PRIVILEGED

Meeting of the Delegations of the U.S. National Academy of Sciences and the Academy of Sciences of the U.S.S.R. on Biological Weapons

Moscow, October 8-9, 1986

SUMMARY

Delegations from the U.S. National Academy of Sciences (Committee on International Security and Arms Control subgroup on Biological Weapons) and the Academy of Sciences of the U.S.S.R. met on October 8-9, 1986, at the Shemyakin Institute of Bioorganic Chemistry in Moscow. Dr. Joshua Lederberg, President of Rockefeller University, chaired the American delegation. Dr. Evgeniy Sverdlov, of the Institute of Bioorganic Chemistry, chaired the Soviet delegation.

The agenda for the meeting was a synthesis of items suggested by both sides and included discussion of a) the problem of biological weapons and control of their proliferation; b) problems in U.S.-U.S.S.R. confidence in areas related to biological warfare and measures to build confidence in these areas; and c) possible areas of scientific cooperation to increase contacts and enhance confidence between American and Soviet biomedical scientists.

Problems of Biological Weapons and Their Control

Both delegations came to rapid agreement that biological weapons were extremely dangerous, had no rational military utility for a superpower, and that their development should be prevented in accordance with the 1972 Biological Weapons Convention. They agreed that neither the U.S. nor the U.S.S.R. had used BW in recent history, and that both countries shared an interest in preventing the proliferation and use of BW by third parties.

They agreed that the primary task now was one of trying to prevent BW development at an early stage. The American side emphasized the difficulties involved in drawing the line between permitted and unpermitted research under the Biological Weapons Convention, and addressed the problem of the dual nature of fundamental research whereby it is applicable to both the civilian and military spheres. Inherent in this situation is the unavoidable possibility and danger of rapid breakout from the Convention. The American side emphasized that the control of the development of BW, unlike nuclear arms control, would depend not on the limitation of technical developments but on limitations on the transfer of technology emanating from the medical community to military organizations. The American side emphasized that this clearly posed monumental challenges in definition and verification which would be much more difficult to solve than analogous challenges in the nuclear realm.

The Soviet side was eager to report the results of the recently concluded Biological Weapons Convention Review Conference in Geneva. Ustinov, a Ministry of Foreign Affairs representative who had been on the Soviet delegation at the Review Conference, offered an upbeat report of the Conference and emphasized Soviet initiatives made in the area of measures to strengthen verification. He expressed Soviet surprise at the negative response of the U.S. at the Conference to Soviet proposals for legally binding measures to strengthen the verification of the Convention. Ustinov catalogued Soviet offers to declare hazardous facilities and the basic thrust of their research, as well as to expand publication of research from those facilities. He was optimistic that these measures could be elaborated at the April 1987 experts meeting. In a similar spirit, several members of the Soviet delegation made efforts to describe the research being

undertaken in their own labs and extended open invitations to the Americans to visit their labs and talk directly with researchers in them.

Problems in U.S. - U.S.S.R. Confidence in Areas Related to BW

Because of the inherent possibility for dual application of fundamental biological research to the civilian and military spheres, both sides recognized that full exchange of information about their scientific research was the best way to promote confidence. However, they acknowledged and discussed the existence of barriers to this openness including national security considerations, industrial proprietary secrecy, and differences in the scientific cultures of each country.

In one of the few polemical statements made at the meeting, Schvedkov called attention to recent American press reports about increased Department of Defense spending on BW development and possible testing. The American side took advantage of this remark to stress that open information on and debate about the U.S. program was a positive development, and that the lack of information from the Soviet side was a source of tension and anxiety in the U.S. about Soviet activities in this area. The American side was responsive to Soviet concerns about reports of increased U.S. activity, and took the opportunity to clarify what the U.S. was and was not doing. The American side emphasized that the asymmetry in available information contributed to an atmosphere of distrust and even a technology race within the limits of the BW Convention.

In prior discussions, the American side had (as has the U.S. government over many years) raised Sverdlovsk as an issue corrosive of confidence because of Soviet reticence in supplying comprehensive

information on the epidemic as called for under the BW Convention. Dr. Nikiforov, the physician from the Ministry of Health called in to treat the victims of the 1979 Sverdlovsk anthrax epidemic, gave both delegations a two-hour lecture on the epidemic, showed autopsy slides of the victims, and responded to questions. The Soviet delegation as well as the Americans were quite interested in the presentation. Some Soviets indicated they had been familiarized with the Sverdlovsk incident only in preparation for this meeting. The American side explained why this has been such a serious issue in the U.S., commended the recent Soviet efforts to be more forthcoming with information about this event and in general, and encouraged the publication of the details of this epidemic for a broader audience.

The Americans requested and were given an additional two hour question and answer session with Nikiforov and his assistant Yampolskaya to probe further into the matter (see attached appendix). The Soviet doctors were forthcoming in the session, providing essentially the same information they had provided to another American scientist in August 1986. Two new pieces of information they provided were that 1) they had lectured extensively over the last five years on the Sverdlovsk epidemic to many Soviet doctors, particularly in the Sverdlovsk region; and 2) there were incidences of more than one anthrax case in some families.

Possible Areas of Scientific Cooperation to Increase Contacts and Enhance Confidence Between Scientists

Both sides agreed that scientific cooperation in the biomedical area could contribute over the long term to enhanced confidence through personal contacts and the opening up of a window on the activities of the other side. The Soviets, not surprisingly, were eager for scientific cooperation and contacts. Mirzabekov noted that the current U.S. policy seemed to be one of limiting Soviet access to

biotechnology and genetic engineering, and said that a first step toward enhancing confidence would be to gain a relaxation of the current restrictions.

Sverdlov firmly pushed for the establishment of an Academy to Academy institutional mechanism for scientific cooperation directly related to confidence-building in the BW area. The American side said the essential criteria for cooperative programs were that they be: 1) of humanitarian significance and great medical benefit; and 2) that they lend themselves to true scientific reciprocity and symmetry of input. The Soviets stressed the criteria of 1) humanitarian significance and 2) prestige and ability to attract first-rate scientists on both sides. Both sides agreed the chosen topics should hold great promise for scientific success. The American side stressed that human rights issues remain a possible barrier to cooperation because many American scientists oppose cooperation with Soviets until certain human rights cases are resolved.

The specific areas for possible collaboration raised in this meeting were: 1) structure of the human genome; 2) development and cell differentiation in cancer; 3) vaccine development; 4) genetic engineering of plants (a Soviet proposal aimed at helping and including the Third World); 5) mutational genetic load of man in the biosphere.

General Observations

The atmosphere of this meeting, coming after the BWC Review Conference and before Reykjavik, was very good. There was rapid agreement on the necessity of discouraging BW development, and interesting discussions on possible areas for scientific collaboration and on tangential scientific topics. The Soviet delegation indicated privately that they had been brought together as

a delegation for the first time for this meeting, and had been briefed both on the Sverdlovsk incident and on the BWC Review Conference also for the first time in preparation for this meeting. The discussion of the Sverdlovsk incident was extremely interesting.

There were only two or three interjections that could be characterized as polemical. Schvedkov's lengthy statement endorsing every Soviet nuclear arms control proposal and calling attention to American press reports about U.S. BW activities was one of them. Most members of the Soviet delegation were serious and prominent scientists, rather than political types.

Sagdeev came in at the end, primarily to give strong Academy endorsement to the continuation of this dialogue and the initiation of a cooperative scientific program. He did make a rambling statement discussing the differences between the BW problem and the nuclear arms problem, including an uncharacteristically caustic remark, two days before the Reykjavik meeting, about those who would defer substantial reductions in nuclear arms now for a perhaps unobtainable hope of protecting entire populations from the nuclear threat sometime in the future.

The meeting concluded with an understanding that each side would take the resulting ideas back to their respective Academies for further discussion, and that perhaps there would be another meeting of this group in Washington in May or June 1987.

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The first session of a two-day meeting of delegations of the U.S. National Academy of Sciences (a subgroup of the Committee on International Security and Arms Control) and the Academy of Sciences of the U.S.S.R convened at 11:30 a.m. on October 8, 1986, at the Shemyakin Institute of Bioorganic Chemistry in Moscow.

The members of the U.S. delegation were: Joshua Lederberg, chairman; Ivan Bennett; Paul Marks; Alexander Rich; John Steinbruner; Theodore Woodward, and Lynn Rusten (See attachment #1).

The members of the Soviet delegation were: Academicians R.Z. Sagdeev, N.P. Dubinin, and R.V. Petrov; Corresponding Members V.T. Ivanov, A.D. Mirzabekov, and E.D. Sverdlov; Academician S.G. Drozdov; Dr. Y.A. Schvedkov; Dr. V.I. Ustinov; Dr. O.M. Lisov; and Dr. Y.K. Shiyan (See attachment #2). N. Belousov and Mr. Chesnokov from the Foreign Relations Department of the Academy of Sciences of the U.S.S.R. also sat in on portions of the meeting, as did two unidentified individuals said to be experts on the subject sitting in on behalf of Academician Sagdeev who was absent most of the meeting.

Ivanov opened the meeting by welcoming everyone to the Shemyakin Institute. He expressed Academician Ovchinnikov's regret that he was unable to attend this meeting because he was out of the country. Ivanov noted the propitious timing of this meeting, coming just a few days before the Reagan-Gorbachev Reykjavik meeting.

Sverdlov said he had been asked by Ovchinnikov to co-chair the meeting with Lederberg. He suggested they begin with introductions. He said the Soviet delegation consisted largely of people from the Academy of Sciences of the USSR and the Academy of Medical Sciences and that they were well-known people in the Soviet Union involved in biology and medicine. He introduced each person and gave their affiliations, as indicated on the attached delegation list. He added that Petrov was chairman of the Immunologist Society and a member of both the Academy of Sciences and the Academy of Medical Sciences.

Lederberg thanked Sverdlov. He recalled his last visit to Moscow in June 1985, when there had been a good opening discussion on these issues in the regular CISAC meeting. He expressed regret that Ovchinnikov could not attend, but thanked his institute for its hospitality and noted the symbolic importance of holding the meeting at an institution where exciting advances were taking place. Lederberg introduced his delegation as follows: Ivan Bennett, a Professor of Medicine and former Dean of the New York University School of Medicine, and long a student of the problems of BW; Paul Marks, President of the Memorial-Sloan Cancer Center and known for his leadership in scientific research in cell biology and cancer; Alexander Rich, professor of biology at MIT who has done important work, including discovering new forms of DNA, and who had worked closely with Mirzabekov; Theodore Woodward, a professor of infectious diseases at the University of Maryland and chairman of the Armed Forces Epidemiology Board, which provides scientific guidance to U.S. Army Programs; John Steinbruner, a political scientist, Director of the Foreign Policy Studies Program at Brookings, and a member of the regular CISAC committee; and Lynn Rusten, staff to the CISAC

committee of the National Academy of Sciences. Lederberg said he was President of Rockefeller University, and had spent many years at Stanford teaching molecular biology.

Sverdlov said he and Lederberg had discussed the agenda (see attachment #3) and that they had agreed to discuss today the problem of biological weapons and the recent Biological Weapons Convention Review Conference. He said they would work in an atmosphere of candor and openness, with everyone free to make comments at any time. He said they could spend the entire day on the first point, and then go on to discussions of possible areas of cooperation the second day. He said Lederberg would start on the first point with a position paper he had prepared.

Lederberg said he appreciated this opportunity for discussion. He said he had been involved for 16 years in efforts to control biological weapons, that he had played an active role in the U.S. in efforts resulting in President Nixon's unilateral moratorium on BW. He said he advised the U.S. Arms Control and Disarmament Agency during the negotiation of the Biological Weapons Convention, and that long prior to that, he had a deep concern that the fruits of biological research be used for the benefit of mankind, not for military purposes.

Lederberg said this group did not need to be reminded of the urgent reasons for strengthening controls on biological weapons, however he brought a copy of a prior statement reviewing the issue for the benefit of those present who had not participated in the previous meetings. Lederberg said the recently concluded five-year review conference on the BW Convention demonstrated the importance of review conferences and of efforts to strengthen the treaty. He said this concurrence was an important step forward, and that their discussion here would be very much in the spirit of implementing the strengthening measures advocated at Geneva.

Lederberg said that even with the best of good will and mutual confidence, the control of BW posed serious difficulties, and it might not be possible to solve all of them as long as there remained unresolved sources of interstate conflict. He said that even while we sought progress toward broader aims of harmony, prevalent suspicions, fears and doubts about BW remained a serious obstacle to those goals. Confidence-building measures therefore remained the most important step we could take, both for BW arms control and for broader aims.

Lederberg said certain progress had also been made at the Conference on Disarmament and in bilateral discussions towards advancing non-proliferation and disarmament in the chemical weapons field. He said his own discussion would center entirely on BW with infectious agents to the exclusion of toxins and of CW, while acknowledging that progress in each arena contributed to the others. He said he was therefore more optimistic than had been possible for several years.

Lederberg said he would be compact in his outline, but even so, his talk would take an hour. He welcomed questions at any time. He identified the central difficulties in BW arms-control as a) definition; b) verification; c) the rapid advance of biotechnology; and d) the potential for rapid breakout.

Lederberg said research and development related to BW was difficult to define, so much so that definition might be a graver problem than verification. He said the scale of facilities needed for production forbidden under the BWC was fairly small and difficult to separate from the scale for research and development which was allowed under the BWC. He said defensive work, such as the production of vaccines or the testing of potential threat agents in order to refine countermeasures, was difficult to separate from work with offensive goals. Lederberg said the BWC was somewhat vague about the level of production that would clearly mark an effort as offensive and illegal. At the same time, biomedical research, their

common war against nature's enemies, required almost identical tools, training, and knowledge as those which would have potential military application. He added that, conversely, work in military laboratories had played an important part in the history of the conquest of communicable diseases.

Lederberg said the limitations of BWC verification by National Technical Means (NTM) have been well understood; several states were reluctant to sign a treaty that seemed to depend entirely on cooperative verification. He said cooperative verification was tightly intertwined with mutual confidence: each depended on the other. He said it should be in the interest of each state to do everything possible to reassure the others. He said he was pleased that a reaffirmation of this principle, and hopefully a fresh start in its practice, were signalled at Geneva. Lederberg said CW arms control may also show how mutually satisfactory regimes of inspection may be crafted that could later be applicable to BW as well. He said he would say more about confidence-building measures later.

Lederberg said the growth of biotechnology posed other problems. It would eventually enable the production of BW agents of greater precision of targetability and control, attributes that were far more important than lethality to make them more usable for military purposes. He said the future prospects of such military uses heightened the anxiety about the intentions of work that was kept secret. At the same time, industrial biotechnology had already greatly expanded overall investment in large scale microbiological facilities which might have dual potential (i.e. to produce BW agents). He said there was also a certain international competition for economic purposes, and industrial proprietary secrecy also may complicate the effort to build confidence by the freer exchange of information.

Lederberg said there was, and should be, grave concern about breakout because however effective an arms-control and

confidence-building regime we might build tomorrow, either side's accumulated knowledge, technical knowhow and industrial facilities could be rapidly converted from civilian to military purposes.

Lederberg said that medical scientists in any country therefore had a complicated burden of conscience: on the one hand, to sustain their own country's security with realistic advice about vulnerability to attack with BW; on the other to do all possible to assure that biological weapons were never used, never produced, and insofar as possible never developed by anyone. Lederberg said his advice to his government had always been, unequivocally, to avoid BW as a military weapon; and he believed any informed medical scientist would speak with the same voice to his government. He said openness may therefore have a twofold benefit: to provide reassurance building confidence as between countries; and to give medical scientists everywhere the best opportunity to advise their own governments about the wisest policies for their own national as well as global interests. He said he feared development of BW by governments who lacked good advice from scientists who knew its danger and uncontrollability.

Lederberg said medical scientists, besides their unique ethical situation, also were uniquely qualified to work out the most feasible framework of cooperative verification, to understand its possibilities and its limits, and to take an active role in its implementation. He said they had a difficult task in thinking of measures that could meet the constraints of verification, definition, rapid technology and breakout well enough to promote confidence and enhance mutual security. He said they could not expect perfect solutions overnight, and pragmatic advances would need the most thoughtful participation of scientists from all sides. Lederberg said it was therefore especially gratifying that they had succeeded in arranging for this meeting, and its particular membership.

Turning to some remarks about confidence-building, Lederberg said the Geneva BWC Review Conference suggested a number of measures, above all mutual consultation in a variety of forums and with the participation of experts. He said the U.S. government had acknowledged the value of informal exchanges, and encouraged them; it also insisted that formal consultation within the terms of the treaty not be evaded. A meeting was agreed to be held in Geneva in April 1987 to work out the modalities of exchange. He said today's discussion could be useful in outlining certain measures. Other steps included the registration of high-hazard facilities, and the publication of research related to BW. He said the overall framework of scientific cooperation in biotechnology and other biomedical research should be bolstered, and they should discuss all of these, and other possibilities, at this meeting.

Lederberg said he would not be candid if he overlooked what has been a major impediment in mutual confidence from a U.S. perspective, and that his delegation was also here to learn what the U.S.S.R.'s concerns might be. He said he was glad to acknowledge a major positive step on the U.S.S.R.'s part in opening up discussion about the anthrax outbreak in Sverdlovsk in 1979. He said this was a great step. He wanted to explain what a serious issue this had been in the U.S. He said there had been some propaganda surrounding the issue, but that also there had been at the highest levels of government a sincere adoption of a malignant interpretation of that event. Lederberg said he was glad there had been a chance to ventilate it, and that he had been delighted to learn from Dr. Matthew Meselson about his visit in August this year with Moscow public health officials who were directly involved in managing that outbreak. Lederberg said Meselson had briefed this delegation about what he learned. Lederberg also received notes of Dr. Antonov's report to the BWC Review Conference on the same subject. He said these reports provided detail that was not hitherto available and opened up clear channels for further discussion with the relevant public health

authorities, all a very large and positive step that he commended. Lederberg said he was glad that Dr. Nikiforov would participate in this meeting so they could discuss the issue again more fully. He said he hoped this could erase a needless point of controversy between their two countries. He said the epidemic was a subject of considerable scientific interest, and hoped they would have time for some informal discussion with the principals to learn more from that perspective, as well as to advance the publication of detail in a way that might overcome the accumulated speculation of the past six or seven years.

Lederberg said a more difficult problem, because it must touch on the policies of controlled disclosure that were the privilege of each country, was wider exchange of information about facilities that work on BW-related matters. The U.S. already published some information on these subjects. Lederberg said he was not authorized to speak on behalf of the U.S. government, but was confident that many still larger steps could be agreed to on a reciprocal basis. He said without broader disclosure, many biotechnology-related facilities in the U.S.S.R. rumored to be BW-related caused anxiety, and motivated initiatives to match them in the U.S., resulting in a tacit BW technology race within the latitude of the treaty. Lederberg said if these anxieties were groundless, it was not in the U.S.S.R.'s interest that they be sustained by a refusal to discuss them; and needless to say, vice versa.

Lederberg said third party and terrorist use of BW should be a matter of equal concern to the U.S. and the U.S.S.R. Similar concerns about CW have been discussed bilaterally at Berne. He said if they could achieve higher mutual confidence about BW, they would be better able to advance their mutual stance about BW proliferation and terrorism.

Lederberg said an important objective, as well as instrumentality, of confidence-building measures was enhanced scientific cooperation. It was unrealistic to expect striking

progress in cooperation so long as fear about the other side's technology was the dominant emotion in the relationship. He said the U.S. could benefit from Soviet experience and skills in many aspects of epidemic disease; and the converse was true for industrial and pharmaceutical biotechnology. He said that most important, perhaps, was that the third world was legitimately demanding that both superpowers mitigate the bilateral problems, and devote attention and resources to its needs.

Lederberg said he had as an appendix excerpts from Articles V and X of the agreed conference report from the 1986 Geneva BWC Review Conference, but in the interest of time he would just table them rather than read them aloud. He concluded his statement, which was met with applause.

Sverdlov said Lederberg's remarks were of overriding importance, and that he would add a few words of his own. He quoted a Soviet scientist who said: "Science lies in the palm of the state and warms itself on the heat of that palm." Sverdlov said science was becoming increasingly hot, that the role of science was increasing with the greater development of society. He said the scientific community was a presence in today's arena that could not be ignored, and that its role should be positive. He said science had been used both to harm and to benefit mankind. Madam Curie did not realize her discoveries would result in the bomb. Sverdlov said he was a specialist in the chemistry of radioactive isotopes produced by neutron absorption. He said he was struck by some of the things written in a book by Ralph Lapp called The New Force: Atoms and Men. Lapp participated in The Manhattan Project. In this book he wrote about the myth of radioactivity, saying that Hiroshima proved that a city could be lived in after bombing, that radioactivity was not as dangerous as it was once thought to be. Sverdlov said that Lapp did not foresee the long-term consequences. Sverdlov said today presented a situation like that of the 1940's and 1950's, when lots of gaps in our

knowledge existed. He said today we did not foresee the long-term consequences of developments in our labs. However, he said the biological sciences were in a better stage than nuclear research because there was a ban on biological weapons calling for the destruction of all stockpiles. Sverdlov said this was a first step toward the elimination of all weapons of mass destruction. He said at the recent Review Conference they declared that all biological weapons were disposed of and the signatories could continue building on confidence-building measures.

Sverdlov said he was preoccupied also with the differences between biological research and atomic bomb research. He said nuclear research was controlled by the state, because it required so much capital, etc. But biological research was undertaken privately in some countries, so it was more difficult to control by the governments. He said they had to think about the dangers of this research and possibility of circumvention of the rules and regulations governing it. He said some of the issues were being oversimplified. He said the Nobelist Wilbur had said that any recombination was less dangerous than natural occurrences. Another Nobelist believed that in the labs there was nothing new or worse than occurred in nature, like recombination, mutants, etc., and that what had not been created in nature would be in the future. Sverdlov, however, said that what happened in nature happened on an individual scale, but in the lab they created populations and favorable conditions for their survival, and they did not know what would happen if they escaped from the lab.

Sverdlov said there were two camps: the prophets of doom and the optimists. He said they should be more attentive to the prophets of doom, learning a lesson from the negative results of atomic research. He said this was the viewpoint of the staff of his institute, and that they had discussed it with their director, Ovchinnikov. He said they designed their lab as a P-III level

containment lab and it was becoming almost a P-IV level containment lab. He said he was offering this information about his lab as had been suggested at the Review Conference. Sverdlov said they were developing a vaccine against leukosis of cattle. He said they spent $5 million for the lab on top of ruble expeditures, and that they were willing to do this to protect personnel and the environment. He said the lab would be completely open and he invited everyone present to visit it when it came on line and said they would be free to ask questions of the workers, etc. Sverdlov said this should be an important discussion point of this seminar.

Sverdlov said his second point was that the problem of confidence-building measures was a most crucial issue. He said if there were mutual confidence, then issues such as propaganda about certain events became less important. He said for instance that if he and Rich were in frequent contact, and if there were allegations that Rich was involved in developing BW, that Sverdlov would be able to discount those allegations. But if he did not know Rich and his work, he would not be able to evaluate those charges.

Sverdlov said it was important to collaborate on the most humane biological problems. He said in this meeting they could formulate areas of collaboration to present to their Academy leaderships. He noted the existing record of scientific collaboration, recalling a time when they tried to organize a permanent seminar on molecular biology. He said the first meeting, attended by David Baltimore, occurred in 1975 in Kiev, but that regrettably was the first and last meeting. Sverdlov said they had bilateral symposiums with other Western countries, but regrettably they did not know as much about scientists in the U.S. He said this went to the level of friendship as well as to professional relationships. Sverdlov asked that these points he raised be added to Lederberg's list of issues to discuss.

Petrov said Lederberg had mentioned the ethical responsibility of scientists. Petrov said this was well understood and that it was his understanding that this responsibility rested heavily on scientists

who had made major breakthroughs. He said they were familiar with Lederberg's accomplishments. He said these techniques were now available to "the man in the street," and that maintaining the responsibility of scientists was easier to achieve than resolving the responsibility of "the man in the street." Petrov said this ethical dimension became very important because who knew what were the ethics of the man in the street. He said it was difficult to predict the areas in which a major breakthrough would be disseminated to lesser minds.

Petrov said he was an immunologist, trying to remove immunity by creating tissue compatibility. He said if this occurred by a new method, then BW would not be needed. Any germ in the environment would become a danger, the body would be open to assault by hostile germs. Petrov said he said this to make the point that someone needed to make a list of the most potent hazardous lines of biological research and determine whether the research was necessary. He said it was necessary to monitor and verify these research facilities, and asked where the dividing line was to be drawn. Petrov said genetic engineering was on the hands-off list. He asked whether suppression of immunity for transplants needed to be closely monitored. He reiterated the necessity to list these potentially dangerous areas and to make humankind aware and alerted to the dangers.

Sverdlov agreed Petrov's point should also be discussed. The meeting broke for lunch.

After lunch, Rich said he wanted to make some statements reinforcing some of the comments made earlier. He said that BW were weapons of mass destruction, and that both the U.S. and the U.S.S.R. already had weapons of mass destruction. He said the fact that other nations might develop BW posed a great risk, and it was in both countries' self-interest to set up a system of adherence to the BWC and to make it impossible for others to develop BW. Rich said their

countries' interests were congruent in this area, and they had the opportunity here to exercise ingenuity. He asked whether they could invent political and social mechanisms which would build confidence and strengthen the treaty. He asked whether they could do things to ensure that BW development was not being considered. Rich said he could think of many approaches, and the most obvious had to do with openness. He said they in the U.S. were interested in and encouraged by the Soviet policy of "glasnost." He said this principle could be applied in the field of BW. Rich said he wanted this kind of activity to be discouraged in the world, that he did not want BW falling into the hands of terrorists, and so they were left with the challenge of inventing mechanisms that build confidence.

Schvedkov said it was his privilege to address this meeting in a broader framework. He said this reflected not only how he felt about it, but also what his profession as a political scientist motivated him to do. Referring to the hazards and dangers of BW proliferation, Schvedkov said he had been asked at lunch whether the Soviets were worried about the development of BW in the U.S. He said the U.S. press had given them reason to worry. He said it was one thing when they wrote about developments in Southeast Asia, but another when they wrote about Department of Defense activities. He said the Washington Post and Wall Street Journal reported on U.S. programs to test BW. Schvedkov said they were concerned about these developments. However, despite this, he said he wanted to make clear they regarded the BWC Review Conference as a first step toward eliminating weapons of mass destruction and changing the way of thinking in this century. He said in the late 1960's, some people thought BW could serve a rational purpose as weapons of mass destruction or for terrorists, but this realization did not come that easily to the U.S. Schvedkov referred to a book by Graham Allison on U.S. foreign policy which demonstrated that the rational argument to give up BW was resisted by DoD. Schvedkov said proof of this existed

in recent reports in the U.S. press. He said from a broad political perspective, it was not possible to examine compliance with the BWC outside of confidence-building between the U.S. and the U.S.S.R.

Schvedkov said the Soviets did want to progress in advancing new innovative concepts. He referred to the Soviet proposal to eliminate nuclear weapons and the Warsaw Pact proposal to make deep cuts in weapons from the Atlantic to the Urals, both butressed by their moratorium on nuclear testing. He said these proposals signified progress in the thought of the Soviet people and leadership, and the desire of the leadership to deal with those concerns. He said they did not believe the American Generals anymore then American Generals believed them, so they too wanted far-reaching verification. He quoted a Gorbachev interview of September 9, 1986, in which he said there could be a supranational network of CTB verification. Schvedkov said that to him personally, this was a serious phrase with far-reaching implications. He said the Soviet government recognized the feasibility of international and supra-national forms of verification. He said the Warsaw Pact in its proposals was calling for verification and on-site inspection, and that in the Chemical Weapons talks they were discussing far-reaching methods of verification. The Stockholm accord represented early steps toward confidence-building measures.

Schvedkov apologized for talking about things so remote from BW, but said they were related. He said BW could be expected to be used in a war of complete destruction. He said confidence-building measures were related to measures to increase security between their two countries. But the third-country problem was reflected by this upsurge of terrorism, which was generated by countries feeling insecure. He said they had to do more than limit BW, they must ensure confidence between their two countries, and then maybe the entire international environment would be more stable. He said they could provide an additional impetus toward better and more

international security, and scientists could do much to promote international negotiations. Returning to the subject of BW, Schvedkov said they should go on record to say that the BWC was a working convention. He said he did not think it was being violated anywhere, and biological scientists would have to do their utmost to enhance the convention.

Lederberg said he was interested that Schvedkov raised questions about publicly available information in the U.S. on BW. Referring to a Wall Street Journal article of September 17, 1986, Lederberg said he would stipulate that the numbers were approximately correct and showed an increase in research in this area, with spending at $40 million in 1986. Lederberg repeated that this was publicly available information, and that the nature of the facilities at Dugway was under intense debate, with close scrutiny by Congress. He said these activities were legal and within the bounds of the Treaty, yet they must make the Soviets very uneasy about the long-range intentions of the U.S. Lederberg said maybe they thought this was just the tip of the iceberg. Yet, he asked them to try to look at the problem from the American point of view, where there was not this kind of open information about Soviet activities. He said in the absence of public information, there was only speculation with a tendency toward worst case scenarios, and this drove the process. Lederberg said he was worried about a technology race within the bounds of the BWC. He said an important step would be reciprocity with regard to providing information. He said more, not less, discussion on both sides would produce realistic appraisals of each others' activities. He said he was alarmed because it was natural that these newspaper articles would alarm the Soviet Union and spark Soviet activities, thereby feeding into a cycle of technology race. He said openness must be encouraged by an understanding of the possible disastrous final consequences. He said there was agreement on this point, that it was reflected in the Review Conference in Geneva.

Lederberg said he had with him public information about U.S. programs which was fairly comprehensive. He said questions must be addressed not just through the press, but through proper channels. He said he agreed generally on the relationship between BW and arms control. The prospect of nuclear annihilation was the main source of anxiety, but he worried that if nuclear weapons were controlled, there would be easy recourse to BW as weapons of mass destruction, and they would be technologically more readily available to other countries. He said he hoped the Convention was working, but it was not enough that each side knew it was complying; each must know that the other was complying. He said they had to discover more active means of assuring each other, through what he termed "affirmative cooperative verification." He said progress was being made in that direction.

Bennett made some additional comments on what had appeared in the press. He said the numbers were quite accurate and showed an increase in spending. But, he pointed out that a lot of that money was for vaccines, and full scale production of vaccines was costly, so just looking at the numbers could be misleading. He said concern about research in the U.S. was also related to concern about the environmental hazards of this research. He explained this had ended up in the U.S. courts on that basis, and unfortunately not on the basis of whether these activities were in compliance with the BWC. Bennett said this discussion pointed out that the asymmetry in available information was a source of tension. He said he favored this idea of affirmative exchange of information so we could know what each other was doing. He said they needed to talk about what they as scientists could do to build confidence in the BWC, and he hoped they would come up with concrete suggestions at this meeting.

Turning to a new subject, Dubinin said that 50% of zygotes persisted in the natural environment. He said this was a biological point, that environmental mutagens were little else than a way to affect human inheritance. He said environmental mutagens were

related to nuclear weapons by a steady, gradual, slow process. He said they could be incorporated into the environment and could be large enough to affect mankind. He said in that area, one needed to have methods of analysis into the mutation of man, but these methods were not practical because they required high investments. He said six methods were being developed for DNA mutagenesis; none were realistic, but they were in progress and could become an area of joint Soviet-American research. Should this research be achieved, he said it would build confidence. Ten point five percent of newborns were born with genetic defects. He said they could affect human development in a common effort to make new peaceful developments.

Lederberg said he shared an interest in this problem of chemical factors in the environment, some natural and some from pollution, and now the problem of toxins for military uses. He said this research should be encouraged and would produce positive results. He said the relationship of this to confidence-building was that openness should operate internationally and intranationally. He reiterated that the Wall Street Journal article was a matter of public debate, and they could learn by talking to American scientists about these programs. He agreed there was deep interest in this area in the U.S. and that direct measures of mutational changes within the U.S. population would be achievable at lower cost in ten years.

Steinbruner called attention to the peculiar character of this problem as an arms control problem as different from other arms control problems. He said the good news was that the problem was almost entirely in the future, if at all. The BWC was in place, there had been no recent modern day use of BW, and there was only one past incident that needed to be cleared up and that had begun. He said they were preventing something, rather than having to roll something back. He said BW arms control also had a different character in that the research and technological dynamic was coming not out of the military community, but out of the medical community,

which was conducting the research for good reasons. Technology to help society could be used to hurt it. He said this was mixed up with constructive work in a way that weapons were not. He said they could not try to limit technology development as they did in the ABM Treaty. Fundamental techniques would be created for medical purposes. He said they had to get at intentions, instead of capability, and this posed a very big challenge. He said openness and cooperation were necessary, but very abstract. They faced the problem of bringing definition to these principles that would give them meaning. Steinbruner said that if the technology were developed outside of military organizations, an important key to control would be prevention of the transfer of technology to military organizations. To do so in a credible, verifiable way, they would have to depend on rules of how military organizations conduct themselves, and that would put them into the different area of how one observes military operations to be sure their character reflected what they had agreed was limited. He said they would have to think about how to control the transfer of technology from the civilian to the military sector.

Lederberg said one criterion to define the dividing line was secrecy. He said large scale conversion of civilian technology to the military would be done in secrecy. It was not impossible to imagine an agreement that the militaries would not conduct BW prevention research, but that would require enforcement.

Sverdlov said he had a few words of commentary on the issue of openness. He said the problem was vaster than one of openness, that confidence was the criterion of confidence and that was a vicious cycle. He said the people at this meeting were organizers of research. He said an agreement required an organizational and institutional mechanism to ensure confidence. He said they all subscribed to the ideas expressed so far, but the big issue was to take action.

Merzabekov said that governments sometimes made decisions without consulting scientists. He said scientists thought that if anything was interesting, it should be studied, regardless of possible long-term hazards. Politics did have an impact on scientists. He said President Reagan regarded biotechnology and genetic engineering as areas where the Soviets should have limited access. Merzabekov said the first confidence-building measure should be to increase the sheer numbers of people in scientific exchanges. Governments sought advice from scientists. He said if American scientists harmonized with Soviet scientists, the U.S. government would listen. Merzabekov said there was always the danger one side could duplicate what the other was doing in its labs, and this fact could lead to restraint. He expressed his hope that at Reykjavik the politicians could make a step forward in confidence-building measures as a step toward further openness.

Marks offered some personal reflections on the comments made so far. He agreed with Sverdlov that communication must be freer and said the challenge was how to accomplish that. He said they had to understand the differences in the cultures in which they worked. He said the Americans could provide the Soviets with more information about Department of Defense support of microbiological research. He expressed the view that the Soviets had nothing to worry about so long as it was in the open realm and subject to public discussion. He said the amount of communication between scientists in the U.S. was more intimate and rapid than within the U.S.S.R. If this was not true, he asked to be informed and educated. He said these steps required commitment to a long-term process. Neither side had a record of resorting to biological warfare. But, he said the technology was evolving rapidly and they had a window in which to move expeditiously toward full public disclosure and a process of science fully in the public eye. He said this group must move slowly in the area of scientific seminars to explore advances. Marks said

that one could not understate the problems of differences of perception due to differences in the scientific cultures of their two countries. He recommended they take a long-term view of achieving these goals through the establishment of coordinating committees in the two Academies to oversee joint projects. He suggested certain areas for collaboration including vaccines and cancer research.

Ustinov offered some remarks on the translation of confidence building measures into specific steps. He said actions should be taken at the junction of science and politics. Ustinov said the Soviet side made some steps at the Review Conference, including a proposal to have a group of scientific experts discuss breakthroughs in technologies relevant to the BWC. Other suggestions they made included exchange of data on research centers undertaking biological research including location of facilities, and volume and basic thrust of work; and on epidemic breakouts. He said the Geneva forum accepted many of these suggestions and they were translated into a decision to convene in April a conference of scientific and technical experts to work out these measures. Ustinov said the Soviets were open to the ideas of other parties, including the U.S. proposal to intensify the publication of research relevant to the BWC. He said Sverdlov's call to complement the exchange of ideas with an exchange of information would build confidence. Ustinov said the Soviets preempted the U.S. side at the Review Conference by proposing to formulate a protocol to the Convention to include legally binding measures to improve compliance with the BWC. He said the Americans were the first to oppose this proposal and it surprised them because usually the Americans were vigorous in looking for stronger verification measures. He said the Americans were not prepared to accept this idea, even though it was supported by Ireland, Pakistan and the socialist countries. He said if they were preoccupied with the BWC, then they might think of it also in these terms: That promoting it and ensuring its effectiveness was a matter of goodwill

and of what the U.S., the U.S.S.R. and the U.K. would do -- this would determine world perception of the BWC. Ustinov said it now had 100 or 103 signatories, but now there were hesitations to join due to internal reasons, such as some African countries not being ready to address the BWC. He said there was some relation between the BWC and the negotiations to ban chemical weapons. In 1969, they decided to ban BW and chemical weapons in separate treaties. He said the chemical ban may soon be ripe for signature, but there was an attitude to wait until the end of the chemical weapons negotiations so that some of those verification methods could be used to verify the BWC.

Rich said there was strong sentiment that the BWC had been effective, and it might be unwise to open it up and change it. He said the Americans may have felt that opening the treaty to add verification measures might also open it up to measures that could weaken it. He said it would be possible to develop measures to strengthen it without opening it up to discussion and risking weakening it.

Drozhdov said the problems being discussed here had been discussed from different angles. He said he was a virologist, and this created for him the image of using viruses as weapons to cause outbreaks of epidemics. He was glad to learn of the existence of the Convention and its effectiveness. He asked how it could be made workable, how the world public could be given guarantees against possible violations. Drozhdov said that researchers were responsible for the outcome of their research and its possible misuse. He said research was two-sided. If something was ripe to be examined, scientists examined it. He said gene-engineering could be both a great benefit and a great detriment to mankind. He said BW was not realistically applicable today, but it was self-reproductive and self-propagating, and unless it was controlled, it could destroy mankind. He referred to a Jack London story, "Scarlet Fever," which

was about the destruction of society except for two men. He said one idea heard here for averting such a catastrophe was to develop protection from BW through vaccines. He said products to counter BW would contribute to confidence building, and if they could work for defense, instead of attack, this would modify the mindset of the people involved in it.

Drozhdov said he was from the Institute of Polioviruses, which was open to foreigners and was itself an outgrowth of U.S.-Soviet cooperation in developing the vaccine against polio. He said his institute was open to all guests and it was necessary that each side go to the other side and question what it was doing, rather than having to resort to press reports. He said each side should visit the other side's labs and ask questions of the researchers. That kind of cooperation would be useful. He said what was happening now was that scientists were harnessing powerful forces that were hard to control, and their task was to give humanity safeguards that these forces would be used for good, peaceful developments, and not to the detriment of mankind.

Lederberg suggested they look ahead. He said they were just starting to look at problems at the boundary of science and politics. He said they could take some encouragement from progress at the BWC Review Conference, including the ad hoc meeting of experts in Geneva in April which might cover some of the issues they have been concerned about. He said looking ahead, there might be a special role to be played by this group. He suggested an extension of these discussions after the experts' meeting in April. Lederberg invited the Soviet delegation to continue this discussion in Washington at a mutually convenient time, perhaps in May or June.

Woodward said the most important product of this meeting had been the openness of the discussion and confidence-building between these two groups. He said if this process stopped here, it would stop on shallow ground, so he hoped there would be a continuation of the dialogue.

Woodward said he would follow up on some of the comments made earlier. He said he was interested in infectious diseases, and noted that $40 million was spent by the U.S. military on infectious diseases research. He said the problem was that diseases like malaria did not interest their civilian researchers, that their purpose was to protect military people in areas where those diseases persisted.

Woodward said this conference reminded him and Bennett of a meeting twenty-five years ago where they evolved a joint U.S.-Japan medical cooperative program. He said he could think of one area where U.S. and Soviet scientists could cooperate to build confidence: in smallpox, which had been eradicated except from primates in Africa. Woodward said the U.S. had stopped immunization against smallpox. He said they could agree to do away entirely with the smallpox vaccination, and this was an example of how to take a little step toward progress. He said he did know that military research had helped the civilian sector, so they were talking about a two-way street as far as military research was concerned.

Sverdlov said he would offer some concluding remarks for the first day. He said their discussion had been open, candid and friendly. He said the plan was to talk about joint research programs the following day, but they had started on that today. He suggested that the next day they start thinking in institutional terms about confidence building measures. He said Marks had made a suggestion similar to one of his own, and which he had discussed with Ovchinnikov. Sverdlov said there was a very good starting point in launching U.S.-Soviet joint committees to organize cooperative projects, seminars, and committees. He said the discussions had been useful and they had heard a series of interesting specific suggestions. He thanked everyone for a useful day of discussions.

Lederberg agreed, saying it had been an exemplary discussion. He said it was an historical event to get well-known scientists to discuss these issues at the border of science and politics. He said this day alone was an outcome that justified the effort involved.

Sverdlov thanked the interpreters for their good work. The meeting adjourned for the day and resumed at 10:30 a.m. on Thursday, October 9.

Sverdlov opened the Thursday session, saying that Dr. Nikiforov had been invited by Lederberg and Marks to address the group. Nikiforov was the immediate physician at Sverdlovsk during the anthrax outbreak. Sverdlov said Nikiforov did not bring his slides, but they could be brought here. He asked Lederberg what he preferred to do. Lederberg said it would be better if Nikiforov brought his slides. Sverdlov said it was agreed then that Nikiforov's slides would be brought here and while they waited, they would start on the discussion of specific measures of confidence-building. He asked Lederberg if he wished to make any remarks.

Lederberg thanked Sverdlov. He said confidence-building measures fell into two categories. The first was steps specifically related to BW programs. He said they also fully understood the importance of more general measures of scientific cooperation to improve the quality and effectiveness of medical research. Lederberg said they probably wanted to spend most of their time today discussing the second category. He said it was unfortunate that they lived in a world where they had to discuss this, because science ideally should have no national bounds. He said there was, of course, individual competitiveness, but that was not a serious problem. He said the intermingling of the pursuit of science with national competition and rivalry was the source of the problem. In regard to military applications of science, Lederberg said it would be desirable to reverse the trends of the last 10-15 years. He said they must do this in a step-wise fashion and start with those things that would have the least resistance and the widest appeal due to their humanitarian significance. He recommended focusing on subjects with these features: a) programs stressing medical problems of broad significance; b) programs with true reciprocity, where both sides

would bring something of equal significance and magnitude. Lederberg reiterated that if they proceeded in this manner, they would be least likely to counter resistance in the U.S., and he said he thought there were probably similar sentiments in the U.S.S.R. Lederberg said they should of course work on things of interest and importance in which there was eagerness to participate on both sides. He said his statement was obvious, but served as a good guideline for their discussion.

Sverdlov said he was struck by the degree of coincidence of philosophy of himself and Lederberg. He said Lederberg's thoughts were remarkably similar to the ideas he had written down in preparation for today's discussions. He told a story of a Russian general practitioner of the last century who always turned away from a cemetery when he rode past it, explaining that he was ashamed because many in that cemetery had been his patients. Sverdlov said their shame as medics could be reduced by cooperating on medical problems. He said Lederberg had ably expressed that concentrated scientific programs could help achieve medical, biological and human goals, as well as build confidence.

Sverdlov said he would read his prepared notes, which were interesting in that they were so close to Lederberg's remarks. Sverdlov said the first requirement of cooperation was that there be just a small number of well thought-out programs. Second, they must be relevant to the times and humanistic, the opposite of BW in substance, operating under the slogan "biology for the benefit of mankind." Third, they must be prestigious, attracting serious scientists, and they must be successful projects. He said the programs must be well financed, and there should be bonuses and incentives to attract the best scholars. Those involved must realize that they were to advance both science and politics, and it was hard to say which was more important. He said scientists' personal ambitions must be in harmony with the project and they must realize

that they were part of a scientific and political experiment which could lay the foundation for cooperation. There must be a political result as well as a scientific result.

Sverdlov recalled that Marks the previous day said that management of the program should be by a joint committee which should provide a broader context such as information sharing through seminars, workshops, etc. Sverdlov said one possible program could be in research on the human genome and diagnosis and treatment of hereditary diseases. He said this was an important problem on which there was already scientific cooperation, as in Huntington's disease, muscular dystrophy, etc. These involved methods of pre-natal diagnoses, but could involve later gene therapy. He suggested they formulate a specific program on structure of the human genome. He said this was a costly program which perhaps could be done on the international level. Sverdlov said a second area was development and cell differentiation in cancer, with the long term goal being to cure cancer. He suggested looking at the role of the individual gene in carcinogenisis.

Petrov said it appeared they had reached some agreement already, with everyone agreeing there should be uniform guidelines. He said the main idea was to oppose BW and the intervention of BW into human organisms. He said there were certain scientific fields that were very hazardous for the production of BW, and that they should keep promising scholars in those fields in mind and set exclusively peaceful objectives before them and not let them get into the hands of the military. Continuing the ideas expressed by Drozhdov the previous day, Petrov said they should discuss new approaches to designing new vaccines. This was important because it involved some of the same fields and scientists as could be involved in BW activities. He said Pasteur's principles for designing vaccines were not working for new infections, and no other types of vaccines were capable of killing some types of infections. He said they must try to create artificial vaccines, recombinated vaccines, on the basis of

genetic engineering synthesis. He said work in this direction was taking place, they were trying to integrate and complex natural and artificial material, and they were on the threshold of success in this field. He said working on this were Professor Lerner in the U.S., a large group of scientists in Israel, Professor Ladnor in France, Svenson in Sweden, and a large group of Soviet scientists doing work on this in the Institute of Virology and Immunology. Petrov said he was putting forward another program idea dealing with genetic vaccines, involving the fields and scientists discussed here.

Lederberg expressed interest in Petrov's proposal. He said in the U.S. they had reached a tragic impasse in technical and legal developments regarding vaccine development. He said every vaccine would have side effects, even though it would save many lives. He spoke of the so-called "swine flu fiasco." That was a good vaccine, but it became enmeshed in politics. Lederberg said legal liability for vaccine side-effects had become a big problem. Juries tended to focus on individual distress, not the larger humanitarian and medical context. Lawyers, eager to earn large fees from large damages, were pushing this in a vigorous way. He said the net result was that it was almost impossible for pharmaceutical firms to stay in the vaccine business, and the ones that stayed in charged a great amount for vaccines, with 95% of the cost to cover insurance. He said it would be natural for this to be succeeded by a nationalization of the process, removing the profit motive. Lederberg said this area should be socialized, but it was taking a long time in the U.S. Technical possibilities were far ahead of the legal possibilities. He said AIDS represented serious technical problems with the possibility of vaccines, but the technical problems were small compared with the operational problems of getting into testing and development of vaccines. Lederberg asked what was happening in the Soviet Union in this regard. He asked whether they had analogous problems, or whether they were able to test and develop vaccines as easily as twenty years ago. Lederberg said it had been said that the polio

vaccine could never have been tested in the U.S. today. He said it would be ten to fifteen years before this situation changed in the U.S., and asked what was the situation in the U.S.S.R.

Sverdlov said Petrov and Drozhdov could provide exhaustive answers to this question. Petrov said he had only a small remark, which was that it seemed the U.S. now faced a situation where there were fewer legal barriers to the creation of BW than to new vaccines.

Drozhdov said Lederberg's question about operational differences with vaccines was interesting and complicated because it illuminated a range of problems. He said doctors were concerned about improving human health, but the final testing must be done on people. He said that according to Soviet medical tradition, at a certain stage they begin "field tests," which were required before introducing medicines. He said they were familiar with the problems in the U.S. of legal actions taken against vaccine producers and improvers. The World Health Organization tried to work out an international position on that problem. He said he attended this meeting, which resulted in a document outlining new principles to be used in the development and production of vaccines. Drozhdov said this document could be a good basis for a solution, to control the relationships between the designer, producer, state and recipients of the products. He said he was not familiar with the legal basis in the Soviet Union, but offered to explain their guarantee system that guaranteed safety to the participants. He said vaccines went through testing before they were adopted for distribution, and this was approved by the Ministry of Health. The test results were discussed by the Committee on Vaccines of the Ministry of Health, which was authorized to carry out independent recommendations which were binding on the Ministry of Health. Drozhdov said they were aware of possible side-effects, so they considered public opinion and the opinion of all relevant organizations. He said they had a different system, and also a different system for compensation for health damages. He said

international cooperation could help to solve this problem on the basis of recommendations made by Petrov. He said in the U.S. there were tests of vaccines which were the basis of the polio vaccine, and wide testing in the U.S. and the U.S.S.R. speeded up its development. He said widespread testing could yield information on epidemiology and side-effects, and they could use cooperation in some way to develop new vaccines.

Sverdlov called for a coffee break and said Nikiforov's slides would arrive shortly. After the break, Drozhdov reiterated that these cooperative programs must have a high measure of publicity so that everyone's reputation would gain and good researchers would be attracted.

Rich endorsed the comments made by Petrov and Drozhdov concerning the field of vaccine development. He said it was an area of increasing importance for a variety of reasons. He said the important point about doing joint research in this area was that it was at the heart of mutual confidence because it would involve the same people as those involved in BW research. Rich said it would be effective in letting people feel they had a window on the activities of both sides. He said it was a very useful area deserving a lot of attention for confidence building in the BW area.

Lederberg said he was glad to have been reminded of the history of cooperation in this field. He recalled a moving article by Sabin about the development of the polio vaccine. He said that prior example lent credibility to this as an area for cooperation. He said what should happen next was that each side should refer this and the other proposals raised back to their respective Academies. He said he would also bring back these ideas to the NIH Director, who would be coming to the U.S.S.R. in the next month primarily to discuss cancer research. Lederberg noted that Marks and Rich were both on the advisory committee to the NAS on international activities, so they would have a strong voice in Academy deliberations.

Lederberg asked whether they should talk more about specifics. He said whooping cough represented a problematic situation in the U.S. There was a vaccine, but it caused side-effects because it was toxic. He said there had been a public reaction against it, particularly in Great Britain. The quality of the vaccine may be among the worst that is produced. He said this was a complicated problem that deserved attention, and the appropriate route for vaccination was uncertain. He said there was lively interest in this in the U.S. and the U.S.S.R. Lederberg said diarrheal disease was underestimated as a cause of morbidity in the world, and it would be desirable to have more effective approaches to deal with it. He said the World Health Organization sponsored efforts in other areas such as leprosy and TB. He said the BCG vaccine for TB was now believed to have limited value and this would be another important area of inquiry. He said it would be interesting to have some discussion on this.

Sverdlov observed that this problem of vaccines had stirred a lot of resonance. Woodward expressed his agreement with Lederberg on the importance of diarrheal disease. He said another possible vaccine candidate was encephalitis. He said this was an important area of bilateral pursuit that would help the world at large.

Bennett said it was useful to discuss candidates, but the final choice should be to work on vaccines for specific diseases. He said this should be looked at from the point of view of scientific opportunities. He suggested a mechanism modeled after the program with Japan, which also bore on rewards to the scientists involved. In the program with Japan, they had a panel on viral diseases which would work on two or three diseases at a time. But, they held annual symposia which would be addressed by the most prominent virologists speaking about their work. Their techniques could be applied more broadly. Bennett said the choice of topics should be made by experts who could evaluate the scientific opportunities to succeed.

Lederberg said he was reminded of an Institute of Medicine report on priorities for vaccine development, which he said he would be sure to share with his Soviet colleagues. Bennett said that report was based on both priorities of public health and scientific opportunities.

Marks endorsed what Bennett had said about the importance of opportunities for progress. Marks said research on cell differentiation and the human genome were both areas that provided opportunities for broad collaboration in areas of basic science. He strongly endorsed these areas and said they would be well-advised to focus much more specifically within these areas. For cell differentiation, Marks said an important concept was that of the reversibility of malignancy. He said this was opening an important conceptual approach to treatment, and some labs in the Soviet Union were also involved in this. He said it was so complex and broad that it would require a significant commitment at the clinical level. Sverdlov agreed this was an interesting field from the scientific point of view.

Merzabekov said they had been participating today in a seminar organized as a consequence of expanded cooperation of scientists. He said they should think about cooperation in basic research. In researching the human genome, Merzabekov said there were opportunities to make physical maps of the human genome, to make sequences of the original genome structure, and to understand the operational process of chromosomes and genomes. He said they could begin long-term research in this field; they were at the initial stages of this research, and it was important to begin collaboration at the beginning.

Merzabekov said they had started new research in DNA operation in terms of the human genome in certain tissues. He said it was recently reported that this could be useful in treating AIDS. The inhibition of replication of certain viruses could be of fundamental importance. He observed that one danger of these bilateral meetings

was that some countries might suspect a "superpower condominium," so it would be good if they could do something about hunger by engineering the development of plants and vegetation. He suggested they could include Third World people in these discussions.

Sverdlov said the slides had arrived and they could now hear the presentation by Nikiforov.

Nikiforov said he would like to present material on a special form of Siberian anthrax. He said he was a general practitioner who had devoted almost all of his career to its study. He said it was a source of great trouble in Russia and its danger was still significant today. He said it was endemic in Sverdlovsk, which happened to be the interest of certain researchers, as well as of political interest. Nikiforov said that since 1938, there had been over one hundred fifty recorded cases of animal diseases, and anthrax had been reported in 30 administrative areas in the Sverdlovsk region. He said that against this background, an outbreak in this region could have passed unnoticed, except for the fact that in the Soviet Union, 98% of anthrax in man occurs in a dermal form. However, in Sverdlovsk in 1979, they were faced with a large outbreak of intestinal anthrax. He said they had been unable to totally explain the pathogenesis of this. He said in a previous outbreak in Smolensk [sic] the cause of the outbreak was contaminated sausages, and twenty seven out of thirty seven cases died. Nikiforov said one or two anthrax cases annually was usual for the Soviet Union.

Nikiforov said what was extraordinary about Sverdlovsk was the intestinal form. The outbreak had been preceded by morbidity among domestic animals. He explained that people with private livestock circulated meat and bone flour that proved to be infected with the agent that caused anthrax. It took four to five days to market the flour, followed closely by disease outbreaks among animals. He said some of the sick animals were killed and their meat was sold on the black market, bypassing proper inspection. He said this occurred

mostly in the southwest portion of Sverdlovsk. The first human case was on April 5. It was very serious, with incredibly fast lethal outcomes. He said the disease set on violently, acutely, with unbearable cutting pains in the abdomen which they were unable to control. He said the victims had swollen bellies, bloody diarrhea and vomit, and clinical symptoms of toxic infectious shock including labored breathing (47 breaths per minute), cyanosis, tachycardia, and an unstoppable fall of arterial pressure. He said there were major disturbances in coagulation, fibronolysis, increased urea, and the body temperature rose to 41° centigrade and then fell to 35-33° centigrade. Nikiforov said many patients developed subjective improvement with the fall of fever, but then died within five to seven hours. He said this summed up the general clinical picture of the symptoms of the patients.

Nikiforov said he was flown to Sverdlovsk on April 6. The number of cases kept increasing and so did their lethal outcomes. He said on some days they had to autopsy five or six corpses. In one month, 96 people got the disease, representing the largest single outbreak of this disease in Soviet and Russian history. He said 17 were identified as having the pure form of dermal anthrax, of which six cases had this form complicated by generalization of the process. He said 79 had the pure intestinal form, and out of those, 64 died. Fifteen patients with the intestinal form survived. Nikiforov said that, apparently, this was an extraordinary thing to achieve, since they knew of no other survivors in the world of this form of intestinal anthrax.

Nikiforov explained what they did. First, they took strict hygienic steps to withdraw the infected meat, broadly communicated the danger and warned people not to eat it. Second, they installed promptly a treatment clinic next to a hospital, converted it into an anthrax treatment center and took there all people with fast rising temperature, bad feelings and changes on their skin. He said they

intentionally erred toward hospitalizing more people than probably had anthrax. He said they used the latest available antibiotics in 1979, and used them in maximum allowable doses. They diagnosed a total of 96 anthrax cases, even though they hospitalized and examined five times as many to detect all anthrax cases. He said they were very fast in diagnosing anthrax. On April 10, they obtained bacterial evidence to confirm the diagnosis of anthrax, and the strains proved identical from animals and people. He said the strain was virulent, with sharply defined capsula. It was sensitive to all the antibiotics they had at their disposal, including penicillin. He said they paid maximum attention to bringing patients out of toxic shock, but the most active treatment failed to produce much result. Nikiforov said it was impossible to stop the clinical development of toxic shock and the patients died within twenty-four hours after the shock developed. He said the life of the infected persons was only 24-48 hours, and it took intense efforts to extend that period even a few hours.

Nikiforov said there was edema of the brain and of different tissues. There was acidosis indicated by an extremely low pH of 6.8. Early introduction of active treatment allowed them to save 15 patients. He said they were unable to bring patients out of toxic and infectious shock. Nikiforov said he would show some slides, and he apologized for the poor quality of some of them, explaining that sometimes he had a shortage of color film, and that the situation was such that taking pictures was not the most important thing. He then showed a series of slides showing skin lesions and autopsy slides showing severe damage including extensive hemmorhage to the intestines, spleen, lungs and brain of several anthrax victims.

Sverdlov thanked Nikiforov and said it was time for the lunch break. After the break, Sverdlov said Nikiforov was available for questions now, and that the Americans would meet with him further the following day.

Lederberg said he would have more detailed questions for him the following day, but did have one question now. He said the epidemic must have been very difficult to treat, because it had many unique qualities. Lederberg asked whether lab studies had been done on the strains they isolated in the epidemic to ascertain whether they were extraordinarily virulent.

Nikiforov said they conducted research to determine if it was anthrax or some other infection, and to learn its sensitivity to antibiotics and discover regular features of the strain.

Woodward said he and Nikiforov had a good discussion during the lunch break and summarized for the group the results of that discussion. He said each patient that had the cutaneous form had contact with animals. The man with the swollen arms shown in the slides had been given steroids which had no effect. He said there was a relationship between earlier treatment and earlier recovery. Woodward noted parallel features with hemorrhagic fever, where once shock appeared, steroids also had no effect.

Nikiforov said that all cases of skin form of anthrax in the uncomplicated form survived, and that penicillin was quite successful. He said the treatment of toxic shock included treatment with intravenous medication and large doses (up to 10 grams) of steroids. He emphasized the necessity of administering large doses because the sensitivity of tissues to these steroids had changed. He said they used colloids and blocking "ferments." They administered large quantities of intravenous fluids plus calcium chloride and insulin when they recorded DVC (diffuse vascular coagulation) syndrome. Nikiforov said they administered antibiotics, using a wide range in the case of toxic shock. However, they could not find any that were clinically effective in diagnosed cases, including tetracycline and penicillin. They also used cardiac stimulants. Nikiforov said finally the toxic shock was complicated by kidney failure and insufficiency. He said the difference between

hemorrhagic fever and anthrax was that with anthrax, the kidneys were the first to be damaged. He said that with hemorrhagic fever in Korea, the kidney problem was secondary, occurring after toxic shock. He noted that kidney insufficiency was now a common problem in the Soviet Union, characterized by strong hemorrhaging around the kidneys.

Lederberg thanked Nikiforov for his comments and said he looked foward to discussing more of the details the following day. (See attached appendix.)

Sverdlov said they could now further discuss the proposals on the table.

Lederberg said they had discussed earlier in the morning work on the human genome. He said one subset of that issue was the suggestion for a crash program to sequence the entire human genome. He said the idea of achieving total understanding of the entire genome was an important metaphor, but he had problems with doing this to the exclusion of other scientific research. He said captivating the image of this one highly mechanized program could replace thought with brute force. He said there was a place for some investigation, for instance to decide to map one X and one Y chromosome. Still, there was the problem of deciding whose X and whose Y chromosome to map. There is no average genome, but perhaps a consensus genome. He said it could be as interesting to focus on the differences as well as to get the totality of it. He said this was an oversimplified statement of the objectives - the problem of focus on certain loci of genetic disease, half a dozen loci with genetic polymorphic diversification. He said the concept "the human genome" became faulted when you looked more closely. For example, the mechanism of antibody formation was based on somatic genetic diversification. Differentiation in other systems may be comparable, i.e. in the neurosystem. There are also examples in the development of invertebrates - gene amplification. Lederberg said it would be

better therefore to state proximate objectives and landmarks; he said he thought this inevitably would happen. He said he did not know if there was widespread agreement with this idea.

Lederberg asked what were the high priority problems. He said fixed costs were paid in medical care, so we already got information about sickle-cell anemia, for instance. He said they were encouraged to do those investigations because there was a medical reason. He said the structure of a protein could be altered by the change of one amino acid. DNA changes could be correlated with the protein outcome. He said there were many polymorphisms. He said we came back to the fact that polymorphism had a relation to medically significant syndromes.

Lederberg said they had more findings in new methodology for tagging chromosomes, allowing mapping from parental to the F1 and F2 generations. He called for further study of genes that have to do with mental traits like schizophrenia. He said they have had positive experience in learning about chromosomes relating to cholesterol. Receptor defects are involved with hypercholesterolemia. He said people were looking for polymorphisms at these loci. These contributed to most basic issues. Lederberg asked what were the priorities? He said he thought there was a unique opportunity in psychiatric disorders, that they have had no good way to trace genetic factors. He said this was a favorite topic of his, but required populations willing to disclose information about psychological disorders.

Rich said he would make a few comments, since he had been involved in the U.S. in discussions of the human genome. He said the issue had a technical and a political dimension. The political dimension related to the larger issue of the funding of science in the U.S. He said there were a number of groups within the government and outside who were interested in this project. He said a meeting at the NAS brought these groups together to discuss how to proceed. He said there was also a scientific problem. We could now sequence

small segments of DNA. The process was labor intensive, moderately expensive and slow. Some people would like to do the whole job - not a crash program, but a long-term, expensive one. Rich said the decision was made that sequencing would require machinery that would automate sequencing, which would not be available for five to six years. In the interim, the plan was to use large pieces of DNA, to isolate individual chromosomes and break them up further into an ordered set of overlapping cosmid clones. He said that with 50,000 base pairs, it would take 60,000 cosmid clones to organize three billion nucleotides of the human genome. Rich said this ordering of the human genome could be accomplished with modest cost using well developed technologies. In the end, one would have fragments of DNA in an ordered array on filtered paper equaling one chromosome in a series of 1000 dots. He said the point was that you could take a chromosome and identify where in that chromosome a gene is found with resolution 10^2 times better than what we now have. Rich said this was important for mapping. It was not yet sequencing, but it was making ordered large groups. He said this would facilitate investigations of genetic diseases. He said the advanced machines were likely to be available in five to six years. Japan has been developing a machine since 1981 which was being made by three companies in association with people from the University of Tokyo. The plan was to automate the existing technology with robots, which would allow a computer printout of the sequence. Rich said it would be erroneous to automate sequencing now with the primitive technology. He said he was not keen to divert research money into a project of this type. A consortium of U.S. government agencies was in the process of forming to act as a clearing house for international information. He said this was a collective activity. It was not a crash program, but a program with some planning. He said it would transform their ability to understand some diseases. He said they had the methodology and would have the information and

would have to learn the meaning of this sequence. Rich said it should be an international effort.

Lederberg acknowledged the arrival of Roald Sagdeev.

Bennett asked Rich whether there would be any international members of the consortium. Rich said the problem right now was one of too many voices in the U.S., which they were trying to meld into one voice before inviting foreign participation.

Sverdlov noted that discussion of sequencing the human genome was going on intensively, noting one West German who was doing this. He said he agreed with Rich that the process was still a concept. He said it must go on and that they should think about how to coordinate the effort so that individual efforts did not overlap.

Mirzabekov said the use of equipment and machines for this was not a scientific, but a technical problem. He recommended concentrating their efforts on learning about differences between different loci, and after that they could deal with sequencing of the entire human genome.

Marks asked if sequencing the human genome was a high priority for the Soviet Academy of Sciences. Sverdlov responded that they had no program for this, that they were still discussing it. He said they agreed with Rich that complete sequencing was most unrealistic today, and that one runs into difficult technical problems. He said they were working on selected points in his lab and in Ovchinnikov's. He said they had determined sequencing of one of the human genes - the protein responsible for transportation of potassium. Sverdlov said each researcher was engaged in the field that interested him most, but there was no uniform plan to sequence the entire human genome. He said Lederberg had talked about the fascinating problem of the genetic/psychological disorder relationship. He said they were working on programs to compare different human genomes. In his institute, three researchers were comparing a human with a chimpanzee genome to find the principal

differences between humans and apes. He said they found some sequences they believed to be typical of a human. They had not done it with the ape yet, but this was the work they were engaged in now.

Sverdlov suggested they now sum up their discussions. He noted that Sagdeev had joined them, so they had a representative from the Committee of Soviet Scientists for Peace, Against the Nuclear Threat. Sverdlov said they had discussed candidly the possibility of cooperation and ideas for topics. He asked Lederberg to sum up.

Lederberg said the atmosphere of their discussion reflected a fresh start on this issue. He said this had been reflected also in the BW Convention Review Conference and the report they had heard of that. He said they were dealing here with the prevention at an early stage of a problem that could become uncontrollable in the future. He said they had propitious ground to strengthen the Biological Weapons Convention. He said the atmosphere of openness was to be commended. He said they had much further to go, but this was start. Lederberg said he would leave behind information including a listing of all research programs funded by NIH and the Defense Department Annual Report on the Chemical Warfare and Biological Defense Research Program. He said the latter provided details on the U.S. research program, and that even though some of the attributions were vague, having this in the public record permitted questions for more details and debate. He urged open publication of similar information in the Soviet Union.

Lederberg expressed appreciation for the poignant talk by Nikiforov on his experience dealing with the anthrax epidemic in Sverdlovsk. He said in the last few months there had been more information on this. He said things would not change overnight, but the mood was right and this group's involvement in these issues should have a positive effect.

Lederberg said they had earlier discussed areas of scientific cooperation. He said the most effective programs would be those that had medical benefit for all and a symmetry of input from both sides.

He said there were still difficulties over human rights, explaining that for many individuals in the U.S. this remained an important issue that impeded willingness to undertake scientific collaboration. However, he said that programs of great medical benefit and potential for reciprocity in input could overcome some resistance and that his delegation would support those.

Lederberg said he found this meeting personally, professionally and technically informative. He suggested waiting until after the BWC April meeting of experts to decide the next steps of this group. He noted he could discuss this with Sagdeev when he is in Washington for the April CISAC meeting. He said they would want to see the formation of specialized expert groups on whichever programs proved most appropriate. He thanked Sverdlov and the entire Soviet delegation for their participation.

Sverdlov expressed for his entire delegation gratitude for this friendly and informative dialogue. He said they had found many common points of understanding, that it was obvious that none of them wanted biological weapons to exist and that they all wanted confidence-building measures and collaboration that would further these objectives. He said he would stress the basic points from their discussions which they would each have to report to their respective Academies: 1) Sverdlov and Marks suggested a committee in each of the Academies be constituted to coordinate their activity; 2) It was important to determine the most humanistic and important subjects for collaboration, and they should be prestigious; 3) Specific suggestions included; a) structure of the human genome; b) problems of the development of cell differentiation in cancer; c) vaccines; d) genetic engineering of plants. Sverdlov said they could select specific subjects within these topics. He said the projects should be supported by the two Academies and be continued until positive results were achieved so as to generate and expand confidence. He said he hoped this summary could form a basis of their research, and if so he would like to have it typed and distributed.

Lederberg said he thought it would be wise not to have a joint communique or declaration, stressing that it is the policy of CISAC not to do so.

Sagdeev thanked everyone for the constructive and fruitful atmosphere of the meeting, and for making this first meeting a success. He said the monopoly of those in physics, mathematics and political science in meeting with CISAC was lost, but not regretted. He said that nothing was as useful as prevention.

Sagdeev recalled that CISAC had been at work for five years, and that their ninth meeting took place last week. He said those meetings were always candid and businesslike, and that they always began with a stocktaking of the current balance of forces and examination of trends in the key technologies and their possible effects on strategic stability. He said for many years these matters had been confined to the balance of offensive forces - accuracy of terminal guidance as a trend which could inhibit retaliation, cruise missiles, etc. Sagdeev recalled that at Geneva, their two leaders agreed that the nuclear threat had to be averted. He said that unfortunately, there were two views. One side called for liquidation of the nuclear threat, a course that was difficult but necessary. The other side said it would be nice to stick with half measures until we could find a way to make ourselves safe against nuclear weapons in the future, meaning SDI. Sagdeev said the comparison of these two viewpoints was central to the international debate and the upcoming Reykjavik meeting. He said the Soviet side believed in the relationship between offense and defense, and that unless we abandoned the idea of superiority, it would be difficult to accede to liquidation. He said that so far the ABM Treaty had deterred both sides from this race. He said they believed there were advances so that today at the government level they could say that high levels of verification had to be adopted. He said this had been done at Semipalatinsk. Gorbachev made the open labs proposal to constrain

technological competition. Sagdeev said this group's confidence-building measures were steps toward this.

Sagdeev said the Soviet Union was abiding by two unilateral moratoriums: on anti-satellite testing and nuclear testing. He said the CISAC discussion must have had a more technical/military/strategic character than the BW discussion because the nuclear disease was more advanced. He said they had agreed that cooperation was needed. He said he would repeat an analogy he made at the CISAC meeting: The U.S. administration said the ABM Treaty allowed development and testing. He said the Soviet outlook was that they should not leave the limits of fundamental research, which he said was analogous to "harmless flirtation" under a marriage contract, while the U.S. position was a more serious indiscretion.

Sagdeev said the Soviet Academy would like to see the BW meeting continued. He said their Academy would gladly accept the invitation to continue this discussion next April.

Sverdlov clarified that his earlier statement was meant to be typed up and distributed as an informal "memory jogger" for both sides for discussion with their Academies, but that it was not meant as a formal joint statement. He said he would add to the list Dubinin's suggestion for joint research on the role of mutagens in the environment. Sverdlov reiterated several times how useful this summary memo would be. Lederberg said he thought it would be okay so long as it was not an official communique. Sverdlov said that was good, and that he would be sure to get this informal paper, a memory jogger for forthcoming discussions, to Lederberg before his departure (see attachment #4).

Sverdlov distributed gift books to the group, and suggested they have tea before touring the institute.

The meeting adjourned at 5:00 p.m.

Lynn Rusten

PRIVILEGED

Appendix: Special Session with Dr. V.N. Nikiforov and Dr. Olga Yampolskaya

A special informal session was held with Dr. V.N. Nikiforov and Dr. Olga Yampolskaya from 10:00 a.m. - 12:00 on Friday, October 10, 1986, at the Shemyakin Institute of Bioorganic Chemistry. Present at the session were: Dr. Sverdlov, Dr. Lederberg, Dr. Bennett, Dr. Marks, Dr. Woodward, Lynn Rusten and an interpreter from the Academy of Sciences of the U.S.S.R. Dr. Nikiforov and Dr. Yampolskaya from the Ministry of Health treated the victims of the 1979 Sverdlovsk outbreak. This appendix summarizes the information they shared about the Sverdlovsk epidemic.

Dr. V.N. Nikiforov said he was Chairman of the Department of Infectious Diseases, Central Institute for Post-Graduate Training, Moscow. His Department had 360 beds, and 280 M.D.'s were trained per year in infectious disease. Twenty-eight thousand physicians were trained per year in the Post-Graduate Institute which had 110 departments. Training periods were for 1 to 4 months. He said there were 1,200,000 M.D.'s in the U.S.S.R. Olga Yampolskaya said she was an assistant in Nikiforov's Department. She spent half of each day caring for patients and half of each day providing practical instruction for M.D.'s. She said her research was mostly involved in clinical observations on virus hepatitis, and the Institute of Virology performed the laboratory studies. Nikiforov's Department had two docents, six assistants (of which Yampolskaya was one) and twenty-two other M.D.'s.

Nikiforov said he was generally called to consult on all outbreaks of infectious disease in the U.S.S.R. In the Sverdlovsk epidemic of 1979, Nikiforov was called by Professor Kortev, Chairman of Infectious Disease in the Sverdlovsk Medical Institute. Nikiforov said he was called two to three days after the first two cases of acute severe illness were seen. When Nikiforov arrived in Sverdlovsk his first impression was that these patients had a very serious disease which was strange. He said his first impression was that it was due to an intoxication -- but the high fever made him consider infection. After being present at the first autopsy (on April 6 or 7), he thought it might be intestinal anthrax. Nikiforov said that Dr. Peter Burgasov, Deputy Minister of Health for the U.S.S.R, was involved in providing overall direction for dealing with the epidemic. Burgasov had retired one week prior to this meeting. Dr. Ivan Bezdenejnich, Chief Epidemiologist of the Russian Federation Department of Health, was the epidemiologist called to Sverdlovsk and responsible for accummulating the epidemiological data during the Sverdlovsk anthrax epidemic. Nikiforov said Bezdenejnich died during the month prior to this meeting. Yampolskaya said she learned about the epidemiologic data when she heard Bezdenejnich's presentation to Professor Matthew Meselson in August 1986.

In response to a question, Nikiforov indicated there were some instances of multiple cases in a single family, but did not have the exact data. These data were obtained by Bezdenejnich. Nikiforov said he had seen about 100 to 120 cases of gastrointestinal anthrax prior to the Sverdlovsk outbreak, and all had died. Thus, he said that fifteen of seventy-nine in the Sverdlovsk outbreak were saved was unusual. He believed more individuals ate contaminated meat than became ill and died. He believed illness was determined by dosage of anthrax organism and state of health of the host. He said variation in preparation of food might also be a determinant. Nikiforov said the Sverdlovsk epidemic took on a political coloring for him only when Meselson arrived in August 1986.

Nikiforov said that only one child - a six year old girl - fell ill. Yampolskaya gave the following age distribution of the victims:

Age	Number of Victims
under 20 (female child, age 6)	1
20 - 29	11
30 - 39	10
40 - 49	32
50 - 59	10
over 59	12

Nikiforov said there were 17 dermal cases, and out of those 6 became generalized. He said the usual percentage of dermal cases that became generalized was 5%. He said that in the Soviet Union, dermal cases which were not serious did not regularly go to the hospital.

Of the lethal cases, none of the victims had skin lesions. Nikiforov said there was nothing unusual about this particular strain of anthrax. He said there were many degrees of virulence of strains in the Soviet Union, and confirmed that there was a correlation between the thickness of encapsulation and the virulence of the strain.

When asked if any examples of this strain had been preserved, Nikiforov said perhaps, but he did not know for sure. He did not preserve the strain. He explained there was a special institute that dealt with dangerous strains and that perhaps it had kept samples.

Nikiforov said he did not know how air samples had been taken in the hospital rooms of the victims, but said he thought the surfaces and dust had been analyzed. He said cultures of air samples were negative.

When asked if there had been other cases of anthrax in Sverdlovsk since the 1979 incident, Nikiforov said there had been no cutaneous cases in the city of Sverdlovsk. However, he said that in Sverdlovsk

oblast there were some cases every year, and that there had been three cases of cutaneous anthrax and cases of gastrointestinal and generalized form of the disease.

When asked if he had ever seen a case of pulmonary anthrax, Nikiforov responded that he had seen such cases in Albania, where he had worked for three years. When asked what the lungs looked like in those cases, he said the main symptom was hemorrhagic edema of the lungs, and that they did not resemble the brain shown in his autopsy slides the previous day. When asked if he was surprised that the patient with the severely affected brain did not have damaged lungs, Nikiforov responded that in that case the lungs were affected partly, that there was some hemorrhaging.

Woodward asked whether a vaccine program was begun. Nikiforov explained that the Soviets vaccinate two million people every year against anthrax. He said that thirty districts in the Sverdlovsk region were regularly vaccinated in the spring, but that if there were an outbreak, then the plan called for immediate vaccination regardless of the time of year. Nikiforov said, then, that in this case the vaccination time was changed to take place right after this outbreak, but he emphasized that this was not a special program of vaccination, but an additional vaccine ditribution at that time, as called for in their plan. (There was some confusion in Nikiforov's answer to the questions on this topic.) When asked whether the vaccine against anthrax was effective in people, Nikiforov said it was his personal opinion that it was not effective.

Asked which antibiotics were used for prevention, Nikiforov said that for the families of the victims it was his personal opinion that antibiotics in the tetracycline family were most effective, though he had no statistics to validate this. He said there were some people who received antibiotics but fell ill. In fact, he said those people had very severe symptoms and did not survive. In response to another question, Nikiforov said there were variations in the time of onset when there was more than one case in a family. As best he could

recollect, Nikiforov said there were perhaps ten families which had more than one case. He said he could look up the exact number later. When asked by Marks if he had lectured about this outbreak, Nikiforov responded that he had lectured many times in Sverdlovsk about this epidemic and that he gave this lecture and the slides he had shown this group to many Soviet doctors.

Lederberg urged Nikiforov to publish this information in detail because it was so important and scientifically interesting. Lederberg then spent a few minutes explaining to Nikiforov the news sources (New York Times article of July 16, 1980, was given to Nikiforov) of the rumors about the Sverdlovsk outbreak resulting from an accidental release of anthrax spores from a closed BW facility. Lederberg asked if they had heard these kinds of rumors when they were in Sverdlovsk. Yampolskaya responded that she did not hear these rumors in Sverdlovsk, but did hear them afterwards in Moscow.

Lederberg asked them how these rumors might have started. Sverdlov interjected with an anecdote of how he had taken in Soviet evacuees, whom he did not know, from Kiev to stay with him after the Chernobyl accident. One of these women was very concerned that her hair would fall out, and she asked for daily blood tests. She refused to believe that the results were negative, and insisted on independent confirmation. She also told Sverdlov that she was sure her friend in Kiev had lost her hair. Sverdlov reported that the friend later came to visit, and had a full head of hair. He told this story as an example of how rumors spread. Nikiforov agreed that the New York Times article about the Sverdlovsk outbreak which Lederberg showed him reflected similar kinds of rumors. Nikiforov related a story about a cholera epidemic, during which he heard reports of his own death over the radio.

In the New York Times article, a map of the Sverdlovsk region was reproduced showing Sverdlovsk and a town, Kashino, 18 miles SE, which was cited as a locale of additional cases of anthrax. Nikiforov said he did not know of such a town. Yampolskaya also indicated she had

not heard of any of the three towns indicated on the map reproduced in the New York Times -- Polevskoi, Sysert or Kashino.

When asked about the sanitation measures that were taken, Nikiforov said he did not know in great detail. He said they did burn old buildings where the contaminated animals had been kept. He said these were mostly in the suburbs, where people kept their private animals. He said the diseased animals were also burned, not buried. He said only one or two sheds within the city were burned, but many in the suburbs were burned. Yampolskaya recalled that they were in the south part of the city.

Lederberg said there were rumors that the hospital was taken over by military personnel. Nikiforov adamantly said there was not one military person there, not even one policeman. He said he thought the epidemic station did the burning, not the military. In response to a question, Nikiforov said these sheds were burned in the middle and end of April.

Sverdlov noted that it was not unusual for the military to be requested to help in some cases. He referred to a fire that took place in Zagorsk just a few days ago, at which he said military men were used to help fight it. Sverdlov said that was a natural thing and did not mean that the burned structures were military properties.

Woodward asked how dermal anthrax was treated. Nikiforov indicated he treated dermal lesions with penicillin -- 30 million units every 24 hours, until the fever disappeared and the dermal lesions regressed, usually in seven to ten days. Nikiforov said he believed patients with dermal lesions did not gain immunity to future infections.

Lederberg expressed his gratitude to Nikiforov and Yampolskaya for their time and willingness to discuss this outbreak in such great detail. The session adjourned at 12:00 p.m.

Lynn Rusten