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AIDS: THE LONG HAUL

Robert A. Weinberg

Seven years of experience with the AIDS crisis have dispelled many of the fears and hopes that were attached to the epidemic when it was first recognized. We now know how many of us are infected with the AIDS virus, HIV, and have reasonable estimates of the rate at which it will spread. As Jeffrey Harris describes here, the virus is increasingly understood as contained in a well defined, high risk population with a, thus far, circumscribed spread into the general population. This might spawn the hope that the HIV will be in due course eradicated. The current reality is otherwise. As many as 1.5 million Americans have already been infected and each of these can serve as the source for further seeding in the general population. Research into the virology, immunology and molecular biology of the HIV has to date provided no clear indications of treatments or vaccines that would block the transmission of virus from this large infected pool to the uninfected population. To date, behavioral modification provides the only sure mechanism of containment.

All this means that AIDS will be with us for a very long time to come. Indeed, it may become endemic, like tuberculosis and syphilis in the 19th century. AIDS will evolve from an acute crisis into a chronic problem affecting a very large number of our fellow citizens. Most of us have been dulled to insensitivity by daily media exposure to AIDS facts and figures. With this desensitization comes the unspoken thought that somehow AIDS will go away once we have spoken and written enough about it.

We are only just beginning to realize the long term consequences of this disease for our society. In almost all respects, we remain quite unprepared to deal with the deluge of pain and suffering that we will see over the next decade. Even if the disease spreads only slowly beyond the presently infected pool, the cohort of already infected individuals will force many parts of our health care system to the brink of collapse. As Harvey Makadon argues, the present patchwork quilt of health care delivery systems is poorly designed to meet a concerted stress like the HIV epidemic. Central coordination of efforts in this area are still almost non-existent. In addition, John Creedon makes it amply clear that the related problem of financing health care delivery for AIDS victims is one that all but the most intrepid have chosen to flee. While the overall costs of the HIV epidemic are rapidly becoming apparent, there is no consensus as to who will pay the enormous medical costs incurred by AIDS victims.

Light at the end of this long tunnel should come from the research community that is now heavily involved in AIDS research. Even here there are doubts that we are as well-organized as we need to be. To be fair, biological laboratories have responded magnificently since 1981: within several years of our awareness of the AIDS syndrome, the causative agent, HIV, had been identified. Several years thereafter, the most minute molecular details of the viral growth cycle had been elucidated. Regrettably, this abundance of scientific wisdom has provided no solid leads for immunizing the uninfected or treating the already infected.

David Baltimore's words make it apparent that the organization of our basic research effort, like the provision of health care, is largely a patchwork of *ad hoc* efforts. An Executive Branch ostensibly uninterested in this problem has not provided strong leadership. In addition, the organizational chart of NIH has left it ill-prepared to launch a coherent, well-organized effort against this epidemic and future epidemics caused by other agents. It will take 20 years before we know whether our present *ad hoc* way of organizing AIDS research represents inadvertent wisdom or great foolishness.

AIDS is but one of a large number of infectious diseases that have erupted in the recent history of our species. Has our experience with AIDS left us better prepared for the next epidemic? The facts are not reassuring. As the following essays show, we have only begun to muster an adequate response to AIDS. The implications for permanent changes in health and research policy will be long in coming. ■



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HETEROSEXUAL AIDS: WHAT TO WATCH FOR

By Prof. Jeffrey E. Harris

So far, the widely-anticipated explosion in heterosexual AIDS has not occurred. Neither, however, has the bomb been defused. The key issue in the coming years will be: What signs of an impending blast should we watch for?

Heterosexual AIDS Cases

By June 13, 1988, the Centers for Disease Control (CDC) had reported 64,896 AIDS victims. Of these cases, 1,598 adults used no intravenous drugs and had exclusively heterosexual contacts with AIDS victims or with persons at a high risk for AIDS. To this official total one needs to add about 500 cases that have already been diagnosed by physicians but still not registered with the CDC.

That makes about 2,100 heterosexual AIDS victims since the start of the epidemic in this country, around 12 years ago. While this statistic doesn't seem very ominous, the current tally of heterosexual AIDS cases is not as important as its rate of increase.

Of the estimated 2,100 cases so far, about 1,100 have occurred within the last 12 months. This means that it is now taking less than one year (about 11 months) for the number of heterosexual cases to double. Such a doubling time is much shorter than for all AIDS cases, and approximates the doubling time for AIDS among gay men in the early 1980s. At the current doubling rate, we would have 85,000 heterosexual AIDS victims in five years.

Accordingly, the first key indicator to watch is the doubling time of heterosexual AIDS cases. If there is really no impending epidemic of heterosexual AIDS, then this doubling time should soon start to rise.

HIV Infection Rates

HIV, the human immunodeficiency virus that causes AIDS, takes years to incubate. The great majority of heterosexuals infected after 1985 are still in their early stages of progression toward AIDS. But people infected before 1985 probably make up one-half of the current tally of 2,100 heterosexual AIDS victims.

This means that the current incidence of heterosexual AIDS is at best an imperfect indicator of the recent spread of HIV among heterosexuals. To get a better handle on the future of AIDS, we need to survey current HIV infections in the general population.

Such surveys rely upon blood tests for the presence of antibodies to HIV. While these blood tests do have some technical drawbacks, the real problem with surveys for HIV antibodies is that we don't always know who is being surveyed.

My best estimate is that by the end of 1987, there were 47,000 HIV-infected people who were exclusively heterosexual and did not use intravenous drugs. That comes to 1

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Tertiary Transmission



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in 2,500 Americans between 15 and 44 years—the most sexually active age range. This rate is about the same as that found among first-time blood donors, but falls far below that found in other populations. Thus, the infection rate is about 1 in 700 among applicants for military service; 1 in 500 for childbearing women in Massachusetts; and 1 in 300 for Job Corps entrants, who are mostly disadvantaged teenagers.

Such a wide disparity in infection rates could be easily produced by small variations in the number of high-risk people who are surveyed. This is because the HIV infection rates are now very significant among high-risk people.

For example, for every 10,000 military applicants tested, there are about 14 HIV-positive individuals. My estimate of the heterosexual infection rate, by contrast, would predict only 4 positive applicants. Where might the remaining 10 come from? At least 25 percent of intravenous drug-users are now infected. So, in order to get 10 more positives, all we would need are 40 drug-using applicants out of 10,000.

As might be expected, recent attempts to track changes in the infection rate among blood donors, military applicants and other groups have yielded very unstable results. Any genuine trend in heterosexual infection rates is easily masked by small changes in the number of high-risk persons in the sample.

Monitoring HIV infection rates in the general population may be superior to just watching heterosexual AIDS cases. However, without some method of identifying high-risk persons, such surveys may turn out to be quite uninformative.

In the United States, the AIDS virus has spread primarily among gay/bisexual men and intravenous drug users. So far, the heterosexual victims of AIDS are “secondary cases.” That is, they were the heterosexual partners of the primarily infected, high-risk people. If there is going to be a massive new wave of heterosexual AIDS in this country, then the virus will have to start spreading to the partners of the partners. The question is: How can we tell whether such “tertiary transmission” is taking place?

One approach has been to measure HIV infection rates among the most sexually active heterosexuals, particularly those attending venereal disease clinics. As in the general population surveys, these rates have varied greatly—from zero up to 1 in 20. Likewise, it is difficult to tell exactly who is being tested in these clinics. But in surveys where attendees were rigorously interviewed face-to-face, the infection rate among exclusively heterosexual persons with no history of intravenous drug abuse has been at most 1 in 100.

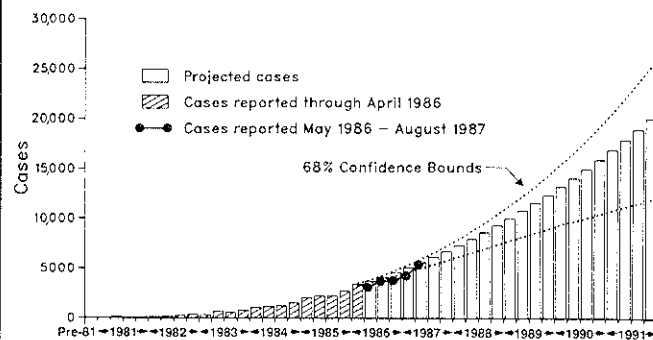
An HIV infection rate of 1 in 100 would be 25 times that estimated for the general population. But this does not by itself mean that HIV is spreading into a sentinel population of promiscuous heterosexuals. In the careful interviews, virtually all HIV-positive heterosexuals admit to sexual contacts with drug users or bisexual men.

The key indicator to watch is the number of tertiary heterosexual infections that have been credibly identified in venereal disease clinic populations. Right now less than 1 in 50 infected heterosexuals is a tertiary case. A small increase in this fraction would mean real trouble.

Even without a new explosion, we are bound to see more and more heterosexual AIDS victims. As the number of infected intravenous drug users grows, so will the infection rates in their partners.

But will the partners of the partners contract HIV? If it is going to happen at all, my hunch is that we'll know within the next two years. In the meantime, the potential for a megaton epidemic remains. ■

CASES OF AIDS WITH PROJECTIONS THROUGH 1991



James Curran, Science Vol. 239, Feb. 5, 1988 p. 610-616. Copyright 1988 by AAAS.

CARING OR COPING: PROVIDING HEALTH CARE SERVICES FOR PEOPLE WITH HIV INFECTION IN THE 1990's

By Harvey J. Makadon, M.D.

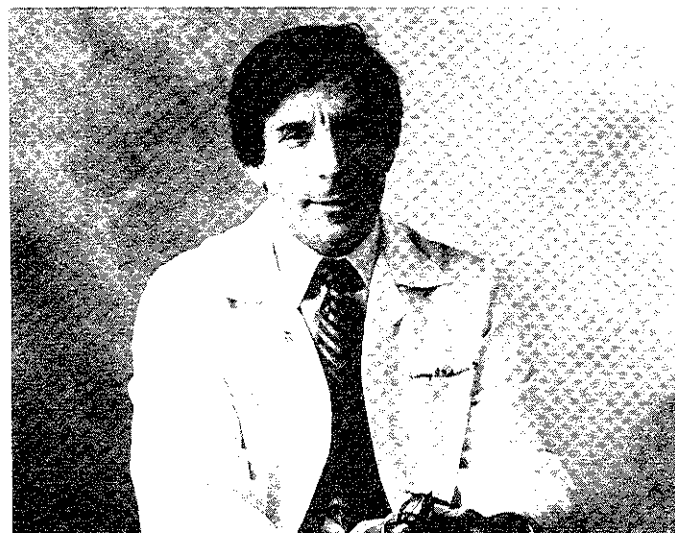
Since the first reported AIDS cases in 1981, communities and health professionals have struggled to put in place a system to provide support and care for individuals with HIV infection. At first clinician-researchers defined new syndromes, established AIDS clinics and served as primary care givers. Many caregivers in the gay community dedicated themselves to the care of patients with HIV infection. Initially, the number of individual providers and institutions caring for AIDS patients was small. Over the years, there has been growth in the involvement of more community based providers and health care institutions of all types. Community based AIDS service organizations which were developed to provide supportive services, not usually well incorporated into a traditional medical model of care, have flourished and provided a great deal of support and care for those affected by the epidemic.

Nevertheless, there are increasing signs that these systems of care, developed largely on an ad hoc basis, are becoming severely strained. New York City reports long waits in the Emergency Departments of overcrowded hospitals where AIDS patients occupy a growing proportion of inpatient beds. The hospital that cares for the largest number of AIDS patients in Boston has had to suspend appointments for new patients in its AIDS program. There is a catastrophic shortage of facilities to care for IV drug users. Many are concerned that volunteer efforts may not be able to sustain their ability to provide the same high level of supportive services they have to date.

Considering these issues in the context of projections of the number of expected AIDS cases over the next several years raises grave questions about our ability to continue to provide care of which we can be proud. In contrast to 64,000 AIDS cases reported by June, 1988, the Public Health Service estimates there will be over 285,000 cases by the end of 1991 and 450,000 cases by 1993. In 1991 alone, more than 75,000 new cases and 50,000 deaths are expected. A far greater number will require treatment for other HIV related syndromes.

Against this backdrop, we urgently need to consider how we will provide care for individuals with HIV infection over the next decade. This will necessitate a critical analysis of current projections, a review of current models of the epidemic, an inquiry into appropriate systems for providing care, an evaluation of the likelihood that AIDS service organizations will continue to be able to provide supportive services on a volunteer basis, an assessment of the impact and implications of the nursing shortage, and the consequent issues raised with respect to the responsibilities and education of health professionals.

As a first step in meeting the challenges of providing care, it will be crucial to build our capability to provide primary care for those with HIV infection. If all general internists and family physicians would provide basic care



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for a handful of individuals with ARC or AIDS, there would be far less need for specialized AIDS professionals and treatment centers. Fears, facts and finances are some of the obstacles that need to be faced in creating an effective response. There must be appropriate education and emotional support for caregivers and institutions. These efforts have begun, they must be expanded and continued.

The nursing shortage, already causing severe problems in many hospitals, raises poignant questions about how that profession will cope. Nevertheless, caring for AIDS patients has been satisfying if stressful work for many and could be used as a model to alleviate this potential crisis. It may be that this epidemic which so clearly demonstrates the advantages of multidisciplinary approaches to care could help nursing leaders define new ways of sharing and caring, and letting professional nurses focus on the care of their patients. Others may need to take on purely administrative or clerical functions that keep nurses from the bedside. We may need to train an entire new cadre of health care workers to fill some of these needs.

As we learn more about HIV infection and as infected individuals live longer, it is clear that many have neuropsychiatric and chronic debilitating syndromes which will make it necessary for them to receive substantial mental health and supportive services. These services are often the least available, and must be carefully thought out if we are to avoid the dubious options of crowding these individuals into acute care hospitals or caring for them on the streets. We need to critically evaluate our need for long term, chronic and hospice care, and rapidly develop an effort to meet these needs.

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We have begun to learn about the needs and ways of caring for intravenous drug users with HIV infection. We must recognize that there is a spectrum of responses necessary to adequately care for this population. We will need to advocate additional treatment programs as well as pragmatic approaches such as needle exchange programs to prevent to spread of HIV infection. We must be willing to put aside political or moral concerns in shaping our responses if we are to be effective.

Finally, many potential caregivers are kept at a distance by concerns about the economic risks involved in caring for an underinsured population with intense health care and social needs. While direct medical costs for HIV related illness are estimated at up to \$22 billion dollars through the end of 1991, this cost is small when compared with our annual national expenditures for health care. Nevertheless, the impact of costs on uninsured individuals and institutions caring for AIDS patients in high prevalence areas is great. We need a national effort to implement changes in financing and the structure of health care benefits that will insure that individuals have access to a full continuum of care provided in the most cost-sensitive manner.

The reality of the epidemic is clear. We cannot avoid the future. We must meet the challenge of AIDS with a commitment to consider all the alternatives and rapidly effect changes to provide access to quality care for all in need.

AIDS AND THE INSURANCE INDUSTRY

By Mr. John Creedon

The AIDS epidemic is causing us as a nation to focus on the responsibilities of the private insurance industry and is spotlighting weaknesses in our nation's system for meeting the costs of providing health care. Private insurers are sometimes criticized for not meeting their obligations or for dealing unfairly with individuals unable to obtain needed insurance. Yet, a thoughtful look at the facts will change this view. The insurance industry is currently fulfilling its contractual obligations, and will continue to do so in the future, by paying AIDS claims arising on persons already insured and on persons who become infected after purchasing insurance.

A recent survey indicates that private life and health insurers paid more than \$290 million in AIDS-related claims in 1986, six tenths of 1% of the industry's total claims. At Met Life, cumulative AIDS-related life and health claims surpassed the \$100 million mark in March 1988. While these levels of AIDS claims represent relatively small percentages of total claims, AIDS claims levels can be expected to rise significantly as the caseload increases. It has been estimated that by the year 2000, cumulative AIDS claims on individual life insurance will reach \$50 billion. In the mid-1990s, AIDS claims might represent 15% of all individual life insurance claims.

Far from fostering inequity, current underwriting procedures were developed to ensure fairness by setting premi-

um rates or denying coverage for prospective insureds based solely on expected mortality and state of health. For example, individuals with expected mortality in excess of 500-750% of standard are generally not insured. Individuals who are seropositive for AIDS are known to have mortality rates in excess of 2500% of standard, placing them outside the range normally handled by an insurance mechanism which depends on voluntary premium payments.

Competition demands that the range of risks covered by a particular class of individual policies be minimized. If prices are too high in relation to the risk, individuals will not buy the insurance. Likewise, insurers cannot continue to do business if prices cannot be set at a sufficient level. Insuring a disproportionate share of impaired individuals, such as those infected with HIV, would necessitate a major increase in rates. As a result, healthier risks would decide that insurance is not worth the cost and would not buy it. Insurers, in turn, would be forced to raise their rates even further to reflect the higher percentage of unhealthy insured lives. This cycle, known as the "assessment spiral," makes economically sound insurance coverage impossible and undermines the insurance mechanism itself.

Finally, ethical problems would arise if coverage were granted to known HIV infected individuals. Those with serious health conditions such as heart disease or cancer who are not already insured will generally be denied health coverage. Treating HIV infected individuals differently by granting them insurance would be unfair.

These considerations have led insurers to conclude that individuals determined to be HIV infected and who do not have existing coverage cannot be insured under a voluntary private insurance system. As evidenced by recent public opinion polls and legislative and regulatory activity, this conclusion is gaining increasing respect among the public at large, as well as among legislators and regulators.

Since known HIV infected individuals without current insurance cannot be granted coverage under a private insurance system, the question has been raised as to who should pay for their health care costs. This question needs

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to be viewed in the context of the nation's health care cost sharing system which balances a variety of funding sources, including private and public insurance and public assistance. Governments, insurers, and businesses, who are paying most AIDS claims, are under increasing pressure to hold the line on medical care costs. Increasing the burden of private sector payors can be justified only if it can be shown that these payors are paying less than their equitable portion of the costs.

Medical care costs beyond those equitably provided for by the present participants are a societal responsibility, and require the development of new funding approaches. In the case of persons who wish to purchase insurance protection but cannot be granted it due to HIV infection, one possible solution would be the expanded use of state risk pools with excess costs funded from general revenues. Such pools balance the concerns of equity, funding, and societal responsibility and address the problems of financing the care of AIDS victims, as well as of others unable to obtain health insurance.

THE RESEARCH RESPONSE TO AIDS: IS NIH PREPARED FOR EMERGENCY ACTION?

By Dr. David Baltimore

For the research scientists, AIDS is the most frustrating infectious disease ever to make its appearance among us. Our bodies fight off most diseases caused by microorganisms and the majority of the remaining ones are sensitive to antibiotics. The few we cannot handle, like herpes viruses, are so rarely lethal that we consider them mainly annoyances. But human immunodeficiency virus (HIV), the virus that causes AIDS, is highly lethal — 35% of infected people are dead within 8 years; most or all infected people may die of the infection. For some reason our bodily defenses are unable to cope with this particular infection — we as yet do not know why. A highly lethal virus infecting millions world wide and at least a million Americans is a medical emergency; how are we responding?

The research community responded to AIDS slowly. Luckily, one laboratory able to recognize the virus and study it effectively became involved early. Although a French laboratory first detected HIV, Robert Gallo's laboratory at the National Institutes for Health (NIH) first grew it in large amounts and provided the basis for a rapid development of diagnostic reagents. But Gallo's laboratory so dominated efforts that others were hesitant about being involved and for a number of years, very few laboratories studied the agent. Another inhibitory factor was the danger of working with HIV; few laboratories had safe facilities and no government programs for building such laboratories existed.

In the last five years, a number of new investigators have become involved in studying HIV infections. While large parts of the research community, including many with relevant experience in immunology and virology, are still on



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the sidelines, money for biohazard control is now available, a program for reagent distribution is in place but not yet functional and the challenge of HIV is widely appreciated.

The National Institutes of Health (NIH) was slow to marshal the research community in the battle against AIDS. Following a long-standing tradition, this agency was loath to direct the activities of scientists but saw its role as mainly responding to their proposals. This was an insufficient response in a health emergency and revealed a serious defect in our government's readiness to cope with newly-emerging problems. NIH needs a procedure whereby it can respond to health emergencies by facilitating relevant research activities.

HIV is unlikely to be the last new pathogen to make its appearance among us. As life styles continue to evolve, we can expect further surprises to emerge from Nature's caldron. It is increasingly likely that HIV was infecting humans for many years, but only when habits evolved of extensive sexual and blood contacts among large populations did the virus become an evident and then epidemic agent of disease. Other such cases in recent times, although none so devastating, are Lyme disease, spread by the ticks on an increasing population of deer, and Legionnaire's disease, caused by a bacterium that found a happy home in building cooling systems.

The Center for Disease Control (CDC) is prepared to investigate new outbreaks of disease and often to identify the agent involved. But NIH needs an equivalent capacity and organization to allow it to respond to new challenges as they emerge — helping to isolate new agents, prepare diagnostic reagents, design vaccines and facilitate drug development. NIH may not want this mandate, and may argue that it is part of CDC's responsibility, but if that is to be policy, CDC needs a much greater laboratory research capability.

NIH has a peculiar organization: it is a group of independent Institutes, each with a particular health goal, knit together by a Director's office with limited powers and

authority. When a new health need emerges, especially one that does not fit neatly into the mandate of a single Institute, the NIH is poorly-positioned to respond. NIH funds research at its Bethesda campus and at universities and research institutes around the country. In both cases, the individual investigators have autonomy in their decisions about research directions and goals. NIH cannot use its power to force investigators to change their directions — that would be antithetical to the principle of academic freedom — but it does need to be able to cajole, assist, entice and inform and it must be prepared to use that power. Ideally, it should be the Director's responsibility to identify new needs and see that they are met. To this end, the Director needs broader authority over the Institutes. He needs, and does not now have, flexible funds at his disposal and an ability to go to Congress to seek enlarged, targeted research resources to meet emerging challenges. Whether such authority would and should undermine the traditional autonomy of the Institutes is a broader question that deserves serious study. At present, it appears to me that the Director of NIH has insufficient managerial authority and therefore cannot expeditiously maneuver to handle evolving requirements.

A different reason for re-evaluating the organization of NIH is the increasing unity of biological research. It is no accident that the National Cancer Institute was the locus of early AIDS research — HIV is more closely related to cancer-inducing viruses than to any other. But a new infectious disease is the supposed responsibility of the National Institute of Allergy and Infectious Diseases. Other examples abound of how compartmentalizing research into individual Institutes is counterproductive and inefficient. Unfortunately, the Institute structure serves political ends effectively by providing a focus for lobbying efforts by concerned citizens; and new Institutes are proliferating.

Today, NIH is finally poised to provide the research leadership AIDS requires. With new initiatives and leadership now in place, a strong program of fundamental and applied research should be mounted that will take full advantage of America's predominant strength in biomedical investigation. We need to support heavily direct studies of HIV and of its analogs among animal viruses. We also need to support basic studies in immunology and virology that may not focus directly on AIDS or HIV. There is much to learn of general nature that can inform the more targeted studies on HIV and its animal relatives. Events in Congress recently bode poorly for support of basic research efforts. Funds for basic research are being cut while "AIDS research" is not. It is crucial that Congress understand that we cannot separate AIDS activities from more general work in immunology, cell biology and virology.

We have been slow to respond to the research challenge of AIDS but the situation has markedly improved recently, although defects remain. We should take this experience as a basis for thinking about the role of NIH in responding to health emergencies and, more generally, whether the various governmental agencies are prepared to cope with the inevitable new health dangers that will plague us in the future. ■

HELPING GORBACHEV: AVOIDANCE AND DENIAL

We have, at least, finally resolved the issue of whether there are "moderates" in the Kremlin.

But while virtually the entire population roots for Gorbachev—and some polls show him to be, for Americans, the 8th most respected person—a new expert consensus can easily emerge that we ought not do anything about it.

There is no rush by specialists to explain to the public the importance of helping Gorbachev in whatever way we can. It would sound unprofessional. It would, worst of all, seem too enthusiastic.

Ironically, unlike the experts, our public may be more motivated—in psychologic or political logic—to reach agreements as a way to help a charismatic and daring "underdog" than it would be motivated to enhance its own security.

Of course, the real issue is one of helping ourselves by encouraging businesslike U.S.-Soviet relations with carrots as well as sticks.

Success in foreign policy is a major support for reform in the Soviet Union. It follows immediately that we can be helpful to Gorbachev if we could figure out what we really wanted on conventional troop withdrawals in Central Europe; in regional disputes; in strategic weaponry, and so on, and then negotiated, in a businesslike way, to achieve moderate goals.

On human rights, the time has come to attack the double standard—set in motion by anti-communism and the century old interests of American Jews in protecting their kin—which leads America to attack the human rights problem in the Soviet Union with so much more vigor than in all other countries bereft of either American relatives or American ideological enemies—Iran, Iraq, China, Pakistan, or Argentina. The time has come to universalize our human rights approach.

Another of the benefits of glasnost, is a new popular appreciation of the weakness of the Soviet Union—a weakness that could be the political support for permitting higher technology sales.

Of course, one important way to "help" Gorbachev is to treat him with respect and to treat his country with respect. The Russians are very sensitive to our attitudes toward them.

Businesslike relations with the Soviet Union are something which the West has long sought and now, in some circles, fears. Gorbachev said recently:

"Everyone is interested in Soviet-American relations being switched on to a normal and healthy track."

Unfortunately, some Western experts see as always, dangers to the defense budget and to the Alliance from normal relations. Predictably, they want commissions of experts to be set up to control the process of improving relations.

Gorbachev is, really, a test. Can the West adapt its attitudes to the circumstances in time to take advantage of a new situation?

—Jeremy J. Stone

FAS CALLS FOR SPACE NUCLEAR POWER BAN AS COSMOS 1900 BEGINS TO CRASH

In a divinely inspired coincidence, an FAS press conference calling for a ban to "prevent the use of reactors in Earth orbit by either side for any purpose—whether offensive or defensive" was held on the same day on which the Soviet Embassy was forced to admit that one such satellite, a Cosmos 1900 RORSAT, was beginning an uncontrolled re-entry.

The environmental consequences of having fission products from such satellites dispersed was a major reason for the ban. Another purpose was to discourage military uses of space some of which would depend on nuclear power.

Participating in the press conference was Academician Roald Sagdeev, Director of the Soviet Space Institute, who was in Washington, among other things, for one of a series of workshops with the Federation on Cooperative Means of Verification of Disarmament. (These workshops are part of a five year agreement between the Federation and the Committee of Soviet Scientists for Peace and Against the Nuclear Threat which is chaired by Academician Sagdeev.)

Questioned about the application of the ban to the Soviet RORSAT surveillance satellite Sagdeev said, "The point is that even if these particular reactors are used for reconnaissance, which present strategic thinking would consider as a benign use of military technology in space . . . it is time to reconsider the use of nuclear power even for such benign purposes. Future verification techniques in space should be based on clean technologies. If we promote our common cause with the Federation of American Scientists and with the world-wide scientific community, we could probably make such a change—the new thinking involved is: try to get rid of all garbage."

Daniel Hirsch of University of California Santa Cruz, who chairs an FAS working group on space nuclear power, pointed out that the U.S. was spending "hundreds of millions of dollars to develop new space based nuclear reactors to power Star Wars battle stations, reactors that would

be many times larger and thus more dangerous than the Soviet RORSAT reactors." Thus, he said, there should be "at least as great concern about the proposed U.S. space nuclear program" as about RORSAT.

Discussing previous RORSAT crashes, FAS Fund Chairman von Hippel said that, in one case, unvaporized pieces of irradiated fuel had actually been spread over parts of Canada which could provide a dangerous dose to persons coming into contact with the debris. In another case, with a more modern RORSAT, the satellite ejected its fuel from the reactor so as to increase the likelihood that the fuel was vaporized with a view to putting the fission products in the stratosphere. This provides a small associated risk of cancer to the world population.

The FAS working group is moving on to drafting the ban for which they called. Much of the basic work leading to the press conference sprang from the Los Angeles-based committee to Bridge the Gap directed by Steven Aftergood.

—JJS



From left to right: Daniel Hirsch, Dr. Roald Sagdeev, Dr. Frank von Hippel answer questions at press conference.

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