

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 carcinogenesis.

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 hemorrhage 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 forward 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