestic actions, and collaborate internationally, to see to a ramping-up of vaccine production capacity, and to back the best science and production of a potentially useful

avian flu vaccine. Currently, two companies are tasked to make some 2.4 million shots of an experimental vaccine. It is of the utmost importance to *evaluate* and *vastly expand that program.*

The Nov. 11-12 [2004] unprecedented "Flu Summit" of 50 government leaders and 16 vaccine manufacturers in Switzerland, has created an institutional forum through which a crash program of vaccine production can take place, if the United States and collaborating nations act on this.

The "Flu Protection Act," sponsored by Senators Evan Bayh [D-Ind.] and Larry Craig [R-Id.], and many others, has been introduced into Congress, and includes the initiatives essential to ensuring the needed volumes of vaccine. The measures contained in this bill have been endorsed by the American Public Health Association, the American Lung Association, and many other organizations.

Medical Treatment Contingencies: Also in the short term, Federal intervention is required to aid states and localities to provide contingency plans for hospital emergency rooms and beds, antiviral medicines, staff, and so on, to handle any surge of patients caused by the fact that in this 2004-2005 season, the United States lacks half the needed flu shots.

The need for contingency logistics has in fact been heightened, because Federal authorities did not take timely action immediately after Oct. 6, 2004—the day of the announcement of the delicensing of the Chiron plant in Liverpool—to collect and re-allocate scarce flu shots. Thus closed a window of opportunity for at least mitigating the chaos, and that means that harm will now be inevitable.

The takedown of the U.S. hospital system, Veterans Administration hospitals, and public health agencies has been so drastic over the past three decades of the "managed care" ideological era, that even a mild flu season, with plentiful vaccine, has seen hospitals overwhelmed. The Homeland Security fund infusions of 2002-2004 have in no way reversed the net decline of the U.S. health system.

On Oct. 18, 2004, the American College of Emergency Physicians, an organization of 22,000 doctors meeting in San Francisco, issued a plea for Federal action and resources to be able to handle the coming wave of patients.

Return to the 'Hill-Burton' Principle

The principle to guide both short-term contingency medical arrangements, and the restoration of the U.S. health system, is the traditional American health-care policy known historically as the "Hill-Burton" principle. This refers to the 1946 bipartisan law, "The Hospital Survey and Construction Act." This simple, nine-page law mandated that every county in the nation must provide hospital facilities on a ratio of licensed beds per 1,000 residents, based on modern medical standards of treatment. During the years from the late 1940s through the mid-1970s, this policy led to the successful provision of hospital beds in nearly all 3,069 U.S. counties, at a ratio of 5.5 beds per 1,000 in rural areas, and 4.5 per 1,000 in urban areas (where transportation was easier).

During the 1950s and 1960s, the same "Hill-Burton spirit" governed the aggressive efforts to defeat poliomyelitis and other diseases, as a matter of principle.

Then came the dismantling of this system, and the thinking behind it, with the passage in 1973 of the first HMO furtherance act, the subsequent deregulation of health care, and the concept of "managing" care, instead of combatting disease.

March of Dimes

A widespread public health campaign for polio vaccinations in the 1950s, vastly decreased the incidence of poliomyelitis, and eliminated it in North America by the 1970s.

Today's flu vaccine fiasco in the United States underscores the point that generally, the economic system itself is now breaking down; along with it, the ideologies that rationalized the economic takedown all along, are disgraced. We face the opportunity and the necessity to return to the principles and tasks of restoring the physical economy—in particular, health care.

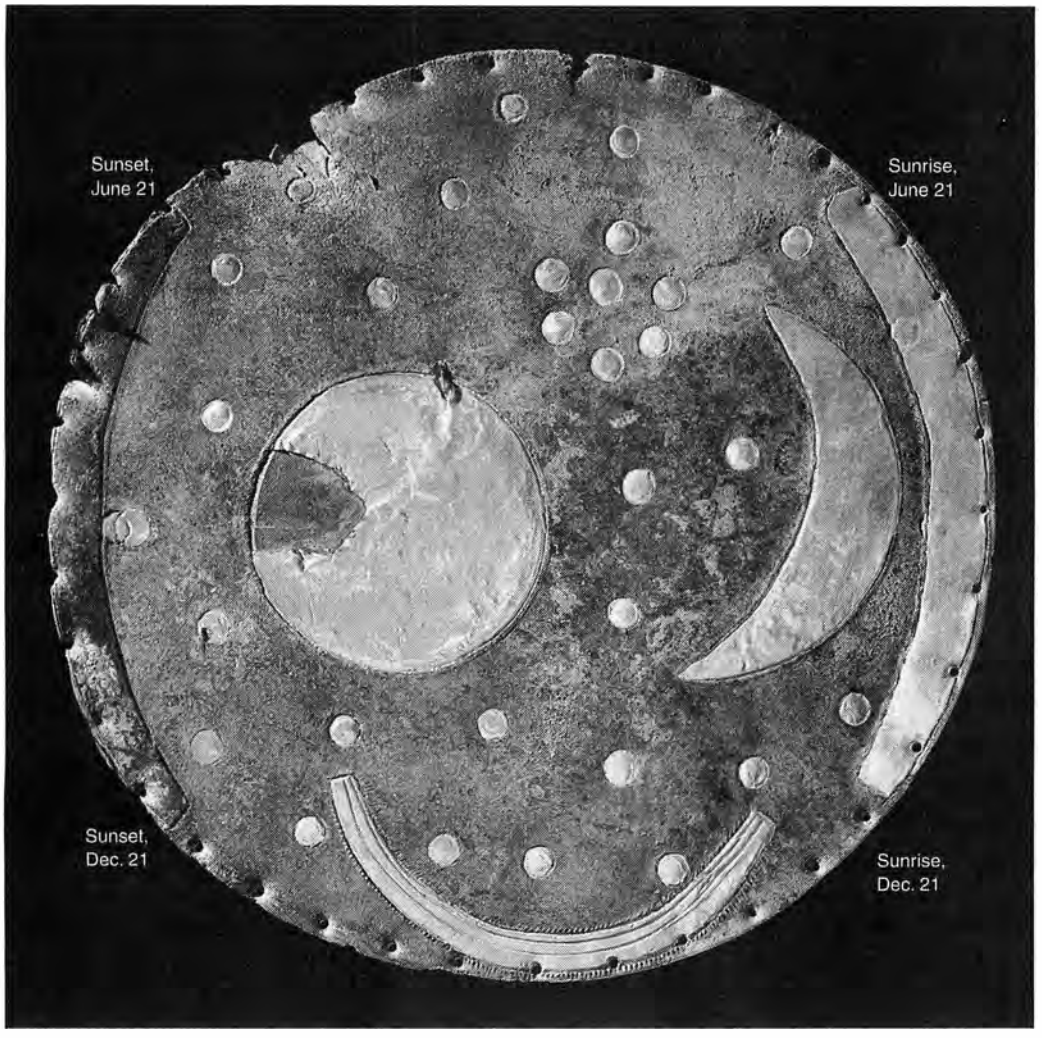
This is a bipartisan duty of the highest level. Sen. Harold Burton was a Republican from Ohio; Sen. Lister Hill, a Democrat from Alabama. Both were advocates of industry, agriculture, and public-serving infrastructure, as well as health care in particular.

Your leadership on this Committee, on the particular matter of flu vaccine, can provide a needed impetus across the board to bring about the collaborative steps necessary to restore the health-care system, and the economy itself.

On Oct. 6, [2004] Lyndon LaRouche, asked about the significance of the 50-million-flu-shot cancellation, during an international webcast in Washington, D.C., said: "To put the human race at risk in this way, was a mistake! We have to adopt a policy of correcting that mistake, by reversing the policies which led to that mistake. . . . Do whatever it takes."

The Ancient Origin of The Calendar In Eastern Germany

by Dino De Paoli



Landesmuseum für Vorgeschichte, Halle, Germany

The Nebra Sky Disk: This 32-cm diameter disk was found on the Mittelberg Hill near Nebra in Saxony-Anhalt, and is thought to represent a "portable" calendar, recording Winter and Spring solstices based on a 1600 B.C. star map. The disk is bronze with gold inlays. The arcs along the rim, left and right, extend over 82°, marking the sunrise and sunset at each solstice.

New evidence unearthed in Saxony-Anhalt, Germany, establishes a northern origin of the calendar at an early date, and implies an origin of astronomical observations at least as early as 30,000 B.C.

Until recently, the dominant thinking has been that the birthplace of the calendar was either Egypt or Mesopotamia, in the period spanning 3000 to 2000 B.C., and that from there the calendar spread into the northern regions. Two recent discoveries in Germany challenge such a view, while reinforcing the hypothesis that northern Europe contributed to, or even originated, the elaboration of the first astronomical calendar.

In this article, I will present the new discoveries, framed in a terminology of "visual astronomy": That is, a type of astronomy which can be replicated everywhere, without any optical device. In visual astronomy, the celestial objects are thought to "move" in relation to an observer and a "fixed" reference.

I would like to make it clear from the beginning, that for me "visual" does not support the empiricist illusion that ideas result from objects hitting our senses. The myth that "at the beginning" knowledge must have been based only on the senses is precisely that—just a myth, which was founded by the empiricists themselves. Even animals, in their relationship with their environment, operate with an inborn tendency to actively differentiate between "good" and "bad" food, or to discover new things by playful learning. Man, and man alone, as we will see, was able to include in the "good" food, the discovery of principles regulating the sky above him. Each animal species "sees" its environment differently; the human species changes what and how it "sees," according to its cultural development. We miss or see events according to the ideas that we have been able to develop.

We will come back to this point at the end of the article. But first, I will present what was going on 7,000 years ago, in a place today called Saxony-Anhalt in eastern Germany.

The Sky Disc of Nebra

Recently in the Landesmuseum für Vorgeschichte (State Museum of Pre-history) in Halle, Germany, there was an exposition called "The Forged Sky," where one could admire the now famous "Disk of Nebra." The exposition, which began on Oct. 15, 2004, had such an unprecedented flow of visitors—30,000 to 40,000 per month—that it was extended twice.[1]

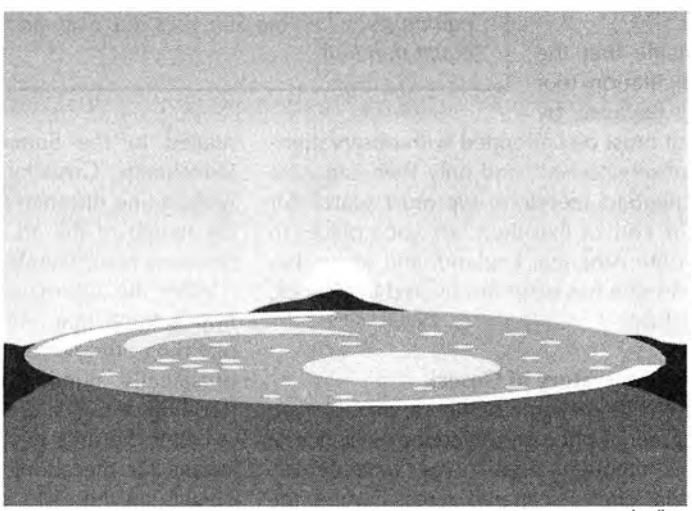
The Nebra disk, now generally considered to be a major archaeological and astronomical discovery, is made out of bronze, weighs 2 kilograms, and has a diameter of 32 centimeters. It was deposited 3,600 years ago, together with swords, jewels, and other tools, on the summit of the Mittelberg Hill near Nebra, and stayed there until it was rediscovered in 1999 by archaeological scavengers, and then recovered by the police. On the disk there are golden figures which show astronomical objects: a crescent Moon; a circle (Sun or full Moon); a cluster of seven points (most likely the Pleiades); scattered other stars; and three arcs, two lateral and one on the bottom part of the disk. There are many interpretations of such a "cosmos," but nobody doubts that somehow it has to do with either symbolic or practical astronomy.

Let's try to examine in detail the possible meaning of the objects.

The Lateral Arcs

According to the archaeologist Harald Meller and the astronomer Wolfhard Schlosser, who have closely studied the disk, the two opposing arcs running along the rim extend over 82°. Therefore, if the lower points mark the Sun's position at sunrise/sunset on the Winter solstice, the uppermost points mark sunrise/sunset on the Summer solstice for Nebra, 3,600 years ago. Schlosser says in the Museum's booklet on Nebra:

> If from the Mittelberg hills, one keeps the disk flat, then the ideal line going from the lower part of the right arc to the upper part of the left arc will reach the top of the Brocken (a 3,747-foot peak in the Harz Mountains, 80 kilometers from Nebra). Indeed, during the Summer solstice, seen from Mittelberg (Nebra), the Sun sets behind the Brocken. Therefore, the disk could have been used as calendar, based on the Sun-year.



Lexikon

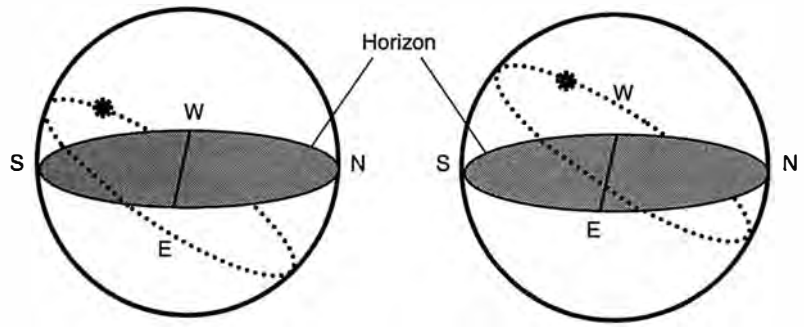
The Nebra Disk on edge. From Mittelberg Hill, the disk could be oriented to a sunrise or sunset over Brocken Mountain, to calculate important seasonal inflection points like the equinoxes.

To make this clearer, we have to study step by step how our ancestors discovered universal principles governing the motions of the celestial bodies, starting with the relationship between the "two motions" of the Sun.

The Arcs of the Sun

The cultures which developed around the equator, were confronted with relatively constant, equal lengths of the days, but the more the cultures moved towards the northern regions,[2] the more they were confronted with an incredible variation in such lengths: a minimum length in Winter and a maximum in Summer. It must have been very quickly discovered that the variation in the duration of the daylight was related to the change in the places where the Sun rises and sets on the horizon. The shortest day (Winter solstice) coincides, in the north, with the Sun rising and setting at its southernmost point, while the longest day (Summer solstice) coincides with the Sun rising and setting at its northernmost point.

Whenever a culture decided that it was useful to have a reference for such minimum-maximum or "turning" points, they looked for some physical "fixed" object to mark them; and it is easiest to look for some mountain on the horizon. The "calendar maker" of Nebra used the Brocken as a marker for the Sun setting at the Summer solstice. As already noted, the arc-length between the points marking the Summer and Winter solstices, increases as we move north of the equator. In Nebra, such length is approximately 82°. This length coincides precisely with the length of the two lateral arcs in the disk![3] The combination of the two motions of the Sun: the daily east to west and the yearly north to south, is the basis for the measurement of time in relationship to social activities: that is, a calendar.[4]



Christine Craig

THE SEASONAL ARC OF THE SUN

Because of the 23.5° tilt of Earth's axis to its orbit as it circles the Sun, our planet experiences changes in the length of day correlated with the seasons. The upper arcs represent the arc of the Sun for Winter (left) and Summer (right) in the Northern Hemisphere. The arcs below the central horizon can represent either the arc of night in the same hemisphere, or the arc of the Sun "down under."

In the Northern Hemisphere, the arc is short in the Winter and to the south, while in Summer the arc is long and to the north. Only at the Spring and Fall equinoxes, when the Sun rises due East, and sets due West, are day and night of equal duration.

It is therefore probable that the Nebra disk was a calculation tool for such a calendar. Because by itself it is not reliable, it must be calibrated with observations made in stable "Sun-observatories," and only then can it be used as a portable calendar; therefore, we must search for such observatories. It is known that there are such places in Egypt, China, India, South America, England, and so on, but now a new and very old one has been discovered in Goseck, just 20 km south of Nebra!

The Sun-observatory of Goseck

In 1991, approximately 20 km south of Nebra, on a plateau near Goseck, Germany, aerial photos showed the existence of a 75-meter-wide circle. Although aerial surveys have demarcated hundreds of similar circles scattered across Europe, the Goseck structure proved to be the oldest and best preserved of the 20 excavated thus far; and it is the first whose function is absolutely evident. In 2002, the first excavation brought to light remains of a construction that, although called the "German Stonehenge," precedes Stonehenge by at least 2,000 to 3,000 years! The linear designs on pottery shards found within the compound indicated that it was used already in 4900 B.C. Therefore, for the moment, it is not only the oldest construction of this type in Europe, but is also older than the Egyptian pyramids.

The excavation showed that the Goseck structure consisted of "four concentric circles—a mound, a ditch, and two wooden palisades about the height of a person—in which stood three sets of gates facing southeast, southwest, and north, respectively." According to the analysis made by Schlosser, "on the Winter solstice, someone at the center of the circles would see the Sun rise and set through the southern gates with a precision of three to four days around 4800 B.C." In 2004, a fourth observational point was discovered in the palisade related to the Summer solstice. It is worth noting that Stonehenge, Goseck, and Nebra are located at approximately the same distance from the equator (51° N), and therefore the length of the arc between the points of solstices at the horizons is measurable with the portable disk of Nebra.

After the discovery of Goseck, it should be considered now a "fact" that 7,000 years ago some culture was already planning Summer and/or Winter holidays! Or perhaps more prosaically: hunting, migrations, farming, biological cycles, flooding of rivers, and so on.

But if the arcs of the Sun's motion already give so many means for measuring "time," what is the use of the other objects on the disk, for example the seven spots, which are thought to be the Pleiades? Why include such a group of stars?

The Pleiades

The Pleiades are an incredibly beautiful group of stars whose brilliance, caused by the presence of luminous gases, makes them a sky object that cannot be missed.[5] With the naked eye one spots nine stars, although in antiquity they were often represented with seven points called the "Seven Sisters." Today's names are derived from Greek mythology: the seven sisters (Alcyone, Asterope, Celaeno, Electra, Maia, Merope, and Taygeta) are the daughters of the other two visible stars—Atlas and Pleione—and they are supposed to be chased by Orion. In the northern sky, they are visible from mid-September until the end of April, protected by the umbrella of the Milky Way, caught between Perseus and Taurus, followed by the hunter Orion.

The Pleiades have been considered by all ancient cultures as special stars: some researchers believe they recognize the Pleiades even in the 17,000-year-old paintings in the caves of

Lascaux in France, where above a big bull (Taurus) is represented a group of six dots. In any case, from Egypt to Mesopotamia, from China to India, the Seven Sisters are always mentioned in stories or represented in paintings. Hesiod (800 B.C.), in his *Works and Days,* gives us a clear example of the way myths and stories were used to transmit astro-economical knowledge:

> When the Pleiades, daughters of Atlas, are rising, begin your harvest, and your ploughing when they are going to set. Forty nights and days they are hidden and appear again as the year moves round, when first you sharpen your sickle. This is the law of the plains, and of those who live near the sea, and who inhabit rich country, if you wish to get in all Demeter's fruits in due season, and that each kind may grow in its season. Else, afterwards, you may chance to be in want, and go begging to other men's houses, but without avail; as you have already come to me. But I will give you no more nor give you further measure.[6]

The farmers in Hesiod's time could see the Pleiades setting, following the Sun at the end of March. Then the constellation would disappear for 40 days, covered by the Sun. They would reappear as "morning stars" preceding the Sun in late May. Then they would rise earlier and earlier until they would set just before the Sun would rise in October. Hesiod's myths are nothing but a written version, derived and adapted from a much more ancient oral tradition, to which the relatively young "model" of Nebra belongs.

But this brings us to a new question: Why did our ancestors start relating the motion of the Sun also to the stars' motions? Any "wanderer" knows how important it is to understand the position of the stars and the Sun, to orient himself. Our ancestors must have realized the same, in even more dramatic situations, during their long migrations. We know that 30,000 years ago, the ancient navigators in Polynesia must have used stars and the Sun to navigate.[7] The Polynesians were navigating along and around the equator where, as noted, the yearly variation of the sunrise and sunset is small, so one can have a relatively constant indication of the east/west axis. At night, the stars, too, have a vertical motion, and continue to mark the east/west axis.

For the northern cultures, orientation was more difficult; the Sun largely shifts its points of rise/set, and the stars move, not vertically, but obliquely. For these reasons, the northern cultures had to combine orientation through a celestial compass, with knowledge of the seasons: That is, they had to keep in mind the changing points on the horizon where the Sun rises and sets along the "full year." In other words, the development of spatial orientation demanded the discovery of the "measure of time" and the making of a calendar!

We have seen that on some occasions ancient cultures measured the rising and setting through a fixed object on the horizon, usually a mountain. But this cannot be easily universalized: What if there are no mountains? One can construct a pyramid, but that is a lot of work, and therefore it is much more creative to move the "fixed" points in the sky itself! Such points are the stars that visually rise always in the same place at the horizon. This is why the Pleiades, among others, have taken so much importance in the ancient oral and written traditions. If a "priest-scientist" in northern Germany would have told his Egyptian colleague: "The

Landesmuseum für Vorgeschichte Sachsen-Anhalt

Landesmuseum für Vorgeschichte Sachsen-Anhalt

Goseck's ancient calendar enclosure. In 2003, a team of archaeologists from the Archaeology section of the Saxony-Anhalt State Museum of Pre-history began to excavate the site in Goseck (a), which contained an ancient circular enclosure with three gates (b). Goseck is thought to function like a calendar of the seasons in the manner of Stonehenge and other megalithic sites.

Jan Herold

At this location on Mittelberg Hill near Nebra, the Nebra disk and other artifacts were unearthed in 1999.

Summer solstice takes place when the Sun sets over the Brocken," the Egyptian would not know how to replicate such knowledge. But if the same "German" would tell a priest in *any* country: "When the Pleiades precede the rising of the Sun, then it is the Summer solstice," this would be very useful and replicable knowledge for constructing a calendar. All cultures can see and locate the same star, but cannot see or locate the same mountains.

In reality, for pedagogical reasons, I did slightly exaggerate. Is it really valid *everywhere* that such and such a Sun-star combination indicates, let's say, the approaching Summer? Not really! When a northern observer experiences Summer solstice, his Chilean colleague experiences Winter solstice. But both are observing the *same* star preceding the *same* Sun: In our era, for example, the Pleiades fill this role! Therefore we could say that the same celestial combination is a universal singular point of reference, whose different bounding conditions on the Earth result in opposite physical effects (different seasons).

But, there are star-Sun combinations which result in more common universal physical effects: This happens at the equinoxes, the transition season called Spring and Autumn when the Sun rises and sets in the east-west axis for *all* the observers in the Earth. And therefore given that Spring, in particular, also has an enormous importance in the life cycles, it slowly replaced Summer and Winter as the major point of reference. Today Spring is announced by the Sun rising after the appearance of the constellation Pisces on the eastern horizon. In 4500 B.C., in Goseck as in Egypt, the Pleiades preceding the sunrise announced Spring. So the sky actually changes. Spring is not always announced by the *same* star preceding the Sun: Every 2,000 years, the Sun has to be associated with a new group of stars in Spring, for reasons which are too long to explain here. It was the beauty of the area of the sky where the Pleiades are located (with Orion, Sirius, Taurus, and so on) that made the Seven Sisters, for a very long period, the "star" of the myths used to transmit knowledge to the next generation.

There is another interesting and beautiful event that happens around the Pleiades, which brings us to the next object on the Nebra disk: the Moon.

The Moon

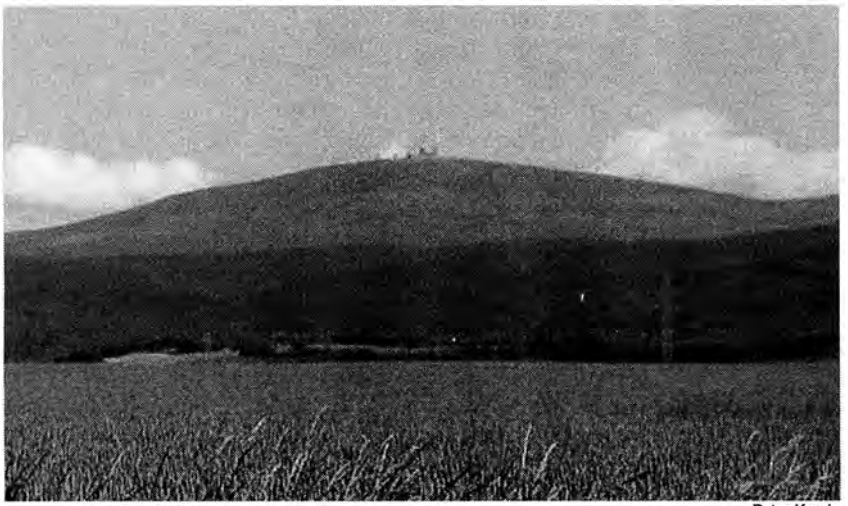
This object is and has been always an attraction for the sky watcher, for the mythologist, but also for the scientist. The "queen of the night," is not as stable as the Sun: It changes shape nightly. From a tiny crescent, its brilliant side grows constantly into a round "full Moon," then decreases and disappears completely to restart again the same cycle approximately every 29 days.

The Moon also has a more complicated apparent motion. It does not follow the same circular path of the Sun, but nervous or playful, it also moves up and down as it circles. Such variations complicate the forecasting of solar or lunar eclipses, which otherwise would be a monthly occurrence. Nevertheless, one can find a cyclical constant in such a double motion of the Moon, and the observers in Goseck and Nebra probably did.

In Goseck, as they were constantly monitoring the variation of sunset and sunrise, ancient observers probably noticed that the extreme points, where the full Moon rises during its Winter or Summer solstice, do not coincide with the points that had been marked for the Sun. In general, the full Moon "opposes" the Sun: This means that, for example, at the Summer solstice, while the Sun is setting at its maximum point in the northwest, the full Moon rises at its most extreme point to the southeast, near the point marked as Winter solstice for the Sun.

But, also in such variations, there were some cyclical constants to be grasped as "law." Every 19 years, the full Moon solstice occurs 5° farther north than the point where the Sun rises at the Summer solstice. It is this cyclical variation of 5° above the Sun which causes the observed phenomenon of the Moon periodically "eating" the poor seven sisters of the Pleiades (which are located approximately 5° above the path of the Sun). Each 19 years the Moon covers and hides the Pleiades. This cycle was explained by the Greek Meton in 380 B.C.

For example, if we take the period of the Nebra observers from 2160 B.C. until approximately 1600 B.C., every 19 years between February and March, soon after the Sun set, they would see in the west an illuminated "sickle" crescent Moon which would move slowly towards, and finally "eat" the Pleiades. This phenomenon results from the fact that the non-



Peter Kamin

Brocken Mountain, the tallest in northern Germany, is hypothesized to be the fixed structure visible from Mittelberg Hill, over which the risings and settings of the Sun were viewed in relation to the seasons. Brocken was one of the three mountains used by Carl Gauss during the 1820s for his famous study of space curvature (the other two being Inselsberg and Hohehagen Mountains). Brocken is also a setting in Goethe's drama Faust.

illuminated part of the Moon would at a certain point cover the star group as in an eclipse.

Such a representation—the Pleiades followed on the right by a rising Moon—is precisely what we see in the Nebra disk. In the evening during October, soon after sunset, the same observers in Nebra would also experience, every 19 years, a rising full Moon in the eastern sky, following or "trying to capture" the Pleiades. This is also represented on the disk, if we take the bigger object left of the Pleiades as a full Moon. In this context I find interesting what Ralf Koneckis, author of *Mythen und Märchen* (Myths and Fairytales) has to say. He thinks that the tale "The Wolf and the Seven Young She-goats" "is simply the poetical representation of Venus (the 'mother she-goat'), who during her orbiting visits the Pleiades ('seven young she-goats') and warns them of the Moon ('the wolf') which covers the Pleiades, but always misses one of the seven stars: 'and only the youngest found it not.' "

Let us continue with the myths, and look at the last element on the disk: the third arc on the lower part of disk. Is it a "boat" which carries the Sun through the underworld each night before being reborn in the morning? In Egypt and Scandinavia we find similar representations. Schlosser says that: "nevertheless it is also possible to consider another astronomical meaning. If one turns the disk 180°, the arc will move above and could represent the Milky Way which is over the Pleiades."

Bal Gangadhar Tilak, Indian independence leader, documented the northern reference points of the astronomical references in the ancient Indian verses of the Rig Veda.

Ancient Astronomy: How Ancient?

No matter the possible variations of interpretations, we are definitely confronted with the fact that a culture in central Europe was making astronomical representations which, if taken together with the activities in the observatory of Goseck, confirm that the farmers of the Neolithic era were constructing calendars much earlier than has been officially accepted until now. And if they were making constant observations of the sky, there is also no doubt that they also began to track down the behavior of the major planets—Venus, Jupiter, Saturn, and Mars. It is generally accepted that astronomy and calendars were born either in Mesopotamia or Egypt, although the "experts" are in dispute over the dates, which range from 1800 to 4000 B.C. Others propose China, around 1500 to 2000 B.C., as the possible place of origin of the calendar.

Now we know that this process of calendar formation must have started much earlier, and was probably transmitted from culture to culture, and adapted to local habits—sometimes favoring the solar motion, sometimes the lunar motion, sometimes the combination of the two.

In this context, the thesis of a "northern" origination of the calendar, supported among others by Herodotus, and later by the Indian independence leader Bal Gangadhar Tilak, seems to receive certain backing. Tilak, in his *Arctic Home in the Vedas* (1903), said that the verses in the *Rig Veda* which identify the beginning of the year with the vernal equinox, or Spring, in "Aditi" (twins), imply that the observations were made around 5500 B.C. Then they refer to the vernal equinox in "Ardra" (Orion), which would imply the period around 4000 B.C., and finally the vernal equinox in "Krittikas" (Pleiades), which means around 2000 B.C.

In my opinion, if not a full calendar, at least astronomical observations began much, much earlier than the development of agriculture around 8000 B.C. It has been rightly noticed that the constellations have never been represented with plants or flowers, which would be normal for an agricultural culture. Therefore, migrations and intellectual

Maria Schmitz

Dino De Paoli addressing a Schiller Institute conference in Germany.

curiosity pushed man to register celestial events at least around 30,000 B.C., when migrations and navigations indicate a high level of intellectual power and a need for such astronomical observation. Many cave pictures and sculpted objects—the "Venus" of Laussel, the "Eagle's Wing" of Dordogne, the "Prayer" in Geissenklösterle—have clear marks and ordering of points indicating the observation of cyclical events such as the cycles of the Sun and Moon.

But we can go even much earlier: In the State Pre-history Museum of Halle, one floor above the one where the Nebra disk is displayed, there is a magnificent example of how our ancestors were able to "count" by marks on a bone found in Bilzingsleben (Nordthüringen) and dated 350,000 B.C.! This is also the same period when other people in Schöningen (Braunschweig) made the wooden spears whose precision and calibration have revealed that man possessed a high cognitive power much earlier than thought.

Empirical observation or science? It would be a big mistake to think that 7,000 or 30,000 years ago, those people just "observed" things without any scientific theory. There is not and there never has been a pure "observation," just as there has never been a simple passive "being struck" by some natural celestial event. Even animals do not passively wait with open mouth for food to jump in and go to their stomachs. They have an active "inborn" search for the "good" food. It seems that animals never considered the observation of celestial events as part of their "right" food. But man did. Animal biology knew, and knows, how to adapt to the celestial cycles of day-night and the seasons. Man's reason looked for the "why" and "how" of such cycles, and used them, not just for the consumption, but for the production of the "right" food. The control over time and the making of calendars were linked to social-economic life to increase productivity and to try to control natural catastrophes.

In ancient astronomy, we are clearly confronting mental images and ideas that direct observation and are linked to it. Therefore, the first implicit scheme led to circles. Let's remember that all the known Sun observatories in central Europe were "circles." That is, we are confronted with analog models like our clocks. It is unknown whether they arrived at notions of "spheres," but it is certain that they soon confronted more "ideal or universal" models, which are today called "geometry." The division of such circular motions, and the relation of the solar and lunar cycles soon led to new dimensions of problems. We have records both for Mesopotamia and Egypt, that around 2000 B.C., individuals started confronting the issue of the relation of the radius to the perimeter of circle, which we call "pi."

It is said that the notion of incommensurability was discovered only around the triangle, but the first problems of incommensurability start as soon as one tries to codify, in a calendar, the solar and the lunar cycles: Even today we have to continuously *(ad infinitum)* readjust the calendar because of the incommensurability of the solar and lunar cycles. When this awareness happened is not clear, but I would not be surprised if this happened much earlier than is commonly thought. Geometry now allows us "to see" unobservable parts of the celestial clock: for example, the "night" and the "complete" yearly path of Sun. But we are still in the realm of taking for "true" the motions we observe—the scientists "believe" in the truths derived from such models. The criticism of Plato against the "astronomer" is pertinent in this context. Only by taking as real our creative power can we escape the notion that truth must be observable by the senses, and thus arrive at the hypothesis of Aristarchus (300 B.C.) that it is *we* who turn around the Sun, although such truth cannot be sensually observed!

Dino De Paoli, a long-time associate of Lyndon LaRouche, is based in Hanover, Germany, and has written widely on the history of science.

Notes

1. See the website at www.landesmuseum-fuer-vorgeschichte-halle.de.
2. To make things simple we will consider only the Northern Hemisphere.
3. Actually, the solstice is not fixed, it has a minimal shift: 0.4° each 1,000 yearsl The angle between the solstices is today 1.6° farther apart than the period of the Nebra disk.
4. Even today we do not have a totally precise calendar. We have to readjust it periodically, and many cultures have calendars which are no more precise than the one we have described.
5. A young "open cluster" in our galaxy (the Milky Way), consisting of approximately 1,200 stars.
6. Hesiod, *Works and Days*, lines 383-404 (Cambridge, Mass.: Harvard University Press, Loeb Classics, 1914).
7. See my article on ancient seafarers in the German-language newspaper *Neue Solidarität*, Vol. 26, June 25, 2003.

Information Service of India

USGS

India has a plentiful supply of thorium in the rare earth monazite, found in its beach sands. At left, workers transport sand to the Rare Earth Processing Plant at Alwaye. Inset is a backscattered electron image of a monazite crystal. Pure thorium is silver in color, but it becomes gray and then black as it oxidizes.

Thorium: Preferred Nuclear Fuel of the Future

by Ramtanu Maitra

Thorium is an abundant element in nature with multiple advantages as a nuclear fuel for future reactors of all types. Thorium ore, or monazite, exists in vast amounts in the dark beach sand of India, Australia, and Brazil. It is also found in large amoungs in Norway, the United States, Canada, and South Africa. Thorium-based fuel cycles have been studied for about 30 years, but on a much smaller scale than uranium or uranium/plutonium cycles. Germany, India, Japan, Russia, the United Kingdom, and the United States have conducted research and development, including irradiating thorium fuel in test reactors to high burn-ups. Several reactors have used thorium-based fuel, as discussed below.

India is by far the nation most committed to study and use of thorium fuel; no other country has done as much neutron physics work on thorium as have Indian nuclear scientists. The positive results obtained in this neutron physics work have motivated the Indian nuclear engineers to use thorium-based fuels in their current plans for the more advanced reactors that are now under construction.

India decided on a three-stage nuclear program back in the 1950s, when its nuclear power generation program was set up. In the first stage, natural uranium (U-238) was used in pressurized heavy water reactors (PHWRs), of which there are now 12. In the second stage, the plutonium extracted from the spent fuel of the PHWRs was scheduled to be used to run fast breeder reactors. The fast breeders would burn a 70-percent mixed oxide (MOX) fuel to breed fissile uranium-233 (U-233) in a thorium-232 (Th-232) blanket around the core. In the final stage, the fast breeders would use Th-232 and produce U-233 for use in new reactors.

One main advantage of using a combination of thorium and uranium is related to the proliferation question: There is a significant reduction in the plutonium content of the spent fuel, compared with what comes out of a conventional uranium-fueled reactor.

Just how much less plutonium is made? The answer depends on exactly how the uranium and thorium are combined. For example, uranium and thorium can be mixed homogeneously within each fuel rod, and in this case the amount of plutonium produced is roughly halved. But mixing them uniformly is not the only way to combine the two elements, and the mix determines the plutonium production.

Indian Initiatives

To a certain extent, India has completed the first stage of its nuclear program, putting on line a dozen nuclear power plants so far, with a few more plants now in the construction process.

The second stage is as yet realized only by a small experimental fast breeder reactor (13 megawatts), at Kalpakkam. Meanwhile, the Indian authorities have approved the Department of Atomic Energy's proposal to set up a 500-MW prototype of the next-generation fast breeder nuclear power reactor at Kalpakkam, thereby setting the stage for the commercial exploitation of thorium as a fuel source.

India's commitment to switch over to thorium stems, in part, from its large indigenous thorium supply. India's esti-

mated thorium reserves are 290,000 tons, second only to Australia. But the nation's pursuit of thorium, which helps bring it independence from overseas uranium sources, came about for a reason that has nothing to do with its balance of trade.

India is a nonsignatory of the Nuclear Non-Proliferation Treaty (NPT). Hence, India foresaw that it would be constrained in the long term by the provisions laid down by the commercial uranium suppliers, which would jeopardize India's nuclear power generation program. The 44-member nuclear suppliers group requires that purchasers sign the NPT, and thereby allow enough oversight to ensure that the fuel (or the plutonium spawned from it) is not used for making nuclear weapons.

India began the construction on the facility for reactor physics of the Advanced Heavy Water Reactor (AHWR) last year. The AHWR will use thorium, the "fuel of the future," to generate 300 megawatts of electricity, up from its original design output of 235 megawatts. The reactor will have a lifetime of 100 years, and is scheduled to be built on the campus of India's main nuclear research and development center, the Bhabha Atomic Research Center (BARC) at Trombay.

The construction of the AHWR will mark the beginning of the third phase of India's nuclear electricity-generation program. The fuel for the AHWR will be a hybrid core, partly thorium/uranium-233, and partly thorium-plutonium. The reactor will be a technology demonstrator for thorium utilization. According to B. Bhattacharjee, Director of the Bhabha Atomic Research Center, "At the international level, the AHWR has been selected for a case study at the IAEA [International Atomic Energy Agency] for acceptance as per international standards for next-generation reactors."

Abundance of Thorium

Although India's embrace of thorium as its future nuclear fuel is based mostly on necessity, the thorium fuel cycle itself has many attractive features. To begin with, thorium is much more abundant in nature than uranium. Soil commonly contains an average of around 6 parts per million (ppm) of thorium, three times as much as uranium. Thorium occurs in several minerals, the most common being the rare earth thorium-phosphate mineral, monazite, which usually contains from 3 to 9 percent, and sometimes up to 12 percent thorium oxide. In India, the monazite is found in its southern beach sands.

Th-232 decays very slowly (its half-life is about three times the age of the Earth). Most other thorium isotopes are short-lived and thus much more radioactive than Th-232, but of negligible quantity.

In addition to thorium's abundance, *all* of the mined thorium is potentially usable in a reactor, compared with only 0.7 percent of natural uranium. In other words, thorium has some 40 times the amount of energy per unit mass that could be made available, compared with uranium.

From the technological angle, one reason that thorium is preferred over enriched uranium is that the breeding of U-233 from thorium is more efficient than the breeding of plutonium from U-238. This is so because the thorium fuel creates fewer non-fissile isotopes. Fuel-cycle designers can take advantage of this efficiency to decrease the amount of spent fuel per unit of energy generated, which reduces the amount of waste to be disposed of.

There are some other benefits. For example, thorium oxide, the form of thorium used for nuclear power, is a highly stable compound—more so than the uranium dioxide that is usually employed in today's conventional nuclear fuel. Also, the thermal conductivity of thorium oxide is 10 to 15 percent higher than that of uranium dioxide, making it easier for heat to flow out

WORLD THORIUM RESOURCES
(economically extractable)

Country	Reserves (tons)
Australia	300,000
India	290,000
Norway	170,000
USA	160,000
Canada	100,000
South Africa	35,000
Brazil	16,000
Other countries	95,000
World total	1,200,000

Source: U.S. Geological Survey, Mineral Commodity Summaries, January 1999.

Information Service of India

The Bhabha Atomic Research Center (BARC) in Trombay, India. Thorium fuel cycles have been intensively studied here, and the design phase of the thorium-fueled Advanced Heavy Water Reactor is under way. At an August meeting in Brussels on emerging reactor designs, two BARC scientists unveiled their design for an Advanced Thorium Breeder reactor (ATBR) that can produce 600 MW of electricity for two years, with no refueling.

of the fuel rods used inside a reactor.

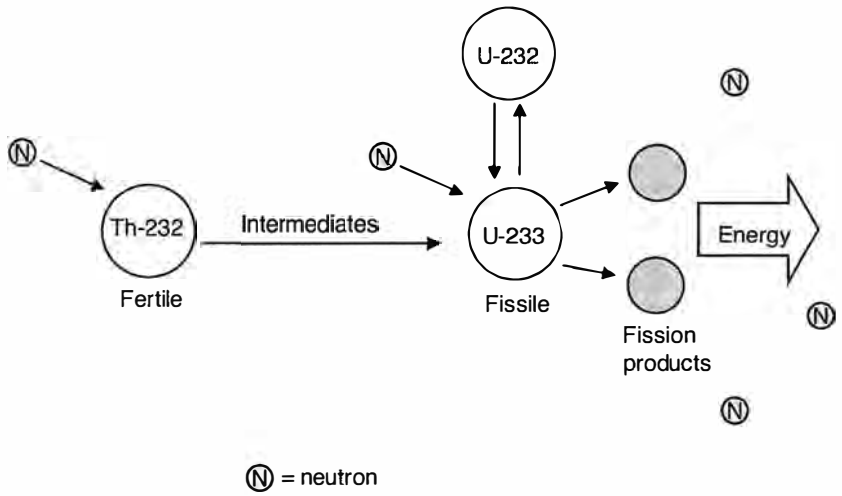
In addition, the melting point of thorium oxide is about 500 degrees Celsius *higher* than that of uranium dioxide, which gives the reactor an additional safety margin, if there is a temporary loss of coolant.

The one challenge in using thorium as a fuel is that it requires neutrons to start off its fission process. These neutrons can be provided by the conventional fissioning of uranium or plutonium fuel mixed into the thorium, or by a particle accelerator. Most of the past thorium research has involved combining thorium with conventional nuclear fuels to provide the neutrons to trigger the fission process.

The approach undergoing the most investigation now is a combination that keeps a uranium-rich "seed" in the core, separate from a thorium-rich "blanket." The chief proponent of this concept was the late Alvin Radkowsky, a nuclear pioneer who, under the direction of Admiral Hyman Rickover, helped to launch America's Nuclear Navy during the 1950s, when he was chief scientist of the U.S. Naval Reactors Program. Radkowsky, who died in 2002 at age 86, headed up the design team that built the first U.S. civilian nuclear reactor at Shippingport, Pennsylvania, and made significant contributions to the commercial nuclear industry during the 1960s and 1970s.

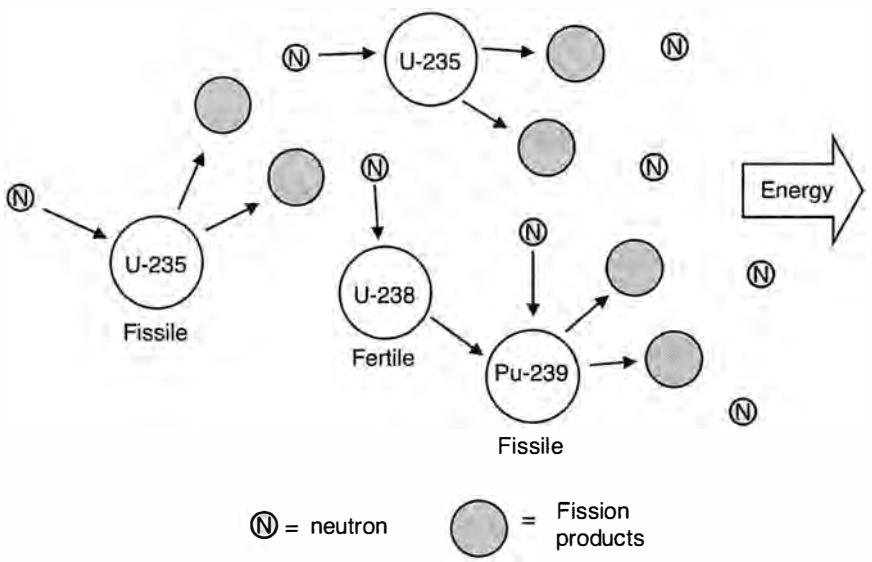
Although thorium is not fissile like U-235, Th-232 absorbs slow neutrons to produce U-233, which is fissile. In other words, Th-232 is fertile, like U-238. The Th-232 absorbs a neutron to become Th-233, which decays to protactinium-233 (Pa-233) and then to fissionable U-233. When the irradiated fuel is unloaded from the reactor, the U-233 can be separated from the thorium, and then used as fuel in another nuclear reactor.

Uranium-233 is superior to the



SIMPLIFIED DIAGRAM OF THE THORIUM FUEL CYCLE

The neutron trigger to start the thorium cycle can come from the fissioning of conventional nuclear fuels (uranium or plutonium) or an accelerator. When neutrons hit the fertile thorium-232 it decays to the fissile U-233; a neutron striking the U-233 leads to fission products, more neutrons, and a lot of energy. (Not shown is the short-lived intermediate stage of protactinium-233.)



SIMPLIFIED DIAGRAM OF THE URANIUM FUEL CYCLE

In the conventional uranium fuel cycle, the fuel mix contains fissionable U-235 and fertile U-238. A few fast neutrons are released into the reactor core (for example, from a beryllium source), and when a neutron hits a U-235 nucleus, it splits apart, producing two fission fragments (lighter elements) and two or three new neutrons. Once the fission process is initiated, it can continue by itself in a chain reaction, as the neutrons from each fissioned uranium nucleus trigger new fissions in nearby nuclei. Some of the U-238, when hit by a neutron, decays to plutonium-239, which is also fissionable.

conventional nuclear fuels, U-235 and Pu-239, because it has a higher neutron yield per neutron absorbed. This means that once it is activated by neutrons from fissile U-235 or Pu-239, thorium's breeding cycle is more efficient than that using U-238 and plutonium.

The Russian-U.S. Program

Since the early 1990s, Russia has had a program based at Moscow's Kurchatov Institute to develop a thorium-uranium fuel. The Russian program involves the U.S. company Thorium Power, Inc. (founded by Radkowsky), which has U.S. government and private funding to design fuel for the conventional Russian VVER-1000 reactors. Unlike the usual nuclear fuel, which uses enriched uranium oxide, the new fuel assembly design has the plutonium in the center as the "seed," in a demountable arrangement, with the thorium and uranium around it as a "blanket."

A normal VVER-1000 fuel assembly has 331 fuel rods, each of 9-millimeter diameter, forming a hexagonal assembly 235-mm wide. The center portion of each assembly is 155-mm across and holds the seed material, consisting of metallic plutonium-zirconium alloy (about 10 percent of the alloy is plutonium, of which more than 90 percent is the isotope Pu-239) in the form of 108 twisted three-section rods, which are 12.75-mm wide, with cladding of zirconium alloy (See page 51).

The blanket consists of uranium-thorium oxide fuel pellets (in a ratio of uranium to thorium of 1:9, with the uranium enriched up to almost 20 percent) in 228 cladding tubes of zirconium alloy, 8.4-mm diameter. These pellets are in four layers around the center portion. The blanket material achieves 100 gigawatt-days burn-up. Together as one fuel assembly, the seed and blanket have the same geometry as a normal VVER-100 fuel assembly.

As reported by Grae et al. (see note 4), thorium fuel burns 75 percent of the originally loaded weapons-grade plutonium, compared with a 31 percent burn for mixed oxide (MOX) fuel, which is made of a mixture of uranium and plutonium. But unlike MOX, thorium fuel does not produce more plutonium and has cost advantages over MOX. Grae et al. conclude:

"Thorium fuel offers a promising means to dispose of excess weapons-grade plutonium in Russian VVER-1000 reactors. Using the thorium fuel technology, plutonium can be disposed of up to three times as fast as MOX at a significantly lower cost. Spent thorium fuel would be more proliferation-resistant than spent MOX fuel. . . . [The thorium fuel technology] will not require significant and costly reactor modifications. Thorium fuel also offers additional benefits in terms of reduced weight and volume of spent fuel and therefore lower disposal costs."

Four Decades of R&D

Concepts for advanced reactors based on thorium fuel cycles include:

Light Water Reactors. Fuels based on plutonium oxide (PuO_2), thorium oxide (ThO_2), and/or uranium oxide (UO_2) particles are arranged in fuel rods.

High-Temperature Gas-cooled Reactors (HTGR). These are of of two kinds: the pebble bed and the prismatic fuel design.

The Pebble Bed Modular Reactor (PBMR) originated in Germany, and is now being developed in South Africa and in China. It can potentially use thorium in its fuel pebbles.

The Gas Turbine-Modular Helium Reactor (GT-MHR) was developed in the

Thorium Converter Reactor Ready for Development

An attorney-inventor working with Lawrence Berkeley National Laboratory physicists has proposed a small 50-megawatt-thermal thorium converter reactor for multiple uses: producing electricity (15 megawatts), burning up high-level actinides from spent fuel, and producing low-cost, high-temperature steam (or process industrial heat). This high-temperature steam can be used for extraction of oil from tar sands, or desalinating, purifying, and cracking water. The reactor's fuel matrix can be "tuned" to provide the right output for each particular work process.

Designed by Charles S. Holden, working with physicist Tak Pui Lou, the reactor core is a squat cylinder, about 3 meters wide and 1 meter tall. Its size makes it portable, so that it can be brought to a remote work site and supply electricity there without dependence on long-distance transmission lines. Its small size also allows it to be factory-built and transported to its destination, "plugged in" in a deep underground containment structure, and put to work quickly. The core can be shipped back to the factory when the fuel needs to be changed.

The reactor configuration is different from the Radkowsky design in the Russian thorium-burning reactors. Its ceramic fuel is dispersed in an inert metal matrix covered by Holden's provisional patents. This solid state metal alloy is composed of four materials. The thorium and uranium fuel particles are embedded in the alloy, which both slows and moderates the fissioning process. Using the metal as a moderator (instead of the water used in other thorium reactor designs) allows the reactor to operate in a more energetic neutron spectrum so that its core can have a long life.

The self-regulating reactor is expected to operate for 10 years without needing refueling. The neutrons to start it up will be provided by a fusion-driven neutron generator, designed by Dr. Ka-No Leung, head of Plasma and Ion Source Technology under the Accelerator and Fusion Research Division of the Lawrence Berkeley National Laboratory. The alloy and fuel configuration are expected to be tested at the Advanced Thermal Reactor testing complex at the Idaho National Lab; computer modelling of the system will also be done in the national laboratory system.

Holden and Pui's company, Thorenco LLC, is now looking for investors to develop a commercial prototype. Thorenco is based in San Francisco, and can be reached by e-mail at rusthold@mindspring.com or by telephone 415-398-7878.

—Marjorie Mazel Hecht

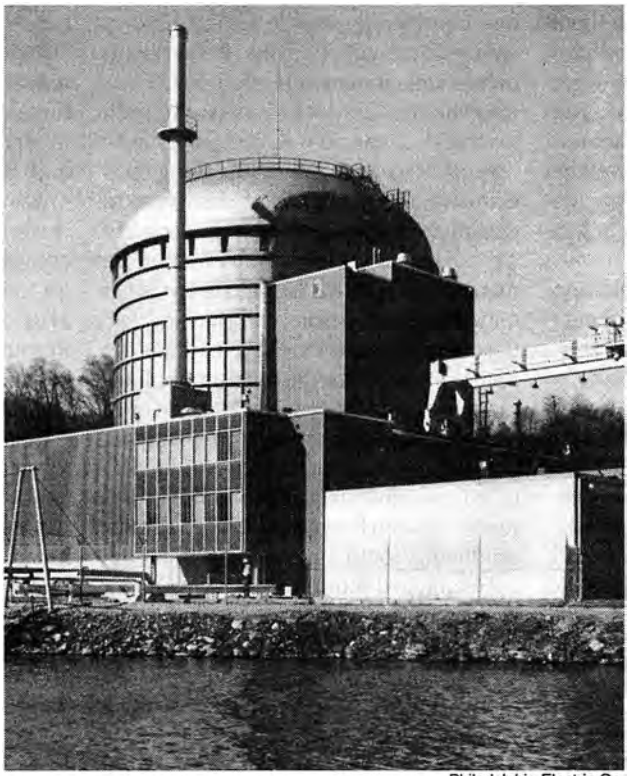
United States by General Atomics using a prismatic fuel. The use of helium as a coolant at high temperature, and the relatively small power output per module (600 megawatts-thermal), permit direct coupling of the reactor to a gas turbine (a Brayton cycle), resulting in power generation at 48 percent thermal efficiency (which is 50 percent more efficient than the conventional nuclear reactors in use today). The GT-MHR core can accommodate a wide range of fuel options, including highly enriched uranium/thorium, U-233/Th, and Pu/Th. The use of highly enriched uranium/thorium fuel was demonstrated in General Atomics' Fort St. Vrain reactor in Colorado (see below).

Molten salt reactors. This advanced breeder concept circulates the fuel in molten salt, without any external coolant in the core. The primary circuit runs through a heat exchanger, which transfers the heat from fission to a secondary salt circuit for steam generation. It was studied in depth in the 1960s, and is now being revived because of the availability of advanced technology for the materials and components.

Advanced Heavy Water Reactor (AHWR). India is working on this, and like the Canadian CANDU-NG, this 250-megawatt-electric (MWe) design is light-water cooled. The main part of the core is subcritical, with Th/U-233 oxide, mixed so that the system is self-sustaining in U-233. A few seed regions with conventional MOX fuel will drive the reaction and give it a negative void coefficient overall. (In other words, as the reactor heats up, the fission process slows down.)

Accelerator Driven Systems (ADS). In accelerator driven systems, high-energy neutrons are produced through the spallation reaction of high-energy protons from an accelerator striking target heavy nuclei (lead, lead-bismuth, or other materials). These neutrons can be directed to a subcritical reactor containing thorium, where the neutrons breed U-233 and promote its fission. There is therefore the possibility of sustaining a fission reaction which can readily be turned off, and used either for power generation or destruction of actinides resulting from the uranium/plutonium fuel cycle. The use of thorium instead of uranium means that fewer new actinides are produced in the accelerator-driven system itself.

The difficulties, as of now, in developing the thorium fuel cycle include the high cost of fuel fabrication. This is partly because of the high radioactivity of U-233, which is always contaminated with traces of U-232; similar problems in recycling thorium because of the highly radioactive Th-228, and some weapons proliferation risk of U-233; and the technical problems (not yet satisfactorily solved) in reprocessing.



Philadelphia Electric Co.

General Atomics' Peach Bottom reactor, 65 miles southwest of Philadelphia, began commercial operation in 1967. This high-temperature, graphite-moderated, helium-cooled reactor operated between 1967 and 1974 at 110-MWt, using highly enriched uranium with thorium.

Thorium Fuel Operating Experience

Between 1967 and 1988, the AVR experimental pebble bed reactor at Jülich, Germany, operated for more than 750 weeks at 15 megawatts-electric, about 95 percent of the time with thorium-based fuel. The fuel used consisted of about 100,000 billiard ball-size fuel elements. Overall, a total of 1,360 kilograms of thorium was used, mixed with highly enriched uranium (HEU). Maximum burn-ups of 150,000 megawatt-days were achieved.

Thorium fuel elements with a 10:1 ratio of thorium to highly enriched uranium were irradiated in the 20-megawatts-thermal (MWt) Dragon reactor at Winfrith, United Kingdom, for 741 full-power days. Dragon was run as a cooperative project of the Organization of Economic Cooperation and Development and Euratom, involving Austria, Denmark, Sweden, Norway, and Switzerland, in addition to the United Kingdom, from 1964 to 1973. The thorium-uranium fuel was used to "breed and feed," so that the U-233 that was formed, replaced the U-235 at about the same rate, and fuel could be left in the reactor for about six years.

The General Atomics Peach Bottom high-temperature, graphite-moderated, helium-cooled reactor (HTGR) in the United States operated between 1967 and 1974 at 110-MWt, using highly enriched uranium with thorium.

In India, the Kamini 30-kWt experimental neutron-source research reactor started up in 1996 near Kalpakkam, using U-233 which was recovered from thorium-dioxide fuel that had been irradiated in another reactor. The Kamini reactor is adjacent to the 40-MWt Fast Breeder Test Reactor, in which the thorium-dioxide is irradiated.

In the Netherlands, an aqueous homogenous suspension reactor has operated at 1 megawatt-thermal for three years. The highly enriched uranium/thorium fuel is circulated in solution, and reprocessing occurs continuously to remove fission products, resulting in a high conversion rate to U-233.

Thorium in Power Reactors

The 300-MWe THTR reactor in Germany was developed from the AVR, and operated between 1983 and 1989

with 674,000 pebbles, over half of them containing thorium/highly enriched uranium fuel (the rest of the pebbles were graphite moderator and some neutron absorbers). These pebbles were continuously recycled on load, and on average the fuel passed six times through the core. Fuel fabrication was on an industrial scale.

The Fort St. Vrain reactor in Colorado was the only commercial thorium-fueled nuclear plant in the United States. Developed from the AVR in Germany, it operated from 1976 to 1989. It was a high-temperature (700°C), graphite-moderated, helium-cooled reactor with a thorium/highly enriched uranium fuel, which was designed to operate at 842 megawatts-thermal (330 MWe). The fuel was contained in microspheres of thorium carbide and Th/U-235 carbide, coated with silicon oxide and pyrolytic carbon to retain fission products.

Unlike the pebble bed design, the fuel was arranged in hexagonal columns ("prisms") in an annular configuration. Almost 25 tons of thorium were used in the reactor fuel, achieving a 170,000-megawatt-days burn-up.

Thorium-based fuel for Pressurized Water Reactors (PWRs) was investigated at the Shippingport reactor in the United States (the first U.S. commercial reactor, started up in 1957), using both U-235 and plutonium as the initial fissile material. It was concluded that thorium would not significantly affect operating strategies or core margins. The light water breeder reactor (LWBR) concept was also successfully tested at Shippingport, from 1977 to 1982, with thorium and U-233 fuel clad with zircaloy, using the "seed/blanket" concept.

Another reactor type, the 60-MWe Lingen Boiling Water Reactor (BWR) in Germany also utilized fuel test elements that were thorium-plutonium based.

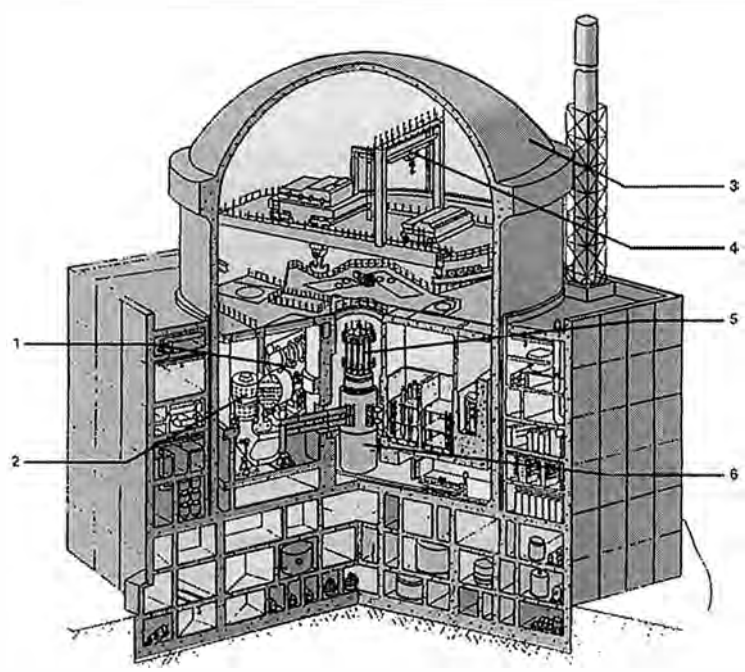
Proliferation Issues

In the early days of the civilian nuclear program, the Acheson-Lilienthal Report in 1946 warned of the connection between civilian nuclear power and nuclear weapons, and concluded that the world could not rely on safeguards alone "to protect complying states against the hazards of violations and evasions"—illicit nuclear weapons. Acheson-Lilienthal proposed international controls over nuclear power, but also considered possible technical innovations that would make it harder to divert nuclear materials into bomb-making. The thorium fuel cycle is one such technical innovation—as yet untapped.

A 1998 paper by Radkowsky and Galparin (see note 8) describes the most advanced work in developing a practical nuclear power system that could be made more "proliferation resistant" than conventional reactors and fuel cycles. Based on a thorium fuel cycle, it has the potential to reduce the amount of plutonium generated per gigawatt-year by a factor of five, compared to conventional uranium-fueled reactors. It would also make the generated plutonium and uranium-233 much more difficult to use for producing bomb material.

Heightened current concerns about preventing the spread of bomb-making materials, have led to an increase in interest in developing thorium-based fuels. The U.S. Department of Energy has funded Radkowsky's company (Thorium Power) and its partners in their tests with Russian reactors, as well as three other efforts (two national laboratories, two fuel fabrication companies, and a consortium of three universities). This research is geared to designing a thorium fuel system that will fit with conventional reactors. (See box, p. 48, for another thorium design.) There is also a new company, Novastar Resources, that is buying up thorium mines in anticipation of thorium-fueled reactors in the future.

The proliferation potential of the light water reactor fuel cycle may be significantly reduced by using thorium as a fertile component of the nuclear fuel, as noted above. The main challenge of thorium utilization is to design a core and a fuel cycle that would be proliferation-resistant and economically feasible. This challenge is met by the Radkowsky Thorium Reactor concept. So far, the



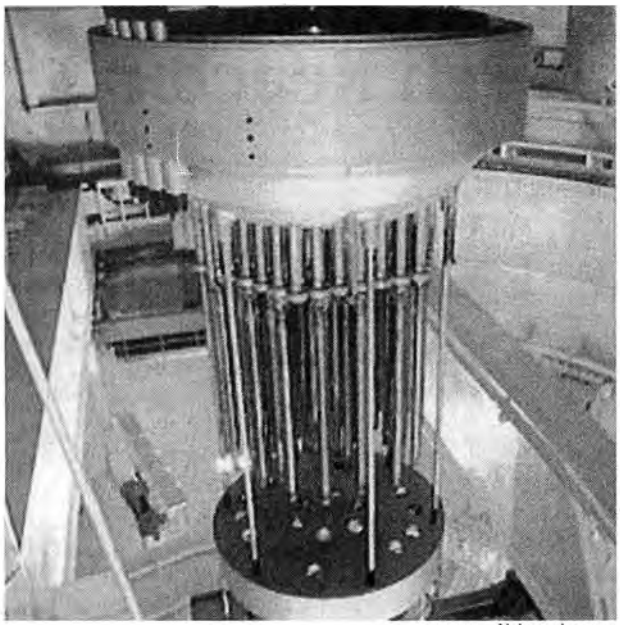
(1) Horizontal steam generator
(2) Reactor coolant pump
(3) Containment building
(4) Refueling crane
(5) Control rod drive assemblies
(6) Reactor vessel

Argonne National Laboratory

CUTAWAY VIEW OF THE VVER-1000

The 1,000-MW VVER, Russia's conventional reactor design is shown here in its third-generation version. It is a pressurized light-water-cooled and -moderated reactor, similar to Western pressurized water reactors in operation and safety standards. The Thorium Power/Radkowsky design would modify the core for a thorium fuel cycle that would burn up weapons-grade plutonium.

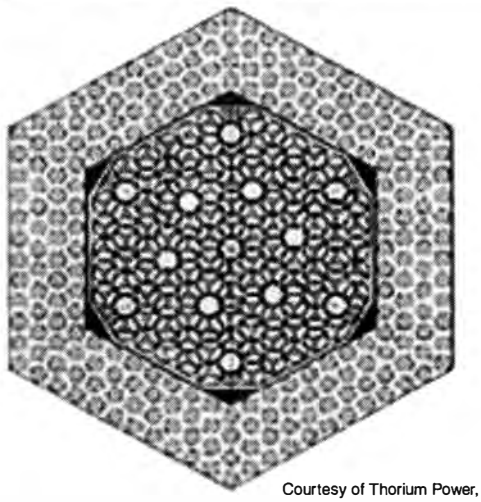
(a)



Nukeworker.com

VVER fuel rod assembly

(b)



Courtesy of Thorium Power, Inc.

Radkowsky design for the thorium seed/blanket assembly. The seed fuel is the inner part of the fuel rod (three-sectioned), and the blanket fuel is the outer part. The thorium fuel assembly is designed to replace the current fuel assembly, without requiring a major design rehaul.

concept has been applied to a Russian design of a 1,000-MW pressurized water reactor VVER, designated as VVERT.

The main results of the preliminary reference design are as follows: The amount of plutonium contained in the Radkowsky Thorium Reactor spent fuel stockpile is reduced by 80 percent, in comparison with a VVER of conventional design. The isotopic composition of the reactor's plutonium greatly increases the probability of pre-initiation and yield degradation of a nuclear explosion. An extremely large Pu-238 content causes correspondingly large heat emission, which would complicate the design of an explosive device based on plutonium from this reactor.

The economic incentive to reprocess and reuse the fissile component of the Radkowsky Thorium Reactor spent fuel is also decreased. The once-through cycle is economically optimal for its core and cycle.

To reiterate the proliferation difficulties: the replacement of a standard (uranium-based) fuel for nuclear reactors of current generation by the Radkowsky Thorium Reactor fuel will provide a strong barrier for nuclear weapon proliferation. This barrier, in combination with existing safeguard measures and procedures, is adequate to unambiguously dissociate civilian nuclear power from military nuclear power.

Other scientists point out that even if a terrorist group wanted to use the blanket plutonium for making a bomb, the process of extracting it from thorium fuel would be more difficult than removing it from conventional spent fuel. This is because the spent blanket fuel from a thorium fuel cycle would contain uranium-232, which over time decays into isotopes that emit high-energy gamma rays. To extract the plutonium from this spent fuel would require significantly more radiation shielding plus additional remotely operated equipment in order to reprocess it for weapons use, making a daunting task even more difficult. It would also be more complicated to separate the fissionable U-233 from uranium-238, because of the highly radioactive products present.

Overall, the development of thorium fuel cycles makes sense for the future, for advancing the efficiency and economy of nuclear power plants, ease of recycling, and making it more difficult to divert radioactive materials for weapons.

Ramtanu Maitra, a nuclear engineer, is a member of 21st Century*'s scientific advisory board.*

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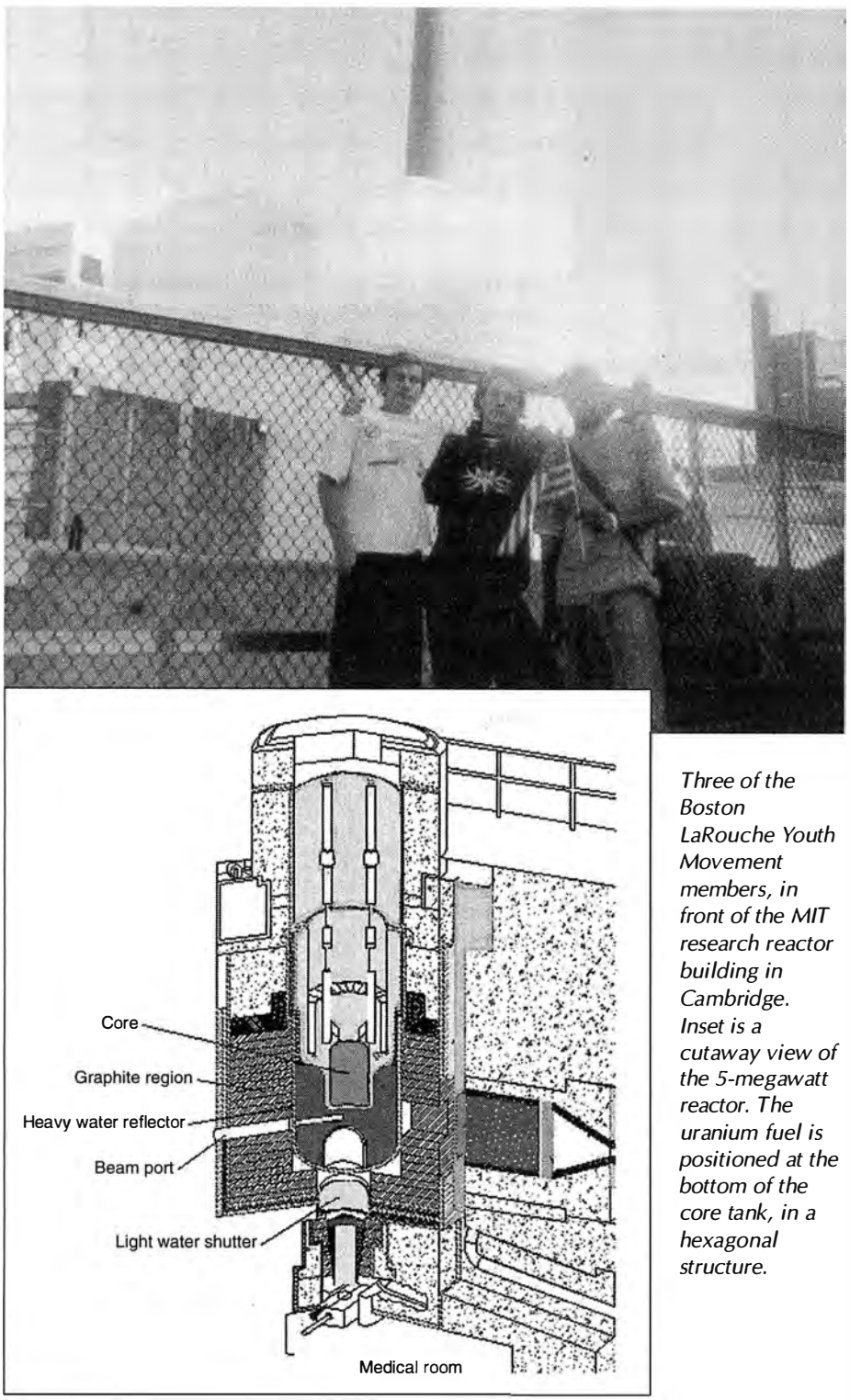
NUCLEAR POWER OR THE 'GANG GREEN'

A Visit to MIT's Research Reactor

by Robert Detloff



Three of the Boston LaRouche Youth Movement members, in front of the MIT research reactor building in Cambridge. Inset is a cutaway view of the 5-megawatt reactor. The uranium fuel is positioned at the bottom of the core tank, in a hexagonal structure.

Cambridge, Mass. A tour of the Massachusetts Institute of Technology Test Reactor-II (MITR-II) facility has just come to an end. A Greenpeace activist's mind is filled with fluttering Jacobin witches, sledgehammers in hand, who destroy the facility and pour sand into the reactor. Startled out of his fantasy, the Greenpeacer presents his hands for the final scanning by a Geiger counter, the last step before leaving to ensure that no one has been contaminated while in the facility.

CLICK . . . CLICK, CLICK, CLICK, CLICK, CLICK, CLICK, the instrument measures a series of hits.

His mind races, "My God, I've been contaminated."

The technician passes it over his wrist again, unalarmed, and chuckling, says, "Does your watch glow in the dark?"

Trembling, "Yes!"

"Well, the radium in your watch is exposing you to more radiation than standing a few feet from a nuclear reactor does," quips the technician.

Confused, eyes to the ground, the activist shuffles out the door, his mind attempting to fit what just happened into his distorted view of the universe.

So, who and what scientific method, if any, supplied this young man with the "scientific data" on which Greenpeace bases its vitriolic hatred of nuclear power?

In his book *Earth's Next Fifty Years,* Lyndon LaRouche writes that "Dissent is the ferment of genius and foolishness alike, but remains, nonetheless, the breeding place where something could emerge, by aid of which a people liberates itself from the deadly grip of misguided customs."[1]

It is this "dissent," which has been used for the past 40 years to breed a

population of people so foolish as to conduct themselves in the above-outlined manner, and other varying degrees of similar inhuman insanity; but it is also that dissent within which a new order must emerge.

The real fight surrounding nuclear power has absolutely nothing to do with safety or technical issues, contrary to popular opinion. It is a fight motivated and funded for purely political reasons. The Wall Street elite and its allies in the Council on Foreign Relations, and other environmentalists in three-piece suits, have attempted to build a wall up in the minds of the population, so that people will deny, and even aggressively resist, that which is absolutely necessary for lifting the nations of the world out of poverty. These top-down efforts have taken a major toll on our nuclear capabilities today, both mentally and physically.

As LaRouche further outlines, it must be our mission to end poverty in the span of one generation! What is necessary to accomplish this politically and technologically? How will *your* identity have to change to facilitate such a change? How do you know the technologies to be employed in furthering this goal? And how do you dump the counter-cultural pestilence that you've been infected with over the past decades?

Our Tour of the MITR-II

In March 2005, the Boston LaRouche Youth Movement set out to tour MIT's Test Reactor-II, to learn firsthand the science upon which we are reorienting our people, to aid them in again becoming a "beacon of hope" to the world, which is our nation's true historical mission. We recognize that the fate of nuclear technology will be determined only by the citizenry, which today is grossly ill-prepared, with a totally inadequate understanding of both physical economics and scientific method.

Situated on an obscure side street in Cambridge, surrounded by nondescript buildings and nothing which draws much curiosity, sits the MIT Test Reactor-II. Originally built in 1958, this reactor operated continuously on a 24-hour schedule from July 1959 until May of 1974, when it was shut down for modification and overhaul. Two years later, in 1976, it resumed its 24-hour continuous operation schedule.

From its inception, the idea of the project was to teach students not to be monkeys who manipulate formulas, but to gain the physical knowledge necessary to solve the yet-unknown problems. These might be new discoveries in the realm of nuclear physics, as well as conceptions that will help America build thousands of new nuclear power plants, here and internationally! Thus the reactor itself was designed and built by students. Everything, down to the configuration and machining of the fuel rods, is still, to this day, done by students. And the daily operations are regulated and monitored by students.

Our tour began with an orientation about what a nuclear reaction is, and how it is managed. I shall begin your tour in a similar manner, making this as basic as possible.

What Is Fission?

Uranium is a naturally occurring element. Like most elements it has more than one isotopic form, an isotope being a form of the element which has the same number of protons, but a different number of neutrons in the nucleus. If isotopes are separated out, they have slightly different weights. The symbol U is used for the element uranium. U-238 (or ^{238}U) describes the most abundant isotope, which has an atomic weight of 238. U-238 makes up 99.3 percent of natural uranium. The other uranium isotope, U-235, comprises 0.7 percent of natural uranium.

The U-235 isotope is important because it is fissionable: It can much more easily be made to engage in nuclear chain reactions. Raw uranium material, or yellow cake, is generally not useful in producing nuclear criti-

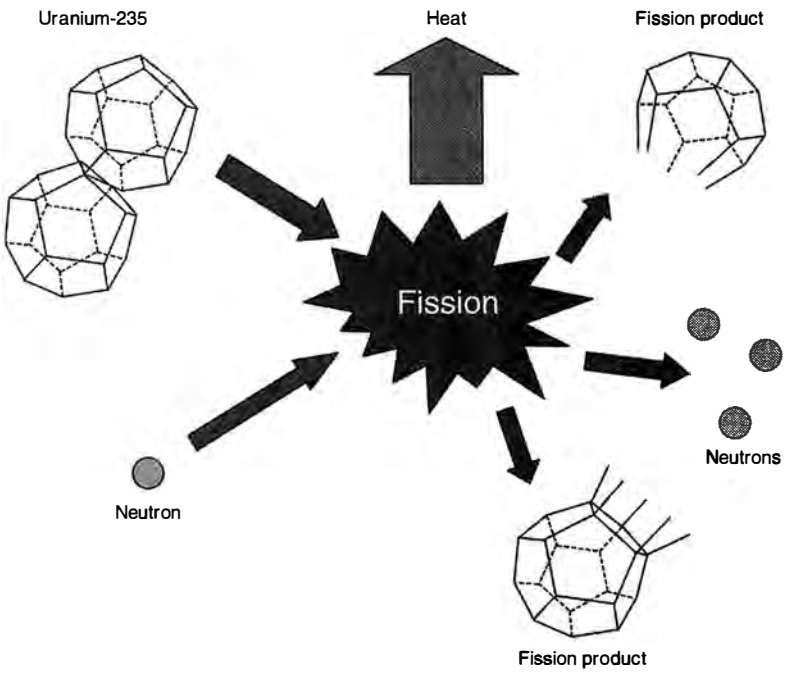


Illustration by Christine Craig

THE FISSION REACTION

In the fission reaction, the uranium isotope U-235 is hit by a neutron and splits apart, producing heat and releasing two or three new neutrons and fission products. The released neutrons then bombard other U-235 atoms, continuing the fission process. The MIT reactor is used primarily as a producer of neutrons for medical and industrial applications.

cality until it has been refined and enriched to increase its content of the U-235 isotope.

By its structure, uranium is unstable. Like many other elements, it can absorb neutrons into its nucleus. But unlike the others, it can break apart after absorbing a neutron. The uranium nucleus literally breaks up into two parts of unequal size, which go flying off in opposite directions, generating a lot of heat in the process, and giving off several more neutrons. This is called fission.

Although science does not have a complete explanation of why fission takes place, an analogy can be made between the neutron dynamics in the uranium nucleus during fission and the gyroscope children often play with. When spinning fast, the gyroscope remains stable, and strongly holds its vertical position. However, if you place a small weight on the spindle of the gyroscope, and again spin it as before, it will throw the gyroscope entirely out of balance. The gyroscope will not perform as before, and can be thought of as "unstable." In the nuclear realm, man is not quite certain what happens, though it can be likened to the following.

In order for the the gyroscope (uranium atom) to return to stability, it has to shed some weight from its nucleus (the spindle of the gyroscope). As it spins rapidly, it kicks the attached weight off in the form of a neutron (much more takes place in such a reaction, but I will not cover it here). This is natural "radiation."

SCIENCE and the LaRouche Youth Movement

That neutron which gets kicked out, normally is absorbed into many other elements, but a nuclear reactor manages this process so that these already unstable nuclei catch, or are bombarded by neutrons kicked off the surrounding U-235 nuclei, again forcing more overloaded U-235 to dump more neutrons, while trying to stabilize.

Now in a nuclear reactor, a dense, refined amount of U-235 is placed in a vessel, allowing this reaction to accelerate the process of tossing neutrons; those tossed neutrons impact the neighboring nuclei, which thus must toss their neutrons, impacting more and more nuclei. When that process becomes continuous, the reactor has become "critical," or achieved a continuous nuclear reaction.

Moderating the Reaction

The crucial aspects of the process are many, from the degree of refinement of the U-235, to the moderators, the substances (such as water) that mediate or regulate the speed and number of the ejected neutrons. The moderators are crucial, for if the neutrons are travelling too fast, the probability is that they will impact fewer of the surrounding U-235 nuclei, and thus the reaction will fail to reach criticality. As when shooting pool, if you have a shot where the eight-ball is mere inches from the pocket, and you slam the cue ball as hard as you can, you will likely eject the eight-ball off the table, and not into the pocket where you need it. However, a slow gentle tap wins you the game.

Graphite, boron-coated stainless steel, and water are commonly used as moderators. The moderators slow down the fast-moving neutrons (resulting from the fission reactions), and thus allow a greater number of impacts on the surrounding nuclei. This was the crucial discovery made under the football field of Chicago University by Robert J. Moon and his associates.[2]

So, a nuclear reactor is taking this naturally occurring neutron radiation, and regulating its effects, in order to generate a series of fission reactions, whose output is heat, which is used to flash water to steam to turn a turbine generator, which in turn produces electricity. There are innumerable other ways of utilizing radiation, and man has yet to understand just how essential it is that we master our understanding and application of such principles. This is the reason that the MIT reactor and similar research reactors exist today.

The nuclear reaction takes place in what is called the reactor vessel, in which the fuel rods and control rods (which contain the moderator substance) are regulated mechanically from the top. With the rods in place, the shim blades (neutron-absorption moderators) are lifted to allow a greater number of neutron impacts in the surrounding uranium; or they are lowered to slow the reaction down; or they are dropped, which shuts down the fission process in less than 1 second. The reactor vessel contains water, which acts as an additional moderator and coolant for the reaction.

Heat is regulated both by the degree of reaction allowed to take place, and by series of cooling systems called "loops." This reactor has two loops, the primary loop, where the fuel rods reside, interacting directly with the water in the reactor vessel; and the secondary loop, which is hermetically sealed from the first, and used for moving flashed water (steam) to turbines, or cooling areas. The MITR-II is a research reactor and does not use the steam to produce power.

The MITR-II reactor is a 5-megawatt, tank-type reactor, with a light water coolant-moderator and an outer tank that is a heavy water neutron reflector. The reactor is small, compared to a typical nuclear power facility of 1,000 megawatts. It has more than 20 area and effluent radiation monitors operating continuously, to provide radiation level readings at various points both inside and outside the reactor. Sensors, when detecting irregular levels of radiation, automatically seal off the reactor containment building ventilation systems.

There are 52 different ways that the reactor can be shut down, all of which have a tolerance of less than 1 second! An exterior shield gives radiation protection, so workers and researchers can conduct experiments and training without hazard.

What Can You Do with a Reactor?

So what use are these reactors? Some say there is none, and that they should be shut down, with the effect that all construction of new nuclear power plants in the United States has been stopped since 1971. And all reprocessing facilities for spent nuclear fuel have been shut down. However, people with such views have little knowledge that not only does their livelihood and welfare depend on nuclear energy, but so does that of their posterity.

I will just begin here to say why it is imperative that readers place absolutely no boundary conditions on the potentials with which man can benefit from

REACTOR CORE STRUCTURE

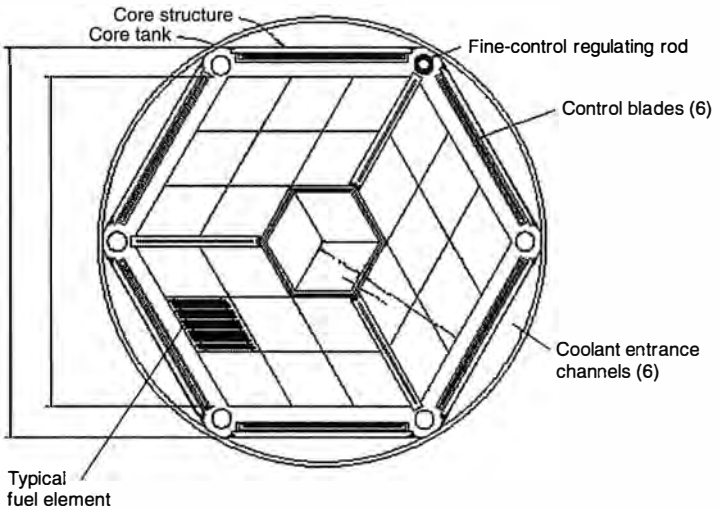
(a) The hexagonal core of the reactor has 27 positions, mostly for fuel elements. The remaining two to four positions are for in-core experiments, or are filled with a solid-aluminum "dummy" element.

There are six boron-stainless steel blades, one on each side of the core, each of which can be dropped into the core to shut down the reaction in less than 1 second. The water coolant flows down through the six entrance channels, and up through the fuel elements, cooling and moderating the reactor power.

A cadmium aluminum regulating rod is used for fine control of the reactor, making slight changes to keep power constant.

(b) This is a view of the reactor core tank, looking down from the top. The fuel elements are visible in the fuel storage ring around the core. The six electromagnets that drop the boron-stainless steel control blades into the core, if necessary, are around the sides of the core.

(a)



(b)

investigations into mastering nuclear science.

MITR-II has been primarily engaged in two types of research. The first is in the science of Boron Neutron Capture Therapy (BNCT).[3] BNCT is being developed as a promising treatment for the purpose of bombarding skin cancers or the deadly glioblastoma multiforme brain tumors with neutrons, destroying the cancer-causing cells. The process involves concentrating a compound of boron in the tumor cell, by injecting it into the bloodstream. When sufficient amounts of the compound have concentrated in the area of the tumor, the area is saturated with the thermal (low-energy) neutron beam, focussed from the reactor core. The boron condensed in the cancer cell attracts and absorbs neutrons from the beam, causing the boron to become unstable and split into two parts, both of which, in a sense, explode, with their blast area covering only the size of one cell. Thus, this micro-explosion destroys the cancerous cells without damaging the surrounding healthy tissue.

Neutron diffraction is the second main facet of operational research being done at MITR-II. This is the process for annealling, or doping, high-grade silicon for semiconductors. Ingots of silicon with purity of 99.99999999999 percent are used, meaning that only one atom out of 10,000,000,000,000 (or 10 trillion) is not silicon! Under this condition of purity, the silicon does not conduct electricity, and therefore the annealling is necessary to produce conductivity.

The silicon ingots are exposed to varying degrees of radiation fed directly through the reactor, sometimes within inches of the core. Absolutely precise timing and rotation are essential to produce an even "coating" of the ingots. With previous methods, foreign substances had to be applied when the silicon was super-heated, in order to bond with the silicon, and precision was difficult because of uneven coating. With the neutron defraction method, the silicon atoms absorb some of the escaping neutrons from the reactor. Most commonly, when a silicon atom absorbs a neutron, it becomes unstable and decays into a phosphorus atom. It is the addition of the impurity of phosphorus which increases the conductivity, and so the time for which the silicon is left in the reactor determines with great accuracy the conductivity of the silicon.

Nuclear 'Economics'

With such potential, one would think that a lab like MITR-II would be bustling with breakthrough work. But two years ago, the lead physician overseeing the BNCT project was offered a

better paying job in our "privatized" health-care system. Since his departure, all active work with patients and BNCT has ceased. We were told that it will be at least another two years before a qualified replacement is found.

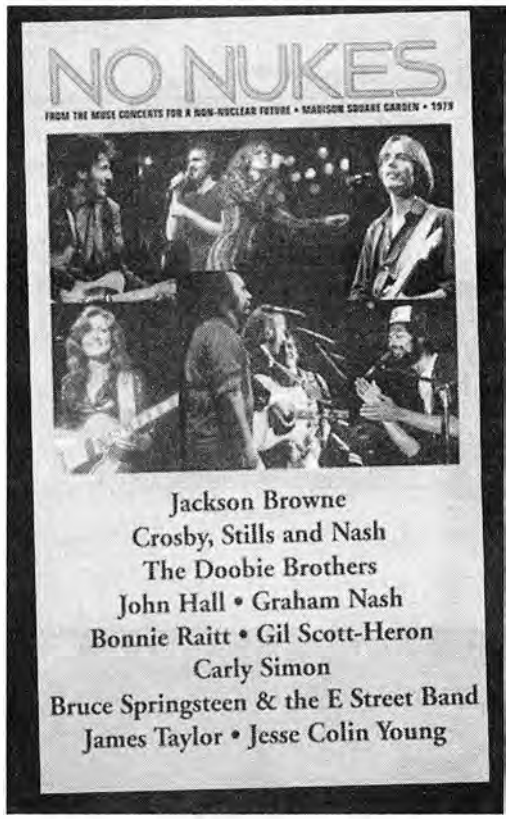
It takes a certain amount of work to understand that the propaganda and brainwashing about nuclear science has a nonlinear effect, for should it be such a challenge to find a qualified replacement for such a position? If we were educating, training, and providing the sort of financing necessary for such fields, would there be a shortage of qualified personnel? What could have been accomplished in those past two years, or the two to come?

Could MIT students have made the breakthroughs allowing man to master processes like BNCT? How many lives could have been saved in those two years? Of greater importance, is not our generation, but those generations of our posterity, who will have no cure for new cancers, although it is well within our grasp to find them. How much longer will man have to wait before "death by cancer" has become a distant memory? The answer to this question lies in *you!*

MITR-II receives *no government funding;* it relies on private contributions and grants, although the BNCT side of operations receives some government aid. But what can be done given the above-stated setbacks? Many facilities, including MITR-II, have had to resort to taking contracts for silicon annealing from computer chip companies to keep their facilities operating. How much ability is there to advance the field of nuclear physics when such things as a 4-foot-square radiation-proof window cost upwards of $25,000? The cost of such an endeavor is large, but are not the benefits to our posterity the most noble of investments into the future?

"Atoms for Peace?" we asked. "Atoms for money!" was the technicians' response.

The MIT Nuclear Lab, and similar labs elsewhere, face problems which most people overlook when thinking about the hotdog they just heated in the microwave. The tools and instrumentation being manufactured today, are of a significantly inferior quality and shorter lifespan than those of 30 years ago. This costs the program more money, and more downtime when tools break and have to be resupplied. The technicians to repair specialized equipment are not only rare, but shockingly expensive. That specialized equipment quality has also plummetted, meaning more frequent repairs, and downtime, resulting in a greater overall operating cost, and diverting funds away from crucial experimentation and toward simply maintaining stability.



A concert poster from 1979-1980. The "toxic culture" from the 1970s and 1980s was created to brainwash youth against science, technology, and progress.

It is also such national economic policies of idiocy that create accidents, for being safe necessitates a commitment *politically* to make it safe, which requires investment to ensure safety. As the saying goes, "it's expensive to be poor."

Under such practices, the potential for catastrophic disasters is greatly magnified, because corners are cut, poorly trained staff are used to keep cost down, and safety procedures are overlooked to save money. Although MIT is not at this point yet, it could be forcibly thrust there soon. It is primarily the economics of budget cutting and austerity that creates disasters in any field, not the inability of man to perfect sciences like nuclear power!

Planned obsolescence is taking a major toll. This is when manufacturers design into their products a lifespan, guaranteeing it will fail after, say, 10 years, ensuring the manufacturer a future market. Magic of the market anyone? Can you imagine working in an environment as sensitive and technical as nuclear physics? Having problems with your toaster is one thing, but for precision instrumentation and tooling for the advancement of nuclear power, it's unacceptable.

The physical-economic breakdown has a magnified impact on such fields as this. The cost of maintaining, supplying, and equipping such facilities has skyrocketed. The training of skilled laborers and technicians has become more expensive, and is done in fewer places, yet the very value of the dollar has been declining. Some aspects of maintenance have increased by more than 30 percent in the past 10 years.

The think-tanks and rabid environmentalists have bombarded the population with alleged "scientific data and measurements," showing that nuclear power is too expensive, while admitting that their formula for measurement leaves out the effect of an increased potential for productivity, development, and creativity on the whole economy. Nor do they account for the amount of fraud in the realm of environmental impact studies, and fines and permits that contractors have been forced into paying, sometimes midway through projects, which effectively strangle the project to death. For example, MITR-II submitted requests to make upgrades seven years ago, and will likely wait seven more for approval.

Your Toxic Culture That Wasted Nuclear Power

Most malicious has been the psychological manipulation of *you* through your culture. You've had year-after-year of movies, comics, and cartoons all filled with viciously false ideas about man's mastery, or supposed inability to master, nuclear power.

Reflect on your youth and innocent "entertainment." How did Peter become Spiderman? A spider stepped in some radioactive material in the lab and bit him. The Hulk? Nuclear scientist Bruce Banner is contaminated by radioactive material. What kills beastman superhero Clark Kent, aka Superman? Surprise, surprise! Radiation.

In "Captain Planet," Mother Earth's "Gaia" spirit empowers five token children from around the world with magic rings, whose combined power creates the "Ubermensch" Captain Planet, who battles evil eco-villains like Duke Nuk'em and Looten Plunder, who are out to destroy and pollute the world with radiation. Homer Simpson, of course, your "typical" nuclear power plant technician, is always accidentally leaving vials of radioactive material in his back pocket. Godzilla, rudely awakened from his slumber on the bottom of the ocean by atomic bomb tests, threatens mankind.

Giant grasshoppers from nuclear contamination wreak havoc over the Midwest in "The Beginning of the End." A nuclear power plant executive discovers that his evil son is plotting to destroy the world with nuclear power in "The Chosen," 1978. A nuclear reactor melts down all the way to China!—starring British agent Jane Fonda, "China Syndrome," 1979.

A Florida nuclear power plant springs a leak, the result: giant killer crabs, "Island Claw," 1980. Nuclear waste dumped off of Connecticut creates mutant sea creatures who invade the beaches, "The Horror of Party Beach," 1964. Evil pro-nuclear advocates funnel money into a pro-nuclear political candidate in "Touch and Die," 1991. A woman aggressively against nuclear power sneaks onto a fuel transport ship, and mysteriously dies of cancer, "Blueprint," 1992.

And how many more, I can't even name.

"But my music is my revolution," you say? In 1980, Jackson Browne, Crosby Stills and Nash, The Doobie Brothers, Bonnie Raitt, Carly Simon, James Taylor, Bruce Springsteen, Jane Fonda, and others put on a giant concert titled "The Muse Concert: No Nukes"—a protest of the development and application of nuclear power. Again in New York City, 1982, the rally "In Our Hands" with Benjamin Spock, Carly Simon, Peter Paul and Mary, Ellen Burstyn, Orson Welles, Meryl Streep, and others—all propagandizing against nuclear power!

For some reason, they didn't include in their anti-nuclear efforts campaigns against sleeping next to two others, which exposes you to more radiation than living next door to a nuclear plant. Nor did they note that coal plants emit more radiation than a nuclear power plant, in the form of radon.

I heard no mention of anti-brick or anti-adobe building rallies (for these materials also expose you to radiation). Or, what about, most emphatically, smoking, which exposes you to quite significant amounts of radiation from radon. I have yet to see any anti-Earth rallies, for yes, the Earth is always exposing you to radiation.

Overall, these so-called enviromentalists are against mankind. They are saying that their "feelings" are more important than the truth, and "damn it, it feels good to be against nuclear power," especially when it pays to be so. It's the "in" thing to be an environmentalist.

Do people who promote such "Gang Green" activities know what a nuclear reaction actually is? Do they know the potential of things like BNCT to improve mankind and lengthen lifespans? Or do they think that cancer is "natural," and therefore we must help the cancer? For all we know, a cancer cell might have "feelings." You could hurt its feelings. Good greenies don't like to hurt anything's "feelings." But man doesn't count, for he is not "natural."

Develop the World with Nuclear Power!

Coming from such a degenerate culture, but being political revolutionaries, there was no way to keep our politics from bursting out at the seams at MIT's reactor! We wanted no museum tour, and were excited to teach the technicians about the potential for massive development of nuclear power and related technologies. Despite a certain amount of pessimism, they are proud of their work; although we found to our surprise that the political and physical-economic fight for nuclear power had either been stymied, or had never even been allowed to bud in this environment. The technicians did not have an apparent connection to the massive deployment of the nuclear technology for which they, in a sense, are currently the gate-keepers.

We made it a point to get copies of LaRouche's book *Earth's Next Fifty Years* to several of the technicians, and we let them know that we're going to need them for massive projects on nuclear power development internationally. We talked about how modular nuclear reactors could be brought into the most remote parts of Africa, to set up both power generation and desalination, with large-scale irrigation to conquer the unfriendly deserts of a continent on the verge of extinction; how man's leap to fusion power can only be through the segue of massive development of nuclear power; how the Eurasian Land-Bridge project will require massive power for its very development, not to mention the necessity of great numbers of skilled laborers to help make such a grand idea a reality.

How many high-technology hospitals will be essential? To give the growing need for greater population potential wings, we'll need power, and a lot of it! Most significantly, centers like MITR-II, need a working conception of LaRouche's physical economics, and the interconnectedness of development of basic economic infrastructure and the purpose of government and economics: human happiness!

We have to get such individuals out of their hermetically sealed intellectual laboratory environments, and get them fighting for the application of the technology they're working to master. We have to help them help us ensure that the next 50 years see the blooming of the true nuclear age!

Notes

1. "A Crucial Paradox," in Lyndon H. LaRouche, Jr., *Earth's Next 50 Years* (Leesburg, Va.: LaRouchePac, 2005), pp. 154-161.
2. See *21st Century*, Spring 2005, for more on the Manhattan Project and Dr. Moon.
3. See the accompanying article on BNCT by Cloret Ferguson. p. 58.

The Promise of Boron-Neutron Capture Therapy for Treating Brain Tumors

by Cloret S. Ferguson

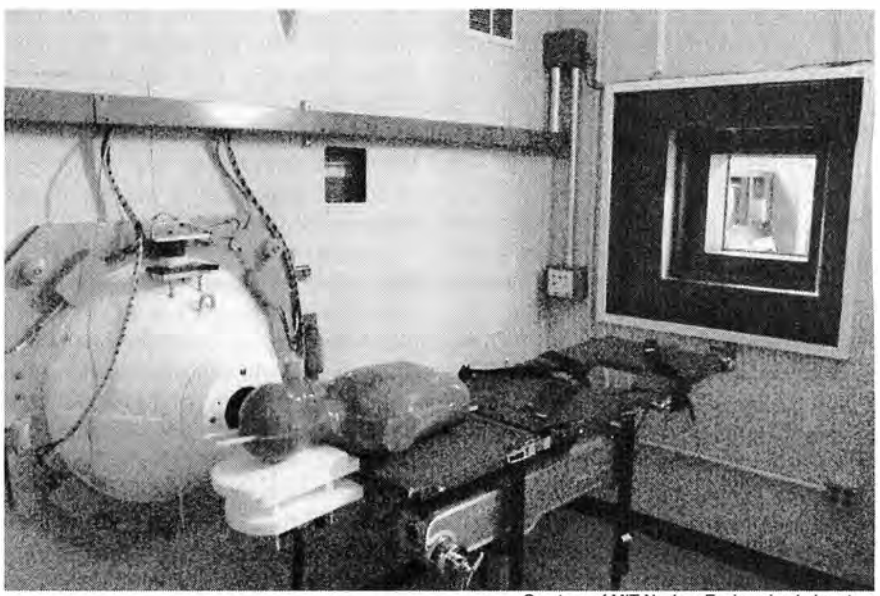
Nearly nine years ago, I made my first visit to the Massachusetts Institute of Technology Research Reactor (MITR-II) to accompany the late Susan Parmacek Johnson, a long-time associate of Lyndon LaRouche, who was one of the first brain tumor patients in the Harvard-MIT clinical trials of Boron Neutron Capture Therapy (BNCT). Recently, I returned to the MITR-II, this time to accompany members of the LaRouche Youth Movement in a tour of the facility.

The progress in the therapy technology since my first visit, coupled with the stagnation of the use of BNCT, prompted this article.

Boron Neutron Capture Therapy (or Neutron Capture Therapy in general) targets irradiation to destroy extremely malignant brain tumors, with the aim of preventing them from recurring, and without damaging surrounding tissue. Given the far-reaching benefits that BNCT offers in conquering these deadly tumors, it should be developed for widespread use.

BNCT could reverse the bleak outlook for a better quality of life experienced by the approximately 29,000 people diagnosed with primary brain tumors each year. Of these tumors, 6,000 are new glioblastoma multiforme, extremely aggressive metastatic tumors, which cause fatality within 6-12 months of diagnosis, even if the patient undergoes surgical removal and conventional radiation therapy or chemotherapy.

Primary malignant brain tumors occur relatively frequently, killing 12,000 to 15,000 patients each year in the United States alone. Secondary brain tumors kill even more people. According to Dr. Arthur Nelson, Jr., of the Boron Neutron Cancer Therapy University Consortium and the Idaho State University College of Pharmacy, "... [B]rain tumors that result from cancers originating elsewhere in the body kill an estimated 70,000 people a year." Nelson notes that the five-year survival rate for primary malignant tumors is less than 5 percent, and that "other new treatment modalities for brain tumors simply have not worked."



Courtesy of MIT Nuclear Engineering Laboratory

Inside the BNCT medical room, where the patient dummy is positioned near the fission converter beam for treatment. Medical personnel can observe through the window.

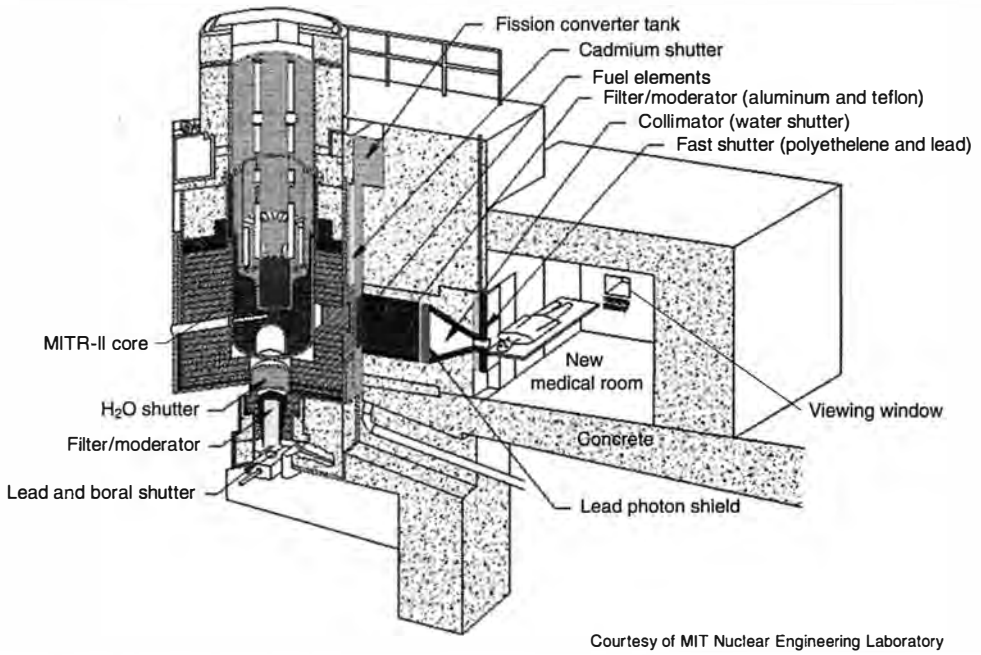
In principle, BNCT was introduced in America during the mid-1930s, and the first clinical trials occurred in the late 1950s and early 1960s (see box). Yet, no BNCT treatment programs are now available in America. It has taken more than 50 years for the clinical trials in BNCT to limp along from Phase I (toxicity), Phase II (efficacy), to Phase III (comparison with best conventional practice).

In America, Phase III clinical trials were largely initiated during the last 10 years. The MITR-II facility was upgraded in 2000, with a new fission-converter-based epithermal beam, and stands poised for such trials. Yet, as of March, the MIT program was still without a certified physician to oversee the entire BNCT program since the departure of the last physician-director 18 months ago.

In contrast, in Japan, BNCT has been available as a treatment since the late 1960s. At least 201 patients were treated with BNCT from 1968 to 2001, at five different reactor sites. Dr. Hiroshi Hatanaka, the initiator and lead physician of the Japanese BNCT program, until his death in 1994, trained at Brookhaven National Laboratory in New York during the early phases of BNCT. Since Hatanaka's death, Dr. Yoshinobu Nakagawa, a close collaborator, has continued BNCT in Japan.

Unlike the American BNCT program, treatments in Japan have employed intraoperative BNCT, together with a boron compound—boroncaptate sodium—referred to as BSH. In order to ensure delivery of the thermal neutrons,

Diagram of the MITR-II research reactor showing the setup of the new medical room and the fission converter tank. The fission converter contains 10 spent fuel elements from the reactor, cooled by heavy water. A shielded beam line tailors the neutron energy spectrum into the desired range for the patient. A collimator then defines the beam aperture and directs the beam to the shielded medical room for patient treatment.



Courtesy of MIT Nuclear Engineering Laboratory

which tend to be less penetrating than the more effective epithermal neutrons utilized in American BNCT programs, the Japanese BNCT program has used craniotomies.

At the Kyoto University Research Reactor, BNCT trials were initiated in May 1974, and then regularly performed up to 1990. By November 1995, just prior to the reactor remodelling, 61 clinical trials were carried out over 6 years at the Kyoto Research Reactor. Some results are described below.

How BNCT Works

Prior to undergoing BNCT, the patient must have extensive resection of the tumor. Approximately a week after the surgery, CT/MRI scans of the area are repeated, providing images that are introduced into special computer treatment software used for the treatment planning phase. The patient's medical team (neuropyschologist, neuro-oncologist, neurologist, neuropathologist, neurosurgeon, radiation oncologist, and possibly neuro-oncology nurse) then determine the dose level of the pharmacological agent and neutron beam, and the time intervals at which to administer an infusion of the drug—a compound of boron or gadolinium—which is tagged with nonradioactive atoms.

The drug preferentially concentrates more densely in tumor cells than in normal brain tissue, where it will lie in wait for the neutron beam. Within an interval of hours after this infusion, the head of the brain tumor patient is positioned in a specially designed medical apparatus to prevent movement. Then the tumor site is irradiated with a neutron beam, in a medical irradiation room. The patient lies on a stretcher, and an apparatus focusses the neutron beam from the reactor core into and through a shielded horizontal beam line.

At the MITR-II, the new Fission Converter Beam (FCB) utilizes a patient collimator to define the beam aperture and extend it into the shielded medical room. The actual beam irradiation is performed in a few minutes. (A similar procedure nine years ago confined the patient in an awkward, isolated position hoisted almost 10 feet in the air up close to the ceiling, to be as near the beam aperture as possible, and maintained this confinement for a duration of two 20-minute intervals, with the patient allowed only a short break between the sessions.)

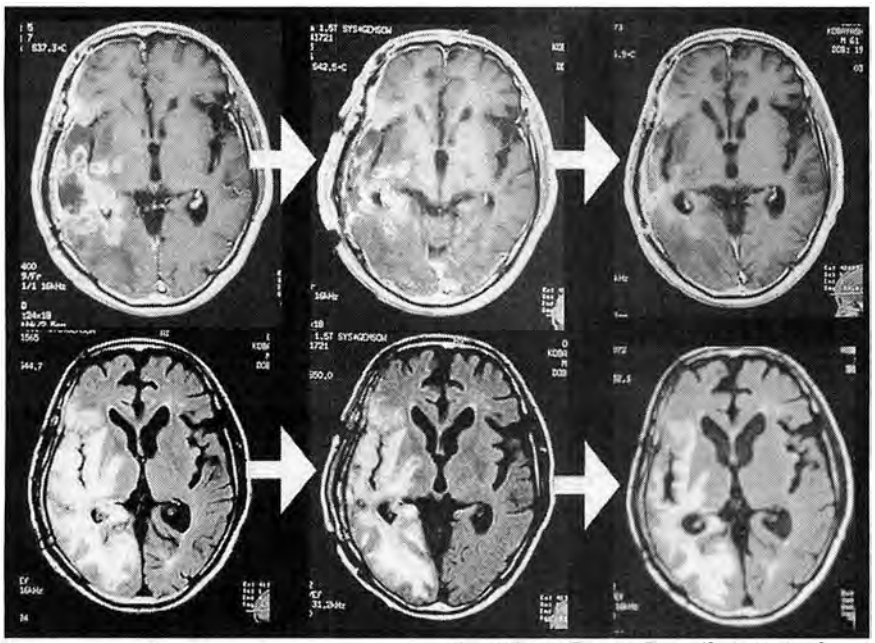
No additional surgery is required to

The BNCT Pioneers

First attempted at Brookhaven National Laboratories in 1951, the late Drs. Lee Edward Farr and William H. Sweet, and their medical teams, performed BNCT on 10 patients over two years. Although several patients experienced some short-lived improvement, the results were poor, and the research doctors published some of their hypotheses in medical and scientific journals. They questioned whether the radiation dose delivered was too low, whether the neutrons used had too low penetration, and whether an optimal pharmacologic agent had been used.

For the next decade, Dr. Sweet and other clinical researchers improved upon the methods of the initial BNCT trials. Dr. Sweet moved his trials to MIT, where the reactor facility could deliver a therapeutic dose of neutrons in less time, a more optimal boron compound could be used, and doctors could expose the tumor more directly to the neutron beam, because of the placement of the equipment and the room in which the beam would be delivered.

During this same period, Dr. Hiroshi Hatanaka, who trained with Dr. Sweet at Brookhaven, began performing BNCT in Japan with marked results, including lengthening survival rates for BNCT patients.



Kyoto University Research Reactor/Osaka Medical College

Brain scan of a Japanese patient showing the antitumor activity as early as 48 hours after BNCT treatment. Shrinkage of the tumor (whitish areas) and tumor-related swelling was observed more than five weeks after the treatment.

bring the neutrons to the tumor site with the above described procedures. There is also no need to use anesthesia.

What happens when the beam is turned on, and the epithermal neutrons pass through the patient's scalp and skull, into the brain? The boron-10 atoms, or a similar compound concentrated at the tumor site, capture the neutrons that pass near it. Then the boron-10 atoms become unstable, and release alpha particles, highly energetic subatomic particles that can kill the tumor cells.

Because the alpha particles travel only short distances—approximately the length of a single cell—it is expected that if the particles are released inside a tumor cell, they will damage only the tumor cell and not the normal brain cells nearby. The relationship of the higher dose given to the tumor cells than to the normal surrounding cells is called the therapeutic ratio.

In conventional radiation, the doses of radiation delivered to the tumor cells and to the nearby healthy cells are equal and therefore the therapeutic ratio is 1:1. But BNCT, which delivers a higher dose to the tumor cells, has a therapeutic ratio much greater than 1. Some currently used boron compounds have a therapeutic ratio as great as 6:1, and it is expected that ideal capture compounds will achieve ratios as great as 10:1.

Malignant glioma tumors are resistant to most conventional therapeutic treatments, including surgery, chemotherapy, and radiation therapy. It is also very difficult to use radiation after surgery with these tumors, because of the need to safely irradiate through the patient's scalp, temporal muscle, and cranial bone without causing damage to normal brain tissue, and at the same time kill the tumor. BNCT provides a way to safely and effectively direct radiation to the tumor site.

The Japanese Results

Japan's early BNCT work is noteworthy for several reasons. The Japanese were able to use only thermal neutrons, and therefore patients had to undergo an invasive cranial procedure (craniotomy) in order to have the tumor site irradiated sufficiently and effectively. The patient had to spend approximately 7 hours "bolted inside" the antechamber of the Japanese reactors, sometimes anesthesized for as many as 12 hours!

As of December 1992 (reported in 1994), 120 patients with 119 intracranial tumors and one extracranial nerve-related tumor were treated by the standard BNCT, using ^{10}B-sodium-mercaptoundecahydrododecaborate. Out of 87 patients operated on before May 1987, 18 lived or have lived longer than 5 years. Nine of these 18 lived or have lived longer than 10 years. Among the more-than-10 year survivors, only two have died, at 17 and 12 years. All of the others are still alive, as of the report date of 1994.

The two who died, did so because of delayed damage from conventional radiation treatment; BNCT was used with glioblastomas which had recurred after those treatments, and there was no evidence of tumors present when they died.

Out of the nine more-than-10-year survivors, three had been previously treated by conventional external radiotherapy, and they later developed radiation damage which brought them ultimately to an incapacitated condition. The other six, who were free from previous radiation history, are active in their jobs and have no evidence of tumors.

As Dr. Arthur A. Nelson testified before a U.S. Senate hearing on BNCT in 1994: ". . .[T]here is some evidence that BNCT treatments of brain cancers is efficacious. The Japanese have deployed this treatment modality for a number of years with moderate success, strongly encouraging us to further investigate this treatment modality. . . . Regrettably . . . the Japanese have been required to use a rather inappropriate nuclear reactor. There have been 13 U.S. patients treated in Japan over the last six years. Given the extremely invasive nature of the Japanese [BNCT] treatment, it is remarkable that seven of these patients are living today, six of whom have a high quality of life. . . ."

It should be noted that 7 of the 13 U.S. patients who chose to submit to the rather crude and demanding BNCT procedures in Japan are physicians or spouses of physicians!

Dr. Nelson reported that based upon these reports, and other data from the Japan BNCT program, the Japanese physicians hypothesize that, if conducted without conventional radiotherapy, "it can be suggested that BNCT is a radiotherapy that can produce 'cure' of both malignant and benign brain tumors while preserving a good quality of life."

Yet, apart from individual physicians and researchers, the American scientific

and medical community, as a whole, he said, argues that "it is difficult to draw any conclusion," from any aspect of the work in Japan. In preferring to doubt, and cling to skepticism concerning whether or not the work of Dr. Hatanaka's group was conducted and recorded with meticulous care, they belittle the fact that some of his patients have their health restored and the death sentence of their cancer removed. They also ignore valuable lessons and vital information that can be garnered even from the treatments which were not successful in preserving the other lives.

Court Vindicates BNCT Researchers

Could today's anti-science hysteria lead to court trials for Louis Pasteur and Jonas Salk for injecting live viruses into humans? Could it be argued that Pasteur and Salk "acted intentionally negligently," or that their "actions were unreasonably unsafe"?

That is the irrational thinking of the families who dragged BNCT neurosurgeons, the late Drs. William H. Sweet and Lee Edward Farr, to court with a tort claim in 1995.

On Aug. 27, 2002, a U.S. Court of Appeals ruling laid to rest a tort claim filed in 1995 by relatives of two research patients who were consenting participants in BNCT trials in the 1960s. The court rejected the broad-ranging claims against BNCT pioneering research doctors Farr and Sweet, along with a university, a hospital, and the government of the United States.

Originally, all defendants faced 11 causes of action including a claim of crimes against humanity (for which the Nazis were tried at Nuremberg after World War II!), battery, and intentional infliction of emotional distress. By the time the case went to trial, there were only three causes of action remaining.

The attorneys for the plaintiffs argued that the court should treat as "admissions of wrongdoing, and violation of duty of care," the research papers written by the defendants and presented for discussion within the scientific and medical communit . One such article, co-authored by Dr. Sweet and titled: "Boron-Slow Neutron Capture Therapy: Present Status," examined "deficiencies" of previous BNCT trials.

A 'Chilling Effect'

The appeals court ruled: "There would surely be a chilling effect on research in the medical field and deterrence of important progress in medical treatments if doctors and scientists could not frankly assess the successes and failures of their studies in published academic articles so that others can build on their work and learn from it."

The appeals court cited the expert testimony provided by the defendants which documented the meticulous and comprehensive standards under which they conducted their BNCT trials. Dr. Sweet's proposal to conduct BNCT trials in 1960-1961 received three levels of administrative review, and medical school representatives reviewed and granted approval for biomedical experiments at the reactor from the point of view of "provision of maximum safety to investigators, patients, or any human beings on whom tracer experiments, diagnosis, or therapy is to be performed."

The court also affirmed the defendants' argument "on the informed consent claim." This argument states that if the two patients "were adequately informed about the treatment, its experimental nature, and its known risks, and agreed to undergo the treatment nonetheless, then Dr. Sweet cannot be liable for performing the very treatment to which the patients consented." Both patients had been diagnosed with the deadliest form of brain cancer, glioblastoma multiforme.

Risk vs. Certain Death

To many healthy people, submitting to BNCT may seem a huge risk, because it is yet unapproved by the Food and Drug Administration and other regulatory agencies, but consider how an individual suffering from the certain death of brain cancer must view the promise of regaining some quality of life through an ingenious procedure like BNCT.

Dr. Michael H. Werner, a BNCT patient in Japan, elaborated to a Senate hearing, in 1994, how and why he decided to submit to BNCT: ". . . I was prepared to meet my maker, and I heard about BNCT. I am here. I am here I think because of BNCT . . . indeed the type of tumor I had was a glioblastoma multiforme. I had learned in medical school that the diagnosis of glioblastoma multiforme was a sentence of death. . . .

"Tumor cure by conventional methods requires destruction or removal of all the brain that is invaded by the tumor, and since the tumor intersperses with normal cells, trying to remove all of the tumor usually leaves the patient with an unacceptable lifestyle. . . ."

Life Expectancy

The court also found that "There is no evidence at all in the record that BNCT hastened decedents' deaths." The medical witness for the plaintiffs had testified ". . . in the early 1960s the median life expectancy for glioblastoma multiforme patients . . . from diagnosis to death, without treatment, was four to six months," and "that life expectancy for glioblastoma multiforme patients who underwent conventional therapy, including conventional radiation, was eight to twelve months."

Of the two patients whose relatives sued, one lived 11 months after undergoing BNCT. The other survived for 7 months after he was first diagnosed, but he had undergone 20 conventional radiation treatments prior to BNCT. After these early trials, researchers determined that use of conventional radiation treatments prior to BNCT would cause delayed radiation damage.

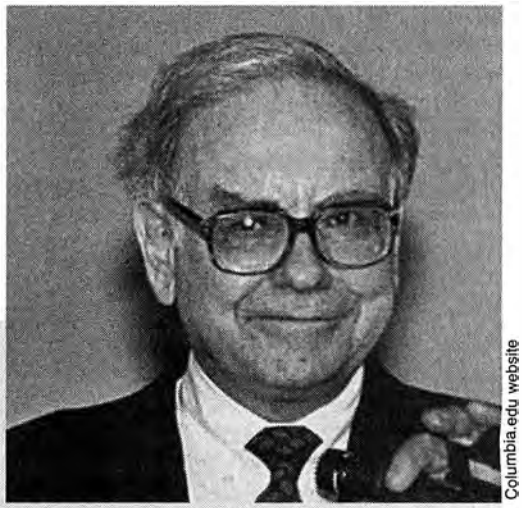
The two doctors most closely associated with pioneering work in BNCT did not testify in their own trials. Dr. Farr, who supervised the Brookhaven BNCT trials died in 1977. Dr. Sweet, who died after the trial in 2001, could not testify because his age and medical condition had by then rendered him incompetent.

—Cloret S. Ferguson

CHENEY'S ENERGY ACT

Will Warren Buffett Be The New Samuel Insull?

by Paul Gallagher



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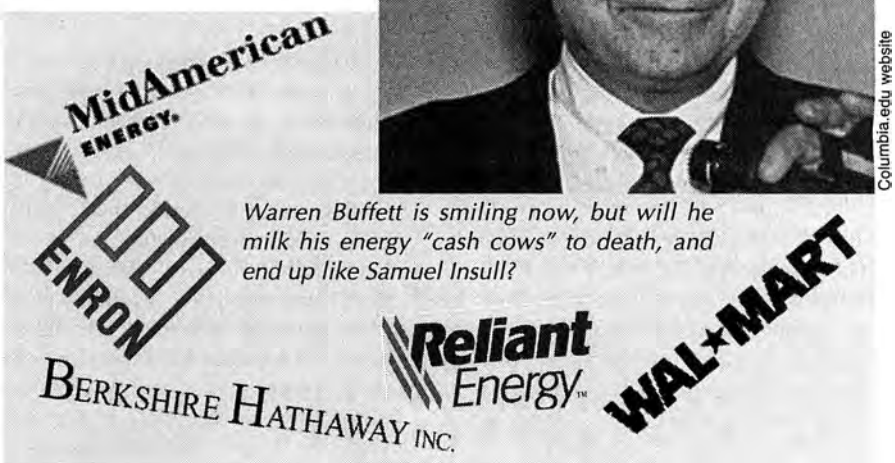


Warren Buffett is smiling now, but will he milk his energy "cash cows" to death, and end up like Samuel Insull?

When George W. Bush signed the new energy bill in an Albuquerque ceremony on Aug. 8, Omaha-based mega-billionaire Warren Buffett could take the most direct credit for the legislation's worst mistake: repeal of the 1935 Public Utilities Holding Company Act (PUHCA).

Buffett, advisor and political controller of Gov. Arnold Schwarzenegger, and a mover of the disastrous California "electricity deregulation" fiasco of 2000-2001, had repeatedly told Congressional committees since then, that he had $10 billion he would invest in electric utility infrastructure as soon as Congress repealed PUHCA. The so-called super-investor and "sage of Omaha" personally lobbied all the Western states' governors on that idea, and his flunky George Sokol, CEO of the MidAmerican Energy Holdings subsidiary of Buffett's Berkshire Hathaway Corp., lobbied former Congressman Billy Tauzin of Louisiana to first put PUHCA repeal in the House version of what's now the new energy act.

With Franklin Roosevelt's landmark PUHCA out of the way, Buffett thinks it will now be a simple matter for his MidAmerican to buy the major Oregon-based electric utility, PacifiCorp, triggering a wave of takeovers of utilities by financial companies, conglomerates, and larger utilities. Texas Pacific Group, backed by Berkshire Hathaway shareholder Bill Gates and Buffett, will buy Portland General Electric, a sale that was previously blocked.

The big energy-marketing conglomerates Cinergy and Exelon, which have bought up half the nation's nuclear power plants between them, will merge, respectively, with Duke Energy and Public Service Enterprise Group. The 2000 purchase by American Electric Power of Central and Southwest Corp. created the country's biggest mega-utility, and was waved through by the passive Federal Energy Regulatory Commission (FERC)—but then *declared in violation of PUHCA* by the Securities and Exchange Commission this year.

Now that PUHCA has been repealed and SEC chairman William Donaldson has been booted out by the White House, the mega-utility will be home free. The 220 investor-owned public utilities in the United States will be up for sale, and "within the next five to ten years, could shrink to just 10," as one leading energy lawyer forecast.

With MidAmerican, Buffett's Berkshire Hathaway has formed a classic, nationwide, speculative public utility holding company of the 1920s type to which Roosevelt's PUHCA gave the death sentence. It owns utilities and/or power plants in Nebraska, Iowa, California, and in England; is near adding one or more utilities in the Northwest; and has gotten control of North America's biggest gas pipeline networks for sales to utilities in a period in which both electric usage and prices of natural gas have been, and are still, rising sharply.

Using Berkshire Hathaway loans to distressed energy companies at rates of interest ranging up to 30 percent, Buffett assembled the gas pipeline complex, at bargain-basement prices, out of the self-destruction of Enron, Williams, Dynegy, and other "energy pirates" who roamed the high seas of deregulation. MidAmerican is also the second-largest residential real estate brokerage in the United States, through its HomeServices of America subsidiary, much of which is based in California.

Allow History to Repeat?

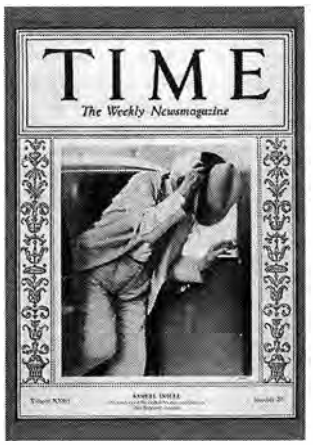
Before PUHCA, in the 1920s, the barons of the speculative public utility holding companies were Samuel Insull's Commonwealth Edison and J.P. Morgan's General Electric. Insull was an engineer who had worked with Thomas Edison, but by the "Roaring Twenties" became an ally of the Morgan financiers who had taken what was originally Edison General Electric, away from the great inventor and builder.

As Richard Freeman of *Executive Intelligence Review* described in a 2000 report, "Between 1922 and 1927, the utility holding companies swallowed more than 300 small- to medium-size private companies *per year*. The holding companies financed the takeover of the smaller companies by issuing either new

debt or new stock. . . . During the 1920s, one-third of all corporate financing in America was issued by private power companies. . . . The private electric holding company was leading the speculative stock market boom."

Why? The utilities they were buying up were ideal cash-revenue sources for diversion to other speculation. Freeman continues:

"In 1930, the Senate Interstate Commerce Committee held hearings in which it found that utility holding companies' servicing fees imposed upon subsidiary companies often 'milk[ed] the subsidiaries [so that] in many instances they yielded profits ranging from 51 percent to 321 percent of the cost of the services performed.' " Electricity rates, of course, rose considerably, while the spread of electrification out of the cities into rural areas, was blocked.



Samuel Insull, before (1929) and after (1934). Insull, once an associate of Thomas Edison, later allied himself with the Morgan financiers in the speculative stock market boom, and then lost millions in 1932. The financial scams of Insull and Morgan with their holding companies, victimized the nation's consumers and led to the regulatory measures of the Public Utilities Holding Company Act in 1935. The just-passed Energy Act repeals PUHCA.

Samuel Insull's holding company empire controlled 10 percent of all electricity generation in America by 1929, with 18 major holding companies owning more than 175 operating companies. (Morgan's United Corp. supergroup of holding companies had far more control, 27 percent of all electricity-generating capacity in the United States; with General Electric as well, Morgan's control was near 40 percent.)

"Between January and August 1929, a share of stock of Insull's Commonwealth Edison more than doubled in price, from $202 to $450, while a share of stock of Insull's Middle West Utilities more than tripled in price, from $169 to $529." But in April 1932, denied loans by Morgan and the other New York banks, Insull's companies defaulted on $200 million in obligations, hitting their investors with stock losses which may have reached $2 billion. Insull fled the country.

Field Day for Looters

Already in the first week of August 2005, a boom in utility stocks took off, in anticipation of the buyouts and mergers the new energy act will allow. Standard and Poor's research division forecast in a July report that stocks of the merged utilities would be "levered up to use the cash to invest in higher-risk, unrelated ventures" (the 1920s term was "watered" stock).

The 2005 Energy Act repeals PUHCA, modifies the New Deal-enacted Natural Gas Act, and weakens the 1935 Federal Power Act, which was passed to give the Federal government the power to ensure "reasonable pricing" in wholesale (interstate and inter-region) sales of electricity. That Act had already been deliberately unenforced since 2000, against the dereg looters like Enron, Reliant, and so on, by the FERC which is supposed to enforce it.

The *Christian Science Monitor* noted on Aug. 1, that FERC "hasn't rejected a utility merger since 1994. When states' attorneys general recently requested a hearing by FERC on whether consumers might be harmed by the nation's largest proposed utility merger of Newark-based Public Service Enterprise Group and Chicago-based Exelon Corporation, FERC declined. It approved the merger in July without a hearing."

The legislation also stops the states from enforcing regulations which the Bush Administration has let lie fallow, and allows Washington, for example, to overrule the states' blocking of dangerous liquefied natural gas (LNG) ports and storage terminals, which will further drive up the price of natural gas if they are widely built on the coasts. The feckless FERC will be able to bypass state licensing proceedings and streamline environmental review by other Federal agencies. Immediately, California's court challenge to a Buffett/CalEnergy LNG terminal proposed in Long Beach Harbor, will be trumped, as the Federal government will now control LNG siting.

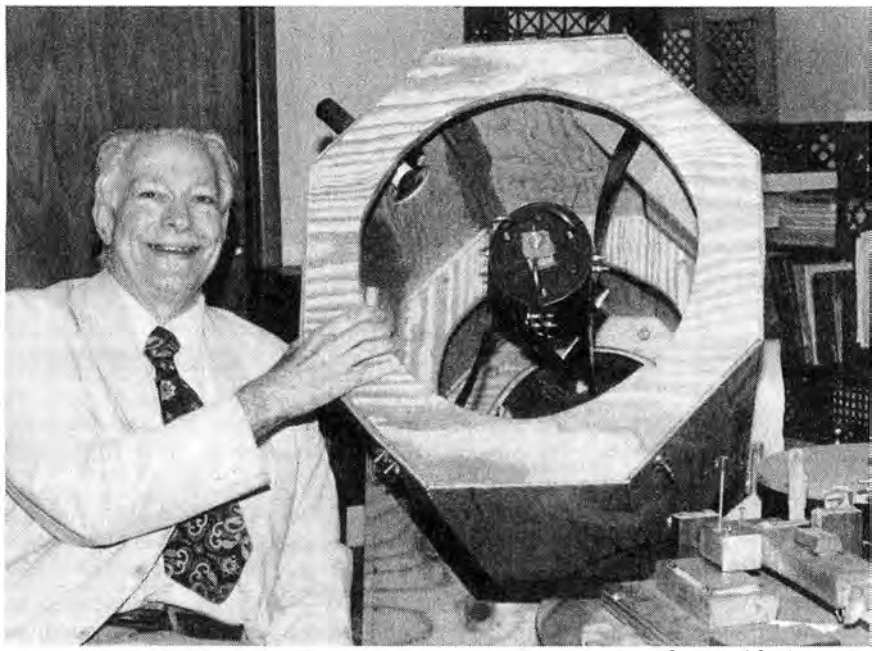
The bill removes the major impediment to investment in the electricity and natural gas industries by non-utility businesses, from private equity funds, to large manufacturing companies, to investment banks. In addition, it removes geographic limits to the size of electric and gas utilities.

Buffett and Wal-Mart

Fifty percent of the revenues and net profits of Buffett's Berkshire Hathaway empire come from ownership of insurance companies, and another one-third comes from owning McLane Corp., the distribution company for all Wal-Mart goods. The third and fourth major areas are residential real estate and natural gas fields and pipelines. Insurance company holdings are risky; the sector is currently using high premiums of all kinds to make up for Greenspan's low-interest-rate regime and for unpredictably surging disaster claims. Let the U.S. real estate bubble deflate—along with the consumer spending dependent on it—and Buffett would be facing low-to-negative returns in much of his empire.

Berkshire Hathaway has essentially been a high-interest bank to MidAmerican Energy Holdings, charging the latter 11.5 percent on nearly $2 billion in loans since its acquisition by Buffett in 2001. Berkshire Hathaway charged Williams Corp. 30 percent for the loan by which Buffett eventually grabbed his biggest pipeline network; and he is trying to do the same to Nebraska Public Power, from whose Cooper nuclear unit MidAmerican buys power. For PacifiCorp, all his talk is of windpower, biopower, and investment in transmission systems. But *The Oregonian* on July 18 warned that Buffett wants a captive PacifiCorp primarily to lend to it—up to $4.5 billion—at high interest rates (thus driving up its electricity rates), to develop it as a cash source for his other investments.

The utilities Buffett is buying up could become his cash cows—until they end up like Sam Insull's.



Courtesy of Charles Hughes

The author with the octagonal mount (in construction) for a Dobson-style telescope with a 16- or 18-inch mirror.

Constructing a Very Large, Short-Focus Telescope

by Charles Hughes

It was 1986: the return of Halley's comet after 76 years! What a shame that none of my friends in the New Jersey LaRouche movement owned a telescope. All that we possessed were a few pair of binoculars, and reports in the newspapers stressed that the comet would be quite dim this time around. So, we all agreed to purchase a small reflecting telescope of the so-called Newtonian type, with a 4-inch mirror diameter, for about $300. As it turned out, the comet was so dim in our light-polluted skies that it looked like a fuzzy haze through the telescope.

I had been interested in astronomy since the age of five or six, when my father told me about a "star called Mars" and told me how his father had seen Halley's Comet in 1910, before my father was born in 1913. In the region where I lived and grew up, the stars were quite bright, light pollution being nonexistent at that time.

In 1987, a year after the comet, the LaRouche office in Palisades Park, New Jersey, was raided by Federal agents, who were trying to destroy the LaRouche movement and to kill or jail Mr. LaRouche. The agents took all items in the office, including books, musical instruments, and the telescope! My interest in the stars continued, but the office was in no position to buy another telescope. What was to be done?

My answer: Learn how to build a telescope myself, as cheaply as possible. I saw an ad in *Sky and Telescope* magazine for a 10-inch telescope mirror for less than $150, which needed only a deposit, until the company, Coulter Optics, delivered it. So, I built the mounting from plans in a book, and waited for the mirror to arrive. It arrived two years later (!), during which time I had gotten impatient; and so, having decided to make my own, I followed a very good book, *Amateur Telescope Making,* which has been continuously republished since 1926, and was the basis for the amateur astronomy movement of the last 80 years.[1]

While I was working on a 6-inch telescope, and later a 10-inch, I had the good luck to find a 60-mm refractor telescope, which had been discarded on the street for trash collection. It was usable, and bridged the gap to my completion of larger reflector telescopes of the home-rolled variety.

The Dobson Telescope

John Dobson, the inventor of the Dobson Telescope, wrote a book which greatly influenced me: *How to Build a Sidewalk Telescope.*[2] The Dobson method was to build very large telescopes, say 16 to 24 inches of mirror diameter, using cheap porthole glass and simple lightweight plywood mounts and cardboard tubes, with azimuth-tracking (up and down, instead of the conventional 360-degree equatorial style). He would take these large telescopes out to public places, and in this way introduce the heavens to crowds of people. His aim was to organize the population to love astronomy. By this time, 1996, I had a few telescopes on the roof of our office in Ridgefield Park, N.J., and I began to build a big, Dobson-type instrument.

But, I did not know where to find and obtain porthole glass. Corning Glass Company, I knew, was the main producer of glass in the USA. The company referred me to its retailer, United Lens Company in Springfield Mass. For $200, United supplied me with a square of Pyrex glass, and agreed to remove four of the corners at no charge.

To avoid the company's unaffordable (for me) charge of $200 more to make a 16-inch disc, I made the disc round in only two months, grinding and polishing it by hand. It then became an f/5 telescope—the focal length (f) being 5 times as long as the diameter of the mirror. But this was a real monster, weighing 150 pounds.

We used this telescope last in the Fall of 2003, to view the close opposition of Mars, showing the polar caps and the dark terrain features on Mars's surface. This telescope was dismantled in October 2003, when our office moved to Hackensack, N.J., where a roof observatory could not be set up. The solution to this problem was to make smaller, portable instruments that could be easily stored when not in use.

Why Bigger Is Better

John Dobson had emphasized in his book that in order to see the heavens and celestial objects as they really appear, a very large aperture telescope is necessary—at least 16 inches. By collecting a huge quantity of light from dim objects in the heavens, such as the well-known Crab Nebula, the receptors in the retina of the eye are properly stimulated, even enough to detect some color in the object viewed.

The stunning photos of nebulae released by observatories are usually the result of very long exposures with film which is especially red-sensitive. The human eye is very insensitive to red in particular, especially at the low light levels produced by a telescope. To give a concrete example, when I view the Orion Nebula, the brightest nebula in the sky, with the 16-inch telescope described above, the predominant color is green, with hints of very pale violet.

Two Mirrors, One Mount

For this reason, I wished to build some really big scopes. In 1998, I was able to purchase some very large porthole glass discs from Roger Calvin, a friend in Baltimore. A friend of his ran a junk and scrap-metal yard, and had some portholes taken from old transport ships. I eventually ended up with a large collection of portholes. The largest, I planned to make into mirrors, using the smaller ones as tools to grind out the big ones.

Now, this may seem to be a wide digression from the subject in the title of this paper, but I wanted to situate this account of telescope-making in its 10-year history. I worked two 18-inch discs into mirrors, one with a short focal length, the other with a very long focal length. The new, compact telescope would have a tube only 48 inches long, with a 24-inch tube diameter. In this way, I could use both of my large mirrors in one mount.

The main effort would focus on working my two remaining portholes, both 16 inches in diameter and 1-inch thick. One-inch was considered too thin by old-time optical workers, who would use at least 2-inch-thick glass, to prevent flexure, or the "potato chip" effect, causing distortion.

But because 1-inch is as thick as portholes come, I avoided trouble by putting my thin mirror in a special cell, or harness, where the glass is supported on little rubber bumps spaced in a geometric array. Dobson-type telescopes move only up and down, with the base resting in one place, so that the mirror is not tilted into various orientations, as it is in an equatorial mount. (Equatorials were the axiomatic norm until Dobson's time. Dobson's telescope design threw out many standards that were previously considered mandatory.)

I began work on the mirror for this new instrument in March 2004, planning the curve to be an f/3, or about 50 inches focal length (this would be about 50 power, using a standard eyepiece of 25-mm focal length.

Most amateurs grind and polish their mirrors by hand, even 24- or 30-inch monsters, on a table that is constructed to allow the worker to walk around the table as he grinds or polishes. Lacking this setup, you can put a wet towel on a table and rotate the mirror as you work. John Dobson, in fact, having no fixed residence, would grind and polish on a park bench!

Grinding Is Hard Work

A 24-inch mirror is about the size limit one worker can handle alone, so I was lucky to have the use of a grinding machine constructed by another associate from New Jersey, Jeremy Batterson. It was not very sophisticated, but it did the job of removing glass. With such large mirrors, the mirror disc is placed on the bottom. One first puts about a tablespoon of abrasive in a water slurry on top of the glass; then a glass tool, about the same diameter as the main disc, is put on top of the abrasive, and the grinding is started.

If you don't have a glass tool, you can cast a tool of plaster or cement and then glue onto it (with epoxy) very hard, small bathroom floor tiles, to make a very good tool. A plaster tool must be sealed with oil paint or shellac to keep the plaster dry. These details are covered in any good book on telescope making (although for large mirrors consult the resources on the internet), so I

Courtesy of Charles Hughes

On the roof with a 10-inch Dobson-style telescope. The author is at left.

will skip over a lot of the fabrication details.

I began to grind with very coarse abrasive: 16-grit carborundum (carbo), then 60-grit carbo, 150-carbo, 250-carbo, 500-carbo, and finally 15-micron aluminum oxide. Then I polished with cerium oxide, followed by optical rouge.[3]

Carbo soon breaks down to a mud of glass and carbo, which has to be washed off with a sponge into a water-filled bucket. Never put carbo mud in any sink or toilet drain, as the mud compacts like concrete.

By July 2004, the curve of the glass was down to the proper depth, about three-tenths of an inch. This took 70 hours of work.

The work was then delayed for six months, as I became ill with a foot infection and required hospitalization. The work recommenced about Dec. 15, 2004, when I finished up the fine grinding of the mirror. The depth of the curve was checked after each working session by measuring the sagitta, or depth at the center of the mirror, with a steel ruler and a spark plug gauge.

This distance is related to the focal length of the mirror by a simple mathematical formula that allows you to solve for the radius of curvature: Sagitta equals radius of the mirror squared, divided by twice the radius of curvature.

By January 2005, the glass was fine-ground enough to begin the polishing operation. This is quite complicated, and I will not cover all of the details. (You may read my book review about mirror polishing, and making pitch polishers, in the Spring 2004 *21st Century,* page 58.)

The glass-grinding tool was a tar-like resinous material, mixed with hot pitch. A rubber mold was put on the pitch, and pressed down to form small pitch squares on the tool, which is called a lap, in mirror-maker's jargon. The pitch surface is broken up into squares and channels, so that the pitch can flow to fit the changing shape of the glass as it gets worn down under the action of the polishing agent and water.

Polishing with the lap was too difficult to be done by machine, which would stall out. Instead, I put the work on a wet towel on my work bench, and rotated it by hand as I polished. It took a month to

Courtesy of Charles Hughes

The 16-inch porthole glass in the process of transformation into a paraboloid. It is about halfway there.

polish the mirror enough to remove all the pits from the grinding operation. This was tested by shining a flashlight on the surface of the mirror until the beam could not be seen at all. The polishing operation took about 20 hours of very hard work.

Next, I attempted to turn the shape of my mirror curve from a spheroid into a paraboloid. The difficulty of making a short focal length mirror is, of course, the amount of glass which must be ground out. But harder still is the job of deforming the glass, which tends to become spherical with the circular polishing action.

Testing the Mirror

Now, I had to make the mirror a paraboloid. The paraboloid is usually obtained by deepening the center of the mirror, leaving the rest of it the same. My strategy was to work over the mirror, concentrating the polishing strokes on the center, and testing my parameters periodically: to see the shape of the curve I was getting, the accuracy of the focal length, the condition of the surface holes, and whether I had a bad, or turned, edge (the bugaboo of mirror-makers since the 19th Century).

Such tests involve light, as no mechanical tests are accurate enough. For a machinist, thousandths of an inch will suffice; but for a mirror maker, the mirror must have a surface accurate to one 10-millionth of an inch, and the rays reflected to the eye must converge to within an eighth of a wavelength of light. Jean Foucault, a French scientist, invented the light test, variants of which are used by all amateurs today. In the 1850s, Foucault popularized the use of glass mirrors for telescopes in France.

A German scientist Justus Leibig, a chemist, discovered how to deposit silver chemically onto glass. Foucault then proved that silver-coated glass mirrors would reflect more than 90 percent of incident light, compared to about 45 percent for speculum metal, which had been used since the invention of the reflecting telescope in the 17th Century. Foucault's silvered-glass mirrors made possible the monster mirrors of modern times. Today's mirrors are coated with aluminum, which is less reflective than silver but more resistant to tarnish. The aluminum is deposited by the strong vacuum process.

Foucault's test for mirrors consists of two parts. The first test shows if the mirror has a spherical surface and if there are any gross defects, such as hills, holes, turned edge, or zones of curvature at variance with the rest of the mirror.

The second part of the test shows the shape of the curve, and what part of a conic section it is. If you want to build a Foucault tester, then follow the plan in T. Texereau's book, *How to Build a Telescope,* page 67.[4] My tester was built according to the Texereau plan.

To test a mirror, put it on test stand, at a distance equal to twice the focal length, which is also the same as the radius of curvature of a sphere. Imagine your mirror as a part of a big globe; light from the center of the globe will bounce off the inside of the globe and return to the center. A spherical mirror has no focus, just a center of curvature. When the sphere is deformed into a paraboloid, it will have a focus, but it will no longer have a radius of curvature. The deformation process is called "figuring" in mirror-making jargon.

The lamp on the tester is made to send a beam of light through a pinhole, to the mirror, and then back to a blade near the tester's eye. To the operator, the mirror appears to become illuminated like a television screen. The blade is inserted into the beam until the mirror goes dark. This is the point where the rays converge, and the knife-edge cuts them all off. Any defects at this point show up as shadows on the mirror, indicating that you have a sphere.

As the mirror gets closer to a parabola shape, as you deepen the center with the small polisher, you no longer have all the rays coming to a point; instead, the rays form a confused area called a "caustic." This is because the light projected from the Foucault test lamp is producing non-parallel light, not light from infinity, such as a star would produce.

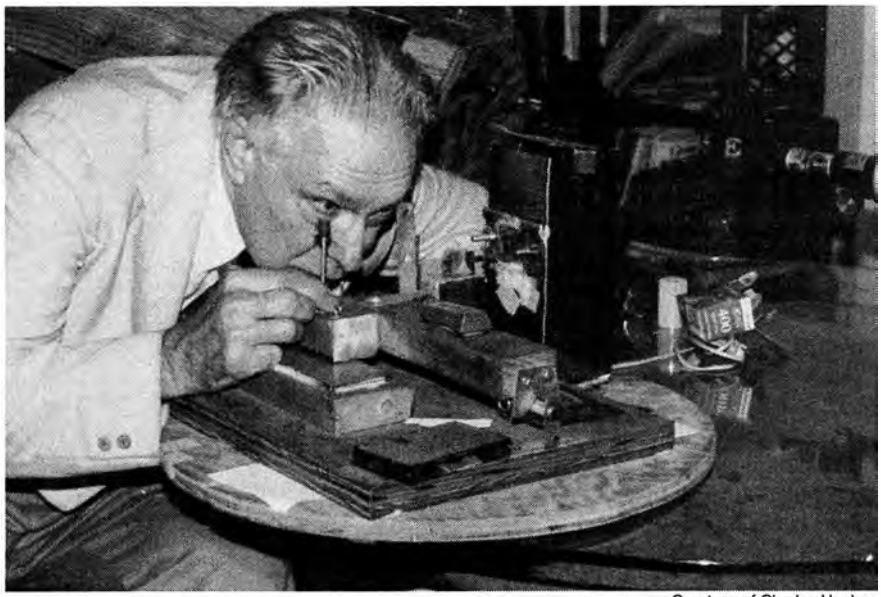
Foucault showed that the curve could be determined without going to the trouble of producing light from infinity, but by reading the curve from an examination of the caustic, especially by accurately measuring the caustic's length.

To measure the caustic, set up the tester and determine that you can find no point where the beam is totally blocked (or "nulled") or goes flat. Insert the knife into the beam. If the light projector and the knife are on the right, and if you are in front of the caustic, the shadow will move in from the left (and vice versa). As you get to where the caustic starts, a dark, faint shadow forms in the center of the half-moon-shaped shadow. Mark this point with a pencil on a card held in front of the knife holder.

If you pull back more, the central shadow gets larger, and another shadow comes from the left side and forms a donut-shaped shadow in the center. Mark this position on the card. Pull back more, and the shadow moves to the left and forms a half-moon on the left, with a faint shadow fringe on the right edge. This is the end of the caustic. Mark it again, and take the card off the tester. Measure the total spread of the three pencil lines.

For a parabolic curve, this value should be one-half the value of the mirror's sagitta, and the three lines should be equally spaced. Measure these values as accurately as possible, using a micrometer. Of course, you could make a setup which projects parallel light, and do a null test as in the first part of the Foucault test. You could also place a correcting lens, called a compensator, in front of the beam of your tester.

When such a test was done on the Hubble Telescope, the compensator was not correct, which caused a terrible error that was reported extensively in the popular press, and made "spherical aberration" a household word. This test is called the Dall test, after the 19th Century inventor Horace E. Dall.



Courtesy of Charles Hughes

Testing the paraboloid shape of the mirror for defects in the Foucault testing setup, the author holds a small knife blade. The lamp on the tester sends a beam of light through a pinhole to the mirror, and then back to the knife blade. As the blade is inserted into the beam, its shadow on the caustic can be measured to determine the accurateness of the parabolic curve.

The theoretical value for my 16-inch f/3 mirror was 0.6265 inch, and I continued to polish and test until my caustic shadows gave a caustic length of 0.6000 inch, which is 90 percent of a parabolic curve. I must do the star test as a confirmation, before I have the mirror aluminized, which is very expensive for this size mirror.

The most accurate confirmatory test for the mirror, is to put the mirror in the telescope mount and look at a star. When you look at the star at focus, the image should be a sharp point of light. The eyepiece, which should be of a high power, such as a 6-mm, is taken in front of focus and then in back of focus. If the mirror is perfect, the two images should be the same.

The Challenge of the Mount

Making the mirror is just half the job. Then one has to make the mounting for the mirror. As I had very little money to spend on the whole job, I decided to make the mount in the Dobson style with some modifications of my own. The basic plan was taken from Dobson's book *How to build a Sidewalk Telescope*.[5]

I decided to use plywood for everything, including the tube, because a 24-inch-diameter tube would have cost as much as all of the plywood for the job. Most amateurs, however, make use of the cardboard "Sonotube," which is used by construction workers to form a mold to cast concrete.

The mirror's focal length was 51 inches, accurately found in the aforementioned Foucault test. The tube can be 12 inches shorter, to allow for the light to hit the diagonal mirror and go toward the side to the eyepiece. My 24-inch tube diameter allows clearance around the mirror, and also makes possible the use of 18-inch mirrors, if desired. Because plywood comes in sections of 96 inches by 48 inches, I saved excess cutting of wood by making my telescope tube length 48 inches long.

The entire mount will consist of an octagonal tube, which will have large 10-inch stancheons on the side, like a cannon. The tube will drop into two recesses 11 inches long, in a square box open at the back, to allow for elevation and depression of the tube. The box rotates on a square base, secured by a 5/8-inch bolt, rotating on large caster wheels of rubber.

Making the Tube

The most difficult part of the job was making the tube. Out of 3/4-inch plywood, I cut four squares, 24 inches on each side. I cut off the four corners on each piece, to form regular hexagons. A cardboard pattern must be made first, to get the geometry correct and as accurate as possible.

Each hexagonal bulkhead had an 18-inch hole cut out of it, except the number three bulkhead, which had a 19-inch hole, because this is the area that must be large enough to expose all the mirrors, 16-inch and 18-inch, as the case may be. The rear bulkhead forms a cap over the end of the tube and holds the mirror in its cell. This one has no hole cut into it.

Courtesy of Charles Hughes

The telescope mount with its hinged "trap door," showing the hexagonal bulkhead.

The rear bulkhead is secured to bulkhead number three with 5/8-inch hex head bolts and wing nuts, so that it can be opened and closed to remove the mirror, which is quite heavy and must be taken out of the tube in order to transport the telescope safely.

Strips of thin plywood were cut to fit each side of the hexagon bulkheads, beveled on each edge at a 72-degree angle, and glued and fastened with dry wall screws 1-inch long. One upper side slot was hinged, and not screwed down, so that it could act as a trap door into the inside of the tube, to facilitate installation of the diagonal mirror and its adjustment.

The big box consisting of a bottom, a front, and two sides—called the rocker box—was made to come apart to make transporting and storing the scope easier. It was lined with 2 X 2-inch planks, with holes bored to receive a 3/8-inch bolt, four per side with wing nuts. These could be assembled and dismantled by hand.

The side stancheons ride in slots on each side board, on bearings made of Teflon, for friction-free movement. The wood was sanded smooth and coated with linseed oil. I found that soybean oil can also seal wood, but it takes several weeks to dry.

Installation of the diagonal mirror was the hardest job of all. My telescope had an f/3 focal ratio, and needed a very large diagonal to accommodate the light cone—about 7 inches in diameter, but circular and not elliptical, as a proper diagonal should be. It was homemade, as a 7-inch flat mirror would be impossibly unaffordable (for me).

My holder was a circular type, designed to suppress diffraction distortion of star images. Two semi-circular pieces of 3/32 inch stainless steel, 2 inches wide, were attached at their midpoint to a 6-inch section of plastic pipe, the front end of which was cut at a 45-degree angle. The inside of the pipe was filled with a round wooden plug that has a hole in the center, through which a 3/8 inch bolt was fitted.

A provision was made to be able to alter the angle of the diagonal, which was glued with silicon rubber cement to the end, cut at a 45-degree angle. The stainless supports were bolted to the sides of the tube, with small hex-head bolts and wing nuts.

There remained only to make a hole in the upper side of the tube to hold the eyepiece, and put the mirror into the cell with silicon rubber. The cell is secured to the rear bulkhead with a 5/8 inch hex-head bolt and wing nut. The metal fasteners were made rather large, so that they jam and stick less, which speeds set-up and take-down time.

The Biggest Problem

The biggest problem of the entire project was the removal of so much glass to grind the extreme, very deep curve needed for an f/3 16-inch mirror. I found that the "hogging out" would take forever, so I started with very gross abrasives. I began with number 20 carborundum, and also made use of the same size of crushed steel, which can be washed and reused, and really tears up the glass.

I also experimented with another abrasive, which I knew is used on cutting tools, tungsten carbide. I found a supplier for this on the internet, the Tungsten Company of Depew, N.Y., which sells this abrasive in all the usual grain sizes, with a 10-pound minimum order at $100. I tried this in 20-grain size, and I think it cuts faster than carborundum.

Other advantages are that tungsten carbide stays intact and can be washed and used again several times, whereas carborundum breaks down very quickly into mud. Aside from the high price, I think that amateur telescope makers should make more extensive use of tungsten carbide.

I would hope that readers of this account of how I built this inexpensively made telescope will want to think big, and make your own giant telescope. So get on the internet and get those big portholes! If you have questions about the project, I am available to talk with you at (201) 441-4888 (the New Jersey office of the LaRouche movement).

Notes

1. Albert G. Ingalls, ed., *Amateur Telescope Making*, Vols. 1-3 (Richmond, Va.: Willman-Bell Co., 1996).
2. John Dobson, *How to Build a Sidewalk Telescope*, available online at: http://www.telescopesineducation.com/dobson.
3. Carborundum, or carbo, is almost as hard as diamond; it's 9.5 on the Mohs scale, and diamond is 10. The hardness scale of minerals was devised by German mineralogist Friedrich Mohs in 1812.
4. Jean Texereau, *How to Build a Telescope*, (second edition, 1984) is available from the Willman-Bell Co. of Richmond, Va., which also sells abrasives, glass, and other things that you may need for telescope-making.

VERNADSKY MUSEUM CONFERENCE

Optimism in the Midst of Political Uncertainty

by Jonathan Tennenbaum

The Vernadsky Museum, Moscow

On May 16-18, the Vernadsky State Geological Museum, located across from the Kremlin in the center of Moscow, hosted a remarkable conference entitled "Science and Our Future: Ideas to Change the World." The conference, the second yearly event of this kind, brought together 65 Russian scientists and research workers from a wide spectrum of fields of research, ranging from geology and geophysics, biology and medicine, theoretical physics and engineering, to areas related to improving the living conditions and infrastructure of human populations. And, indeed, several of the ideas, discussed during the three days of sessions, do have the potential to change the world in a significant manner.

The Vernadsky Museum itself, in addition to being a unique exhibition of Vernadsky's discoveries in biogeochemistry and his conception of the Noösphere, houses a research institute with unique competence in problems concerning the origin, exploitation, and management of the Earth's mineral resources. Lyndon LaRouche, who with his wife, Helga Zepp-LaRouche, visited the Museum in April 2004, has repeatedly emphasized the crucial importance of these and related capabilities, embodying the scientific heritage of Vernadsky, for organizing a world economic recovery in the period immediately ahead.

A Charged Political Atmosphere

The conference sounded a hopeful note amid an atmosphere of uncertainty about the future of Russia, and of Russian science in particular. Mad President George Bush's provocative visit to the Baltic, the destabilizations in Kyrgyzstan and Uzbekistan, the implications of the "Orange Revolution" in Ukraine, and arm-twisting efforts of Condoleezza Rice during her visit in Moscow, added up to a sense of hostile "strategic encirclement" of Russia—just as the nation moved to celebrate the 60th anniversary of the victorious end of World War II.

On the streets one could hear people say that the losses suffered by Russian society as a result of the economic disintegration and looting of the country by so-called "liberal reformers" and "oligarchs," after the collapse of the Soviet Union, have been in some respects even worse than those suffered in World War II.

In any case, since the mid-1990s the Russian population has been shrinking at a net rate of between 500,000 and 1 million persons every year. Many of the most promising young scientists and other professionals have emigrated to the West, in search of a better life.

Unfortunately, the economic policies of the present Russian cabinet, still dominated by the likes of German Gref, as well as the policies of the hated former cabinet official, Anatoli Chubais, threaten to drive the country even further in the direction of a social explosion somewhere down the line. The tension could be felt, not least of all, in the scientific milieu itself.

Just days after the conference, a stormy Plenary Session of the Russian Academy of Sciences took place, at which, for perhaps the first time ever, a Minister of the Russian government—Science and Education Minister Fursenko—was booed from the audience and abruptly departed from the scene. Fursenko has been promoting a misguided policy of "reform" of the Academy of Sciences, which many of its senior members denounce as a virtual dismantling of the Academy.

The Academy of Sciences constitutes probably the single most important national institution in modern Russian history, an institution whose origins go back three centuries, to Gottfried Wilhelm Leibniz's personal meetings with Peter the Great.

According to scientists we spoke with, the present government intends to "compensate" for the catastrophic reduction of state support for the once-

powerful, but now vastly underfinanced Academy, through measures that will only make the situation even worse. These include closing a number of institutes, increasing salaries at the cost of drastically reducing the overall number of researchers, and promoting a far-reaching "privatization" of research.

In this atmosphere, charged with the danger of a strong anti-Western turn in the mood of the population and institutions, it was important to be able to brief Russian friends, including individuals of some considerable influence there, on recent developments in the United States, centered on Lyndon LaRouche's leading role, together with his Youth Movement, in organizing an effective political force in opposition to the insanity of the Bush-Cheney Administration. The prospect for a potential positive change in U.S. policies, expressed especially in an emerging, bipartisan alliance for an alternative economic and foreign policy, in and around the U.S. Senate, is profoundly remoralizing for people in Russia.

At the same time, the conference itself bore witness to the fact, that, despite the difficult situation, important forces in Russia are working optimistically for a brighter future—forces that see Lyndon LaRouche and his movement as friends and allies. LaRouche himself is virtually a household word in Russia; his writings are in great demand, including impatient requests I received, as LaRouche's representative to the conference, for Russian translations of his book *Economics of the Noösphere,* and his more recent *The Earth's Next Fifty Years.*

Remarkable Research

From some 140 papers submitted from all over Russia, 25 were selected by expert review for plenary presentation and discussion over the three days of the conference, and prizes awarded to the three best, as determined by a vote of the scientists themselves. The topics of the three prize-winning papers, already give an impression of the range of subjects touched upon at the conference: "The Speed of Migration of Carbon and the Regeneration of Oil Deposits," "Laser Systems for Optical Communication between Relay Satellites," and "Adaptive Systems for Fire Safety of Human Activities."

Thomas Nilsen/www.barentsinfo.org

"Renewable" Oil: Extensive evidence was presented, in the first-prize paper, of oilfields filling up again, through constant migration of carbon and hydrocarbon compounds from deeper layers in the Earth's crust. Here, an oil rig in Murmansk.

Other papers of interest included novel methods for the large-scale production of hydrogen; new approaches to controlled thermonuclear fusion via "ultra-high-compression"; increases of agricultural productivity through artificial enrichment of rare earth elements to the soil; electromagnetic structures involved in the origin of tornadoes and other severe storms; and anomalies in the motion of the Moon, calling for a revision of present textbook doctrines of gravitation; and many others. Here I shall only briefly describe the three prize-winning papers.

Remarkable was the synthesis between fundamental research, and the development of technologies with the potential to revolutionize broad domains of human activity on this planet.

The first of the mentioned papers, on the regeneration of oil reserves, actually underlines a key point Lyndon LaRouche has been making recently, in his proposal for a "Vernadsky Strategy" for a new type of economic cooperation among the world's nations. LaRouche pointed out, that the magnitude of long-term requirements for mineral resources, posed by the ongoing economic development of the populations of China, India, and other Asian nations, necessitates a new cooperative approach to the management of the world's raw materials.

The required approach must, among other things, go beyond mere prospecting and extraction, to focus on the processes by which mineral resources are created in the Earth in the course of geological history, and how such resources might in the future be *replenished* or *regenerated,* at an increasing rate, through Man's deliberate intervention into the geosphere and biosphere.

Abiotic Oil Generation Abiotically?

One key area for this, needless to say, is that of oil and natural gas. For many years a controversy has raged among specialists, whether the petroleum reserves, now used by Man, originated in biological material (biomass) accumulated over millions of years, or whether petroleum is in some way being *continuously generated* within the Earth, by essentially abiotic processes.

In their prize-winning paper, V.D. Skaryatin and M.G. Makarova of the Vernadsky States Geological Museum, cite extensive evidence to the effect, that oil fields in various areas of Russia and adjacent countries, some abandoned after long periods of exploitation, are gradually *filling up again,* through a constant process of "migration" of carbon and hydrocarbon compounds from deeper layers of the crust. Evidence of the same process of gradual replenishment-—occurring on the scale of mere decades, rather than the millions of years often supposed necessary for biogenic production—is also found in sys-

tematic discrepancies between originally estimated size of deposits, and the significantly larger amounts actually recovered in the course of exploitation.

While quoting Mendeleev's famous admonition, that petroleum's true value is as a chemical feedstock, rather than a fuel, Skaryatin suggested that, once the conditions of continuous generation of oil and gas within the Earth's crust are properly taken into account, in the process of planning and organizing extraction operations, these resources could be made essentially "renewable," and Man need not fear "running out" of them in the foreseeable future.

The potential impact of *human economic activity* on the "spontaneous" generation of oil and natural gas in the Earth's crust, was emphasized in another, most interesting paper, presented to the conference by the well-known Russian geophysicist A.A. Barenbaum, from the Institute for Problems of Oil and Gas of the Russian Academy of Sciences.

Barenbaum proposed, in accordance with the principles of Vladimir Vernadsky, a synthesis of the two "competing" schools of thought on the biogenic versus abiotic generation of oil and gas. According to Barenbaum, the ongoing synthesis of petroleum, in certain regions of the crust, is, in and of itself, an essentially abiotic, thermochemical process. However, the *input* of carbon, hydrogen, and other substances into that process, is largely a function of the *biosphere circulation of carbon and water,* which in turn is driven by living matter—and increasingly, by Man's own activity!

In particular, Barenbaum said, carbon dioxide and other forms of carbon, circulating in the biosphere, are transported by water into inner layers of the crust, where they become "raw materials" for petroleum synthesis. This suggests the possibility that Man, through the increased production of carbon dioxide in the atmosphere as a result of industrial activity, may actually be accelerating the generation of oil and gas within the Earth's crust, within time scales of mere decades, that is, much shorter than normal geological cycles. Barenbaum pointed to some crucial evidence for his thesis, including the discovery of traces of man-made isotopes that do not occur in nature, in deep oil deposits.

Precise Measurement

A completely different example of man's technological innovation was provided by A.V. Bagrov, of the Institute of Astronomy of the Russian Academy of Sciences. He reported a revolutionary new type of satellite-based instrument, capable of measuring angles between astronomical objects with a precision of mere microseconds of arc. That angular error would correspond to the apparent diameter of a basketball on Mars, as observed from the Earth some 50 million kilometers away!

With such a precision, it becomes possible to observe the motions and pathways of motion of neighboring stars in our galaxy, within time frames of mere *hours*—as opposed to years or even decades—to detect planetary systems, and to determine precise distances of various astronomical objects.

At the same time, the new methods could open the door to a revolution in global satellite communication systems, by permitting the use of optical lasers, instead of the microwave frequencies presently used. This would mean increasing the communication density by orders of magnitude beyond anything presently existing. A key barrier to the use of lasers in satellite communications, until now, has been the problem of how to determine the precise positions of orbiting objects and to steer a narrow laser beam from one to the other over thousands of kilometers.

A similar challenge arose, in the 1980s, in efforts to develop laser antiballistic missile defense systems. However, the demands for precision and stability, required for reliable laser-based communications between satellites are in many ways even greater, than for first-generation "Star Wars." Key to the new Russian work, reported at the conference, is the use of multiple interferometry.

The third prize-winning paper was of a very different character, less fundamental in terms of scientific principle, but oriented more directly to the immediate needs of the population. Y.E. Boguslavsky of Rostov University, together with a group of collaborators from several institutions, made an exhaustive analysis of fires in two regions of Russia, focussing particularly on the role of defective household appliances, which constitute a major cause of fires involving loss of life.

On this basis, they proposed a system of "Adaptive Fire Safety" designed to reduce loss of life by as much as *two orders of magnitude.* Among the novel technical features of their proposal are:

(1) The use of a new, "cryothermic, gravitational-acoustic-emission" measurement system, also developed at Rostov University, to provide quantitative data for the evaluation of fire safety of materials used in building construction and household objects. In this method, test samples are subjected to combinations of thermal and pressure stress, and response characteristics are measured by a variety of devices, including especially detectors of low-level acoustical signals generated by crystal dislocations and other processes leading to mechanical failure.

(2) The "intellectualization" of household electrical appliances, converting them from potential sources of fire danger, to fire-alarm systems, able to detect and signal their own malfunction as well as the presence of dangerous gases.

If We Could Land a Man on the Moon. . .

by Marsha Freeman

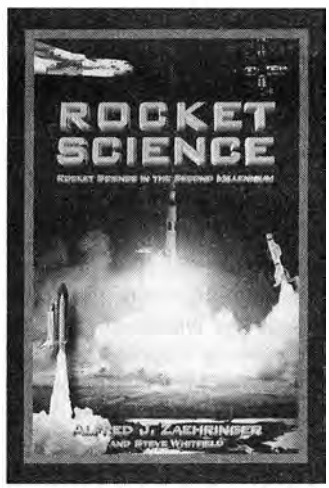
Rocket Science
by Alfred J. Zaehringer (with Steve Whitfield)
Burlington, Ontario: Apogee Books, 2004
Paperback, 216 pp., $20.95

Since the successful Apollo 11 mission of astronauts Neil Armstrong and Buzz Aldrin in July 1969, people tackling difficult (but achievable) challenges are often admonished, "this is not rocket science," or "you don't have to be a rocket scientist," indicating that nothing was as difficult as landing men on the Moon.

In June 1947, Alfred Zaehringer and a handful of colleagues in the Detroit Rocket Society began publishing a journal called *Rocketscience*. By doing so, they introduced a word, and more important, a concept, into the lexicon, which would become sensible only a few years later, when "rocket science" created the age of space exploration.

Zaehringer had his first encounter with rockets during World War II, when he watched German V-1s and V-2s used against London. He had experimented with rocket propulsion as a teenager, tested various propellant materials, and put on demonstrations for his high school chemistry club. At the end of the war, Zaehringer was in the U.S. technical military group to whom the German rocket pioneers, led by Wernher von Braun, surrendered to the U.S.

With an appreciation for the groundbreaking work of the German space pioneers, after the war Zaehringer enlisted the participation of Hermann Oberth, Wernher von Braun, Eugen Saenger, Krafft Ehricke, and other German visionaries in his *Rocketscience* journal, to write and help translate seminal work in this new field. A decade before the first rocket had successfully orbitted the Earth, the journal dealt with the fundamentals of orbital, planetary, and manned space flight, and future technologies, such as nuclear propulsion. During its five-year span of publication, *Rocketscience* was read around the world, by a burgeoning network of



space enthusiasts.

The Detroit Rocket Society, like similar amateur groups in New York and Cleveland, carried out rocket tests, and actual flights, of liquid- and solid-fueled rockets. Alfred Zaehringer contined a career in chemistry and worked on research related to rockets in industry, and in parallel, continued writing and editing. His book, *Soviet Rocket Technology,* was released on April 12, 1961, the same day Yuri Gagarin became the first man to orbit the Earth.

Now into his 80s, Alfred Zaehringer has maintained an active interest in space developments, and in this new book, he takes a retrospective look at how far we have come, and where we have yet to go.

Energy and Economics

The starting point of Alfred Zaehringer's evaluation of various rocket technologies, the which he thoroughly reviews and explains in his book, is the cost of the energy required. He compares the energy cost of various modes of terrestrial transportation to what is available in rocket technology, concluding that until the price per pound of bringing material to space can be reduced, little progress will be made in making flight into space as common as travel on and around the Earth.

Zaehringer reviews the span of technologies that the military and NASA have taken only halfway steps to develop, over the past 50 years. These include ramjet applications, nuclear propulsion technologies, magnetic lift systems, and other novel concepts. But because of the cost of bringing such revolutionary propulsion technologies to fruition, these projects were all abandoned.

"It's clear that the state of the art in space propulsion systems is in direct proportion to the amount of money that has been spent on research and development," Zaehringer observes in his book. "Expenditures to date may seem excessive, but in relation to the overall U.S. Gross Domestic Product, or even just compared to military R&D spending, it has been only a drop in the bucket."

In a radio interview with Dr. David Livingston in "Space Show" on Jan. 4, Alfred Zaehringer proposed that the "next quantum factor is transportation" in ultimately enabling the large-scale exploration of space. Systems should be developed which allow the hypersonic transport, in "90 minutes, of people and cargo across the Earth, including the military and tourists," he stated. Such a program, dubbed the "Orient Express," was initiated by President Ronald Reagan in the early 1980s, but the funding was never provided to conquer the scientific and technical challenges.

The 1990s brought us no closer to the goal, Zaehringer said, noting that former NASA Administrator "Dan Goldin's policy of 'faster, better, cheaper,' seems to have overlooked quality, safety, and integrity." He finds it foolish to outline a program to go back to the Moon and then to Mars, as President Bush has done, without making the budgetary commitment necessary to develop the new transportation capabilities that are prerequisite to get us there.

Mr. Zaehringer is an author with a long and personal history of involvement with the array of technologies he describes in this work. His book is very readable, and as it is geared for the interested layman, you don't have to be a rocket scientist to benefit from and enjoy it.

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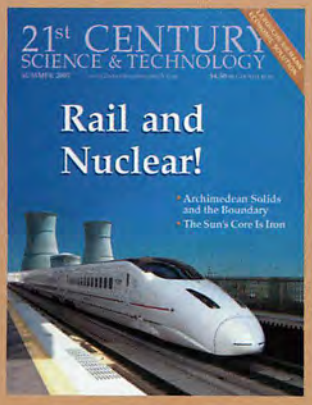

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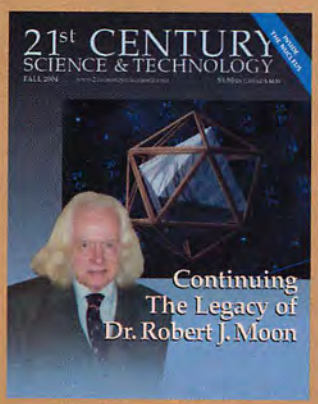

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In This Issue

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LEIBNIZ VS. NEWTON: WHAT'S THE DIFFERENCE?

If you were taught that Leibniz and Newton both discovered the calculus, think again. An English translation of the 1682 Leibniz essay "On the Expression in Rational Numbers of the Exact Relationship of a Circle to Its Circumscribed Square," and an exploration by LaRouche Youth Movement leader Merv Fansler of "What's the Difference," will help you to overcome some miseducation, and discover what discovery really is about.

SCIENCE and the LaRouche Youth Movement

Portrait by Sir James Thornhill

Gottfried Wilhelm Leibniz (left) vs. Isaac Newton (right). Leibniz's approach led to a flowering of the sciences in Europe and the nascent United States, while Newton's led to a stultification of science in England. The battle of their irreconcilable epistemologies continues today.

ASTRONOMY IS OLDER THAN YOU THINK

The Nebra Sky Disk, found near Nebra in the eastern German region of Saxony-Anhalt, is thought to be a "portable" calendar, recording Winter and Spring solstices based on a 1600 B.C. star map. As Dino De Paoli reports, the disk and a nearby observatory dating some 3,000 years earlier, establishes a northern origin of the calendar before Mesopotamia, and implies an origin of astronomical observations at least as early as 30,000 B.C.

Landesmuseum für Vorgeschichte, Halle, Germany

The Nebra disk is bronze with gold inlays. The arcs along the rim, left and right, extend over 82°, marking the sunrise and sunset at each solstice (Summer is top, Winter at bottom).