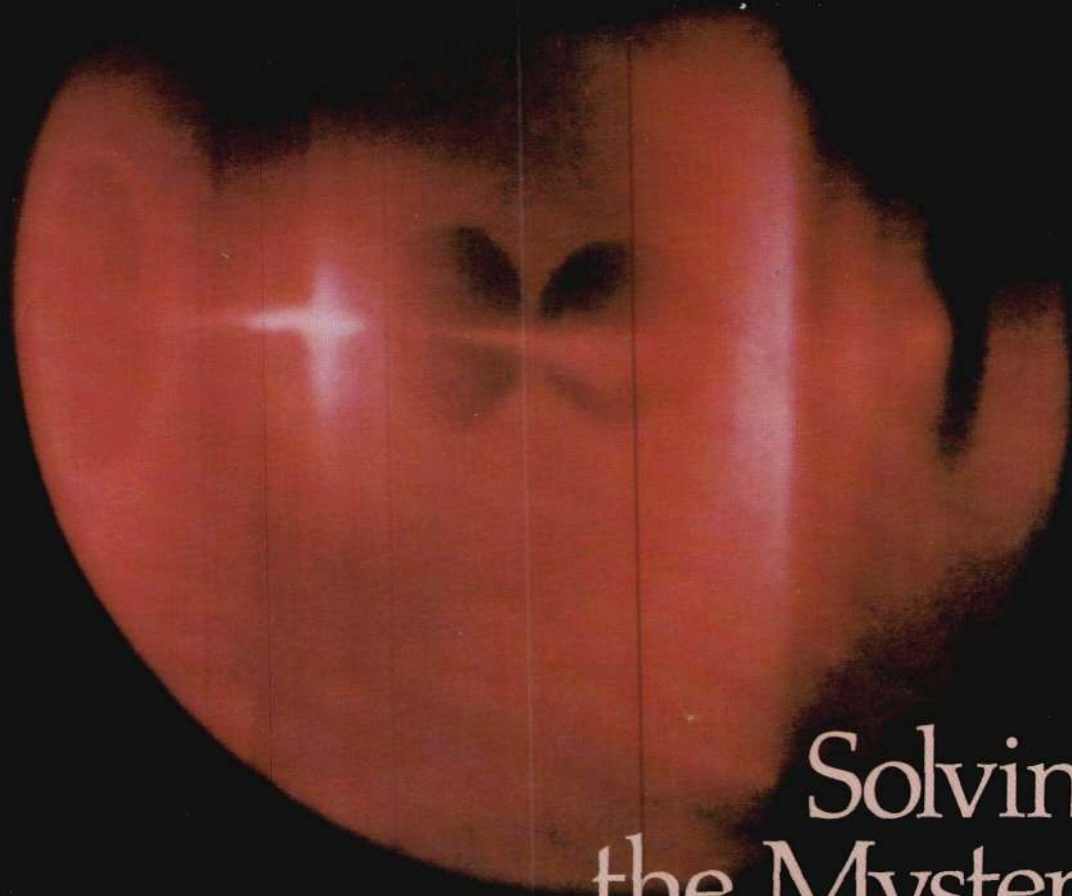


FUSION

MAGAZINE OF THE FUSION ENERGY FOUNDATION

September 1979

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in Canada



Solving
the Mystery
of Electron
Transport



FUSION

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Features

- 30 **Electron Transport in Tokamaks:
A Case Study in Negentropy**
by Dr. Steven Bardwell
- 41 **The Drug Plague:
Who's Fighting It?**
by Ned Rosinsky, M.D.
- 44 **The Biological Effects of Marijuana**
by Gabriel Nahas, M.D.
- 52 **Ending the Delphi Project:
An Open Letter to Readers**
by Dr. Morris Levitt, Editor-in-Chief
- 56 **SAFE: A Delphi Case Study**

News

NATIONAL

- 8 Shutting Down the Economy: The Effect of the IMF Policy
9 10 Years After Apollo 11

SPECIAL REPORT:

Investigating the Harrisburg Hoax

- 10 1. Independent Commission Launches Advertising Campaign
10 2. TMI Valves Remain a Mystery
11 3. NRC Hires Environmentalist to Investigate TMI

INTERNATIONAL

- 12 After Tokyo: Europeans Organize for Development
13 Soviets: Nuclear Development Means Peace
14 Brazil 'Stretches Out' Nuclear Program
14 Brazilian Fusion Scientist Dies

WASHINGTON

- 15 Hirsch Panel Pushing to Double Fusion Budget
16 Congressional Line-up: Militarization and Synthetic Fuels
16 NASA-Japan Space Cooperation Under Discussion

INAPPROPRIATE TECHNOLOGY

- 18 The Gasohol Fraud: More Money, Less Fuel
21 Why Liquid Coal Synthetics Won't Work

FUSION NEWS

- 23 Fusion Theory Center Proposed
24 New Foster Report Under Wraps
26 Advanced Fusion Fuels Look Good
26 Alcator Going Full Speed Ahead
26 Los Alamos Explores Z-Pinch

CONFERENCES

- 27 FEF Africa Conf., Paris, June 27-29:
Ensuring the Industrialization of Africa
29 National Space Institute Conf., June 25-26:
Fighting for a U.S. Space Program

BOOKS

- 61 *The Continuing Crime of Claudius Ptolemy*
by Molly Kronberg

Departments

- 2 EDITORIAL
3 LETTERS
3 CALENDAR
4 THE LIGHTNING ROD
6 NEWS BRIEFS
17 INSIDE DOE
62 BOOKS RECEIVED
63 FEF NEWS

Now Is the Time For Nuclear

The present chaos and confusion in Washington in the wake of President Carter's July 15 energy address to the nation has many political causes, but it also flows directly from the foolish attempt to impose an unwanted and unnecessary energy austerity policy on the nation.

In the short term at least, there is no oil problem and there is no nuclear problem. These are two of the cheapest, safest, most efficient and productive forms of energy for industrial processing and electrical generation. There are adequate oil reserves and nuclear fuel resources to bring a growing world economy smoothly to the point where fusion and plasma-based technologies can be phased in at the turn of the century.

The Fusion Energy Foundation has committed its full scientific and technical resources to a task force commissioned to define the parameters for a massive gearup of U.S. nuclear reactor production capabilities. As a result of discussions with specialists in every area of nuclear technology, the task force has put forward the following goals for the United States:

- Install 1,000 gigawatts of domestic nuclear capacity by the year 2000
- Export 1,500 1,000-megawatt capacity nuclear reactors to the developing sector by the year 2000
- Develop the first stages of fusion and fusion torch technology in addition to the fusion-fission hybrid breeder and the high-temperature fast breeder and gas reactors by the end of the century.

A Qualitative Breakthrough

This program not only is eminently feasible but necessary. It will mean the onset of highly productive uses of nuclear-derived energy in industrial processing, and it will open the way to the tremendous qualitative breakthrough represented by fusion power, fusion-based synthetic fuel production, and plasma-torch resource processing technologies.

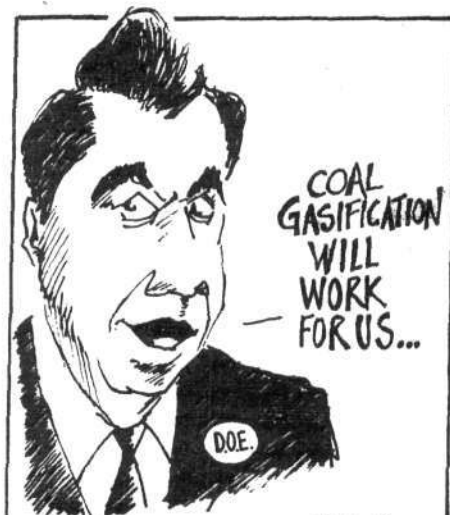
Another task force is now working out a detailed comparison between the economic effects of the Carter policy and the nuclear policy proposed here. That evaluation will be based on the powerful method of analysis in the LaRouche-Riemann computerized economic method described in our July issue. Even before the detailed results are in, however, there is no question about what they will basically tell us: Carter's austerity and fuel synthetics programs and other similar programs—with or without a dash of nuclear—mean continued economic and political chaos in the United States and globally. Carter's is not an "energy war" policy but, quite literally, a war policy.

The policy proposed here, on the other hand, if coupled to a new international monetary system to promote high-technology investment, would mean a great economic boom and peace. The United States would quickly expand its nuclear and related technology exports by tens of billions a year. Most of the Third World would become a vast, growing export market and trading partner as developing nations industrialized on the basis of nuclear-electrical grids.

This is a policy most Americans will completely support, if they are given the opportunity to do so.

The time for compromising with the minority of environmentalists and Malthusians is over. They are the ones destroying the biosphere and the world economy.

Now is the time for full speed ahead with nuclear power!



Letters



To the Editor:

In the May issue of *Fusion* you did a review of the TV series "Nova"'s antifusion documentary. As horrendous a piece of trash that it was, it is interesting to note that in 1974, "Nova" did another program about fusion energy. It was the complete opposite of the one they broadcast this year. It started by giving a history of the efforts up till that time to confine a plasma and heat it to ignition. They used film footage of I.V. Kurchatov's visit to Britain in 1956 to discuss all the Soviet work. They also had a physicist from MIT explain the theory behind a fusion reaction. No scientist interviewed said that fusion was not feasible. French, as well as American and Soviet work was shown. Stellarators, tokamaks, and laser fusion were all explained.

This is a very puzzling thing to me as to why the Ford Foundation would have funded that particular program five years ago and also the abomination that they put on today. The Ford Foundation was a toilet five years ago just as much as it is today.

Bill Graziosi
Philadelphia, Pa.

FIGHTING TO WIN

To the Editor:

I am a graduate of Mississippi State with my B.S. degree in nuclear engineering. Since my graduation, stumbling blocks such as President Carter's veto on an appropriations bill to the Clinch River Breeder Reactor Project and Schlesinger's "go slow nuclear" and "zero-growth" DOE have gotten in my way. Believe me, this is not the "American Way."

As far as I'm concerned, Three Mile Island proved the safety of the nuclear industry and if we could get government out of the energy business, we may still have a chance, with the use of nuclear power, to build a stronger

nation and to provide a future for our next generations.

I'd like to encourage all my fellow nuclear engineers and scientists to write to their senators and congressmen and convince them to push for more nuclear power plant production and to seriously consider abolishing the DOE.

Michael Vincent
Houston, Texas

The Editor Replies

The zero-growth and go-slow nuclear problems that you mention are not inherent in "government" per se. The governments of France, West Germany, and the Soviet Union, for example, are moving full speed ahead with pronuclear and profusion programs. And in this country, as *Fusion* has reported, the nuclear industry does not always act in its own interest.

The solution is political. It requires people like you—which is probably 80 percent of the American population—to probe the reasons and the persons responsible for the decline in America's traditional values of growth and progress and to go after the enemy, no holds barred.

A few of our readers, as the letters below indicate, find politics nasty, dirty, and detrimental to the otherwise pleasant experience of reading the "science" in *Fusion* magazine. The point is that *science is politics*. There is a war on, and the antisience faction is going after the proponents of growth and technology if not with guns then with equally lethal dirty tricks and Delphic operations. This is not a question of "style," but the simple truth of the matter.

The choice readers have is to be "nice" and see everything you stand for go down the drain, or to name the enemy and fight to win—just the way Ben Franklin, Samuel Morse, and other scientific fighters for the American republic did.

To the Editor:

Why confuse the intellectual issue of developing a power source with the emotional/political issue of one man's life and politics (Ted Kennedy).

Continued on page 4

Calendar

August

1-3

1979 Symposium of Thermofluids
Concepcion, Chile

5-8

9th Biennial Conference on
Reactor Operating Experience
Arlington, Va.

5-8

18th National Conference
on Heat Transfer in
Heat-Generating Fluids
San Diego, Calif.

9-10

Power Generating Conference
San Jose, Calif.

19-23

International Meeting on Fast
Reactor Safety Technology
Seattle, Wash.

26-29

Electromagnetic Waves
International URSI Symposium
Munich, W. Germany

27-Sept. 8

Physics of Plasmas Close
to Thermonuclear Conditions
Como, Italy

Readers are invited to submit calendar items. Address correspondence to *Fusion*, 304 West 58 Street, New York, N.Y. 10019.

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American Tradition
of Science
and Progress
with a contribution
to the
Fusion Energy
Foundation



Letters

Continued from page 3

This seems to be in poor taste and will alienate those who may not have decided on the nuclear power issue before they obtain further information on same.

I would recommend that you should not cloud your cause with dirty politics, but present the facts and issues in an intelligent manner.

H. Garrett Hayward
Boston, Mass.

To the Editor:

The Fusion Energy Foundation, through your magazine and the many young people at the airports, is providing a critically needed information service for the American people. . . . I agree with your position that fission nuclear power plants are an interim solution to our energy problems until the fusion nuclear process is developed.

As the Asian and African nations endeavor to industrialize, the world energy requirement will far outstrip fossil fuel availability. The living standard of these people is tied directly to the successful development of fusion electric power generation. This theme must be properly developed to get the support of the black American population. You failed to do this in your June issue.

I suggest you downplay the conspiracy theories and concentrate on the logical and factual presentation of the national and world energy plan from our present state through fission to fusion. . . . You should direct your attention more to the middle American with limited technical education who wants to know how to: (1) Keep on living in suburbia; (2) Drive his car; (3) Provide a better life for his children.

Show him that he does not have to fear fission any more than he should fear electricity or fire. Both were feared by his ancestors in their time. We must and will master fission as we have with all other technological breakthroughs in the past.

Joseph O. Wagner
Bayville, N.J.

To the Editor:

The *Fusion* articles in the June issue were so definitive that your editorials created an enormous confusion in my mind; i.e., I found Tim Pike's DDT article eminently logical and well-researched. Why put it into the limbo of nonacceptance (by me) by editorially "explaining" to me that you are as fanatic in your cause as your opponents are in theirs—and, therefore, we . . . can never ever find the truth. I enjoyed the book. I look forward to the next issue, but please don't destroy your credibility with bigotry.

Socrates once said something to the effect that if Man is privy to all the facets of a situation he will always choose the good because by his nature Man is basically good and he

follows his nature. Have faith in your readers! I found the TV publicity on Three Mile to be reporting of the most sensational sort, but you do not enhance my cause—which is to denounce such publicity—by your paucity of language. . . .

Robert J. Guerriero
Salem, Mass.

To the Editor:

. . . With so many scientific researches going on, each group and its supporters expect their projects to receive the largest share of the pie. This being true, these groups must supply the facts as correctly and succinctly as possible.

This brings me to the point which

The Lightning Rod



My dear friends,

I enclose the remainder of a psychologist's report on Secretary of Energy James Rodney Schlesinger, which recently came into my possession.

Schlesinger's adult career constitutes, in Freud's words, "a museum of symptoms," many traceable to the psychic disturbances of childhood and youth.

Entering the federal government as a budget trimmer at the Office of Management and Budget, Schlesinger apparently spent six months plowing through estimated expenditures looking for the Silver Cord, which he told associates he was determined to cut.

This oedipal fixation was partially overcome only after Rodney was introduced to his future wife, a 5'10" neo-Malthusian model weighing less than 85 lbs. She swept him off his feet,

but later left him to resume her career at *Vogue* and star in the film "Dracula Was a Woman."

In his next post as chairman of the Atomic Energy Commission, Schlesinger invented his famous "limited war" doctrine, perfected when he called in tactical barrages of environmental regulations against his own troops, while negotiating simultaneously with Ralph Nader. During this period, Schlesinger developed a serious case of atomic stockpiles, writing obsessively that U.S. warheads would become "defecative" if not constantly tested, and babbling a good deal about "nuclear waste" and "clean weapons."

has been bothering me about your magazine. With so much excellent information to be exposed in your periodical I am somewhat at a loss when I read so much of your own political propaganda. In my mind, this type of literary verbosity is 75 percent bullshit and does nothing but damage to the fusion energy endeavor. It turns me and my fellow engineers off.

I suggest that your periodical get back to showing the worth of fusion research with factual expositions and plain understandable pieces to inform the reader. To quote an ancient saying, "A man who walks in truth needs no weapons to defend himself."

Zbigniew Lawrance Pianka
Milwaukee, Wis.

His interest in military matters made Schlesinger Secretary of Defense under Presidents Nixon and Ford, and turned his attention to the Navy. He became preoccupied with securing open sea lanes, and called for the formation of a Mobil strike force to remove blockages in the Alimentary Canal, which he seemed to regard as an Arab waterway.

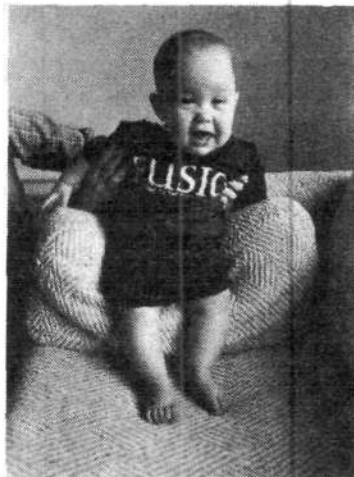
From here it was only a short step to total fulfillment as President Carter's energy czar. Reportedly Schlesinger's latest enthusiasm is a bill creating a new government agency to color all synthetic fuels green, like margarine during World War II, so they can be distinguished from the real thing.

To this useful summary of the problem I can add only that even Schlesinger's close friendship with Jimmy Carter may not allow him to escape "presidential firepower"—so little do our citizens appreciate the results of play therapy in public office.

Yr. obt. svt.,

Benjamin Franklin

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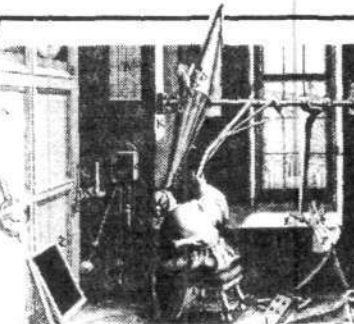
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Speer was convicted at Nuremberg in 1947 of crimes against humanity. Above, Speer and Hitler in Paris, 1940.

News Briefs

ALBERT SPEER APPLAUDS CARTER SYNTHETIC FUEL PROGRAM

The *Washington Post* reported July 22 that the Carter synthetic fuel program was "applauded" by Albert Speer, Hitler's war production chief. Under a Bonn, West Germany dateline, the *Post* quoted an enthusiastic interview by Speer whom it called "the war production chief who kept Nazi Germany's industry running despite shortages and day and night bombings by the allies."

According to the *Post*, Speer said, "It is not utopian to believe that Carter's plan to develop a new industry to produce the equivalent of 2.5 million barrels of oil daily in synthetic fuels can be carried out." In August 1936, after Hitler ordered the German economy to be ready for war within four years, "synthetic gasoline production was the biggest and most important project," Speer said.

FUSION BUDGET CUT UP IN THE AIR

The fusion budget for fiscal year 1980 was sent to a joint House-Senate committee in mid-July with several million dollars cut from the Applied Plasma Physics division. It will be up to the conference committee to determine how much if anything is to be cut. The House and Senate each passed the fusion budget with different amounts cut from this program. According to staffers from the House Science and Technology committee, which initially recommended the cuts, committee members had expected that the full House would either restore the budget cut or vote up a supplement to the total budget.

The burden of the cut falls almost entirely on university graduate training programs for fusion scientists, a fact which the FEF has stressed in its discussions with congressional staffers to restore the cuts.

LATIN AMERICA BACKS MEXICAN CALL FOR ENERGY DIALOGUE

The Latin American Organization on Energy, OLADE, voted support to Mexico's President Jose Lopez Portillo's call for a "universal dialogue" on energy that would bring together the advanced capitalist sector, the Third World, the oil producer countries, and the socialist sector. The OLADE decision was incorporated in a document called the "Resolution of San Jose," named for the Costa Rican capital where the ministerial-level meeting took place in mid-July.

The Mexican representative at the meeting, Industry Minister Jose Andres de Oteyza, explained that when President Lopez Portillo presents his energy proposal at the United Nations General Assembly Sept. 27, he will be representing not only Mexico's position on energy, but the entire "Latin American bloc's position."

SAFE—FROM SKYLAB'S HIGH TECHNOLOGY?

Skylab fell to earth July 11 amid incredible press hysteria about the potential danger, despite the known fact that the National Aeronautics and Space Administration was controlling the satellite's reentry through on-board equipment. While the media interviewed people on the street with such questions as "Where will you be when Skylab falls?" the orbiting scientific research lab fell over sparsely populated Australia, hurting no one.

Launched May 14, 1973, Skylab provided the nation with priceless knowledge about human adaptability to low-gravity conditions, weather patterns, solar flares, vacuum processing of materials, hydrodynamics, meteorology of the earth, and so on. Skylab's work was cut short by budget cuts in the Space Shuttle Program, which is now being converted to a defense-oriented program. The shuttle would have boosted Skylab to a higher orbit.

The Soviets, whose offers to save Skylab had been turned down by the



The New York Post: Continuing the hysteria against science and technology.

Carter administration, are proceeding with their orbiting space lab, Salyut 6. As of July 31, two Soviet cosmonauts had spent a record 155 days living in weightless conditions aboard Salyut 6.

JERRY BROWN JOINS ABALONES AGAINST DIABLO

After an hour-long session with Abalone Alliance leaders, California Governor Jerry Brown was permitted by the environmentalist group to give a five-minute speech to their June 30 antinuclear rally at St. Luis Obispo airfield. According to the July 2 San Luis Obispo County *Telegram Tribune*, Brown told the crowd of 30,000 people: "I've just decided to join your effort to deny a license to the Diablo Canyon nuclear power plant. I personally intend to pursue every avenue of appeal if the Nuclear Regulatory Commission ignores the will of this community."

Brown, who said the rally symbolized "the triumph of people over power" and "a growing force to protect the earth," concluded by chanting, "No on Diablo." Questioned by reporters, Brown admitted that he had no idea what to do with the \$1.6 billion Diablo plant constructed six miles northwest of Port San Luis, should it fail to get its operating license.

SOUR GRAPES FROM THE BRITISH EMPIRE

Blaming their U.S. "cousins" for causing the oil shortage, the London *Guardian* openly criticized the American Revolution in a July 4 editorial: "By proclaiming themselves independent, the Americans set a fashion which they must now regret. Had they not given the signal for the dissolution of the British Empire, most of the major oil-producing regions of the world would today be under British control."

Admitting that George III was "in some ways a deficient monarch," the *Guardian* then pointed out that "today Americans observe Independence Day when they have never been so dependent in their lives."

SCHMIDT ATTACKS 'ENVIRONMENTALIST IDIOTS'

"We don't need the opinions of environmentalist idiots on the energy issue. . . . If the energy crisis is not solved through the development of nuclear energy, then what will happen in Europe will make the Sahel look good," declared West German Chancellor Helmut Schmidt at a mid-June cabinet meeting.

Schmidt's strong stand reflects the growing realization of his party, the Social Democrats, and its coalition partner, the Free Democrats, that environmentalism must be openly attacked as an enemy of progress. At the June 15 convention of the Free Democratic Party in Bremen, West German Foreign Minister Hans-Dietrich Genscher received a five to one margin in support of nuclear energy when he told the convention that, "Besides nuclear energy, there is no alternative to coal, gas or oil."

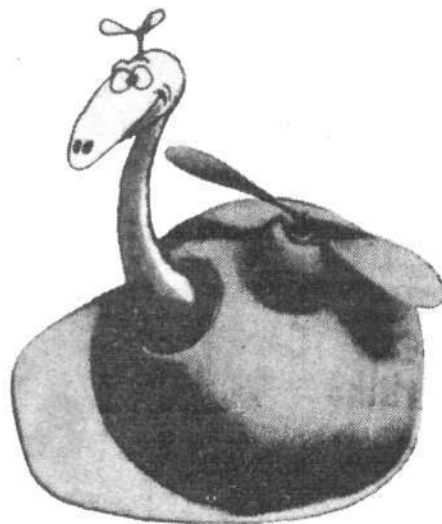
LOUSEWORT LAURELS TO ANONYMOUS ENVIRONMENTALIST

The lousewort laurels award this month goes to the anonymous environmentalist who invented the solar beanie. According to a reader who informed us that he read about the beanie in a *New York Times* article on alternative energy, the beanie has absolutely no function. It is a propeller device atop a hardhat that spins if you wear it in the sun. Supposedly it proves that solar power works.

Fusion would be pleased to learn the identity of the inventor so that the lousewort award could be made more personal.



Brown: Toeing the Abalone line.



The Effect of IMF Policy:

Shutting Down the Economy

The policy that the United States delegation brought to the seven-nation economic summit meeting in Tokyo at the end of June—high energy prices and consumption cutbacks—would send the world economy through the floor, according to the quantitative evaluation of the computerized Riemmanian economic model, announced this month by the *Executive Intelligence Review*.

The results of the model, shown in the accompanying figures, illustrate what would happen to the advanced sector if oil prices increased by 48 percent. Results for the less developed countries are even more drastic.

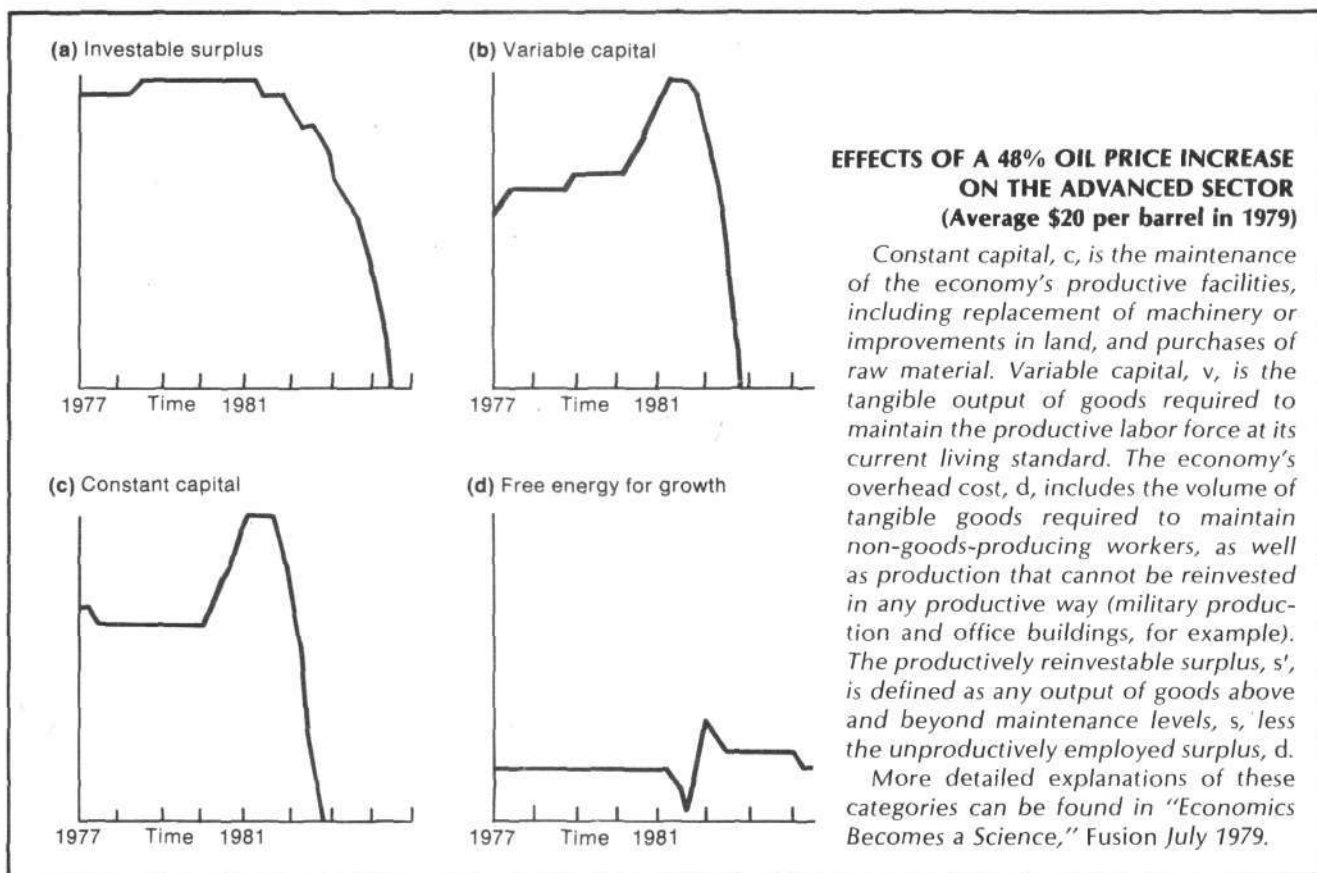
The model, described in detail in the July issue of *Fusion*, is unique in

that it distinguishes between the productive and nonproductive uses to which the tangible output of an economy is put, discarding the standard GNP method of valuation of economic activity. It was developed by political economist Lyndon H. LaRouche, Jr., the chairman of the U.S. Labor Party, and centers on the application of Bernhard Riemann's mathematical discoveries to the "American System" economics of Alexander Hamilton, Henry Carey, and Friedrich List.

Executive Intelligence Review economics editor David Goldman, who is coordinating the computer study on the impact of energy prices on the world economy, announced July 3:

"The indisputable conclusion, based on our computer study, is that the International Monetary Fund policies backed by the United States at the Tokyo summit will produce an international breakdown crisis, including a reduction of the population of the developing sector on the scale of Cambodia, by the early 1980s. Simultaneously, the advanced sector will cease to function as an economic entity in the sense we know it."

The IMF scenario on which the computer study is based is summarized as follows: Oil prices reach a new plateau; the means of recycling the additional oil earnings of the producing countries back to deficit countries will not be available as in 1974-



75; those developing countries that have chosen capital-intensive development on the basis of borrowing to import Western industrial goods will be effectively prevented from doing so through the centralization of spare world credit resources in the International Monetary Fund.

This IMF scenario was bought hook, line, and sinker by the Carter administration, which has worked to raise the price of oil well beyond any OPEC maneuvers in order to justify austerity. In fact, a June 28 memorandum to President Carter by White House advisor Stuart Eizenstat lays out a plan to "scapegoat" OPEC and "mobilize the nation around a real crisis and with a clear enemy."

What the Model Measured

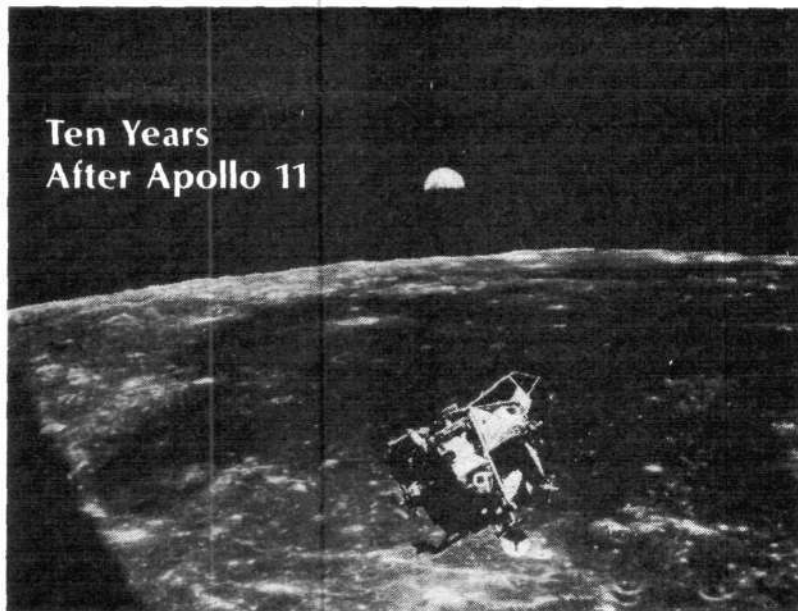
The computer model measured (1) the production of surplus in the studied sector; (2) the production of means of consumption for the productive population; (3) the production of capital goods and raw materials; and (4) the rate of surplus production—surplus divided by categories (2 + 3).

As the figures here illustrate for the advanced sector, there is a reduction of these categories during 1980, followed by an exponential rate of decline. The intervals between the initial reduction and the exponential decline vary, ranging from one year in the case of the countries least able to sustain the scenario, to three years in the case of the economy with the highest productivity, Japan.

Goldman stressed that the results are not an "econometric projection" in the sense that the Wharton School or Data Resources economists would offer. "The IMF-World Bank scenario may or may not occur," Goldman said. "We will present similar, hypothetical quantifications of opposing 'scenarios' in the future—notably LaRouche's proposal that the newly created supply of petrodollars be recycled into development lending of the type proposed for the European Monetary System."

For more information on the Riemannian economic model, contact the Executive Intelligence Review in New York City.

Ten Years After Apollo 11



On July 20, 1969, man stepped on a celestial body other than the earth for the first time in history. The successful landing and return of Neil Armstrong and Edwin Aldrin in the Apollo 11 mission culminated an eight-year program started by President Kennedy, which included five manned Apollo flights and three flights to the moon. For most Americans Apollo symbolized what this country could do, given a national effort.

During the decade of research, development, and preparation for that trip 10 years ago, the National Aeronautics and Space Administration built a scientific, engineering, and advanced technology infrastructure unparalleled in U.S. history. Not only did NASA meet the planned goal ahead of schedule; it also created thousands of scientists, tens of thousands of engineers, and entire new industries that have provided the pool of experience and expertise needed today to bring us into the fusion age.

Since that day when millions of the world's people watched the landing and marveled at man's ability to conquer a new frontier, the U.S. space effort has declined—as has the national will to tackle large-scale exploration and scientific development. The space program has been under near-constant attack since the mid-1960s. Scientists, administrators, and industrial participants—as well as the American public—have been told that the money spent on going to the moon was a waste compared with the task of solving problems on earth.

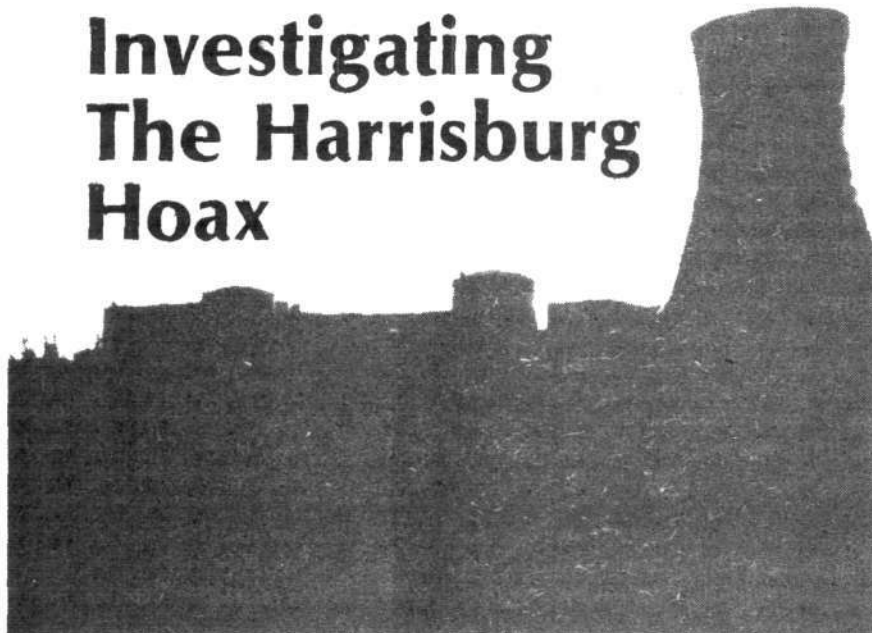
Today, the very belief that man defines his relationship to the rest of the universe has eroded to the point where a minority dictates to the nation the view that scientific research and applications to new technology and modes of production will not be able to ensure our future existence here on the earth—much less set our sights to explore our universe.

We need an Apollo mission today, a mission comparable in money, manpower, and resources to Apollo, to develop the new frontiers of science and to harness commercial fusion energy.

The scientific capability, the network of laboratories, the extraordinary managerial and administrative skills of NASA are needed to meet the urgent missions of the rest of this century. A \$50 billion research and development program in advanced technologies, nuclear energy, and fusion science should be the national mission of NASA for the next decade.

Special Report

Investigating The Harrisburg Hoax



2

TMI Valves Remain A Mystery

The two closed auxiliary (emergency) feedwater block valves, initially identified as the key to possible sabotage at Three Mile Island by Fusion Energy Foundation investigators, have been named in official hearings as the big "unknown" in the Three Mile Island nuclear plant accident.

Four operators at the TMI nuclear plant have given sworn statements that they left the pump valves open at the plant after testing them two days before the March 28 accident. In testimony May 29 before the Harrisburg hearings of the presidential commission investigating TMI, shift

1

Independent Commission Launches Advertising Campaign

The Independent Commission of Inquiry into the Three Mile Island Incident, a group initiated by the Fusion Energy Foundation in April, launched a pronuclear educational advertising campaign June 27. The commission's first full-page advertisement was run in the Harrisburg *Patriot News* June 27, a paper with a central Pennsylvania circulation of 117,000.

Evidence of Sabotage

The first advertisement questioned why the official investigating bodies are not investigating possible sabotage at Three Mile Island and presented a summary of the evidence that points to sabotage as the most likely cause of the incident.

The ad reports the specific suspicious circumstances prior to and during the incident at Three Mile Island, as well as the role of the media, the environmentalists, and the Nuclear Regulatory Commission. As the ad

states, the most substantial evidence of sabotage is the fact that auxiliary (emergency) feedwater flow valves had been manually shut off prior to the incident, and that the incident itself, which was caused by a loss of main feedwater flow, was also triggered manually.

This same ad appeared in two other newspapers as well: July 3 in the Collegeville (Pa.) *Independent* and July 13 in the *New Mexico Independent*. The latter paper, published in Albuquerque, reaches the scientific communities of the Los Alamos and Sandia National Laboratories.

Pronuclear Education

As a result of the commission's fundraising efforts, several individuals in various parts of the country have pledged to raise the money to run this ad and others in their local media.

The commission released a fundraising letter June 30 on behalf of all

11 members. In it the commission states that it is committed to saving the U.S. nuclear industry and the U.S. economy and, therefore, is launching a fight to educate the public and turn around the antiprogress environment here. Subsequent advertisements will cover the facts on such subjects as nuclear energy and the economy, nuclear power safety and the environment, who are the antinukes and who funds them, and the oil hoax and its relation to the antinuclear attack, just to mention a few.

Through this education campaign, the commission intends to clarify these issues and activate the support of the 70 to 80 percent of the U.S. population that is already committed to the American system of economic growth.

Readers who wish more information about the pronuclear educational campaign should contact the Fusion Energy Foundation, which is administering the commission. Checks or money orders should be made out to the Fusion Energy Foundation, earmarked for the commission, and sent to the Independent Commission of Inquiry, Box 1443, Radio City Station, New York, N.Y. 10019.

foreman Carl Guthrie said: "I opened the valves myself, and three of us went into the control room and checked the lights that said they were open. I then verified it and signed off on a written checklist that the valves were opened."

Guthrie added, "I have no idea" who closed the valves.

The fact that the valves were closed prevented emergency cooling water from getting to the reactor and led to more serious consequences than might have resulted if the valves had been open. The plant's manufacturer, Babcock and Wilcox, is on record as stating that the incident could have been avoided if the valves were open, and similar incidents at many other plants have shown that this is the case.

Given the testimony—as well as the consequences of TMI—the obvious questions would seem to be: How did the valves get closed, who closed

them, when, and why? One would expect that any competent investigation would approach these questions with at least two possibilities in mind: first, did someone do it on purpose to create the incident; second, could it have happened somehow by accident.

Presidential Coverup?

The presidential commission investigating TMI plans no such line of inquiry. Dr. Morris Levitt, executive director of the Fusion Energy Foundation and a member of the Independent Commission of Inquiry, learned in a meeting with representatives of the president's investigating commission June 26, which included the commission's chief counsel, that the president's group did not consider the valve question important.

The commission staff conceded that there is no explanation for why the two valves on the independent back-

up water cooling lines were closed at the critical point when they were needed to provide water after the main cooling line was cut off by questionable maintenance procedures. However, the president's commission is preparing to argue that the incident would have happened even if the valves had been open.

When Levitt asked the staff what effect they thought the highly suspicious valve closing had, they replied that it was "not a first order effect." It might have contributed to the confusion in the first fateful minutes of the accident since the control room operators did not know that the valves were closed, they said. But this would be a case of "incidental sabotage." To give another kind of example of this pseudolegalism: it is arson only if someone sets fire to a building, not if the building happens to burn down after the water supply is shut off.

3

NRC Hires Environmentalist To Investigate TMI

The Nuclear Regulatory Commission has hired a leading environmentalist lawyer to head the NRC's Independent Investigation of the Three Mile Island nuclear incident—Mitchell Rogovin of the Washington law firm Rogovin, Stern and Huge.

When questioned as to why the NRC would pay \$450,000 to have a known antinuclear lawyer conduct their investigation, staff members of the NRC called Rogovin a "hot potato," claiming they weren't responsible for Rogovin's appointment and had not even known of it beforehand. One member of the NRC staff said, "My God, we didn't know this about Rogovin but we didn't appoint him. The five commissioners met and appointed him."

The NRC commissioners' office then denied this, saying, "No, the five commissioners didn't appoint him. His name was given to us by Leonard

Bickwit, the general counsel for the NRC."

As for the nuclear industry's reaction: A representative of the Atomic Industrial Forum denied that the AIF had been quoted correctly in the June 18 *Washington Post*, which said the AIF would support Rogovin because "he doesn't seem to have an axe to grind." Later, however, the AIF spokesman retracted this denial, saying that "everyone here at the AIF seems to be very happy with Rogovin's appointment. We haven't heard any complaints from the nuclear industry about him."

Who is Mitchell Rogovin and why is his appointment such a disaster?

Rogovin is currently a member of the New York Council on Foreign Relations, whose on-record policy is the "controlled disintegration of the global economy."

Rogovin is a fellow and general

counsel to the Institute for Policy Studies, which is involved in the funding, training, and deploying of environmentalist and terrorist groups. Rogovin's law firm controls major activities of the Institute for Policy Studies. Among other legal activities, his firm is handling the "water case" in California, attempting to deny federal water supplies to people who own farms of more than 160 acres.

Rogovin has been vice-chairman of the Center for Law & Social Policy, which controls the network of radical lawyers used to defend terrorists. The center is avowedly antinuclear and has filed three suits to prevent the export of nuclear fuel to India, as part of its overall policy of keeping the U.S. nuclear industry from exporting technology to the developing world.

Rogovin has also been general counsel to Common Cause.

The Independent Commission of Inquiry will be releasing a report on its investigations, including the valve question, within the next few weeks. Earlier reports of the Independent Commission and the FEF can be found in the May, June, and July issues of *Fusion*.



After Tokyo:

Europeans Organize For Development

Although the seven-nation economic summit June 28-29 in Tokyo saw the Europeans capitulate to the Anglo-American pressure and endorse both a policy of oil import curbs for the advanced sector and World Bank austerity for the Third World, postsummit European organizing has been in the opposite direction. In fact, the postsummit spate of diplomacy and public statements indicates that France, West Germany, and Italy view the summit as a failure.

At the summit, participants agreed that "the most urgent tasks are to reduce oil consumption and to hasten the development of other energy sources," and they worked out a full program for curtailing oil consumption. The participating nations acknowledged that "without the expansion of nuclear power generating capacity in the coming decades, economic growth and higher employment will be hard to achieve," but the statement lacked the strong terms with which the Europeans had addressed the nuclear question before the summit.

Perhaps the most devastating was

the European commitment at the summit to the "appropriate technology" antidevelopment alternative for the Third World. As part 8 of the summit's final communiqué reads: "We will do more to help developing countries increase the use of renewable energy; we welcome the World Bank's coordination of these efforts."

Oil for Technology

Since the summit, it has been clear that continental Europe is following the policies set forth not at Tokyo but at the premeeting of European Economic Community heads of state at Strasbourg June 22. The four proposals adopted at the Strasbourg meeting include intervention on the Rotterdam oil spot market to curb the speculative maneuvers of the British and American oil multinationals, the development of nuclear energy, setting up a consumer-producer dialogue with the oil-producing nations, and—last on the list—temporary energy conservation.

The key to the postsummit diplomacy is the European movement toward a dialogue with OPEC to promote peace in the Mideast and the

sharp criticism of the U.S. anti-OPEC policy.

France, which maintains the most privileged political and economic ties with the Arab world, has been most active in the diplomacy to secure a producer-consumer dialogue and a development-based peace for the Mideast. For example, France has negotiated an oil-for-nuclear-technology deal with Iraq that includes Iraqi agreement to increase its supply of oil to meet one-third of France's oil needs, up from the current 18 percent.

Mideast Peace

At the center of the Franco-Iraqi agreements was the question of Mideast peace. Iraqi Prime Minister Saddam Hussein proposed the creation of an "international fund" between oil producers and industrialized consumers to subsidize Third World energy needs. And the joint communiqué published July 10, states "The implementation of the new world economic order, which should be based on entente, requires the resolution of the oil question.

The theme of the Franco-Iraqi communiqué was echoed by France's ambassador to Mexico Jean René Gernard in a statement to the press. "It is necessary to avoid a confrontation between oil producers and consumers," Gernard said. He called for the realization of a new world economic order, and he emphasized the development of nuclear power.

A similar call was made July 7 by Carlo Sarchi, the international director of Italy's state energy consortium, ENI, before the Italo-Arab Friendship Association in Rome: "Nuclear energy is a key and unstoppable factor of development. . . . We have to intensify (oil) consumer-producer relations to create a new world economic order."

Sarchi, who had just returned from a visit to Moscow, called for the creation of "international development banks" to finance "specific development projects" in the Third World based on European and Arab banks and funds, implying not just the bypassing of the International Monetary Fund and the World Bank, but the creation of new institutions.

Soviets: Nuclear Development Means Peace

High-level Soviet government and scientific representatives have made it clear in the last few weeks that the development of nuclear power is the key to world peace and that they intend to aggressively pursue a policy of nuclear technology export and fusion development—with or without Western input.

Energy cooperation between East and West has been the theme of recent diplomatic meetings in Moscow with the French, West Germans, and the Italians, with several specific deals in the works for joint nuclear development throughout Europe and into the Third World.

On his way to the Tokyo economic summit, West German Chancellor Helmut Schmidt met with Soviet leaders and released a press statement saying the Soviets were interested in participating in an international conference on energy supply. Schmidt reported that "the problem poses itself to the Soviet Union basically the same as it does to us. Coal is important, but without nuclear energy a solution is impossible." In that light, Schmidt stated that he was considering a proposal to export German nuclear power plants to the Soviet Union in exchange for raw materials.

Other joint nuclear development projects are under discussion with Italy and France. In response to the openness from the Western European heads of state, Soviet Prime Minister Kosygin renewed President Brezhnev's 1977 call for a Europe-wide conference on energy, transport, and the environment.

A Europe-wide Electric Grid

At the conference of the 24-nation Union of Electricity Producers and Distributors, Unipede, in Warsaw June 11-15, members agreed upon a Europe-wide electric grid, a program originally proposed by Petr Neporozhnyi, Soviet minister for power and electrification. The plan calls for the construction of a 750-kilovolt electricity transmission line to link the Soviet Union to West Germany, through Poland and West Berlin. This would make it possible to shift loads

across a wide geographical area, taking advantage of the varying peak usage periods in different time zones.

The second stage of the project would be a transmission line from the East bloc to Finland, Sweden, and Norway. Details of the package will be worked out at the United Nations Economic Commission for Europe in Geneva.

Both the Unipede meeting and the conference of Comecon heads of state held in Moscow the last week in June also discussed a program to implement an international division of labor in producing nuclear reactors.

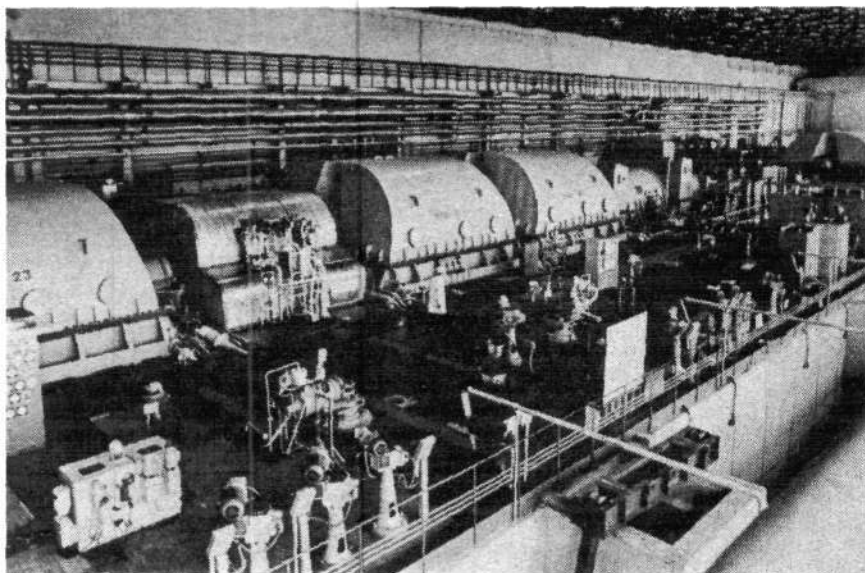
Comecon is planning to integrate non-Soviet members of the trade bloc into the production of assembly-line reactors at the Atomash facility in the southern Soviet Union. Atomash, which will produce its first reactor in 1980, will mass produce reactor vessel and turbine systems. Czechoslovakia announced that it will contribute piping and other auxiliary equipment for the reactors, many of which are planned for export.

The international consequences of not going nuclear worldwide has been a second theme in the Soviet nuclear campaign. In an extraordinary interview published in the *Washing-*

ton Star July 4, Academician A.P. Aleksandrov, the president of the Soviet Academy of Sciences and director of the I.V. Kurchatov Institute for Atomic Energy, warned that resistance to the development of nuclear power as an energy source "poses more danger for mankind than the original splitting of the atom."

The world has perhaps 50 years of oil and gas deposits, Aleksandrov said. "We must therefore build nuclear power reactors in all parts of the world, otherwise wars will one day be fought over the remnants of oil and gas deposits. And they will be wars, however peculiar this may sound, between the capitalist countries, because the Soviet Union will have concentrated on the production of nuclear power and be ahead of everybody else."

This same theme was stressed by Soviet Minister Neporozhnyi in a recent tour of the United States on the occasion of signing a three-year extension of the U.S.-Soviet energy cooperation agreements. Neporozhnyi expressed shock at the state of U.S. energy, particularly the antinuclear situation. In California he told reporters that by the end of this century the Soviet Union will produce at least 30



Novosti Photo

Without nuclear power development, war. Above, the turbine room of the Leningrad Atomic Power Station.

percent of its power from nuclear energy and that "soft" energy options are not being taken seriously.

Asked what the role of solar energy would play in the future of the Soviet Union, Neporozhniy replied, "It will be nothing."

Fusion: The Nuclear Future

For the past two years, rumors have persisted that the Soviet fusion effort was in financial trouble and that scientists were having as much of a problem getting adequate funding there as they are in the United States. In a private meeting with the Fusion Energy Foundation June 29 in New York City, Academician E.P. Velikhov, a leader in the Soviet fusion effort and vice president of the Soviet Academy of Sciences, assured the FEF that the Soviets are actively pursuing all creative approaches to fusion.

The tokamak, which the Soviets developed in the 1950s, may not ultimately be the most economical pure fusion system, Velikhov said, so the Soviets are also directing significant effort into nontokamak designs. Tokamaks will be very important for fission-fusion hybrid systems, he said, but Soviet scientists are taking a serious look at electron beam and fast liner fusion experiments.

Velikhov emphasized the scientific and strategic importance of international cooperation in fusion research: "This cooperation should take place in the most advanced scientific fields. The importance of the proposal I made last year for building an international engineering tokamak experiment is not just for fusion. It is for all of mankind."

Velikhov's remarks were echoed in an article by Aleksandrov, "Toward an Experimental Thermonuclear Plant," that appeared in *L'Humanité*, the daily newspaper of the French Communist Party.

"Within 10 years an experimental plant will be built.... We can envisage for the coming century the construction of great plants for industrial use." As for the question of the international fusion effort Aleksandrov said, "These problems interest the whole of humanity and it would be absurd to do it in isolation."

—Marsha Freeman

Brazil 'Stretches' Nuclear Program

"We'll soon have to get used to living under a war economy," Brazilian President J. B. Figueiredo admonished his nation July 4. Figueiredo went on to decree a "recycling" of the Brazilian economy with conservation and biomass substituting for imported petroleum and a postponement of "large-scale generation of nuclear power" until the next century.

Government spokesmen explained that Brazil would not break its model nuclear agreement with Kraftwerke Union of West Germany, which provides for eight power stations and a plant for enrichment and reprocessing of fuel. Rather the agreement will be "stretched out" and focused on "the absorption of technology" instead of energy production.

Brazil is now planning to end the century with nine nuclear plants, producing only 11,000 megawatts, compared with the 100,000 nuclear megawatts predicted two years ago by the head of Brazil's nuclear industry, Paulo Nogueira Batista. Nogueira conceded June 22 that the main ob-

jective of the nuclear effort would now become the mining, processing, and exporting of Brazil's estimated 142,000 tons of uranium ore, which is expected to bring in \$14 billion on today's market.

Brazil's new war economy will give top priority to energy conservation, finding more oil in Brazil, the \$5 billion expansion of alcohol fuel production, and dam-building. President Figueiredo acknowledged that cane-sugar alcohol, Brazil's high ash-content coal, charcoal, and solar energy are more expensive than the oil they replace.

The productivity of "biomass conversion" of sugar cane to alcohol is so low that it requires five manual workers employed (at \$3 per day wages) for each of the 70,000 barrels per day of oil that Brazil is currently replacing with alcohol fuel. Even Antonio Ermirio de Moraes, a leading proponent of abandoning what he calls Brazil's "economically unviable" nuclear development in favor of home-grown fuels, recently complained that to replace the fuel oil used in just one of his 1,000-ton per day cement plants by charcoal would require burning 238,000 acres of eucalyptus forests each year.

Brazilian Fusion Scientist Dies

Dr. Sergio Porto, Brazil's foremost fusion scientist, died June 21 while attending a conference on coherent and nonlinear optics in Novosibirsk, Siberia. A laser physicist, Porto was passionately devoted to training Brazilian scientists and engineers to become contributors to worldwide scientific progress. He was 53 years old.

Porto pursued a successful career in the United States working on lasers at Bell Laboratory, working for NASA on the Apollo 12 moon shot, and heading the laser group at the University of Southern California. After he returned to Brazil to work, he convinced many other Brazilian scientists who had emigrated to the United States to return so that he and they could train new generations of scientists in Brazil in the world's most advanced technologies.

"The by-products of the nuclear deal [with West Germany] will be giant steps toward the creation of Brazil's own technology," Porto said.

At the time of his death, Porto was the director of manpower training for the National Scientific and Research Council. He was actively promoting the use of laser technology in Brazilian medical practice and just beginning groundbreaking research on the use of chemically specific laser beams to isolate deuterium isotopes from seawater, a process that would make deuterium fusion fuel easier to obtain.

Hirsch Panel Pushing To Double Fusion Budget

A panel of science and industry fusion experts led by Dr. Robert Hirsch of Exxon Research and Engineering Company heard testimony from congressional members of the House Science and Technology Committee and the leadership of the Department of Energy fusion program, July 10 in Washington, D.C. Informed sources report that in closed deliberations the following day, the panel considered recommending a significant increase in the fiscal year 1980 appropriations for fusion energy and a 50 to 100 percent increase in fiscal year 1981.

The advisory panel on fusion energy was convened by Rep. Mike McCormack (D-Wash), the chairman of the Energy Research and Production subcommittee of the House Science and Technology committee, which oversees the magnetic fusion authorization.

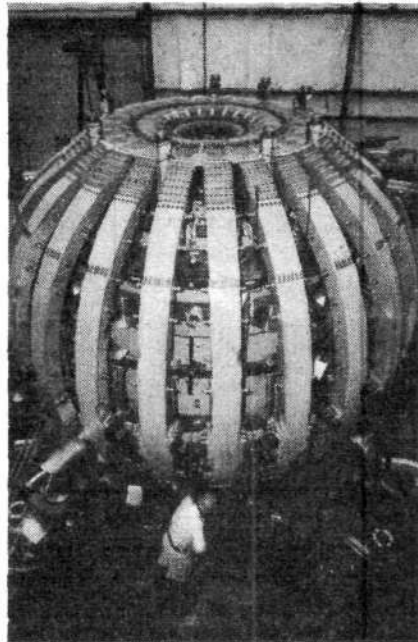
In announcing the formation of the panel June 26, McCormack noted: "Nuclear fusion has the greatest potential of any advanced energy technology. It offers a literally inexhaustible and practical energy source—all the energy that mankind can use for all time. Our goal is to have the first commercial demonstration fusion plant on line by the year 2000."

"To accomplish this," McCormack continued, "we must move forward with an aggressive R & D program now. The advisory panel will provide the committee and the Congress with the kind of forward thinking scientific guidance and management expertise required to make the best possible decisions on the \$500 million fusion program, and to make the goal of practical fusion power a reality."

Robert Hirsch, McCormack's choice to head up the panel, is the

"Our goal is to have the first commercial demonstration fusion plant on line by the year 2000."

— Rep. Mike McCormack



The Doublet III tokamak.

former director of the controlled thermonuclear research divisions of both the Atomic Energy Commission and the Energy Research and Development Agency, the DOE's predecessor.

According to Washington observers, the report from the Hirsch panel will give Congress the ammunition it needs to proceed with a demonstration power reactor before the end of the century. Current DOE policy would wait until 1986 to begin to

build an Engineering Test Facility, the step before a demonstration reactor in the DOE timetable.

DOE: 'Go Slow'

No one present at the hearings, either from the private sector or government, took seriously the DOE's current timetable for "fusion by 2050." Although acting Undersecretary John Deutch boycotted the hearings, he is the one who developed the "2050" fusion policy and has been pushing it within the DOE. Dr. Edwin Kintner and Dr. Greg Canavan, heads of the department's magnetic and inertial fusion programs respectively, outlined the current DOE perspective for fusion.

Both panel members and congressmen (including some not on the committee) voiced concern about the pace of the DOE program, saying that between \$100 to \$150 million should be immediately added to next year's budget. To meet the goals set by McCormack and the committee, there would have to be a doubling of the effort by 1981.

Although the full committee did not sponsor the event, committee chairman Don Fuqua (D-Fla) attended the meeting, as did more than a dozen members of the congressional committee as well as several other congressmen concerned about the fusion program.

Ranking minority committee member John Wydler (R-NY) stated straightforwardly that no fusion effort would be successful without an aggressive nuclear fission program. There should be no thought that the demise of the nuclear option in the United States will help the fusion program, Wydler warned, referring to the political fallout on Capitol Hill after the Three Mile Island incident.

Other members of the Hirsch panel include Dr. Kenneth Fowler of Lawrence Livermore Laboratory, Dr. Harold Furth of the Princeton Plasma Physics Laboratory, Dr. Alvin Trivelpiece of Science Applications, Inc., Robert Smith, chairman of the board of Public Service Electric and Gas, and Dr. Tihoro Ohkawa from the fusion division of the General Atomic Company.

—Marsha Freeman

Congressional Line-up:

Militarization and Synthetic Fuels

The Moorehead Amendment to the Defense Production Act of 1950, passed by the House in early July, would make all phases of energy production and distribution subject to emergency military control by the administration. In addition, House Bill 3930 puts forward a \$20 billion-plus coal-based energy program that mimics the energy plan of Hitler. The Moorehead plan is based exclusively on producing synthetic fuels from coal, oil shale, and tar sands.

The Moorehead Amendment gives the president and the National Security Council authority to bypass all constitutionally mandated institutions and manage emergencies through the appointed staff of the newly created Federal Emergency Management Agency, FEMA. As of July 1, FEMA assumed total control over all the federal agencies that deal with disaster and crisis management.

Although the government's own studies show synthetic fuel programs

to be costly, inefficient, and labor intensive, Congress has rushed to put together several synthetic fuel bills as well as youth labor legislation and minimum wage exemption legislation that would provide the low-paid labor required to make the projects approach feasibility.

Among the synfuel bills pending are the following:

- Senators Don Riegle (D-Mich) and Jacob Javits (R-NY) introduced the Senate complement of the Moorehead Amendment June 28 which guarantees the government purchase of 500,000 barrels a day of synthetic fuel by 1984. The legislation includes provisions for loan guarantees to the industry and carries a price tag of \$3 billion.

- Sen. Pete Dominici (R-NM) has introduced a bill to create a \$75 billion energy development corporation for the development of synthetic fuels from coal, oil shale, and tar sands.

- Sen. Henry Jackson, (D-Wash) has

a bill to provide \$3 billion for speeding up existing projects and establishing new pilot projects for the development of primarily synthetic fuels.

- Rep. Carl Perkins (D-Ky) has introduced HR 4514 establishing \$200 billion in loans granting purchasing authority and bonding authority for the creation of a synthetic fuels industry.

Perkins has also authored amendments to CETA legislation that would create low-skilled, labor-intensive jobs through the establishment of a synthetic fuel corporation. When questioned on how unemployed youth concentrated in the cities could work in rural regions where synfuel plants would supposedly be located, an aide to Perkins commented: "We've moved workers around before, in the 1930s."

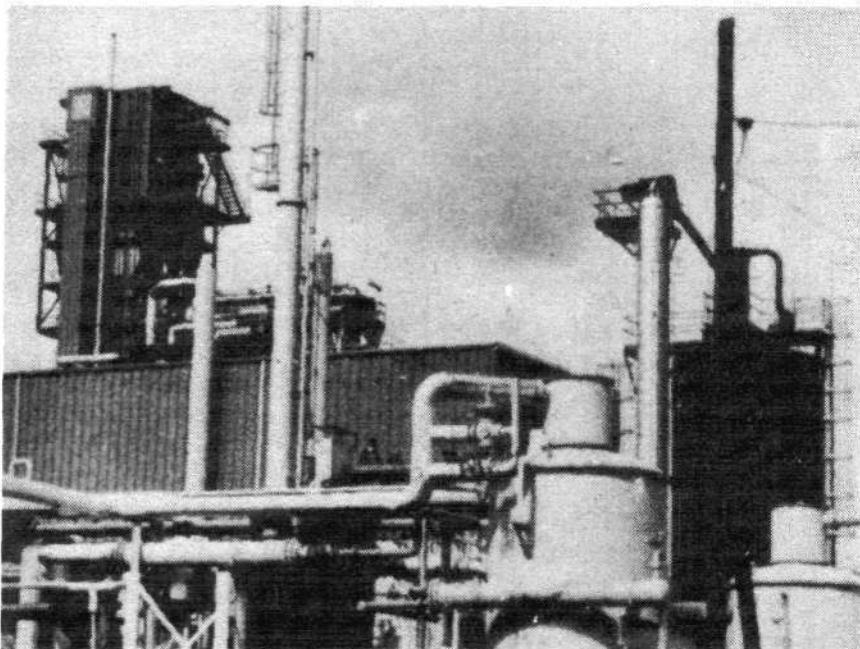
An analysis of the synthetic fuel program appears in this issue's Inappropriate Technology section.

NASA-Japan Space Cooperation Under Discussion

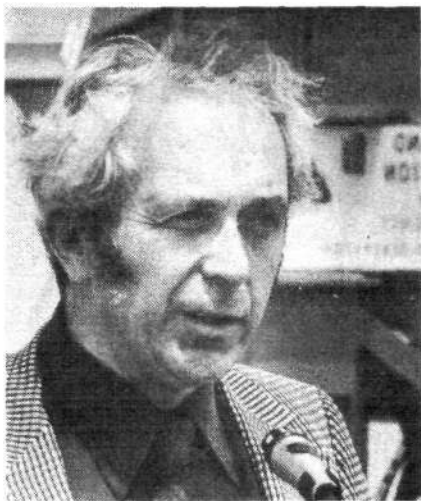
The joint NASA/Space Activities Commission of Japan Study Group has completed its work and submitted a final report to Dr. Robert Frosch, NASA administrator, and to Dr. Tsuyoshi Amishima, acting chairman of the Space Activities Commission. The joint study group was established last year to assess areas and methods of possible additional cooperation in space projects.

The preliminary report indicates that Japanese cooperation would help buoy longer-term future efforts—such as the Saturn orbiter fuel probe mission, which is in the early planning stage and not an approved mission at this time.

The list of recommended project areas for joint work include a study of ocean dynamics, a study of marine resources, potential evaporation studies, X-ray astronomy, a program on the origin of plasmas in earth's neighborhood, collaborative solar studies, and Spacelab life sciences studies.



This synthane pilot plant for coal gasification near the Pittsburgh Energy Research Center has been in operation since July 1976.



Dr. William Jackson

Jackson Leaves DOE

Dr. William D. Jackson, the former head of the U.S. magnetohydrodynamics program, resigned from the DOE June 29. Jackson was the last of a group of scientists who had led a high-technology R & D program for the government under the Energy Research and Development Administration to be forced out by Energy Secretary Schlesinger.

Jackson came into the MHD program in 1974 and developed an ambitious and highly successful effort. One of his major accomplishments was a cooperative program with the Soviet MHD scientists. To date it is the only U.S.-Soviet cooperative program that has included not only the exchange of personnel and data but the exchange of hardware (the Argonne magnet, for example).

Jackson developed working relationships with Academicians Velikhov and Sheindlin of the Soviet MHD program, and he pulled together a coordinated, coherent program from a number of competing individual experiments scattered around the country. This work was principally what kept the MHD program on course for three years.

A few months after the formation of the DOE, Schlesinger removed

Jackson from the leadership of the MHD program. Subsequently, he was shifted from one job to another in the Office of Energy Research under John Deutch.

After Jackson's involuntary departure from the MHD program, John Deutch initiated one of his characteristic "reviews" of the program and concluded that the MHD effort lacked strong management and direction. This program review, which has not been released, recommended that there be no increases in funding in the program because of its management problems. *Fusion* magazine has requested the release of the report under the Freedom of Information Act.

Before joining the government program, Jackson was the principal research scientist at Avco-Everett's MHD laboratory in Massachusetts, a visiting professor at the Technical University in Berlin, and an associate professor of electrical engineering at MIT. He has published more than 80 papers on MHD and related topics and has done work in biomedical engineering.

MHD Director Resigns

Dr. Richard Shanklin, who has headed the DOE's MHD program for the past 18 months, resigned to return to industry in early June.

Sources close to the MHD program report that the person being considered for the job of director is Tom Dooley, project manager for the DOE Component Development and Integration Facility in Butte, Montana.

The Butte MHD facility has added engineering and testing experience to the MHD effort, but has lengthened the time scale for commercial MHD technology, in much the same way that the DOE's insistence on an Engineering Test Facility in the fusion program before a demonstration reactor can be planned has added steps to the timetable for commercial fusion.

Deutch Confirmation On Hold

What was expected to be a perfunctory Senate Energy Committee hearing June 26 instead put the confirmation of John Deutch as undersecretary of the Department of Energy on hold. The hold prevents the confirmation from being voted on by the full Senate.

The committee hearing turned into a tug of war between pro-Malthusian enthusiasts led by Senator Scoop Jackson (D-Wash) and the protechnology faction of Senator John Melcher (D-Mont), according to inside reports. When Deutch responded to a question from Melcher on the DOE's sagging magnetohydrodynamics program by insisting that it could not productively absorb any more than the approximate \$72 million already in the DOE request for fiscal year 1980, Melcher clamped the hold on Deutch's confirmation.

Until the senator, a long-time supporter of the MHD program, removes the hold, the confirmation remains on ice. It is unlikely that a one-senator holdout will be able to stall the confirmation process indefinitely.

Deutch, who actively downplayed the Princeton PLT tokamak breakthrough last August, is closely associated with Schlesinger policies.



Deutch: On ice

Inappropriate Technologies

More Money, Less Fuel:

The Gasohol Fraud

Gasohol, a gasoline additive produced from grain, is a fraud. Its introduction on any significant scale would absolutely reduce the fuel-energy supply and the energy efficiency of American transportation, tending to make the current fuel-energy hoax into a real and worsening shortage. Furthermore, a gasohol production program would cause a gross reduction in the productivity of American agriculture.

The simple fact is that gasohol production uses up three times as much fuel energy and fuel-energy products as its consumption can provide and at a greater dollar-cost than the fuel it replaces (see box). Only a liar could call gasohol a conservation measure.

The more sinister feature of the gasohol program lies in its potential to disembowel the productive capability of American agriculture, with corresponding, far-reaching ecological results. Indeed, the environmentalists and their supporters in Con-

gress not only recognize this effect of gasohol production; they applaud its role in returning the United States to the more primitive days of the small family farm and its stoop labor.

The distillation of alcohol as a gasoline additive would require significant diversion of the output of American croplands away from the food cycle. As the U.S. Department of Agriculture reported in *Farm Index* June 1978, "... if grain alcohol is to replace 10 percent of the gasoline used for fuel, 40 percent of the total harvest must be diverted to ethanol production."¹

From the standpoint of the biosphere, plant vegetation as an element of the food cycle represents a far more intensive and highly ordered energy flow than the same "biomass" constitutes when treated as fuel energy. The disruption of this critical energy flow is comparable to the far-reaching impact of deforestation (for wood fuel and charcoal) on climatic,

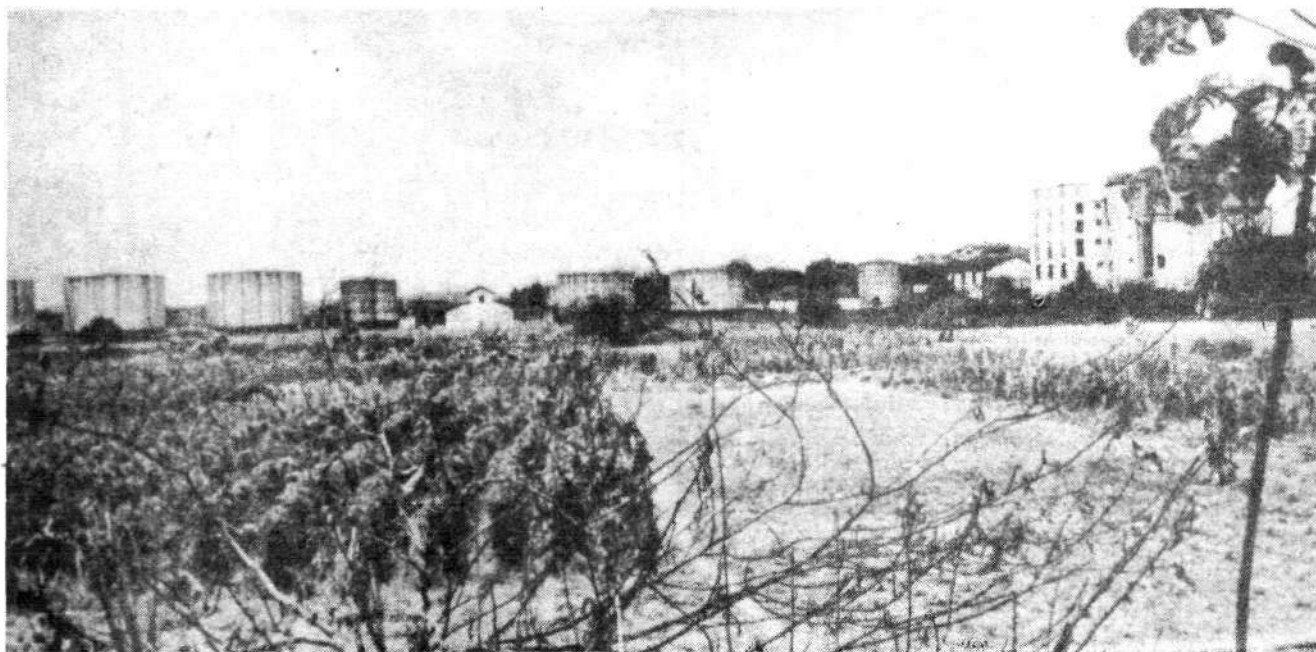
geological, and biological processes. As a reduction of energy throughput in the biosphere, gasohol, like any program that reduces food production, is a massive threat to the environment.

Put another way: The use of gasohol and other biomass-derived fuels is antinegotropic in two ways. First, their low efficiency reduces the productivity of human energy use. Second, such fuels take biological material out of the context in which it is negentropic and use it like a mere physical material where it has no such negentropic properties.²

The Federal Program

Gasohol is being sold at about 800 stations in the midwestern corn belt, and its influential proponents—including Senator Jacob Javits and Senator Charles Percy as well as several Carter administration officials—would like to universalize its use. In an April speech in Des Moines, President Carter committed himself to extending federal subsidies and tax breaks for gasohol producers.

Already, the federal government has exempted gasohol from the 4 cent Highway Fund Tax until 1984. (Hence, 40 cents per gallon of alcohol is being cut out of highway tax revenues.) In addition, 10 states, mostly in the Mid-



Ruining agriculture and the economy: A gasohol plant in Brazil.

west, have granted gasohol exemption from state taxes or tax rebates.

In Kansas, the subsidy through exemption is equivalent to 85 cents per gallon; in Nebraska, 50 cents per gallon. Moreover, the Carter administration is seeking to make the federal highway tax exemption permanent and is already providing for a 20 percent investment tax credit on ethyl alcohol stills, while it considers other inducements to "raise demand."

The Carter administration plans for 500 to 600 million gallons of ethanol to be produced annually by 1985. Current gasoline production is roughly 110 billion gallons. Even this small percentage of gasohol substitution, under current subsidy arrangements, could cost the taxpayers \$600 million a year.

However, the evidence shows that existing subsidies will be nowhere near enough to make gasohol competitive. Peter J. Reilly of Iowa State University concluded in his "Economics and Energy Requirements of Ethanol Production": "It is obvious . . . that no single factor could possibly make gasohol competitive without tax subsidy, and it is very difficult to envision any group of factors doing so. If anything, it appears that the gap between gasohol and gasoline will widen or stay constant in the future."

Cloud Cray of Midwest Solvents Corp., a highly efficient ethanol producer, told a seminar on gasohol in Brazil that just to break even his company's production facilities would have to be subsidized at 66 to 80 cents per gallon of ethanol mixed with gasoline—double the fuel value of the ethanol. He also delivered congressional testimony reporting that taxpayer subsidy of ethanol production for gasohol would have to equal \$3.12 per bushel of corn used, much more than the farmer is paid.

"We think it is absolutely ridiculous that any government would subsidize an industry to the extent of twice its value for any appreciable period of time," Cray said.

Yet that appears to be exactly what the Carter administration and other "gasoholics" have in mind.

Senator Birch Bayh (D-Ind.) exhorted the Senate last summer: "It is

GASOHOL ENERGY EFFICIENCY			
Energy Inputs	Energy Quality*	Energy/min. BTU	
		Corn	Sugar Cane
Agricultural production	High	2.1	1.8
Simple sugars	Medium	2.2	1.7
Fermentation and distillation	Low	6.4	5.1
Stillage drying	Low	1.2	1.2
Total		11.2	9.8
Energy outputs			
Ethanol	High	4.1	5.6

*"High" indicates liquid fuel of a quality required for internal combustion.

"Medium" and "Low" indicate heats at or below the boiling point of water.

Gasohol yields only one-third to one-half the energy it takes to make it.

my fervent hope that we can learn something from the Brazilian government's efforts in this area. . . . Alcohol fuels work in Brazil, and they will work in the United States, if given a chance."

Senator Jacob Javits argues that alcoholic fuel made from fermenting a wide variety of food crops and agricultural and urban wastes is the ideal way of reducing American dependency on the Arab-OPEC oil suppliers, while at the same time putting our own land and people to work.

The Brazilian Myth

But Cray of Midwest Solvents has refuted both Bayh and Javits. "We say you are not reducing imports from abroad with this . . . gasohol program. The only way you can . . . is like Brazil does, bring your biomass to market in horse carts and burn it, or cut your forests down and bring them in, or use some other source of energy to convert this grain or agricultural source [into alcohol]."

The truth is that alcohol fuels do not "work in Brazil."

The Brazilian system employs a half-million laborers cutting sugar cane by hand at wages of \$3 per day to produce a mere 70,000 barrels of alcohol per day.

Even worse, Brazil's gasohol program has so diverted croplands and labor resources from food production that the nation—the world's second greatest agricultural exporter—is running into severe food shortages, high inflation for food prices, and the need to import more than \$1 billion in foodstuffs that could be cheaply produced at home.

As Cray pointed out, the only way one can successfully produce alcohol from crops with a greater fuel value than the fossil fuels consumed is at the price of using cheap human hand labor and animal traction in every phase of the production process, from crops, to transport, to collection of crop residues, to fermentation and distillation.

In short, gasohol appears "efficient" only in a technologically backward nation that plans to stay that

way, or in a nation that is being deindustrialized and made backward.

For example, Midwest Solvents Co. is the most energy-efficient grain alcohol producer in the country. It still has to use 139,000 BTUs of natural gas or no. 6 fuel oil to ferment and distill a mere 85,000 BTUs of alcohol. This ratio does not include consideration of the energy involved in producing and transporting the sweet sorghum, corn, and wheat required. "Estimated conservatively," says Cray, "it takes 2.72 times the energy to produce one gallon of alcohol, if you consider all these other inputs to the process."

Even gasohol advocates like William Scheller of Nebraska, accused by the Department of Agriculture of fudging experimental data in favor of the program, and Edward Lipinski of Battelle Laboratories in Ohio acknowledge a 2:1 or 3:1 ratio between the total energy input and ethanol output (see table).

In fact, the energy efficiency ratio taken from the standpoint of the economy as a whole, and not simply the ethanol production process itself, turns out even worse.

Seeking ways to eliminate fossil fuels from the distilling process, gasoholics have pointed to sugar cane, as

in Brazil. By drying out water-laden fibers (bagasse) and then burning it to provide heat—not an easy task—you can theoretically cut down use of liquid fuels to the point of expending only 3.3 million BTUs liquid fuel to obtain 5.6 million BTUs alcohol. However, the United States has only 1.7 million acres of land suitable for sugar cane, capable of meeting only 1 percent of overall fuel needs if all were employed for this purpose.

As a result, the gasohol program now focuses on the burning of corn stalks and wheat straw, the latter currently plowed under in the great mid-west grain belt as a necessary source of soil nutrients. The energy-efficiency result? Dr. Leonard Schruben of Kansas State University, in an article titled "The Gasohol Bubble," calculated it would take 50 percent more straw than all the straw in Kansas to replace coal in a single Kansas electrical plant. Furthermore, Schruben said: "If stalks or straw, etc. are removed from the field, additional fertilizers would be needed to replace the plant nutrients lost. Fertilizer is energy costly. And costs of controlling erosion would increase if residue and organic matter were not returned to fields."

The logic behind the gasohol program keeps coming back to the same point. Just as the program can succeed only as American industry becomes more backward, gasohol production can proceed only by effecting a major reduction in the productivity of American farmers. Gasoholics confirm that this is their objective.

Gasohol Versus Agriculture

Scott Sklar, a former Javits aide who now works at the National Center for Appropriate Technology, laments that U.S. agriculture is so efficient "It only employs 3 percent of the people but consumes 25 percent of the energy." His organization's aim, he admitted, is to use the gasohol program as part of a plan to induce farmers to abandon high-technology energy-intensive methods, which have doubled productivity in one generation, in favor of returning to the primitive approach of the Maoist peasant.

Sklar says that thanks to the gasoline hoax, he now draws 500 to 1,000 farmers a night to his midwestern gasohol "teaching sessions." Sklar sees gasohol leading back toward the self-sufficient—and inefficient—family farm. "If we can decentralize energy and fertilizer dependency, it may save the small farmer." Doesn't this mean much more primitive and labor-intensive farming? "Sure," says Sklar, "but farmers see the gain. President Carter's \$11 million program for small technology stills—that'll fire it up."

Moreover, says Sklar, gasohol production could even provide "food" if it's done right. Following a World Bank prescription on this matter, Sklar's Center for Appropriate Technologies recommends turning the dried distillery wastes, the residue of distillation processes, into edible material.

Soylent Green, anyone?

—Mark Sonnenblick

Gasohol Production: The Facts

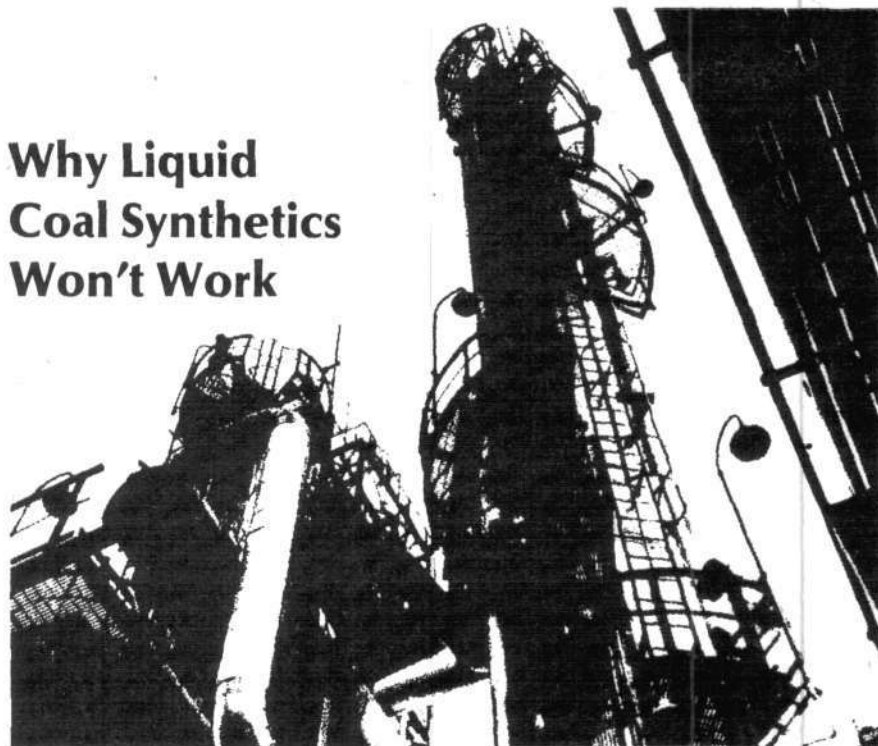
Here are the basic facts concerning gasohol as fuel-energy:

- (1) The production of a gallon of ethanol alcohol costs three to four times more in dollars and cents than the volume of gasoline it replaces, requiring that the government subsidize its production to the tune of at least 66 to 88 cents per gallon. This in turn means higher taxes.
- (2) A gallon of alcohol costs from 2.5 to 2.8 times more fuel energy to produce than the energy value of the alcohol. The net result of gasohol production would be a growing waste of natural gas and crude oil required for production—not the conservation gasohol advocates acclaim.
- (3) The net effect of these cost factors means the cost of producing ethanol, now higher than other energy fuels, must not only go still higher in the future, but increase at a more rapid rate than other energy fuels.
- (4) Gasohol is "fuel efficient" only in a technologically backward nation like Brazil, providing more liquid fuel energy than its production consumes because its production employs only the energy of hand laborers, donkeys, push-carts, and so on. The program could grow in the U.S. only through the demechanization of agriculture and distillation processes, a stated objective of "gasoholics."

Notes

1. Despite this research, the USDA reported this month that Agriculture Secretary Bergland is going ahead with a gasohol, biomass, and woodchip program for American farmers. Bergland told Congress a year ago, "The area which promises by far the largest contribution toward achieving net energy self-sufficiency for agriculture and forestry by 1990 is fuels from biomass."
2. This analysis is developed in a forthcoming book by Lyndon H. LaRouche, Jr., *How to Defeat the Liberals and William F. Buckley*, to be published by University Editions.

Why Liquid Coal Synthetics Won't Work



Although Congress and President Carter have only recently gotten caught up in the coal synthetics fever, Energy Secretary James Schlesinger has been funding research on Nazi coal synthetics for the past two years to get the United States ready. At Texas A & M University's Documents Retrieval Center a group of scientific researchers have been reading, translating, and summarizing documents on Nazi Germany's coal synthetics programs. Their results are being fed into a computer in Tennessee for use by the Department of Energy in implementing its own programs.

The plain fact is that the kind of coal synthetics programs now being proposed will cost more and produce less fuel than conventional methods (see table). And as I shall show, coal synthetics will turn the U.S. economy into a war economy—like Nazi Germany.

The development of a liquid fuel from coal, a fuel that could be processed and used instead of petroleum, was the work of a group of Nazi doctors—the Nobel laureates and Ph.D.'s in chemistry who supervised the concentration camps and work camps built by I.G. Farben, the British-financed chemical conglomerate.

Actually, Auschwitz and other "camps" were "factory towns," built to provide liquid aviation fuel and motor fuel for the German military campaigns. Hundreds of thousands of men and women were worked to death building the plants and mining the coal. This labor-intensive policy was necessary, according to Nazi logic, to prevent the hyperinflationary blow-out of the German economy that would have resulted if the government had paid actual wages on top of the outrageously expensive cost of the synthetic fuel.

For the Nazis, the synthetic fuels policy was a war policy. The Nazis never expected to run an "economy" on synthetic fuels. They simply needed an assured supply of fuel to get them to the point of taking oil from Romania and the Soviet Baku oil fields.

The effects of the proposed multi-billion dollar taxpayer-funded coal synthetics programs put forward by the president and Congress and supported by the United Mine Workers would destroy the U.S. economy. Synthetic liquid fuels, selling for double the current market price of oil, or about \$40 per barrel-of-oil-equivalent, would immediately make a sig-

nificant cut in the standard of living of every American, simply by making gasoline, home heating oil, and petroleum-based products luxuries.

More important, the increased cost of industrial transportation and processing, both dependent upon liquid fuels, would soak up every penny of potential capital investment from basic U.S. industry, committing the industrial infrastructure to the 20th century scrapheap.

The quadrupling of oil prices in 1973-74 has given us double-digit inflation, zero real economic growth, and near double-digit unemployment. Most important, however, is that industry's real reinvestable surplus, essential to expand the economy and improve productivity, dropped by 50 percent.

The effect of a synthetic fuel program ensures that there will be a drastic drop in available surplus—to the point that there will be no capital available to invest in new industry or in the development of advanced technologies such as fusion. Ironically, it is advanced forms of nuclear technology—the high-temperature gas-cooled reactor and the fusion-fission hybrid, for example—that will enable the United States to develop an advanced synthetic fuels program. The only cost-effective synthetic fuel method will be to use the process heat from advanced nuclear reactors on a variety of feedstocks to produce hydrogen and hydrogen-combination fuels.

What Are Synthetic Fuels

Coal is a fairly energy-dense but dirty-burning fuel. Compared to petroleum or natural gas, it contains many impurities that are identified as "pollutants" after going through a combustion process. In order to turn solid coal into a liquid fuel, the major task is to at least double the ratio of hydrogen to carbon in the coal.

In the first quarter of this century German chemists Fischer and Tropsch developed a two-step method of turning coal first into a gas and then into a liquid. Operating under relatively low pressure and temperature, this two-stage process lost significant amounts of energy in each step of the conversion process. Nevertheless, the

Fischer-Tropsch method is still used today in South African production of Sasol liquid fuel.

During the same period, other German chemists, Fritz Haber and Carl Bosch, were working on creating fixed nitrogen for fertilizer production. Using high pressure and high temperature, they experimented with various catalysts. By 1923, this team developed a process similar to the earlier fixed-nitrogen ammonia synthesis process to produce synthetic methanol (wood alcohol) by hydrogenation.

In essence, ammonia synthesis was the combination of hydrogen with nitrogen; methanol synthesis was the hydrogenation of carbon monoxide gas from coal.

By 1927, already preparing Germany for the next war, I.G. Farben announced that if Germany did not have colonies to loot for raw materials, it must have chemicals. The task became the conversion of plentiful coal to manufacture explosives, quinine for war in tropical climates, and, most important, liquid fuels.

Carl Bosch, codeveloper of the direct hydrogenation process, was by then a director of I.G. Farben.

The Haber-Bosch process eliminated the gasification step in the Fischer-Tropsch method by using a "brute force" method to combine the hydrogen in steam with the carbon in the coal. Powdered coal suspended in oil is pumped under a pressure of 10,000 pounds per square inch into a converter, in the presence of hydrogen and an iron-based catalyst. After about an hour, baked at a temperature of about 900 degrees Fahrenheit, a liquid is produced that can then be refined and upgraded to produce methanol, propane, butane, gasoline, and what the Nazis called "iso-octane," or aviation fuel.

Huge Cost

By 1931, Farben's Leuna plant achieved the goal of a 100,000-ton annual production but at a cost of 40 to 50 pfennigs per liter—more than twice the cost of imported fuel. (At that time, the price of American export gasoline was about 17 pfennigs per liter.) Farben's huge investment cost to produce the synthetics had to be protected by a huge government subsidy. The government slapped a 16-pfennig import duty on oil, and by late 1933 the government agreed to guarantee a sales price on oil equal

to the cost price of the synthetics. This is exactly the same proposal the U.S. government has made today.

The Alternative

When coal is burned directly and taken through the conventional steam turbine cycle, approximately 35 percent of the energy in the coal is converted to usable electric power. If the coal is first hydrogenated to produce a liquid fuel, between one-third and one-half of the coal's energy content is lost in the conversion process. Therefore, it takes twice as much coal to produce the fuel to go into the combustion process as it takes to produce the same output of electrical energy.

Any proposal to replace imported oil used to generate electric power with coal synthetics, therefore, at minimum will *double* the cost of delivered electricity. On the other hand, more advanced technology such as coal-based magnetohydrodynamics, which bypasses the steam-turbine cycle and converts a plasma directly into electricity, can actually cut in half the cost of delivered electric power.

This is accomplished by improving the efficiency of the conversion process, eliminating moving parts (turbines, generators and so forth), and by making use of the next generation of plasma technologies.

Less than 20 percent of U.S. oil consumption is used to make electricity today. If nuclear power replaced oil-generated electric capacity, and if coal MHD were on line in the 1990s, more than enough electric power would be produced without using any oil. That 20 percent of current consumption would then be available for transport, petrochemical feedstocks, and industrial processing.

In addition, there is no doubt that there are adequate reserves of petroleum, which can be exploited at a cost-effective price even at today's level of technology, to take us into the next century at an increasing growth rate. Beyond that, synthetic fuels that use the fusion torch and other high-temperature plasma processes will easily and cheaply be able to develop a plentiful fuel source for the future—hydrogen.

—Marsha Freeman

**THE COMPARATIVE COST
OF THREE COAL TECHNOLOGIES**
(in millions of 1975 dollars)

	Coal MHD	Conventional Coal	Synthetic Coal Liquids
* 1,000-megawatt plant Capital cost	\$180	\$330	\$300
Fuel development* Capital cost	70	110	200
Fuel process plant** Capital cost	—	100	460
Total capital cost	\$250	\$540	\$960
Price of electric power (mills/kilowatt-hour)	15	31.7	58.8

*Includes the capital cost of building new coal mines, the cost of mining the coal, and the transport capital cost for the increased coal use.

**Includes stack gas cleanup (scrubbers); for synthetics, the cost of creating liquid fuel from coal.

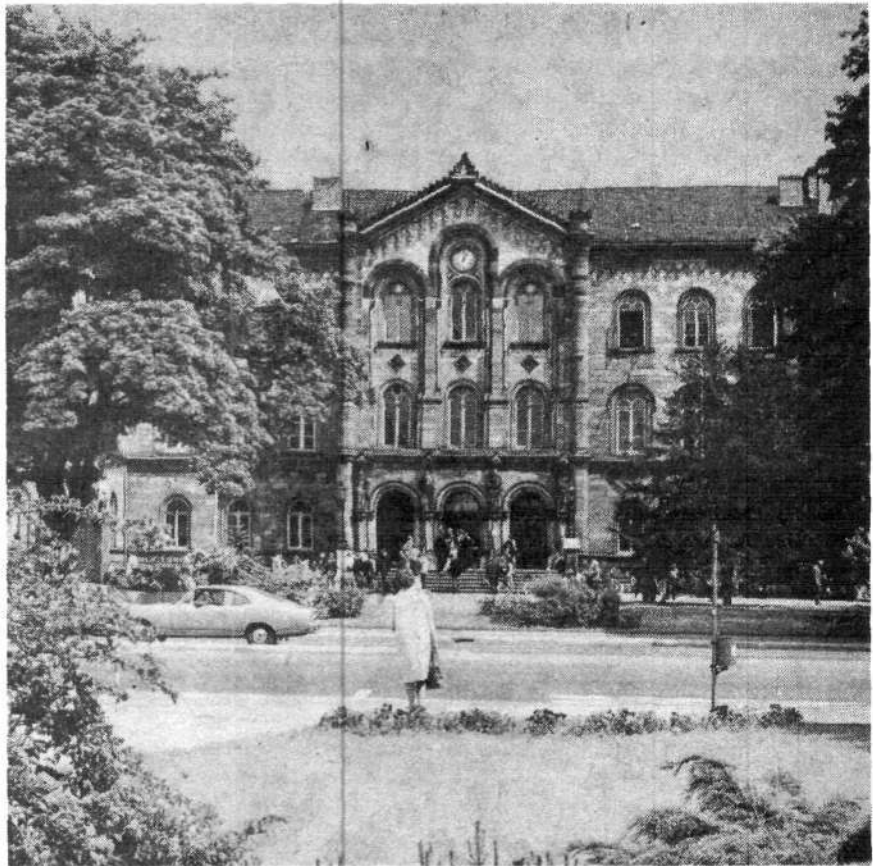
Fusion Theory Center Proposed

In May 1978, former Japanese prime minister Takeo Fukuda made his startling proposal to President Carter for a joint \$1 billion fusion research program. Later, Japanese scientists included in the package a joint center for theoretical research. Despite the obvious benefits to the U.S. fusion program, Energy Secretary Schlesinger delayed the agreement by insisting that the cooperative energy program include a primary segment for coal liquefaction.

Nearly a year later when the U.S.-Japan agreement was finally signed, the DOE Office of Fusion began discussing the proposal for a theory center. Excerpts from a Fusion Energy Foundation memorandum to the Office of Fusion on the proposed theoretical center appear below. In previous statements on the fusion budget, the FEF had proposed that several such theory centers be the nuclei of fusion and advanced technology research complexes across the country.

The proposed new Center for Fusion Theory offers a tremendous opportunity to put the fusion program on a coherent theoretical basis for the first time. Up to the present time, "theory" has had many meanings, ranging from the identification of the dominant processes in various fusion devices to the development of better computational machinery for processing experimental data. Although this activity has been extremely useful in many cases, it is still an inadequate notion of theory.

We propose to restore theory to its proper role, which will also have the most positive impact on the fusion program. That role is the development of new and better conceptual



We must revive the tradition of Göttingen and the Ecole Polytechnique. Above, Göttingen University.

approaches to plasma processes and, more importantly, the development of students who understand the method by which such advances are realized.

There are two vantage points from which to grasp the meaning of what we propose: first, by examining the historical development of the most advanced schools of theoretical work; and second, by examining the epistemological significance of various crucial or unique experiments in plasma physics.

No two institutions have shaped modern physical science more than the Ecole Polytechnique of Paris at the end of the 18th century and the University of Göttingen throughout most of the 19th and early 20th centuries. Both were focal points for the simultaneous development of industrial technology, advanced theoretical science, and scores of students committed to scientific and technological

progress within a framework of republican nation-building. Both these institutions importantly intersected a similar tradition in the United States exemplified by such individuals and institutions as Benjamin Franklin, Joseph Henry, West Point, and the early Massachusetts Institute of Technology.

The relevant point for the proposed new U.S. theory center is that this line of scientific development was the most fruitful in history because it combined investigations in basic mathematics with research into critical physics phenomena. That is why it produced scientists of the caliber of Gauss, Cauchy, Riemann, Cantor, Klein, Hilbert, Minkowski, Schrödinger, and Einstein. Theoreticians of such depth do not exist today. But the problem of fusion demands that they be re-created.

It is generally accepted in the leading international fusion research

circles today that it is extremely problematic whether a "window" of plasma parameters exists within existing fusion concepts for the development of an economical pure fusion reactor. The tokamak and other magnetic confinement devices are suitable for fusion-fission hybrid breeders but are uncertain as pure fusion machines. Small-pellet inertial confinement is equally uncertain, especially in terms of achievement of needed compression and ignition within the existing experimental framework. These circumstances have led the Soviets in particular to look for a possible "brute force" solution, such as fast imploding liners.

The fundamental problem, which this situation reflects and which the FEF has identified in various writings, is that most plasma processes involve types of singular structures, phase changes, self-organization, and energy transport phenomena that can be described phenomenologically but that appear to be "anomalies" from the standpoint of existing mathematical physics. These are just the types of processes, however, that must be better understood and controlled if an efficient pure fusion reactor and related plasma processing technologies are to be achieved.

We do not expect any existing institution to develop the needed research and training program overnight. What we can do immediately is to identify the desired goal and the institution(s) best situated to move in the right direction with the appropriate leadership. Institutions with a strong tradition in hydrodynamics are generally best situated to do so, and are in fact direct offspring of the Ecole-Göttingen tradition.

The Theory Program

In summary, we need a program with the following basic elements:

- (1) A thorough grounding in the actual historical development of mathematical physics centering on the relationship between investigations of the mathematical continuum, function theory, and the field-particle problem. This also includes a thorough grounding in hydrodynamics, MHD, and nonlinear field theory.
- (2) Maintenance as a constant topic

of ongoing seminar-type discussions of the entire range of singular plasma phenomena, such as solitons, current filaments, etc., and their relationship to global plasma properties. Such reviews should be conducted in close conjunction with reviews of related areas of astrophysical and fluid-dynamical interests (for example, solar-plasma oscillations and cavitation).

- (3) Close coordination of theoretical work and small scale experimental investigations of critical plasma phenomena aimed at identifying the precise areas where existing theories break down and new concepts are required.
- (4) Independent review of the theoretical analyses developed at other institutions to assess the feasibility of various mainline and alternative approaches to fusion.

In order to achieve these goals, the theory center should ultimately have a large number of students, faculty, classes, and seminars and a high ratio of senior staff to students. Since there are now very few scientists prepared to conduct such a program, as many of these as possible should be recruited to regular or visiting positions at the new center and provided with all necessary resources until the program begins to gel. The FEF can recommend a number of working scientists who would qualify for the staff.

Quite clearly no present institution can do the job as it is presently structured and staffed. In assessing which existing institution is best qualified as the site of the new center, the criterion therefore, should be which site has the best potentiality as a nucleus for the new center and the highest commitment to create something new and productive along the indicated programmatic lines.

The FEF will do everything possible to help this project succeed. That includes contributing our unique expertise in the historical and epistemological dimensions of the program, as well as the foundation's own research experience in nonlinear hydrodynamics, ranging from climatology and desalination to the many-body and MHD aspects of fluid, superfluid, and plasma physics. . . .

ISX Completes 1st Phase Of Key Experiments

The Impurities Studies Experiment tokamak (ISX) at Oak Ridge National Laboratory in Tennessee has proved to be one of the most productive fusion experiments, with 20,000 experiments carried out to date. Since it was started up in spring 1977, the ISX has completed key studies on such diverse questions as keeping out impurities from a fusion plasma, neutral beam injection for heating, pellet fueling of a fusion plasma, materials utilization in fusion devices, and magnetohydrodynamic stability with relatively high betas (beta is a measure of the efficiency with which a magnetic field confines a fusion plasma).

The device was recently shut down for maintenance and upgrading and in its next phase of operation, the ISX will be carrying out experiments with microwave heating of fusion plasmas.

Pellet Heating

Among the scores of issues resolved or significantly advanced by the ISX tokamak is the question of how the fusion plasma is to be fueled. One

New Foster Report Under Wraps

A new fusion study by the Department of Energy's Foster Committee has been making its way through the DOE bureaucracy since the beginning of May. The subject of the study is inertial confinement fusion, including laser, electron beam, and ion beam fusion.

Although Dr. Greg Canavan, the

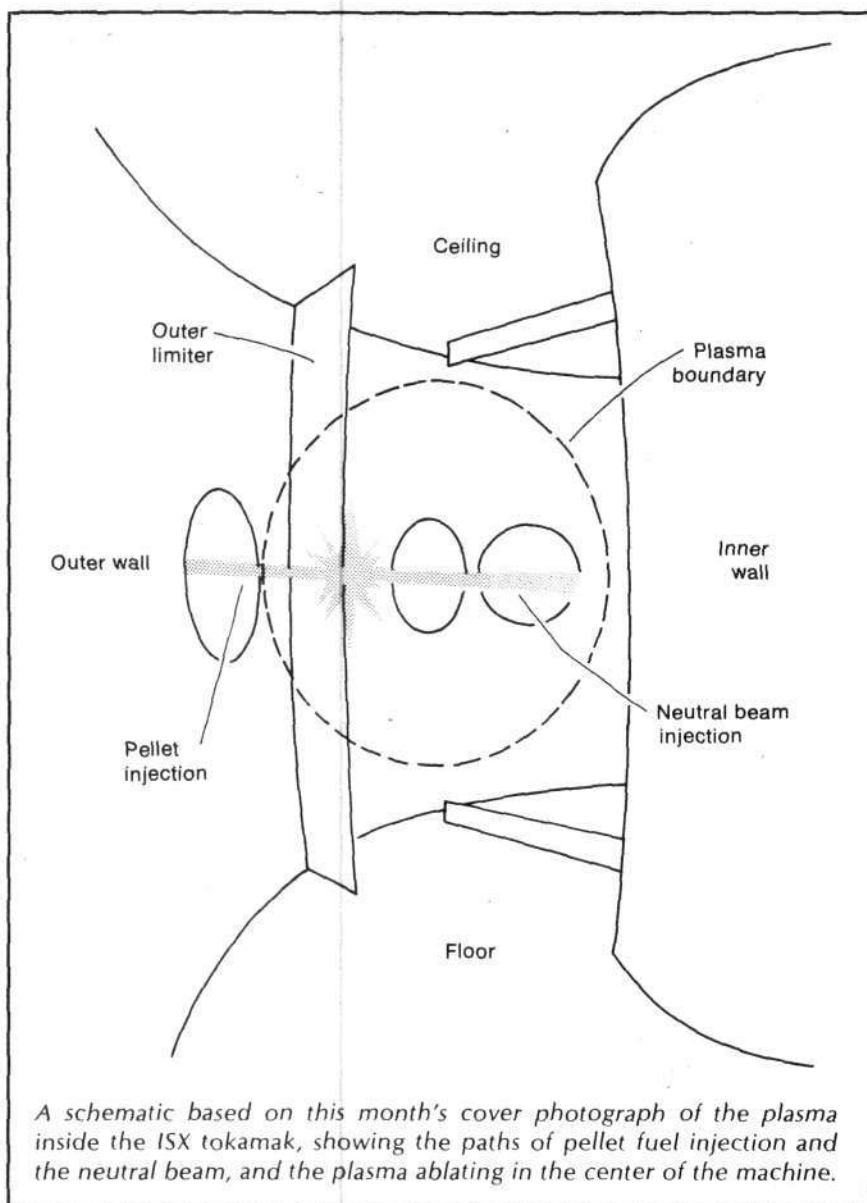
straightforward method the ISX tested is the injection of solid pellets of fusion fuel into the tokamak fusion plasma. The hot plasma heats and ionizes the pellets. (This is the process going on in this month's cover picture.) In fact, since tokamak plasmas operate at low densities (several orders of magnitude less dense than normal air), a few pellets could provide enough fuel to increase the density of the entire plasma several times—even in a large experiment.

The main problem with pellet injection into tokamak plasmas is that the pellet may cause the onset of instabilities, because of the large increase of local density and plasma cooling in the region where the pellet is deposited in the plasma.

A second problem is if and how a large pellet can be stably absorbed. The larger the pellet, the deeper it can be injected into the plasma. This increases the central density, which is most desirable. Also, large pellets would make the pellet injection technology simple for reactors.

The results of pellet experiments like these on the ISX have demonstrated that large pellets can indeed be readily injected and absorbed in tokamak plasmas without any instability being generated. This successful pellet injection approach developed at Oak Ridge will be a key component of future tokamak experiments and reactors.

A full report on the ISX pellet injection process will appear in a future issue of Fusion.



A schematic based on this month's cover photograph of the plasma inside the ISX tokamak, showing the paths of pellet fuel injection and the neutral beam, and the plasma ablating in the center of the machine.

new head of the DOE Inertial Fusion Office, described the new report in his speech to a Washington conference on laser applications and engineering in June, it has not been released to the public, nor have there been any further DOE public statements on it.

Canavan summarized the major conclusions of the Foster Committee study as follows:

(1) Because fusion is so important and inertial fusion is one of the most viable approaches to harnessing it, the inertial research effort must be upgraded to the level of the magnetic effort; specifically, the

earliest possible commercialization must be achieved.

(2) To accomplish this, the budget for the inertial confinement should be increased to permit research and development of the efficient type of laser, electron, or ion beam that would be needed in an actual power reactor.

In addition, Canavan presented charts showing what the Foster Committee had proposed as the funding and schedules for the various inertial research facilities.

The pursuit of an efficient inertial confinement driver previously had not been a priority in the fusion pro-

gram since experiments could be carried out on a one-shot basis with existing, though inefficient, glass laser technology. The existing DOE program plan calls for developing the reactor driver after these experiments had demonstrated scientific feasibility.

Canavan, who headed up a major Air Force laser weapons development program before coming to the DOE, specialized in efficient, high-repetition gas lasers. The particular system he helped to develop, the krypton fluoride laser, in fact, is the most likely candidate for development of a reactor-type laser.

Advanced Fusion Fuels Look Promising

There is a growing consensus in the fusion community that the more advanced fusion fuels, in particular the deuterium-deuterium nuclear fusion reaction, could be used in the first generation of fusion power plants.

The reason for this optimism is the overall advance in magnetic fusion energy research and the realization that there are no beta limits in the main magnetic confinement approaches. Beta is the measure of the efficiency with which magnetic fields are utilized to confine and insulate hot fusion plasmas.¹ In general terms, the capital costs of fusion power plants will be directly proportional to both the power density and the magnetic field strength (and thus the beta limit).

Since higher temperatures are needed to ignite the more advanced fuels like deuterium-deuterium (D-D), much higher plasma betas are needed to obtain the same power densities as reactors based on deuterium-tritium (D-T). D-D ignites at temperatures greater than 500 million degrees Celsius, while D-T ignites at 50 to 100 million degrees.

The initial "removal" of beta limits in the mainline tokamak and mirror magnetic confinement approaches was based primarily on theoretical studies. These theoretical projections are now being confirmed by the rapid progress in Soviet and U.S. tokamak experiments, such as the Kurchatov T-11, the General Atomic Doublet III, the Massachusetts Institute of Technology Alcator C, the Oak Ridge ISX-B, and the Princeton PLT.

The situation is similar for the magnetic mirror machine, particularly the tandem mirror. Mirror experiments recently have attained peak betas greater than 100 percent; the ISX-B is currently getting peak betas of greater than 6 percent.

The D-D Fuel Cycle

Various spokesmen in the Department of Energy Office of Fusion have

termed D-D fuel to be in the same position that D-T was in 1975 in terms of its scientific feasibility; that is, there is confidence that it could work.

The D-D fusion fuel cycle has a number of major advantages over D-T. First, since tritium would not have to be bred from lithium, there is no need for a lithium breeding blanket. Second, the neutrons from D-D are not as energetic as those from D-T; therefore, there is less damage to the reactor's first wall.

Third, the D-D reaction generates more neutrons at lower energies per unit energy output than D-T, so that its performance in a fusion-fission hybrid reactor as a generator of fissile fuel would be much greater per unit energy output.

And fourth, deuterium is readily available from the ocean. One gallon of seawater contains enough deuterium to generate the equivalent of more than 300 gallons of gasoline.

Notes

1. Specifically, plasma beta is the ratio of the magnetic field strength squared divided by the plasma gas pressure.

Alcator C Going Full Speed Ahead

Although the full power supply will not be ready to hook into the new Alcator C tokamak experiment until the fall, fusion scientists at the Francis Bitter Magnet Laboratory at the Massachusetts Institute of Technology are going full speed ahead using the Alcator's present power supply.

The Alcator C is the followup to the original high-field Alcator, which holds the current record for plasma confinement conditions of density and confinement time. MIT scientists are confident that the C will attain breakeven density and confinement times, although not temperature, sometime late this summer.

The Alcator C was run up to about half its magnetic field capacity (70 kilogauss), with more than 400 kiloamps of plasma current, temperatures greater than 11 million degrees, and densities in the range of 300 trillion nuclei per cubic centimeter.

The number of experiments run on the C was so great that after only a

few months of operation the plasma limiter burned out. The limiter is a slab of metal that prevents the hot plasmas generated in the center of the tokamak from contacting the vacuum chamber walls, and takes only a week to replace.

Los Alamos Explores Z-Pinch

Dr. J. Hammel at Los Alamos Scientific Laboratory in New Mexico has started a series of high-density fusion experiments with a dense, fast z-pinch. A z-pinch uses electrical current to compress a plasma cylinder radially.

In these experiments, a laser is used to heat the plasma. The dense hot plasma produced in the experiments lasts only a billionth of a second. The basic idea is to see whether the electrical current that flows through the plasma and generates the z-pinch can be increased more rapidly than the heat that is lost through radiation.

One of the initial interesting results of these fast z-pinch experiments is the observation of what appears to be vortex filaments. During its few billionths of a second of life the plasma column seems to wrap up like a twisted rope. This filamentary behavior is similar to what has been predicted by Dr. Winston Bostick at the Stevens Institute and Dr. Daniel Wells at the University of Miami in their work with plasma.

Los Alamos is now beginning a series of experiments very similar to those Wells has pursued. In these experiments, a plasma donut generated in a theta pinch (a theta pinch compresses the plasma longitudinally) is shot into a mirror magnetic field. The mirror field is increased, which causes the compression and heating of the plasma ring. Simultaneously, a large plasma gun is shot at the ring.

Los Alamos is one of the major fusion laboratories of the DOE. LASL scientists began the exploration of these high-density approaches to fusion last year after Energy Secretary Schlesinger closed the promising fast liner program by cutting its budget. (See "The Case of the Fast Liner," Fusion, March-April 1979.)

Conferences

FEF Africa Conference, Paris, June 27-29

Ensuring the Industrialization of Africa

"To ensure the global industrial cooperation that is the only means for securing world peace, we must shape the political-economic perception of the African continent. We must show Africa its potential for industrialization, and that this is not only important for the African population but for the world population. This is our task." With these words, Hans Bandmann, the European director of the Fusion Energy Foundation, laid out the work for conference participants in his opening address to the FEF Conference on the Industrialization of Africa held in Paris June 27 through 29.

The 60 conference attendees included students from several African nations, representatives of the African press, the first secretary of the Embassy of Zaire in Brussels, a representative from the Soviet Embassy in Paris, and representatives from various companies and embassies including Alcatel, a French engineering firm; Eurospace; Electricité de France, the state-run power company; the Hungarian Embassy; the Embassy of Gabon; Centre Européen de Coopération Internationale; Institut de l'Entreprise; and the European Humanist Academy.

Bandmann's speech set the tone for the conference, which in its three days of speeches and discussion covered the theoretical background for solving the problems of Africa today and then set out a concrete plan for bringing Africa into the industrial world of the future. As Bandmann explained, the overall perspective for Africa will be either the neo-Malthusian policy of such groups as the International Monetary Fund and the New York Council on Foreign Relations, or the industrial "American System" of the new world economic order in which Africa would play a role as an increasingly industrialized continent.

Bandmann described the view of Africa according to the Council on Foreign Relations' book, *Africa: A Continent in Crisis*, part of the Council's "1980s Project": "Quarreling breaks out, authoritarian regimes multiply, competition over scarce resources increases, with states maintaining a constant state of military readiness. . . . As the 1980s draw to an end, the world would decide that Africa is not worth the conquest, leav-

"The behavior of an African is transrational, he doesn't only look at what's observable. . . . There are some things which escape the West. The West should study them and try to integrate them."

—African student
on first day of conference



ing the continent a ghetto to fight its own battles."

Bandmann showed how this vision of Africa's future is a lawful consequence of the policies of the International Monetary Fund, which forces African nations to pay off spiraling debts with slave-labor projects of appropriate technology, with one year of human labor required for \$1 worth of oil energy. He explained how the American System of progress is the only means for developing the wealth of the African continent: "Technological-scientific progress creates the basis to surpass every limit....There must be the systematic development of the productive powers of labor, with capital-intensive modes of production."

Other speeches on economic policy and how Africa's growth will be financed took up this theme, showing how the European Monetary Fund must be implemented to lend money at low interest rates for long terms to develop Africa. As Philip Golub said in his presentation, "After IMF policies were instituted in Zaire in 1973, the debt service as a percentage of reserves for Zaire rose from 8 percent in 1972 to 50 percent in 1978."

Real Economics

Lyndon H. LaRouche, Jr., noted economist and chairman of the U.S. Labor Party, further developed the overall concept of real economics in his presentation, "The Myth of Equilibrium Economics." LaRouche explained how a Riemannian model of the economy works, with the nonlinear effects of new technologies being introduced an essential part of the model. An equilibrium model of the economy can never work because it does not allow for economic growth, LaRouche said.

"In the American System of Alexander Hamilton and Friedrich List the ultimate source of real wealth is the development of the productive pow-

ers of labor, whereas in the British System of the London School of Economics and Adam Smith economic wealth is measured according to a national accounting system which includes in the GNP all sorts of unproductive economic activity," he said.

Explaining how the Bretton Woods system is just a revival of the 18th-century British methods denounced by President Roosevelt and how British "free trade" methods imposed backwardness and poverty on nations like India, LaRouche said, "Without junking those miserable varieties of political economy, the new world economic order cannot be brought into being. . . . If the European currencies are pegged to a parity based on the price of gold, bonds can be issued, inflation-proof, by the central banks. Credits could be granted at 3 to 4 percent interest over 15 to 25 years. . . . Africa is on the verge of being plunged into chaos. The forces based in London have stated that they are dedicated to reducing the human population to one billion by the year 2000. . . . The choice is between the immediate implementation of the European Monetary Fund and the systematic butchery of three billion people. That's the choice."

Nuplexes and City-Building

Concrete proposals for the industrialization of Africa were then presented by various speakers, who developed the concept of the nuplex, an agroindustrial complex centered around one or more nuclear reactors, as the "seed crystal" for industrialization. Since the education of the workers will be essential to success, the speakers stressed, various stages of development must be passed through on the way to the nuplex: First you build a cement industry. Then you use it to build plants for heavy machinery. Then you develop heavy industry. In the process, you develop your labor force as they learn higher and higher skills in their work, with the eventual integration of education and production possible in a nuplex city. The nuplex will integrate processing, with waste products being used for other processes such as fertilizer production.

Speakers also presented specific

"You have showed many theories to be totally wrong. You are animated by the humanist spirit. You have to make Africans understand the need for a new world economic order. I hope with all my heart that your project will be understood and accepted by Africans."

—same student
on last day of conference

plans for industrializing every sector of the African economy.

The concept of city-building was discussed by Helga Zepp-LaRouche, a leader of the Islamic Foundation and chairman of the European Labor Party. Zepp-LaRouche gave as a model for African nuplexes the eighth-century construction of Baghdad under the Bassadid Caliphate. She stressed that these humanist circles used the most modern forms of science and technology to build Baghdad from scratch, providing homes, workplaces, libraries, and commerce for a population of one million. From Baghdad radiated the progressive ideas of the Islamic Renaissance, said Zepp-LaRouche, and Africans should identify with this development in their own struggle to enable people to think.

Kotto Essomé, professor at the University of Paris, reviewed the tradition of city-building in Africa, demonstrating that precolonial Africa had large and prosperous cities, based on well-established trade routes. In West Africa, for example, he said, towns such as Timbuktu, Djenné, and Gao had well over 100,000 inhabitants at the end of the 16th century. But the colonial powers cultivated the "cliche of the precolonial virginity" of Africa to justify their looting policies, which destroyed the African infrastructure and urban life, he explained.

Emmanuel Tremblay, a demographer, demonstrated how Africa today is underpopulated and must greatly increase its 400 million population to support industrialization. The concept

of a "negentropolis" was then presented by Swedish architect Gregor Ahlberg, who showed how cities must be built to allow for future growth, with space and systems developed to integrate new structures that come on line. He gave a detailed description of how such an agroindustrial complex could be built in Uganda.

Magic Versus Mind

The problem of raising the education level of the population so that they can become the innovative workers of an industrial society was addressed by other speeches. Muriel Mirak, a professor of literature at Milan University, showed how the notion of tribalism as an African reality has nothing to do with real African history. "Tribalist culture has been imposed on Africa, and this doesn't leave room for the idea of progress. It prevents the individual from developing the idea of himself as human," Mirak said. Since the individual identifies as a static tribal member, he thinks his culture is particular and opposed to the interests of others, she added. This idea allowed the colonial powers to set one tribe against another, Mirak said.

"Tribalism is the result of economic devastation. . . . Africa needs a new culture, new literature, new education, to create scientists and artists," she concluded.

An African student in the audience then argued for the unique "transrational" worldview of the African: "You say that magic opposes the scientific spirit. Aren't you simply using the word 'magic' for traditional African medicine? There are cases where, for example, the mother was worried about her son who was misbehaving far away. She did some magic, and the son immediately felt a pain and knew it was his mother."

Several people answered him, saying that the proximity of death in populations with inadequate food and health care leads to a feeling of hopelessness, so that magical ideas of control over the universe are appealing. But these magical ideas make it impossible for them to grasp scientific concepts, which would give them real control over their world.

Zepp-LaRouche criticized the idea

that Africans have some unique "transrational" quality, saying that "if the argument that Europeans couldn't understand Africans is legitimate, then so is the argument that people from Bonn can't understand people from Bavaria. Even though there are specific characteristics from each culture, it is necessary to distinguish what is universal to all human beings. ... Don't take only the best from what Africa has produced, take the best that mankind has produced and use it."

Other speeches developed the idea that health and adequate diet are necessary for the development of Africa. The presentation of André Dodin, a nutrition expert from the Pasteur Institute, on epidemics in Africa showed how many of the endemic illnesses could be prevented by scientific waste disposal, but the magical ideas of the population resist such changes. Marlene Goodwin from the FEF further developed the idea that illness and hunger have become a way of life in Africa, with malnutrition increasing the death rate from relatively minor illnesses. "The only way we can hope to meet the minimum food needs of the population is by introducing modern agricultural technology," she said.

Perhaps the overall impact of the conference can be summed up in the comments of one African student, "It's absolutely right what was said here. Africans have been brainwashed into thinking of themselves as another race. It's not true. We are part of world history. The Europeans always said, 'you don't do anything, we will just take your resources, you're not able to do anything.' That has to change."

—Catherine Caffrey

Blueprint for the Industrialization of Africa

A comprehensive report on African development prepared by the FEF Planning Commission is available from the FEF. The document includes a sector-by-sector analysis of the needs and potential for a continentwide industrial program as well as transcripts of the conference presentations. Copies are \$80 each and must be prepaid.

National Space Institute Conf., June 25-26

Fighting for a U.S. Space Program

"If the same people who were in charge of Apollo were in charge of our energy program, we wouldn't be in the mess we're in now," former NASA administrator James Fletcher told the fourth annual conference of the National Space Institute in Washington, D.C., June 25-26. The conference, attended by about 200 persons, was titled "Space Program 1979: A Time for Public Decision."

Ironically, although the conference included many of the political and scientific forces that have had a hand in shaping the U.S. civilian space program and these participants identified key problems, the conference fell short of coming up with a clear perspective for the future of the space program.

The National Space Institute is a nonprofit science-and-technology-oriented organization set up in 1975 by Werner von Braun to "tell the American public about the practical uses of space by people on earth." The Institute presented the conference with a document on "Space Program Options," which included many of the practical programs and technology applications possible from the space effort, as well as a proposal for joint NASA-Department of Energy fusion development written by the Fusion Energy Foundation.

As the presentations made clear and as everyone attending the conference was aware, the U.S. space program has been drifting for nearly a decade. "We don't have a national space program. We have sporadically

Continued on page 64

Figure 1

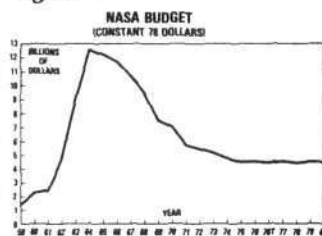


Figure 2

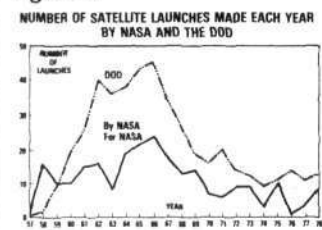
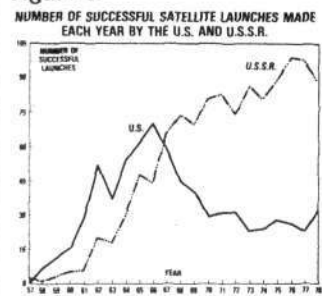


Figure 3



The cuts in NASA's funding have now grounded the agency that 10 years ago put a man on the moon.

Electron Transport in Tokamaks:

by Dr. Steven Bardwell

THE SOLUTION OF ELECTRON TRANSPORT in tokamaks, one of the most perplexing problems yet to be mastered before we can operate fusion tokamaks efficiently, also implies a profound revolution in our understanding of the laws of physics. In fact, a recent theoretical explanation of experimental findings on electron energy loss across magnetic field lines promises to demonstrate the phase-space similarity of solitons, vortices, and shock waves—negentropy.

The Grad-Hogan theory has long offered an understanding of tokamak dynamics (see *Fusion*, Oct. 1978). Most tokamak specialists ignore it, however, preferring to treat each new problem, such as the loss of energy through electron transport, as a separate "technical" difficulty.

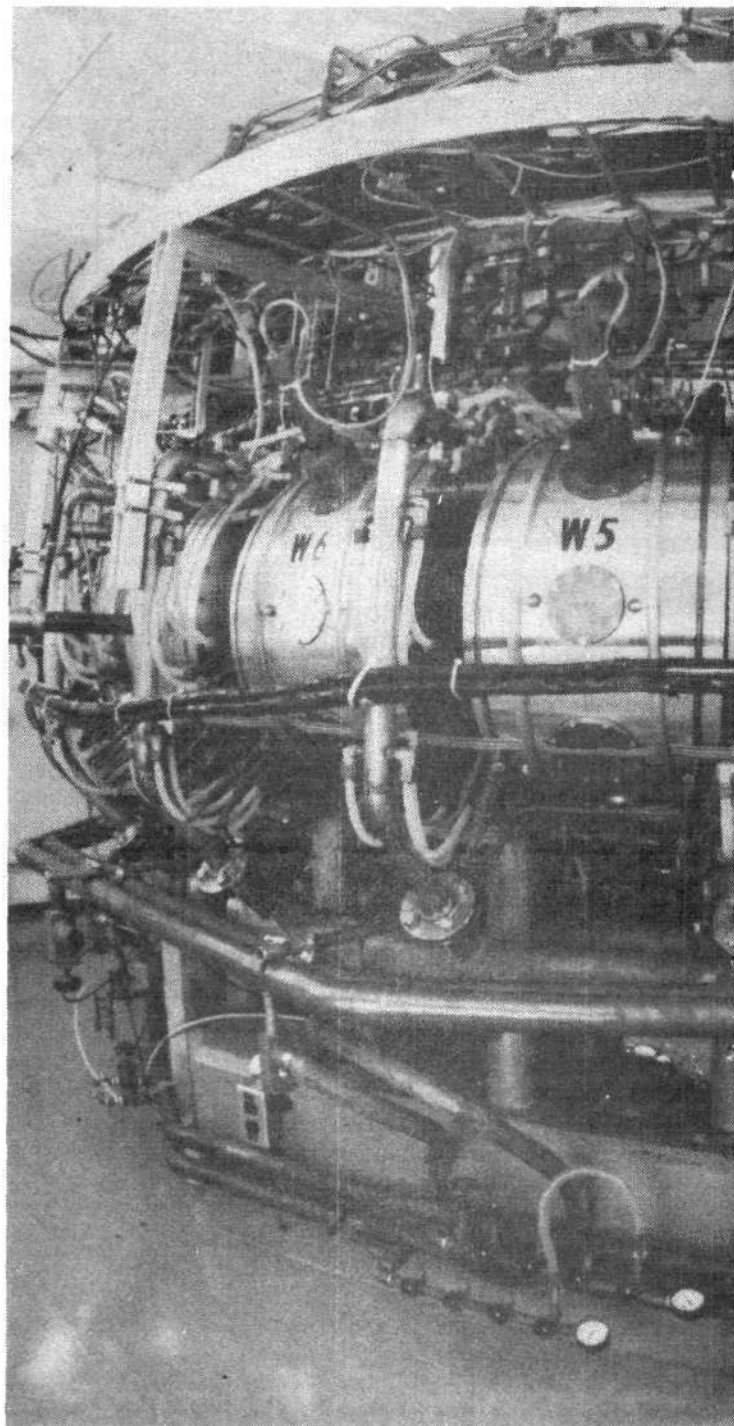
Although the gross behavior of the tokamak plasma ions is reasonably well described by present theory,¹ which has also provided insights sufficient for adequate experimental design and calculation, the behavior of the plasma electron remains inexplicable. The energy in the electron component of the plasma leaks out of the tokamak very rapidly; this energy loss and consequent cooling of the plasma is accompanied by a host of microscopic, turbulent energetic reactions in the plasma; the magnetic field acquires a pathological set of high-frequency oscillations as the electron energy is lost.

As recent as nine months ago, researchers at the Massachusetts Institute of Technology's Alcator, a high-field tokamak, commented:

While anomalous electron heat loss is clearly one of the major physics problems in toroidal confinement, the process or processes responsible for it are still largely unknown.²

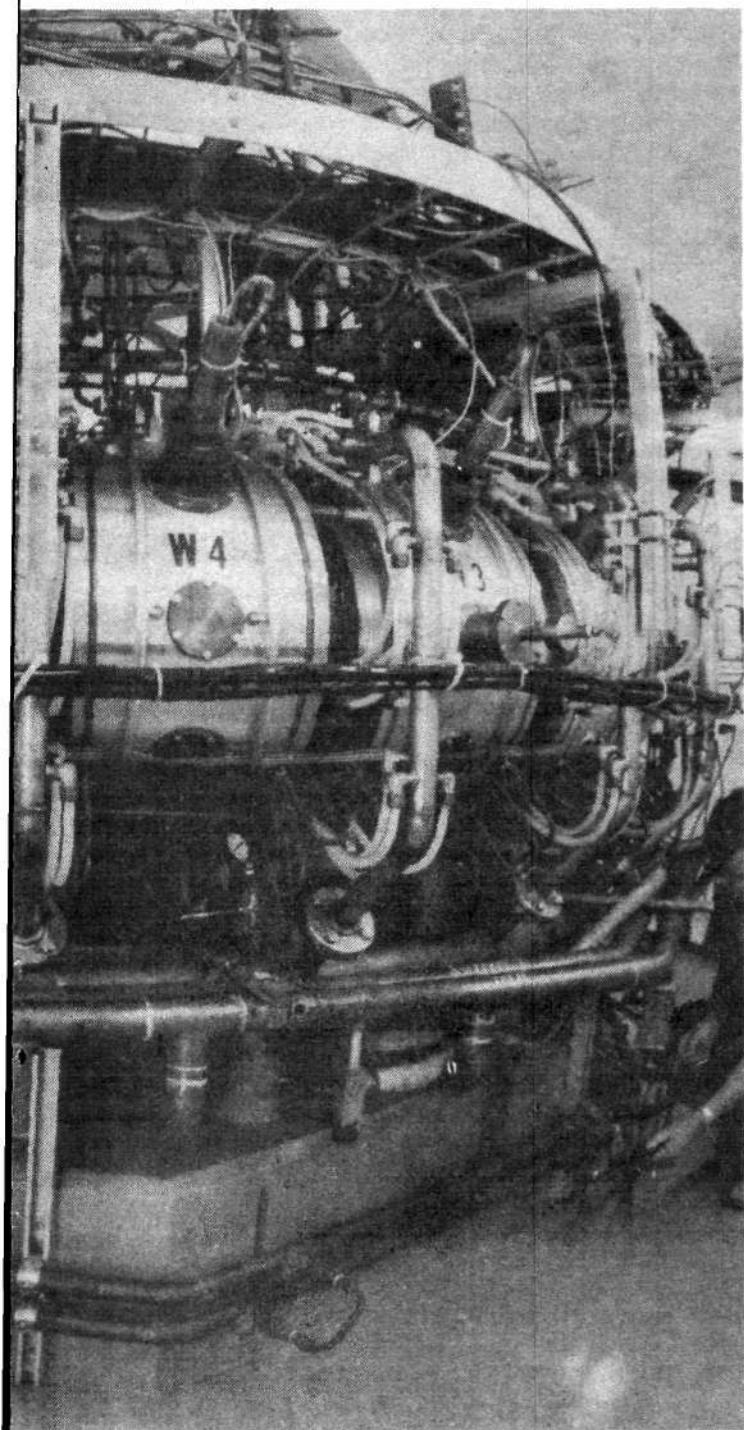
The chief diagnostician at the Princeton Large Torus (PLT), another leading U.S. tokamak experiment, agreed:

In spite of a vast amount of work, the confinement of electrons in a low-beta toroidal magnetic configuration is still an unsolved problem. The reason is not only our limited knowledge of this phenomenon, but also the difficulty of interpreting the experimental



The ISX-B at Oak Ridge National Laboratory

A Case Study in Negentropy



ORNL

data in a unique way. This is particularly true in the field of tokamaks where a single plasma parameter, the toroidal electric current, not only determines the equilibrium and the stability of the magnetic configuration, but also provides the only effective way of heating the electrons.³

Just recently, however, a series of new experimental and theoretical results has appeared that represents a significant breakthrough toward the solution to the problem of electron energy transport in tokamaks. The implications of these results for the further progress of fusion as an energy-producing technology are promising; the abnormally large energy leakage through electrons is predicted to disappear at higher temperatures and densities. But the implication of the new theoretical work for the foundations of physics is quite astounding. These new results provide a striking glimpse of the geometric texture of the manifold underlying physical evolution.

Experimental Results

The experimental evidence for what has been called the "persistent anomaly of electron energy confinement in tokamaks"⁴ is surprisingly universal in all the tokamaks studied to date. There are five pieces of the puzzle that must be fitted together in any attempt to explain the energy balance in a tokamak.

Energy Confinement Time

The first and most obvious problem is the length of time for which a tokamak can contain the energy in the electron component of the plasma. When the plasma is first created and heated in a tokamak, the electrons and ions of the plasma quickly reach roughly the same temperature. The ions, however, can be maintained at this temperature much longer than the electrons. In the PLT, before the neutral beams were used for additional heating, the ions could be kept hot for about 100 milliseconds—the electrons for only 10 milliseconds.³ For the higher-temperature discharges that were obtained with neutral beam heating, the electrons remained hot for only about one-half the time that the ions did. Figure 1 shows some quantitative properties of this electron energy confinement. As the figure shows, the electrons share the amazing property of the plasma as a whole of being easier to confine as they get hotter, but the electron's energy just doesn't stay around as long as the ions.

Traditional theory predicts that the electrons and ions should share about the same energy transport properties and thus predicts for the electrons considerably longer

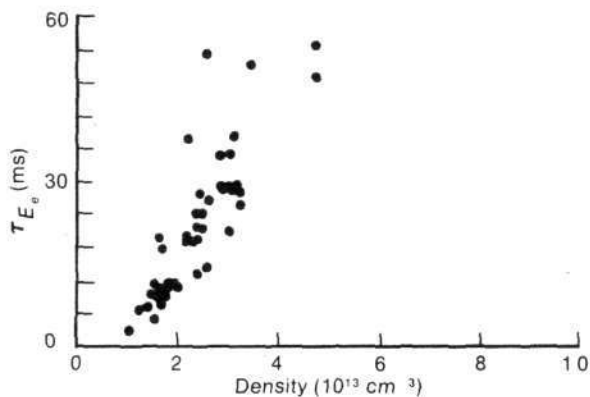


Figure 1
ELECTRON ENERGY CONFINEMENT TIMES
IN THE PLT TOKAMAK

As the density increases, the electron confinement time also increases. But electron confinement times are always shorter than ion confinement times. The time on the vertical axis is measured in milliseconds.

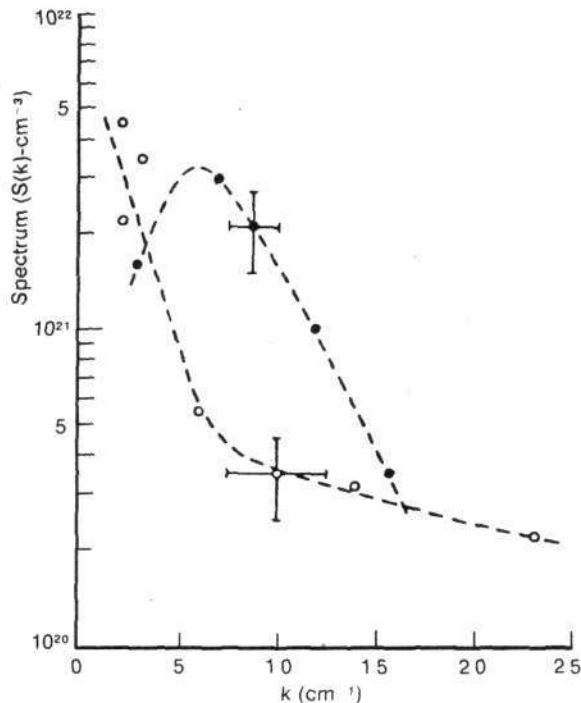


Figure 2
SPECTRUM OF TOKAMAK
DENSITY FLUCTUATIONS

The shape of the two spectra shown is an important diagnostic of tokamak plasma behavior. The figure shows the intensity (vertical axis) of the fluctuations as a function of the reciprocal (horizontal axis) of the wave length of the fluctuation. The open circles show results from the Princeton PLT tokamak. The black circles show results from the ATC, an older Princeton tokamak.

energy confinement times than are actually observed. Experiments consistently show the electron energy confinement time to be anywhere from a factor of 2 to 10 times less than the ion energy confinement time.

Density Fluctuations

The small-scale, rapid, "turbulent" fluctuations in a plasma are one of the most important indicators of the internal state of that plasma. In a tokamak, the most easily measured of these fluctuations are those in density.

The hot plasma is characterized by the swirling and churning that evidences itself in rapid and continual perturbations in the average density of the plasma. Since they occur on very short time and space scales, these fluctuations in density are especially important for indicating the behavior of the light, rapidly moving electrons in the plasma. The conventional technique for studying these density fluctuations is to measure their distribution as a function of the characteristic length scale of the perturbation. This distribution, called the spectrum, shows how the average strength of the fluctuations depends on the spatial extent of the fluctuation.

Figure 2 shows the spectrum of density fluctuations from several tokamak experiments. These spectra are characterized by the overall energy in the fluctuations (the integral of the spectrum over all length scales), the shape of the spectrum, and the width of the spectrum.

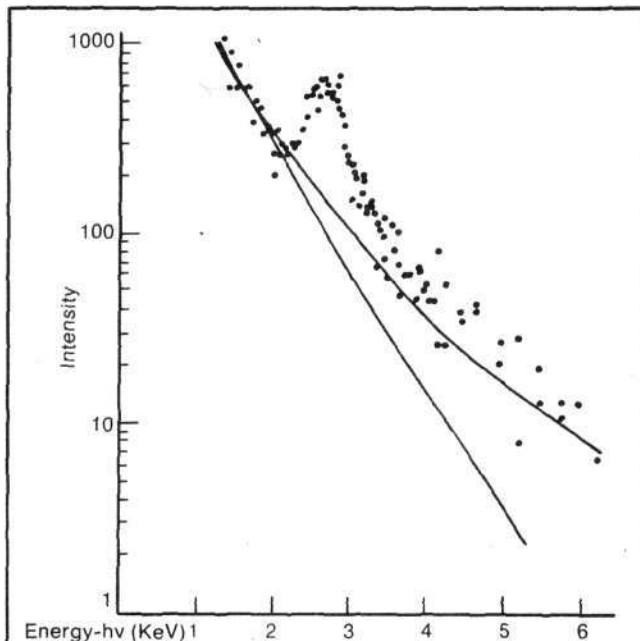


Figure 3
X-RAY SPECTRUM FOR
A TYPICAL ALCATOR DISCHARGE

The lower curve shows the X-ray spectrum expected from a single-temperature group of electrons. The upper curve includes the perturbation induced by magnetic fluctuations. The hump is caused by molybdenum ions contaminating the plasma.

Traditional theory predicted the overall energy in the spectrum of density fluctuations with considerable accuracy. Its estimate was that the center of the tokamak should have density fluctuations about 1 percent of the background density, but this is the only feature of the density fluctuation spectrum it accounted for successfully. The shape of the spectrum was predicted to have no maximum and to be narrower than observed. Worse yet, if the overall level of fluctuations was used to calculate a confinement time for the electron energy, the result was much too long.³

Temperature Fluctuations

All the physical quantities in the plasma fluctuate, and in the usual theories of plasma behavior the fluctuations of all are closely intertwined. The temperature fluctuations provide another sensitive measure of the internal processes in the plasma. The traditional theory applied to the temperature fluctuations in a tokamak predicted that the temperature fluctuation spectrum should closely resemble that of the density. However, the experiments in the PLT showed a quite surprising discrepancy: the temperature fluctuation spectrum was 3 to 4 times wider than predicted (though it did not peak, as the theory had predicted).³ The source of this large spread remains inexplicable in terms of the old theories.

X-Ray Spectrum

The rapidly moving and colliding charged particles making up the tokamak plasma give off radiation in almost all parts of the electromagnetic spectrum. For the study of electrons, the most interesting parts of the radiation con-

centrate in the X-ray region of the spectrum. When they collide with the heavier ions, the electrons give off X-rays whose energy is closely related to the energy of the electrons. By measuring the wavelengths of the X-rays given off by the plasma, a quite precise measure of the distribution of electron energies can be obtained.

In 1978, the researchers at MIT reported an unexpected result from their measurements of the X-ray spectrum from the Alcator 2. Figure 3 shows the measured distribution of X-ray energy as a function of wavelength from their plasma. On the basis of traditional theory, they had expected to see a single, uniform distribution of energy. Instead, they saw two overlapping energy distributions, which indicated two "populations" of electrons in the plasma—one a cooler bulk population of electrons, and the second a very high-energy population, which generated the higher-energy "tail" of the X-ray spectrum.

Magnetic Field Fluctuations

At the time of the observation of these anomalous X-ray energies, a new theory was proposed to explain the electron behavior in a tokamak. The observations at MIT were important for the validation of this theory, as we shall see. Based on this theory, an additional set of observations was made on a small tokamak at the University of California.⁴ Until this experiment, the fluctuations in the magnetic field had not been successfully measured in any other tokamak.

Since the new theory depended critically on the presence and spectrum of magnetic field fluctuations, researchers set out to measure these fluctuations. They

Some ABC's Of Plasma Physics

To the well-known three states of matter—gases, liquids, and solids—must be added a fourth, the plasma state. Whenever a substance continues to be heated after it becomes a gas, at about 10,000 degrees the particles of the gas begin to interact so violently that the electrons surrounding the nuclei of the atoms are split away. The resulting new state of matter resembles a gas in some respects, but a gas made up of electrically charged particles. As exotic as a plasma state may be on the surface of the earth, more than 99 percent of the matter in the universe exists in this plasma state—all stars and most interstellar matter are plasmas.

To create plasmas on earth requires

input of energy. Small amounts of energy create plasmas of low temperature, like flames and neon lights; tremendous energies are required to create and ignite fusion plasmas. Because of the high energy content of plasmas they represent not only a new state of matter, but one whose properties are so new, so different from nonplasma matter, that plasma physics has become the frontier of modern physics.

There are three properties of a plasma that result in its extraordinarily rich and complex behavior: first, the particles in a plasma are strongly interacting. In normal matter, atoms or molecules a short distance from each other generally do not affect each other. Only the closest neighbors in a crystal, for example, strongly affect each other. In a plasma, however, because of the electrical charge on the particles each particle is affected by many billions of others. Since electrical forces are many thousands of times stronger than the forces in nor-

mal matter, all the particles act together in a plasma.

Second, these forces are long ranged. This means that a plasma has modes of interaction where widely distant parts of the plasma can "communicate" with other parts, resulting in uncanny forms of large-scale ordering and coherence. Third is the closely related fact that the forces predominating inside a plasma are created by the plasma itself, not introduced or controlled from the outside. This results in a natural sort of feedback inside the plasma.

There is no controversy over the fact that these three properties of a plasma result in a plasma behaving totally contrary to intuition based on the other familiar states of matter. But a plasma does resemble other states of nonliving matter. It becomes more organized the more energy it contains, it tends to form large-scale coherent structures, and it is inherently dynamic, lacking any accessible equilibrium state.

found a high level of small fluctuations in the tokamak's radial direction (see Figure 4). These fluctuations disrupted the otherwise smooth magnetic field surfaces in the tokamak.

The fact that this critical measurement was made at a small university experiment devoted to purely scientific experimentation (as opposed to technological application) is itself astounding. Previous attempts to measure these magnetic field fluctuations had failed because the plasma in the larger machines was hot enough to melt any probe, but had low enough magnetic fields so that laser methods were insufficiently sensitive. It took a small, relatively low-temperature machine to do the experiment.

Theoretical Results

There have been several attempts to explain this set of experimental evidence.⁵ A new theory of J. Callen at the Oak Ridge National Laboratory, however, has been much more successful than the old theories at describing the electron behavior. Callen's discovery of the essential mechanism for electron energy transport in a tokamak plasma turns out to have implications far beyond the problem of energy transport in magnetized plasmas.

The most bothersome fact about the electron transport in a tokamak is the ability of the electrons to circumvent the confining magnetic fields in the machine. Like all magnetic confinement devices, the tokamak operates on the principle that charged particles—both the ions and the electrons in the plasma—have great difficulty traveling across magnetic field lines. If one can construct a magnetic "bottle" whose field lines are all parallel to the walls of the bottle, the plasma should be constrained to stay inside the bottle. The tokamak is such a bottle in the shape of a donut.

It has been known for some time⁶ that this overall confinement property of a magnetic field could be over-

come preferentially by the electrons if there were a short-wavelength, rapidly oscillating magnetic field superimposed on the background confining field. Such a field, called a stochastic radial field (since it would be like that pictured in Figure 4), was studied in other contexts, but there was no known plasma interaction that might cause such oscillations in a tokamak and thus, at least hypothetically, account for electron transport.

Callen, however, discovered such a mechanism; his theory is based on the nonlinear state (that is, high-amplitude form) of a very common type of wave in a plasma, the drift wave. The drift wave arises from small-amplitude oscillations of the steady state shown in Figure 5. In a plasma in which the background magnetic field B_0 is not parallel to the direction of change in the density of the plasma (this direction is called the density gradient), the plasma will be pushed in a direction perpendicular to both the density gradient and the magnetic field.⁷ If we assume that there is such a steady state, then we can equate the electromagnetic force and the pressure force from the density gradient, with the result that there is a so-called drift velocity of the plasma that it must assume if the two forces are to balance.

Like any steady background state, this state can support waves, that is, periodic oscillations of the system. The myriad waves (in density, in magnetic field, and so on) that a plasma with crossed fields and gradients generates are all called drift waves. Callen was the first to point out that if such waves arise in a tokamak, they will result in the generation of a new background state caused by the interaction of the drift waves not only with the background fields but, more importantly, with themselves.

This new background state—called drift-wave turbulence in analogy with nonlinear states of other wave interactions, results in a qualitative change in the magnetic field of the tokamak. Callen showed that the energy of

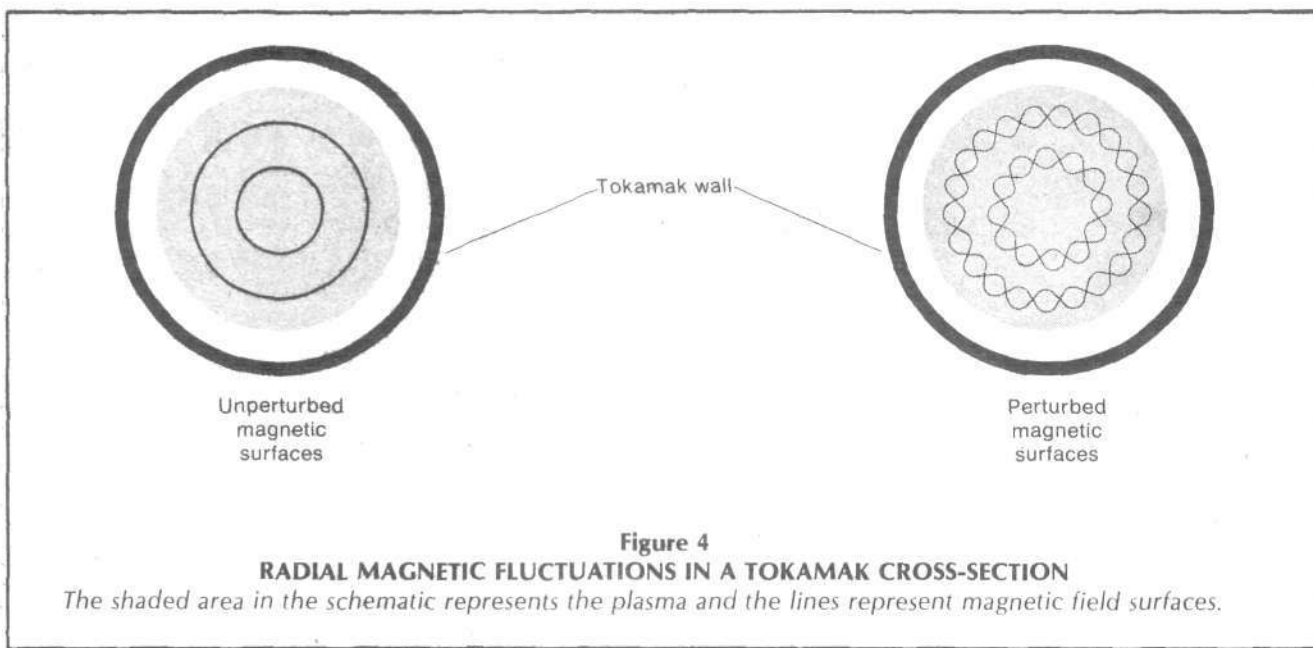


Figure 4
RADIAL MAGNETIC FLUCTUATIONS IN A TOKAMAK CROSS-SECTION

The shaded area in the schematic represents the plasma and the lines represent magnetic field surfaces.

the drift-wave turbulence concentrates in a stochastic perturbation of the magnetic field, resulting in a crinkling and rippling of the magnetic surfaces in the tokamak until they look like that shown in Figure 6.

The fluctuating magnetic field affects the electrons and ions differently. Because the ions are heavier and slower moving, they "see" only an average magnetic field that closely resembles the original background field. That is, they can move only a small distance during the period of a fluctuation and are not transported any net distance by the rapid, small-scale radial magnetic field fluctuations. On the other hand, being light and easily moved, the electrons have their crossfield transport greatly enhanced by the foamy, bubbling magnetic field. Accordingly, the electrons quickly exchange their energy across the field lines, leaking energy from the hot central electrons to the cooler outer electrons.

The experimental evidence offers dramatic support for the basic insights of Callen's theory. The overall levels of turbulence and the spectral shape are well-accounted for, but more interesting, the central role for the stochastic magnetic field, predicted by the theory and then found in the University of California experiment, is borne out by other experimental evidence. The high level of X-rays in the Alcator is a result of a selective acceleration of the electrons from the repeated formation and destruction of magnetic field lines in the stochastic magnetic field of the drift-wave turbulence.

A particularly striking piece of experimental evidence that Callen's theory sheds light on is shown in Figure 7, a plot of the two types of electron temperature profiles found in the PLT. The more common type of discharge has the electron temperature peaked in the center of the plasma, while a rarer type is shown with the solid dots in the figure—in which the electron temperature distribution is hollow. The puzzling aspect of these two profiles, as

noted by the Princeton investigators, is the fact that the hollow discharge has considerably higher levels of turbulence associated with it. Callen's theory provides a natural cause-effect relation here. The higher levels of turbulence are responsible for the rapid transport of energy out of the center of the discharge and the creation of the hollow profile.

Callen's theory pictures the following chain of events as responsible for the electron dynamics in a tokamak. The

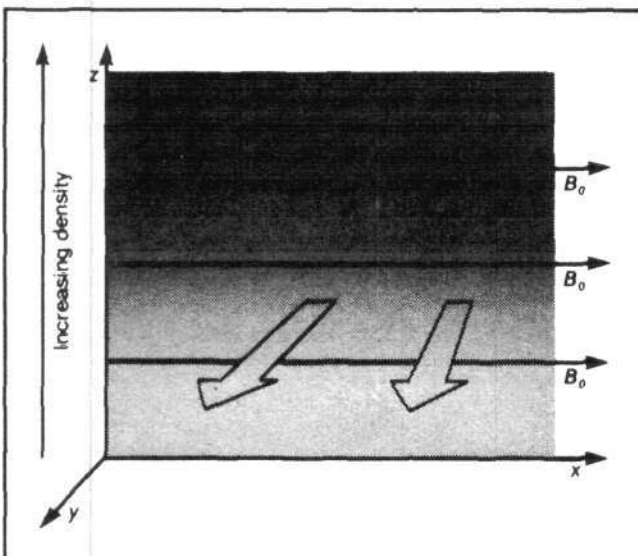


Figure 5
DRIFT STEADY STATE

This steady state results from balance of the Lorentz force against the pressure caused by the density gradient. The plasma flows in the y direction, out of the page.

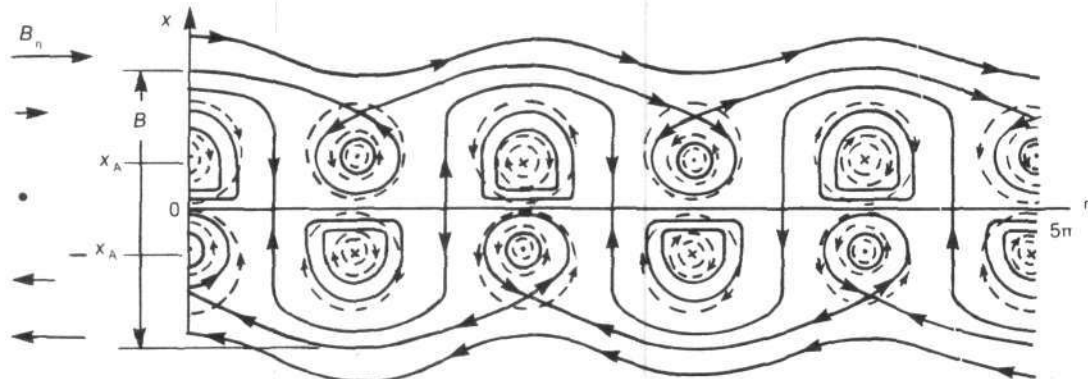


Figure 6
MAGNETIC ISLAND STRUCTURE

The magnetic island structure formed by the combination of the radial magnetic field and the helical component of the equilibrium magnetic field, B_0 .

Source: After J. Callen, 1977, *Phys. Rev. Lett.*, 39, p. 1540.

initial discharge in the machine sets up a host of drift waves, as the newly created plasma churns inside the tokamak. These drift waves quickly reach a high level of now self-consistent interaction forming a strong drift-wave turbulence. This turbulence has a magnetic component that sets up a short-wavelength, short-time-scale fluctuation in a magnetic field, preferentially allowing the electrons to cross field lines. The electrons can quickly spread out their energy and leak away the heat generated in the center of the tokamak by the plasma current. One important component of the electron energy is carried away by electrons that are themselves accelerated by the rapid break-up and reformation of the magnetic field lines by the churning magnetic surface, resulting in a two-component X-ray spectrum. The net result is a considerably higher transport rate for electrons compared with ions, whose large inertia prevents them from being affected by the rapid oscillations of the magnetic field.

Implications of Electron Transport

The picture that Callen provides of the phenomena surrounding electron transport in magnetized plasmas is physically appealing, but the implications of this work go much deeper than might be expected. Two aspects of Callen's description have become even more significant in light of other recent theoretical work.

First, several authors⁹ have noted that the ability of drift-wave turbulence to agglomerate magnetic islands is ac-

tually quite extraordinary and is caused by the same process responsible for the formation of large-scale vortex motion in fluids and large magnetic vortices in other plasmas.¹⁰ Callen originally described the formation of the turbulent magnetic foam as a statistical process, but the coalescence of these magnetic islands turns out to be due to an "inverse cascade" process in which the energy in the drift-wave spectrum moves from small scale lengths to large scale lengths. As the accompanying graphics show, our conventional ideas of the natural direction of evolutions of physical systems imply the opposite—the natural flow of energy from large-scale, coherent energy to smaller and smaller, chaotic energy-containing modes. The opposite happens in a plasma, and the phenomenon of electron transport is an indication of the pervasiveness of this countertendency in a plasma.

There is a second important piece of evidence provided by the problem of electron transport concerning the central role played in all plasma behavior by the general class of phenomena that I have called "self-organizing." The acceleration of a high-energy tail on the electron distribution, as indicated by the MIT results on the X-ray distribution, results on a detailed level from the formation of the complex magnetic field geometry shown in Figure 8. This figure shows an enlargement of one of the many points in the turbulent magnetic field created by the drift-wave turbulence where the magnetic field lines cross. The reconnection of the magnetic field lines at this point

Phase Space Versus Physical Space

Common-sense intuition about physical objects and their movement begins with the idea of "physical" space—height, width, depth, and time suffice to specify the position and velocity of a body. These are also the quantities of interest in Newtonian mechanics—the so-called dynamical variables. The object of classical physics is to specify the position as a function of time for a given physical system.

This simple idea of geometry, however, turns out to be insufficient *in principle* for understanding physical systems of any degree of complexity; in fact, physical systems with large internal energies, systems that interact with themselves, and biological or so-

cial systems are inherently inexplicable from the standpoint of an *a priori* specification of common-sense geometry.

A different concept of the actual geometry of physical systems was devised in its first form by work done in the 1700s and 1800s by such French and German physicists as Euler, Lagrange, and the Bernoullis, who used a hydrodynamical analogy to describe a new geometry for physical events. With the work of Riemann in the middle of the 19th century, the full elaboration of the concept of "phase space" as the true geometry of physical events obtained its deepest foundations.

The basic fact of modern physics as described by Riemann is that a physical system determines its own geometry through its own dynamics. That is, it is impossible to specify "beforehand" the appropriate "space" for a given system—the geometry is as much a dynamic variable as is the position. Riemann showed that the phase space describing the actual

universe would have to be of a new sort—a noncontinuous space, characterizable by its singular behavior.

The simplest heuristic for a phase space is gained by looking at a straightforward problem in classical dynamics like the pendulum (a simple harmonic oscillator). In normal space the pendulum swings back and forth. The time it takes to complete one complete cycle is its period. The basic feature of this motion, that the amplitude of the swing (at least for swings of less than 10 degrees) does not affect the period, is merely a *derived* result in classical dynamics. The natural geometry for the pendulum, however, is not normal space at all, but rather a phase space whose first coordinate is the velocity of the pendulum and second coordinate the angle of swing. In this phase space the trajectory of a swinging pendulum is a circle, and the constancy of period is a necessary *geometrical* result! You may think that your pendulum clock is swinging in the living room—it actually exists in a totally different place.

generates a series of shock waves, which accelerate beams of particles.¹¹ That is, the high-energy electrons observed to accompany the anomalous electron energy transport, although critical evidence of the role played by the magnetic field, more importantly provide insight into the role played by another self-ordered effect, shock waves.

The appearance of two instances of self-ordering phenomena in the problem of electron transport is surprising. Here are phenomena that, on the surface, seem amenable to a purely statistical or "mechanical" solution, but, on closer examination, show the central importance of two instances of nonentropic temporal processes. As I have shown elsewhere, shock waves and inverse-cascade processes are both examples of a small group of phenomena occurring in continua whose implications for the foundations of physics are revolutionary. Shock waves and vortex formation are instances of temporal evolution in a physical system that proceeds in a direction contrary to all intuition based on the idea of a natural tendency toward increasing disorder and homogeneity. In these two instances, we see a physical system spontaneously progressing toward states of higher energy concentration and inhomogeneity and large-scale order.

The understanding of these self-ordering phenomena in a plasma is the most challenging and important problem faced by plasma physics today, and the problems surrounding electron transport allow the solution to one especially bothersome part of the conundrum these pervasive phenomena pose for scientists. On intuitive grounds, it seems obvious that there is a similarity between shock waves, vortex phenomena, and solitons.¹² They are the three clearest examples of self-organizing behavior in plasmas. Yet, attempts to find a systematic connection among the phenomena until recently have met with no success. At the very least, some sort of organic similarity was needed to take plasma theory beyond the merely subjective feeling that the three phenomena were related.

The seriousness of this deficiency in our theoretical understanding of self-ordering phenomena is reemphasized by the recurrence of these same phenomena in the case of the electron transport problem: the constant appearance of the same types of self-organizing phenomena at the heart of problem after problem in plasma physics cannot be coincidental—something very basic is going on.

Inspired by the form this problem took in the case of electron transport, I believe it is now possible to state with a minimum of speculation exactly what the connection is among these phenomena. Figure 9 shows in a schematic form the connection desired.

The situation is as follows: Solitons and shock waves are both phenomena that concentrate energy through a regular (not inverse) cascade process, transferring energy to small scale lengths. Because this cascade proceeds with phase coherence, however, the energy is not dissipated at small scales, but rather results in an intense concentration of energy at a specific position in space. Mathematically, both result in singularities arising in finite times in the

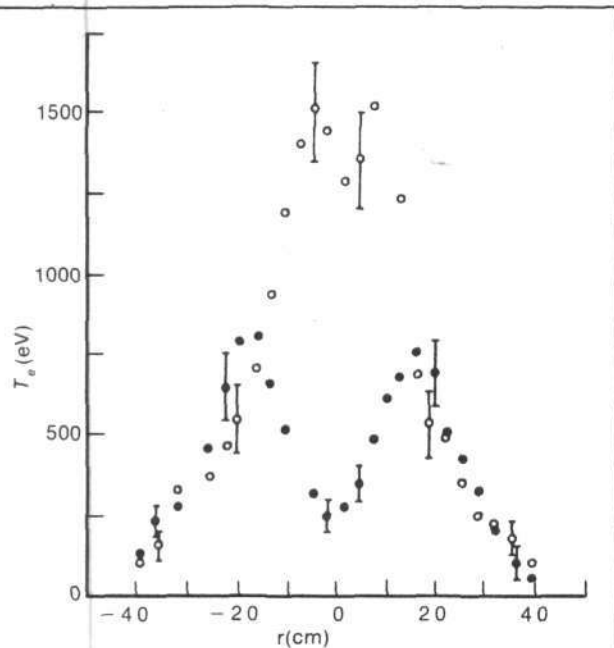


Figure 7
TEMPERATURE PROFILE
OF PLT TOKAMAK DISCHARGE

The temperature, a function of the distance from the center of the plasma (z), is shown for two types of discharges. The open circles show usual temperature distribution, which is peaked at the center. The black circles show a "hollow" discharge.

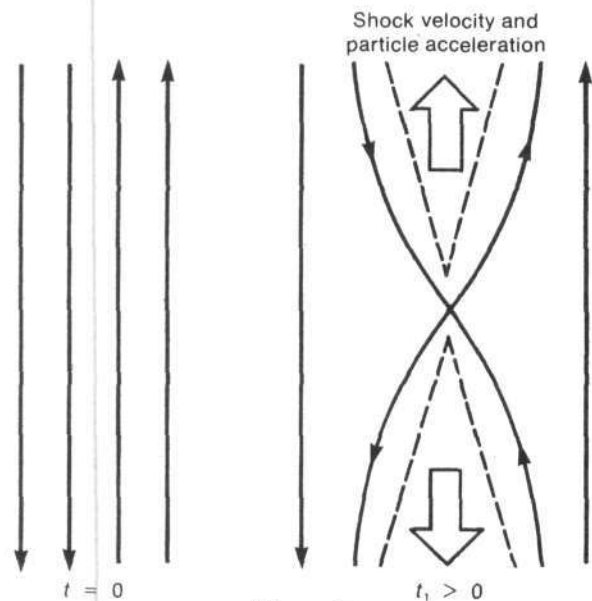


Figure 8
GEOMETRY OF RECONNECTING
MAGNETIC FIELD LINES

The configuration at left with opposing magnetic field lines is unstable. The magnetic field lines can reconnect accelerating particles as shown at right.

"PHYSICAL" SPACE		
Cascade	Appearance	Singularity in finite time
Shock wave	<p style="text-align: center;">Regular energy cascade results in formation of shock front</p>	<p>Yes, well known property of Poisson integral¹¹</p>
Vortex	<p style="text-align: center;">Inverse cascade for energy dependent on dimensionality</p>	<p>No, although see Reference 17</p>
Soliton	<p style="text-align: center;">Regular energy cascade as a result of modulational instability</p>	<p>Yes, very similar to renormalization singularity in elementary particle physics¹³</p>

"PHASE" SPACE

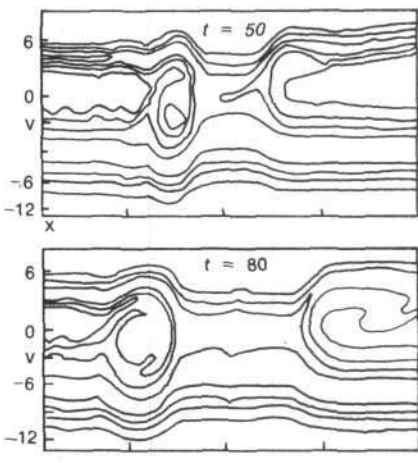
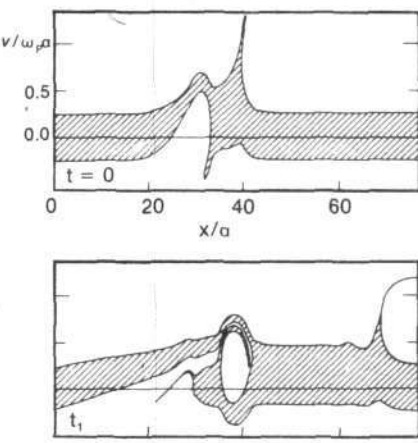
Cascade	Appearance	Singularity in finite time
<p>Seems to be inverse cascade, at least qualitatively as shown in Reference 16</p>		<p>No, well behaved</p>
<p>Probably not. When no inverse cascade then singularities develop (see Reference 17)</p>	<p>Forms shocklike structure as boundary is reached</p>	<p>Yes, as hypothesized in Reference 17</p>
<p>Inverse cascade as particles are trapped</p>		<p>Unclear</p>

Figure 9
PROPERTIES OF THE
THREE GENERAL
CLASSES OF SELF-
ORGANIZED
PHENOMENA IN
PLASMAS

Note the "duality" of the three when looked at in phase space and physical space.

physical systems supporting the phenomena.¹³ Figure 9 summarizes the spectral and cascade properties of each.

The characteristics of the vortex are almost the direct opposite: it evolves through an inverse cascade, there is no evidence of the formation of singularities, and large-scale coherent structure is formed. As long as these three phenomena are compared on this level, their only similarity is the subjective impression that they look somewhat alike.

But, suppose we look at these self-organizing structures in phase space.¹⁴ The "natural" geometry for physical problems is rarely normal space of three space dimensions and time, but, rather, a dynamically determined space, in this case made up of the spatial dimensions and a new set of dimensions consisting of the velocity of the particles in the plasma. In phase space, solitons and shock waves become vortices and a vortex looks like a shock wave!

There is a duality between the phenomena that is truly astounding—in the appropriate phase space, the soliton and shock wave not only look like vortices but, there is good evidence, form as the result of an "inverse cascade in phase space." Analogously, a vortex forms in physical space because of the development of a shock-wavelike occurrence in phase space—whether this is rigorously a shock wave remains to be proved, but there is very convincing evidence that in systems characterized by vortex formation in physical space, singularities occur in finite amounts of time in phase space and there arise small, highly concentrated regions of shock-wavelike singularities.

There are two possible explanations of the figure shown here. On the one hand, it is possible to claim that this is still coincidence, a hodge-podge of unrelated phenomena that are permanent anomalies, but anomalies nevertheless, having no systematic importance for physics. On the other hand, as I think it must be admitted, something very basic may be evidenced by these facts. There is a pervasive tendency toward ordering and at least nonentropic, if not negentropic, evolution, even in physical systems. The repeated observation of this same complex of self-ordering phenomena in plasmas is an indication of a fundamental feature of the universe—it cannot be dismissed any longer as a sequence of "anomalies."

If this latter conclusion is accepted, as I think it must be, then a very interesting antinomy arises. Suppose that the fundamental tendency in physical (or any other kind) evolution is toward states of higher internal differentiation and order. This is a perfectly coherent assumption for short periods of time, but a fundamental problem appears in the longer run—only a certain, finite amount of order can be generated within the confines of a given set of physical laws. The zero point of entropy, as is well known, is fixed and determinable. This implies that either self-ordering processes can only be local occurrences in the universe or that the laws of the universe are not fixed.

Phrased another way—if self-ordering phenomena are as pervasive as I have argued, then they imply something fundamental about the "texture" of the geometry (in a

Riemannian sense) that could support such dynamical laws; namely, that that geometry (and laws) cannot be fixed.

This is the implication of self-ordering phenomena in a plasma. As has been elaborated in other places,¹⁸ the geometry of the universe is adequately described only by a nested set of Riemannian manifolds, each characterized by a different cardinality. What we see in the case of the soliton-vortex-shock-wave complex is a footprint of the tendency for transition from one manifold to the succeeding one.

We cannot really understand, for example, the overall tendency of evolution in a nonliving system like a plasma unless we can make that evolution coherent with the broader tendency evident in matter to give birth to living systems, and living systems, in turn, to generate thinking ones. Plasma physics, even in such mundane manifestations as the problem of electron transport in a tokamak, requires our coming to grips with this problem.

Dr. Steven Bardwell, editor of the International Journal of Fusion Energy, is the FEF director of plasma physics.

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The Drug Plague



Who's Fighting It?

by Ned Rosinsky, M.D.



Drug abuse is now the number one public health problem in the United States. The vast proportions of the problem are well known to every parent, teacher, doctor, policeman, judge, and clergyman in the country. More than 20 million of the nation's youth are regular marijuana users, and as the medical research outlined in the following article by Dr. Nahas shows, these millions are in danger of a wide range of harmful effects, the most important of which is brain cell damage.

Since the 1960s, the great majority of Americans who sensed that the massive spread of drug abuse spelled the death of the next generation and of the nation have been

bombarded with media propaganda to the effect that marijuana is "harmless" and that smoking marijuana is a "victimless crime." This media campaign combined with the proliferation of drugs and the drug culture demoralized the antidrug majority into virtual silence.

The prodrug minority has been sinking millions of dollars into public relations, lobbying for the decriminalization of marijuana, cocaine, and heroin and promoting the lie that marijuana is a useful treatment for diseases such as glaucoma.

The antidrug majority, for the most part, has just watched in horror as the situation continued to get worse.

In the past few months, this situation has begun to be turned around by a group that intends to make the drug fight a leading issue in the 1980 elections—the Anti-Drug Coalition. The Coalition began in Michigan as a nonpartisan, multidenominational meeting in Detroit in December 1978, attended by 600 persons representing civic and community groups, industry, labor unions, churches, and political organizations. The difference between this and past efforts to fight drugs was its approach. The Michigan Anti-Drug Coalition went after the problem from the top down rather than the bottom up; the object was to end the international network of drug traffickers.

Today there are Anti-Drug Coalitions in several regions of the country, and the leadership of these groups has put out a call for a founding meeting of a National Anti-Drug Coalition in Detroit Sept. 29. So far, the call has been endorsed by representatives of several hundred organizations and prominent individuals (see box).

To give a sense of this fight against drugs, I'll describe some of the activities of the New York-New Jersey Anti-Drug Coalition, of which I am a board member. I'll start with a statement by Fausto Charris, the head of the FANAL, the largest peasant federation in Colombia, South America, whom the New York-New Jersey Coalition recently invited to speak at a meeting in New York City. Charris has campaigned in Colombia on a platform of "Plant Food, Not Marijuana."

Without nuclear energy drugs cannot be destroyed, because drugs are the daughter of backwardness and vice, and nuclear energy is born of the application of science. Although Colombia produces 90 percent of the marijuana imported into the United States, I can tell you that the peasants of Colombia are against marijuana cultivation. We are in favor of food production, using fertilizer, tractors, and irrigation. We are in favor of industrializing our country based on advanced science. Science is the solution to the drug problem, both in the United States and in Latin America.

Charris's statement identifies the key to ensuring that our country's youth are not destroyed by drug abuse, that they rightfully become tomorrow's scientists, educators, engineers, and skilled workers. As he noted, the fight against drugs and to develop the minds of our youth is

the same as the fight for high technology. It's a political battle in which the participants have to identify and go after the real enemy.

'Going After 'Dope, Inc.'

Although the medical effects of marijuana use are not common knowledge, the bigger scandal is that the illegal drug trade, 90 percent of which is marijuana, is one unified business organized from the top down. Its annual receipts total \$200 billion, and it interfaces with a number of outwardly respectable banks, shipping firms, and foreign policy think tanks. The New York-New Jersey Anti-Drug Coalition has as a stated objective the identification and destruction of the drug trade, the \$200 billion business, which it has dubbed "Dope Incorporated," after the 1978 book of the same name written by a U.S. Labor Party investigating team.

In a major legal victory for the Anti-Drug Coalition, the bank that the Coalition identified as the central bank for the heroin trade, the Hongkong and Shanghai Banking Corporation, was recently denied its attempt to take over the Marine Midland Bank of New York, the 13th largest bank in the United States. New York State Banking Superintendent Muriel Siebert vetoed the takeover one day after the Coalition testified at a special state hearing that had been prompted by the Coalition's charges that the HongShang bank was involved in drug running. According to the *New York Times* July 2, the HongShang is now trying to skirt the outrage of New York State banking regulators by having Marine Midland rechartered as a federal bank and then attempting the takeover again.

In addition to its lobbying around the HongShang case, the Anti-Drug Coalition has maintained a strong presence in both the New Jersey and New York legislatures leading the fight against the decriminalization of marijuana for "medicinal" purposes in New Jersey and for the recriminalization of marijuana in New York. The Coalition has also campaigned to educate parents, youth, and community groups about the dangers of marijuana, in the press, in the schools, and in open meetings. The following article by Dr. Gabriel Nahas, a renowned authority on the medical damage from marijuana use, was adapted from his speech at one of the conferences the Coalition has sponsored.

The New York-New Jersey Coalition along with other regional groups plans to present an extensive resolution on stopping international drug traffic to the United Nations General Assembly. The resolution includes several specific items, among them a proposal to subsidize development projects for Third World countries like Colombia that want to stop producing marijuana.

For more information about the Anti-Drug Coalition activities and the national meeting planned for Sept. 29 in Detroit, contact the Michigan Anti-Drug Coalition (the address is at the end of the accompanying box).

Ned Rosinsky, a practicing physician in New York City, is a member of the FEF biological sciences staff.

A Call for a National Anti-Drug Coalition

We stand confronted with a great moral crisis threatening our nation, drug abuse. And it is incumbent upon us to initiate immediate action to turn the tide on this alien, anti-progress epidemic, which if left unopposed will result in the destruction of our society's moral fabric.

We cannot stand by watching organized crime push drugs, knowing full well that its result, and its intent, is to destroy the minds of our children and our skilled workforce, and therefore, our institutions and our country.

For two decades now, our industrial economy and its supporting educational system have been systematically dismantled, in large part because of this drug menace. American labor, technicians, and scientists are being destroyed by drugs, just as our youth are. Our industrial plants and cities are shutting down, with drugs a contributing factor.

We knew, when the Michigan Anti-Drug Coalition began its efforts to bring the many organizations under one banner against drugs, that the population of this country was just waiting for leadership on this issue. Eight state coalitions sprang up immediately after the December 18, 1978 founding of the Michigan Coalition. And this readiness was not limited to Michigan or this country. Leaders from Colombia, Mexico, France, Germany, and Taiwan expressed a desire to join forces with us for a coordinated attack on the drug financiers and traffickers.

Within this context two things must be accomplished:

One, we must form a National Anti-Drug Coalition that will sweep the rest of the states into a unified machine capable of ridding our nation of this drug epidemic.

Two, we must make the penalty very high for those leaders who are either doing nothing or who

are a contributing factor to this drug epidemic. It is no exaggeration to say that many political offices, labor elections, and the integrity of our spiritual leadership will be put on the line based on what these leaders do or don't do on the drug question. Our policy must be one of an uncompromising commitment to elected officials that their reelection will depend on their stance on drugs. It is our personal commitment that even the Presidency of the United States will be determined on this drug issue.

This is one side of our task: to make drugs the hot issue in this country to the point where something is done to shut down the production and trafficking of drugs. The other side we are already doing: working with civic, religious, labor, political, educational, and community groups to provide the educational and therapeutic programs which will deal with the tragedy of drug addiction, and to provide the preventive educational programs for our youth which will lead them toward a productive and useful life.

It is with this in mind that we make this call to our local and national leaders and organizations, to place their names on the following statement:

We the undersigned, pledge to vigorously organize representatives and members of all sectors of our country to attend a founding convention in Detroit, Michigan Sept. 29, 1979 for the formation of a National Anti-Drug Coalition.

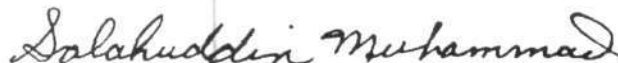
Furthermore, we call upon other leaders and organizations to sign this statement along with us as a demonstration and a determination to rally the majority of Americans against this drug epidemic.

At issue is the future of our children and of our nation.

Sincerely,



Juan Torres, President



Salahuddin Muhammad, Vice President

Michigan Anti-Drug Coalition, Inc. P.O. Box 2421 • DETROIT, MICHIGAN 48231 (313) 964-2550 • 964-2066

The Biological Effects of Marijuana

by Gabriel Nahas, M.D.



When people take drugs, they alter some basic mechanisms in their bodies that allow them to function properly and to think properly.

In a sense it's a little redundant to go through the scientific evidence that shows how marijuana is a very destructive drug, since this has been observed directly by so many people who have as much authority as a scientist to speak on drugs. But there are some people who want to have scientific proof, so here it is. I want to note, however, that all of the scientific proofs that we scientists can give to such people might not turn them toward deciding upon a behavior that is not drug-oriented. To change behavior, especially for youth, requires much more motivation than just raw, uninspiring scientific facts.

The importance of these scientific facts is, rather, that they actually allow us to immediately discard all of the extraordinary deception that has been poured upon the American public concerning the "relative harmlessness" of drugs, especially of marijuana. We have been subjected to an extraordinarily dishonest and intense barrage of drug information that says marijuana is just a harmless weed that may even be very useful for many conditions.

This is a lot of nonsense, and there is now scientific evidence to prove it.

There is also a lot of talk claiming that marijuana has a therapeutic effect in cases of asthma, vomiting from anti-cancer drugs, and in the treatment of glaucoma. Although intake of marijuana may have such therapeutic properties, all of these properties are associated with the very serious, deleterious side effects I describe below. Furthermore, there are more specific, more efficient drugs without the dangerous side effects of marijuana that can be used with a much greater rate of success. So the talk that marijuana is an effective medical treatment is just as much nonsense as the talk that says marijuana is harmless.

10 Years of Research

It took 10 years of intensive study to prove what people already knew; namely, that marijuana is destructive. These years have been very interesting, because they have shown how much knowledge we have and how well, using such knowledge, we can relatively rapidly determine what a substance can do to the body—in other words, to go to the very basis of the action of marijuana.

Marijuana is a plant that is known in technical terms as

Cannabis sativa. There are two different varieties. One is the fiber type with which ropes and fibers are made, and this has been cultivated in the West for a long time. Even George Washington had some hemp plants on his plantation, like many other colonists, because he had to make ropes. Since the advent of synthetic fibers, this variety is not cultivated very much.

The second variety, the drug type of marijuana, is cultivated mostly in the semitropical areas of the world, in a belt that spans Colombia, Mexico, Morocco, the foot of the Himalayas, Lebanon, and so forth. This drug type contains in its leaves and flowering tops certain active substances that when smoked, inhaled, or even eaten will give an intoxication or high.

The first series of studies on the marijuana drug began about 10 years ago after chemists were finally able to isolate the different substances in marijuana. This was a difficult task because these substances, such as THC, are present in very small amounts, a few milligrams or so per marijuana cigarette. This immediately implies one important thing—that marijuana is a very powerful drug, because very small amounts of its chemical substances like THC produce intoxication.

There is no question that marijuana is *not* just a mild intoxicant; it is a very potent drug that in small amounts—milligrams, thousandths of an ounce—can have profound physiological effects.

Cannabinoid Effect on Cell Division

I began to study these effects in my laboratory at Columbia University about 10 years ago, because as a pharmacologist I had an interest in the way the drug acts on the very basis of life, the cells. In my early experiments I was able to show that the substances extracted from marijuana, the cannabinoids, slow down cell division and prevent the formation of DNA, the genetic material, and certain other nucleic acids contained in the cell, substances that are essential for the division of the cell and for the expression of specific cell functions.

When I reported these scientific results, it created a furor. At the time I was attacked by the promarijuana lobby just because I said that marijuana users should be very careful because marijuana substances in very small amounts, millionths of a gram, will slow down cell division, which might be a very serious matter for future generations, for the users' offspring.

"How can you say that; you don't know," was the chorus from the marijuana lobby. Of course, I didn't know, but it was obvious that a substance that attacked the heart of life could have some damaging effect on growing cells, the cells of the embryo. The funny thing was that everybody admitted the danger to offspring for all other drugs that slow down cell division or affect DNA, but apparently marijuana was in a privileged position. It was supposed to give you a high with no harm, and scientific facts were apparently irrelevant.

This opposition did not prevent me from going ahead and doing more research, and I was especially pleased to see that many other scientists throughout the world began to find exactly the same thing I had found in their own studies.

Cumulative Effect

One of the things that caused us great concern at the time was the realization that the substances in marijuana remain in the body for a very long time. Although alcohol is harmful, it is excreted by the body very quickly; it takes about six hours for a couple of drinks to be completely eliminated. It takes 30 days, however, for a single dose of marijuana to be eliminated. The half-life of marijuana, the time it takes half of the dose to be eliminated, is one week, which means that it takes seven days for 50 percent of a single dose to be eliminated.

The relevance of these facts is that people who smoke marijuana several times a week or daily are actually storing in their bodies all those substances that might be doing harmful things to their cells.

Further Experimental Results

Let's look at some more of the experimental results. The first area of the body affected when one smokes marijuana is the lung, because it is the point of entry. We have now scientifically proved that the very high concentration of marijuana substances in the lung is damaging. Although everyone had known this from experience with patients, now we have the objective data.

The first people working on this problem were scientists, clinicians, studying in Boston and Los Angeles. The subjects were young men who were brought into the hospital and paid \$20 or \$30 dollars a day to smoke marijuana. After a few days, the young men were asked to blow into machines to show what their pulmonary function (measures power of lungs to inhale and exhale) was. It wasn't good. The men could still breathe well, but quantitative measurements showed that their lung vital capacity had fallen to 70 or 80 percent of critical normal. Furthermore, special X-rays taken with radio-opaque material showed that signs of obstructive lung disease were developing.

Long-Term Damage

Although all of this research has been published, we are still working on the problem to determine the extent of the damage to the lung in the long run—with people who keep smoking for 20 to 25 years. Remember, it took 60 years to prove that heavy tobacco smoking was related to cancer of the lung and heart disease. When I was going

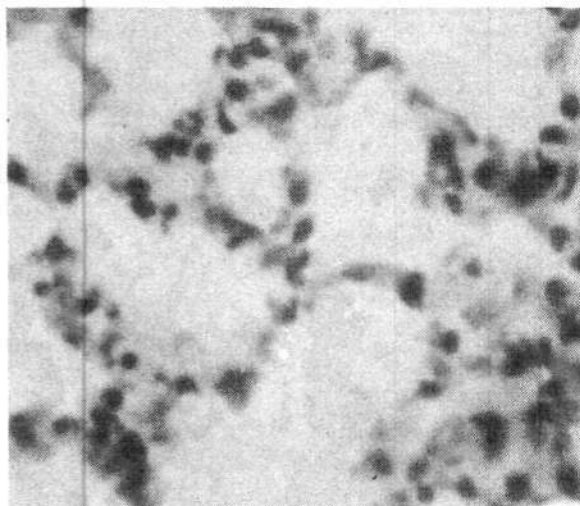


Figure 1
NORMAL RAT LUNG

Shown is a microscopic section of lung tissue. The large open spaces are air sacs, which are surrounded by capillary networks. Oxygen diffuses from the air space into the blood, while carbon dioxide diffuses from the blood vessels into the air sacs.

Source: Harris Rosenkrantz and Robert W. Fleischman.

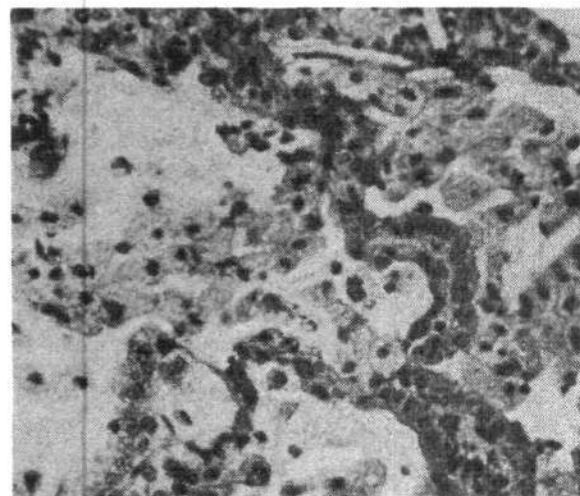


Figure 2
RAT LUNG AFTER SIX MONTHS
OF MARIJUANA SMOKE TREATMENT

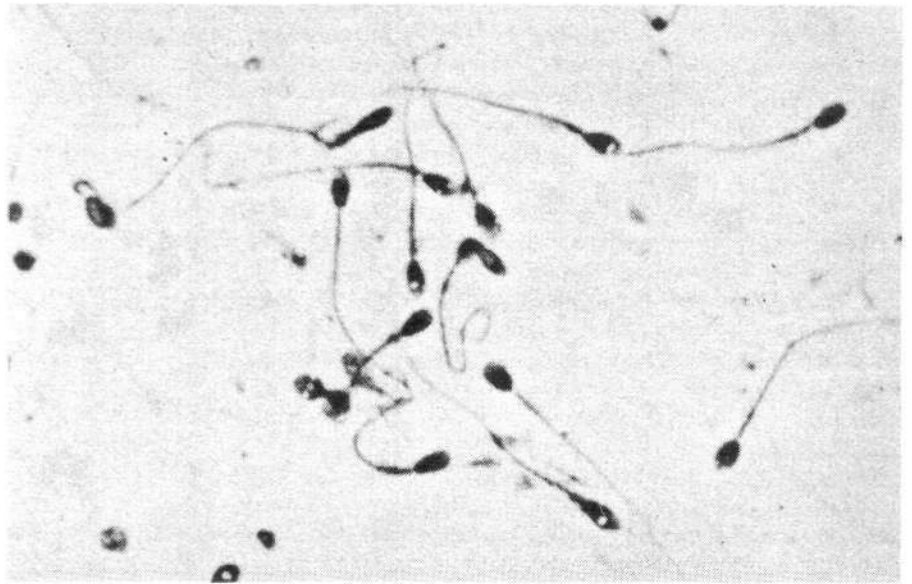
There are marked changes from the normal appearance after one year of exposure to moderate amounts of marijuana smoke. The open air spaces, or air sacs, seen in Figure 1 have been filled with various deposits, decreasing the functional capacity of the lung.

Source: Robert W. Fleischman, John R. Baker, and Harris Rosenkrantz, *Toxicology and Applied Pharmacology*, No. 47 (1979), p. 562.

Figure 3
NORMAL HUMAN SPERM CELLS

Note the normal components of the sperm cells, including the oval-shaped head, the protective acrosome at the front of the head, and the long flagellum used for locomotion.

Source: W. Hembree, J. Huang, G. Nahas, *Bull. Acad. Nat. Med.*, No. 9 (Dec. 1977), p. 639.



to medical school, there was still a great debate on this question of whether it was good, bad, or indifferent to smoke cigarettes—a debate that was settled only after millions of people got lung cancer. And the short-term effects of marijuana are some 30 times worse than cigarettes. Think what this may mean in 30 years for the millions of youth smoking marijuana now.

What the long-term effects in man will be are suggested by animal models, such as the rat. If you subject the rat to marijuana smoke for a year, it is the equivalent to about 20 years in man because a rat lives only for three years, one-twentieth the lifespan of man. This technique with rats has let us observe the formation of irreversible changes in tissues after long-term marijuana smoking—scientific proof of damage.

To demonstrate some of these effects, look at the normal microscopic structure of a normal lung shown in Figure 1; the open areas are air sacs, which are surrounded by blood vessels. The air enters these air sacs, where oxygen and carbon dioxide gas exchange between the blood vessels and the air in the air sacs. The dark spots are immune cells, which are there to defend the lung against bacterial infection. The scientific evidence shows that marijuana reduces and destroys these cells, much more than tobacco smoke does.

Figure 2 shows a section of the lung from a rat that was exposed to marijuana smoke for six months. You can see the destructive changes, appearing as deposits in the air sacs. About 15 to 20 percent of the lung is like this, which indicates that this animal has lost about 15 to 20 percent of its lung capacity from the marijuana.

Male Reproductive Damage

Even more serious is the effect of marijuana on the reproductive function. The first studies on this effect in man were done at Columbia University, where I worked

with Dr. Hembree and his associates, who are specialists in reproductive function. We focused on this area because our prior observation had shown that marijuana products in test tubes slowed down cell division. A great amount of cell division occurs in the testes, in the formation of sperm cells, at an extraordinary rate, averaging hundreds of millions of cells a day.

In these experiments, we gave a number of young men marijuana under controlled conditions. We saw in these subjects not only a marked decrease in the formation of sperm, but also—and this came as a surprise to us—a marked increase in the abnormal forms of sperm.

Again this raised the question I asked myself 10 years ago when I first saw in test tubes that DNA was altered by marijuana: what about the offspring of steady marijuana users?

What we saw were human germ cells made profoundly abnormal by the use of marijuana. Figure 3 shows normal sperm cells. Notice the oval-shaped appearance of the head. The head contains the genetic material, the DNA (very dark area in figure). It is protected by the rounded area covering the front of the head, called the acrosome. You can also see the long tail or flagella, with which the sperm swims. These cells are samples from a tobacco smoker, about 22 years old.

Figure 4 shows the extraordinary abnormality in the sperm cells of a marijuana smoker. You can see this abnormality in the shape of the head, which in many cases has lost the protective shield, the acrosome, and which has lost its oval shape. There are also some very abnormal cells with deformed nuclei, which indicates that there are immature forms present. This evidence indicates the profound changes that marijuana can produce in those cells that are essential for the preservation and transmission of our genetic heritage. There is no question about this abnormality caused by marijuana.

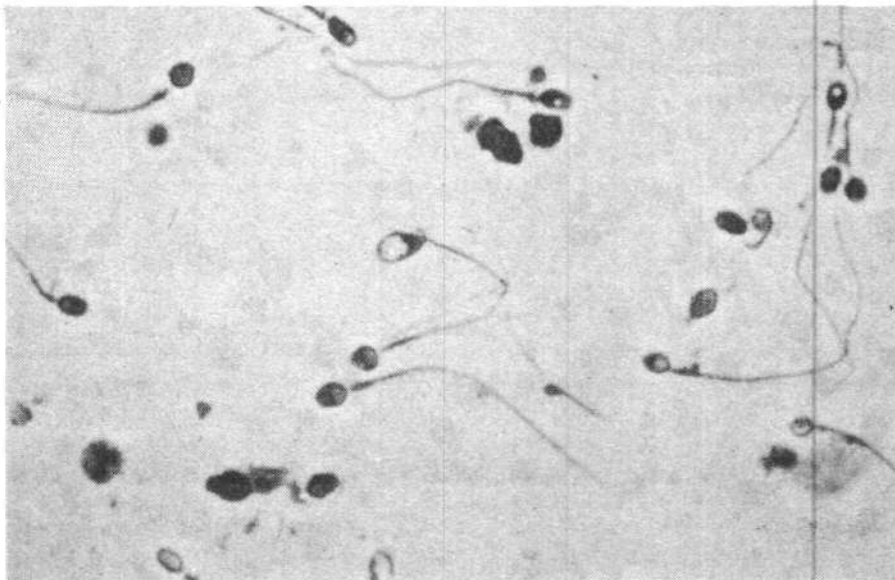


Figure 4
SPERMS CELLS OF A HUMAN MARIJUANA SMOKER

There is a large proportion of abnormal forms, including abnormal shape of the head, loss of the acrosome, absence of head, and others.

Source: W. Hembree, J. Huang, G. Nahas, *Bull. Acad. Nat. Med.*, No. 9 (Dec. 1977), p. 639.

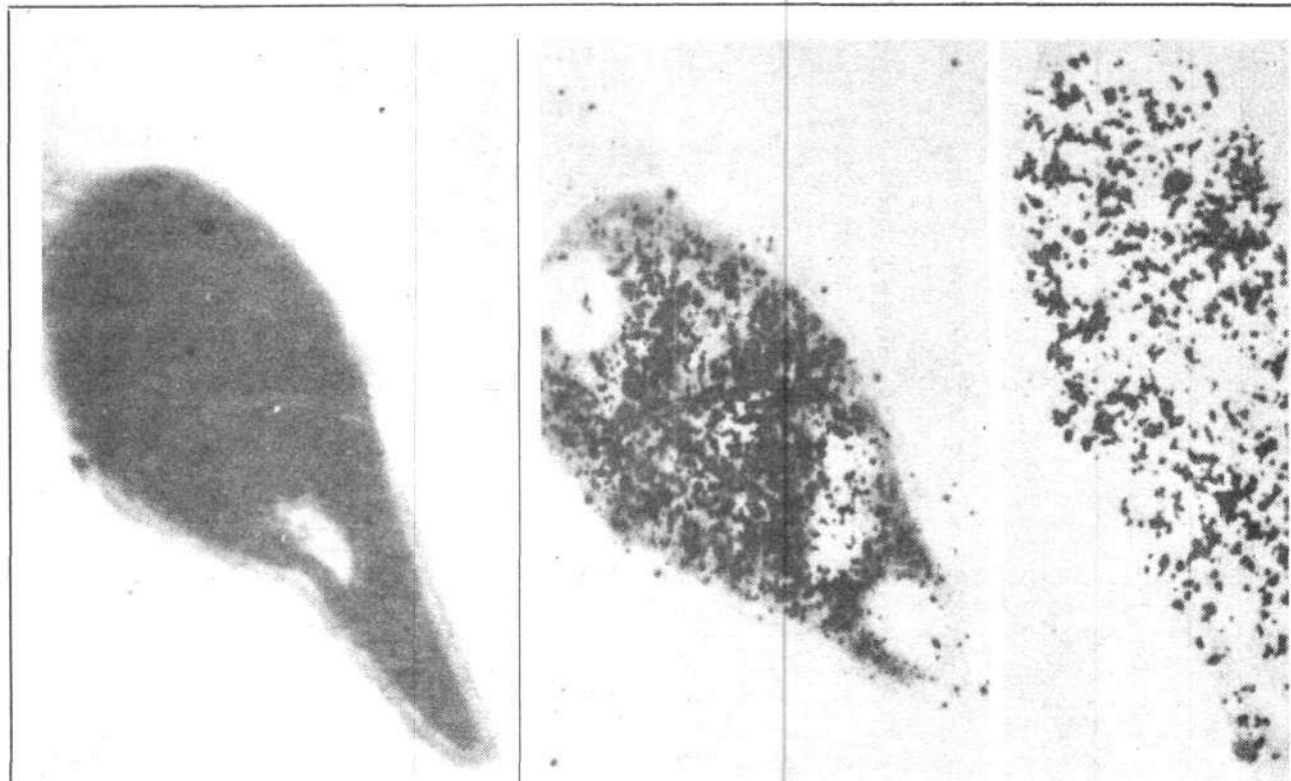
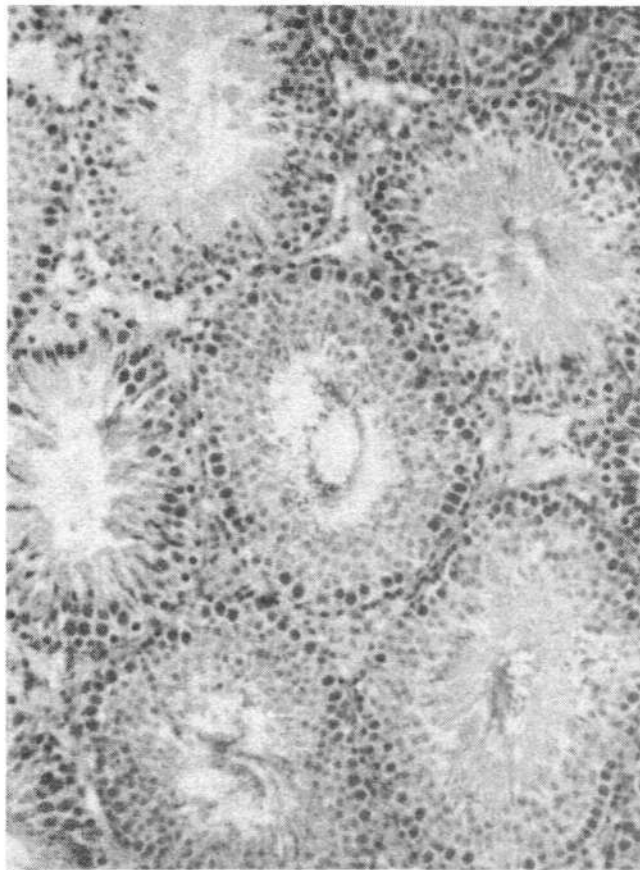


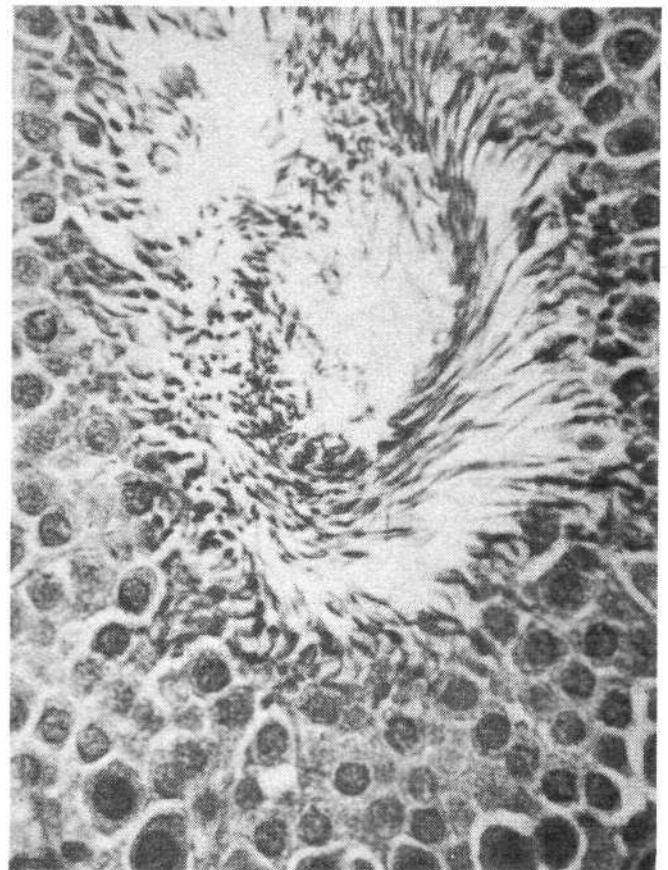
Figure 5
SPERM CELLS FROM A HUMAN HASHISH SMOKER COMPARED TO A NONSMOKER

In this high-power micrograph of sperm cell heads, a sperm cell from a nonsmoker is on the left; sperm from a hashish smoker are on the right. Note the absence of dark staining material in the sperm from the hashish smoker. In this preparation, the stain is evidence of protein and genetic material, thus showing the severe changes in these substances in the hashish smoker's sperm

Source: Drs. C.N. Stefanis and M. Issidorides, in *Marijuana: Chemistry, Biochemistry and Cellular Effects*, Nahas et al. eds., New York: Springer Verlag, 1976.



(a)



(b)

Figure 6
NORMAL RAT TESTIS

In (a), the photomicrograph shows several subdivisions of the normal rat testis. Each subdivision is lined with cells that divide at a high rate to form large numbers of sperm cells. These sperm cells accumulate in the center of each subdivision. In (b), one of the subdivisions is shown at a higher power of magnification. An accumulation of sperm cells is in the center.

Source: Harris Rosenkrantz and David W. Hayden, *Toxicology and Applied Pharmacology*, No. 48 (1979), p. 380.

Just as an aside, I want to note that I reported these studies two years ago and they are all in the medical journals, but we are still waiting for them to be reported in the *New York Times*.

Figure 5 shows some more results of marijuana use on human sperm. The experiment was carried out by a Greek group studying chronic hashish users, and it duplicated the study we did at Columbia. You can see the sperm cells of the users on the right; they are very spotty compared with the dense material shown on the left, which is in a sperm cell from a control subject who does not smoke marijuana.

We were very pleased when we saw that this Greek study got results identical to ours. It shows that there must be something in marijuana smoke or hashish smoke that destroys man's germ cells—precisely what we were able to document with the studies we did on rats.

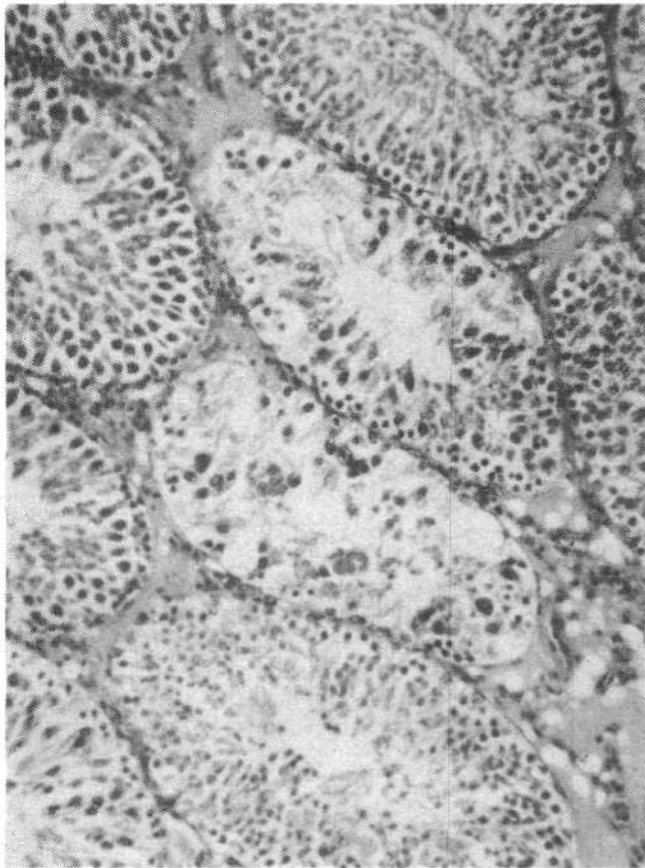
This material on how marijuana affects male reproduc-

tion is very solid, and now we are beginning to discover the effect of marijuana on female reproductive function. It is curious to note that in Oriental cultures (which I know well because I have visited there and I was born in Egypt) the men smoke marijuana or hashish, as it is called, but there is a social taboo for women to use it. Perhaps we will understand better why this taboo exists now that we have some results for the studies performed over the past two years on the effect of marijuana on female reproduction function.

The THC Question

Another question we investigated is what particular chemicals in marijuana produce these effects. Is it the THC, the intoxicating material that is supposed to be so innocuous? You can't answer these questions completely by doing studies in man because you cannot do certain studies on man that you can do on rats.

This is what we did to resolve this question. We took



(a)



(b)

Figure 7**TESTIS OF RAT AFTER TREATMENT WITH THC FOR 60 DAYS**

There is nearly a complete disappearance of the sperm cells after moderate exposure of the animal to the marijuana substance THC. The magnification of (a) and (b) is the same here as in Figure 6 (a) and (b).

Source: Harris Rosenkrantz and David W. Hayden, *Toxicology and Applied Pharmacology*, No. 48 (1979), p. 379.

some male rats and injected them with THC in doses that corresponded to the doses the human subjects were taking. After 60 or 90 days of this, the animals were sacrificed, and we removed their testes in order to examine their microscopic structure. The results indicate the same kind of destruction shown in the experiments with humans and we have published this in the medical literature. These results have not been reported yet in the newspapers, but when they are, there will be a hullabaloo, and I hope that some heads will fall.

Figure 6 shows a small section of the testis taken from a normal rat. You can see the beauty of nature, which is able to produce these millions of cells daily, shown here as the dark rounded cells that are on the periphery.

Figure 7 shows the testes of an animal that was treated for 60 days with THC. This rat could still run around in his cage, but he had marked alterations in his testes—a complete disappearance of sperm cells.

The next question a scientist asks himself is what causes these changes? Is it a marijuana product that goes into the cell and prevents it from dividing, or might it be due—and this is a much more interesting question—to something that goes on in the brain?

The reason we ask this question is that we know the brain produces certain chemicals that control the reproductive organs. In fact, we have found that those changes you can see in the testes are not only due to the fact that the substances in marijuana act on the testes but also to the fact that THC changes the chemical substances produced by the brain that control the various aspects of testicular function.

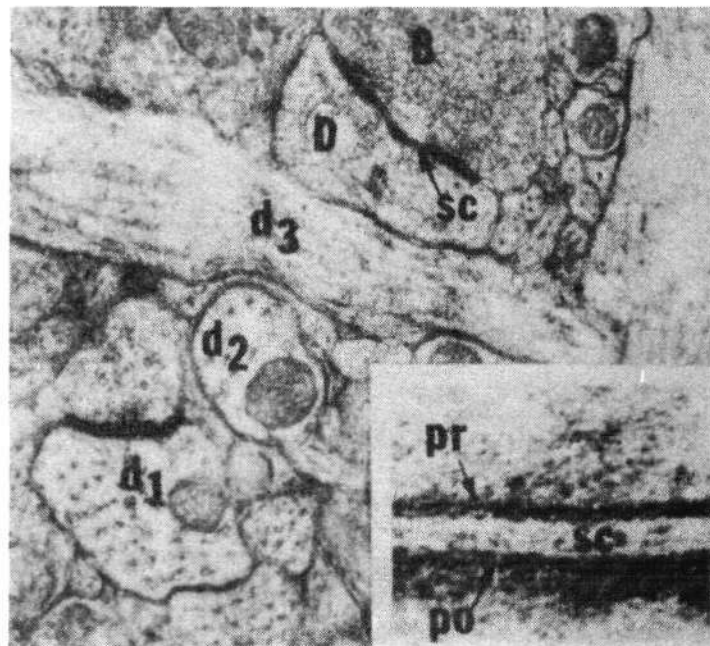
The Brain and Female Reproduction

The disturbances caused by marijuana in the way the brain controls sexual function have been clearly illustrated by studies in women as well as in primates. Most of the studies of female reproductive function were done with

Figure 8
NORMAL BRAIN CELLS IN THE RHESUS MONKEY

Normal Rhesus monkey brain tissue is magnified here using the electron microscope to 30,000 times original size. The black area between B and D is the synaptic cleft (SC), the communication space between two adjacent nerve cells across which the neural impulses must travel for the cells to function normally. The inset shows the synaptic cleft at higher magnification (80,000 times).

Source: Jon W. Harper, Robert G. Heath, and William A. Myers, *J. of Neuroscience Research*, 3 (1977), p. 89.



primates. When scientists attempted to study the effects of marijuana on women, they ran into some opposition from the U.S. Food and Drug Administration, which claimed that there was evidence that the offspring of animals which were subjected to marijuana were abnormal or that there was an increase in abortions and neonatal deaths. Therefore, the FDA decided that young women should not be allowed to smoke marijuana in medical experiments.

As a result, the initial studies on the female reproductive function were performed on Rhesus monkeys, which have almost exactly the same physiological menstrual cycle as women. These studies were performed by Dr. Carol Smith, who showed that a single injection of THC into a primate will change the production of the brain hormones controlling the ovary.

What this means can be seen by considering the reproductive function in the female. The sexual reproductive organs, the ovary and the uterus, are closely controlled by the pituitary, the master gland located in the part of the brain called the hypothalamus. There are two main areas of the brain, the evolutionarily new brain area, or neocortex, and the old brain, or paleocortex. These correspond to very different anatomical and functional activities.

The hypothalamus is at the base of the brain in the paleocortex, and it is an area that is necessary for all of the various activities related to physiological preservation, such as temperature regulation, and for reproduction. This control mechanism gives signals in the form of certain chemicals to the master gland, the pituitary, which then secretes substances called FSH and LH. FSH and LH regulate the menstrual cycle, and their concentrations in the

blood vary with different phases of the female reproductive cycle.

Dr. Smith showed that a single injection of THC, which acts on the hypothalamus and which produces there a concentration of a billionth of a gram percent, will change the secretion of FSH and LH and, in turn, alter the reproductive cycle. This has also been shown recently in a group of young women studied at the well-known Masters and Johnson Institute in St. Louis.

The most important aspect of this alteration in the menstrual cycle is that the level of these hormones in the blood in the vicinity of the ovary is essential for the proper maturation of the egg, and if the cycle is disturbed—that is, if these hormones are changed too often during the cycle—there will be no maturation or an abnormal maturation of the ovum.

Embryotoxicity

What does this alteration in the female menstrual cycle mean for the future offspring? It is foreboding. Other experiments have shown that primates which were subjected to daily administration of THC had a marked increase of loss of conception. In the group of monkeys on which this experiment was performed in Davis, California, loss of the embryo in the control monkeys (those who were not subjected to marijuana) was about 8 percent.

The group of animals who took THC daily, however, had a 40 percent occurrence of neonatal and perinatal deaths and abortions. Furthermore, the male offspring of the treated animals were hypotrophic, that is, inadequate in their growth, and had abnormal behavior.

The Davis scientists concluded that THC and marijuana are embryotoxic, meaning that they kill the embryo, the fetus. This seems to occur through the pituitary by dis-

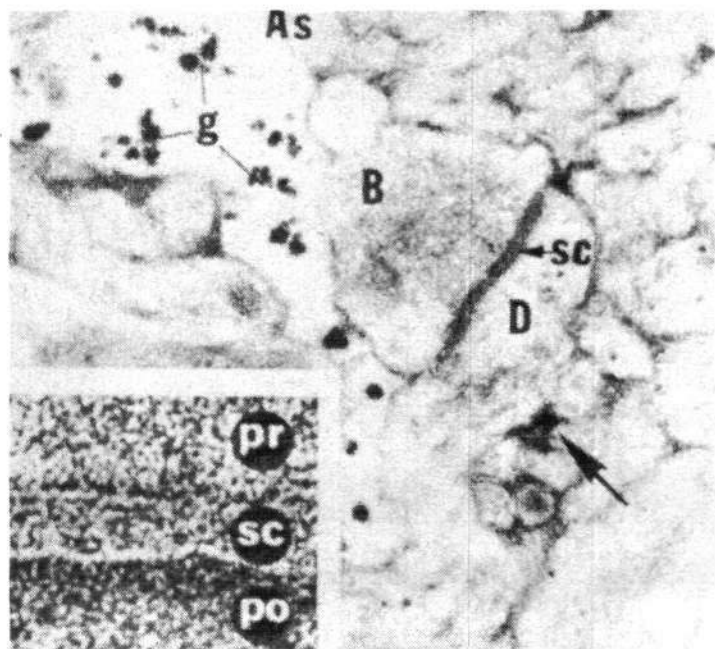


Figure 9
BRAIN CELLS OF THE RHESUS MONKEY
AFTER THE ANIMAL WAS TREATED
WITH MARIJUANA

In these animals the size of the synaptic cleft (magnified 30,000 times) is pathologically widened by an average of 25 percent. This change is associated in the animals with abnormal electrical activity of the cells. The inset, magnified 80,000 times, shows the widening of the synaptic cleft (SC), as well as an accumulation of unidentified dark material in the cleft space.

Animals treated with moderate amounts of marijuana for six months and then kept free of the drug for nine months still showed this evidence of brain damage. This specific type of damage is seen in several other conditions: brain poisoning with such agents as carbon tetrachloride and severe vitamin B deficiency that results in psychosis.

Source: Jon W. Harper, Robert G. Heath, and William A. Myers, *J. of Neuroscience Research*, 3 (1977), p. 90.

turbing the hormonal balance that is important for maintaining the pregnancy; in turn, this hormonal change disturbs the blood supply to the fetus, the fetal-placental circulation.

The story is now clear from a scientific viewpoint. Young women who want children should not smoke marijuana. Smoking even a couple of times a week will perturb the cycle and the maturation of the ovum.

Brain Damage

The most important damaging effect of marijuana is directly on the brain cells. The drug acts primarily on the evolutionarily old structures of the brain, the limbic system, which is associated with short-term memory, certain aspects of emotions, and attention span.

Dr. Robert Heath at Tulane University in New Orleans has shown that moderate amounts of marijuana in Rhesus monkeys damages this area of the brain on the cellular level (Figures 8 and 9). Monkeys given the equivalent for their weight of one joint per day, five days a week for three months, developed unmistakable evidence of brain damage. This damage was observed as cellular changes under the electron microscope. Specifically, the synapse or communication space between adjacent cells, the area across which the nerve impulses must be transmitted, was pathologically widened. This effect has been observed otherwise only in cases of brain poisoning with agents like carbon tetrachloride and in cases of severe vitamin B deficiency associated with psychosis. Several other pathological changes in these cells were also noted, including clumping of the chemical neurotransmitter substances.

Even more disturbing, Dr. Heath found that in monkeys taken off the marijuana for periods of up to nine months, the changes did not revert to normal. These studies are

available in any medical library, published in the *Journal of Neuroscience Research* in 1977 and 1979. They have never been challenged. Yet the mass media has never publicized this evidence of marijuana causing brain damage, and most practicing doctors are not even aware that such studies exist.

The case that marijuana is dangerous has been proven, as this brief review of the scientific evidence shows. Our laboratory and dozens of others around the world are continuing the effort to elaborate on what we see as just the tip of the iceberg. We are continuing this crucial area of research because it affects many millions of today's youth—and our future generations.

A preeminent authority in the narcotics field, Gabriel Nahas is Research Professor of Anesthesiology at the Columbia University College of Physicians and Surgeons in New York City and Special Advisor to the United Nations Commission on Narcotics. This article is adapted from his speech at the April 12 conference of the New York-New Jersey Anti-Drug Coalition in New York City.

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Ending the Delphi Project

An Open Letter to Readers from
Dr. Morris Levitt, Editor-in-Chief

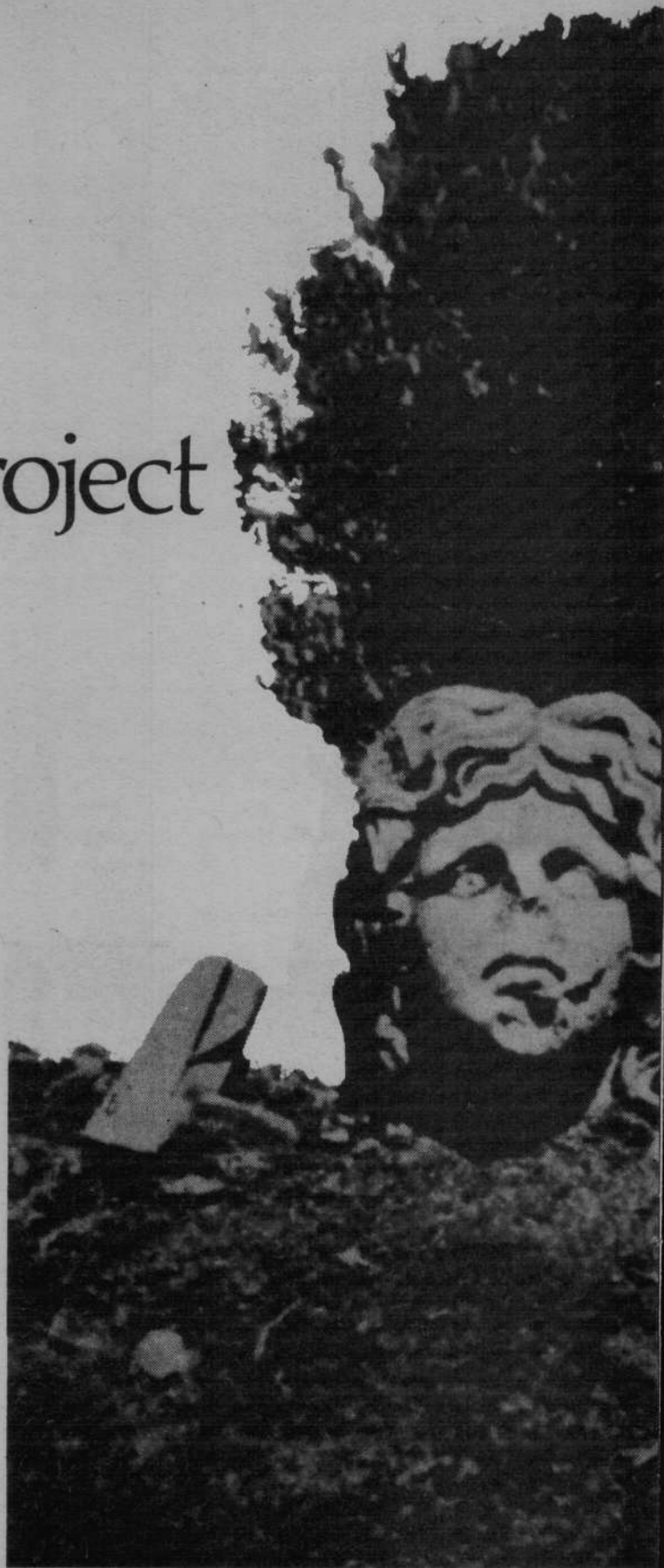
I AM TAKING an unusual step of writing a public memorandum directly to readers in order to alert you to a series of important articles now being assembled by the Fusion Energy Foundation staff. This series will expose in detail the entire gamut of operations that aims to control and contain real science by putting forward fraudulent "proscience" operations. I am presenting a summary overview of the situation here in order to speed up the process of exposure and the implementation of effective counter-measures.

The problem we must deal with is an old one. It can be traced back many thousands of years, but it appears in clear, documentable form in the expulsion of Aristotle from Plato's Academy.

Aristotle's banishment resulted from more than just his treasonous activity on behalf of the Persian Empire and its Greek allies against Alexander the Great. His real crime was his anti-Platonic epistemology.¹ While Plato represented city-building, republicanism, and the method of "the higher hypothesis" (Reason), Aristotle stood for Malthusianism, oligarchy, and the sense-certainty method of "logic." Nonetheless, Aristotelian agents throughout the ages have attempted to subvert Platonism and the great line of Neoplatonic thinkers from Roger Bacon and Avicenna through Cusanus to Leibniz and Riemann by pretending that Platonism and Aristotelianism are somehow complementary.

As a result, today's scientists, engineers, industrialists, and the public in general have no sense of discrimination between these two totally opposed traditions. To that

This colossal marble head of Apollo was found at Patara in Lycea, thought to be the site of the oracle that Herodotus compared to the Egyptian Thebes in Babylon.





extent, they tolerate ideas and movements they otherwise know to be evil, such as environmentalism, or they permit the enemy to set up shop right in their midst because of some seemingly attractive camouflage.

Both the historical and the more modern aspects of this problem have been treated in earlier pieces in *Fusion*, including Carol White's open letter to Soviet Academician Basov on the Bacon-Newton problem (July) and Mary Gilbertson's article on the Rand Corporation's Delphi Project (May). Now it is time to expose the origins of ongoing Delphi operations in order to inoculate the scientific community and to destroy the influence of the Delphic enemies of science once and for all.

It is important to remember that the Rand Delphi project was named after the oracle at Delphi, which was used by the Persians to "predict" certain events and the outcomes of intended actions in order to influence the gullied citizens who visited the oracle for divine advice. Delphic science operations imitate the real thing, but today's Delphi controllers, like the Persians, guarantee that the outcome of these operations will further their own political aims.

Delphi and Sci Fi

The Gilbertson article asked readers, "Have you been Delphied?"—a reference to the Rand Corporation technique of manipulating a bureaucratic "consensus" within science and industry to slow down necessary rates of scientific achievements and to destroy creativity.

Now we ask with equal importance, "Have you been *Omnied*?" That is, have you been manipulated into a "science fiction" view that defines scientific progress as discrete areas of science disembodied from the central political questions of economic development and epistemology? If so, then you've been had by *Omni* and the gaggle of other pseudoscience magazines on the market.

Looking at a few of these magazines is a good way to begin to understand the larger operation behind them. The first question to ask, of course, is why there are so many new "science" magazines all of a sudden? (In addition to *Omni* and the *New York Times* weekly science section, the publishers of *Science*, *Time*, and the Hearst chain have all announced that they are sponsoring new "popular" science magazines.) There are three pieces of evidence to consider:

First unfortunately, there is no general upsurge of interest in science or in national policies of commitment to scientific achievement or scientific education. Since at least the mid-1960s, the trend has been quite obviously the opposite.

Second, there are bonafide large-circulation magazines in existence that cover basic developments in science for nonspecialists. Although *Scientific American* and *Science News* do not exactly qualify as great scientific journals, they do provide information judged as adequate by prevailing standards.

Third, there are numerous existing journals that promote a vicious Malthusian-Aristotelian line on science,

ranging from *Science*, *Natural History*, and the *Smithsonian*, to the hard-core British *New Scientist*, *Nature*, and the *Bulletin of Atomic Scientists*.

So why this bunch of new "popular" science magazines? The answer is that none of the existing publications has been effective in using the Delphi method to cast a containment net around *Fusion* magazine, and *Fusion* has been successful in reawakening a combative spirit in the scientific and industrial communities. This failure of the Delphi operation against *Fusion* is viewed as a major threat by the leaders of the financial centers of London and New York who are attempting to impose a neo-Malthusian model on the world today. (An article next month on The Council on Foreign Relations' 1980s Project will detail who these neo-Malthusians are.)

I have been told directly by a British science fiction writer and computer specialist who is close to *Omni* that that publication sees itself as doing what the FEF and *Fusion* do—but "by different means." According to this *Omni* view, only a minority of the FEF's constituency has the qualities required to assimilate from an advanced standpoint the theoretical conceptions, epistemology, republican history, political economy, and analysis of today's science and energy issues that the FEF and *Fusion* magazine represents. *Omni* thinks it can "excite" interest in science and in the fight against restrictions on science among much larger circles by appealing to simpler emotions and satiating readers with simple facts.

So what are *Omni* and its new competitors peddling? Nothing but the same old H.G. Wells formula, devised 50 years ago explicitly to put a leash on scientific breakthroughs. That is, utopian little projects and colonies in space à la Buckminster Fuller and the futurist L-5 movement, with a sprinkling of straight factual reports on fusion and other research to give a gloss of scientific credibility.

The suspicion of readers that publishers of science fiction intend to promote science as pornographic is fully confirmed by the fact that *Omni* is published by *Penthouse*, a top porno magazine run by a London-based company. And the suspicion that *Omni*'s slickness is related to the drug counterculture is confirmed by the fact that its artwork is often the product of the art director of *Rolling Stone*, a leading drug magazine.

In fact, *Omni* is the paradigm for the truth behind the facade of the new science wave. Porn culture, drugs, and sci fi are the exact formula devised by British Intelligence in the 1920s to replace generalized scientific progress with the "New Dark Ages" concept of intelligence agents Bertrand Russell and H.G. Wells. In future articles we will completely document the specifics of this intelligence operation and its spin-offs down to the present. And we will let the words of the Wells faction speak for themselves in telling why this faction prefers the hardships of the Dark Ages to the benefits of progress.

This New Dark Ages analysis also provides the framework for understanding what the more respectable *Science 80*, the popular magazine planned by *Science*, and the *New York Times* science section are all about.



Science magazine and its parent group, the American Association for the Advancement of Science, have been Dark Ages conduits since at least the time when Philip Abelson became editor of the magazine and Margaret Mead took control of the association.

Abelson comes from that British Intelligence outpost in Washington, D.C. known as the Carnegie Institution. He openly supports the antiscience energy policy of using "biomass" energy sources—in other words, literally returning to Dark Ages technology. Although it maintains nominal connections with important research centers, under Abelson's direction *Science* has supported every proposal for dismantling mission-oriented and basic science in the United States in the name of appropriate technology.

The now deceased Margaret Mead, as *Fusion* will document, became a cult expert for British Intelligence directly in charge of subverting American culture and science. Mead's role extended well beyond her perversion of anthropology with the doctrine of "cultural relativism," the glorification of tribalism. She and her husband, Gregory Bateson, along with the perverted Aldous Huxley, were directly involved in carrying out the British Intelligence-CIA project called MK-Ultra that purposely introduced LSD and other mind-killing drugs on a massive scale in the United States in order to monitor their effects over time.

The SAFE Affair

In addition to the plethora of new magazines, the corporate element of the Wells and Russell networks at the so-called Nuclear Club of Wall Street have set up a



"Popular" science magazines: Promoting the lie that environmentalism and science fiction are real science.

little anti-FEF operation through one of their junior partners, the Slaner Foundation. Slaner is behind the new Society to Advance Fusion Energy, conspicuously called SAFE, whose Delphic *raison d'être* is to oppose the FEF and to promote fusion as a safe alternative to fission. We document below the pedigree of this whole nest.

The Nuclear Club of Wall Street operation is itself an offshoot of the organized subversion operation against the high-technology-oriented United States that grew out of the 1920s and 1930s Wells antiscience operations run by British Intelligence. The more recent subversive activities were launched during World War II and immediately afterward by none other than Sir William Stephenson (The man called "Intrepid"), the head of the British North American intelligence operation who was headquartered in Rockefeller Center during the war.

Stephenson's work involved several British Intelligence suboperations including the Rand Delphi project; parapsychology promotion for the purposes of subverting U.S. and Soviet science; deployment of Canadian, Israeli, and Zionist financier scientific intelligence; creation of environmentalist foundations; control of science classification along the model of the British secret military center at Aldermaston; and a spate of Rand, Naval Intelligence, and MK-Ultra operations. These operations intersected the already accomplished domination of all the scientific disciplines by academics groomed by British Intelligence in the Aristotelian-Malthusian tradition. Like Newton, these "scientists" promoted the kind of science that does not need or use hypotheses.

These operations, combined with Energy Secretary James Schlesinger's inside wrecking crew, would have

swept the field of any serious opposition—if not for the scientific work of the FEF and its intellectual founder, Lyndon H. LaRouche, Jr. Instead, the FEF and *Fusion* magazine have become recognized in leading scientific circles as intellectually hegemonic in all basic areas of science, from physics and biology to economics. Worse yet, from our enemies' standpoint, our many friends are beginning to actively assimilate and use our method.

The slick new pseudoscience publications, as well as the environmentalist-oriented SAFE operations, will try again to financially and politically contain and then destroy the FEF by intensifying their Delphic "noise" and the anti-FEF slanders to which our constituency is subjected.

But two things are going to combine to defeat these efforts. You, our readers, are going to continue to become more and more intelligent as you comprehend the method of Reason, and you will support us even more enthusiastically and with more resources than in the past. In this manner, *Fusion* will continue to reach more and more Americans who thirst for our material and who want to really understand the frontiers of fusion science as well as the story of who is trying to hold the nation back from the necessary scientific breakthroughs, and why.

Of course, if you give up the fight, we can still lose, with all the horrors that means. But if you pursue it under our leadership we will be in a commanding position to win. Then the battle will be fought on the field of scientific ideas, which is *our* terrain.

Notes

1. For the Aristotle story, see Criton Zoakos's article "Aristotle, Political Warfare, and Classical Studies," in *The Campaigner*, Sept.-Oct. 1978, pp. 43-73.

SAFE: A Delphi Case Study



One of the most important Delphi operations since World War II has been the control of nuclear technology. It is essential in understanding how Delphi works to know that the essence of the Delphi principle is to control all sides in any political situation. Thus, as we have documented, both the antinuclear groups as well as most of the institutions of the nuclear industry itself are subject to top-down control by the same political and financial grouping.

As a result of the political impact of the Fusion Energy Foundation, this Delphi game is being extended to the control of fusion development. A major vehicle in this operation is the newly formed Society to Advance Fusion Energy, or SAFE. This summary of the background of SAFE was prepared by the FEF staff with assistance from supporters in the fusion community and investigators of the Executive Intelligence Review.

NO SCIENTIST, ENGINEER, or layman committed to the continued technological, scientific, and epistemological advancement of humanity should be fooled by the practiced charm of Luella La Mer Slaner, president of the newly formed Society to Advance Fusion Energy.

SAFE, as its name implies, is designed to play on an individual's fears about the way the Fusion Energy Foundation organizes the political fight for fusion energy. Yes, SAFE says, there is a nonpolitical, noncontroversial organization, headed by a nice grandmother, that is interested in fusion development—as opposed to unsafe fission which is a very messy thing to support these days.

Let's look at the facts.

First, SAFE is explicitly opposed to fission energy and to the use of first-generation fusion technologies that promise near-term availability of cheap, abundant fusion energy.

Second, the people who formed SAFE are members of a U.S. network grouped around the Nuclear Club of Wall Street that is associated with Israeli intelligence and has engaged in nuclear espionage. This network was instrumental in providing Israel the capability to manufacture hydrogen bombs.

Third, these same individuals, most of whom hold positions in top Wall Street financial firms and philanthropic foundations, have directly funded the antinuclear movement and known terrorist front groups. In addition, the connections of these individuals extend to the international drug-dealing networks, including Nicaraguan dictator Somoza and his sponsor, United Brands.

It should be noted at the outset that the real force behind SAFE is not its group of public representatives and certainly not any of the scientists who may be duped onto its board of directors. This Delphi operation is run by the combination of British, Israeli, and Canadian intelligence agencies that have worked with leading Anglo-American corporations since World War II to maintain control of civilian and military nuclear technology.

SAFE's Birthplace, July 31, 1978:

The Dreyfus Corporation at 600 Madison Avenue.

The history of this operation can be traced back to Lord Rutherford and Chaim Weizmann, the science advisor to Sir William Stephenson, "Intrepid," who headed up British Intelligence's North American operations, and to the nuclear control policies engineered by Bernard Baruch and David Lilienthal. Today, Delphi policy is determined by the Schlesinger faction in the Department of Energy, the nuclear section of the Anglo-American Ditchley Foundation, the Nuclear Club of Wall Street, and the chief of Israeli scientific intelligence, Yuval Ne'eman.

An Anti-FEF Operation

The most damning evidence to demonstrate that SAFE is not what it claims to be is that Alfred P. Slaner, an executive of the Kayser-Roth textile firm and founder of SAFE, has consistently refused to meet with FEF executive director Dr. Morris Levitt. If the Slaners were truly interested in promoting fusion energy, it would stand to reason that they would want to cooperate with the most influential organization working to that end. Mr. Slaner's reply to Levitt's overtures has been, "There is nothing to discuss."

Both Mr. Slaner and Mrs. Slaner, however, have had plenty to discuss about the FEF with others. The Slaners and their SAFE coworkers have told individuals in the fusion community as well as reporters that they are worried about the rapid growth of FEF influence and feel that it is necessary to provide a "safe" organization to which they can attract scientists. The Slaners have also repeated a string of slanders about the FEF and the U.S. Labor Party.

Several months ago, in the early stages of the SAFE project, the Slaners commissioned the Max and Anna Levinson Foundation to do research on the FEF. The information reported to the Slaners was a rehash of lies and slanders emanating from the environmentalist and terrorist networks about the FEF. This could hardly have been a surprise to the Slaners since the Levinson Foundation funds these environmentalist and terrorist groups. For example, among the Levinson projects in the recent past are large contributions to the rabidly antinuclear Union of Concerned Scientists, which is leading the fight after Three Mile Island to shut down U.S. nuclear power; the Youth Project, which acts as a recruiting funnel into the antinuclear movement and into its terrorist fringes; and other environmentalist groups that are variations on the "public interest" theme—a code word for something which, if not directly tied to Ralph Nader, espouses his method and goals.

Another Levinson project was the sponsorship of an economic study that says economic growth is not connected to increased energy consumption and that the United States would not suffer with a 30 percent cutback in energy.

The Levinson Foundation also cosponsored, along with the Stern Family Fund, a conference for what they call "antinuclear funders" held in Washington, D.C. in April 1979. The Stern Fund has funded the Youth Project as well as Nader's Public Interest Research Group (PIRG), the Environmental Action Fund, and the Institute for Policy Studies. This last organization was founded in 1963 by a



American Machine & Foundry Co.

This nuclear research reactor at Rishon le Zion was built for Israel by the American Machine & Foundry Co. under President Eisenhower's Atoms for Peace program. Atoms for Peace has been turned into atoms for war by the nuclear espionage project carried out by the Mossad and the Nuclear Club of Wall Street.

"We would not give support for breeder reactors and the whole range of nuclear support that they offer. . . . We are opposed to D-T and the tokamak design."

—Frank Millspaugh, SAFE public relations

former staff member of the U.S. National Security Council and since that time has served as an umbrella for every terrorist group in the country—from the Weatherunderground to the Mobilization for Survival.

One of the main questions to ask about SAFE, therefore, is why an allegedly protechnology group would work with the major backers of the antiscience movement?

Against Breeders . . . and Tokamaks

The next question is where does SAFE really stand on fusion—and on fission?

Let's look at Frank Millspaugh, who handles the Slaners' public relations campaign for SAFE through a firm tellingly called Public Interest Relations, Inc. Millspaugh is the former station manager for WBAI "listener sponsored" radio in New York City, which is part of the Pacifica radio network. Under Millspaugh and since Millspaugh, WBAI has been known for its open advocacy of drugs, terrorism, environmentalism, New Leftism, and gay rights, to name just a few of its main program topics. After the Three Mile Island event it ran day-long antinuclear diatribes, complete with hysterical greenies spouting about the end of the world and two-headed babies. (There was "no time" during this period to air a comment by the FEF, the station told us.)

(It is also interesting to note that Pacifica was set up by Aldous Huxley, the British Intelligence operative who directed the MK-Ultra project, whose stated purpose was to measure the effect of drugging large numbers of American youth with LSD. Huxley's intimate in this project was Gregory Bateson, former husband of Margaret Mead, who is now involved in an extension of the MK-Ultra project, the futurist L-5 group that combines pseudoscientific space colonization with a mixture of solar energy, drugs, parapsychology, and group sex.)

Here's how Millspaugh explained to a recent inquirer SAFE's outlook on energy production:

We would not give support for breeder reactors and the whole range of nuclear support that they offer. And, as I say, our emphasis in fusion is on the development of advanced fuels for their greater cleanliness and inexpensiveness and availability. We are opposed to D-T [the deuterium-tritium fuel cycle, which is the easiest way to achieve fusion and would allow the production of fusion energy commercially before the end of this century] and the tokamak design. . . . It's not the kind of operational design we

want to see developed. For one thing, the tokamak is a huge thing that can't be flexibly sited—you can't put one in the basement. Most of the designs right now lend themselves to breeding, and become rapidly contaminated through neutron radiation, placing them in a category with fission.

(Most *Fusion* readers should already know that the tokamak device holds the most promise for early commercial development and that the "flexible siting" question is one of the environmentalists' most frequent arguments for dismantling centralized power stations and replacing them with decentralized, individually owned backyard solar units.)

SAFE's antipathy to "dirty" D-T fusion reactions is also made clear in the prospectus the Slaners have prepared. And in the SAFE literature packet that is sent out to inquirers, the Slaners include a reprint of a *New York Times* May 15 feature article by science writer Walter Sullivan that specifically plays up fusion as the "alternative" to fission. (The article is titled, "Fusion: The Answer to Fission?")¹ Also in the package is a reprint of a pro-fusion article from the Feb. 2 *National Review*, coauthored by SAFE board member Professor George Miley. As *Fusion* has commented (March-April 1979), the *National Review* special issue on "The Anti-Nuclear Lobby" explicitly viewed fusion as the alternative to fission and backed nuclear power only as part of a geopolitical strategy for nuclear war. The pseudoconservative *National Review* has also been a vehicle for slanders against the FEF, the flip side of the kinds of lies that emanate from the environmentalist circles.

As for SAFE's outlook on technology in general, here's what Mrs. Slaner's secretary—who handles inquiries about SAFE—had to say about the U.S. space program:

I assure you I'm very nervous about the hunk of Skylab. I think it's shocking that the government can build these fantastic, almost outer space, out-of-this-world things. They go so far and they don't worry about results. I know that there was this Skylab thing monitoring and finding out all sorts of marvelous things that will probably ruin mankind. This is like the atom bomb hitting Hiroshima or Nagasaki.

Nuclear Espionage

In a 5-minute television spot on New York's WNBC June 27, Mrs. Slaner noted that SAFE had "Wall Street" support. The facts behind this statement are that SAFE's support and some of its board members are located in the Nuclear Club of Wall Street, a clandestine organization that was instrumental in giving Israel the capability to manufacture hydrogen bombs.

Described by its own members as a "covert" organization operating through Wall Street brokerage houses, executive positions in industrial companies, and small so-called scientific firms in the New York area, the Nuclear Club of Wall Street is the core of the atomic espionage network established by Israeli intelligence, the Mossad.

The Nuclear Club membership, which reads like a Who's Who in the U.S. Mossad, has a special focus on scientific, uranium mining, and associated nuclear capabilities.

Here, in brief are some of its membership profiles:

Its operating chief, Marvin Rose, is a director of Allied Chemical, a firm created after World War I by Bernard Baruch and Eugene Meyer, the founder of the Lazard Freres investment house. Baruch later promoted the Baruch Plan, a scheme to limit the peaceful development of nuclear energy in the United States. Meyer's daughter, Katherine Meyer Graham, is the publisher of the anti-nuclear *Washington Post* and a major stockholder in Allied Chemical.

The president of the Nuclear Club of Wall Street is Jeffrey Friedman, a partner of the Dreyfus Corporation, one of the most important and best identified American financial conduits for the Mossad. Through the late 1960s, Dreyfus Corporation created and employed Bernie Cornfield and his Investors Overseas Services as an offshore financial link to Mossad's director of logistics Tibor Rosenbaum, a Geneva banker.

Another director of the Nuclear Club, Irving Harold Sherman, is a past vice chairman of Becker Securities, which is owned by the Warburg family's London branch. Sherman is also close to the former British intelligence station chief in New York City.

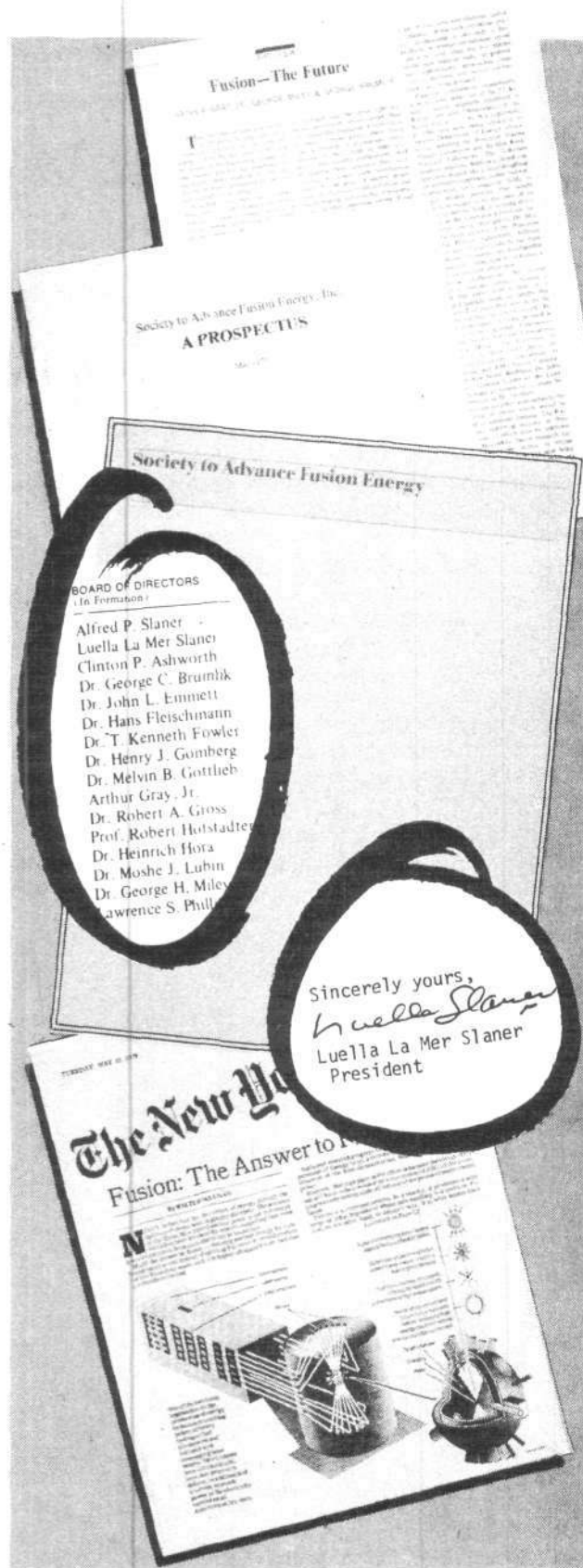
The Hora Story

The most visible connection of the Nuclear Club to the Israeli bomb program at the Soreq Nuclear Research Institute in Israel, which is widely known to be the production center for Israel's atomic weapons, is one Dr. Heinrich Hora. A physicist of uncertain reputation who now lives in Australia, Hora has been dismissed from laser fusion research organizations in both Italy and the United States. The dismissals were due in part to security problems, including Hora's eager attempts to elicit sensitive information from his Soviet counterparts in laser fusion research.

Hora's chief collaborator on the Israeli side is Dr. Aaron D. Krumbein of Soreq. In what we have now established as the Delphi modus operandi, Hora and Krumbein came around the Fusion Energy Foundation in 1976 and both joined the initial editorial board of the FEF's theoretical journal, the *International Journal of Fusion Energy*. Just at the time that other members of the board were subjected to a massive intimidation campaign by various U.S. government agencies, Hora and Krumbein pulled out.

This operation delayed the start of *IJFE* publication for well over a year, after the Department of Defense used financial pressure to stop the original publisher from going ahead with publication.

Curiously, just as SAFE was getting started and three years after this first sabotage attempt, the Delphi operation launched a journal to counter the *IJFE*, the *Journal of Fusion Energy*. Its editors are the former fusion scientist David Rose and his associates at the Massachusetts Institute of Technology who are notorious in the fusion community for their attempts to slow down the rate of fusion



SAFE's Literature packet: Fusion versus fission.

development with incompetent analyses of the remaining problems to be solved.

Hora met with the Nuclear Club July 31, 1978 at what Nuclear Club chairman Myron Wein described as a "super-secret" meeting in the boardroom of the Dreyfus Corporation at 600 Madison Avenue. A major item on the agenda was a scheme, to be funded by Alfred P. Slaner, to create SAFE. During this trip to New York Hora stayed at the home of Dr. George C. Brumlik, who is now the executive director of SAFE. Hora is a member of SAFE's board of directors.

Not too much is known about Brumlik's past; he claims that his major occupation has been as a scientific consultant for a number of Wall Street investment houses that he is reluctant to name. Brumlik also has publicly claimed some sort of association with New York University, but according to NYU officials Brumlik has not had any official relationship to the University since he was a student there in the 1950s.

One of Brumlik's recent activities was to show up "by coincidence" at the Edison Museum in West Orange New Jersey to question an FEF staff member who was doing research on the Anglo-American financiers' takeover of Thomas A. Edison's work. Brumlik identified himself to the staff member as from "New York University."

The Case of Zalman Shapiro

One further connection of SAFE to the Israeli nuclear espionage networks is through Zalman Shapiro, who is now under investigation by the FBI and the Nuclear Regulatory Commission for alleged theft of plutonium. Last fall, congressional aides identified Shapiro, now the head of the Westinghouse Fusion Program in Pittsburgh, as lobbying on Capitol Hill on behalf of SAFE and the Slaners, and it is known that officials of the Office of Safeguards and Security for the Department of Energy were watching his activities.

Given Shapiro's past, such caution on the part of this DOE office was well taken. Shapiro has been identified in many places, including the leading Soviet journal *New Times* (Feb. 1979) as the main figure in illegally getting uranium to Israel. In 1957, Shapiro founded the Nuclear Materials and Equipment Corporation in Apollo, Pennsylvania. The company reprocessed enriched uranium for the reactors in U.S. submarines.

In the mid-1960s, a technical CIA team determined that Israel possessed a laboratory working with huge amounts of enriched uranium and that the Israeli Air Force was training pilots to use maneuvers that made sense only if they were going to be releasing atomic bombs. Shapiro and his firm came under suspicion (and in fact, audits of the firm show that 60 pounds of uranium became unaccounted for in the 1960s). The FBI suspected specifically that Shapiro's firm had delivered the raw materials and equipment through its various overseas contacts.

Shapiro disposed of the Apollo Company in 1967 and began recruiting scientists to work on projects of interest to Israel. FBI surveillance of Shapiro during this period

was hampered by the fact that he began to use the Israeli consulate as a base of operations, placing his telephone calls on their telephone lines, which cannot be tapped.

Consistent with the Delphi profile, Shapiro has been an active saboteur of FEF activities. Shapiro's wife has bragged in Pittsburgh of how the two of them nearly shut down the FEF conference on energy technology held in Pittsburgh in spring 1977. Mrs. Shapiro's tactic was to call everyone who was slated to participate in the conference and spread the slander that the FEF was "antisemitic." The FEF obtained a federal court injunction in 1977 to stop the Department of Energy and others in this slander campaign. (During this same period, Energy Secretary Schlesinger made Pittsburgh the center for "Operation Pacesetter," a project designed to convince industry to conserve energy.)

There is one further area of SAFE's connections that is still under investigation. One of Slaner's colleagues at Kayser-Roth and the Nuclear Club of Wall Street is Disque D. Deane, who has been implicated in an assassination attempt against the chairman of the U.S. Labor Party, Lyndon H. LaRouche, Jr. Deane allegedly brought into the country a professional Mossad "hitman" for the job, one Zwi Aldoubi. Aldoubi recently served five years in a Spanish jail for his part in a failed attempt on the life of a high government official.

Also implicated in this operation is another Mossad operative, Nahum Bernstein, who operates out of the Jerusalem Foundation, a cover for Mossad activities. Thirty years ago, Bernstein and another Keyser-Roth executive, Abe Feinberg were active in the Sonnenborn Institute, whose primary purpose at the time was providing illegal guns for the Haganah, which was later to become the Israeli army. The Sonnenborn Institute has since had a long record of gun-running and dope trafficking to the most reactionary regimes in Latin America—a role that is now coming to light in the various exposés appearing in the press about the Nicaraguan dictator Somoza and his chief corporate supporter, United Brands (which used to be called United Fruit).

Politics?

Perhaps the most shocking fact of all is that a number of leading fusion scientists and project directors have joined the Board of SAFE. Many of them are individuals who have collaborated with the FEF in the past on a modest level but who were afraid of full, public collaboration because the FEF was "too political," too outspoken in defense of the American System, and too bold in calling for a full fission export policy and a crash program of fusion development.

What will these newly politicized gentlemen do now, when the truth about SAFE and its treasonous activities becomes public knowledge?

Notes

1. Here's a sample from the Sullivan article: "Fission is a contrived process. In a reactor, it generates a wide range of lethal by-products whose safe handling is a problem. Fusion, on the other hand, is nature's way...."

Books

The Continuing Crime of Claudius Ptolemy

The Crime of Claudius Ptolemy,
Robert Newton,
Baltimore & London:
Johns Hopkins University Press, 1977,
411 pp., \$22.50

This book tells the story of one of history's most far-reaching frauds: the production in second century AD Alexandria of the "Ptolemaic system" of astronomy.

Although Robert Newton's book has now been available to campuses, scholars, and laboratories for well over a year, Newton's demonstration that Claudius Ptolemy fabricated his own data and falsified his predecessors' data to shore up his own geocentric astronomy has made strangely little impact on the teaching of the history of scientific creative endeavor. Yet, seen in its proper context, Newton's book is one of the most important pieces of research in the history of science in many years.

A practicing astronomer at the Johns Hopkins Applied Physics Laboratory, Newton discovered the Ptolemy fraud as a result of his concern for the validity of ancient observations important for his own work.

What *The Crime of Claudius Ptolemy* shows is devastating. The "raw" data Ptolemy cites for his lunar theory, planetary theory, solar theory, stellar catalogue, eclipse theory—mostly data that are impossible to have observed because they are wrong—are reported with incredible precision and staggering inaccuracy.

Doctored? The data fit Ptolemy's theory to the proverbial "tee." Newton's conclusion is that Ptolemy calculated his data requirements from his predecided theories and then reported the results of his calculations as what he had observed. Newton's conclusion is not optional but inescapable, as any honest reader of *The Crime of Claudius Ptolemy* will confirm.



An illustration of Ptolemy's geocentric theory in the *Almagest*.

Claudius Ptolemy was part of a conspiracy against scientific progress, traceable directly back to Aristotle and the Lyceum in Athens from Aristotle's lifetime in the third century BC. Aristotle's immediate heirs in a cultural and political-intelligence deployment against Platonist science—Aristotle's successors, the Peripatetics of Ptolemaic Egypt and their Stoic project—are the network from which Claudius Ptolemy's fraud emerges.

Plato's Academy and its offshoots had launched a rich variety of research and education in scientific projects. Euclid's *Elements*, Eudoxus's cosmology, Theatetus's mathematical physics, and the history and conception of science presented in Plato's dialogues, notably the *Timaeus*, figure among these projects. Against this propagation of science and its city-building projects, Aristotle aimed his *Physics* and *De Caelo*.

Aristotle's geocentric "universal machine"—a world of dead matter and ineffable "quintessences" where every "thing" kept its "place"—was designed as part of the same anti-scientific offensive that gave rise to Aristotle's contribution to political science: the hideous theory of the natural slave!

In contrast, Plato, his forebears, and his heirs adhered to a cosmological physics and astronomy coherent with their insistent concern for human

creativity. The great Archimedes and Aristarchus—the latter persecuted almost to death by Cleanthes the Stoic for "displacing the gods" with his elaborated heliocentric theory—were explicitly Plato's heirs.

Against this, Claudius Ptolemy was explicitly Aristotle's heir. It was to Alexandria that the Aristotelian Peripatetics came en masse (at the invitation of Aristotle's factional ally, Ptolemy I of Egypt) after the Aristotelians had been expelled from Athens about 320 BC for treason. There, within the Ptolemies' royal precincts, they erected a new Lyceum: the Alexandrian Museum and Library.

That complex, the "Royal Society" of its day, for four centuries specialized in the following: profiling subject populations around Isis-modeled "Great Mother" cult religions, as one will find by reading Museum and related "research reports"; Aristotelian "synthesis" of "disciplines" with heavy emphasis on linguistics, grammar, nominalist logic, and "literary criticism"; suppression or alteration of inconvenient ancient manuscripts; the systematic suppression of crucial scientific work, like that of Aristarchus (which has come to us through Archimedes)¹; and a series of ambitious projects of fraudulent science.

In Roman Imperial times no less than under the Ptolemy Dynasty, the Museum/Library continued as a Royal Society. In the second century AD two significant frauds were produced: Galenic medicine² and Ptolemaic astronomy.

Ptolemy's Sabotage

Ptolemaic astronomy took the body of Aristotelian physics, so-called, which was more ignored than derided by Hellenistic scientific thought, and added to it the data that for the first time "proved" its tenets. The underlying tenet, as significant for its epistemological as its physical consequences, was geocentricity.

Nor did Ptolemy restrict himself to

sabotaging astronomical and cosmological thought that was in the Platonic tradition. His *Optics*—shown to be a fraud in the recent book of Saleh Beshara Omar¹—did a similar job on Euclidean geometrical optics. And his two “respectable” and “authoritative” tracts on astrology, the *Tetrabiblion* and *Centiloquium*, were central to the Peripatetic/Stoic introduction of Chaldean star-lore as a science into the oppressive decadence of Imperial Rome. As Johannes Kepler noted, Ptolemy was “steeped in pagan superstition . . . [and he] undermines the whole possibility of astronomy.”

Together with the appearance of Ptolemy's *Almagest* came the disappearance, forever, from history of well-known crucial original research by such scientists as Hipparchus and Aristarchus, apparently at the hands of the Alexandrian “librarians.”

Ptolemy's heavy hand has lain on astronomy, not just until Copernicus and Kepler—each of whom identified Plato and, in particular, the Platonic dialogue *Timaeus* as appropriate sources of a truly scientific outlook—but until the present. Certainly Ptolemy's was not the last such scientific fraud. Britain's Royal Society has mass produced many more, including Sir Isaac Newton's corpus, the Piltdown Man hoax, and, most recently exposed, the racist fraud of eugenicist Sir Cyril Burt.⁴

These frauds were “genetic” descendants of the Alexandrian Museum and Library—similar not just in fraudulence, but in the ideological method of the fraud. Identical to Aristotle and Ptolemy, Newton's universe, with its categories of absolute time and absolute space and its ungraspable action-at-a-distance between unknowable ultimate “things,” is impossible to understand and incapable of existing. It is, exactly as the Ptolemaic system was, not a cosmology, or rational account of the order of the world, but a mental map of Newton, or Ptolemy, or Aristotle, reminiscent of modern “statistical” approaches that hysterically deny truth as the efficient concept for scientific work.

Sir Cyril Burt too was a descendant of Ptolemy: His fabricated data, de-

signed to prove the genetic inferiority of the “lower classes,” were amazingly precise and wholly inaccurate. As in the case of Ptolemy, so also for Sir Cyril, inaccurate theories were used to generate inaccurate data, and what the data lacked in accuracy was made up for by assigning to them impossible degrees of precision.

Today's Fraud

To this very day, the historians of science who dominate such suggestively named journals as *ISIS* have shown no inclination to transmit Robert Newton's findings to their students. Instead, the March 1979 issue of *Scientific American* reported in its “Science and the Citizen” section with relief that Noel Swerdlow of the University of Chicago has vindicated Ptolemy by asserting that Newton's use of statistical analysis is “faulty.”

The truth of the matter is that the identical Aristotelian outlook, grounded in an identical commitment to zero growth, dominates every university today that is still patterned after Oxford and Cambridge and the Museum and Library at Alexandria.

A reading of Newton's *The Crime of Claudius Ptolemy* is recommended for every American teacher and student of science. Such a reading (or rereading), informed by recognition of the implications of Ptolemy's exposed antiscientific hoax, can go a long way toward freeing American education from the antiprogress taint it has absorbed from the Alexandrian-Royal Society model.

—Molly Kronberg

Notes

1. Aristarchus, working in about 250 BC in Samos, developed a full heliocentric theory in his writings. Although we have his *Treatise on the Sizes and Distances of the Sun and Moon*, everything subsequent in which he laid out his heliocentric theory has vanished. It is known that Ptolemy had access to the astronomer Hipparchus's full work, which disappeared right after Ptolemy had cribbed from it, and the strong presumption is that Aristarchus's works met the same fate. The only contemporary reference we now possess to this is from Aristarchus's contemporary Archimedes, who describes in his *Sand-Reckoner* a “universe many times greater than the one just mentioned. His hypotheses are that the fixed stars and the Sun remain unmoved, that the Earth revolves around the Sun in the circumference of a circle, the Sun lying in the middle of the orbit, and that the sphere of the fixed stars, situated about the same center as the Sun, is so great that the circle in which he supposes the Earth to

revolve bears such a proportion to the distance of the fixed stars as the center of the sphere bears to its surface.”

The convention that the ancients believed in a geocentric universe (and perhaps even a flat earth) throughout most of classical times is demonstrably false.

2. Richard Welsh, 1978. New York (unpublished).
3. Saleh Beshara Omar, *Ibn al-Haytham's Optics*, Minneapolis and Chicago: Bibliotheca Islamica, 1977.
4. See, for example, “I Don't Make Hypotheses—I Manufacture Data” by Carol White in *Fusion* Dec. 1978, pp. 48-54.

Books Received

The Production and Application of New Industrial Technology. Edwin Mansfield et al., New York: W.W. Norton & Company, 1977, 212 pp., \$15.95.

Industrial Applications of Lasers. John F. Ready, New York: Academic Press, 1978, 575 pp., \$28.50.

National Historic Mechanical Engineering Landmarks. Richard S. Hartenberg, ed., New York: The American Society of Mechanical Engineers, 1979, 146 pp., \$15.00.

The Practical Inventor's Handbook. Orville N. Greene and Frank L. Durr, New York: McGraw Hill, 1979, 256 pp., \$19.95.

The Cost of Energy and a Clean Environment. Russell G. Thompson, et al. Houston: Gulf Publishing Company Book Division, 1978, 550 pp., \$32.50.

The Scientist as Editor. Maeve O'Connor, New York: Wiley, 1979, 218 pp., \$12.50.

Mercedes-Benz: A History. Robert Nitske, Osceola, Wis.: Motor Books International, 1978, 228 pp., \$19.95.

Economic and Environmental Impacts of a U.S. Nuclear Moratorium, 1985-2010. The Institute for Energy Analysis, Cambridge, Mass.: MIT Press, 1979, 370 pp., \$17.50.

Mind and Nature—A Necessary Unity. Gregory Bateson, New York: E.P. Dutton, 1979, 238 pp., \$11.95.

Gödel, Escher, Bach: An Eternal Golden Braid. Douglas R. Hofstadter, New York: Basic Books, Inc., 1979, 777 pp., \$18.50

The Dancing Wu Li Masters—An Overview of the New Physics. Gary Zukav, New York: William Morrow and Co., 1979, 352 pp., \$12.95.

The Passive Solar Energy Book. Edward Mazria, Emmaus, Pa.: Rodale Press, 1979, \$12.95.

Star Atlas. Drs. Jacqueline Mitton and Simon Mitton, ed., New York: Crown Publishers, Inc., \$1.95.

Photopion Nuclear Physics. Paul Stoller, ed., New York: Plenum Publishing Co., \$42.50.

Levitt Accuses AIF Officials Of Dirty Tricks to Slow U.S. Nuclear Development

In a July 12 press conference in Washington, D.C., Dr. Morris Levitt, executive director of the Fusion Energy Foundation, accused officials of the Atomic Industrial Forum, Inc. of using "dirty tricks" to slow U.S. nuclear development.

"Certain AIF officials," Levitt said, "have conducted a slander campaign telling U.S. corporations the outright lie that the FEF is calling for the nationalization of the nuclear industry. Considering the fact that the nation is in the midst of an energy crisis and that the FEF has proposed a sound proposal for the kind of massive exports of nuclear technology that will return this country to a position of leadership in nuclear technology, we ask what side the AIF is on?"

Levitt then challenged Carl Walske, president of the AIF, to repeat the slanders against the FEF in person and to debate him on the question of nuclear development.

"Let's get this discussion out in the open," Levitt said. "We know that at least one AIF official, Ms. Marie Dunkel, intervened to get the FEF removed from its scheduled speaking spot Friday, July 13 at the American Legion state convention in Pittsburgh. We know that Ms. Dunkel told Wayne Godwin of the internal affairs section of the national American Legion staff that the FEF was 'radical,' not an 'official member' of the nuclear industry, and 'too optimistic about the timetable for fusion power.'"

"My challenge to Mr. Walske is as follows," Levitt said.

"Let's debate the question of sabotage at Three Mile Island; let's debate whether there is now a Malthusian conspiracy in this country and whether the best way to fight it is to 'lie low'; let's debate what you told the Foratom European nuclear congress recently, that many people are likely to die in nuclear accidents in

the future; and, most important, let's debate our proposal for a nuclear policy that would put this country on the map again as a high-technology, growth-oriented exporter."

Commission Holds Albany Press Conf.

Dr. Morris Levitt and Frank Hewes, corporate treasurer of the Adirondack Steel Company, gave a press conference in Albany, N.Y. July 11 to report on the work of the Independent Commission of Inquiry into Three Mile Island. Levitt briefed the group on the necessity to expose the controlled economic shutdown policy behind the TMI incident and Hewes reviewed the organizing of the commission among the scientific and industrial communities.

Among those attending the press conference were representatives from the State Departments of Industry and Agriculture, the American Legion, delegates from the Building Trades Central Labor Council for the Albany-Schenectady area, and local industries.

Levitt Speaks At Harrisburg Area Town Meeting

Responding to a call from beleaguered pronuclear Harrisburg-area residents, Dr. Morris Levitt spoke at a town meeting in Highspire, Pa., July 5 on the issue of whether the Three Mile Island Plant should be reopened. The request from Harrisburg came in response to the full-page advertisement placed in the Harrisburg *Patriot News* June 27 by the Independent Commission of Inquiry on Three Mile Island, a group initiated by the FEF.

Levitt reported back that there still is substantial pronuclear sentiment in

the Harrisburg area, but it is kept quiet by an atmosphere of hysteria, especially among young mothers, that is kept going by continuing false press accounts of the incident and the activities of antinuclear groups in the region.

Fundraising Dinner In Virginia

A highly successful FEF fundraising dinner in Arlington, Va. June 27 on the topic of energy and the economy drew 75 persons. Among the audience were representatives of the Union of Operating Engineers, several high-technology firms in the northern Virginia and Washington area, the Office of Fusion in the DOE, and several foreign diplomats. The keynote speech was given by Dr. Uwe Parpart, FEF director of research.

FEF Award Nomination

The Fusion Energy Foundation has been notified that the special report on the "Harrisburg Hoax" in the May issue of *Fusion* has been nominated for a Freedoms Foundation journalism award.

Montreal Conf. on Development Policy

"Rather than a scheme for a North American 'common market,' what we require is the kind of development perspective that Mexican President Lopez Portillo is currently fighting for. According to this view, energy can be properly termed humanity's patrimony," Dr. Uwe Parpart told an FEF conference at the University of Montreal June 20.

Referring to the labor-intensive and inefficient programs proposed in the common market plan, Parpart said: "We must look to the stars, not to the ground for tomorrow's energy policy. Quebec's real resource is its population. Quebec must aim for the establishment of a hundred centers of advanced scientific learning in the coming decade or so."

Conferences

Continued from page 29

funded separate projects," commented Space Institute executive director Chuck Hewitt.

A look at the NASA budget over the past 20 years graphically demonstrates when the space effort began to decline (Figure 1). As Senator Harrison Schmitt (R-NM) pointed out, the problems that NASA has now "are from plans that were not made many years ago."

Senator Schmitt, Senator Adlai Stevenson (D-Ill), and Space Institute director Hewitt all pointed to the danger that the civilian space program would become subordinated to the military-run program, a tendency that can be seen in Figure 2.

Another aspect of the decline of U.S. space effort was addressed by Dr. John Stewart, a staff member of Stevenson's Senate Subcommittee on Science, Technology, and Space, who forcefully noted the problem of the loss of U.S. international leadership in space (Figure 3).

Stewart, who had recently returned from a trip to Europe, reported that Japan, the European Space Agency, the Soviet Union, and developing nations like India were pushing ahead with their own space efforts. The plans of these nations include programs for remote-sensing satellite systems to aid in meteorology, resource location, and communications—but there is almost no cooperative work planned with the United States.

There was a great deal of appropriate outrage expressed by conference participants at the destruction of the national commitment to explore and develop space.

'Know-nothingness'

Author James Michener, for example, said he was shocked at the "counterrevolution against intelligence and the antiscience movement for 'know-nothingness' going back 200 years." "This is an abdication of reason," Michener stressed, and "is antithetical to the aims you've had all your lives."

The nation's response to Three Mile Island was "juvenile, irresponsible, and hysterical, leading to mob decisions and economic madness," Michener said, and the response to the DC-10's was "equal to if not surpass-

ing Three Mile Island. Society has been made to think that it is good to have no risks. All great exploration and discovery involved risk; some with less than a 50 percent chance of success for the explorer."

Yet, despite the appropriate anger at the present situation, the conference lacked a political and theoretical program for getting NASA moving again. The solution lies in getting the space program and the fusion program to join forces in an effort to break through the frontiers of physics both in the laboratories and in space.

—Marsha Freeman

Ms. Freeman is working on a history and analysis of the U.S. space program that will appear in a forthcoming issue of Fusion.

'An Olympiad Theory of Technology'

"What we're interested in is all the rest of the universe. We're acting as if we have to be defensive about our interest in the light-years radius of the universe. . . . Whatever can be accomplished on earth, will at some point, though certainly not in the immediate term, reach limits. At some point we will even be interested in the rest of the universe in an explorative sense. Can we wait until we've solved our problems here on the ground or do we take that interest now?"

"We've never solved 'today's' problems by attacking them directly. We have to expand our perspective, our knowledge and our space. We should have an Olympiad theory of technology—it is natural that athletes train for an event by doing something it's impossible to do at the start. The same is true for technology. We expand our capability to solve problems by doing things that are too hard to be done."

—NASA Administrator Robert Frosch

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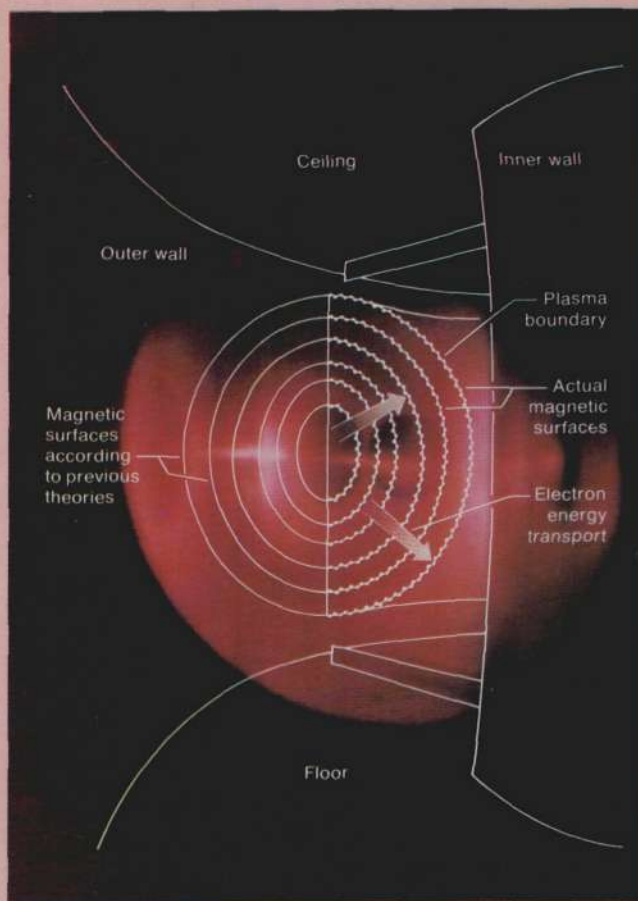
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In This Issue



ELECTRON BEHAVIOR: MORE EVIDENCE OF NEGENTROPY

By far the most perplexing problem in the development of nuclear fusion by magnetic confinement has been the strange behavior of electrons in the tokamak reactor. Many of the initial reports on the anomalous behavior of electrons came from data gathered at the Impurity Studies Experiment, the ISX tokamak at the Oak Ridge National Laboratory in Tennessee. And as Dr. Steven Bardwell demonstrates in our lead feature, recent theoretical work done at Oak Ridge has produced a surprising explanation for this electron behavior, opening up exciting new frontiers in the science of plasmas.

The extraordinary front-cover photograph shows the plasma fuel inside the ISX as viewed from one of the ports in the tokamak machine. The figure here shows representations of undisturbed magnetic field surfaces at left and bubbly magnetic field surfaces at right, superimposed on the plasma fuel photograph. The bubbles in the magnetic field allow for the so-called anomalous electron transport from the hot core of the plasma to the cooler outer parts. The arrows show the direction of this energy transfer.

Details on the unique ISX pellet injection and neutral beam heating system can be found in the fusion news section.



THE DRUG PLAGUE

Drug abuse is the number one public health problem today, yet the mass media encourage Americans to think that drugs are not only "in" but "harmless." Dr. Gabriel Nahas, a world-renowned authority on the biological effects of marijuana, presents the scientific evidence that marijuana causes damage to the brain and to the reproductive functions. And Dr. Ned Rosinsky, a board member of the New York-New Jersey Anti-Drug Coalition, tells how that organization is fighting the drug plague nationally.



ENDING THE DELPHI PROJECT

Since the time of Aristotle when the Persians sent their political enemies to the oracle at Delphi to receive biased advice, the Delphi technique has been used to keep scientific inquiry—and new ideas in general—within the limits defined by the Aristotelians. It's time to end this containment of science, says Dr. Morris Levitt, *Fusion* editor-in-chief, in his open letter to readers. Levitt announces a series of forthcoming articles aimed at giving readers the information they need to recognize and counter the current Delphi projects run by British Intelligence and its collaborators—from *Omni* magazine to new attempts to keep support for fusion "SAFE."

The cover: The front cover photograph is courtesy of the Oak Ridge National Laboratory. Cover design by Christopher Sloan.