

September 1, 1992
Ekaterinburg

Dear Professor Meselson,
first of all, these are our answers:

1. We are quite satisfied, thanks a lot.
2. 11 April.
3. A more detailed discussion of primary anthrax pneumonia in the present manuscript is not necessary.
4. The book of Pr. Derishanov of 1935 should be included into the referens list.
5. There is a paucity of clinical information for correlations, but this information is quite sufficient for the description of the desease manifestations.
6. Whether there were really 17 cases of cutaneous anthrax, we are not in the know. According to autopsies there were no such cases. That's why we suggest that the whole paragraph concerning cutaneous anthrax should be deleted.
7. This information is presented in the book by Pr. Derishanov. So a proper reference is necessary in the last sentence of the 1 paragraph on page 8. In our opinion this phrase should be changed.

These are our suggestions :

1. Page 2, sentence 1. The words ' many persons' should be replaced by '64 persons'. It is very important.
2. There shold be no discrepancy as far as figures in our articles in 'Archive of Pathology' are concerned. So if it is possible please change the beginning of the last paragraph on page 5. There should be : ' ... including serohemorrhagic and hemorrhagic leptomeningitis (21 cases)'. A bit further 16 cases should not be mentioned. The term 'serohemorrhagic and hemorrhagic leptomeningitis' should be given in the table. In the cases 6,14,22,29,40 ' - ' should be changed into ' + '.
3. Page 2. In the sentence beginning with 'Bacillus anthracis...' '22 cases' should be changed into '20 cases'. Respectively in the table in cases 10, 41 '+' should be changed into '- '.

Now about the slides. Practically all of them (except a few ones not connected with pathoanatomy) were made by us. We have sound evidence of that and the young Nikiforov was informed about it. In his letter to us he gave no objections.

We hope to complete our work on the manuscript in the near future.

The publication in 'Archive of Pathology' is to appear late in 1992 or at least in the beginning of 1993.

With our best wishes
Abramova, Grinberg

P.S. I would like to ask you to transfer this information to Pr. Walker, if you can.

'Dear David, my letter covers all the questions in detail. Here is urgent information concerning my visit.

My wife - Sheremetjeva Natalja Gennadievna, the date of birth - May 7, 1952, citizen of Russia.

My son - Grinberg Michael Lvovich, the date of birth - August 2, 1979. Best wishes Lev Grinberg ''

msm@wjh12.harvard.edu

13 August 1992

Dear Drs. Abramova and Grinberg,

Here for your review and comment is the current draft of the manuscript summarizing your pathoanatomical work and conclusions. Before I proceed with final editing and submission of the manuscript to the Proceedings of the U.S. National Academy of Sciences, I would like to know if you wish to make any changes or additions.

In particular, I would like to have your answers to a number of questions:

1) We wish to assist you to establish your intellectual and professional priority in this matter. Does the present text make clear in a manner satisfactory to you that you made the reported observations and interpretations before we met you in Ekaterinburg? If not, what suggestions do you have for doing so?

2) Page 5, line 1. Is it correct that positive identification by bacteriological culture was first made two days after the April 10 autopsy, as stated here? Or was the pathogen identified the day after the autopsy, April 11?

3) As explained in the Discussion, the current view of human inhalatory anthrax pathogenesis is that spores do not germinate in the lungs but do so only after they are transported to lymph nodes. In view of this, do you wish to qualify or further discuss your report of a primary pulmonary lesion on the surface of the lung in 11 patients? I leave this to your judgement.

4) Page 8, paragraph 1. It is important to include a reference to the 1936 book of Derizhanov, as you did in your earlier manuscript (1982?). There is a copy of it at the National Library of Medicine in Bethesda and at my request the Library is preparing an English translation that will be available for general use. Unless you wish to include the reference elsewhere in the present manuscript, I will place it here, as reference 22.

5) Page 8, paragraph 2. You correctly state that there is a paucity of available clinical information. I would therefore ask if you are comfortable with the description of clinical manifestations given in the rest of the paragraph?

6) Page 9, paragraph 2. In their presentations in the US in 1988, the

Soviet physicians said that there were 17 cases of cutaneous anthrax, 6 of which had toxemia and that none of the 17 died. Could this be correct? If so, the words "small number" in your manuscript should be changed.

7) Finally, it would be most important for the logic of the paper if you could cite published evidence that there is no mediastinal involvement in cases of epidemiologically diagnosed gastrointestinal anthrax. So far as you know is there any such information in the Russian literature on gastrointestinal anthrax?

I apologize for having to send you this letter in English. Unfortunately I have no easy or rapid way to translate it into Russian. Unless you have a better way to respond to me, please give your answers to the above questions to Professor Borisov, who can transmit them to me by electronic mail.

Now on a different subject, I received from young Nikiforov in Moscow a copy of your old manuscript, which I enclose. He also gave me two boxes of photographs (slides) for me to copy and return. One box he said was made by his father. He said the other box was not. So it may be yours. I intend to make two copies of the slides in this box and send one set to you, return one set to young Nikiforov and keep one set here. If I hear from you that they are definitely your slides, no use of them would be made without proper credit to you. I hope this is satisfactory.

Jeanne and I hope that this finds you both well and that it will not be long before we can renew our friendship.

All best wishes,

Matthew Meselson

cc: Dr. David Walker
Dr. Olga Yampolskaya

Dear Alexis,

Thank you for yesterday's fax. Yes, let's go over the MS page-by-page on the telephone. But first wait for a somewhat revised version that I will express to you today, minus figures 2 and 3. Over the weekend, we'll be in NYC for the opening of our son John Guillemin's exhibition of photographs of "Rumania after Ceausesceau" at the Rumanian Cultural Center. I'll telephone on Monday.

Yes, I did send the MS to David. I explained in my letter to him that I did not include him as an author because this MS, describing the epidemiological part of our study, does not include any of his contributions.

The rule I follow in writing papers is that authors should have contributed a seminal idea or should have significantly contributed to the organization, execution or analysis of the work or to the writing of the article.

Incidentally, it is not at all correct that "we would not have found the right track" if David had not been put in touch with Abramova and Grinberg. Excellent and valuable as his contribution has been, the epidemiological part of our study is quite independent and was already extensively planned before we left for Russia. Its central objective from the start was to distinguish airborne from foodborne sources. Surely you remember that we brought with us systematic interview forms and meteorological data for 1979.

Woods Hole, MA
8 July 1994

Dear Alexis and Martin,

I have withdrawn the article from Nature and submitted it to Science. Here is the peculiar story:

On 1 March, I sent the MS to John Maddox, Nature's editor. Hearing nothing by mid-April, I telephoned shortly before leaving for CSAC/BW meetings in Moscow and London. John said he assumed I had understood the MS was accepted and that we should have dinner in London on my way back from Moscow. This we did most pleasantly on 21 April, accompanied by Brenda Maddox and Paul Doty. During dinner John said it was necessary only to remove 250-300 words. We agreed that I would go to the Nature office the following evening to do the editing together. This we did, whereupon John said he would "not change a word you have written." Proof would come on May 11 and publication on the 19th. On returning home, I printed out the agreed version, dating it 26 April.

About a week after seeing Alexis in Washington on 13 May and with no proofs from Nature, I telephoned and got Maxine Clark, the assistant editor for biology. She said that an additional 500 words and the table would have to be cut, inasmuch as the piece could not be an Article (for which the 26 April version would have been of acceptable length). Instead, it had to be Commentary, which must be shorter. She explained that Articles are for original research and Commentaries for overviews. Also, epidemiology was generally not published by Nature, the reason being something I was too amazed to remember.

I responded to Clark during the telephone conversation and then by fax that all the data presented was the result of original research, as appropriate for an Article. But that regardless of whether Nature called it Article or Commentary, I felt a responsibility to keep the account and its supporting data intact. This could only be done by keeping to the length John and I had agreed in London. If this could not be done, I would withdraw the MS. The fax went unanswered.

Through a traveller, I learned that John was still considering the matter and that the piece would have to be reviewed by an outside reviewer if accepted as an Article.

At this point, 23 May, Paul kindly wrote the enclosed letter to John, urging prompt publication or at least prompt decision.

More calls to John. Eventually I got through. He said the piece would have to be reviewed if it was to be an Article. I said excellent. He

added that a Russian reviewer would be needed and that he would decide the matter and would telephone me before dinner time. No call came.

Then in mid-June, Dick Garwin telephoned with some questions about anthrax. In the course of the conversation, I related the above saga. Dick offered to ask his daughter Laura for a status report. She is the Nature physical sciences editor. Laura telephoned me on 22 June. She had talked with John. He had decided it had to be Commentary and would telephone. I replied that the deciding issue for me was length and that unless the agreed length could be accepted, the MS should be considered withdrawn. Next day Laura sent the enclosed letter. Still no word from John.

All of my communications with Maddox and with his staff have been cordial. I do still consider John to be a friend. My only speculation is that Clark opposed his initial decision and made office politics of it. Nature has always been eccentric.

I changed the format to conform with the style of Science, made some changes in the text and Figure 4 and sent the MS to Washington yesterday. I'll keep you posted.

Sincerely,

Sverdlovsk anthrax questions

- 1) What are the views of knowledgeable Russian military scientists regarding the source and spread of the infection?
- 2) Would Russian military experts care to include independent Russian and non-Russian scientists in their study of the epidemic?
- 3) What is known about the aerosol source?
location
 date
 time of day
 duration
quantity
 strain characteristics
 nature and reliability of evidence for above items
- 4) Was there more than one release? If so, address questions under (3) above.
- 5) Is there any evidence suggestive of a different or additional location for the source(s). If so, describe?
- 6) What is known about the initial fatal human cases?
 name
 age
 date of onset
 date of admission
 date of death
 hospital
 burial location
 residence location
 workplace location
 are they on the official list and/or on our cemetery list?
- 7) More generally, provide above information for all fatal and non-fatal cases and compare with our data.
- 8) Specifically, what were the onset dates, residence locations and workplace locations of the cutaneous cases?

- 9) What is known about the initial animal cases?
date
place
basis of diagnosis
disposal methods
- 10) As in (9) above for all animal cases in Sysertskiy rayon for March-April 1979.
- 11) What activities with B. anthracis were taking place at Compound 19 in March-April 1979?
purpose
quantities, spores and vegetative
strain characteristics
operations involved
disposal
immunization of personnel
other bio-safety measures
location of operations on area map of Compound 19
strain samples
- 12) Provide 1979 area map of Compounds 19 and 32 including barrack and residence locations and street names and numbers.
- 13) Locate NII 44, 34 MSD, and Sovremennikov.
- 14) Regarding persons working or residing at Compound 19 or Compound 32 in 1979
number residing at Compound 19
number residing at Compound 32

For those who were infected:

name
onset
admission
death, if fatal
immunization status
residence location on area map
workplace location on area map

- 15) Regarding assemblies at Compound 32 and Compound 19 during first week of April 1979. (The rayon registration and enlistment offices, Voenkomat, may have records.)
- dates
 - hours
 - number of participants in each
 - location on area map
 - name, residence, usual workplace, onset date, death date, hospital, and burial place for any assembly participants who contracted anthrax.
- 16) Area map of ceramics factory. Approximate numbers of persons working in each building at each shift in Spring 1979.
- 17) Meeting with Dr. P.N. Burgasov.
- 18) Thesis of young Burgasov.
- 19) Russian data sources
- known available sources
 - possible existence of additional sources
- 20) Regarding therapy and outcome
- Kortev, Kyumov, Trakhina and other clinicians who cared for anthrax patients in Sverdlovsk.
 - hospital case histories.
- 21) Aerial or satellite photograph of Chkalovskiy rayon in winter or spring in 1979-82 at resolution better than SPOT.
- 22) What is known regarding thoracic involvement in epidemiologically verified food-borne anthrax? In fatal cutaneous anthrax?
- 23) Provide actual data regarding Fig 1 in H.N. Glassman, *Bacteriological Reviews* **30**(3): 657-9, 1966.
- 24) Provide data regarding anthrax aerosol dose-response for sheep, cows and goats. See Fort Detrick data in R.F. Lincoln, et al., *Federation Proceedings* **26**(5): 1558-1562, 1967.

- 25) Compute isopleths for ground-level inhaled dose of >1, >10, >100, >1000, and >10,000 aerosol particles following point release of 10^{11} particles. Assume steady wind of 1m/sec (2mph) and 5m/sec, Pasquill stability categories F and D, ground-level and 15m release heights. Also compute ground deposition density for applicable surface characteristics, assuming particle diameter 1 micron, particle density 1.2 or using measured deposition velocity for anthrax spores.
- 26) Provide data on sheltering factors for aerosols. CREDC has data some of which is classified.
- 27) What is the evidence for release of viable anthrax spores or other pathogens from open pit burning or rendering of contaminated carcasses, hides, etc?
- 28) Provide sample(s) of anthrax strain(s) in use at Compound 19 in 1979. Ditto for any strains recovered from patients, animals or environment at the time.
- 29) Compose detailed account of the epidemic, stating supportive and non-supportive evidence and suggesting further tests.
- 30) Form a mixed Russian-US-UK scientific group to conduct further studies jointly. Findings to be published except details judged hazardous if publicized.

5 January 1993

Dear Professor Antonov,

Robinson and I look forward to meeting you at Sheremetyevo airport arriving Air France flight number 1850 scheduled to arrive 17:25 Moscow time, Sunday 17 January.

We invite you to dine with us that evening.

Thankyou for hotel reservations. My wife is not coming to Moscow.

Robinson and I will remain in Moscow until Monday morning, 25 January.

My colleague, Dr. Boris Olegovich Glotov, Deputy Director, Institute of Molecular Genetics, is coordinating our schedule in Moscow. Telephone 196 1864; telefax 196 0221.

Meselson.

1 December 1993

Dear Alexis,

Here is a draft of the epidemiology part of our report.

Publication quality figures are in preparation. I hope to send the MS to *Nature* by the end of the year.

Let me know the numbers of any items you would like to have from the reference list and I will send photocopies. I will also send some correspondence I have and some I expect soon to receive regarding atmospheric diffusion and dose-response.

I look forward to receiving your comments and corrections.

Best wishes,

Matthew Meselson

From urgu.quorus.e-burg.su!borisov@relcom.kiae.su Tue May 5
10:10:23 1992 Received: from relcom.kiae.su by techno.fuug.fi with
UUCP id AA28971 (5.65c/IDA-1.4.4 for msm@wjh12.harvard.edu); Tue,
5 May 1992 15:29:43 +0300 Received: by relcom.kiae.su; Tue, 5 May
92 14:54:18 +0300
Received: by quorus.e-burg.su; Tue, 5 May 92 14:59:03 +0400 (EBD)
Received: by urgu.quorus.e-burg.su (UUPC/@ v4.05 from Ache,
26Feb92); Tue, 05 May 1992 14:30:16 MSD
To: msm@wjh12
Message-Id: <AAtGj1gec4@urgu.quorus.e-burg.su>
Organization: Urals State University
From: borisov@urgu.quorus.e-burg.su (Borisov Sergej)
Date: Tue, 5 May 92 14:30:15 -0500 (EDT)
Return-Receipt-To: borisov@urgu.quorus.e-burg.su
Subject: to prof. M.Meselson
X-Mailer: BML [MS/DOS Beauty Mail v.1.23]
Status: R

TO: Prof. M.Meselson
Harvard University
Cambridge, Massachusetts
Internet: msm@wjh12.harvard.edu
FROM: Prof. S.F.Borisov
Ural State University
Internet: borisov@urgu.quorus.e-burg.su

May 04, 1992
Ekaterinburg

Dear Prof. Meselson,
I have received you first e-mail message 30 Apr.92. Because the
May Holidays I could not answer earlier.

We are doing some preparatory work for your visit. In
particularly we are trying to find the persons you mentioned. I had
a talk with Prof.Kortev by phone. He is O.K. now. I am going to meet
him soon to familiarize with your program.

Unfortunately the people who worked on the problem in 1979
during all this 13 years had too many contacts and talks and got tired.
So it'll be the the problem to involve them in new program.
Nevertheless we'll try to arrange all the meetings you plan.

The person who is interested in the problem is Dr.Shepetkin of
Biology Dept. of the Ural State University. If we find other people
who still are interested in it we'll try to involve them to the
"team".

Sincerely,
Prof. S.F.Borisov.

From urgu.quorus.e-burg.su!borisov@relcom.kiae.su Fri May 22 03:27:58
1992 Received: from relcom.kiae.su by techno.fuug.fi with UUCP id
AA23559 (5.65c/IDA-1.4.4 for msm@wjh12.harvard.edu); Fri, 22 May
1992 07:42:40 +0300 Received: by relcom.kiae.su; Fri, 22 May 92
07:13:40 +0300
Received: by quorus.e-burg.su; Fri, 22 May 92 08:57:47 +0400 (EBD)
Received: by urgu.quorus.e-burg.su (UUPC/@ v4.05 from Ache,
26Feb92); Thu, 21 May 1992 17:57:17 MSD
To: msm@wjh12
Message-Id: <AAxo17gyP5@urgu.quorus.e-burg.su>
Organization: Urals State University
From: borisov@urgu.quorus.e-burg.su (Borisov Sergej)
Date: Thu, 21 May 92 17:57:15 -0500 (EDT)
Return-Receipt-To: borisov@urgu.quorus.e-burg.su
Subject: to prof. Meselson from E-burg
X-Mailer: BML [MS/DOS Beauty Mail v.1.23]
Status: R

TO: Prof. Matthew Meselson
University
Massachusetts
Internet: msm@wjh12.harvard.edu
FROM: Prof. S.F.Borisov
Ural State University

May 21, 1992 Harvard
Ekaterinburg Cambridge,

Dear Professor Meselson,
I have received you e-mail with the plan of the work in
Ekaterinburg.

We have to discuss it with people involved and city
officials. But now I should make at least one note. As I
understood from my talks with officials it would be good to have here
before your visit a document (permission or something likes that)
from Moskow officials at the Russian Government level which permits
us to realize your program in Ekaterinburg. The thing is all the
activities in 1979 were realized under the guideline of Moskow (I
mean former Soviet Government) and people here, official
and not official. Still are under press of prohibitions of that time.
Be sure that it is not only psychologycal aspect. In the case
of such permission it will be no problems to have support from the
local officials of any levels.

Let me know please about the documents agreed with Moscow
officials and the possibility to have them here. Beleave me that it
will be really good for the sucesess of our joint activities in
Ekaterinburg.

Cordially,
Sergei Borisov.

From urgu.quorus.e-burg.su!borisov@relcom.kiae.su Wed Sep 2
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22Mar92); Wed, 02 Sep 1992 16:36:38 EBD
To: msm@wjh12
Message-Id: <AApa9fgi35@urgu.quorus.e-burg.su>
Organization: Urals State University
From: borisov@urgu.quorus.e-burg.su (Borisov Sergej)
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Return-Receipt-To: borisov@urgu.quorus.e-burg.su
X-Mailer: BML [MS/DOS Beauty Mail v.1.25]
Status: R

TO: Prof. Matthew Meselson
Harvard University
Cambridge, Massachusetts
Internet: msm@wjh12.harvard.edu
FROM: Prof. S.F.Borisov
Ural State University

September 1, 1992
Ekaterinburg

Dear Matthew,
We have received your message of August 25, 92. Thank you ever
so much for financial support of the research being done by Ilona
and me. Whatever materials ready by September 17 will be sent with
Olga Gubanov. Re: addresses of poliklinic 2 of hospital
24 (used to be in 3 Monsterskaya St. which ran off Titova St.,
poliklinic 3 is in 82 Aviatsionnaya St. I had a talk with Mishustina,
the Deputy of the Parliament of Russia whom we met during your
visit to Ekaterinburg. Its very nice of her that she promised to
help in clarifying the location of NII 44 and MSD, she also
strongly supports the idea of the conference to be held in the Urals.
Full name of Sasha is Tiutiunnik Aleksandr Petrovich.

Re : your inquiry about Grinberg , please, see
information below. Speaking about establishing communication between
astronomers there was no possibility to get precise information
as they are on vocation I believe it would be best to discuss this
problem as well as possible projects of the department of
Physics during my visit in October. other projects of the
department of Physics during my visit in October.

Yours sincerely,
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Would you like to sent me E-mail address of David Walker on the
request of Dr. Grinberg.

Dear Professor Meselson,
first of all, these are our answers:

1. We are quite satisfied, thanks a lot.
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in the present manuscript is not necessary.
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We hope to complete our work on the manuscript in the near future.

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4. The book of Pr. Derishanov of 1935 should be included
into the referens list.

5. There is a paucity of clinical information for correlations, but this information is quite sufficient for the description of the disease manifestations.

6. Whether there were really 17 cases of cutaneous anthrax, we are not in the know. According to autopsies there were no such cases. That's why we suggest that the whole paragraph concerning cutaneous anthrax should be deleted.

7. This information is presented in the book by Pr. Derishanov. So a proper reference is necessary in the last sentence of the 1 paragraph on page 8. In our opinion this phrase should be changed.

These are our suggestions :

1. Page 2, sentence 1. The words 'many persons' should be replaced by '64 persons'. It is very important.

2. There should be no discrepancy as far as figures in our articles in 'Archive of Pathology' are concerned. So if it is possible please change the beginning of the last paragraph on page 5. There should be : '... including serohemorrhagic and hemorrhagic leptomeningitis (21 cases)'. A bit further 16 cases should not be mentioned. The term 'serohemorrhagic and hemorrhagic leptomeningitis' should be given in the table. In the cases 6,14,22,29,40 ' - ' should be changed into ' + '.

3. Page 2. In the sentence beginning with 'Bacillus anthracis...' '22 cases' should be changed into '20 cases'. Respectively in the table in cases 10, 41 '+' should be changed into '- '.

Now about the slides. Practically all of them (except a few ones not connected with pathoanatomy) were made by us. We have sound evidence of that and the young Nikiforov was informed about it. In his letter to us he gave no objections.

We hope to complete our work on the manuscript in the near future.

The publication in 'Archive of Pathology' is to appear late in 1992 or at least in the beginning of 1993.

With our best wishes

Abramova, Grinberg

P.S. I would like to ask you to transfer this information to Pr. Walker, if you can.

'Dear David, my letter covers all the questions in detail.

Here is urgent information concerning my visit.

My wife - Sheremetjeva Natalja Gennadievna, the date of birth - May 7, 1952, citizen of Russia.

My son - Grinberg Michael Lvovich, the date of birth - August 2, 1979. Best wishes Lev Grinberg '

msm@wjh12.harvard.edu

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Prof. M. Meselson
Harvard University
Internet:
msm@wjh12.harvard.edu
Fax: (617) 495-2264

Dear Professor Borisov,

I have learned from Professor Suetin that you are willing to participate in our forthcoming research in Ekaterinburg and to provide our communication link. I am most grateful for this and look forward to meeting you.

This first e-mail message will serve to verify two-way communication. Could you please confirm its receipt?

Our travel plans now are as follows:

Tuesday 2 June: Arrive Moscow 15:30 local time on Finn Air #704 from Helsinki.

Thursday 4 June: Depart Moscow 10:15 AM on Aeroflot #261.
Arrive Ekaterinburg 12:45 (moscow time).

Sunday 14 June: Depart Ekaterinburg 06:15 (Moscow time)
on Aeroflot #262.
Arrive Moscow 08:45.

Wednesday 17 June: Depart Moscow 16:25 on Finn Air # 705.

In addition to myself, our party will consist of:

Professor Jeanne Guillemin, Department of Sociology, Boston College;

Professor Martin Hugh-Jones, School of Veterinary Medicine, Louisiana State University, Baton Rouge, Louisiana;

Professor David H. Walker, Department of Pathology, University of Texas Medical Branch; Galveston, Texas;

Dr. Alexis Shelokov, Director of Medical Affairs, Salk Institute Government Services Division, San Antonio, Texas; and

Dr. Olga Yampolskaya, Department of Infectious Diseases, Botkina Hospital, Moscow.

Drs. Shelokov and Yampolskaya both speak Russian and English. Professor Guillemin is my wife.

As for accommodations, we are all good travellers and do not need luxury.

An early step to be taken before we arrive is to designate the Ekaterinburg "team" -- two or three colleagues interested in the problem and willing to participate before and especially during our visit. I understand that Drs. Shepetkin and Novozhemov may wish to work with us. At the start of our visit, preferably over dinner on the day we arrive, we should meet with the Ekaterinburg colleagues who will be working with us to get acquainted and to agree on a general plan of study.

It would be good if, before we arrive, our Ekaterinburg colleagues could view the VHS videotape and printed articles that I sent to Professor Gubanov while he was in Illinois.

We would be very grateful if a number of things could be arranged for us in advance. Although we have a tourist map of the city, it may not show all of the streets. Could you obtain for our use a good street map?

At this time, I would also ask if you or your colleagues could contact the following persons before we arrive so that we may meet them during the first part of our visit:

- 1) Professor Arkady I. Korteve, former Director of the Sverdlovsk Medical Institute. He is a distinguished physician whose previous specialties included anthrax. During the outbreak, he worked many days in the intensive care ward at Hospital number 40. Unfortunately, he suffered an aneurism some months ago and may still be in fragile health. Please try to make an appointment for us to consult with him early in our visit. He will surely remember Dr. Olga Yampolskaya, the assistant to Professor Nikiforov, with whom he worked closely. If his health is still not good, he need not see all of us. If at all possible, however, at least Drs. Yampolskaya, Walker, and Shelokov should consult with him. If there are any special medicines he needs, let me know and I will try to bring them. Because of his outstanding reputation, specialized knowledge and extensive direct experience with the patients, meeting with Professor Korteve is a high priority for us.

- 2) Dr. Faina A. Abramova, formerly of the faculty of pathological anatomy of the Sverdlovsk Medical Institute.

- 3) Dr. Lev Grinberg, former assistant of Dr. Abramova and a practicing physician in Ekaterinburg.

- 4) Scientific representatives of the Military Epidemiological Sector knowledgeable regarding the 1979 outbreak. Incidentally, we will also try to come prepared to discuss the potential for possible commercial utilization of the facility, if that is desired.

5) Any individuals who you or your colleagues consider to be truly knowledgeable regarding the medical-pathoanatomical, epidemiological, veterinary or other important aspects of the 1979 outbreak.

At a later time, I will prepare a list of several others who we would like to meet, including survivors and relatives of the deceased.

Cordially,

M. Meselson

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Prof. M. Meselson
Harvard University
Internet:
msm@wjh12.harvard.edu
Fax: (617) 495-8308

5 May 1992

Dear Professor Borisov,

I was very glad to find your e-mail of yesterday and to learn that Professor Korteve is well. Please express to him my appreciation of his willingness to meet with us.

Could you please ask Professor Korteve if he has any pathoanatomical photographs, glass slides, paraffin blocks or other research materials relevant to the 1979 epidemic that we might be able to study while in Ekaterinburg?

We would ask the same question of Dr. Abramova, Dr. Grinberg and anyone else in Ekaterinburg who might have such materials.

For examination of glass slides, we would need access to a research microscope with good optics and overall magnification from approximately 25X to 1000X. Phase-contrast optics would not be needed but it would be very helpful to have a 35mm camera attachment. We will bring the appropriate photographic film.

There is a mistake in my previous e-mail. I gave my telephone number but called it a fax number. My fax number is (617) 495-8308.

By next Monday, I will send more details of our preliminary study plan.

With many thanks,
Cordially,

M. Meselson

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

19 May 1992

Dear Professor Borisov,

I am now able to propose to you the outline of a work plan for our combined US-Ekaterinburg team and would like to have your advice and comment. There would be two principal lines of study. One line would focus on clinical, pathoanatomical and therapeutic problems while the other would concentrate on epidemiological aspects.

I. Clinical-pathoanatomical-therapeutic problems.

Interviews:

Professor Arkady I. Kortev

Dr. Faina A. Abramova

Dr. Lev M. Grinberg

Dr. Margarita Ivanova Ilenko, in 1979 was head physician at Hospital number 24

Dr. Yakov Iosifovich Klipnitser, in 1979 was Head Physician at Hospital number 20.

Other medical specialists who may have relevant information.

Visits to hospitals:

Hospital number 40

Hospital number 20

Hospital number 24

Other relevant hospitals, if any, possibly including the medical facility of the Military Epidemiology Sector.

Examination of pathoanatomical materials:

Seek such materials from any of the above persons, hospitals, etc. Such materials would include glass slides of tissue sections, photographs, medical records, notes, other documents. For examination of glass slides, we would need 25X - 1,000X power research microscope with 35mm camera attachment and appropriate light source. We will bring film. Also needed will be 35mm slide (diapositive) projector, access to a photocopier, and, if possible, access to a US

style VCR video tape player.

In examining pathoanatomical materials, we would like to have the collaboration of an experienced Ekaterinburg pathologist. In that case it would be desirable but not essential to have the use of two microscopes.

II. Epidemiological aspects.

Field work:

Visit Vostochnoye Cemetery Administration Office and Sector 15 of the cemetery. We would record the names and dates of the deceased. This would require several hours.

Visit City Records Office (ZAGS) and possibly other relevant offices. Record information regarding the deceased.

Interview families of the deceased in cases where that is acceptable. Two or at most three members of the team would conduct each interview. This may require several days.

Interview sanitary, epidemiologic public health officials at oblast and at Chkalovskiy and Sysertskiy rayon levels who were active in 1979.

Interview veterinary officials at oblast level and at Chkalovskiy and Sysertskiy rayon levels who were active in 1979.

Visit Ekaterinburg Plant for Ceramic Items and meet medical personnel there.

We will need a car and driver every day, if possible, and street maps of Ekaterinburg City and its southern suburbs. For visiting offices and officials, we should have the support, either in person or in a document, of an appropriate official whose authority would be respected.

III. Other

Meet with personnel of the Military Epidemiology Sector.

Meet with Aleksandr Pashkov, Ekaterinburg correspondent for Izvestiya. Please tell him that I am a friend of his colleague Svetlana Tutorskaya, who is studying at the Harvard School of Public Health here in Boston Massachusetts.

We look forward to meeting you and your colleagues soon.

Cordially,

Matthew Meselson

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

Friday, 22 May 1992

Dear Professor Borisov,

First, let me thank you for again taking the time to assist us, especially in dealing with the various city officials. I have just spoken by telephone with Professor Eugene Sverdlov in Moscow. On Monday, he will try to resolve the problem described in your e-mail of the 21st. I am hopeful that this can be done. If you wish to contact him directly, he is at

internet: img@glas.apc.org
fax: 196-02-21
office telephone: 196-02-06
home telephone: 441-99-80

Looking forward to working with you in Ekaterinburg.

Cordially,

Matthew Meselson.

25 August 1992

Dear Ilona,

Thank you so much for the work you have done with us thus far. We would like for you to continue your excellent interviews in order to obtain information for cases that have not yet been interviewed or have been interviewed incompletely. Please use the existing interview form and procedure, as you have been doing. It is important to learn where the individual was during the daytime on weekdays in late March and early April 1979--at work, at home, in a military assembly, or wherever--and to locate each place on the map.

In addition to the two cases mentioned in your letter, the following is a list of cases for which we still need information. The numbers are those from the official list, which you have. Please continue to assign S (supplementary) numbers to the names without official numbers.

- #22 BORISOV, Valentin Petrovich Sanitornaya 11-30.
- #37 BUCHELNIKOV, Vitalii Aleksandrevich Shevskaya 17-6
- #25 CHIKALOV, Konstantin Mikailovich Profsoyuznaya 55-18
(You learned from his wife that he was on vacation in April. Please ask where he spent his days in late March/early April.)
- #18 JELEZNYKH, Boris Andreyvich Batalonnaya 4-7
- #53 MAKAROV, Ivan Vasilyevich Kolkhoznikov 87-25
(You have done this interview but we have two questions: (1) Was he the brother of Pyotr Vasilyevich MAKAROV, #40? If so, where did Pyotr Vasilyevich reside and work? If you learn the residence, please conduct an interview. (2) Do we understand correctly that Ivan Vasilyevich did not work at Compound #19 and that the #19 in the name of his workplace has no relation to Compound#19?)
- #33 LYZLOV, Vladimir Pavlovich Kraulya 4-33
(Please try to get more information about where he was during daytimes early in April. Had he any occasion to go to Chkalovskiy? If so, where and when?)
- MOCHALOV, Mikhail Maksimovich Agronomicheskaya 5a-1
- #36MOCHALOVA, Taisa Pavlovna Sukhalkozhskaya 6-52
(Jeanne interviewed a grand-nephew who was very young in 1979. Please try to interview the niece or other family member who was an adult in 1979. Where was MOCHALOVA actually living in late March/early April 1979?)
- POLESHAEV, Andrei Pavlovich Selkorovskaya 102/3-10

#6ROMANOV, Boris Georgevich

Frunze 76-71

#20SHATOKIN, Nikolai Afanasevich

Bardina 39-83

(Please try to get more information about where he was during daytimes in late March/early April. Had he any occasion to go to Chkalovskiy? If so, where and when?)

#10 SYSKOV, Alexey Nikolaivich

Bisertsкая 6-58

#35 TRETNIKOV, Vasiliy Ivanovich

Malakitovyi per 56-1

(Jeanne interviewed neighbor but did not learn the exact workplace. The son still lives there.)

#54YASINSKAYA, Nina FedorovnaSuhalozhskaya 10-69

The following persons are believed to have survived their illness:

Supl. #5 STERKHOV, Anatoli Ivanovich

Poldnevaya 53

(You learned that he was on vacation in Leningrad before becoming ill. Please find out from him directly the dates during which he was away from Sverdlovsk and where he was during the daytimes on weekdays the last days of March and the first week of April.)

-- DANILOV, V.P.

Eskadronnaya 37-22

--FEDULOVA, M.S.

Promyslovia 88

--NOVOKRESHCHENOVA, A.A.

Bisertsкая 22-12

--PRITCHIN, V.A.

Eskadronaya 5a-71

--YAKOVLEV, N.V.

Gazetnaya 34-14

Lastly, we have some questions:

1) Do you agree with our conclusion that NII 44 is in or part of Compound #19?

2) What were the hours of each shift at the ceramics factory and approximately how many people worked in each shift?

3) What were the hours for an assembly? Do the men taking part in an assembly live at the compound or at home? If you encounter any further cases of attendance at an assembly, try to learn just what days it took place, how many participants it had and if any others became ill.

4) Where is polyclinic 2 and what approximate area did it serve in 1979? The same questions for polyclinic 3.

5) Where were the schools attended by children and young people from homes in the Lyapustina-Kashinskiy-Poldnevaya neighborhood in 1979?

6) There is a factory in Chkalovskiy where animal products are rendered. Rendering is the process by which animal carcasses and waste materials are boiled to give usable fats, bones and other materials. The Russian word may be TOPIT.

7) Are we correct in assuming that when you ask about animals, people understand you mean sheep and goats and not just cows?

8) Finally, do you have any ideas about the location of 34 MSD?

Olga Gubanov, the daughter of Professor Gubanov, plans to return from Ekaterinburg to Illinois on September 17. Whatever materials you have ready at that time, she will be able to bring back to us. Professor Borisov has \$250.00 on account to reimburse you for this second stage of work. Is this sufficient? I realize that your vacation must soon be ending. I hope you will be able both to continue to collaborate with us and have time to enjoy the summer before it is over. I will call you within the next few weeks. My thanks again for your excellent work on this project.

Sincerely,

Jeanne Guillemin

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

Tuesday 6 July 1992

Dear Sergei,

Jeanne and I cannot accept that you are now thousands of miles and several frontiers away. I am sure that we shall meet again, here or in Russia. In the meantime, we will keep strong memories of you and the other remarkable friends we found in Ekaterinburg. We thank you and your family for the many ways in which you helped us.

I have spoken on the telephone to Volodya and Fred and I have sent the materials to them as you instructed.

Also, Jeanne telephoned Ilona Nikolaevna Nikonova and found that she is proceeding well with the remaining interviews. Thank you for giving her the additional addresses sent via Boris Olegovich. She should be finished her work within a month, at which time we will contact you and ask you to pay her the total amount (\$400.00) we left behind for this purpose.

Sergei, on the night of Sunday 12 July, an old and good friend of mine will arrive in Ekaterinburg to investigate possibilities for joint ventures and investment on behalf of his own company and also on behalf of the European Bank for Development and Reconstruction. His name is Joseph Campbell and his company is the New York investment firm of Paine-Webber. You will remember that I told you about him. I believe that his flight from Moscow will arrive at 9:45 PM Ekaterinburg time.

Campbell would like to meet you. I urge you to see him. I took the liberty of giving him your home telephone number (51 03 48) and your FAX number (55 59 64). Starting on 8 July, he can be contacted in care of the Hotel Savoy in Moscow, although he may be away from Moscow part of the time before coming to Ekaterinburg. The general numbers of the Savoy are 929 85 00 and 929 85 58. If you wish to contact him there or to leave a message telling how and when best to reach you in Ekaterinburg, he would welcome your doing so. You could also send a FAX to the Savoy, although I do not know the FAX number.

Campbell did not know the name of the place where he will be staying in Ekaterinburg. It is a former Communist Party guest house. If he fails to reach you by the middle of the day on Monday, you may wish to find him through persons who he will be visiting. These are A.A.

Rossel, Vladimir Vasilevich Volkov, and Semyen Phillipovich Barkov. The latter two men are at the Sverdlovsk Regional Committee for State Property Administration. The telephone of Volkov is 58 92 12. That of Barkov is 58 95 04. The general number of the Committee is 51 16 38. Campbell would welcome your advice about various enterprises and opportunities in Ekaterinburg.

In a day or two I will send to you by e-mail a DRAFT of a letter to Rector Suetin, along the lines that you and I discussed. Then you should send me your comments before I send the letter in final form. Meanwhile, I will try to contact the Director of the Harvard-Smithsonian Astrophysical Observatory to see if there is interest in possible collaboration with the Department of Astronomy at the Ural State University. Have you any other ideas for practical collaboration?

With warm regards,

Matthew

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

Wednesday 15 July 1992

Dear Sergei,

Still a little exhausted from last month and from work that had accumulated here, Jeanne and I leave today for a three-week vacation in Greece. We will return August 4.

I have talked with the Director of the Harvard-Smithsonian Astrophysical Observatory, Dr. I.I. Shapiro. He asked that I provide him with some specific information regarding the activities and interests of the astronomy group at Ural State University so that he can know if there are potential joint interests. Can you send me a paragraph or two summarizing these things?

I am afraid that writing a preliminary report of our Ekaterinburg study for Rector Suetin will take longer than I first thought. There will be at least two parts. The first, on the pathoanatomy, came from David today and will be sent to reviewers from my office this week. When the reviewers comments and criticisms have been taken into account I will e-mail or fax a copy before sending it to the Proceedings of the U.S. National Academy of Sciences.

Regarding your e-mail address, which is better: with or without the @fuug.fi ?

By now Joe Campbell should have come to Ekaterinburg. I hope that he met you and that this was useful. As you and Volodya also believe, the further development of Ekaterinburg as a first-class scientific-technical-industrial center requires excellent academic back-up. This provides a strong argument for assisting the University.

Before he left the States, I asked Volodya to please bring back copies of the interviews completed so far by Ilona, both in the original russian and in english translation. The original copies should stay in Ekaterinburg for safekeeping. Could you please be the go-between?

Finally, may I ask that you communicate a message to General Kharechko? It is appended at the end of this transmission.

Warm regards to you and Natasha from Jeanne and me,
Matthew

Harvard University
Cambridge Massachusetts

15 July 1992

Dear General Kharechko,

Following our exchange of letters in Ekaterinburg last month, I wish to let you know the present status of our study.

A draft manuscript dealing with pathoanatomic aspects has been prepared and after review the completed manuscript should be ready in about a month. At that time, I will send a copy to you and to Rector Suetin. A summary of our epidemiologic materials should be ready by early September and will also be sent to you and Rector Suetin. At that time, I will also submit for your consideration and advice a preliminary proposal for a small scientific meeting along the lines mentioned in my letter of 13 June. With this in mind, I have asked the MacArthur Foundation of Chicago Illinois for financial assistance in support of the Russian and American expenses of such a meeting. I am hopeful that the response will be positive and will keep you informed.

Let me again convey my appreciation for your letter of 12 June and express the sincere hope that we will be able to contribute jointly to the study and solution of scientific problems of common concern.

Sincerely yours,

Matthew Meselson
Professor of Biochemistry and
Molecular Biology

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

Tuesday 11 August 1992

Dear Sergei Fedorovich,

Thank you very much for sending me via Professor Gubanov the interviews from Ilona Nikolaivna. Her work is excellent. I hope the University knows how professional she is. Please give the \$400 I allotted for her research.

As I have already discussed with Ilona Nikolaivna by telephone, I will send you some additional addresses for her within the next few days. In the meanwhile, my most sincere thanks for all your help with the interview project, which she has told us about.

Please give my greetings to Natasha, Sasha and the family.

Yours,

Jeanne Meselson.

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

25 August 1992

Dear Sergei,

Thankyou for transmitting the last communication from Jeanne to Ilona. Appended to this e-mail is another communication for Ilona requesting her to conduct the last phase of the interviews. Please give it to her. We hope that at least part of the results will be available in time to be sent to us with Olga Gubanov.

If you can help to answer any of the questions we have asked at the end of the letter to Ilona, we would be most grateful, especially as to the location of 34 MSD.

Can you let me know the full name of Sasha? I would like to acknowledge his assistance at the end of our group report. As we agreed, I will send you a copy of the report and allow time to receive your comments and suggestions and those of Vladimir before sending it to be published, probably yo Nature. You should already have seen the first draft of the Abramova et al. manuscript, sent with Olga Gubanov. I look forward to receiving the answers of Abramova and Grinberg to my editorial questions so that the manuscript can be sent to be published. Would you mind calling them to ask when I might expect to hear from them?

On another subject, do you think it worthwhile to pursue our effort to establish communication between astronomers in Ekaterinburg and my colleagues in the astronomy department here? If so, let me have some description of the interests there.

As ever,

Matthew.

Dear Ilona,

Thank you so much for the work you have done with us thus far. We would like for you to continue your excellent interviews in order to obtain information for cases that have not yet been interviewed or have been interviewed incompletely. Please use the existing interview form and procedure, as you have been doing. It is important to learn where the individual was during the daytime on weekdays in late March and early April 1979--at work, at home, in a military assembly, or wherever--and to locate each place on the map.

In addition to the two cases mentioned in your letter, the following is a list of cases for which we still need information. The numbers are those from the official list, which you have. Please continue to assign S (supplementary) numbers to the names without official numbers.

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- #36MOCHALOVA, Taisa Pavlovna Sukhalkozhskaya 6-52
(Jeanne interviewed a grand-nephew who was very young in 1979. Please try to interview the niece or other family member who was an adult in 1979. Where was MOCHALOVA actually living in late March/early April 1979?)
- POLESHAEV, Andrei Pavlovich Selkorovskaya 102/3-10
- #6ROMANOV, Boris Georgevich Frunze 76-71
- #20SHATOKIN, Nikolai Afanasevich Bardina 39-83

(Please try to get more information about where he was during daytimes in late March/early April. Had he any occasion to go to Chkalovskiy? If so, where and when?)

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#35 TRETNIKOV, Vasiliy Ivanovich Malakitovyi per 56-1
(Jeanne interviewed neighbor but did not learn the exact workplace. The son still lives there.)

#54 YASINSKAYA, Nina Fedorovna Suhalozhskaya 10-69

The following persons are believed to have survived their illness:

Supl. #5 STERKHOV, Anatoli Ivanovich Poldnevaya 53
(You learned that he was on vacation in Leningrad before becoming ill. Please find out from him directly the dates during which he was away from Sverdlovsk and where he was during the daytimes on weekdays the last days of March and the first week of April.)

-- DANILOV, V.P. Eskadronnaya 37-22

-- FEDULOVA, M.S. Promyslovia 88

-- NOVOKRESHCHENOVA, A.A. Bisertskaaya 22-12

-- PRITCHIN, V.A. Eskadronaya 5a-71

-- YAKOVLEV, N.V. Gazetnaya 34-14

Lastly, we have some questions:

1) Do you agree with our conclusion that NII 44 is in or part of Compound #19?

2) What were the hours of each shift at the ceramics factory and approximately how many people worked in each shift?

3) What were the hours for an assembly? Do the men taking part in an assembly live at the compound or at home? If you encounter any further cases of attendance at an assembly, try to learn just what days it took place, how many participants it had and if any others became ill.

4) Where is polyclinic 2 and what approximate area did it serve in 1979? The same questions for polyclinic 3.

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are boiled to give usable fats, bones and other materials. The Russian word may be TOPIT.

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8) Finally, do you have any ideas about the location of 34 MSD?

Olga Gubanov, the daughter of Professor Gubanov, plans to return from Ekaterinburg to Illinois on September 17. Whatever materials you have ready at that time, she will be able to bring back to us.

Professor Borisov has \$250.00 on account to reimburse you for this second stage of work. Is this sufficient? I realize that your vacation must soon be ending. I hope you will be able both to continue to collaborate with us and have time to enjoy the summer before it is over. I will call you within the next few weeks. My thanks again for your excellent work on this project.

Sincerely,

Jeanne Guillemin

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

Wednesday, 2 September 1992

Dear Sergei,

What good news that you will be our house-guest in October!

Thankyou for your e-mail of yesterday.

The e-mail address of David for Dr. Grinberg is bitnet:
dwalker@utmbeach.

Sergei, could you please communicate the questions at the end of this message to Dr. Grinberg?

Warm regards,

Matthew

Dear Dr. Grinberg,

In my notes from your presentation I have written that during the epidemic you and Abramova autopsied a total of 96 bodies and diagnosed 42 of them as anthrax. Is the number 96 correct? If not, approximately how many of those who you autopsied at hospital 40 during the epidemic did you diagnose as not having anthrax?

Thankyou for your answers to my questions about your manuscript. In your response you say that you hope to complete work on "the manuscript" in the near future. Are you referring to the manuscript with David and Olga? If so, I will delay sending it to the publisher until hearing from you again. Best wishes to you and Natalja. Matthew.

14 October 1992

Dear Sergei,

Jeanne and I really enjoyed your visit except it was too short. We hope that the year ahead will be good for you and all your family.

As for our joint project, here is a list of questions and requests for Ilona and you to consider.

- 1) What is the street address of UZPPM, the work place of Dayanov and Permyakov? The information I have now is only last transport stop in Elizavet.
- 2) What is the street address of Construction Directorate SU-19, near or on Sukholozhskaya, the workplace of Makarov?
- 3) What is the street address of UPTK Chemical Construction, near the ceramics factory, the workplace of Sizikov?
- 4) Is it confirmed that Tretnikov worked at MEX 44, Selkorovskaya 114?
- 5) What is the street address of the knitting factory, apparently near Korpusnaya, the workplace of Runev?
- 6) Did Vostrikov, official list #47, participate in an Assembly in Chkalovskiy rayon in April 1979?
- 7) We would appreciate any further information about the 1979 daytime locations (work, school, assembly, at home not working, etc) of people listed in the e-mail letter from Jeanne to Ilona of 25 August. You have sent some of this information already but please look over the e-mail letter again and let us know whatever additional information you may have already or may have time to discover regarding persons on this list. We know this is a very busy time for you, so please do not feel obliged to go beyond what you can comfortably make time for.
- 8) Can you send us a copy of the new official list with the next traveller?
- 9) Is Sovremennikov a street inside Compound 19? Is it a residence address or a workplace address? What is the source of the Sovremennikov addresses, the new official list or some other source?

10) For the Control Interviews:

Use the "Guide for Control Study" to choose the streets or buildings

for interviews.

We need at least 40 good interviews with people in the age range approximately 40 to 85 years, with approximately 30% women and 70% men.

Please determine (1) present age; (2) work place/school place or other usual daytime location in 1979; (3) residence address in 1979; and (4) present address.

Finally, as we discussed, I would be very glad to arrange a small scientific meeting in Ekaterinburg as you have discussed with Mishustina if there is a good chance that it would accomplish something new and useful. I think this would require the participation of experts from the military, along the lines suggested in the 11 June letter from General Kharechko. Perhaps the Academy of Military Medicine in Sankt Petersburg would participate. Even as recently as last month General (and Academician) Anatoliy Kuntsevich, Chairman of President Yeltsin's Committee for Problems of Chemical And Biological Weapons Conventions, stated in a newspaper interview about the 1979 anthrax epidemic that "The experts advance various scenarios for what happened. Before coming to any unequivocal conclusion, they should all be studied exhaustively."

Maybe this statement of Kuntsevich means that the military would be willing to collaborate with independent scientists like ourselves. Perhaps this should be brought to the attention of Mishustina. In any case please give her best regards from Jeanne and me.

We think of all of you often and look forward to our next meeting wherever it will be.

As ever,

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

25 November 1992

Dear Sergei,

Volodya tells me that someone may be travelling from Ekaterinburg to the United States sometime soon. If so and if Ilona has some new research results for Jeanne, could you please arrange to have them sent to us? We of course understand that Ilona will have been very busy with teaching and also with starting a marriage. Please give her our fond regards.

In a separate e-mail today I will send you a long list of questions about the pathology manuscript for transmission to Lev Grinberg. I hope it will not be much trouble for you to give it to him and to e-mail his reply to me.

When the final pathology manuscript is ready for publication, I will send a copy to Rector Suetin, as we agreed. This should be before the end of the year. In the meanwhile, if he would like to see the present draft manuscript which you transmitted to Dr. Grinberg in August, he is of course welcome to do so. I am assuming that you have a copy.

I am still in the process of writing the second manuscript, concerning epidemiology. I hope to have more information from Ilona before sending you a draft of it for your comments and also to give to Rector Suetin. Also, I am trying to find a scientific journal in Russia that might like to publish it so that it can appear both in Russian and in English.

25 November 1992

Dear Drs. Abramova and Grinberg,

Here is a copy of the letter I sent to Dr. Walker with the final results of the reviews of your manuscript. The page and paragraph numbers refer to the copy I sent to you in August. Please let me have via e-mail any comments on the various points that you wish me to pass on to David. Because of the difficulty of communication, I have asked him to take the responsibility for the final version but I am sure that he would respect your wishes on any points of special concern to you. In any case, please let me know that you received this e-mail.

Do you have a literature citation yet for your papers in Arkh. Patol.? If so, we should include it in the present paper.

I have finally had your slides copied and will send them with the next traveller.

Jeanne and I join in sending you our warm regards.

Sincerely,

Matthew Meselson

20 November 1992

Dear David,

Here is the final round of corrections, suggestions and comments for AGYW. Here too is the English translation of Derizhanov. You may see some things there you wish to cite. He defines and selects gastrointestinal cases by their lack of more widespread involvement, rather than on the basis of epidemiologic information. This may seriously bias his sample.

I greatly appreciate your patience in allowing me to take the time to have this unique and important manuscript reviewed with unusual thoroughness and to mull over it myself for so long. My only excuse for proceeding this way is that the paper will be of special importance to readers generally lacking the knowledge to evaluate the data and interpretations for themselves.

Please incorporate the corrections and make appropriate revisions after considering the suggestions and comments. Then send me the MS on disk and also in hard copy for me to give to the editor of the Proceedings, who has assured me of his interest in publishing it.

1) Abstract, para 1, first sentence. In his e-mail of 1 September (enclosed) Lev Grinberg says "it is very important" to state that the number of deaths was 64. We now understand the official list to include 68 names and there is also the unidentified man. It seems

to me that the exact number is uncertain but if a number is given it should be qualified as "according to local authorities" or in some similar manner. Please do as you see fit.

2) Abstract, para 1, second sentence. Unless we have adequate studies of the pathology of gastrointestinal anthrax for fully reliable differential diagnosis, it would be better to omit the words here bracketed in "...consistently revealed [the] pathologic lesions [that are] diagnostic of inhalational anthrax..."

3) Abstract, para 1 line 8. According to Lev Grinberg's e-mail, the number of cases is 20, not 22. Please revise.

4) Abstract, para 1 line 9. According to Grinberg, the number of cases is 34, not 35. Please revise.

5) Page 3, para 1, second sentence. "...the vast majority of the cases have been traced to residence or work in a limited area on the southern edge of the municipality." It is true that we have traced about 85% of the cases to residence, work, assembly or other activity in Chkalovskiy rayon, about half so far in an apparent narrow plume as you have seen. But since the identification of workplaces and other non-residential locations comes almost exclusively from Jeanne Guillemin's extensive and ongoing interview project which she intends to publish in our group report and then elsewhere as original research, please either cite residence location only or else make reference to Guillemin, personal communication. Alternatively, since residence addresses appear on the official list given to us by Mishustina, no such reference is needed if you say something like "...the majority of the patients resided in a district on the southern edge of the municipality." So as to present the more exact picture in our group report without previous less exact descriptions from our study, I would prefer the second solution. But please revise one way or the other.

6) Page 3, para 1, sentence 2. "...a military facility located immediately north-northeast of where the major outbreak of cases occurred." Here too, the description of case locations developed by interview research should be left to our group report where it can be conveyed more completely and accurately and with explicit attribution. Could you not just say something like "...a military facility located in the district where the majority of patients lived." [Actually, the facility is north-northwest, not north-northeast.]

7) Page 3, para 2, second sentence. According to the enclosed letter of 15 September from Lev Grinberg and as he told us in Ekaterinburg, there were other pathologists in addition to Abramova and himself participating in the 42 autopsies leading to diagnoses of anthrax at Hospital 40. To reflect this, please refer to "...two of the participating pathologists (F.A.A. and L.M.G.)." rather than "...the Russian pathologists..."

8) Page 5, para 1. In his e-mail, Lev Grinberg says the culture

identification was on 11 April. Please revise.

9) Page 5, para 2. Also in his 15 September letter Lev Grinberg confirms that there were 96 autopsies done by the pathologists at Hospital 40, of which 42 were diagnosed as anthrax. You may wish to indicate that the 42 are a sub-set selected from a larger number on the basis of a diagnosis of anthrax. Please do as you see fit.

10) Page 5, para 2, line 2. "...who died usually after a rapid course of 2-3 days duration (Table 1)." The data in the table do not support this conclusion. Fewer than half of the durations given there are in the range 2-3 days. Even leaving out the two longest courses, the average is 3.5 days. It would be better simply to change 2-3 days to 1-4 days, since well over half of the durations do fall in this range. Please revise.

11) Page 5, para 3, first sentence. A correction in accord with that requested by Grinberg in his e-mail would be to replace this sentence with "There were various manifestations of hematogenous spread of B. anthracis infection, including serohemorrhagic and hemorrhagic leptomeningitis in 21 cases (Figures 6 and 7)." Please revise.

12) Page 5, para 3, second sentence. "Gastrointestinal lesions were observed in 39 cases..." Does this mean that there definitely were 3 of the 42 cases without gastrointestinal lesions or is there simply no data for some cases? For case 4, for example, there is no data in your notes. Please clarify.

13) Page 6, para 1. "Mesenteric lymph nodes demonstrated hemorrhagic necrosis in only 9 cases." Two important questions arise here. First, is this 9 out of 42 or were some cases not specifically examined for mesenteric nodes? Second, in addition to cases with hemorrhagic necrotic mesentery nodes, were there any cases with non-necrotic hemorrhagic or with serohemorrhagic mesentery nodes? Please clarify.

14) Page 6, para 2, line 4. Here and in legends 3,7,8 and 9 and in the Table, please abbreviate Bacillus simply as B., having already spelled it out in the abstract and on page 3.

15) Page 6, para 3, second sentence. This description of the pathogenesis of inhalation anthrax conflicts with the finding described on page 5 of focal anthrax pneumonia in 11 patients. The careful reader will be puzzled. The contradiction could be avoided by inserting the word "normal", giving "The pathogenesis of B. anthracis infection that enters via the normal lung..." This would be in full accord with the view of Albrink that anthrax pneumonia can occur when there is pre-existing lung pathology but is not expected for the normal lung. A photocopy of his 1961 review chapter stating this view is enclosed. Please revise.

16) Page 7, para 1, second sentence. "These thoracic lesions are not expected to occur in toxemic cutaneous or intestinal anthrax."

As the principal statement in the manuscript invoking differential diagnosis, the basis for this expectation is crucial for understanding the reasoning that underlies the diagnosis of inhalation anthrax. The great majority of readers of the PNAS will surely not know why such lesions are unexpected in gastrointestinal anthrax, especially since the manuscript records that more than 90% of the series have gastrointestinal lesions. Please explain.

17) Dutz in the letter you have states on the basis of his observations of GI anthrax in Iran that there need be no visible entry site of the pathogen in GI anthrax. Instead, if he is correct, anthrax pathogen passes or is transported from the lumen of the GI tract into the blood vessels of the intestinal wall, causing intestinal hemorrhage. The hematogenous rather than primary appearance of the gastrointestinal lesions is therefor expected for GI anthrax. Considering that very few readers of the PNAS know anything about the pathoanatomy of anthrax, it should be stated explicitly that the hematogenous appearance of the intestinal lesions is not being cited as evidence against a gastrointestinal origin of infection, lest they badly misunderstand the real argument of the paper. Please consider this point and revise accordingly if you think it has merit.

18) Page 7, para 2, line 12. Reference number 9 should be included with the other references here.

19) Page 7, para 2, line 10. "In three of the seven reported cases of the pathology of fatal inhalational anthrax published since 1960, ..." Actually, there are several additional cases that meet these criteria. See the following publications (photocopies enclosed):

Enticknap et al., Brit. J. Industr. Med., 1968, 25: 72-74;

LaForce et al., Arch. Environ. Health, 1969, 18 798-805;

Vessal et al., Clin. Radiol., 1975, 26: 471-474.

These papers describe a total of 4 additional cases, one of which had multiple acute stomach ulcers. Would this bring the tally to 4/11 with gastrointestinal lesions? A search in MEDLINE might reveal additional cases, including some not in English. Please revise as you consider appropriate and specify that the search extended to English-language publications only, if that is the case.

20) Page 7, para 2. The gastrointestinal lesions in the referenced cases of inhalation anthrax for which such lesions are reported appear to be much less severe that those generally seen in the present series. The present MS does point out, on page 8, that the hemorrhagic mesenteric lymph nodes in the present series were "less severely involved than the thoracic nodes". By the same token, if the intestinal lesions described in published cases of inhalation anthrax are substantially less severe than those seen in the

present series, this too should be said. Please consider and revise as you see fit.

21) Page 8, para 2, starting at line 7. The generalization that patients who died after a course of 1 day or less usually did not develop signs is not supported by the data we have for patients on the Abramova-Grinberg list. We have relevant data for all 5 of the Abramova patients for which we have recorded durations of a day or less. The data run like this:

Ab#	duration	signs	source of info regarding signs
5	1	dyspnea, cough	wife
9	1	dyspnea	wife nurse
13	<1	vomiting	wife
37	1	stomach pain, nausea	sister in law
40	1	cough, sneezing, bloody vomit	Abramova

In view of this, I do not think we can be very confident of the statement about the time sequence of signs and suggest that it be removed. Let us wait until all of our clinical information, still being gathered, is assembled and checked. This may avoid having to include a correction in our group report.

22) Page 9, para 2, first sentence. You may wish to change the word "presentations" to "reports", since the elder Nikiforov did project and comment upon slides showing severe thoracic hemorrhage in Moscow in 1986, as noted on page 4 of my "Record of Meetings..." and in point 20 of my 1986 trip memo, at Appendix F of the enclosed.

23) Page 9, para 2, third sentence. It may be misleading to say that the number of cutaneous cases was small. The manuscript given to the State Department in 1988 says there were 17 and an interviewed surviving cutaneous case says the non-septic cases were not kept in the intensive care unit, where Olga worked. Until we know more, why not just say "Description of a number of cases of cutaneous anthrax...?"

23) References 12 and 13. Please consider adding the following reference to an original paper reporting the findings cited in the text:

Smith, H. and Stoner, H.B. (1967) Fed. Proc. 26, 1554-1557.

24) Table. Please delete the designation of the year 1979 from all of the dates in the body of the table. The title of the table adequately designates the year.

25) Table. The age of patient 26 is almost certainly 39 rather than the age 49 given in the table. Olga's notes say <40 and the grave marker date is 1 Sept, 1939.

26) Table. Many of the ages given in the table are one year older

than the age calculated from the actual birth date. Also the birth date of patient 13 according to his wife is 28 October 1934, making him 44 rather than 40. But in all of these cases, unlike the case of patient 26, the ages in the table accurately reflect Olga's notes of the pathologist's data and therefor presumably correspond to the pathologist's notes. Because of that, it may be best to leave these ages as they are, but please correct the age given for patient 26.

27) Table. In Olga's notes, the dates for patients 27 and 28 are in May, not April. I have no additional information for 27 but the grave marker for 28 says April, in agreement with the table. I will try to get confirmation of ages and death dates in time for our group report and will correct any such errors there. For the present MS, please do as you see fit.

28) Table. Please delete the death date for patient 42. In addition to the serious doubts regarding a mid-June date raised by Alexis, the man was found already dead, making the exact date uncertain unless determined by a forensic autopsy.

29) Table. Please enter the various corrections received from Grinberg regarding meningitis as noted in the MS, both in the HEM MEN column and in the legend.

30) Table and abstract. In their ca. 1982 MS (enclosed), Abramova and Grinberg distinguish three degrees of lymphadenitis with increasing severity: serohemorrhagic, hemorrhagic and necrotic hemorrhagic. In the text of the present MS, reference is similarly made to serohemorrhagic lesions, hemorrhagic lesions and necrotic hemorrhagic lesions. But the table legend and abstract imply that all 42 cases had necrotic hemorrhagic thoracic lymph nodes. Is it correct to say that all 42 were necrotic hemorrhagic? If not, please revise.

31) Related to the above question is the description of mesenteric nodes on page 6, para 1. In addition to the 9 patients with "hemorrhagic necrosis" described there, were there additional patients with serohemorrhagic or hemorrhagic mesentery nodes? The important thing is to compare mesentery and thoracic nodal lesions according to the same criteria so far as possible. Please clarify and revise if appropriate.

32) Table. Several patients are recorded in the table as negative for meningitis even though no information regarding the brain is in your notes for them. In some of these cases your notes say "no brain exam". Please check this point for patients 4, 11, 16, 23, 26, 31, 34, 38, and 42. In cases where you have no information, please replace the minus with a question mark.

33) According to Olga's notes, there should be a minus rather than a plus in the Histology column for patient 36. Please revise if appropriate.

34) Figures. Please make sure the inset is in the intended figure and that the legends match. Also, you may want to crop some of the figures, possibly figure 2.

35) Please add to the Acknowledgements the following sentence:
"This investigation was supported in part by a grant from the John D. and Catherine T. MacArthur Foundation to Matthew Meselson for a continuing study of the Sverdlovsk anthrax epidemic of 1979."

As soon as I receive the final MS, I will give it to the editor of the Proceedings. It should then appear in print within a few weeks. Thankyou so much for your essential contribution in this amazing study of the 1979 outbreak.

With best regards,

Matthew

12 December 1992

Dear Sergei,

As Volodya will tell you, I have been peripherally involved in the discussions of George Soros' new enterprise, as described in the enclosed items. The plan is to begin accepting proposals for "phase I" stipends and grants (\$600 and \$6,000 maximum, respectively. See the enclosed) by the end of February. Detailed information on how to apply will probably be announced in Russia by Boris Saltykov. But you and others at the University could begin to think about it now. The following is my unofficial expectation of the requirements:

Applications must be in English. They should be brief. The maximum length has not been decided but I expect it may be as little as 2-3 pages. Each application should concisely state the objective of the proposed work, the names and brief scientific biography of each scientist involved, especially the Principal Investigator. Very important will be references to good publications of the principal investigator, especially in international journals.

Although plans for support of universities are still in formulation, Rektor Suetin may wish to read the enclosed draft of the Soros plan. Please show it to him and extend my regards.

Changing the subject, here are envelopes for Ilona and for Abramova/Grinberg. Please give them all best regards from Jeanne and me.

Please read the letter to Ilona in case you can give her some advice, especially on the possibility of NII and MSD interviews.

We promised to provide Rektor Suetin with our reports before publication. Please give him the enclosed manuscript by Abramova, Grinberg, Yampolskaya and Walker that I communicated to the Proceedings of the US National Academy of Sciences on December 10.

Our paper on epidemiology will not be written until early next year. Of course I will send a copy of it to you and Rektor Suetin as soon as it is done. That paper will include a grateful thanks to the University and to the city officials who so generously consulted with us.

You will remember that I promised to provide General Kharetchko with copies of our reports at the same time as they are provided to Suetin. Please ask Drs. Abramova and Grinberg if they are agreeable to this. Unless they object, please give Kharetchko a copy of the manuscript, along with the enclosed note.

There is a possibility that I will be in Moscow in mid January but unfortunately without coming to Ekaterinburg. I will keep in touch.

With warm regards and best wishes for the New Year,

To: Professor S.F. Borisov
Department of Physics
Ural State University
Ekaterinburg
Internet: borisov@urgu.quorus.e-burg.su

From: Professor Matthew Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax (617) 405-8308

11 January 1993

Dear Sergei,

I have heard from Volodya that you have been in the hospital. Jeanne and I hope that it is nothing serious and that you recover speedily.

Tonight we leave for a week in Paris, after which I will come to Moscow for the period 17-25 January. In case you need to communicate with me, my contact in Moscow is Dr. Boris Olegovich Glotov, Deputy Director, Institute of Molecular Genetics. His telephone numbers are 196 18 64 and 196 02 06. His e-mail address is:
img@glas.apc.org

When you next speak with Ilona please give her our best regards and thank her for the information brought by Voldya in December. We will communicate with her by e-mail in more detail after I return from Moscow. Among the items sent by Ilona was the new official list, with 68 names. Do you or she know if the office that provided this list could also provide a list of the workplaces of the 68 persons?

Rules for applications for the Soros "Phase I" should be announced in mid-February. Announcements with detailed instructions will be published in Poisk and other Russian scientific journals. I will communicate with you and Volodya when I learn more.

Very best regards,

Matthew.

To: Sergey Borisov <72056.3447@compuserve.com>

From: Matthew Meselson <msm@isr.harvard.edu>

15 April 1993

Dear Sergey,

Your two messages both arrived approximately 8 minutes after you sent them -- terrific!!

Thankyou for the sunrise time of 0620 Moscow Summer Time. I would like to ask one more question about it:

When Ilona says that in April 1979 people began the morning shift at the ceramics factory at 0800, does that mean the shift began about 1 hour and 40 minutes AFTER sunrise?

I had thought that local Sverdlovsk time was two hours later than local Moscow time. If so and if the morning shift at ceramics started at 0800 local Sverdlovsk time that would be about 20 minutes BEFORE sunrise. So which is the correct answer, 1 hr 40 minutes after or 20 minutes before? (The difference between the time of sunrise for a given day in 1979 and the same day in 1993, expressed as Universal or Greenwich time is negligible.)

Sergey, regarding the times when Jeanne and I might visit Ekaterinburg again that would be the least trouble for you, is there a time in July that would be as good as the second half of June or is the second half of June the best?

Separately, I am sending an e-mail message for Ilona.

Very best regards,

Matthew.

->

To: Ilona Nikinova in care of Professor S.F. Borisov
<72056.3447@compuserve.com>
From: Matthew Meselson <msm@isr.harvard.edu>

15 April 1993

Dear Ilona,

Your letter of 12 April with information about housing construction answered the questions we had. Thankyou for taking the time to contact the Chkalovsky Chief Architect.

I have three small questions and one large one.

(1) In your list of control interviews, where did Tretnikov, Ivan Vasilievich (#20) work? The list gives the time but not the place.

(2) What is the address of the Mechanization Directorate in Novosiberskaya Street where Klemikhin, Vladimir Nikolaevich (#27) worked?

(3) Where is Veterinarny lane where Abakumov, Nikolay Semenovich (#48) worked and why do you mention the post office in this connection?

In several days, I will send some more questions about interviews that you have done and related matters.

A much more important question is if and when you might have time to work with Jeanne and me again in Ekaterinburg? Would there be a time after the first half of June or in July when you would have the time to be with us most of each day for a week? Please speak with Professor Borisov to see if there is a time in your schedule and his when it would not be too much trouble for us to come. We are not yet sure but we may be able to come in the second part of June or in July.

With best wishes,

Matthew.→

14 July, 1994

Dear Clyde,

Here is a copy of the Sverdlovsk article that I submitted to Science, after Nature insisted on deleting the table and 500 more words. Also the critique that Tom Dashiell sent to Dick Garwin who sent it to me. I will write to Tommy after another cycle or two of conversations with you. Also two papers with very unsatisfying information about sheep.

Here too is a chart I made after our telephone conversation this morning. As you see, I believe that the best we can do on the basis of admittedly inadequate present knowledge of dose-response gives estimates in the range between mgms and gms.

May I ask for a two-dimensional plot of isopleths out to, say, 50 km of total dose computed with the model JAYCOR used for the sheets you gave me but with the conditions stated in my MS? (stability "D", wind speed 5 m/sec, release height 10 m, no mixing layer, no deposition, no decay, breathing rate 0.03 l/min, source strength unity [or anything])? On a scale that I can read? I would like to assure myself that we are using essentially the same numbers.

I think there is much to be gained by working this problem until everyone reaches at least "second-order lack of disagreement."

Best regards

Matthew Meselson

19 July 1994

Dr. Thomas Collins
JAYCOR
1430 Oak Court
Suite 203
Dayton, OH 45430-1063

Dear Tom,

Enclosed please find:

- 1) The current (30 June 94) draft of the article. Also sent to Clyde.
- 2) Copy of 14 July letter to Clyde.
- 3) A sheet dated 14 July 94/cor tabulating source strengths calculated according to a log-normal model and also according to the independent spore action model of Druett. The source strengths are in the milligram range. It is a corrected version of what I earlier sent to Clyde. The corrections do not affect the tabulated source strengths.
- 4) The publication of Druett (1952) describing the independent action model.
- 5) "Basis of Dose Calculations...", a single sheet listing the parameters of my atmospheric dispersion calculations for the article. Like the article, it assumes a breathing rate of 30 l/min, as for a man performing light work. Everything on the sheet can be found in the article itself or in the references it cites. But the sheet is more convenient.
- 6) "GWBasic program STABDH", my BASIC program and printout of dose against x and y . The program uses the parameters on the above sheet except that it uses a breathing rate of 10 l/min rather than 30 l/min. The source strength used in the program is $Q = 10^{10}$ spores.

The printout also includes mortality values calculated for $LD_{50} = 4,000$ spores and probit slope = 0.7. Note that an LD_{50} of 8,000 spores is used in the article.

7) A sheet dated 10 July 94 listing experimental conditions used in obtaining monkey LD50 values by three different groups. I compiled this after discussions with Drs. Jemski, Larson, Pitt and Ivins in which we tried to enumerate the differences in experimental design and conditions that could account for the order of magnitude difference in LD50 values. One of the possibly important differences is that high LD50 values were obtained with dynamic aerosols whereas the much lower values of Jemski were obtained with a static aerosol. This raises the question of whether aging can change the infectivity of an anthrax aerosol. Could aging, for example, act as an adjuvant by altering the chemical or physical structure of the particle or the spores? If so, an anthrax aerosol might become more infectious, on a per spore basis, as it moves downwind. This could be important for estimates of downwind hazard. I urge you to look through the unpublished literature to see if there is any indication that, other things being equal, LD50 values measured for static aerosols are lower than those measured for dynamic aerosols.

Regarding dose-response models for the calculation of source strength at Sverdlovsk, Druett's assumption of independent spore action is biologically plausible and, as he points out, is supported by experimental slope values at doses near LD50. But his model is an oversimplification because of its assumption that the exposed population is homogeneous in its susceptibility. This is unlikely to be true for lab animals, let alone for a diverse human population like that exposed at Sverdlovsk. At attack rates of the order of 1%, as encountered at the ceramics factory and elsewhere in the plume nearby, we are dealing with the especially susceptible tail of the susceptibility distribution. If spores act independently, this means that estimates of source strength based on Druett's model and low attack rates will be too high.

In other words, if anthrax spores act independently and you take the Sverdlovsk human LD50 as 8,000 spores, the source strength giving 2% attack rate at the pipe shop is less than 100 milligrams (see enclosure 3).

A less biologically-based model that does, however, allow for heterogeneity of susceptibility is the log-normal distribution. It has been noted by Bliss, the inventor of probit analysis, and by others that in toxicity analysis the probit slope often decreases as the attack rate drops to low values. Perhaps this is why the slope calculated by Glassman for the large data set of Jemski is lower than that found by some who have little or no data at low attack rates. Or perhaps the reason for the difference lies elsewhere. But, having discussed the experimental procedures at length with Jemski and his former boss Bud Larson, I regard the Jemski-Glassman result as being at least as valid (for monkeys) as any other. While we need to keep the caveats in mind to guide future investigations, it is nevertheless the case that their lognormal distribution, if applied to the Sverdlovsk population, like the independent-action model with heterogeneity, places the source strength in the low milligram range.

Turning now to the data for sheep at Abramovo, 50 kilometers from the source, we face at least three major uncertainties:

a) Atmospheric dispersion estimates of centerline dosage as a function of source strength are less reliable at 50 km than at a few km.

b) Although Young *et al.* (1946) indicate that LD50 for sheep is about ten times lower than that for

monkeys, apparently tested under the same experimental conditions, the opposite is implied by a footnote in Lincoln *et al.* (1967).

- c) Perhaps most important, we have no information regarding the possible effect 2-3 hours of travel in the atmosphere between the source and Abramovo could have had on the infectivity of the aerosol. We do know that some adjuvants can greatly decrease the LD50 for inhalation anthrax, as reported for example by Young and Zelle, *J. Inf. Dis.* **79**: 266-271 (1946).

The large uncertainties regarding atmospheric dispersion estimates at 50 km, sheep susceptibility, and the possible effect of long travel on infectivity of the anthrax aerosol can certainly accommodate our observations at Abramovo to a correspondingly wide range of source strengths, including strengths of only milligrams.

To summarize, unless the human LD50 was higher than 8,000 spores or unless there is a threshold effect in the dose-response relation, the data from the city support a source strength of about 100 milligrams if the exposed population was homogeneous in susceptibility. Since the exposed population was almost certainly not homogeneous, under the above assumptions, the effective aerosol release was less than 100 milligrams.

I reluctantly come to the conclusion from all of this that anthrax may be even nastier than we thought it was.

Tom, if it is not a lot of trouble, could you send me enlarged plots or printouts showing what doses you get from the atmospheric dispersion model you are using. I have difficulty reading the small-scale photocopies you sent earlier.

I look forward to hearing from you after you complete the data comparisons and analysis you spoke of on the telephone.

Sincerely,

Matthew Meselson

cc: Clyde Replogle
Jan Medema

From img@glas.apc.org Tue Mar 17 17:55:16 1992
Received: by cdp.igc.org (4.1/Revision: 1.55)
id AA18189; Tue, 17 Mar 92 14:55:02 PST
Date: Tue, 17 Mar 92 14:55:02 PST
From: img@glas.apc.org
Message-Id: <9203172255.AA18189@cdp.igc.org>
To: msm@wjh12
Subject: Ekaterinburg
Status: R

To: Prof. M. Meselson

From: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
FAX (095)196-0221, E-mail address:
img@glas.apc.org (Internet)
img@glas.apc.org (Bitnet)
glas:img APC networks (Altnet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.)

Re: Yablokov, Ekaterinburg

17 March, 1992

Dear Matt,

A week has passed since I came back and, as we have arranged, I spoke to Mr. Yablokov and gave him your letter. He told me he would write you an answer. I forward to you the essence of our conversation and my personal view.

1. Mr. Yablokov has no doubts that the event in Ekaterinburg is the result of some military activity, although he is sure it is impossible now to find its nature, be it weapons or defence.

2. He thinks that what happened there belongs to the epoch which is in the past forever, and so there is no much sense in additional investigations - "No reason to disturb a skeleton in the cupboard."

3. In his opinion, people and especially the administration in Ekaterinburg will never understand the aim of your visit, they will be irritated and hardly able to assist you, since they have lots of urgent and superurgent problems with delivery of foods and goods to the large city.

4. He figures no obstacles to your visit, except the lack of an organizer in Ekaterinburg.

5. In his view, everything would be considered more friendly in Ekaterinburg if you could find any possibility to come with some humanitarian mission or help. Then you will be able to elucidate your possibilities as to your interest.

Mr. A.Yablokov is now submitting a law about legal responsibility for similar facts in Russia.

After my meeting with him I spoke with Mrs. O. Yampolskaya too. I think she will also write you. Here are my impression after our talk:

1. She is ready to help and accompany you to Ekaterinburg.
2. She has no people there to help her to arrange the visit.
3. Her opinion concerning the way you could be admitted to Ekaterinburg is close to that of Mr. Yablokov.

Dear Matt, I have also talked to many people trying to use them as an experimental model of what could be expected in Ekaterinburg. As a result, I realized that Mr. Yablokov was most probably right: there are so many current problems nowadays that people simply cannot comprehend those of 15 years ago.

I have promised you my help, and it is not my principle to break promises: I shall do my best and I see no problem in accepting you in Moscow. But I wish you clearly understood the present atmosphere in Russia, the atmosphere of extreme social tension, starvation, fear of tomorrow, total irritation and even animosity.

It seems to be worth therefore thinking about possible suspending expedition until better days or conforming it to the moment, as Mr. Yablokov suggested.

I am looking forward to your decision as soon as possible.

You can rely on me as before.

Sincerely Yours, E.D.Sverdlov

From img@glas.apc.org Tue Mar 17 17:55:16 1992
Received: by cdp.igc.org (4.1/Revision: 1.55)
id AA18189; Tue, 17 Mar 92 14:55:02 PST
Date: Tue, 17 Mar 92 14:55:02 PST
From: img@glas.apc.org
Message-Id: <9203172255.AA18189@cdp.igc.org>
To: msm@wjh12
Subject: Ekaterinburg
Status: R

To: Prof. M. Meselson

From: Prof. E.D. Sverdlov, Director

Institute of Molecular Genetics, Moscow

FAX (095)196-0221, E-mail address:

img@glas.apc.org (Internet)

img@glas.apc.org (Bitnet)

glas:img APC networks (Alternet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.)

Re: Yablokov, Ekaterinburg

17 March, 1992

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break promises: I shall do my best and I see no problem in accepting you in Moscow. But I wish you clearly understood the present atmosphere in Russia, the atmosphere of extreme social tension, starvation, fear of tomorrow, total irritation and even animosity.

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I am looking forward to your decision as soon as possible. You can rely on me as before. Sincerely Yours, E.D.Sverdlov

From img@glas.apc.org Mon Mar 30 17:40:17 1992
Received: by cdp.igc.org (4.1/Revision: 1.57)
id AA09106; Mon, 30 Mar 92 14:40:25 PST
Date: Mon, 30 Mar 92 14:40:25 PST
From: img@glas.apc.org
Message-Id: <9203302240.AA09106@cdp.igc.org>
To: msm@wjh12
Subject: confirmatio
Status: R

msm@wjh12.harvard.edu

To: Prof. M. Meselson

From: Prof. E.D. Sverdlov, Director

Institute of Molecular Genetics, Moscow

FAX (095)196-0221, E-mail address:

img@glas.apc.org (Internet)

img@glas.apc.org (Bitnet)

glas:img APC networks (Alternet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.)

Re: confirmation

30 March, 1992

Dear Matt,

March 17 I sent you an imporatan E-male regarding our
Ekaterinburg affair but still have no answer. Could you please
confirm receipt of that message?

Sincerely, E.D.Sverdlov

From img@glas.apc.org Sat Apr 4 06:13:29 1992
Received: by cdp.igc.org (4.1/Revision: 1.57)
id AA07139; Sat, 4 Apr 92 03:13:45 PST
Date: Sat, 4 Apr 92 03:13:45 PST
From: img@glas.apc.org
Message-Id: <9204041113.AA07139@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu

To: Prof. M. Meselson

From: Prof. E.D. Sverdlov, Director

Institute of Molecular Genetics, Moscow

FAX (095)196-0221, E-mail address:

img@glas.apc.org (Internet, Bitnet)

glas:img APC networks (Alternet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.)

Re: confirmation

30 March, 1992

Dear Matt,

Thank you very much for your E-mail of April 2. Please, send passport data to arrange formal invitations. As soon as they are received we shall start going through formalities.

Sincerely, E.D.Sverdlov

From img@glas.apc.org Sat Apr 18 06:41:00 1992
Received: by cdp.igc.org (4.1/Revision: 1.59)
id AA25207; Sat, 18 Apr 92 03:41:28 PDT
Date: Sat, 18 Apr 92 03:41:28 PDT
From: img@glas.apc.org
Message-Id: <9204181041.AA25207@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu

To: Prof. M. Meselson

From: Prof. E.D. Sverdlov, Director

Institute of Molecular Genetics, Moscow
FAX (095)196-0221, E-mail address:
img@glas.apc.org (Internet, Bitnet)
glas:img APC networks (Altnet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.) Re:

confirmation

17 April, 1992

Dear Matt,

Thank you very much for your E-mail of April 4.
We have got all the passport data and started arranging for
invitations etc. Sincerely,

E.D.Sverdlov

From img@glas.apc.org Sat Apr 4 06:13:29 1992
Received: by cdp.igc.org (4.1/Revision: 1.57)
id AA07139; Sat, 4 Apr 92 03:13:45 PST
Date: Sat, 4 Apr 92 03:13:45 PST
From: img@glas.apc.org
Message-Id: <9204041113.AA07139@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu

To: Prof. M. Meselson

From: Prof. E.D. Sverdlov, Director

Institute of Molecular Genetics, Moscow
FAX (095)196-0221, E-mail address:
img@glas.apc.org (Internet, Bitnet)
glas:img APC networks (Altnet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.)

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Sincerely, E.D.Sverdlov

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Received: by cdp.igc.org (4.1/Revision: 1.59)
id AA25207; Sat, 18 Apr 92 03:41:28 PDT
Date: Sat, 18 Apr 92 03:41:28 PDT
From: img@glas.apc.org
Message-Id: <9204181041.AA25207@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Prof. E.D. Sverdlov, Director
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FAX (095)196-0221, E-mail address:
img@glas.apc.org (Internet, Bitnet)
glas:img APC networks (Altnet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.)

Re: confirmation

17 April, 1992

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Thank you very much for your E-mail of April 4.
We have got all the passport data and started arranging for
invitations etc. Sincerely,

E.D.Sverdlov

From img@glas.apc.org Sat Apr 25 06:57:29 1992
Received: by cdp.igc.org (4.1/Revision: 1.61)
id AA19844; Sat, 25 Apr 92 03:58:12 PDT
Date: Sat, 25 Apr 92 03:58:12 PDT
From: img@glas.apc.org
Message-Id: <9204251058.AA19844@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
FAX (095)196-0221, E-mail address:
img@glas.apc.org (Internet, Bitnet)
glas:img APC networks (Alternet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.) Re:
contact information

24 April, 1992

Dear Matt,

Thank you very much for your E-mail of April 23.
Unfortunately, I cannot find your Fax number, please send it asap.
As soon as I get it I shall fax to you all the invitations (would it be
acceptable to send one collective invitation or not?). Best
regards,

E.D.Sverdlov

From img@glas.apc.org Thu May 7 04:37:50 1992
Received: by cdp.igc.org (4.1/Revision: 1.65)
id AA26533; Thu, 7 May 92 01:38:47 PDT
Date: Thu, 7 May 92 01:38:47 PDT
From: img@glas.apc.org
Message-Id: <9205070838.AA26533@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
FAX (095)196-0221, E-mail address:
img@glas.apc.org (Internet, Bitnet)
glas:img APC networks (Alternet, Bolnet,
Homeonet, GreenNet, PeaceNet etc.) Re:
Ekaterinburg

6 May, 1992

Dear Matthew,
Glad to let you know, that the preparations for your visit are going quite good.

1. I have got in touch with Olga Yampolskaya and phoned to Dr. V.V. Nikiforov as she recommended. He agreed to meet your delegation starting from 2 June, 1992. I told him that his advice and help were supposed to be payed. Yampolskaya is ready to accompany you to Ekaterinburg, but she needs an official invitation pointing out who is going to pay the mission. I think that it could be payed at the expense of your expedition. If no, please tell me in advance and I shall try to find money. If yes, the letter or a Fax should be addressed to Prof. V.V. Gavryushov, the Chancellor of the Central Institute of Physician Training, 40 Smolnaya st., Moscow 125 445, Russia. The letter should explain objectives of the expedition, to define its period and indicate that the mission will be payed by the expedition (which is actually the most important). My fax number can be also used.

2. I forwarded your information to Dr. A.V. Yablokov but still have no response.

3. At the moment my Deputy Dr. Boris Glotov is compiling schedules of your visit in Moscow and Ekaterinburg and is arranging for a hotel in Moscow. I hope that soon you will get a preliminary schedule.

4. As for NSF and other funds, I would like to have detailed discussions in Moscow. I am very interested in all kinds of information. Actually, I know quite a number of potential sources of help to former states of the Soviet Union, but still I would like to discuss with you the mechanisms of their use. Moreover, recently we began setting up an (American-Russian) Biomedical Research Foundation to financially support molecular biology and genetics in this country. It would be great if you agreed to take part in this initiative. This is also worth discussing during your visit. If Alexis Shelokov could join you too, it would be excellent. Maybe you could get in touch with Alex Goldfarb in the USA to get more details. I am not sure that Alex and myself think

in the same way as to objectives and functioning of the foundation, but a preliminary talk with him would be of use for future discussions.

5. Unfortunately, I shall not be able to go with you to Ekaterinburg, cause I he a conference in France between June 13 and 20. But I shall certainly meet you in Moscow, and on your way back Boris Glotov, who is a reliable and responsible person, will take care of your group. Hope to see you soon. Best regards to Alexis and Gene.
Sincerely yours,

Eugene

From img@glas.apc.org Fri May 8 11:26:30 1992
Received: by cdp.igc.org (4.1/Revision: 1.65)
id AA20217; Fri, 8 May 92 08:27:31 PDT
Date: Fri, 8 May 92 08:27:31 PDT
From: img@glas.apc.org
Message-Id: <9205081527.AA20217@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
glas:img (APC networks)

Re: Ekaterinburg

8 May, 1992

Dear Matthew,

I am glad to inform you that

1. I have received your FAX to Prof. Gavryushov and forwarded it to Dr. Yampolskaya, thank you.
2. I have got also a FAX from Mr. Yablokov where he expressed his readiness to meet your expedition on June 15 or 16. The exact time of the meeting will be discussed after June 13.

Sincerely yours,
Eugene

From img@glas.apc.org Sat May 16 03:30:39 1992
Received: by cdp.igc.org (4.1/Revision: 1.65)
id AA26080; Sat, 16 May 92 00:31:41 PDT
Date: Sat, 16 May 92 00:31:41 PDT
From: img@glas.apc.org
Message-Id: <9205160731.AA26080@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
glas:img (APC networks)

Re: Ekaterinburg

15 May, 1992

Dear Matthew,

Thank you for your E-mail of May 7.

I would like to propose a preliminary schedule of your stay in Moscow.

June 2. After your accomodation in the hotel a tea or dinner with Dr. Yampolskaya and myself to specify points of the schedule.

June 3. Morning - meeting with Prof. Nikiforov (at the moment he is not in Moscow) and discussion of your future work (2 h). Noon - microscopic works in my Institute (this point is not clear; is only one person of the delegation going to work with a microscope?)

Evening (at 19 ?)- hotel and dinner with those whom you expect to see (depends upon our talks on June 2). At the moment only L'vov, Nikiforov, and Sergiev agreed to meet, others are either not in Moscow or inaccessible for various reasons.

June 4. Departure to Ekaterinburg.

The Moscow schedule after Ekaterinburg is also to be discussed.

I would like to have your ideas and corrections concerning the schedule.

Sincerely yours,
Eugene

From img@glas.apc.org Sat May 23 01:17:01 1992
Received: by cdp.igc.org (4.1/Revision: 1.65)
id AA07617; Fri, 22 May 92 22:18:20 PDT
Date: Fri, 22 May 92 22:18:20 PDT
From: img@glas.apc.org
Message-Id: <9205230518.AA07617@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu

To: Prof. M. Meselson

From: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
glas:img (APC networks)

Re: Ekaterinburg

22 May, 1992

Dear Matthew,

Thank you for your E-mail of May 18.

- 1) We are going to meet you at the airport. Anyway, you will know the name and location of your hotel beforehand.
- 2) We have microscopes with accessories you need for the work, but unfortunately we have no video tape player of VCR style.
- 3) Dr. I. Trakhina told that she had no possibility to meet you, so she is out.
- 4) Dr. Goldansky will join us for dinner Wednesday night and besides he expressed his wish to invite you personally and your wife to his place on June 16 at 7 p.m.
- 5) My constant attempts to get in touch with Dr. Burgasov are still of no result.
- 6) The schedule with your corrections seems good and can be accepted as basic.
- 7) Your question about financial matters is not easy and at least depends upon the sum you need to have. Could I know the size of the sum?

Sincerely yours,

Eugene

From img@glas.apc.org Fri Dec 4 11:01:22 1992
Received: by igc.apc.org (4.1/Revision: 1.42)
id AA23058; Fri, 4 Dec 92 08:02:28 PST
Received: by gn.apc.org (smail2.5)
id AA00004; 4 Dec 92 15:30:26 GMT (Fri)
Received: by glas.apc.org (smail2.5)
id AA18234; 4 Dec 92 16:49:40 MDT (Fri)
To: msm@wjh12
Message-Id: <9212041649.AA18234@glas.apc.org>
Date: 4 Dec 92 16:49:40 MDT (Fri)
From: img@glas.apc.org ()
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)

Re: your msg of 3 Dec.

4 December, 1992

Dear Matthew,

Thank you very much for your e-mail of 3 December. As soon as I receive your FedEx I shall do my best to fulfill all your requests. I am enchanted with the "biological" plans of George Soros and started already consultations with my colleagues (however inconvenient is Friday for this purpose). I shall send you the summary of the consultations between Saturday and Monday as soon as it is evolved.

In the meantime I figure on your help in the sense that you could probably send me additional details concerning the plans of Soros (if you have). I mean an exact figure for the sum of money, is the money for biology only a part of larger sums say for basic research or not, and so on. This information could help me to better design the mechanism of distribution and control of the money.

I was very glad to hear from you. Best regards to Jeanne,
Sincerely yours, Eugene

From img@glas.apc.org Mon Dec 7 10:02:47 1992
Received: by igc.apc.org (4.1/Revision: 1.42)
id AA04693; Mon, 7 Dec 92 07:04:02 PST
Received: by gn.apc.org (smail2.5)
id AA17002; 7 Dec 92 14:23:45 GMT (Mon)
Received: by glas.apc.org (smail2.5)
id AA04930; 7 Dec 92 16:48:20 MDT (Mon)
To: msm@wjh12
Message-Id: <9212071648.AA04930@glas.apc.org>
Date: 7 Dec 92 16:48:20 MDT (Mon)
From: img@glas.apc.org ()
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)

Re: plans of Soros

7 December, 1992

Dear Matthew,

Thank you very much for your swift reply clarifying your position with respect to managing the money to be granted by Mr. Soros. Here I can not help noticing once more how impressive is his decision.

I consider your thoughts principally absolutely correct. Still, I would like to make some comments which are rather my reflections than "ultima ratio".

The problems of our science obviously can not be solved completely even with the help of such a generous gift as the one made by Mr. Soros. Therefore I would like to stress the tasks which I figure out as the most urgent. Here are three of them.

- 1) To prevent the collapse of relatively strong research teams, which are concentrated in the Academy of Sciences and leading universities.
- 2) To slow down the drain of our talented young scientists from Russian research centers.
- 3) To stimulate return to Russia of gifted young investigators. These problems are to my mind the most urgent, and without their solution one way or another the Russian science will have a good chance to become degraded for a long period of time. This will also lead to degradation of the university education because of the violation of the "Humboldt's principle" that the science must be taught by scientists. In this sense the higher education should not to be considered as a priority problem. In Russia the students always conducted their diploma works in research labs of the Academy institutes or universities. In this connection I would suggest for the first time to restrict

allotting the money to the education, otherwise the money will be scattered without hitting the target.

Russia is a huge country which has a lot of universities but relatively few of serious research centers especially in modern biology. The problem of help to the education does exist and must be solved but, to my mind, it will be done mainly using national resources and support by the research centers managed to survive.

Let me now to discuss the three aforementioned problems, and you will see that your ideas have a lot in common.

1) Strong research teams formed a long time before are now close to collapse. Serious lack of money for reagents, equipment, and literature as well as extremely low and absolutely unprestigious salaries result in suspension of investigations and outflow of scientists abroad or to business. At present the situation is critical, and consequently your item 2 (support of research projects of individual scientists) seems to be the most important and urgent. It could be subdivided into two stages:

- a) immediate emergency help, and
- b) long term systematic help.

The long term systematic help can be put into effect according to your idea of grants and peer review, etc. However, you understand that this promises to be time consuming, while we lose the people every day. For example, recently I have lost a talented young man who left the laboratory to be a trader.

Summarizing, I would propose the following plan. The financing is calculated for three years which is a term Russia can be expected to begin to recover. The distribution of the money between the years must be unequal. The first year is to be financed less than the following ones, say in a proportion 1:2:2. I would use the money for the first year in an emergency manner directly distributing it among the laboratories well known for their first rate works. A list of such labs with necessary comments and references could be prepared very quickly. I am ready to make it rather impartially with the help of Georgiev, Spirin, Mirzabekov, Skulachev, and some other our distinguished scientists. To accept it, one must of course proceed from the assumption that these people are not inferior to their american colleagues in intellect, impartiality, and honesty. But this is not so incredible, isn't it?

This approach could efficiently support the strong labs, even \$ 10-15 thousand for 1993 would be enough to let them to continue their work. Meanwhile, the year 1993 could be spent for preparation of grants, their analysis, and allotting the money for the last two years in exact accord with your proposals.

As for a combined steering group I think that the labs to be supported must have freedom in spending the money, in the sense that they could themselves distribute the money between possible items (salary, equipment, reagents etc.). This is important since the conditions the labs are working in are often very different. It should be stressed that salaries are now very important. Our people are literally close to or even beyond the

level of poverty, and maybe their survival is at the moment more important than the investigations they are carrying out. However outrageous it can sound, I am sure that this is the first priority now which will yield good results in future.

Two other problems are closely related to the first one. If the labs are supported, the "brain drain" will be immediately slowed down although not shut down completely. An additional effect could be achieved given that our young men could go from time to time to foreign labs for short periods (1-2 months) to carry out their own work. For this purpose special travelling grants should be envisaged. It seems that there is no immediate need to try to shut the drain down, more important is to achieve dynamic balance between scientists leaving the country and coming back. It follows that the measures stimulating the reverse movement must be reinforced. In particular, a special pool of small grants could be envisaged for those who after having worked abroad have a willingness to return home. An investigator who showed himself to advantage and obtained a consent of his home institute could apply for such a grant and, having it, continue his studies in Russia independently or in collaboration with his american colleagues. Remembering my talks in the USA with the people from my Institute and laboratory I have got an impression that many of them could return on such terms.

No doubt that the infrastructure for the whole project is of paramount importance. The technical problems of transferring money, reagents, and equipment to investigators, purchasing of equipment and reagents etc. must have a solution. I am afraid that for the time being I can not help much in this respect. Probably, it would be reasonable to use the potential of the Moscow Branch of the (former?) American-Russian Biomedical Research Foundation (BRF) which has already a working structure, a small staff, an office, tight relations with biological institutes in Moscow and some experience in transfer of money and equipment. After some reinforcement the Branch could serve as a part of the new program, especially in 1993.

Now a few words about the informational famine in Russia. You have certainly heard about the lack of journals in our libraries, and you are perfectly right proposing to allot some money for subscription. Sharing your opinion, I would suggest also to support in parallel some issues in Russia. We have a number of good journals which could be further improved due to measures I could discuss in detail separately.

Apart from the lack of literature, we all feel our poor possibilities of participation in various scientific forums abroad (conferences, symposia, workshops etc.). The support of this activity could be also of great value. I think we could often cover our travel expenses, but not the stay (accommodation) abroad.

In conclusion let me summarize possible targets of financing:

- 1) support of investigations of research teams and individual scientists;
- 2) grants for short term travelling abroad to carry out a collaborative work in laboratories or to participate in scientific forums;
- 3) small grants for Russian scientists having worked abroad and returning home;
- 4) support of publishing activity;
- 5) infrastructure.

I hope that the results of my thinking will help you in your future discussions. I am sure that we shall have enough time to discuss it minutely later.

Yours, Eugene

From img@glas.apc.org Wed Dec 9 13:11:07 1992
Received: by igc.apc.org (4.1/Revision: 1.44)
id AA15619; Wed, 9 Dec 92 10:12:27 PST
Received: by gn.apc.org (smail2.5)
id AA26318; 9 Dec 92 17:39:05 GMT (Wed)
Received: by glas.apc.org (smail2.5)
id AA03872; 9 Dec 92 19:44:59 MDT (Wed)
To: msm@wjhl2
Message-Id: <9212091944.AA03872@glas.apc.org>
Date: 9 Dec 92 19:44:59 MDT (Wed)
From: img@glas.apc.org ()
Status: R

msm@wjhl2.harvard.edu
To: Prof. M. Meselson
From: Dr. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)

Re: FedEx

9 December, 1992

Dear Matthew,
I have received your FedEx parcel and gave the content to
Olga Yampolskaya. Thank you very much. Do you still want to know
where this manuscript could be published in Russian?

What was the press conference of Mr. Soros today?

Yours, Eugene

From img@glas.apc.org Tue Dec 22 08:05:50 1992
Received: by igc.apc.org (4.1/Revision: 1.49)
id AA28302; Tue, 22 Dec 92 05:07:26 PST
Received: by gn.apc.org (smail2.5)
id AA20050; 22 Dec 92 01:50:28 GMT (Tue)
Received: by glas.apc.org (smail2.5)
id AA07675; 21 Dec 92 23:45:01 MDT (Mon)
To: msm@wjh12
Message-Id: <9212212345.AA07675@glas.apc.org>
Date: 21 Dec 92 23:45:01 MDT (Mon)
From: img@glas.apc.org ()
Status: RO

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)

Re: Soros initiative

21 December, 1992

Dear Matthew,

I have received your FedEx parcel and gave the content to Olga Yampolskaya. Thank you very much. Do you still want to know where this manuscript could be published in Russian?

Thank you very much for your last e-mail. Your information was forwarded to Dr. Antonov by fax (confirmed OK), but as before we cannot find a thread to Prof. Burgasov. Both telephone numbers you gave are of no use but still we are not going to give up.

The most interesting for me and troublesome point at the moment is the \$ 100 million relief effort launched by the Soros Foundation. As it often occurs, I have no information on this point except yours and short report of Boris Saltykov on TV. Maxim Frank-Kamenetskii who has participated in the meeting is in the USA and hardly accessible. A. Goldfarb who previously organized with our help the well known to you Am-Rus Biomed. Res. Foundation also prefers to keep silence.

Dr. Greg Lennon, one of my new American colleagues in LLNL, with whom we agreed to conduct collaborative work on chromosome 19 specific cDNAs, sent me a page of "Science" (11 Dec 92, v. 258, p. 1726) describing some details of the Soros initiative. Unfortunately, the fax was strongly corrupted and hardly legible.

Therefore, I would be very grateful to you if you could clarify those essential aspects of this initiative which are already available, and maybe send a preliminary information on our possibilities at least at the "emergency phase". In particular, how could one practically apply for a financial support? I do hope that this information will be finally widely disseminated in Russia.

Yours, Eugene

From img@glas.apc.org Tue Dec 29 14:54:44 1992
Received: by igc.apc.org (4.1/Revision: 1.51)
id AA12827; Tue, 29 Dec 92 11:56:33 PST
Received: by gn.apc.org (smail2.5)
id AA09231; 29 Dec 92 19:43:56 GMT (Tue)
Received: by glas.apc.org (smail2.5)
id AA02850; 29 Dec 92 22:12:00 MDT (Tue)
To: msm@wjh12
Message-Id: <9212292212.AA02850@glas.apc.org>
Date: 29 Dec 92 22:12:00 MDT (Tue)
From: img@glas.apc.org ()
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
Re:

28 December, 1992

Dear Matthew,

It is very good news that you are going to spend some time in Moscow and I am happy that I postponed my visit to the USA till the middle of February, although I planned it first for the middle of January. I suddenly realized that I am very tired, almost exhausted, that made me change my mind. Your visit is one of the rewards for this decision. Maybe we shall find some time during your stay here to talk. I would be pleased to invite you to my modest flat to spend an evening (or all evenings if you like) and I also hope you will have some time for my laboratory.

Matthew, following your suggestion to help, let me use this kind offer and ask you to bring a parcel for me from David A. Beckman who is the president of the Chemicon International. This company is supposed to receive things from the Promega Corp. and besides to purchase some products for our work. Unfortunately, I could not take them with me when in the USA last time because they have not yet been delivered. Certainly, I wouldn't like to disturb you too much: I have no idea how large the parcel is. If it is too big and/or heavy please leave it at Chemicon till my arrival in February. Could you call or fax David up and find out its size and the possibility to take it?

His whereabouts: Mr. David A. Beckman, President
Chemicon International Inc., 27515 Enterprise Circle West
Temecula, CA 92590
Tels.: (714)676-8080, (800)437-7500 ext. 160;
Fax: (714)676-9209

I hope this parcel will include everything we urgently need for the work. If not, I will have to ask you to bring some reagents for DNA sequencing, namely Klenoff fragment of E. coli DNA polymerase I, Taq DNA polymerase, and ddNTPs, the more the better but certainly in reasonable limits not touching your budget too much.

Another one specific item I would like to ask you to try to

bring with (again within your limits) is amino-7-dUTP produced by Clontech Cat.# 5022-1, a compound with an aminogroup linked to dUTP through a rather long linker. We need this product for non-radioactive fluorescein labeling of DNA. If you know a company producing fluorescein labeled dUTP, it would be much better. The quantity needed is about 5-10 mg.

Very helpful to us would be a piece of information on funding of ex-USSR researchers. As to the Soros initiative, Alex Goldfarb for unknown reasons prefers to keep silence though the whole thing we started together a year ago as the American-Russian Biomedical Research Foundation. Due to the last events this Foundation does not exist any more. The major information we have comes from you.

Apart from Soros, I am aware of Howard Hughes Medical Institute \$ 14 mln initiative. There was also an information in Nature 358, 20 August, 1992, p. 615 on a bill to create a science foundation to promote research in ex-USSR, that has passed the both Houses of Congress (\$ 25 mln), and so on. This is one of the reasons, except just scientific interest, to show you my lab, to tell about what we are doing and to ask for your advice how to get money from the evolving foundations.

At last I would like you to subscribe the "Science" for me. It is rather difficult to do it from here due to a problematic mechanism of payment. If you do it I shall reimburse your expenses just after your arrival. My address for subscription: Shemyakin Institute of Bioorganic Chemistry, Russian Academy of Sciences, 16/10 Miklukho-Maklaya str., B-437 GSP-7 Moscow, 117871 Russia.

Please note that none of my requests is compulsory, I realize that you are very busy and probably will not be able to do everything. I will take it as in the order of things.

I wish you and Jeanne a happy New Year, with warmest regards,

Yours, Eugene

To: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Date: 2 april 1992

Dear Eugene,

Thankyou for your frank and eloquent analysis of the problems and prospects of our proposed visit to Moscow and Ekaterinburg. When your e-mail came, I was in Switzerland and then took a few days to think about what you have said and to discuss it with Jeanne, Alexis Shelokov, and Martin Hugh-Jones. Please excuse me for the delay.

Eugene, we do think that we have something to contribute to the Russia of today -- and of tomorrow -- and to the possibly important scientific understanding of a disease that is still a serious problem in Russia and elsewhere.

First of all, as with any international scientific endeavor, we would inevitably form new collaborations and friendships and strengthen old ones, almost certainly leading to further contacts and collaboration in fields of mutual interest in the health and biosciences.

As you know, we are entering a time when it is both most needed and most possible to initiate such collaborations. Conditions are favorable for obtaining foundation and US government grants for collaboration in areas of medicine and public health. In particular, support for studies of anthrax is available because it is a serious threat to public and animal health worldwide.

Even in the US, where great progress has been made in anthrax eradication in the last 50 years, we had two major outbreaks among livestock just within the past year. The worst of these hit 52 different farms in Arkansas and Mississippi, starting in mid-June 1991. Hundreds of cattle and other livestock were affected. Fortunately, the proper procedures were followed and none of the affected animals was utilized for human consumption. Hugh-Jones tells me that the frequency of significant outbreaks among livestock in Russia is of the order of several hundred per year.

In attempting to understand the tragic Ekaterinburg outbreak, there are certainly areas for productive joint cis-usa research and training in epidemiology and public health. At present, despite all the recent discussion in the press, we understand very little about how the infection was spread, why so many were affected, why so many who should also have been exposed were not affected, why no children died, why the epidemic lasted for weeks, etc.

There is a need for patient, low-key collection and study of the

relevant epidemiological and medical facts. We would hope to find interested collaborators in Moscow and in Ekaterinburg to carry on the study in Russia during and after our visit, culminating after some months in a meeting of all concerned, a possible joint scientific publication, and ideas for possible further steps both in research and in prevention measures. I have a Macarthur foundation grant for this purpose, sufficient to support the expenses in Russia, including honoraria for Russian co-investigators.

Today I think we solved the problem of finding colleagues in Ekaterinburg. I spoke on the telephone with Professor Vladimir A. Gubanov, of the Institute of Chemistry in Ekaterinburg. He is visiting in the us and will return to Russia on tuesday. We had a friendly and substantive discussion. He said that he believes the problem is of importance and would be glad to help us. He will speak to a colleague in Ekaterinburg, a biologist who he believes may wish to take part in the work during our visit and continuing afterwards. Gubanov asked that I communicate our passport numbers and other information to him while he is still in the us, so that he may arrange for invitations needed for the issuance of visas. This I shall do tomorrow, with a copy to you.

Gubanov of course knows of your work and perhaps you have met each other. I told him of our meeting in Cambridge and he asked that I inform you of his willingness to help with the arrangements in Ekaterinburg. His e-mail address in Ekaterinburg is:
onm@ihim.e-burg.su@fuug.fi

Eugene, I think that you could tell during your visit in Cambridge that our interest is genuine and that we are sympathetic and sensitive to the humanitarian needs of present-day Russia. On that basis, we would like to proceed as we have discussed, coming to Moscow and Ekaterinburg for two or three weeks at the beginning of June. Please let me know if this is agreeable. If so we would like to accept the kind offer of Dr. Yampolskaya to work with us and travel to Ekaterinburg.

Could you please inform Dr. Yablokov of this e-mail and thank him on our behalf for his interest and advice. We have tried and will continue to try to follow it.

Except for two short trips April 4-8 and April 14-17, I will answer all further e-mail from you within 48 hours of receipt. Your e-mail messages of march 17 and 30 have arrived within a few hours of their transmission. With every good wish,

sincerely,

Matthew

To: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
Internet: img@glas.apc.org

From: Prof. M Meselson
Harvard University
Internet: msm@wjhl2.harvard.edu

Date: 4 April 1992

Dear Eugene,

Many thanks for your E-mail which arrived 06:13 this morning -- and for your generous help. The passport information is as follows:

Matthew Stanley Meselson
Born Denver, Colorado, 24 May 1930
US Citizen
USA Passport Number Z6855673
Issued at Lyon, France by US Consulate General
Date of issue: 29 May 1991
Expiration date: 28 May 2001

Jean E. Guillemin
Born 6 March, New York, New York, 6 March 1943
US Citizen
USA Passport Number G743909
Issued at Boston, Massachusetts
Date of issue: 18 September 1986
Expiration date: 17 September 1996

Alexis Ioann Shelokov
Born Harbin, China, 18 October 1919
US Citizen
US Passport Number 011628237
Issued at Washington DC
Date of issue: 23 April 1984
Expiration date: 22 April 1994

Martin Eales Hugh-Jones
Born Oxford, England, 15 February 1936
British Citizen
Northern Ireland Passport Number: 700394505
Issued at British Embassy, Washington DC
Date of issue: 20 December 1991
Expiration date: 20 December 2001

David H. Walker
Born Nashville, Tennessee 31 May 1943
US Citizen
US Passport Number P013114640
Issued at Washington DC
Issue date: 14 March 1987
Expiration date: 13 March 1997

Dr. Walker is Chairman of the Department of Pathology, University of Texas Medical Branch, Galveston, Texas. He has been collaborating with colleagues at the Gamaleya in Moscow.

We have reserved seats on Lufthansa flight 3231 arriving Moscow Tuesday 2 June at 15:05 and on Lufthansa flight 3213 leaving Moscow 07:10 on Tuesday 16 June.

I have sent the same passport information to Professor Gubanov. He is leaving Evanston Illinois on Tuesday for Ekaterinburg. There his telephone number is 3432 44 33 04 and his FAX number is 3432 55 59 64.

From today until Wednesday evening I will be in California but will remain in touch with my office.

With warm regards,

Matthew.→

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Date: 22 April 1992

Dear Eugene,

Very glad to have your E-mail of 17 April, which arrived promptly. Numbering E-mail messages to you from the first one, this is number 3.

When the invitations you are arranging arrive, we will immediately apply at the Russian consulate in Washington for visas. Will the invitations be sent by E-mail, FAX or post? It is probably most efficient to send all the invitations to me.

Last night I spoke by telephone with Prof. Gubanov who had returned that day to Ekaterinburg. I think arrangements there will be very good. Should you wish to contact Gubanov, his various addresses are:

Internet: onm@ihim.e-burg.su@fuug.fi

FAX at University: 3432 55 59 64
Telephone at Institute: 3432 44 44 95
Secretary telephone: 3432 44 26 22
Telephone at home: 3432 44 33 04

Since my second E-mail to you, our travel plans have changed. We leave Moscow one day later and the airline will be Finn Air. The full travel schedule is:

Tuesday 2 June: Arrive Moscow 15:30 local time on Finn Air #704 from Helsinki.

Thursday 4 June: Depart Moscow 10:15 AM on Aeroflot #261
Arrive Ekaterinburg 12:45.

Monday 15 June: Depart Ekaterinburg 12:55 on Aeroflot #168
Arrive Moscow 15:10

Wednesday 17 June: Depart Moscow 16:25 on Finn Air # 705

Including Yampolskaya, there will be six of us travelling to Ekaterinburg (unless you would like to come with us!).

I have E-mailed the same travel information to Professor Gubanov.

I received a cordial letter from Alexy Yablokov, posted March 23. I will post a reply to him tomorrow. If it is not an inconvenience for you, could you please let him know how our plans have evolved and how much we appreciate his advice and interest. As our plans develop, I will give every attention to the concerns he expressed and will try to come with possibilities for concrete assistance for Russian scientific colleagues.

With best regards,

Matthew

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax: (617) 495-8308

Sunday 26 April 1992

Dear Eugene,

Here follows E-mail number 4, responding to yours of 24 April.

My FAX number is (617) 495-8308. Yes, one collective invitation naming all five of us will be OK.

We will bring with us all necessary airline tickets, including Aeroflot tickets for travel of the six of us to and from Ekaterinburg. Nevertheless, may I ask that your office check with Aeroflot in Moscow sometime after the middle of May to confirm the Ekaterinburg reservations?

As for accommodations in Moscow, we do not need luxury, we are all experienced travellers.

Eugene, I must also make some other requests but I will try to keep them to a minimum.

The first concerns the glass slides of histologic sections, color photographs, notes and any other materials relating to the Sverdlovsk anthrax outbreak that belonged to the late Professor V.N. Nikiforov. Professor Nikiforov showed much of this to us when he visited the US, as you saw on the videotape. We would very much like to see these materials in Moscow. In particular, it would be important for Dr. David Walker to examine the glass slides under a suitable microscope and, if possible, to photograph them with a 35mm camera attachment. We can bring the appropriate film.

I understand from Dr. Yampolskaya that the materials are probably now in the possession of the son of Professor Nikiforov, Dr. Vladimir Nikiforov, a physician who works in a Moscow clinic. I also understand that it may be a delicate matter to persuade Dr. Nikiforov to let us study his fathers' materials, even though we would of course want to engage him as a consultant in compensation for his participation.

So my request is that you contact Dr. Yampolskaya to discuss the best way to approach Dr. Nikiforov and then to do so. Her telephone at the Botkina Hospital is 945-99-58 and at home is 454-95-14. I spoke to her by telephone today and told her that you might call.

My second request is that you ask Dr. Yablokov if he would like to

meet with us, either before or after Ekaterinburg or both, and make for us the corresponding appointments. It would be good if Dr. Yampolskaya could be included. If there is anyone else in Moscow it is important for us to meet in connection with our study, may I leave it to your judgement to make the arrangements? To avoid schedule conflicts, it would be best to leave our Moscow schedule entirely in your hands. We will be prepared to begin discussions the night of our arrival, June 2. Could we meet with you that evening at or after dinner and with anyone else you decide, including Yampolskaya if she is able?

On a different subject, do you know about the new National Science Foundation program under which US scientists who have current NSF grants may apply for up to \$10,000 supplements to their grants, to be used to purchase equipment and supplies for scientific collaborators in the former Soviet Union. I sent more detailed information to Professor Gubanov while he was in Illinois. He could provide you with it if you are interested. Are there any researchers at your institute who are now collaborating with US scientists who have active NSF grants? If so, this program may be useful for them. I would be glad to contact such US collaborators to inform them of how to apply to the NSF for such a supplement.

I myself may soon be awarded an NSF grant to continue our work on the molecular genetics of rotifers. If so, perhaps I could arrange a cooperative project with someone at your Institute. But first I must wait to see if the grant is awarded.

Best regards,
Matthew

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax: (617) 495-8308

Dear Eugene,

Thankyou for your letter of invitation of 28 April. Its details are correct in every respect except that we do not need hotel bookings for the night of Wednesday June 17, as we are scheduled to leave Moscow at 16:25 that day on Finnish Air flight 705.

If, as I hope, you and Dr. Yampolskaya are successful in enlisting the cooperation of Dr. Vladimir Nikiforov, could the photographs, glass slides and other materials be made available for Dr. Walker to study and, if agreeable, photograph or copy on his first full day in Moscow, Tuesday June 2, and, if necessary, again on the only other full day in Moscow, Tuesday, June 16?

As mentioned in my previous e-mail, study of the slides will require the availability of a suitable microscope and camera attachment. And a projector and screen will be needed for viewing 35mm transparencies. If agreeable, we would also like to have copies of the relevant transparencies, especially those shown here in Cambridge by Prof. Nikiforov in 1988.

If the above can be arranged, I am sure that Dr. Walker would greatly welcome the participation of any interested Russian pathologist who might wish to join him in studying the materials.

While Dr. Walker is studying the pathoanatomical materials, the rest of us would devote ourselves to whatever meetings you arrange. As I mentioned, we would of course like to meet with Dr. Yablokov. There are two others we would also like to see. One is Dr. P. N. Burgasov. He can probably be contacted through his daughter whose telephone in Moscow is 237-40-07. The other person is a former assistant to Professor Nikiforov, Dr. Trakhina, who Dr. Yampolskaya is trying to contact. As for others, please make whatever additional appointments you may consider relevant. With so little time in Moscow, we will be glad to spend long working days and even evenings on our project.

Yesterday we received a most cordial invitation to Ekaterinburg from the rector of Ural A.M. Gorky State University, Prof. P.E. Suetin. As Prof. Gubonov will leave before we arrive, Prof. S. Borisov of the Physics Department has kindly agreed to serve all our communication needs in Ekaterinburg. His e-mail address is borisov@urgu.quorus.e-burg.su and his fax number is (343) 2 55-59-64.

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax: (617) 495-8308

7 May 1992

Dear Eugene,

Again many thanks for all you are doing in preparation for our visit.

Today I sent a fax addressed to Professor Gavryushov, using your fax number 196-0221. We will pay for all of the expenses of Dr. Yampolskaya in connection with our expedition to Ekaterinburg, including travel. We will bring all airline tickets, including hers.

For the examination of glass slides with Dr. Nikiforov, we will need access to a research quality microscope with magnification from 25X to 1000X, with an oil immersion objective for the highest power. A 35mm camera attachment for the microscope will also be needed. There is no need for phase-contrast optics. As I mentioned earlier, we will bring film. We will also need a 35mm slide projector, a screen and some way to have color copies made of the slides. If Dr. Nikiforov has retained any paraffin block histological preparations, we would like to be able to make and examine new sections from them or even take some blocks back to the US, but only if that is completely agreeable.

We will also certainly pay Dr. V.V. Nikiforov for his advice and help. May I rely on you for advice how much this should be and how it should be done? Can you suggest a way in which I could exchange dollars for rubles through a tax-exempt foundation in Moscow so as to obtain a favorable exchange rate and not have to pay the commercial fee for currency exchange? Then the foundation could issue ruble drafts to individual consultants in Moscow and Ekaterinburg as payment for their advice and/or help. What is your opinion of this procedure?

Alexis Shelokov and I would be glad to talk with you about support of Russian biomedical science. I will bring several kinds of information, some of which I hope will be new to you.

Alex Goldfarb telephoned me and told me about the foundation you are setting up. It is a very good idea to help the graduate education and research of young scientists in Russia. Alex asked me to join the Advisory Board and I agreed. He said that Baltimore, Lederberg, Marks, and Rich had already agreed to join the Board.

In addition to Nikiforov, Dr. Yablokov, Professor Burgasov and Dr. Trakhina, and any officials or specialists you think we should meet, we would also like to see some others in Moscow if it can be arranged

in the rather short time available:

Dr. Vladimir P. Sergiev. His telephone numbers are 246- 80-49 and
246-06-44 at the Institute of Medical Parasitology
and Tropical Medicine and 157-26-39 at home.
Professor Dmitri Lvov, your friend and a good friend of Alexis

Professor Vatalii Goldanskii and his wife Mila, friends of
Jeanne and me. His telephones are 137-35-45 at his institute
and 137-34-50 at home.

As I said earlier, we will be glad to work long hours!

As ever,

Matthew

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu
Fax: (617) 495-8308

18 May 1992

Dear Eugene,

Thankyou for your e-mail of 15 May. The basic schedule you suggest is very good. Here is a further development of it for your consideration -- together with some questions.

TUESDAY JUNE 2.

Arrive Moscow 3:30 PM FinnAir flight 704 from Helsinki. Should we look for you or Dr. Glotov or should we go directly to our hotel? If the latter, what is its name and location?

Settle in at hotel. Tea or dinner with you and Dr. Yampolskaya.

WEDNESDAY JUNE 3.

Meeting of the group with Dr. Nikiforov to get acquainted and discuss plans for work on pathoanatomical and other materials from the collection of his father. I think we should allow up to one hour but not two hours for this. Then the group would divide into two parts:

1) Dr. Nikiforov and Dr. Walker would work morning and afternoon at the Institute of Molecular Genetics examining and discussing pathoanatomic glass slides, photographs, notes, and possible other materials. Dr. Shelokov and Dr. Yampolskaya would also take part in this work and help in Russian-English communication. If a senior Moscow pathologist would also like to take part, that would be most welcome. Perhaps you or L'vov can suggest a good person.

Depending on how much material there is to examine, one day may not be enough. If more time is needed, Dr. Walker would wish to continue working with Dr. Nikiforov on our return to Moscow after Ekaterinburg.

The work will need a 25X - 1000X research microscope with a 35mm camera attachment and appropriate light-source. It would be good but not essential to have a second microscope unless we are joined by a Moscow pathologist as mentioned above. The second microscope need not have a camera. The work will also require a 35mm slide projector and screen; access to a photocopy machine and, if possible, a video tape player for US style VCR. We will bring film and histologic stains.

It is important to communicate to Dr. Nikiforov our wish to study all materials relevant to the Sverdlovsk anthrax outbreak: glass slides, photos, documents, notes, etc. In addition, if there are paraffin

blocks of tissue specimens, we would ask that a histology laboratory prepare some sections for Dr. Walker to look at on our return through Moscow. This aspect, if needed, can wait until after we discuss it in Moscow.

2) While the pathoanatomic materials are being studied, the other members of the group would have meetings with various individuals, as follows:

Our first priority is to meet with Dr. P.N. Burgasov. We would like to see him twice, both before and after being in Ekaterinburg. Would you be able to join us for this on June 3? If not, we would need someone to interpret that day. Any time during that day would be good -- morning, lunch or afternoon. I have two telephone numbers for Dr. Burgasov, only one of which was in my e-mail of 29 April. They are 227-41-85 and 227-48-36. His residence or that of his daughter may be on Kotelnicheskaya Naberezhnaya, but I am not certain of this. It would be best if he could meet us at your Institute, but if he would prefer otherwise, we would be glad to meet wherever he likes. In contacting him, please extend our cordial greetings.

Others we would like to see during the day if it can be scheduled are Dr. Irina Trakhina (Dr. Yampolskaya may know how to reach her), and/or any persons you consider to be of interest for our problem. In a few days, I will send names of one or two other persons we would like to meet with in Moscow on this day if they are available, or otherwise on our return from Ekaterinburg.

3) I understand from your e-mail that you L'vov, and Sergiev will join us for dinner Wednesday night. That would be excellent. It would be good to include Yampolskaya.

DEPART FOR EKATERINBURG 10:15 AM THURSDAY JUNE 4. Aeroflot 261.

RETURN FROM EKATERINBURG 8:45 AM SUNDAY JUNE 14. Aeroflot 262.

1) June 15 or 16. Meet with Dr. Alexey Yablokov.

2) We can make detailed plans for June 14-17 when we see you in Moscow.

Finally, please give me advice about financial matters, as mentioned in my e-mail of 7 May. Is it better to bring American Express traveller checks, currency, or bank drafts? I will try to arrange for a tax-exempt exchange rate with MacArthur or Alex Goldfarb, but neither of these two financial offices may be in operation soon enough.

As ever,

Matthew

From img@glas.apc.org Fri May 8 11:26:30 1992
Received: by cdp.igc.org (4.1/Revision: 1.65)
id AA20217; Fri, 8 May 92 08:27:31 PDT
Date: Fri, 8 May 92 08:27:31 PDT
From: img@glas.apc.org
Message-Id: <9205081527.AA20217@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Prof. E.D. Sverdlov, Director
Institute of Molecular Genetics, Moscow
FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
glas:img (APC networks)

Re: Ekaterinburg

8 May, 1992

Dear Matthew,

I am glad to inform you that

1. I have received your FAX to Prof. Gavryushov and forwarded it to Dr. Yampolskaya, thank you.
2. I have got also a FAX from Mr. Yablokov where he expressed his readiness to meet your expedition on June 15 or 16. The exact time of the meeting will be discussed after June 13.

Sincerely yours,
Eugene

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Friday 16 October 1992

Dear Eugene,

I have your e-mail of 5 October and look forward to talking with you when you are in the US.

I would like to be of help to Russian molecular geneticists and would be glad to handle an occasional paper for MGMV if it is in my field. But the truth is that I do not have enough uncommitted time to be a real co-editor. Let's talk about what to do when you are in NY. I will telephone you c/o Dr. Susan on Monday October 26. Until then, very best regards from Jeanne and me.

Matthew

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Friday 4 December 1992

Dear Eugene,

Today I sent to you by Federal Express a manuscript and enclosures for Dr. Olga Yampolskaya. Would you be so kind as to let her know that it is at you institute and that she may come for it? Her telephone numbers are 945-99-58 (Botkina Hospital) and 454-95-14 (home). I would also ask that you relay to me her comments on the manuscript, either by traveller or by e-mail. I am very grateful for your help with this.

Next Tuesday I will go to a meeting at the home of George Soros to join in planning how to use the incredible contribution he wishes to make to Russian biology -- tens of millions of dollars over a two-year period. Please let me have any advice beyond what we have already discussed in this regard.

Warm regards from Jeanne and me,

Matthew

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Friday 4 December 1992

Dear Eugene,

There will be a press conference in Washington on Wednesday to announce the plans of Mr. Soros. Until then, my impression of what he intends to do may not be accurate. My present impression is that he intends to make available of the order of 100 million dollars for Russian science, of which about a quarter or a third would be for biology or bio-medical sciences. I think he intends that the money be spent over a short period -- only a few years. Some of the funds would go for infrastructure, some directly to individual principal investigators who submit meritorious research proposals and some for managing the program itself.

I look forward to receiving your advice about this sometime before Tuesday morning Boston time, when I will leave for New York.

I would appreciate your reaction to some specific points that represent my hasty zeroth-order thinking, after talking with some Russian friends here.

I. EDUCATION AT THE RESEARCH STUDENT LEVEL

- 1) The emphasis here would be to provide assistance in science education to a small group of the best universities, in Moscow and in certain other cities.
- 2) A basic objective would be to communicate to students that natural science can serve important social needs and that it is possible to have a fulfilling life as a scientist.
- 3) The selected universities should be provided with subscriptions to the most important journals in specific fields.
- 4) A program should be established to bring first-rate active scientists from the US and other countries to leading Russian universities to lecture on current research.
- 5) The quality and availability of text books used in science courses should be reviewed and recommendations made for supply of improved texts where needed.
- 6) Selected universities should be invited to prepare proposals for strengthening their programs of graduate-level science education. Such proposals could include, inter alia, requests for library and computer

facilities.

II. RESEARCH SUPPORT FOR INDIVIDUAL INVESTIGATORS

- 1) A program should be established for individual investigators to submit research proposals that would be reviewed and funded on the basis of merit. Proposals could be screened in two steps. The first screen could be done locally and the second by an international group.
- 2) One- or two-day workshops should be organized to help familiarize Russian scientists with how to write a good research proposal for the above program.

III. INFRASTRUCTURE

- 1) (Needs and procedures need to be thought out. I have not tried to do so.)

IV. PERSONNEL

- 1) A steering group of top-quality US scientists would identify Russian colleagues personally known to them. The combined group would then formulate the initial plans, including plans for governance, evaluation and oversight for approval by Mr. Soros and/or his representatives.

V. GENERAL

- 1) All scientists in the specified fields should be eligible to submit research proposals. It should be made clear that the only basis for selection is scientific merit.

Best regards,
Matthew

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjhl2.harvard.edu

Monday 14 December 1992

Dear Eugene,

The meeting in New York to discuss the "International Science Foundation for the FSU" was attended by about 35 scientists, including Maxim Frank-Kamenetski of your institute. I think that Vadim Nikiforov was also there. After the meeting, there was informal discussion at the home of Mr. Soros.

You will no doubt have seen the announcement of the Foundation from Boris Saltykov in Moscow on Wednesday and also will have heard from Alex Goldfarb. So what follows will probably not be unfamiliar to you and is of course less authoritative.

In its December 8 draft formulation, the plan is to begin accepting proposals for "phase I" stipends and grants (\$600 and \$6,000 maximum, respectively) by the end of February. Detailed information on how to apply will probably be announced in Russia by Saltykov. The following are likely to be the application requirements for phase I research grants:

Applications, written in English, should be brief. The maximum length has not been decided but will be only a few pages. Each application should concisely state the objective of the proposed work, the names and brief scientific biography of each scientist involved, especially the Principal Investigator. References to publications of the principal investigator in international journals will be especially helpful.

There was considerable discussion in New York on two particular questions (1) whether to create endowed professorships for the most distinguished scientists and (2) how to deal with support of infrastructure. I assume that this will all have been reported to you by now so I will not try to summarize here.

Beyond the initial goal of providing a safety net to assure continuity of good science, there is another issue that seems most important to me. More significantly, I believe it is an issue high on the list of priorities for Mr. Soros. The question is what will be the nature of science support after the two years have passed and after the 100 million is spent? Ideally, there should be up and running in Moscow an entity resembling the US National Science Foundation, supported by the Russian government, other governments, and private donors. Like the NSF, it should specialize in peer-reviewed support of individual research groups and should have

close and friendly relations with individual scientists. Hardly an original idea, but worth keeping our eyes on as the next two years go quickly by.

Now another subject. I am hoping to come to Moscow on January 17 for several days, leaving either on the 23rd or the 25th. Will you be there then?

While in Moscow, I would like to meet with Professor Nikolai Antonov about a monograph he wishes to write and with Professor Pyotr Nicolaevich Burgasov to show him the results we now have and to obtain his comments. If it is not a great deal of trouble, would you arrange to have the following messages transmitted to these two men?

With best regards, Matthew.

.....

Professor Nikolai Antonov
Association of Independent Publications
Center of National Security and Strategic Stability Studies
4, Zubovsky Boulevard
GSP 103786 K-21
Moscow 119021

14 December 1992

Telephone 201 27 02
Fax 230 21 19

Dear Professor Antonov,

Thank you for your telefax of 16 November suggesting that you might write a scholarly monograph on "Chemical Weapons at the Turn of the Century". Such a monograph written by you would indeed be of much interest historically and scientifically.

Following your suggestion, I could come to Moscow in mid-January so that we could discuss various aspects of such a project directly. The matters we would want to consider would include the detailed contents and scope of the monograph; the nature of the intended audience; the length; the form of publication; and your own compensation.

With your agreement, I would like to invite my colleague Julian Perry Robinson of the University of Sussex to join us in Moscow. Perhaps you know of the quarterly "Chemical Weapons Convention Bulletin", which he and I co-edit. Both of us will be coming from Paris at the time of the signing of the Chemical Weapons Convention.

We would arrive in Moscow on Air France flight 1850 on Sunday 17 January at 5:25 PM and would stay at least until Saturday 23 January. Please let me know when it would be convenient for you to meet with us and if it would be possible for someone to meet us at Sheremetyevo airport on 17 January. Also, can you have rooms

reserved for Robinson and for me at a Moscow hotel that is not too expensive, such as one of the Academy hotels on Leninsky Prospect?

For future communication, you may wish to have my electronic mail address. It is: msm@isr.harvard.edu The telefax number you have used, 617-495-8301 is also satisfactory.

This message is being sent to you by electronic mail. Please note that it supercedes my fax of 3 December in two respects: Only Robinson and I would come to Moscow and we would stay at least until 23 January, somewhat longer than originally planned.

Sincerely yours,

Matthew Meselson
Professor of Biochemistry
and Molecular Biology

.....

Professor P.N. Burgasov

Telephone 227-41-85 (daughter)
 227-48-36 (uncertain)

Dear Pyotr Nicolaevich,

I am planning to be in Moscow January 18-22 and would much appreciate the opportunity to see you. Please let me know through Professor Sverdlov if that would be possible and, if so, what day and time would be convenient for you.

With best wishes for the New Year from Jeanne and me,
Matthew Meselson

->

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Monday 14 December 1992

Dear Eugene,

I am very grateful to you for your kind offer to "control" my visit to Moscow in January. Since Professor Antonov suggested in the first place that I come to Moscow, I believe he would be willing to send invitations and to meet us at the airport and make reservations for us at a hotel. But since I have not yet heard from him, I cannot be sure.

Still, in order to impose as little as possible on your generosity, please let Antonov handle the logistics as much as he can. The most important thing for now is just to telefax the invitations to me so visa applications can be made. Here are the essential data:

I will be accompanied by my colleague and long-time friend Mr. Julian Perry Robinson of the University of Sussex.

We will arrive together from Paris on Air France 1850 arriving at 1725 Moscow time Sunday January 17.

We will leave for Paris together on Air France 1811 departing at 0830 Moscow time on the morning of Monday January 25.

Our personal information is as follows:

Matthew Stanley Meselson
Professor of Biochemistry and Molecular Biology
Harvard University, Cambridge, Massachusetts
Born Denver, Colorado, 24 May 1930
US Citizen
USA Passport Number Z6855673
Issued at Lyon, France by US Consulate General
Date of issue: 29 May 1991
Expiration date: 28 May 2001

Julian Perry Robinson
Senior Fellow
Science Policy Research Unit
University of Sussex
Brighton, England
Born Jerusalem, Palestine, 11 November 1941
British Subject

I have no way to obtain Robinson's passport information until he returns

from vacation in two weeks. But my understanding is that the invitation letter does not need to have this information.

In Moscow, we hope to meet with several people:

1) Professor Nikolai Antonov, as you know. Our purpose in meeting him is to discuss his proposal to write a monograph that I would then edit and seek to publish in English.

2) Professor Pyotr Nikolaevich Burgasov, as you also know. If he cannot be reached at the two numbers you have, Professor Vladimir Petrovich Sergiev may know how to reach him. The telephones for Sergiev at the Institute of Medical Parasitology are 246 80 49 and 246 06 44. His residence number is 157 26 39. I want to discuss our Ekaterinburg findings with both men, but especially with Pyotr Nikolaevich. On the basis of our cordial meeting at the Burgasov Dacha in June, I am confident they would both be willing to see me. If it is agreeable to them, I would like to include Robinson.

3) Academician Anatoliy Demyanovich Kuntsevich. He is now Chairman, Russian Federation President's Committee for Problems of the Chemical and Biological Weapons Conventions. His telephone and telefax number is 206 56 60. But I have communicated with him through his colleague in the Russian Foreign Ministry, Nikolai Georgevich Pyatkov, telephone 244 22 30. Kuntsevich knows I am coming and has indicated that he would be willing to meet with me. My main objective in seeing him is to discuss our Ekaterinburg findings.

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Telephone: (617) 495-2264
Telefax: (617) 495-8308
Internet: msm@wjh12.harvard.edu

Friday 8 January

Dear Eugene,

I telephoned to Alex today but learned that he had just left for Moscow and Kiev. I spoke instead with Greg Johnston to inquire about the status of Soros phase I. They hope to announce the application procedure for stipends and for group research support in the middle of February. The announcement will be widely advertised, including in Russian journals such as Chemistry and Life and Poisk. Greg learned from Doug Berg about your February trip to the US and will schedule time with Alex.

The package came in good condition from Beckman. It contains 500 units of TAQ polymerase in buffer (Promega) and 40 micromoles of each dNTP in buffer, both packaged with dry ice. Also, 100 grams of agarose. In addition, I will bring Sequenase 2.0 (US Biochemical), 2 micro moles of each ddNTP and 25 milligrams of fluorescein dUTP (Sigma). I will replace dry ice in Paris sufficient to last until we meet at the airport Sunday evening. Boris has informed me that Antonov will also meet us at the airport.

Eugene, please if possible keep some time on your schedule and mine for us to talk about a possible collaborative project that I have been thinking about in the area of molecular evolution and which involves DNA sequencing.

As ever,

Matthew.

PROFESSOR MATTHEW MESELSON
DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY
HARVARD UNIVERSITY
7 Divinity Avenue
Cambridge, Massachusetts 02138

Phone: (617) 495-2264
Fax: (617) 496-2444

Date: 31 January, 1994 Pages including this sheet: 1

To: Martin Hugh-Jones: (504) 346-3331

Dear Martin,

Yes, 4"x6" color prints of the Romanov and Sannikov grave markers would be much appreciated. Thanks.

Unfortunately, I have only the self-descriptions you already know regarding the locations of cutaneous anthrax lesions.

At Edgewood last week I gave two talks about the Sverdlovsk outbreak and had good discussions with resident experts and especially with Joseph Jemski. The strain used in his dose-response work was Volum 1B, grown and sporulated at 35° in peptone-pepticase medium. Aerosols were generated in the 1,000,000 liter aerosol chamber still standing at Detrick. The suspension fed into the aerosolizer was at 5×10^9 /ml. This should have given an aerosol in which most respirable particles containing spores contained only one. Monkeys were individually exposed in ventilated cages as described in Jemski's publications. The same experimental procedure was used for both cynomolgus and rhesus monkeys. The work consumed 5 years. Some more definite information about the aerosol structure may be forthcoming.

Martin, everyone who has contributed importantly to the organization, conduct, or analysis of the work reported in this paper or to its writing is included among the listed authors. The essential pathoanatomical work which the present paper cites is already published and fully referenced. Emendation of the published diagnosis of one case and two additional unpublished diagnoses initially made in Russia by pathologists there are properly credited as personal communications but certainly do not merit coauthorship. When I asked Jerry if he should be included in the personal communication, he said not to bother and I have not had David's answer to the same question.

I have not succeeded in convincing you that the authorship criteria I follow are the right ones. It is ironic that this should be so when David's criteria as regards his own publications emanating from the study are more rigorous than those I have observed. I do not find this objectionable but I do feel badly that your approach is not more consistent.

Sincerely,

Matthew

To: Dr. B.O. Glotov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjhl2.harvard.edu

Thursday 28 May 1992

Dear Dr. Glotov,

First, let me thank you for all of the efforts you are making for the success of our study.

Here are the answers to the questions in your two e-mail communications:

1) Our study plan for Ekaterinburg is outlined in the following copy of the e-mail I sent to Professor S.F. Borisov on 19 May:

Dear Professor Borisov,

I am now able to propose to you the outline of a work plan for our combined US-Ekaterinburg team and would like to have your advice and comment. There would be two principal lines of study. One line would focus on clinical, pathoanatomical and therapeutic problems while the other would concentrate on epidemiological aspects.

I. Clinical-pathoanatomical-therapeutic problems.

Interviews:

Professor Arkady I. Kortev

Dr. Faina A. Abramova

Dr. Lev M. Grinberg

Dr. Margarita Ivanova Ilenko, in 1979 was head
physician at Hospital number 24

Dr. Yakov Iosifovich Klipnitser, in 1979 was Head
Physician at Hospital number 20.

Other medical specialists who may have relevant information.

Visits to hospitals:

Hospital number 40

Hospital number 20

Hospital number 24

Other relevant hospitals, if any, possibly including the medical facility of the Military Epidemiology Sector.

Examination of pathoanatomical materials:

Seek such materials from any of the above persons, hospitals, etc. Such materials would include glass slides of tissue sections, photographs, medical records, notes, other documents. For examination of glass slides, we would need 25X - 1,000X power research microscope with 35mm camera attachment and appropriate light source. We will bring film. Also needed will be 35mm slide (diapositive) projector, access to a photocopier, and, if possible, access to a US style VCR video tape player.

In examining pathoanatomical materials, we would like to have the collaboration of an experienced Ekaterinburg pathologist. In that case it would be desirable but not essential to have the use of two microscopes.

II. Epidemiological aspects.

Field work:

Visit Vostochnoye Cemetery Administration Office and Sector 15 of the cemetery. We would record the names and dates of the deceased. This would require several hours.

Visit City Records Office (ZAGS) and possibly other relevant offices. Record information regarding the deceased.

Interview families of the deceased in cases where that is acceptable. Two or at most three members of the team would conduct each interview. This may require several days.

Interview sanitary, epidemiologic public health officials at oblast and at Chkalovskiy and Sysertskiy rayon levels who were active in 1979.

Interview veterinary officials at oblast level and at Chkalovskiy and Sysertskiy rayon levels who were active in 1979.

Visit Ekaterinburg Plant for Ceramic Items and meet medical personnel there.

We will need a car and driver every day, if possible, and street maps of Ekaterinburg City and its southern suburbs. For visiting offices and officials, we should have the support,

either in person or in a document, of an appropriate official whose authority would be respected.

III. Other

Meet with personnel of the Military Epidemiology Sector.

Meet with Aleksandr Pashkov, Ekaterinburg correspondent for Izvestiya. Please tell him that I am a friend of his colleague Svetlana Tutorskaya, who is studying at the Harvard School of Public Health here in Boston Massachusetts.

We look forward to meeting you and your colleagues soon.

Cordially,

Matthew Meselson

2) As to military facilities, as stated in the above outline, we would value the opportunity to meet with personnel of the Military Epidemiologic Sector (Compound 19). We have read recent articles in Izvestiya and other Russian journals containing interviews with officers and scientific staff members of Compound 19, but one cannot get a very clear or scientific understanding of such matters through interviews by journalists. We would therefor like to meet directly with knowledgeable scientists and officers of Compound 19. If it is agreeable to the military authorities, we would also like to visit the hospital or medical facility of the Compound. You may assure your military contacts that we have no pre-determined views regarding the outbreak. But since Compound 19 has been mentioned in nearly every recent account, we believe that it is important to learn the perspective of the specialists there.

As a purely separate matter, not part of our study, we are also prepared to discuss the possibility of conversion and possible joint efforts in medical and agricultural biology with responsible personnel of Compound 19. In this regard, we have been asked by the Monsanto Agricultural Corporation of Saint Louis and by the Paine-Webber Company of New York to explore such possibilities while we are in Ekaterinburg if responsible officials there wish us to do so. We will bring letters from both of these organizations authorizing such discussions. Let me emphasize, however, that we will need to devote most of our limited time in Ekaterinburg to our primary objective of a scientific medical-epidemiological study of the 1979 outbreak rather than to the facilitation of such joint ventures.

3) The only way I know to reach Rector P.E. Suetin is via Professor Borisov by fax: (343) 2 55-59-64 or by e-mail: borisov@urgu.quorus.e-burg.su.

4) I am able to provide \$500 to Dr. V.V. Nikiforov for his consultation and advice. In addition, if the glass slides, photographs, notes, and other materials relevant to the 1979 anthrax outbreak in Sverdlovsk are as substantial as I believe them to be, I will be able to provide an additional \$500. Incidentally, is it possible that Dr. V.V. Nikiforov is related to the Nikiforov who studies transcription at your Institute and who has published with Alex Goldfarb?

Finally, I do hope that you have been successful in reaching Professor Burgasov. I know that he likes to spend considerable time at his dascha -- his daughter may be able to help you reach him there. The only telephone numbers I have are in Moscow: 227-41-85 and 227-48-36.

Again let me express our gratitude for your collaboration and our anticipation of meeting you soon.

Cordially,
Matthew Meselson.→

From img@glas.apc.org Fri Jun 19 05:19:08 1992
Received: by cdp.igc.org (4.1/Revision: 1.4)
id AA01258; Fri, 19 Jun 92 02:19:00 PDT
Date: Fri, 19 Jun 92 02:19:00 PDT
From: img@glas.apc.org
Message-Id: <9206190919.AA01258@cdp.igc.org>
To: msm@wjh12
Status: RO

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. B.O. Glotov, Deputy Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
glas:img (APC networks)

Re: Jeanne

18 June, 1992

Dear Matthew,

I hope you and your colleagues are already at home and everything is good. I would like only to say once more that you are nice and interesting people and it was a pleasure to be with you. I will be happy to see you later.

Prof. Borisov has received E-mail msgs and a fax with a list in excellent quality. He confirmed this by fax and added, that he would do his best to answer the questions and to complete the rest of his tasks.

Best wishes to all of you,

Boris

From img@glas.apc.org Mon Jun 29 09:45:55 1992
Received: by cdp.igc.org (4.1/Revision: 1.4)
id AA28452; Mon, 29 Jun 92 06:46:10 PDT
Date: Mon, 29 Jun 92 06:46:10 PDT
From: img@glas.apc.org
Message-Id: <9206291346.AA28452@cdp.igc.org>
To: msm@wjh12
Status: RO

msm@wjh12.harvard.edu

To: Prof. M. Meselson

From: Dr. B.O. Glotov, Deputy Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
glas:img (APC networks)

Re: Jeanne

28 June, 1992

Dear Matthew,

Eugene told me about his phone talk with you while he was in your country. As far as I understood he is ready to accept your kind proposal to help our Institute with currency. Therefore I would like to ask you to confirm it and to specify the sum of money we are supposed to receive, in order that we could choose the most effective way to use it.

Eugene did not bring Nikiforov's slides with him. Have you managed to copy them?

I ordered in a Medical library the papers and books your group asked for but it will take some time to have and copy them. Now, with a help of Alex Goldfarb, I am trying to arrange my visit to New York in late July but formally I am already beyond the deadline established by our academic bureaucracy.

Best wishes to Jeanne and best regards,

Your Boris

From img@glas.apc.org Fri Jul 10 13:14:19 1992
Received: by cdp.igc.org (4.1/Revision: 1.5)
id AA24904; Fri, 10 Jul 92 10:14:48 PDT
Received: by glas.apc.org (smail2.5)
id AA08435; 10 Jul 92 20:03:28 MDT (Fri)
To: msm@wjh12
Message-Id: <9207102003.AA08435@glas.apc.org>
Date: 10 Jul 92 20:03:28 MDT (Fri)
From: img@glas.apc.org ()
Status: RO

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. B.O. Glotov, Deputy Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
glas:img (APC networks)

Re: slides & money

10 July, 1992

Dear Matthew,

Thank you very much for your warm msg of July 3.

I do not know anybody who returns to our country from the USA in the nearest future. But I know that Alex Goldfarb also wants to send me smth, so you could ask him if he has already found somebody. Besides, as I wrote you before I am going to the USA myself on July 20 (if I get an entry visa in time).

As to the money I would recommend to transfer it to the account of our Foundation (Alex again). This would allow us to spend it for reagents and so on. If you have better ideas, please let me know.

I had a phone talk with Dr. Nikiforov who worried about his slides but I explained him the situation and he seemed satisfied.

Best wishes to Jeanne and best regards,
Your Boris

From img@glas.apc.org Thu Dec 24 09:05:29 1992
Received: by igc.apc.org (4.1/Revision: 1.50)
id AA02621; Thu, 24 Dec 92 06:07:10 PST
Received: by gn.apc.org (smail2.5)
id AA07598; 24 Dec 92 01:20:52 GMT (Thu)
Received: by glas.apc.org (smail2.5)
id AA16175; 23 Dec 92 23:14:42 MDT (Wed)
To: msm@wjh12
Message-Id: <9212232314.AA16175@glas.apc.org>
Date: 23 Dec 92 23:14:42 MDT (Wed)
From: img@glas.apc.org ()
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. B.O. Glotov, Deputy Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-1864, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)

Re: your invitation

23 December, 1992

Dear Prof. Meselson,
Tomorrow I shall fax you an invitation for you and Dr. Robinson to visit our Institute in January, signed by Dr. Sverdlov. Please e-mail a confirmation after having this fax received. It may of course include the information that we request in the fax.

Best regards to Jeanne and to you, Boris

1From img@glas.apc.org Thu Dec 24 14:44:21 1992
Received: by igc.apc.org (4.1/Revision: 1.50)
id AA08000; Thu, 24 Dec 92 11:46:05 PST
Received: by gn.apc.org (smail2.5)
id AA20658; 24 Dec 92 15:50:19 GMT (Thu)
Received: by glas.apc.org (smail2.5)
id AA07951; 24 Dec 92 18:10:53 MDT (Thu)
To: msm@wjh12
Message-Id: <9212241810.AA07951@glas.apc.org>
Date: 24 Dec 92 18:10:53 MDT (Thu)
From: img@glas.apc.org ()
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. B.O. Glotov, Deputy Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-1864, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)

Re: your invitation

24 December, 1992

Dear Prof. Meselson,
Please do not worry, our telephone service could accept my
fax order only for Friday. I am sorry.
Thank you for your e-mail of December 24. We shall try to
find Prof. Burgasov with the help of Prof. Sergiev.
Sincerely, Boris

From img@glas.apc.org Tue Jan 5 20:16:50 1993
Received: by igc.apc.org (4.1/Revision: 1.52)
id AA15713; Tue, 5 Jan 93 17:18:41 PST
Received: by gn.apc.org (smail2.5)
id AA10853; 6 Jan 93 00:33:21 GMT (Wed)
Received: by glas.apc.org (smail2.5)
id AA21185; 5 Jan 93 23:50:51 MDT (Tue)
To: msm@wjh12
Message-Id: <9301052350.AA21185@glas.apc.org>
Date: 5 Jan 93 23:50:51 MDT (Tue)
From: img@glas.apc.org ()
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. B.O. Glotov, Deputy Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-1864, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)

Re: Antonov & Pyatkov

5 Jan., 1992

Dear Prof. Meselson,
The happy New Year and my best wishes to you and your family!
Prof. Antonov is now away on his vacation (I must say he is rather often not in) but I spoke to his colleague who is well informed about your visit. I told him everything you asked and he promised to keep in touch. The hotel is really reserved for you (though he told "Uzkoye", not the one you mentioned in your last e-mail), and they are going to pick you up at the airport. They asked the passport data of Dr. Robinson, and I explained the situation instead.

I have not reached Pyatkov today but will resume my attempts tomorrow.

The only way to get in touch with Prof. Burgasov is to take a car and to go to his dacha what we are going to do very soon. The snag is that my car needs to be fixed, so I have to use the institute's car that is worse.

After only 2 working days (5 and 6 Jan) in the new year we have new 3 off-days (7, 8, and 9 Jan) but I can use my home computer for email.

Sincerely, Boris

From img@glas.apc.org Wed Jan 6 19:01:45 1993
Received: by igc.apc.org (4.1/Revision: 1.53)
id AA24205; Wed, 6 Jan 93 16:03:46 PST
Received: by gn.apc.org (smail2.5)
id AA01417; 6 Jan 93 23:33:12 GMT (Wed)
Received: by glas.apc.org (smail2.5)
id AA25770; 6 Jan 93 23:43:46 MDT (Wed)
To: msm@wjh12
Message-Id: <9301062343.AA25770@glas.apc.org>
Date: 6 Jan 93 23:43:46 MDT (Wed)
From: img@glas.apc.org ()
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. B.O. Glotov, Deputy Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-1864, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)

Re: package

6 Jan., 1992

Dear Prof. Meselson,
No news except that Sverdlov is going to meet you at the
airport too to take the package and thus to save you troubles.
My arms are still too short to reach Pyatkov.

Sincerely, Boris

To: Dr. B.O. Glotov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Thursday 28 May 1992

Dear Dr. Glotov,

First, let me thank you for all of the efforts you are making for the success of our study.

Here are the answers to the questions in your two e-mail communications:

1) Our study plan for Ekaterinburg is outlined in the following copy of the e-mail I sent to Professor S.F. Borisov on 19 May:

Dear Professor Borisov,

I am now able to propose to you the outline of a work plan for our combined US-Ekaterinburg team and would like to have your advice and comment. There would be two principal lines of study. One line would focus on clinical, pathoanatomical and therapeutic problems while the other would concentrate on epidemiological aspects.

I. Clinical-pathoanatomical-therapeutic problems.

Interviews:

Professor Arkady I. Kortev

Dr. Faina A. Abramova

Dr. Lev M. Grinberg

Dr. Margarita Ivanova Ilenko, in 1979 was head physician
at Hospital number 24

Dr. Yakov Iosifovich Klipnitser, in 1979 was Head
Physician at Hospital number 20.

Other medical specialists who may have relevant information.

Visits to hospitals:

Hospital number 40

Hospital number 20

Hospital number 24

Other relevant hospitals, if any, possibly including the medical
facility of the Military Epidemiology Sector.

Examination of pathoanatomical materials:

Seek such materials from any of the above persons, hospitals, etc.
Such materials would include glass slides of tissue sections, photographs,
medical records, notes, other documents. For examination of glass slides,
we would need 25X - 1,000X power research microscope with 35mm camera
attachment and appropriate light source. We will bring film. Also
needed will be 35mm slide

(diapositive) projector, access to a photocopier, and, if possible, access to a US style VCR video tape player.

In examining pathoanatomical materials, we would like to have the collaboration of an experienced Ekaterinburg pathologist. In that case it would be desirable but not essential to have the use of two microscopes.

II. Epidemiological aspects.

Field work:

Visit Vostochnoye Cemetery Administration Office and Sector 15 of the cemetery. We would record the names and dates of the deceased. This would require several hours.

Visit City Records Office (ZAGS) and possibly other relevant offices. Record information regarding the deceased.

Interview families of the deceased in cases where that is acceptable. Two or at most three members of the team would conduct each interview. This may require several days.

Interview sanitary, epidemiologic public health officials at oblast and at Chkalovskiy and Sysertskiy rayon levels who were active in 1979.

Interview veterinary officials at oblast level and at Chkalovskiy and Sysertskiy rayon levels who were active in 1979.

Visit Ekaterinburg Plant for Ceramic Items and meet medical personnel there.

We will need a car and driver every day, if possible, and street maps of Ekaterinburg City and its southern suburbs. For visiting offices and officials, we should have the support, either in person or in a document, of an appropriate official whose authority would be respected.

III. Other

Meet with personnel of the Military Epidemiology Sector.

Meet with Aleksandr Pashkov, Ekaterinburg correspondent for Izvestiya. Please tell him that I am a friend of his colleague Svetlana Tutorskaya, who is studying at the Harvard School of Public Health here in Boston Massachusetts.

We look forward to meeting you and your colleagues soon.

Cordially,

Matthew Meselson

2) As to military facilities, as stated in the above outline, we would value the opportunity to meet with personnel of the Military Epidemiologic Sector (Compound 19). We have read recent articles in Izvestiya and other Russian journals containing interviews with officers and scientific staff members of Compound 19, but one cannot get a very clear or scientific understanding of such matters through interviews by journalists. We would therefore like to meet directly with knowledgeable scientists and officers of Compound 19. If it is agreeable to the military authorities, we would also like to visit the hospital or medical facility of the Compound. You may assure your military contacts that we have no pre-determined views regarding the outbreak. But since

Compound 19 has been mentioned in nearly every recent account, we believe that it is important to learn the perspective of the specialists there.

As a purely separate matter, not part of our study, we are also prepared to discuss the possibility of conversion and possible joint efforts in medical and agricultural biology with responsible personnel of Compound 19. In this regard, we have been asked by the Monsanto Agricultural Corporation of Saint Louis and by the Paine-Webber Company of New York to explore such possibilities while we are in Ekaterinburg if responsible officials there wish us to do so. We will bring letters from both of these organizations authorizing such discussions. Let me emphasize, however, that we will need to devote most of our limited time in Ekaterinburg to our primary objective of a scientific medical-epidemiological study of the 1979 outbreak rather than to the facilitation of such joint ventures.

3) The only way I know to reach Rector P.E. Suetin is via Professor Borisov by fax: (343) 2 55-59-64 or by e-mail: borisov@urgu.quorus.e-burg.su.

4) I am able to provide \$500 to Dr. V.V. Nikiforov for his consultation and advice. In addition, if the glass slides, photographs, notes, and other materials relevant to the 1979 anthrax outbreak in Sverdlovsk are as substantial as I believe them to be, I will be able to provide an additional \$500. Incidentally, is it possible that Dr. V.V. Nikiforov is related to the Nikiforov who studies transcription at your Institute and who has published with Alex Goldfarb?

Finally, I do hope that you have been successful in reaching Professor Burgasov. I know that he likes to spend considerable time at his dascha -- his daughter may be able to help you reach him there. The only telephone numbers I have are in Moscow: 227-41-85 and 227-48-36.

Again let me express our gratitude for your collaboration and our anticipation of meeting you soon.

Cordially,
Matthew Meselson.

To: Prof. E.D. Sverdlov
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

3 July 1992

Dear Boris,

On behalf of all the members of our group I want to thank you for your very generous help and collaboration in Moscow.

I came home with a case of influenza that kept me away from work for a week, but now will be able to integrate and write up the results of our study. I will of course send a copy to the Institute as soon as it is ready. We hope to have a first paper, on the pathoanatomical part of the work, sometime before October. Although important questions remain, we were fortunate in being able to accomplish a great deal, in good part because of the help and support you and Eugene provided.

Boris, I hope you have not troubled yet with the book by Derizhanov. To my surprise, I found a good copy of it at the National Library of Medicine in Bethesda. I am also trying to find the other Russian papers. So until I contact you again in this regard, do not go to any additional trouble.

The slides belonging to Dr. Nikiforov will be duplicated next week. Do you know of anyone coming to Moscow to whom I could entrust them? As for the other slides from Dr. Nikiforov, those belonging to Dr. Abramova, I will arrange to have those returned to Ekaterinburg, as I told Dr. Nikiforov.

Finally, please advise me how to transfer \$1,000 to the Institute in compensation for its collaboration and assistance with our study.

Please accept warmest greetings from Jeanne and myself. With all good wishes,

Matthew.

To: Dr. Boris O. Glotov
Deputy Director
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Cambridge, Massachusetts
Internet: msm@wjh12.harvard.edu

25 December 1992

Dear Boris,

Good to hear from you!

The telefaxed invitation arrived in excellent condition, thankyou.

The information you request is as follows:

Matthew Stanley Meselson
Born Denver, Colorado, 24 May 1930
US Citizen
USA Passport Number Z6855673
Issued at Lyon, France by US Consulate General
Date of issue: 29 May 1991
Expiration date: 28 May 2001

Julian Perry Robinson
Born Jerusalem, Palestine, 11 November 1941
British Subject

It will be a week before I will be able to send you the passport information for Robinson.

Best regards and greetings for the New Year from Jeanne and me.

Matthew.→

To: Dr. Boris O. Glotov
Deputy Director
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Cambridge, Massachusetts
Telefax (617) 495 8308
Internet: msm@wjh12.harvard.edu

4 January 1993

Dear Boris,

Greetings for the new year!

I have received the following telefax message from Professor Nikolai Antonov:

"Hotel Academy Leninsky Prospect is reserved for you, your wife and for Julian Perry Robinson. I shall meet you."

Boris, would you please let Professor Antonov know that our plans have changed in two respects:

- 1) Only Robinson and I are coming. Jeanne is not.
- 2) We will remain in Moscow until Monday January 25.

I assume that the telefax from Professor Antonov means that he will meet us at the Airport, coming on Air France flight 1850 scheduled to arrive at 1725 Moscow time. I also assume that he will have a sign with our names or other means wherby we will recognize him. If it is agreeable to Professor Antonov, we would like him to join us for dinner that same night. I will send a telefax to him with all of the above information. Previously, however, fax communication with him has been very slow. Would you therefor please contact him and let me know the outcome by e-mail? His telephone in Moscow is 201 27 02.

I have spoken again with Mr. Pyatkov at the Foreign Ministry, telephone 244 22 30. He confirmed my appointment with Professor Kuntsevich for Monday afternoon. He is attempting to make additional appointments for me at the Ministry of Defense for Tuesday. But so far this is not confirmed. Therefor, please check with Pyatkov in order to avoid conflicts in arranging a meeting with Burgasov and Sergeiv and a separate meeting with Olga Yampolskaya.

I will be in Cambridge until leaving for Paris on the evening of Monday, January 11. In case it is necessary to contact me in Paris, I will be at the Hotel Grandes Ecoles, telephone 33 1 43 26 79 23; telefax 33 1 43 25 28 15.

Please tell Eugene that I received his e-mail of 28 DSecember and that I spoke to David Beckman by telephone. He said that he would ship the package in time for me to get it before leaving for Paris. It will be no problem for me to bring it. I will also try to bring the reagents Eugene mentioned. The only difficulty, for some of them, may be refrigeration. I will also try to bring the latest information about the Soros project. I very much look forward to seeing you and Eugene soon.

Sincerely,

Matthew.

To: Dr. Boris O. Glotov
Deputy Director
Institute of Molecular Genetics
Moscow
Internet: img@glas.apc.org

From: Prof. M. Meselson
Harvard University
Cambridge, Massachusetts
Telefax (617) 495 8308
Internet: msm@wjh12.harvard.edu

6 January 1993

Dear Boris,

I have your e-mail of 5 January regarding Antonov and Pyatkov. Thankyou very much for so much help and especially for taking so much trouble to contact Burgasov.

Here is the passport information for Robinson:

Julian Philip Perry Robinson
Citizen of the United Kingdom
Born Jerusalem, Palestine, 11 November 1941
Passport number 043 845 R
Issued 9 August 1988 at London, UK
Expires 9 August 1998

Sincerely,

Matthew.

Sincerely,

Matthew.

From img@glas.apc.org Thu May 28 10:27:19 1992
Received: by cdp.igc.org (4.1/Revision: 1.1)
id AA27063; Thu, 28 May 92 07:28:32 PDT
Date: Thu, 28 May 92 07:28:32 PDT
From: img@glas.apc.org
Message-Id: <9205281428.AA27063@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu
To: Prof. M. Meselson
From: Dr. B.O. Glotov, Deputy Director
Institute of Molecular Genetics, Moscow
Tel. (095)196-0000, FAX (095)196-0221
E-mail address: img@glas.apc.org (Internet, Bitnet)
glas:img (APC networks)

Re: Ekaterinburg

28 May, 1992

Dear Prof. Meselson,
A. Yablokov has sent the letters we asked for but now new difficulties have arisen. I had a telephone conversation with an officer of the Defense Ministry. He wants to know what institutions (factories etc.) the delegation is going to visit in Ekaterinburg. Could you please email me asap your basic program in this city?

Besides, we would like to know the fax number of Prof. Suetin. Do you have it? Thank you very much in advance.

Sincerely yours,
B.O. Glotov

From img@glas.apc.org Wed May 27 06:59:40 1992
Received: by cdp.igc.org (4.1/Revision: 1.1)
id AA10459; Wed, 27 May 92 04:01:03 PDT
Date: Wed, 27 May 92 04:01:03 PDT
From: img@glas.apc.org
Message-Id: <9205271101.AA10459@cdp.igc.org>
To: msm@wjh12
Status: R

msm@wjh12.harvard.edu

To: Prof. M. Meselson

From: Dr. B.O. Glotov, Deputy Director

Institute of Molecular Genetics, Moscow

Tel. (095)196-0000, FAX (095)196-0221

E-mail address: img@glas.apc.org (Internet, Bitnet)

glas:img (APC networks)

Re: Ekaterinburg

27 May, 1992

Dear Prof. Meselson,

I must apologize for the mistake which appeared in the E-mail sent to you on May 25 on behalf of Prof. Sverdlov. The figure \$400 appeared there by mistake and must be read as \$1000. Please, excuse me once more for the misunderstanding.

Sincerely yours,

B.O. Glotov

From urgu.quorus.e-burg.su!borisov@relcom.kiae.su Fri Sep 18 07:47:22
1992 Received: from relcom.kiae.su by techno.fuug.fi with UUCP id
AA03531 (5.67a/IDA-1.4.4 for msm@wjh12.harvard.edu); Fri, 18 Sep
1992 14:31:27 +0300 Received: by relcom.kiae.su; Fri, 18 Sep 92
13:03:29 +0300
Received: by quorus.e-burg.su; Fri, 18 Sep 92 14:05:12 +0400 (EBD)
Received: by urgu.quorus.e-burg.su (UUPC/@ v4.07 from Ache,
22Mar92); Fri, 18 Sep 1992 13:56:39 EBD
To: msm@wjh12
Message-Id: <ABrkOkqgY5@urgu.quorus.e-burg.su>
Organization: Urals State University
From: borisov@urgu.quorus.e-burg.su (Borisov Sergej)
Date: Fri, 18 Sep 92 13:56:37 +0600 (EBD)
Return-Receipt-To: borisov@urgu.quorus.e-burg.su
X-Mailer: BML [MS/DOS Beauty Mail v.1.25]
Status: R

Dear Pr. Meselson,

Here are our answers:

1. 96 autopsies were made in hospital 40, among them - 42 cases of anthrax, but the phrase "Abramova and Grinberg autopsied ..." is not exact as there were also other specialists involved.

2. In our letter we meant the manuscript that you are going to publish in the transactions of National Academy of Sciences of the USA and that you had sent to us. We are all looking forward to the completion of this very work. Kind regards to Jeanne!

With best wishes Lev Grinberg

Dear all,

Just returned from a meeting in Berlin and about to go to annual retreat of my department over the weekend, I hope by the end of the month to complete the draft of our group report we have been working on.

Meanwhile here are several items for your interest and possible comment:

1) Revised master list, including all names on the official list, the cemetery list, Ilenko 022 names, and the 5 survivor names from Nikiforov, altogether 72 who died and 10 survivors. The names of survivors are preceded by ZZ on the list.

Plotting probable daytime locations obtained from interviews and other sources, both Martin and I find a conspicuous concentration in a rather narrow band that includes the military compounds, the ceramics factory, pensioners residences between the compounds and ceramics and workplaces beyond ceramics. Unlikely to be an artifact of the daytime population distribution, it appears to be compelling epidemiological evidence for wind-borne spread. Further interviews will add more data.

2) An e-mail message from Grinberg confirming his earlier statement that 96 autopsies were done at Hospital 40, of which 42 were diagnosed as anthrax.

3) A matrix showing the presence or absence of the 72 who died on the official, cemetery and autopsy lists. The matrix highlights a number of questions, including:

i) Did the 7 in the cemetery but not on the official list and not on the autopsy list die of anthrax? We have the death certificate diagnosis for 3. None of the three has a diagnosis of sepsis. Instead, the diagnoses are hemorrhagic gastroenteritis (Chapeyeva), specific pneumonia (Chizova), and arteriosclerosis (Dyedov). None of the 7 are recorded as 022 on Ilenko lists. Their death certificate diagnoses and perhaps the lack of a positive bacteriological test may have kept them off the official list whether or not they had anthrax. The question remains unanswered.

ii) What is the status of the 23 on the official list but not on the autopsy list? Grinberg told us that these were early cases, seen by autopsists who did not make the correct diagnosis. In some cases, death certificates do indeed bear diagnoses other than sepsis, i.e. bacterial pneumonia (Komina) and enteritis (Shatokin), both deaths having . In others, with much later deaths, In many of these cases, the diagnosis of anthrax was arrived at by some other means. Since the earliest death date we have is 408, Does this mean that there This implies that even Actually, the dates of death range from 409 to 425, but .) But then how was it decided to place them on the official list

According to an Ilenko list both were in Hospital #40, as confirmed for Lyzlov by his death certificate, which gives sepsis as the cause of death. Question: Does this mean that these two cases were diagnosed as anthrax clinically but not autopsied or not diagnosed as anthrax at autopsy? Or is Grinberg wrong to say that there were just 42 anthrax diagnoses out of the 96 autopsies he says were done at #40?

As for the other 19, the earliest death in the group was 409 and the latest 425. So the earl

re were more than 42 anthrax If, as Grinberg says, 42 of the and this is confiTwo of these, Lyzlov and Poletaev were in hospital #40

17 March 1993

Dear Group,

Here for your interest are copies of the various newspaper accounts of the PNAS article that I have seen, along with the press releases sent out by the NAS and by Harvard. If any of you have additional articles, I would like to have copies. In particular, David, could you please send me a copy of the press release from your news office?

I have ordered reprints and they should arrive in a few weeks. I will send a bundle to each of you.

Best regards,

2 May 1993

Dear Group,

Here, for you Martin, are photographs of 10 cemetery markers that I believe you do not have. By my count there are 9 markers of which you have photos but I do not. Martin, could you please provide me with prints of these? They are indicated by the designation "h" under the heading "Phot" in the printout "Cemetery Data" dated 20.04.93 that I sent to each of you last month:

ABUSAGITOV

BLIUMOVA
CHAPAYEVA
GEPTIN
KOMINA
MUKHAMETSHIN
POLETAEV
SYSKOV
ZAKHAROV

There are also 4 markers that appear in the lists we made at the cemetery for which neither Martin nor I have photos: GAYDA, MOCHALOVA, POLESHAEV, SIZIKOV, UNKNOWN MALE.

Alexis and David, might you have photos of these?

Comparing our lists with the photographs, I found a few errors in the lists. These are indicated in the printout under "Former..." and "Comments". In particular, the ages of three of the victims need to be corrected:

BUHELNIKOV was 41, not 21. This brings our age for him into agreement with the age on Levs' list of 54.

KOZLOVA was 48, not 44.

MARKOV was 46, not 41.

Finally, there are some names on the official list that we did not note in the cemetery: JELEZNYAK (age 38; died 408), KRIVSTOV (age 45; died 414), SERGEEVA, TARASENKO, TEPIKIN, TISCHENKO, ZHELNIN. Does anyone have photos for these or photos of partly illegible markers on which portions of these names can be made out? In two cases, decipherment may be aided by matching ages and death dates (indicated above in parentheses, where known) with whatever can be read on the markers.

Best regards to all,

2 April 1992

Dear Professor Gubanov,

It was indeed a pleasure to make your acquaintance by telephone yesterday. After our conversation, I sent an E-mail message to Professor Sverdlov in Moscow telling him of your kind offer to help facilitate our study in Ekaterinburg. Let me also thank you for suggesting Professor Yuri Movozhenov as a colleague who might be interested in collaborating with us.

As we discussed, I enclose names and passport information for the members of our group. We wish also to include a specialist in pathology but have not yet found a qualified individual free to travel in June. I hope to be able to transmit the name to you soon, either before the week-end or by E-mail soon after you return to Ekaterinburg. The maximum size of our group coming to Ekaterinburg, including Dr. Yampolskaya, would be six. Would that be acceptable? Simple accommodations would be quite adequate, but we would need someone in Ekaterinburg to arrange for them in advance of our arrival. We would cover our living expenses and other costs there in rubles or dollars, whichever is preferable. And our MacArthur grant would also provide an honorarium for Professor Movozhenov if he joins us.

If it is agreeable to colleagues in Ekaterinburg, we would plan to arrive in Moscow on Tuesday June 2 and depart during the period June 15-19, via Lufthansa flights 3212 and 3213, respectively. To be on the safe side, it would be good to have visas valid at least through June 22. After

I am enclosing rather a lot of material to provide you and Professor Movozhenov with background information on the problem. We think that a much better understanding of what happened can be obtained, even at this time, by carefully analyzing the available information in terms of the relevant biological, medical and epidemiological principles. Over the next few weeks, we will refine the enclosed Study Plan and will discuss it with you by E-mail.

Could you please confirm that I have your correct E-mail address: onm@ihim.e-burg.su@fuug.fi

Also, could you please let me have your postal address and telephone and fax numbers in Ekaterinburg?

Cordially,

Matthew Meselson

7July 1992

Dear Volodya,

I have just e-mailed to you at Evanston a copy of my recent e-mail to Sergei in Ekaterinburg. Anyway, here is a fax copy too! Although I believe that Campbell will have left Ekaterinburg before you arrive, I hope that Sergei will be able to meet him.

By the time you are ready to leave Ekaterinburg, Ilona Nikolaevna Nikonova will have completed most or perhaps all of the interviews she is doing for us and will also have prepared english translations of them. May I ask you please to obtain from Sergei copies of the original russian and also the english translations and to bring them back with you on your return to the U.S. and post them to me here at Harvard? The originals should be left in Ekaterinburg for safekeeping.

Although we learned a great deal about the anthrax outbreak, including the important fact that most or all of the cases were airborne, not food borne, one of the most important unanswered questions is whether there was anthrax among animals preceding the human cases. Some public health officials including Viktor Vasilevich Romanenko, Assistant Chief of the Sverdlovsk Oblast SES, told us that there was animal anthrax in Sysertskiy rayon in March 1979, even before the middle of March. But others said that cases of animal anthrax did not occur until April, when the human cases began. We understand that for various reasons an outbreak of animal anthrax may not come to the attention of medical or even veterinary officials until some time after its actual occupance. But making allowance for this factor, what can be said with confidence about the timing of the first cases of animal anthrax cases, especially in Sysertskiy rayon?

Along with a hard copy of this fax, I enclose some photographs to give to Sergei.

Best wishes,

Matthew Meselson

From @techno.fuug.fi,@kia.e.UUCP:onm@ihim.e-burg.su Wed Apr 22
23:25:41 1992

Received: from kia.e.su by techno.fuug.fi with UUCP id AA22268
(5.65c/IDA-1.4.4 for msm@wjh12.harvard.edu); Wed, 22 Apr 1992
10:17:21 +0300

Received: by relcom.kia.e.su; Wed, 22 Apr 92 09:30:26 +0003 (GMT+3:00)

Received: by mplik.e-burg.su; Wed, 22 Apr 92 12:09:06 +0300 (PDT)

Received: by mtmm.e-burg.su; Wed, 22 Apr 92 11:42:31 +0000 (URAL)

Received: by ihim.e-burg.su (UUPC/@ Release 2.01/30Apr91);
Wed, 22 Apr 1992 10:09:16 MSD

To: msm@wjh12

Message-Id: <AAP4Hzfqi9@ihim.e-burg.su>

Organization: Institute of Solid State Chemistry

From: @techno.fuug.fi:onm@ihim.e-burg.su (Oleg N. Mryasov)

Date: Wed, 22 Apr 92 10:09:13 +0200 (MSD)

Subject: from VAG

Status: R

Dear Prof.Messelson,

This message is just the test of the communication
with you. The time now is 10.10 a. m. here in
Ekaterinburg, April 22, 1992. Could you let me know
when you will get this message?

It was a real pleasure to talk to you this morning.
I shall call to Sverdlov in a hour. The Ural State
University is sending the invitations for you today.

Looking forward hearing from you,

Best regards,

V.A.Gubanov

From gubanov@freeman.phys.nwu.edu Wed Jul 8 17:42:14 1992
Received: by pluto.phys.nwu.edu (5.52 (84)/5.17)
id AA00785; Fri, 8 Apr 94 16:29:11 CDT
Date: Fri, 8 Apr 94 16:29:11 CDT
From: gubanov@freeman.phys.nwu.edu (Vladimir A. Gubanov)
Message-Id: <9404082129.AA00785@pluto.phys.nwu.edu>
To: msm@isr
Subject: V.Gubanov
Status: RO

Dear Prof.Meselson

I have got both you e-mail and fax messages.
I suspect that Sergei has not got your message by e-mail, as it usually

does not go if one does not add fuug.fi after su in the e-mail
adress (which makes Sergei adress:
borisov@urgu.quorus.e-burg.su@fuug.fi

This is to connect Relcom to Internet he is in.

I shall tell him on Campbell visit as well as send him your e-mail.
Thank you for the films : I have got them also.

This is really great that you are so willing to help the University
there. We shall prepare the package of proposals till the time you
come back from the vacations. Have a good and pleasant trip.

Yours,

Volodya.

To: Prof. V. A. Gubanov
Institute of Chemistry
Ekaterinburg, Russia
Internet: onm@ihim.e-burg.su@fuug.fi

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Date: 14 April 1992

Dear Professor Gubanov,

This is the first E-mail I will send to you. It will serve as a test of our system of communication and also to ask you a number of preliminary questions.

First, could you let me know the name, title E-mail address, fax number and telephone number of the person in Ekaterinburg with whom we will be working? I believe you told me this would be Professor Movozhenov but my notes are not clear on this.

Second, do I understand correctly that our invitations are being made from Ekaterinburg, not from Moscow. In case you need another copy of the relevant information, it is as follows:

Matthew Stanley Meselson
Born Denver, Colorado, 24 May 1930
US Citizen
USA Passport Number Z6855673
Issued at Lyon, France by US Consulate General
Date of issue: 29 May 1991
Expiration date: 28 May 2001

Jean E. Guillemin
Born 6 March, New York, New York, 6 March 1943
US Citizen
USA Passport Number G743909
Issued at Boston, Massachusetts
Date of issue: 18 September 1986
Expiration date: 17 September 1996

Alexis Ioann Shelokov
Born Harbin, China, 18 October 1919
US Citizen
US Passport Number 011628237
Issued at Washington DC
Date of issue: 23 April 1984
Expiration date: 22 April 1994

Martin Eales Hugh-Jones
Born Oxford, England, 15 February 1936
British Citizen
Northern Ireland Passport Number: 700394505
Issued at British Embassy, Washington DC
Date of issue: 20 December 1991
Expiration date: 20 December 2001

David H. Walker
Born Nashville, Tennessee 31 May 1943
US Citizen
US Passport Number P013114640
Issued at Washington DC
Issue date: 14 March 1987
Expiration date:: 13 March 1997

Dr. Walker is Chairman of the Department of Pathology, University of Texas Medical Branch, Galveston, Texas. He has been collaborating with colleagues at the Gamaleya in Moscow.

We have reserved seats on Lufthansa flight 3231 arriving Moscow Tuesday 2 June at 15:05 and on Lufthansa flight 3213 leaving Moscow 07:10 on Wednesday 17 June. (Not 16 June as planned initially.) After we have satisfactorily tested our E-mail communications with Ekaterinburg, I will send additional information and questions.

With warm regards,

Cordially,

Matthew Meselson.

To: Prof. V. A. Gubanov
Institute of Chemistry
Ekaterinburg, Russia
Internet: onm@ihim.e-burg.su@fuug.fi

From: Prof. M. Meselson
Harvard University
Internet: msm@wjh12.harvard.edu

Date: 22 April 1992

Dear Professor Gubanov,

Very good to talk to you on the telephone yesterday. Our newly revised flight plans are as follows:

Tuesday 2 June: Arrive Moscow 15:30 local time on Finn Air #704
from Helsinki.

Thursday 4 June: Depart Moscow 10:15 AM on Aeroflot #261
Arrive Ekaterinburg 12:45.

Monday 15 June: Depart Ekaterinburg 12:55 on Aeroflot #168
Arrive Moscow 15:10

Wednesday 17 June: Depart Moscow 16:25 on Finn Air # 705

Including Yampolskaya, there will be six of us travelling to Ekaterinburg.

Today I will also send the same revised travel information to Professor Sverdlov by E-mail to Moscow. In case you need the addresses of Sverdlov in Moscow, they are:

Internet: img@glas.apc.org

Telephone: 196 02 06 (Institute of Molecular Genetics)
330-65-29 (Shemyekin Institute)

FAX: 330-65-38

The next step for us is to begin an E-mail discussion with the appropriate Ekaterinburg colleague regarding specific work to be done there, both before and during the visit of our group.

Please let me know the name of the colleague and the E-mail address to use.

Cordially,

Matthew Meselson

To: Professor V.A. Gubanov
Institute of Solid State Chemistry
Ekaterinburg
Russia
Internet: onm@ihim.e-burg.su@fuug.fi

From: Prof. M. Meselson
Department of Biochemistry and Molecular Biology
Harvard University
Internet: msm@wjh12.harvard.edu
Date: Thursday 23 April 92 20:00 Eastern Daylight Time

Dear Professor Gubanov,

Your very welcome E-mail arrived here Wednesday night at 23:25 Eastern Daylight Time, about 22 hours after you sent it.

Now that we have established good communication, let us begin to discuss specific tasks to be done for our collaborative study.

The first step is to designate the Ekaterinburg "team" -- one or two colleagues interested in the problem and willing to spend a good deal of their time before and especially during our visit. As consultants, we would of course expect to compensate them for their time and expenses. An important requirement is that we should be able to communicate by E-mail. Will they be Professors Borisov and Movozhenov, or someone else? And is your E-mail address the one to be used for communication with them?

A first step, of course, is to find accommodations for us. We are all good travellers and do not need luxury.

At this relatively early stage I would ask only one other thing. This is to arrange an appointment with Professor Arkady I. Kortev, former Director of the Sverdlovsk Medical Institute. He is a distinguished physician whose previous specialties included anthrax. During the outbreak, he worked many days in the intensive care ward at Hospital number 40. Unfortunately, he suffered an aneurism some months ago and may still be in fragile health. Please try to make an appointment for us to consult with him early in our visit. He will surely remember Dr. Olga Yampolskaya, the assistant to Professor Nikiforov, with whom he worked closely. If his health is still not good, he need not see all six of us. If at all possible, however, at least Drs. Yampolskaya, Walker, and Shelokov should consult with him. If there are any special medicines he needs, let me know and I will try to bring them. Because of his outstanding reputation, specialized knowledge and extensive direct experience with the patients, meeting with Professor Kortev is a high priority for us.

Cordially,

Matthew Meselson

21 July 1991

Dear Mr. Gumbel,

I enjoyed talking to you Sunday and am glad you got through to Langmuir and Brachman. You would also be well advised to talk with Dr. James H. Steele, emeritus prof at the School of Public Health of the University of Texas at Houston. He is a vet with a great deal of experience and knowledge about anthrax and much else and has spent considerable time with the Soviet physicians in the US.

I enclose a memo on our conversation and some further comments that may be of use. I will send it to Albrink, Brachman, Langmuir and Steele for their comment which I would be glad to share with you. All of us wish we could come to Sverdlovsk too! After years of asking Soviet permission with no positive response, I see that now we could probably just go. Perhaps next Spring.

I do urge you to see Yampolskaya and Burgasov, in addition to Sergiev who you have already contacted. At the Botkina Hospital (Metro Dinamo) the telephone for Yampolskaya is 945 9958. At home it is 454 9514. The number of the daughter of Burgasov is 227 4185. In Sverdlovsk, the Director of the Sverdlovsk Medical Institute who worked with Nikiforov and Yampolskaya at hospital #40 is A.I. Korteov. He had been ill earlier this year.

In addition to my FAS report, corrected at two places, I enclose two articles, a street map and photocopies from a SPOT photo. One article describes an epidemic of gastrointestinal anthrax in Yaroslavl in 1927 with 27 cases, all of them fatal. The other is a report of two legal proceedings in Sverdlovsk dated July 11 and July 18, 1979 for violation of vet laws.

Do let me know where you will be after Moscow as I wish to continue to follow this matter.

Sincerely,

Matthew Meselson

Call from Mr. Peter Gumbel in Vienna to me in Woods Hole, Saturday July 19, 1991 ca 9:30 to ca 10:30 AM. Later in the morning, he called back, as arranged, for phone numbers of Alex Langmuir and Will Albrink, of which I could find only the former. I should have thought to refer him to Jim Steele (713) 781-3653 and to Phil Brachman (404) 261-2369 as well. Gumbel had tried to reach me earlier this week in Cambridge. He is nearing completion of a 2-year assignment in Moscow as Wall Street Journal correspondent. His telephones in Moscow are 280-5049 (o); 280-0352 (h). Can also be reached through WSJ foreign desk in NYC. Telephone (212) 416-3111, ext 2224 Chay (?) Newton, 200 Liberty Street, NY 10281.

Gumbel went to Sverdlovsk where he spoke with a number of medical, veterinary, and ceramic factory personnel and with victim family members and acquaintances. He also went to a cemetery and a hospital. He has no street map of Sverdlovsk. I promised to send one via WSJ foreign desk in NY, along with other items. The original of the map is at the Library of Congress. He asked if there were written transcripts of the presentations made in the US by Burgasov, Nikiforov and Sergiev. I told him that there are only tapes but he did not ask for them. Gumbel intends to return to Sverdlovsk in the near future. But he is under some pressure to publish soon.

Gumbel cited two articles I had not known:

(1) Kuranty, Moscow, 1 November, 1990, article by or about Yeltsin saying he was kept in the dark about the epidemic.

(2) Uralskiy Robochiy, Sverdlovsk, 12 March 1990, page 3, article entitled "Compound Number 19: Reporters are Rarely Guests There", by S. Bogomolov. Describes visit to the facility with Colonel Kharechko (?), members of parliament, city council and the local academy of sciences including a Dr. Chukonov(?), an environmental scientist. Until 1986, the facility made vaccines for the military. Now they work on methods of area disinfection, protection against biological aerosols, and microorganisms to destroy metal (?) and plastics.

Hospitals. Gumbel went to hospital #20 which was one of the places where the earliest cases were taken but not hospital #40 where all subsequent cases were taken. This may be an unfortunate omission, since the physicians who dealt with the epidemic at #40 may have fuller knowledge and understanding of it, including its duration and the results of extensive autopsy studies done there. Dr. Nikiforov said that the early diagnoses were wrong and that only after he came down from Moscow on April 6 and after the first autopsies was anthrax diagnosed even tentatively and then confirmed on April 10 by bacteriological testing.

Graves. Gumbel visited Vashozny (?) East (?) cemetery. Is it the cemetery marked 13 on my map, just southwest of the city center? I

thought I was told that the main burial place for the anthrax victims was west of the city center, but cannot find it in my Moscow or US notes. Could there be two burial places? At the cemetery Gumbel visited, he found metal markers, not stone. The markers were partly illegible. The site where anthrax victims are buried is overgrown with weeds and newer graves are ingressing. He has seen 20-30 markers presumed to be for anthrax victims, but there could be more. He could read dates on several, all early in the epidemic. How early? Are they consistent with the numbers given in my FAS report, which are presentation dates? Where are the later ones? How did he identify the graves of anthrax victims? Is there another site at the same cemetery? Is there a custodian or record keeper who knows or could find out more about dates, names, burial places?

The military biological facility. Gumbel also saw the military biological facility from the outside, noting many buildings inside. His description of the facility and its surroundings agrees with my commercial SPOT photo. It is the facility annually declared by Soviet government under the 1986 BWC Review Conference agreement. He also saw the military installation just south of the facility.

Aramil. He did not say and I neglected to ask whether he visited the factory or slaughterhouse said to have produced the contaminated blood and bone meal, at Aramil ca 15 km south of Sverdlovsk.

Residence clustering. The Soviet physicians said that about 70% of the cases resided in the southern part of the city and its southern suburbs, and 30% in the northern part of the city. The facility is near the southern limit of the city, with apartment complexes to its east and mainly open areas to its west, according to SPOT. Gumbel located the residences of (how many?) victims. How did he do this? These cluster in a region east of the military biological facility near the southern edge of Sverdlovsk. The US explanation is that there was a release of spores from the facility when the wind was blowing southeast. According to Sverdlovsk airport records covering late March and early April 1979 the wind often took this course, although not at all constantly. None of the published USG accounts state just when the alleged release took place. The Soviet physicians attributed the clustering to the locations where contaminated meat was put on sale in "private" markets, after illegal butchering outside the city. The residence clustering does not discriminate the two explanations.

The ceramic factory. The Soviet physicians said that a substantial number of the patients worked at a big ceramics factory with ca 3000 workers in the southern part of the city. They said that several, I recorded 15, cow carcasses were delivered to the factory on April 8, before the cases developed. They said that at least one was suspected of being contaminated because the animal had been sick. Gumbel spoke to a ceramic factory canteen employee (?) who said no carcasses were proven to be contaminated. Sergiev may know more about this and about the reliability of any bacteriological tests that were done, since he was involved in such testing in the case of a cow carcass thrown in a well and subsequently tested positive for bacillus anthracis.

The other view is that the presumed spore cloud passed over the factory during working hours. Again, no clear discrimination between hypotheses.

Household clusters. Gumbel wondered why there were few if any within-household clusters. The Soviet physicians told me of only one instance, a woman and her visiting boy-friend, both of whom died. In a different case, three persons who butchered an infected sheep got cutaneous anthrax. But the rareness of such clusters is unremarkable on either the ingestion or the inhalation hypothesis, owing to the likelihood of a wide distribution of dose and of susceptibility. The latter goes back to the Koch-Pasteur controversy over whether or not intestinal anthrax occurs in sheep! Koch thought not, because he found that sheep intubated with anthrax remained healthy. Pasteur proved him wrong by showing that intubation with anthrax plus pulverized thistles caused anthrax even though intubation with anthrax alone did not. Damage to the intestinal tract rendered the sheep susceptible. In humans, alcohol damage, ulcers, bleeding polyps, etc. might favor infection. As for inhalatory anthrax, there is epidemiological evidence from industrial outbreaks suggesting considerable variation in individual susceptibility. Again, no real discrimination between the two hypotheses.

Sex distribution. I do not recall much discussion during the phone call about sex and age distribution. Dr. Bezdeneznykh said that 2/3 of the 76 cases for which he presented data in 1986 were males, all adult. He left Sverdlovsk on April 30. He thought this tendency reflected greater meat consumption by men. Maybe. It is not implausible that men eat twice as much meat as do women. Alcohol damage to the GI tract, almost certainly more common in adult Sverdlovsk males than in women and children, may be a factor. But there are too many variables that could affect sex ratio for such speculation to be worth much or for the excess of males to be evidentiary with respect to the two hypotheses.

Age distribution. Can Gumbel confirm statements by the Soviet physicians that there was only one child among the 96 anthrax patients, a 6-year old girl who survived? All the other patients were said to be 20 or older. Why were so few children affected? Dr. Bezdeneznykh thought on the basis of his household survey that it was because most of the meat they eat is in schools and day care centers, where inspected meat is served. One might speculate that their GI tracts may be in better shape -- could lack of alcohol consumption be involved here? It would be good to know more about the age distribution in the region where victims resided and about the daily movements of children. At present, I know of no obvious explanation for such a skewed age distribution on the inhalation hypothesis.

Duration of epidemic. I stressed a fact agreed by the initial anonymous press reports, the US government and the Soviet physicians and confirmed by Dr. Olga Yampolskaya from her experience with anthrax

patients in the intensive care ward at Hospital #40: new cases continued to come to hospital and deaths continued to occur for weeks. I explained that such long duration would not be expected for inhalation following exposure to a passing cloud. The cloud would be borne by the wind. Only a small proportion of spores would impact on the ground or other surfaces in the city area. Even these would not resuspend as micron-size particles, as required for inhalatory infection. Consequently, inhalatory infection would be confined to direct exposure to the passing cloud, lasting no more than hours. Since the mean variability of the interval from infection to illness or death is only a very few days, the hospital admissions and deaths would be expected to occur within a brief period, say less than a week. According to Dr. Bezdeneznykh, there were at least 4 new cases per day for the first 12 days and then a total of 22 more cases until the last one on the 46th day. Yampolskaya will know about the presentation of new cases at least until the day she left, I think April 30. So long-lasting an epidemic, even with initial clustering, is not expected to result from a windborne cloud. Secondary exposure via human consumption of meat of animals infected by inhalation seems an unlikely explanation for the long duration. (Since any such hypothesis postulating secondary contamination of food supplies would require numerous ingestion cases, medical or other informants claiming no knowledge of gastrointestinal cases cannot be fully authoritative -- the dog that did not bark!)

Clinical and autopsy evidence. I explained that attempted distinctions between the inhalation route and the ingestion route based on clinical observations could easily be wrong. While no physician, let alone one experienced with both kinds of human anthrax (there may be none in the West), I understand that the toxic shock in both cases has similar clinical manifestations, including shortness of breath, liquid in the lungs and cyanosis. The distinction between the two routes of infection is most reliably made on epidemiological and pathoanatomical, not clinical grounds. As for autopsy evidence, I said that differential examination of mediastinal (draining the lungs) and mesentery (draining the intestines) lymph nodes should distinguish the two routes, especially if severe damage is not too widespread. Dr. Nikiforov showed numerous pictures of hemorrhagic and destroyed mesentery nodes and focal and diffuse intestinal tract lesions apparently from a number of individuals and said that the severity of damage tended to increase with the duration of illness before death. The mesenteric nodes were most typically affected. In some victims, however, the damage was so widespread that even the brain was destroyed ("Cardinals Cap"). In one such case with brain damage, Dr. Nikiforov said, according to my notes, that there was also damage to mediastinal nodes. The slides he showed convincingly portrayed gastrointestinal hemorrhagic pathology. If they were typical of all the deaths, that would settle the issue. Dr. Nikiforov said that all 64 who died were autopsied. I believe that Dr. Yampolskaya was present at most of the autopsies.

Overall conclusions. I expressed my view that the explanation of the Soviet physicians is very plausible, both internally and in terms of what is in the Russian and world literature about anthrax. And it does better than the inhalation hypothesis in explaining the near absence of children and the long duration of the epidemic. The autopsy slides are also supportive. Aside from the separate pieces of evidence, the internal consistency and scientific plausibility of the detailed accounts given to me and others in many hours of informal give-and-take conversation in Moscow and the US with Drs. Bezdeneznykh, Burgasov, Nikiforov, Sergiev and Yampolskaya strongly indicate that their statements regarding fact are essentially true and that their explanations and speculations are honestly given. My overall conclusion therefore is that the epidemic was caused by ingestion and skin contact, not by inhalation.

Granting this, however, the epidemic would simply be non-evidentiary as to the nature of the past and present activities at the military biological facility. That is still unclear.

We discussed the never-completed study of the epidemic by the deceased son of Dr. B. and the slides in the possession of the physician son of Dr. N and several other things but the above is my recollection of the highlights of my conversations with Gumbel, together with additional observations.

Call from me to Peter Gumbel ca. Saturday 10 August in the morning from Martin Kaplan's office in Geneva. This memo is written 27 August at Woods Hole, from scant notes and memory.

Since our conversation of July 19, Gumbel saw Sergiev, who seemed less than forthcoming. I mentioned that Sergiev said in the US that he came late to Sverdlovsk and had little direct role except in organizing the vaccination program for people in Sverdlovsk and in retrieving samples from a cow carcass in an abandoned mine shaft, from which B. anthracis was subsequently isolated. In Cambridge, Sergiev mentioned daily reports and an overall report he prepared for the Ministry of Health. He told Gumbel he would try to retrieve a report ("zacuchenyaya?"), presumably his own, from the MOH.

Gumbel saw Yampolskaya, who recalled her surprise at reading the Liturnaturnya and Rodina articles I showed her in January suggesting the epidemic was airborne and that there had been a cover-up. She was unable to say whether new cases of fatal anthrax continued all the way up until the time of her departure at the end of April although there were still cases in her ward. She referred to them as "generalized gastric". Gumbel also said there were cases "to the end" and that the distribution was "front loaded". I cannot recall how he established this. It agrees with the chronology of Bezdenejnyh.

I asked Gumbel where the ceramics factory was and whether the victims who worked there all worked the same shift. Gumbel said that the ceramics factory was about 1/2 mile SE of the facility, with an area of small wooden houses and then an area of 4-5 story brick apartment buildings between the facility and the factory. Farther SE beyond the factory there were fewer habitations (?). This is consistent with my SPOT photos. People at the factory could not recall whether all the victims worked the same shift or even what shift(s) they worked. There was activity at the factory day and night. I stressed that this could be an important point, since airborne exposure at the factory would be expected to be confined to a single shift.

Gumbel asked if the cases per day given in my FAS Public Interest Report article refer to admissions or deaths. I explained that it could not be deaths, since the total (96) is greater than the number of deaths (64). As stated in the Report, the numbers refer to presentations diagnosed as anthrax.

I told Gumbel I would send copies of numerous Sverdlovsk newspaper articles and posters from April-May 1979 warning of the danger of anthrax from uninspected meat, a short report from Burgasov, and audio tapes of the 15 April 1988 presentations in Cambridge (The photocopies were sent via WSJ/NY in mid-August, the tapes at the end of August.)

Gumbel would go to Sverdlovsk again, on Wednesday the 14th (?).

chronology

25-28 MARCH Sale of 29 tonnes bone-flesh powder at or from

Aramil

29		First animal anthrax, probably		
30				
31				
1	APRIL			
2				
3				
4		5 human cases (admissions), misdiagnosed.		
5		5.		
6		5. Nikiforov arrives		
7		7. Anthrax provisionally diagnosed <u>ca.</u> this date		
8		7. Yampolskaya arrives (?)		
9		6.		
10		10. Microbiological confirmation of anthrax		
11		9.		
12		7.		
13		5.		
14		4.		
15		4.		
16		1.		
17		0.		
18		0.		
19		1.		
20		0.		
21		0.		
22		2.		
23		0.		
24		0.		
25		1.		
26		0.		
27		2.		
28		1.		
29		2.		
30		1.		
1	MAY	0.	11	1.
2	1.120.			
3		0.	13	1.
4		2.	14	0.
5		1.	15	0.
6		1.	16	0.
7		2.	17	0.
8		0.	18	1.
9		1.		
10		0.		
		<u>total admissions</u>		96.

Call from Peter Gumbel in Moscow to me in Woods Hole, Saturday morning August 17 (?), from notes and memory at Woods Hole, August 29. He received my letter, memo and enclosures of 21 July. He plans to write his article soon, before the BWC review conference in September, of which he is aware.

Gumbel went to Sverdlovsk again. At the "east cemetery" he found more grave markers of presumed (why?) anthrax victims, a total of 43. All were in the same flat weedy open area he inspected on his earlier trip to Sverdlovsk. In addition, nearby he found (how many?) graves with no names, only red flags. He wonders if these could be military victims, possibly from Sverdlovsk military hospital, contrary to claim of Burgasov and others that there were no military victims. I told him that some of the victims were said to be from a group of local reservists who were taking some kind of course. This according to one of the published emigre accounts (check this). I also told him Burgasov had said in Cambridge that General Agafanov, epidemiologist of the Ministry of Defense (or Army?) had visited Sverdlovsk during the epidemic to make sure there were no cases in the military and that there were none.

Inquiring about Dr. Korteve, Gumbel confirms that he is seriously ill.

Gumbel spoke with two physicians in Sverdlovsk who claim to have unpublished pathology (?) data not in agreement with official accounts. They nevertheless expressed high regard for Nikiforov. They would not show the data to Gumbel. They may be the physicians who went to give a presentation in Moscow soon after epidemic (?) but were sent back without doing so. Olga may remember something about them.

A Sverdlovsk physician (one of the above?) suggested to Gumbel that the presence of only one child among the 96 cases could result from vaccination of children against other infections. I explained that, on the contrary, because immunization is highly specific no such cross-specific protection is to be expected. Subsequently I confirmed this with three senior specialists in immunology and infectious disease. The Soviet physician in question appears to be given to uninformed speculation.

In Moscow, Bezdenezhnykh presented the age distribution of 76 cases he analyzed, as follows:

under 20	1 (a 6 year-old girl, who survived)
20-29	11
30-39	10
40-49	32
50-59	10
over 60	12

Bezdenezhnykh believed the near-absence of young people resulted from their being much less likely than older people to eat uninspected meat, partly because meat in nursery, pre- and other schools is from inspected sources. See also my comments on age distribution in my 21 July memo. It should be noted that the recent WHO report on anthrax says there is no apparent difference in anthrax susceptibility between children and older persons. No data are cited.

Gumbel said that ceramic factory personnel told him that roof tops

there were sprayed with disinfectant during the epidemic. (Check my copy of official Soviet regulations for anthrax outbreaks to see what disinfection measures are stipulated.) Burgasov said in Cambridge that there had been no aerial spraying. Soviets in Moscow in 1986 told me that liquid sterilization by washing and/or spraying with chloramine was done during the epidemic in refrigerators, apartments, and refuse heaps.

Gumbel said that his investigation had not produced a definitive answer as between inhalation and ingestion routes of infection but that he had found several discrepancies in the accounts of officials. He undoubtedly understands that innocent discrepancies resulting from misperception, misunderstanding, ignorance and speculation are expected to abound in such an emergency situation. Nevertheless, he singled out an apparent discrepancy that causes him particular concern. The question is whether the contaminated bone-flesh meal was actually produced at Aramil, as I had written in my Public Interest Report. Since my 21 July letter mentioning Aramil, Gumbel went there, but was told there was no factory for producing such meal there or within 14 (?) km. What was at Aramil, he was told, was only a facility where bone-flesh meal might be distributed and perhaps tested. I told Gumbel I would check my records on this point. I have gone through my 1986, 1988, and 1991 notes of conversations and presentations in Moscow and in the US and have viewed the videotape of the Soviet 1988 presentations in Cambridge. I have not yet reviewed the tapes from Washington or Baltimore. The only relevant reference I found is a page from my 1986 notes on discussions with BB and N at the Botkina hospital. I enclose photocopies of the relevant pages of my 1986 steno-notebook. I believe it was Bezdenezhnykh who was speaking in Russian, with interpretation into English by Voskresenskiy from the MoH protocol department. The essentials in my notes are:

Such meal is made at 11 slaughter houses in the oblast.

The technology was developed at one of these, Bogdanovichi, 100 km SE of Sverdlovsk.

There were errors, due to lack of analysis, apparently at Aramil, a pachog or workers village, 15 km SE of Sverdlovsk.

29 tonnes, probably made in March, were put on sale to private citizens from 25 to 28 March. All was sold.

B. anthracis was found in 6 samples.

The meal was not properly "dry heat autoclaved". Maybe it was sterilized primitively. There was no temperature control.

I also clearly recall being told that (somewhere) the manometers were too high to read and that the same wheelbarrow was used for sterilized and unsterilized meal. So far I haven't found written or taped records for this. I have always assumed that the actual production of the meal, not just the distribution or testing, was done at Aramil, as I wrote in the Public Interest Report. But now that the question has been raised, I cannot confirm on the basis of any records I have reviewed that actual production is distinct, for example, from distribution

did in fact occur at Aramil. Neither do I recall ever asking specifically where the meal was produced or just what activities took place at Aramil. It is clear from my notes and memory that Aramil was involved, but not that it was the site of production. Sergiev may be able to add more.

I told Gumbel that in Moscow this January I was told that the Army or MoD Procurator was conducting a criminal investigation of the epidemic. He had not known of it.

Gumbel wondered why the sentences for violation of veterinary regulations were so light. I asked what were the maximum sentences under these regulations. He did not know but thought other regulations with more severe sentences could have been found if the authorities wished to do so. Gumbel has spoken with a court official who was present during the trial(s).

Gumbel confirmed with veterinary personnel in the Sverdlovsk region that animal anthrax had occurred south of the city around the time of the epidemic, but said they couldn't recall whether it was before or after the epidemic began. Has Gumbel looked to see if court records include the dates of interest? He might be helped in this by the court official he met, who might also comment on the veracity of the recorded dates.

To summarize my overall view again, the two most evidentiary epidemiological facts regarding the route of infection on which various sources agree are:

- 1) Cases continued to present for more than 6 weeks.
- 2) Only one child was affected.

In addition, granting that Professor Nikiforov was truthful and highly knowledgeable, as I do believe from extensive discussions with him in Moscow and the US, his pathoanatomical series clearly showed severe intestinal and mesentery involvement. From the most rigorous point of view, more information about the mediastinal nodes would be desirable, but consistent severe mesentery damage is nevertheless very significant. There is also good precedent in the scientific literature for all the epizootical and epidemiological features described by the Soviet physicians.

The most reliable and evidentiary evidence, in my opinion, is therefore consistent with the intestinal, not the respiratory route of infection. Nothing I know, from Gumbel or elsewhere, weighs strongly against this conclusion.

This is not to say that there are no honest or dishonest discrepancies in the Soviet accounts. Neither does it reliably establish just how the original contamination came about. Of course, whatever happened some individuals and organizations are seriously to blame and would undoubtedly try to cover up. Although the epidemic was almost certainly gastrointestinal and cutaneous, not inhalatory, it may be that the source of the contaminated food somehow traces back to the facility. But this is sheer speculation. In fact, I have no clear evidence against the explanation Bezdenezhnykh gave for the origin of the contaminated

food, and there is much to support it. I told Gumbel that he might learn more from Shevardnadze, since I was told by a friend that copies of my fruitless repeated requests to the Ministry of Health for an invitation to Sverdlovsk had reached his desk.

9 September, 1991

Dear Mr Gumbel,

On my return to Cambridge this week, I received the sad news that on August 28, Will Albrink died. He was a superb scientist of the highest intellectual standards -- and almost certainly the only American pathologist with detailed first-hand knowledge of the pathoanatomy of human systemic anthrax.

Regarding your questions about Aramil, here is the relevant page of my 1986 Moscow notebook, written at the Botkina hospital as the interpreter translated the presentation of Dr. Bezdenezhnykh. As I told you on the telephone, it is clear from my notes that Aramil played some role in the provision of the contaminated meal but I cannot say from my notes or my memory that any Soviet ever claimed that Aramil did the actual production. On this point, my FAS report is misleading.

As to the information I cited there about the manometers and the wheelbarrow, it came from the manuscript given to me in 1986. At this point I feel that accuracy would be best served by giving you the 1986 manuscript and my permission to quote passages from it. In addition, I will do my best to have a properly translated and referenced version of the longer 1988 manuscript published in an appropriate journal.

The audio tapes from Washington and Baltimore will be sent to you via NY today. Reviewing my records, I see that video recordings were made only of the Cambridge presentation, on August 15. Let me know if you want a copy.

Sincerely,

Matthew Meselson

14 December 1992

Dear Martin,

Thanks for the very useful cross-checks and questions. Here are responses to your two lists:

LIST I

a) Borisov:

- 1) The Sovremennikov address is from the new official list. I expect to receive a copy of it by the time of my return from California ca. January 4 and will send a copy to you.
- 2) Yes, Compound 19. You are right to surmise that I have assigned all Compound 19 and 32 residents to workplaces in their respective compounds, without yet knowing whether this is correct in any individual case. I am trying to get detailed information on this, both from Ekaterinburg and from officials in Moscow.

b) See above.

c) Dyedov: The only source of onset date is an interview stating the 9th. The 10th was an error. Thanks for checking my SPOT map placements. They will all be refined and checked to give the final figure.

d) Komelskikh: The early Ilenko list of 5 gives the 9th; the interview gives the 10th.

e) Vyatkin: The 14th is from the death certificate.

Generic question: I too would generally place more reliance on primary hospital records and on the pathologists notes when there is conflict with other sources. Even here, judgement may be needed where there is reason to think that errors may have occurred in transcription, as appears to have occurred for autopsy cases 27 and 28. Also, I have not yet tried, by cross-checks, to analyze the reliability of the early list of 5 obtained from Ilenko. More to the point you raise, I will adopt a uniform criterion in the next edition of the data base summary. This was not done for the present edition.

f) Koshaleva: Yes, Olga's transcript of the pathologist's notes gives a death date one day later than does the grave marker.

g) Markova: No, Olga's notes and the grave marker both say the 17th. Why do you have the 13th?

h) Spirina. I agree that the 14th is more likely.

i) I.V. Makarov: Again, thanks for the map check.

j) Mochalova:

- (1) According to the interview, she went back and forth between the apartment of her niece and her apartment in Compound 32.
- (2) Pathologist's notes and interview both say she was 68.
- (3) There is ambiguity in the interviews here.

LIST II

Moscow: Thanks for the correction.

SPOT map: Again, thanks for the check.

Chernyaeva: Hospital designates the last hospital to which the patient was taken, even if dead. When two hospitals are designated, the second is the last.

Chizova: Cemetery and interview give death date as April 12 but the early list of 5 is gives the 11th. Interview suggests onset on the 10th but the early list of 5, being contemporary, could well be more accurate.

Danilov: Danilov said it was on his left shoulder.

Dayanov: A man, not a woman. **Where does the date of 501 come from?**

Fedulova: My arithmetic error. She was 68, not 78.

Komina: 410 is from the grave marker. According to interview, she worked from midnight to 8 AM.

Korsaev: The interview gave 411.

Kozlova: Yes, I used the grave marker Dex. As mentioned above, I need to decide how to use the list of 5 in data summaries.

Lavrov: No, we have only Olga's notes from Abramova with the street name, no number.

Loginova: Thanks.

Lyakhova: I must confess that I cannot now locate the source of the statement about being home April 1-5. The database entry is attributed A (=Abramova). I have 4 pages of Abramova notes, transcribed by Olga. How many do you have?

Maslennikov: Onset on 411 is from the interview.

Patrushev: The designation ZA means only a definite or probable survivor with indication of anthrax sufficient to justify trying to obtain an interview. The UZPPM workplace is just plain wrong, slipped

in from Permyakov!

Podgorbunskikh: Again, ZA is not meant to imply definite 022.

Poleshaev: Good question. Absent information to the contrary, I have drawn the line at 70 to get probable daytime location.

Romanov: Noted, but I have no information yet.

Syskov: Thanks.

Tretnikov: Fabrica TRUD is indeed at 82a Selkorovskaya, behind ceramics where I got out of the car to photograph. Why do you say I have placed TRUD at 114?

Volkova, Vostrikov and Zinatulin: To be refined as discussed above.

Birthdays: noted.

Thanks again.

I sent the revised AGYW manuscript to PNAS last week. Should be out early in the new year.

Best wishes,

Matthew Meselson

Dear Ilona,

Thank you so much for the work you have done for us so far. We would like now for you to continue your excellent interviews in order to obtain information for cases that have not yet been interviewed or have been interviewed incompletely. Please use the existing interview form and procedure, as you have been doing. It is important to learn where the individual was during the daytime on weekdays in early April 1979--at work, at home, in a military assembly, or wherever--and to locate each place on the map.

The following is a list of cases for which we still need information. The numbers are those from the official list, which you have.

- #22 BORISOV, Valentin Petrovich Sanitornaya 11-30.
- #37 BUCHELNIKOV, Vitalii Aleksandrevich Shevskaya 17-6
- #25 CHIKALOV, Konstantin Mikailovich Profsoyuznaya 55-18
(You learned from his wife that he was on vacation in April. Please ask where he spent his vacation days in early April.)
- #18 JELEZNYKH, Boris Andreyvich Batalonnaya 4-7
- #53 MAKAROV, Ivan Vasilyevich Kolkhoznikov 87-25
(You have done this interview but we have two questions: (1) Was he the brother of Pyotr Vasilyevich MAKAROV, #40? If so, where did Pyotr Vasilyevich reside and work? If you learn the residence, please conduct an interview. (2) Do we understand correctly that Ivan Vasilyevich did not work at Compound #19 and that the #19 in the name of his workplace has no relation to Compound#19?)
- #33 LYZLOV, Vladimir Pavlovich Kraulya 4-33
(Please try to get more information about where he was during daytimes early in April. Had he any occasion to go to Chkalovskiy? If so, where and when?)
- MOCHALOV, Mikhail Maksimovich Agronomicheskaya 5a-1
- #36MOCHALOVA, Taisa Pavlovna Sukhalkozhskaya 6-52
(Jeanne interviewed a grand-nephew, please try to interview the niece or other family member who was an adult in 1979. Where was MOCHALOVA actually living in early April 1979?)
- POLESHAEV, Andrei Pavlovich Selkorovskaya 102/3-10
- #6ROMANOV, Boris Georgevich Frunze 76-71
- #20SHATOKIN, Nikolai Afanasevich Bardina 39-83
(Please try to get more information about where he was during daytimes early in April. Had he any occasion to go to Chkalovskiy? If so, where and when?)

#10 SYSKOV, Alexey Nikolaivich Bisertsкая 6-58

#35 TRETNIKOV, Vasiliy Ivanovich Malakitovyi per 56-1
(Jeanne interviewed neighbor but did not learn exact workplace.
The son still lives there.)

#54 YASINSKAYA, Nina Fedorovna Suhalozhskaya 10-69

The following persons are believed to have survived their illness:

Supl. #5 STERKHOV, Anatoli Ivanovich Poldnevaya 53
(You learned that he was on vacation in Leningrad before becoming ill.
Please find out from him directly the dates during which he was
away from Sverdlovsk and where he was during the daytimes on
weekdays in the first week of April.)

-- DANILOV, V.P. Eskadronnaya 37-22

-- FEDULOVA, M.S. Promyslovyia 88

-- NOVOKRESHCHENOVA, A.A. Bisertsкая 22-12

-- PRITCHIN, V.A. Eskadronaya 5a-71

-- YAKOVLEV, N.V. Gazetnaya 34-14

Lastly, we have some questions:

1) Do you agree with our conclusion that NII 44 is in or part of Compound #19?

2) What are the hours of each shift at the ceramics factory?

3) What are the hours for an assembly? Do the men taking part in an assembly live at the compound or at home?

4) Where is polyclinic 2 and what approximate area did it serve in 1979? The same question for polyclinic 3.

5) Where did children and young people from homes in the Lyapustina-Kashinskiy-Poldnevaya neighborhood go to school in 1979?

6) There is a factory in Chkalovskiy where animal products are rendered. Rendering is the process by which animal carcasses and waste materials are boiled to give usable fats, bones and other materials.

7) Are we correct in assuming that when you ask about animals, people understand you mean sheep and goats and not just cows?

8) Finally, do you have any ideas about the location of 34 MSD?

Olga, the daughter of Professor Gubanov, plans to return from Ekaterinburg to Illinois on September 17. Whatever materials you have ready at that time, she will be able to bring back to us. Professor Borisov has \$250.00 on account to reimburse you for this second stage of work. Is this sufficient? I realize that your vacation must soon be ending. I hope you will be able to both help us and have time to enjoy the summer before it is over. I will call you within the next few weeks. My thanks again for your excellent work on this project.

Sincerely,

Jeanne Guillemin

12 December 1992

Dear Ilona,

We were so pleased to hear from you this week. We understand how busy you must be in your new life. Keep yourself healthy and Happy!

Attached to this note is a summary of our data on residence and workplace addresses, most of it based on interviews. You will see that there are quite a few that we do not know, indicated by printed question marks. Also, we have some specific questions about street addresses and other matters written in red ink.

Please do whatever you can (but without overworking) to answer the red questions and to obtain information on some of the unknown workplaces. There is no need to send anything before Professor Gubanov returns to America at the end of December. And data obtained even after December would still be appreciated.

As for the control interviews, depending on what you have found so far, it may be that you will already have enough by the time that you receive this letter. If more control respondents are needed, you may want to ask one of your students to help you.

In addition to the "red questions" and our request for any additional workplace addresses you can determine, we have the following questions:

- 1) Do you see any errors in the enclosed chart?
- 2) We suppose that some of the people who lived in Compound 32 or Compound 19 also had their workplaces in the compounds -- but also that the workplaces of some of them were outside of the compounds. Is there any way to determine those who actually worked in the compounds? Is there any possibility to conduct interviews with family members of those listed as NII or MSD?
- 3) If you have any information not already in the table on whether people were day workers or night workers, please add it.
- 4) If you have any information where people could have been in the mornings of April 2-4, 1979 other than what is in the table, please add it.

We will keep in touch with you by e-mail and/or telephone.

Happy holidays and best wishes for the New Year,

10 March 1993

Dear Ilona,

Here are some materials for teaching English as a second language and a guide to business correspondence that I hope will be useful for your students. We contacted a person who teaches English to Russian-speakers here in Boston for advice and purchased the items she recommended:

1) Kossman, Leonid: *Everyday Dialogues*
Level 1 -- two cassettes/ one book
Level 2 -- one cassette/ one book

2) *Think English With Cards and Cassettes*, level 1

3) *Business English*

But the most important requirement of course is an excellent instructor, which your students have already!!

Ilona, I include a photocopy of the bus map with an area outlined in red. I would like to know if approximately as many people resided in this area in 1979 as reside there now. Perhaps you could find out by asking a few of the older residents if there has been much new residential construction since 1979 or if, instead, the area was about the same then as it is now.

Jeanne and I think of you often and hope that all is going well for you. We want to visit Ekaterinburg again, possibly this summer, but at this time we have no definite plan. With best regards,

Sincerely,

To: Irina Belaeva in care of Professor S.F. Borisov
<72056.3447@compuserve.com>
From: Matthew Meselson <msm@isr.harvard.edu>

30 October 1993

Dear Irina,
Jeanne and I were very glad to hear from you and to learn that you are well.

We will obtain the ESL books and tapes and then try to find a traveller going to Ekaterinburg from any place in the US. Please let us know if you know of anyone, perhaps a colleague of Professor Borisov or Professor Gubanov.

The information about Margamova, Lozhkin and Vyatkin was very helpful. Thankyou for it.

If you do have the inclination and the time, but not otherwise, you might seek answers to the following five questions

For Pepelyayev:

- (1) Approximately how many men were in the assembly attended by himself and Lozhkin?
- (2) On Monday 2 April did the members of this assembly stay together at one part of Compound 32 most of the time or did they disperse into smaller groups in different parts of Compound 32?

For Tamara Chernych

- 1) Was Vershinin, an anthrax victim? If so, where did he work in the Ceramics factory and when did he die?
- 2) In past years, especially around 1979, did workers in the pipe shop experience any significantly higher frequency of medical problems, especially respiratory problems, than workers in the tile shop?
- 3) Did we understand correctly that there were about 450 daytime workers in the pipe shop and about 400 in the tile shop?
- 4) Were there any cutaneous cases? If so, what parts of the body had lesions?

Nazarov Brother and wife.

When was his assembly service? Could it have included Monday, 2 April?

Prokharov
Bubenchikov

Buchelnikov

Let Romanenko go.

Phone book for Fokina, etc.??

for Borisov,

Met info and mathematics re dates, size, location, and hospital.

For Gubanov

For Osipov
Q re Fedusov.

For Yablokov
Q re death dates.

With best wishes,

Matthew.

David H. Walker, M.D.
Department of Pathology
University of Texas Medical Branch
Galveston, Texas 77555-0609
Fax: 409-772-3606

8/27/1992

Dear David,

Welcome back from Colorado. Matthew, Alex Langmuir, and I have been working here in Wood's Hole on the first draft of the Ekaterinburg trip report, probably to go to Nature. You, Martin and Alexis will be getting copies of it in a week or two, at which point you can make your comments.

In the meanwhile, here are my remarks on the second draft of your write-up of Abramova and Grinberg's work. They are few, since the paper looks good.

On a general level, I think it is important to be as specific and unambiguous as possible, so that this publication, if it cannot solve all mysteries, at least does not confuse.

1. Page 3, line 12, first sentence: suggest "No published reports or presentations by Soviet physicians have deviated from the intestinal anthrax explanation or offered clinical data to suggest inhalatory anthrax." The 1988 visit of Soviet physicians did make information publicly available in the U.S.; a written version was given to State.
2. Page 3, line 15: add, in order to give the 42 cases a denominator, "(of a total of 96 autopsies performed during the epidemic)"
3. Page 4, line 3,: suggest word reorder "report has the purpose of presenting the major observations"
4. Page 4, line 6: suggest "From June 6-11, 1992, the two pathologists in Ekaterinburg made their materials available to Walker and to Yampolskaya. (In 1979, Yampolskaya was one of three clinicians sent from Moscow to treat victims of the epidemic)." Or something which identifies Olga more clearly.
5. Page 4, line 18, "approximately the sixth day of the epidemic: by what reckoning? Suggest referring to first recorded onset date (4/7) or first recorded admission date (4/8) in this series instead.
6. Page 8, line 12, to top of page 9. Your point about there being no clinical data available is weakened by the list of clinical details that then follows. Suggest adding "From limited clinical notes, we have deduced" or

Guillemin/page 2

something that indicates the qualified source of this information.

7. Page 9, line 12, "Description of a small number...": suggest you either be specific about the number and discuss the cases fully, or leave this for another time.

8. Page 9, line 16. Cite additional sources of funding or not; "in part" is superfluous, if not misleading.

9. Chart: suggest that title should be specific, for example, "Abramova and Grinberg, Autopsy Notes, 1979 Sverdlovsk Anthrax Epidemic."

I would also suggest you double-check your notes against the chart columns, just to make sure they match, or if they do not, why. Unpublished as well as published information will end up as grist for the historical mill, so it is just as well to be careful. Along these lines, the forensic cases might be noted as such. Also, the case of SPIRINA (#24), as described in your notes, does not seem to match the others. The interview information and her residence are also a bit off.

Ilona Nickonova has done some wonderful interviews and is out getting more precise data. We have been going over these and other material to be as sure as we can who was where and when. You will see the results in the draft that is coming your way.

Also, Sam Thier stopped by last week. He worked with Dutz in Iran in 1973 and actually saw an inhalatory anthrax autopsy with all the "jelly" around the lungs. He is helping us track down more Dutz articles. With luck, they will not be in Farsi.

As I understand, Matthew will collect all the outside reviews of your article and send them to you in a bundle as soon as possible.

When I get back to Cambridge next week, I resolve to go through our photographs and send you some. I really do treasure the ones you gave us in Washington. More news to come, then,

Sincerely,

Jeanne

Guillemin

341 Wood's Hole Road
Wood's Hole, MA 02543
508-540-0086
Fax: (MBL) 508-540-6902
cc:team

Martin Hugh-Jones

Professor of Epidemiology
Department of Epidemiology
and Community Health
School of Veterinary Medicine
Louisiana State University
Baton Rouge LA 70803-8404
fax: 504 346-3295

8/27/1992

Dear Martin,

Thanks for your latest fax on categorizing Sverlovsk epidemic victims. Might I suggest just using "A," "B," and "C" to sort cases. It may not be such a terrific problem, since the official list is holding up fairly well.

Matthew and I are just about finished the first draft of a brief general trip report, which we would like to place in Nature. Alex Langmuir, who was here for several days working with us, will give it a quick read. Then you, Alexis, and David can have a go at it.

Ilona, as you know, has been doing interviews and is still helping tremendously to clarify who was where and when. Matthew, I believe, has sent you the latest list of residence and workplace addresses, which we have gone over with a fine-tooth comb. We have asked Ilona to continue her work, the results of which we shall pass on to you. Since I am on sabbatical this year and circulate between my office at Boston College, the Cambridge house, and here in Wood's Hole, Matthew's office is the most efficient way to reach me. I really do want to see what the computer mapping venture can produce.

I am also sending you, for your files, a copy of my letter to David Walker about his write-up of the Abramova-Grinberg material.

Sincerely,

Jeanne Guillemin

341 Wood's Hole Road
Wood's Hole MA 02543
Fax: (508) 540-6902

cc:team

Martin Hugh-Jones
Department of Epidemiology

and Community Medicine
School of Veterinary Medicine
Louisiana State University
Baton Rouge LA 70803
Fax 504-346-3295

September 1, 1992

Dear Martin,

I just received your fax of August 31.

About the number 96 for total autopsies (page 3, line 15), this comes from Matthew's notes on Grinberg's presentation on June 5. Have you anything different in your notes? Perhaps we should check this directly with Grinberg and Abramova.

About pinpointing the beginning of the epidemic (page 4, line 18), I meant that it might be wiser to stay with Abramova and Grinberg's recorded onset or admission dates, rather than reifying April 4, on which there is no information in the article. The phrase "approximately the sixth day" might be thought too off-hand, given the ambiguities about onset in this kind of anthrax, and especially coming from physicians. April 3-5 may indeed turn out to mark the start of the epidemic, or not. If not, people will ask, "So why did you write six days if you didn't have the facts?" and then they begin to wonder what other guesses were hazarded.

I'm glad to know you made it through the storm and hope the machines are all working again.

Jeanne Guillemin

cc:team

31 January 1994

Dear Joe,

It was a great pleasure for me to meet you at Edgewood last week.

Here, as promised, is the current draft of the manuscript I have prepared for Nature.

I would appreciate having your most rigorous criticisms of the manuscript! In particular, please let me know if the citations of your personal communications are alright. I also look forward to receiving references to the work of Edgar W. Larson on the production and characterization of biological aerosols.

You will not be surprised that I have some more questions. Some of them are attempts to understand why older reports give much higher LD₅₀ values than those you obtained and those that are quoted today. For example, Druett, et al. (*J. Hygiene* 51: 359-371, 1953) give a value of 53,000 spores for *rhesus* exposed to single spore aerosols of strain M36. The spores were heat shocked and kept in 1% phenol before use.

Similarly, Young, Zelle and Lincoln (*J. Infect. Dis.* 79: 233-246, 1946) report an LRE of 20, corresponding to an LD₅₀ of about 1,000,000 for monkeys (species not designated) exposed to single spore aerosols of the Detrick 25 strain grown on pepticase, peptone, glucose, yeast extract medium and stored in the cold in phosphate buffer.

So here are the questions:

1) What is going on here? Why do the older papers give such high values? Is it a question of aerosol size distribution, dosimetry, bacterial strain, spore preparation, infectivity loss, animal holding time, acquired partial immunity, or what?

2) Were your *rhesus* dose-response experiments done with the same equipment, strain, and protocol as you used in the experiments with *fasicularis*?

3) Was the aerosol generated directly from spore suspensions at about 10⁹ in phosphate buffer or was that suspension concentrated, diluted,

or placed in a different solution before being loaded into the aerosol generator?

4) What type of aerosol generator was used? Spinning disk, liquid forced through a jet, air-blast atomizer, or something else?

5) What was the particle size distribution of the aerosol as it came out of the generator, before the particles could shrink much from evaporation? Knowing this and the concentration of the suspension placed in the generator, one could calculate the proportion of single-, double-, etc. spore particles in the initial aerosol, assuming a Poisson distribution.

6) Were doses varied by varying the time of exposure, the concentration of aerosol, or both?

The photos I took at Edgewood are not yet developed, so it will be a little longer before I send copies.

With best regards,

Matthew

27 May 1993

Dear Dr. Jemski,

I am very glad to have this opportunity to correspond with you regarding the dose-response data for inhalation anthrax in cynomolgus monkeys cited by Glassman on pages 658-659 of the enclosed article. As he mentions there, the probit slope is lower than one might have expected. This is what caught my interest and caused me to contact you, as the investigator who provided the data to Dr. Glassman.

I would like to pose a number of questions dealing with the experimental procedures that generated the data on which Glassman's Figure 1 is based and also dealing with possible explanations of the low slope.

1) Were the procedures and apparatus for exposing the animals the same as those described in your article in the Proceedings of the Animal Care Panel (enclosed)? If not, how did they differ?

2) Goldman expresses dose in terms of total spores inhaled in particles mainly of diameter 5 microns or less. Brachman *et al.*, in the preceding article, express dose in terms of "*B. anthracis*-bearing particles". Despite the difference in terminology, the methods for measuring dose appear essentially same. I assume that the dispersal of the sampled aerosol in collection fluid and its subsequent plating insured that most of the colonies counted corresponded to individual spores, not to undispersed clumps containing more than one spore -- and that Glassman's definition of dose is therefor justified. Do you agree?

3) After exposure, were the animals kept individually in ventilated cages throughout the period of observation? If not, what precautions were taken against cross-contamination?

4) What was done to prevent infection due to inhalation of spores from contaminated fur? Was the post-exposure air washing procedure described in your article used? If so, were exposed animals that had been air-washed ever caged with control animals in order to determine whether such air washing prevents infection from contaminated fur?

5) Glassman says that the period of observation following exposure was 10 days. Yet he also says that "Several of the animals in that [other] study, which was directed toward determining the minimal holding period required to assure statistically valid dose-response data, died of culturally proven anthrax after prolonged incubation periods--one animal succumbed 98 days subsequent to exposure." Was the observation period for the data of Figure 1 really 10 days? If so, was this long enough to detect most of the infections, even at

the lowest doses?

6) How were animals pre-conditioned and examined before exposure? Were lung mites, TB or other respiratory problems prevalent? What can be said regarding the general health of the animals?

7) Are you aware of any evidence that young animals are less susceptible to inhalation anthrax than older ones -- or of any other influence of age on susceptibility?

8) In Figure 1, Glassman presents a straight line without data points. What was the lowest dose at which infections were found? Are you aware of any experimental evidence that primate infection can result from inhalation of as few as 100 spores or even fewer?

9) In what years were the dose-response experiments performed?

10) How might one recover the actual data or a summary more detailed than Glassman presents? Might his own notes and calculations still exist? If still classified, I could request their declassification. To do this I would need to have a title, an AD number or some other reference. Can you provide me with anything helpful on this score? It would be a pity if the data from these extensive experiments were lost, all the more so since large-scale primate experiments may not again be possible.

11) Do you agree with Glassman's presentation of the dose-response relationship and the conclusion that the probit slope is in a range as low as the he states?

12) What explanations for the low slope seem plausible to you?

13) Are you aware of any other data that would provide an estimate of probit slope for inhalation anthrax, whether for primates or other mammals?

14) Can you direct me to any data that would provide an estimate of probit slope for inhalatory infection of a mammalian species by any pathogen other than anthrax?

Please excuse the length of this list of questions. I realize that experiments done three decades ago are not likely to be fresh in minds of those who performed them and will greatly appreciate whatever information and guidance you can provide.

Sincerely,

Matthew Meselson

Professor

20 December 1993

Dear Dr. Jemski,

Here for your interest and comment is the manuscript I have written about the epidemiological aspects of the Sverdlovsk anthrax outbreak. Next month, after publication-quality figures are done, I will submit it to *Nature*. Before preparing a final draft, I would be very grateful to have your detailed comments.

In particular, I have some questions further to those in my letter of 27 May:

1) What strain of *B. anthracis* was used in the 1200-animal experiment with *M. fascicularis*?

2) How were the spores prepared? I would be interested to know how fully spore formation was allowed to progress, as I understand that there is some evidence for higher virulence of less fully sporulated cells. Also, was there any special treatment such as heat shock, detergent addition, etc.?

2) Was the LD₅₀ value for *M. rhesus* mentioned in your letter of 15 July ever published? If so, can you give me a literature reference? Within the limits of statistical significance, were the results consistent with the low probit slope found in the larger experiment?

3) Do you know of any determinations of probit slope for inhalation anthrax in non-human primates other than that cited by Glassman? If so, what results were obtained and where might I find reference to the work?

The research director at the ARMY RDE Center at Edgewood, Joseph Vervier, has invited me to give a talk about this work on Wednesday 26 January. His office will send you an invitation to attend and to join us for dinner afterwards. I hope very much that you will be able to come.

Sincerely yours,

Ekaterinburg
9 June 1992

Dear General Kharechko,

I write to you as the leader of a group of five scientists from the United States who are studying the medical, pathoanatomic, epidemiologic and epizootic aspects of the outbreak of anthrax that happened in this region in 1979.

I have read in the 20 November 1991 issue of Komsomolskaaya Pravda that scientists at your facility, like ourselves, also wish to understand what actually happened. Therefore I wish to invite you or a member of your scientific staff to meet with us, to hear our findings at this stage of our study, and to exchange information and views regarding scientific aspects of this matter.

I realize that our hosts at the Ural State University have already made contact with your office on our behalf but nevertheless consider it good that I write to you personally.

You may reach me through Professor S.F. Borisov, telephone

Sincerely,

Matthew Meselson

12 December 1992

Dear General Kharechko,

I enclose the first manuscript resulting from our study of the 1979 epidemic. I would be most grateful for any comment you or other scientists on your staff may have.

A second paper, dealing with epidemiological aspects, is still in preparation. I will provide you with a copy as soon as the manuscript is written, sometime early next year.

Meanwhile, let me return to the possibility of a small scientific meeting on the subject of anthrax and on the 1979 outbreak. The MacArthur foundation has expressed interest in supporting such a meeting if it would be possible to obtain the participation of Russian military scientists. If this could be achieved, I could come to Ekaterinburg in the Spring for advance discussions with you and others on how the meeting should be organized. Do let me know if there is interest in this possibility on the Russian side.

With best wishes for the New Year,

Sincerely,

Matthew Meselson
Professor

12 December 1992

Academician A.D. Kuntsevich
Chairman, Russian Federation President's
Committee for Problems of the Chemical
and Biological Weapons Conventions

Dear Academician Kuntsevich,

I take the liberty of transmitting by the hand of my friend Mr. Kyle Olson a request to meet with you in Moscow at any time you may find convenient during the period January 18-20.

I would particularly like to discuss with you the study we conducted last June in Ekaterinburg of the 1979 anthrax outbreak. I have read your interview of 22 September in *Rossiyskiye Vesti* saying that your Committee plans to study this question. Perhaps the data we obtained could be of use to the Committee. In any case, I would greatly value your comments and criticisms and those of any other Russian military scientists particularly interested in the matter.

A second subject I would like to discuss with you is chemical neutralization of chemical warfare agents, particularly organophosphorus agents and mustard. I am a member of the US National Academy of Sciences-National Research Council Committee on Alternative Chemical Demilitarization Technologies. I have responsibility for describing the experience of countries outside the US. My chapter of our report will include a series of tables summarizing some of the main features of each such experience. I enclose copies of my draft tables with the request that you let me have your comments and corrections for the two tables entitled Soviet Union-1 and Soviet Union-2.

I look forward to your response and to the possibility of meeting you in January.

Sincerely,

Matthew Meselson
Professor

Dear Martin,

Here is a draft of the article for Nature reporting epidemiological aspects of the Sverdlovsk outbreak. Publication quality figures are in preparation. If you would like photocopies of any of the references, let me know the numbers and I will send them.

The plan is to send the MS to Nature before the end of the year. I look forward to receiving your comments.

Martin,

Alex,

From urgu.quorus.e-burg.su!borisov@relcom.kiae.su Fri Sep 18 07:47:22
1992 Received: from relcom.kiae.su by techno.fuug.fi with UUCP id
AA03531 (5.67a/IDA-1.4.4 for msm@wjh12.harvard.edu); Fri, 18 Sep
1992 14:31:27 +0300 Received: by relcom.kiae.su; Fri, 18 Sep 92
13:03:29 +0300
Received: by quorus.e-burg.su; Fri, 18 Sep 92 14:05:12 +0400 (EBD)
Received: by urgu.quorus.e-burg.su (UUPC/@ v4.07 from Ache,
22Mar92); Fri, 18 Sep 1992 13:56:39 EBD

To: msm@wjh12

Message-Id: <ABrkOkqgY5@urgu.quorus.e-burg.su>

Organization: Urals State University

From: borisov@urgu.quorus.e-burg.su (Borisov Sergej)

Date: Fri, 18 Sep 92 13:56:37 +0600 (EBD)

Return-Receipt-To: borisov@urgu.quorus.e-burg.su

X-Mailer: BML [MS/DOS Beauty Mail v.1.25]

Status: R

Dear Dr. Meselson,

Here are our answers:

1. 96 autopsies were made in hospital 40, among them - 42 cases of anthrax, but the phrase "Abramova and Grinberg autopsied ..." is not exact as there were also other specialists involved.

2. In our letter we meant the manuscript that you are going to publish in the transactions of National Academy of Sciences of the USA and that you had sent to us. We are all looking forward to the completion of this very work. Kind regards to Jeanne!

With best wishes Lev Grinberg

Dear Martin,

Thanks for your questions and comments of 3 January. I should have final illustrations in about a week and hope to send the MS to Nature soon thereafter.

Again regarding authorship, I do not see the relevance of your indisputable statement about the importance of verifying the diagnosis, inasmuch as the verification is in four published papers, not in the present manuscript.

Neither do I think it relevant to authorship whether or not a colleague is hired. Popova is an academic sociologist who contributed importantly to the research reported in the present manuscript and to its design and analysis.

As to your questions:

1) According to Lev and Jerry Smith, Spirina had no necrotic nodes, little or no mediastinal fibrosis, and no haemosiderosis. Lev and Jerry both saw and agreed with the phrase in the MS that refers to her and the two others on the administrative list for whom their observations do not clearly support a diagnosis of anthrax.

2) Yes, 5 of the 10 tabulated survivors were found by interviewing persons on the Ilenko lists. contradictions?

3) Fedulov and Fedulova may not be a "domestic cluster" in the strict sense, as they both worked at the ceramics factory--itself a very large occupational cluster.

4) XX Poleshaeva is unlikely to be the daughter of YY Polezhaev. First, her patronymic is wrong. Second, the husband of Poleshaeva was extensively interviewed and made no mention of any other family member having had anthrax. Third, the address on the Ilenko list for VV Poleshaev is actually the address where YY Poleshaev lives with his wife XX.

5) A copy of the second Mishustina list is included.

6) What evidence have you in mind to support a higher LD50 of macaca fascicularis is higher than that of other monkeys? I have found no good data to support this. Jemski tells me that he tested 200 macaca rhesus and found LD50 to be 2,500, at least as sensitive as fascicularis. I would be glad to cite different values if they can be supported by publications or perhaps even personal communications based on sufficiently large-scale experiments with good dosimetry. In any case, jacking up the Jemski-Glassman curve to fit a two-fold increase in LD50, as you suggest, makes little change in the calculated attack rates, as one can also see intuitively. Assuming category E instead of D also doesn't make much difference on the centerline.

7) My calculations are for a single-spore aerosol, as produced in laboratory generators. For explicitness, I have added a reference to Henderson's 195x description of such a generator and its performance.

8) The "SIGMAY" in the BASIC program I sent you had an error: the term in the square root should be $1+X/10000$, not $1+X/1000$. This typo was noticed by Steve Hanna. Correcting it gives centerline dosages and attack rates not greatly different from those in the printout I sent to you. Incidentally, the TNO dosages are about twice as high as mine for the same assumptions about wind velocity and stability category. I will find out what model they have used--I assume it is different than the Briggs model I used.

9) Sheep are certainly one of the puzzles. The suggestion is, however, that whatever dose was received by pipe shop workers, the sheep received one or two orders of magnitude less. Lots to learn.

sheep breathing, yablokov, sverdlov, borisov, pageworks, fig 2 and fig 3, run with 10 m elevation, thank Hanna, phone medical Hanna re samples and MS. Kaplan. Rockefeller. Julian.

From mehj2020@bonnet.vetmed.lsu.edu Thu Aug 6 18:17:22 1992
Received: from bonnet.vetmed.lsu.edu by te6000.otc.lsu.edu (AIX
3.1/UCB 5.61/4.03) id AA47578; Thu, 6 Aug 92 17:17:02 -0500
Received: by bonnet.vetmed.lsu.edu (5.65c/1.920109)
id AA06966; Thu, 6 Aug 1992 17:14:24 -0500
Date: Thu, 6 Aug 1992 17:14:24 -0500
From: mehj2020@bonnet.vetmed.lsu.edu (MARTIN E HUGH-JONES)
Message-Id: <199208062214.AA06966@bonnet.vetmed.lsu.edu>
To: msm@wjh12
Subject: Update
Status: RO

Dear Mathew & Jean,

Alexis tells me that you are back! I thought that you would not return for another week or so. Hope that it was a good holiday.

You can see that I have joined the Internet-set. I am still learning so please excuse my frequent typos (no e) that scramble messages so well.

I have mapped the layout (poor pun) of cemetery area 14 by date, name, and route for each of the various live folk (AS, DW & Sasha, and MHJ) who walked around it. These I will get plotted shortly and share with you all.

I have plotted almost all the Russians dying on your masterlist against a correctly registered version of your SPOT image ... the three GPS fixes were adequate but only just; I will fax you a plot of the satellites for June 10th over Ekaterinburg so you can see, belatedly, why it was so difficult. Sergei is helping me by providing directions. This plot is being assembled in two versions: (a) Residence, and (b) Workplace. Each is subplotted by death dates (i) <4.21.79 and (ii) >4.20.79 as a crude indicator of possibly different exposures &/or causes.

I am presently working on the "H" documents in order to construct a master H-List that will include the (a) Confirmed & dead, (b) 022 and live, (c) rest. I have begun to plot this as well. It is very interesting but slow ... every graduate student seems to need help at this time ... you know the problem!

My working timetable for April '79 is as follows:

Monday 2nd: spore dispersal + weather
Tuesday 3rd:
Wednesday 4th: First onset of illness as per ?Besdenikh's numbers
Thursday 5th:
Friday 6th: possible first deaths in the night 6/7 at Hospital 20
Saturday 7th: deaths continue and are seen at Hospital 24
Sunday 8th: deaths continue
Monday 9th: Arenski's epidemiology course and city/oblast realisation
of problem
Tuesday 10th: Abramova confirms Romanov dying of anthrax
Wednesday 11th: Cultures reported positive
Thursday 12Th: Nikiforov Sr. arrives
Friday 13th:
Saturday 14Th: Olga arrives

I think that part of the interpretation problem is that each of our informants had a different starting day from which they recounted events as they wished to recall them . Thus Babich's Day 1 is not the same as Olga's.

Please give Jim Steele my best wishes and also to Alex.

Best wishes to you both,

Martin

Dear Martin,

Good talking with you yesterday. Here are the new workplace addresses I promised:

FATAL CASES

Abusagitov	Uralelektrostroy, 114 Selkorovskaya
Chapeyeva	Elevator plant, Elizavet Settlement
Chikalov	Not working, had a garden in Chimash
Dayanov	Elizavet
Klestov	Ceramics factory
Komelskikh	Ceramics, but on leave
Koshaleva	Kindergarten at Poldnevaya and Musorgskogo, may have showered at Ceramics factory
Krivstov	On leave from TRUD, near Ceramics. Visited wife at Ceramics factory.
Lozhkin	Verkh-Isetsky, tram stop V12. But was at a Chkalovsky military compound sometime in April.
Lyakhova	Brick factory on Pokhodnaya ulitsa
Lyzlov	URALMASH
Makarov	Sukholodgskaya
Nazarov	ELMASH. Said to have been at Compound 19 April 3-8.
Permyakov	UZPPM, Elizavet
Pilyasov	Ural Electrocommunication, 114 Selkorovskaya
Prokhorov	Uralchermetavtomaticheskaya, near Komsomolskaya ulitsa but had done annual military service at Compound 19 or 32 sometime in April.
Shatokin	On vacation from Telephone exchange on Bardina ulitsa.
Syskov	
Vyatkin	Not working. Was at assembly at Compound 32.

SURVIVORS:

Kazakov	Ceramics factory
Sterkhov	Rubber factory, tram stop RTI
Tolmacheva	Forest Industry Machinery Plant canteen, tram stop "lesmash" in Elizavet
Talashmanov	Ceramics

Additional workplace information is in Ilenko lists and in case records I obtained from Nikiforov. Let me know if you do not have the latter.

From mehj2020@bonnet.vetmed.lsu.edu Wed Aug 12 16:13:56 1992 Received:
from bonnet.vetmed.lsu.edu by te6000.otc.lsu.edu (AIX 3.1/UCB
5.61/4.03) id AA53416; Wed, 12 Aug 92 15:13:40 -0500
Received: by bonnet.vetmed.lsu.edu (5.65c/1.920109)
id AA00662; Wed, 12 Aug 1992 15:10:55 -0500
Date: Wed, 12 Aug 1992 15:10:55 -0500
From: mehj2020@bonnet.vetmed.lsu.edu (MARTIN E HUGH-JONES)
Message-Id: <199208122010.AA00662@bonnet.vetmed.lsu.edu>
To: msm@wjh12
Subject: Unknown sites
Status: R

Dear Mat,

Before I contacted Sergei I thought I might check with you just in
case you knew where the following places might be:

Streets ... Zvezdnaya, Gazorezchikov, Balakireva, Energetikov, &
Batalonnaya.

Factories ... Lesmash, Fabrica Trud, Knitting Factory, Building
materials

Polyclinics ... 2 and 3

Thanks but please reply!

Martin Hugh-Jones
WHO CC
346-3335

From mehj2020@bonnet.vetmed.lsu.edu Fri Aug 28 15:32:59 1992
Received: from bonnet.vetmed.lsu.edu by te6000.otc.lsu.edu (AIX 3.1/UCB
5.61/4.03)
 id AA13998; Fri, 28 Aug 92 14:31:46 -0500
Received: by bonnet.vetmed.lsu.edu (5.65c/1.920109)
 id AA01328; Fri, 28 Aug 1992 14:29:05 -0500
Date: Fri, 28 Aug 1992 14:29:05 -0500
From: mehj2020@bonnet.vetmed.lsu.edu (MARTIN E HUGH-JONES)
Message-Id: <199208281929.AA01328@bonnet.vetmed.lsu.edu>
To: msm@wjh12
Subject: The Empty Quarter
Status: R

Mat,

Call me Monday. I think I have the solution to why there is a large
block of
Chkalovski Rayon missing cases.

Have a good weekend.

Martin Hugh-Jones
WHO CC
346-3335

29 November 1993

Dear Martin,

Here is a draft of the epidemiology part of our report.

Your good letter of the 15th had the effect of accelerating the incorporation of our latest information. I look forward to receiving your comments and corrections.

Let me know the numbers of any items you would like to have from the reference list and I will send photocopies. I will also send some correspondence I have and some I expect soon to receive regarding atmospheric diffusion and dose-response. Regarding the former, I enclose a print-out based on the model described in the text, for use in computer-drawn isopleths.

Publication quality figures are in preparation. I hope to send the MS to *Nature* by the end of the year.

Do you agree that the Abramovo AKT means that on 11 April 125 sheep were vaccinated and that serum was given to 173 *other* sheep, for a total of 298? The alternative is that 125 sheep got vaccine plus serum and 48 got serum only, making a total of 173. I have assumed people on the scene understood that vaccine and serum can be mutually antagonistic, as indicated on pages 3 and 5 of the English translation.

Best wishes,

Matthew Meselson

13 August 1992

Dear Martin,

Good talking with you Tuesday. Here are some new workplace addresses, not listed on the "Master" list I gave you at the Brookings meeting:

FATAL CASES

Abusagitov	Ural electrocommunication, 114 Selkorovskaya.
Chapeyeva	Elevator plant, Elizavet Settlement. Near tram "Liftostroytelny". See your bus-tram map.
Chikalov	Not working. Had a garden in Chimash.
Dayanov	Construction materials works, last tram stop in Elizavet.
Klestov	Ceramics factory
Komelskikh	Ceramics, but on leave.
Koshaleva	Kindergarten at Poldnevaya and Musorgskogo, may have showered at Ceramics factory.
Krivstov	On leave from TRUD, near Ceramics. Visited wife at Ceramics factory.
Lozhkin	Verkh-Isetsky, tram stop V12. But was at one of the Chkalovsky military compounds sometime in April.
Lyakhova	Brick factory on Pokhodnaya ulitsa.
Lyzlov	URALMASH, tram stop UZTM square.
Makarov	Construction directorate, tram stop Sukholodgskaya. Address is 19 Sukholodgskaya, not to be confused with Compound 19.
Nazarov	Tram stop ELMASH. Said to have been at Compound 19 sometime during period April 3-8.
Permyakov	Construction materials works, last tram stop in Elizavet.
Pilyasov	Ural Electrocommunication, 114 Selkorovskaya.
Prokhorov	Uralchermetavtomatika, near Komsomolskaya ulitsa. Did annual military service at Compound 19 or 32 sometime in April.
Shatokin	On vacation from Telephone exchange on Bardina ulitsa.
Vyatkin	Not working. Did annual military service at Compound 32.

13 August 1992

Dear Martin,

Good talking with you Tuesday. Here are some new workplace addresses, not listed on the "Master" list I gave you at the Brookings meeting:

FATAL CASES

Abusagitov	Ural electrocommunication, 114 Selkorovskaya.
Chapeyeva	Elevator plant, Elizavet Settlement. Near tram "Liftostroytelny". See your bus-tram map.
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Lyakhova	Brick factory on Pokhodnaya ulitsa.
Lyzlov	URALMASH, tram stop UZTM square.
Makarov	Construction directorate, tram stop Sukholodgskaya. Address is 19 Sukholodgskaya, not to be confused with Compound 19.
Nazarov	Tram stop ELMASH. Said to have been at Compound 19 sometime during period April 3-8.
Permyakov	Construction materials works, last tram stop in Elizavet.
Pilyasov	Ural Electrocommunication, 114 Selkorovskaya.
Prokhorov	Uralchermetavtomatika, near Komsomolskaya ulitsa. Did annual military service at Compound 19 or 32 sometime in April.
Shatokin	On vacation from Telephone exchange on Bardina ulitsa.
Vyatkin	Not working. Did annual military service at Compound 32.

SURVIVORS:

Kazakov Ceramics factory.
Sterkhov Rubber factory, tram stop RTI.
Tolmacheva Forest Industry Machinery Plant canteen, tram
 stop "Sverdlesmash" in Elizavet.
Talashmanov Ceramics.

note: What I have called tram stops could in some cases be bus or train stops. They are easily found on the city transportation map.

I have located some of the places listed in your e-mail received this morning:

 Balakireva is a street three blocks long
 between Lyapustina and Diselni, ending on
Okrushnaya, the street of the Ceramics factory
main gate.

 One of the polyclinics, 2 or 3, is at tram stop
 "Polyclinica". My record of which is at Woods
Hole. I will let you know.

 The locations of Lesmash and Trud are given
above.

This morning I will telephone Gubanov who will probably be able to locate some of the remaining places, saving some work for Sergei. Then I will include whatever queries that are left in an e-mail that I am sending to Sergei this evening, with a copy to you. Please do send me whatever information you have received from Sergei.

Jeanne, Alex Langmuir and I are working at Woods Hole on a our group report, with publication in Nature in mind. We hope to be able to send you, Alexis, David and Olga a draft before the end of the month.

As we agreed in Ekaterinburg, in addition to our group report there should be specialist publications by individuals as they may wish. The AGYW manuscript, your effort and Jeanne's analysis of her interviews will be very solid contributions.

For the group report, we have mapped residences and workplaces on the street map and are doing the same on a scan of my SPOT photograph, but in a less sophisticated manner than what you are doing. We can decide later which map(s) are best for our group paper.

Warm regards,

Matthew.

cc: Alex, Alexis, David, Jeanne

22 Oct 92

Dear Martin,

Here is information on persons with numbers 65-68 on the new official list:

65	DYEDOV, Filipp Mikhailovich	age 70	died 412
	Severskiy 17 Pensioner		
66	SERGEEVA, Galina Pavlovna	age 55	
	Agronomicheskaya 36a-28		
67	ZHELNIN, Aleksandr Mikhailovich	age 26	
	Sovremennikov 27-40		
68	TISCHENKO, Valentina Ivanovna	age 22	
	Sovremennikov 27-37	age 22	

Ilona writes that Sovremennikov is in Compound 19.

I expect that it will be at least a month before Ilona has completed the control interviews. Perhaps a better way to find out about the other 54 autopsies is to ask Grinberg directly, which I shall do and let you have whatever he replies.

Meanwhile, best wishes for an enjoyable and productive journey.

As ever,

14 December 1992

Dear Martin,

Thanks for the very useful cross-checks and questions. Here are responses to your two lists:

LIST I

a) Borisov:

- 1) The Sovremennikov address is from the new official list. I expect to receive a copy of it by the time of my return from California ca. January 4 and will send a copy to you.
- 2) Yes, Compound 19. You are right to surmise that I have assigned all Compound 19 and 32 residents to workplaces in their respective compounds, without yet knowing whether this is correct in any individual case. I am trying to get detailed information on this, both from Ekaterinburg and from officials in Moscow.

b) See above.

c) Dyedov: The only source of onset date is an interview stating the 9th. The 10th was an error. Thanks for checking my SPOT map placements. They will all be refined and checked to give the final figure.

d) Komelskikh: The early Ilenko list of 5 gives the 9th; the interview gives the 10th.

e) Vyatkin: The 14th is from the death certificate.

Generic question: I too would generally place more reliance on primary hospital records and on the pathologists notes when there is conflict with other sources. Even here, judgement may be needed where there is reason to think that errors may have occurred in transcription, as appears to have occurred for autopsy cases 27 and 28. Also, I have not yet tried, by cross-checks, to analyze the reliability of the early list of 5 obtained from Ilenko. More to the point you raise, I will adopt a uniform criterion in the next edition of the data base summary. This was not done for the present edition.

f) Koshaleva: Yes, Olga's transcript of the pathologist's notes gives a death date one day later than does the grave marker.

g) Markova: No, Olga's notes and the grave marker both say the 17th. Why do you have the 13th?

h) Spirina. I agree that the 14th is more likely.

i) I.V. Makarov: Again, thanks for the map check.

j) Mochalova:

- (1) According to the interview, she went back and forth between the apartment of her niece and her apartment in Compound 32.
- (2) Pathologist's notes and interview both say she was 68.
- (3) There is ambiguity in the interviews here.

LIST II

Moscow: Thanks for the correction.

SPOT map: Again, thanks for the check.

Chernyaeva: Hospital designates the last hospital to which the patient was taken, even if dead. When two hospitals are designated, the second is the last.

Chizova: Cemetery and interview give death date as April 12 but the early list of 5 is gives the 11th. Interview suggests onset on the 10th but the early list of 5, being contemporary, could well be more accurate.

Danilov: Danilov said it was on his left shoulder.

Dayanov: A man, not a woman. **Where does the date of 501 come from?**

Fedulova: My arithmetic error. She was 68, not 78.

Komina: 410 is from the grave marker. According to interview, she worked from midnight to 8 AM.

Korsaev: The interview gave 411.

Kozlova: Yes, I used the grave marker Dex. As mentioned above, I need to decide how to use the list of 5 in data summaries.

Lavrov: No, we have only Olga's notes from Abramova with the street name, no number.

Loginova: Thanks.

Lyakhova: I must confess that I cannot now locate the source of the statement about being home April 1-5. The database entry is attributed A (=Abramova). I have 4 pages of Abramova notes, transcribed by Olga. How many do you have?

Maslennikov: Onset on 411 is from the interview.

Patrushev: The designation ZA means only a definite or probable survivor with indication of anthrax sufficient to justify trying to obtain an interview. The UZPPM workplace is just plain wrong, slipped

in from Permyakov!

Podgorbunskikh: Again, ZA is not meant to imply definite 022.

Poleshaev: Good question. Absent information to the contrary, I have drawn the line at 70 to get probable daytime location.

Romanov: Noted, but I have no information yet.

Syskov: Thanks.

Tretnikov: Fabrica TRUD is indeed at 82a Selkorovskaya, behind ceramics where I got out of the car to photograph. Why do you say I have placed TRUD at 114?

Volkova, Vostrikov and Zinatulin: To be refined as discussed above.

Birthdays: noted.

Thanks again.

I sent the revised AGYW manuscript to PNAS last week. Should be out early in the new year.

Best wishes,

Matthew Meselson

Dear Jan,

Here is a nearly final version of the manuscript for your comment and criticism. You will notice a few new bits of information and a little cleaning-up of the exposition.

The dosage contours will be based on the calculations I sent to you on.....

I am asking Steve Hanna about looping and source effects.

2 March 1993

Dear Dr. Nikiforov,

Thank you for allowing me to examine these slides that belonged to your father. As we agreed, I am returning the original slides in the green box, having made copies to keep at this university.

As you thought that the red and white box did not belong to your father and that it probably belonged to Abramova and Grinberg, I have sent it to them.

The paper that I edited and submitted to the Proceedings of the National Academy of Sciences (USA) by Abramova, Grinberg, Yampolskaya and Walker will be published later this month. I enclose a copy of the proofs for your interest. I believe that more detailed papers by Abramova and Grinberg will soon be published in Moscow in Archiv Path. I would of course be interested in any comments or suggestions you may have regarding this work.

Sincerely,

Matthew Meselson

1 December 1992

Dear Olga,

First of all, congratulations on becoming (a very young) GRANDMOTHER!
I just spoke with Sasha on the telephone so I can give you some news:

- 1) Daniel went today to his pediatrician. Everything is excellent.
- 2) Daniel weighs 4.8 kilos and his height is 56 cm.
- 3) He is good-natured but smiles more to himself than to other people (a sign of wisdom).

Sasha is working very hard on her courses. She will send photographs by the first of the new year.

Here are the comments on the AGYW manuscript that I recently sent to David. Please look the comments and the manuscript over carefully and let me know via e-mail (with the help of Boris Glotov) any changes you think should be made.

I also enclose a memorandum summarizing my thoughts about Professor Nikiforov's interpretation of the pathoanatomical findings. In Moscow in 1986, he projected and commented on at least one color slide that showed the thoracic region of a patient who died in the Sverdlovsk epidemic. He pointed out to me and the others present (you were there) that there were hemorrhagic throacic nodes. So he was definitely not ignoring or suppressing this observation. He said that the inside of the lungs was clean. Does this mean that Professor Nikiforov believed that true inhalation anthrax would be accompanied by visable lesions inside the lungs? What do you remember on this point? Even today we do not have adequate descriptions of the pathoanatomy of epidemiologically diagnosed gastrointestinal anthrax. Did Abramova conclude that it was inhalation anthrax already in 1979? Her 1982 manuscript with Grinberg shows only mesentery nodes, not thoracic ones.

I am still writing the manuscript for our next publication, the group report. It will summarize the pathoanatomy but will deal mainly with the epidemiology. For this, the interviews have been very important. From them we learned workplaces and other information about the probable daytime locations of those who died. When I plotted these locations on a map, I found that a significant proportion of them lie in a narrow band from the military compounds to the ceramic factory and beyond. There is still some more information to be mapped. If it follows the same pattern, it will be strong evidence that many or all of the fatal infections were wind born, not food borne. I will send you and the others my draft manuscript of the group report when it is completed.

With warm regards from Jeanne and me,

Dear colleagues,

Here is the final round of corrections, suggestions and comments for Abramova et al. Here too is the English translation of Derizhanov and some other items for your interest.

Please incorporate the corrections and make whatever revisions you think appropriate in view of the suggestions and comments. Then send me the MS on disk and also in hard copy for me to give to the editor of the Proceedings.

1) Abstract, para 1, first sentence. In his e-mail (enclosed) Lev Grinberg says it is very important to state the number of deaths was 64. We now understand the official list to include 68 names and there is also the unidentified man. It seems to me that the exact number is uncertain but if a number is given it should be qualified as "according to local authorities" or in some similar manner.

2) Abstract, para 1, second sentence. Unless there is adequate information about the pathology of gastrointestinal anthrax for proper differential diagnosis, would it not be more accurate to delete the bracketed words in "...consistently revealed [the] pathologic lesions [that are] diagnostic of inhalational anthrax..."?

3) Abstract, para 1 line 8. According to Lev Grinberg's e-mail, the number of cases is 20, not 22.

4) Abstract, para 1 line 9. According to Grinberg, the number of cases is 34, not 35.

5) Page 3, para 1, second sentence. About 3/4 of the addresses in the official list are in Chkalovskiy rayon give references and say reported to have been...Or else cite personal communication.

6) north northwest, not north northeast. give ref.

7) three publications

8) two of the russian palthologists

9) Page 4 recorded at the time, cultures taken at autopsy

10) confirmed, definitivelty documented...

11) evidenced, indicated.

12) Page 5, para 2, line 2. "...who died usually after a rapid course of 2-3 days duration (Table 1)." The data in the table do not support this conclusion. Fewer than half of the durations given there are in the range 2-3 days. Even leaving out the two longest courses, the average is 3.5 days. It would be correct simply to change 2-3 days

to 1-4 days, since well over half of the durations do fall in this range.

13) Page 5, para 3, first sentence. A correction in accord with Grinberg's e-mail would be to replace the sentence with "There were various manifestations of hematogenous spread of *B. anthracis* infection, including serohemorrhagic and hemorrhagic leptomeningitis in 21 cases (Figures 6 and 7)."

14) Page 6, para 2, line 4. Here and in legends 3,7,8 and 9 and in the Table, abbreviate *Bacillus* simply as *B*, having already spelled it out in the abstract and on page 3.

15) Dutz in his letter (enclosed) states that lesions of hematogenous origin occur in GI anthrax. Moreover, in his experience with gastrointestinal anthrax in Iran there need be no obvious lesion marking the entry site of the pathogen. Can it be ruled out that anthrax spores pass or are transported from the GI tract into the sub-mucosa and germinate there? If so, could some or all of the lesions in the Abramova-Grinberg series presently attributed to hematogenous spread result instead from such passage, originating in the GI tract?

16) qualify to normal lung in view of literature and to avoid contradiction with pneumonia cases.

17) Page 7, para 2, line 12. Reference number 9 should be included with the other references here.

18) explain why not to be expected. why not. crux of the diagnosis. not a pathology journal. pnas needs to convey to larger readership.

19) Page 7, para 2, line 10. "In three of the seven reported cases of the pathology of fatal inhalational anthrax published since 1960, ..." Actually, there are several additional cases that meet these criteria. See the following publications (photocopies enclosed):

Enticknap et al., Brit. J. industr. Med., 1968, **25**: 72-74;

LaForce et al., Arch. Environ. Health, 1969, **18** 798-805;

Vessal et al., Clin. Radiol., 1975, **26**: 471-474.

A search in MEDLINE might reveal additional cases, including some not in English. Please add additional cases as appropriate and specify that they include English-language articles only, if that is so.

20) Page 7, para 2. Is it correct that the intestinal lesions reported in most or all cases of epidemiologically supported inhalation anthrax are much less severe than the lesions of the Abramova-Grinberg series. If so, should this not be stated?

21) Page 8, para 2, starting at line 7. The generalization that patients who died after a course of 1 day or less usually did not develop signs is not supported by the data we have for patients on the Abramova-Grinberg list. We have relevant data for all 5 of the Abramova patients for which we have recorded durations of a day or less. The data run like this:

Ab#	duration	signs	source of info regarding signs
	5 1	dyspnea, cough	wife
	9 1	dyspnea	wife nurse
	13 <1	vomiting	wife
	37 1	stomach pain, nausea	sister in law
	40 1	cough, sneezing, bloody vomit	Abramova

Without reliable documentation, the statement about the time sequence of signs should be removed.

22) References 12 and 13. Please consider adding the following reference to an original paper reporting the findings cited in the text:

Smith, H. and Stoner, H.B. (1967) Fed. Proc. 26, 1554-1557.

23) Cutaneous cases

24) Table

25) Figures

26) Acknowledgements

cc: Drs. Abramova, Grinberg, Yampolskaya and Walker. Also Drs. Guillemin, Hugh-Jones, Langmuir, and Shelokov.

20 November 1992

Dear David,

Here is the final round of corrections, suggestions and comments for AGYW. Here too is the English translation of Derizhanov. You may see some things there you wish to cite. He defines and selects gastrointestinal cases by their lack of more widespread involvement, rather than on the basis of epidemiologic information. This may seriously bias his sample.

I greatly appreciate your patience in allowing me to take the time to have this unique and important manuscript reviewed with unusual thoroughness and to mull over it myself for so long. My only excuse for proceeding this way is that the paper will be of special importance to readers generally lacking the knowledge to evaluate the data and interpretations for themselves.

Please incorporate the corrections and make appropriate revisions after considering the suggestions and comments. Then send me the MS on disk and also in hard copy for me to give to the editor of the *Proceedings*, who has assured me of his interest in publishing it.

1) Abstract, para 1, first sentence. In his e-mail of 1 September (enclosed) Lev Grinberg says "it is very important" to state that the number of deaths was 64. We now understand the official list to include 68 names and there is also the unidentified man. It seems to me that the exact number is uncertain but if a number is given it should be qualified as "according to local authorities" or in some similar manner. Please do as you see fit.

2) Abstract, para 1, second sentence. Unless we have adequate studies of the pathology of gastrointestinal anthrax for fully reliable differential diagnosis, it would be better to omit the words here bracketed in "...consistently revealed [the] pathologic lesions [that are] diagnostic of inhalational anthrax..."

3) Abstract, para 1 line 8. According to Lev Grinberg's e-mail, the number of cases is 20, not 22. Please revise.

4) Abstract, para 1 line 9. According to Grinberg, the number of cases is 34, not 35. Please revise.

5) Page 3, para 1, second sentence. "...the vast majority of the cases have been traced to residence or work in a limited area on the southern edge of the municipality." It is true that we have traced about 85% of the cases to residence, work, assembly or other activity in Chkalovskiy rayon, about half so far in an apparent narrow plume as you have seen. But since the identification of workplaces and other non-residential locations comes almost exclusively from Jeanne Guillemin's extensive and ongoing interview project which she intends to publish in our group report and then elsewhere as original research, please either cite residence location only or else make reference to Guillemin, personal communication. Alternatively, since residence addresses appear on the official list given to us by Mishustina, no such reference is needed if you say something like "...the majority of the patients resided in a district on the southern edge of the municipality." So as to present the more exact picture in our group report without previous less exact descriptions from our study, I would prefer the second solution. But please revise one way or the other.

6) Page 3, para 1, sentence 2. "...a military facility located immediately north-northeast of where the major outbreak of cases occurred." Here too, the description of case locations developed by interview research should be left to our group report where it can be conveyed more completely and accurately and with explicit attribution. Could you not just say something like "...a military facility located in the district where the majority of patients lived." [Actually, the facility is north-northwest, not north-northeast.]

7) Page 3, para 2, second sentence. According to the enclosed letter of 15 September from Lev Grinberg and as he told us in Ekaterinburg, there were other pathologists in addition to Abramova and himself participating in the 42 autopsies leading to diagnoses of anthrax at Hospital 40. To reflect this, please refer to "...two of the participating pathologists (F.A.A. and L.M.G.)." rather than "...the Russian pathologists..."

8) Page 5, para 1. In his e-mail, Lev Grinberg says the culture identification was on 11 April. Please revise.

9) Page 5, para 2. Also in his 15 September letter Lev Grinberg confirms that there were 96 autopsies done by the pathologists at Hospital 40, of which 42 were diagnosed as anthrax. You may wish to indicate that the 42 are a sub-set selected from a larger number on the basis of a diagnosis of anthrax. Please do as you see fit.

10) Page 5, para 2, line 2. "...who died usually after a rapid course of 2-3 days duration (Table 1)." The data in the table do not support

this conclusion. Fewer than half of the durations given there are in the range 2-3 days. Even leaving out the two longest courses, the average is 3.5 days. It would be better simply to change 2-3 days to 1-4 days, since well over half of the durations do fall in this range. Please revise.

11) Page 5, para 3, first sentence. A correction in accord with that requested by Grinberg in his e-mail would be to replace this sentence with "There were various manifestations of hematogenous spread of *B. anthracis* infection, including serohemorrhagic and hemorrhagic leptomeningitis in 21 cases (Figures 6 and 7)." Please revise.

12) Page 5, para 3, second sentence. "Gastrointestinal lesions were observed in 39 cases..." Does this mean that there definitely were 3 of the 42 cases without gastrointestinal lesions or is there simply no data for some cases? For case 4, for example, there is no data in your notes. Please clarify.

13) Page 6, para 1. "Mesenteric lymph nodes demonstrated hemorrhagic necrosis in only 9 cases." Two important questions arise here. First, is this 9 out of 42 or were some cases not specifically examined for mesenteric nodes? Second, in addition to cases with hemorrhagic necrotic mesentery nodes, were there any cases with non-necrotic hemorrhagic or with serohemorrhagic mesentery nodes? Please clarify.

14) Page 6, para 2, line 4. Here and in legends 3,7,8 and 9 and in the Table, please abbreviate *Bacillus* simply as *B.*, having already spelled it out in the abstract and on page 3.

15) Page 6, para 3, second sentence. This description of the pathogenesis of inhalation anthrax conflicts with the finding described on page 5 of focal anthrax pneumonia in 11 patients. The careful reader will be puzzled. The contradiction could be avoided by inserting the word "normal", giving "The pathogenesis of *B. anthracis* infection that enters via the normal lung..." This would be in full accord with the view of Albrink that anthrax pneumonia can occur when there is pre-existing lung pathology but is not expected for the normal lung. A photocopy of his 1961 review chapter stating this view is enclosed. Please revise.

16) Page 7, para 1, second sentence. "These thoracic lesions are not expected to occur in toxemic cutaneous or intestinal anthrax." **As the principal statement in the manuscript invoking differential diagnosis, the basis for this expectation is crucial for understanding the reasoning that underlies the diagnosis of inhalation anthrax.** The great majority of readers of the PNAS will surely not know why such lesions are unexpected in gastrointestinal anthrax, especially since the manuscript records that more than 90% of the series have gastrointestinal lesions. Please explain.

17) Dutz in the letter you have states on the basis of his observations

of GI anthrax in Iran that there need be no visible entry site of the pathogen in GI anthrax. Instead, if he is correct, anthrax pathogen passes or is transported from the lumen of the GI tract into the blood vessels of the intestinal wall, causing intestinal hemorrhage. The hematogenous rather than primary appearance of the gastrointestinal lesions is therefor expected for GI anthrax. Considering that very few readers of the PNAS know anything about the pathoanatomy of anthrax, it should be stated explicitly that the hematogenous appearance of the intestinal lesions is not being cited as evidence against a gastrointestinal origin of infection, lest they badly misunderstand the real argument of the paper. Please consider this point and revise accordingly if you think it has merit.

18) Page 7, para 2, line 12. Reference number 9 should be included with the other references here.

19) Page 7, para 2, line 10. "In three of the seven reported cases of the pathology of fatal inhalational anthrax published since 1960, ..." Actually, there are several additional cases that meet these criteria. See the following publications (photocopies enclosed):

Enticknap et al., Brit. J. Industr. Med., 1968, **25**: 72-74;

LaForce et al., Arch. Environ. Health, 1969, **18** 798-805;

Vessal et al., Clin. Radiol., 1975, **26**: 471-474.

These papers describe a total of 4 additional cases, one of which had multiple acute stomach ulcers. Would this bring the tally to 4/11 with gastrointestinal lesions? A search in MEDLINE might reveal additional cases, including some not in English. Please revise as you consider appropriate and specify that the search extended to English-language publications only, if that is the case.

20) Page 7, para 2. The gastrointestinal lesions in the referenced cases of inhalation anthrax for which such lesions are reported appear to be much less severe than those generally seen in the present series. The present MS does point out, on page 8, that the hemorrhagic mesenteric lymph nodes in the present series were "less severely involved than the thoracic nodes". By the same token, if the intestinal lesions described in published cases of inhalation anthrax are substantially less severe than those seen in the present series, this too should be said. Please consider and revise as you see fit.

21) Page 8, para 2, starting at line 7. The generalization that patients who died after a course of 1 day or less usually did not develop signs is not supported by the data we have for patients on the Abramova-Grinberg list. We have relevant data for all 5 of the Abramova patients for which we have recorded durations of a day or less. The data run like this:

Ab#	duration	signs	source of info regarding	signs
	5	1	dyspnea, cough	wife
	9	1	dyspnea	wife nurse
	13	<1	vomiting	wife
	37	1	stomach pain, nausea	sister in law
	40	1	cough, sneezing, bloody vomit	Abramova

In view of this, I do not think we can be very confident of the statement about the time sequence of signs and suggest that it be removed. Let us wait until all of our clinical information, still being gathered, is assembled and checked. This may avoid having to include a correction in our group report.

22) Page 9, para 2, first sentence. You may wish to change the word "presentations" to "reports", since the elder Nikiforov did project and comment upon slides showing severe thoracic hemorrhage in Moscow in 1986, as noted on page 4 of my "Record of Meetings..." and in point 20 of my 1986 trip memo, at Appendix F of the enclosed.

23) Page 9, para 2, third sentence. It may be misleading to say that the number of cutaneous cases was small. The manuscript given to the State Department in 1988 says there were 17 and an interviewed surviving cutaneous case says the non-septic cases were not kept in the intensive care unit, where Olga worked. Until we know more, why not just say "Description of a number of cases of cutaneous anthrax...?"

23) References 12 and 13. Please consider adding the following reference to an original paper reporting the findings cited in the text:

Smith, H. and Stoner, H.B. (1967) Fed. Proc. 26, 1554-1557.

24) Table. Please delete the designation of the year 1979 from all of the dates in the body of the table. The title of the table adequately designates the year.

25) Table. The age of patient 26 is almost certainly 39 rather than the age 49 given in the table. Olga's notes say <40 and the grave marker date is 1 Sept, 1939.

26) Table. As noted in the MS, many of the ages given in the table are one year older than the age calculated from the actual birth date. Also the birth date of patient 13 according to his wife is 28 October 1934, making him 44 rather than 40. But in all of these cases, unlike the case of patient 26, the ages in the table accurately reflect Olga's notes of the pathologist's data and therefor presumably correspond to the pathologist's notes. Because of that, it may be best to leave these ages as they are, but please correct the age given for patient 26.

27) Table. In Olga's notes, the dates for patients 27 and 28 are in

May, not April. I have no additional information for 27 but the grave marker for 28 says April, in agreement with the table. I will try to get confirmation of ages and death dates in time for our group report and will correct any such errors there. For the present MS, please do as you see fit.

28) Table. Please delete the death date for patient 42. In addition to the serious doubts regarding a mid-June date raised by Alexis, the man was found already dead, making the exact date uncertain unless determined by a forensic autopsy.

29) Table. Please enter the various corrections received from Grinberg regarding meningitis as noted in the MS, both in the HEM MEN column and in the legend.

30) Table and abstract. In their ca. 1982 MS (enclosed), Abramova and Grinberg distinguish three degrees of lymphadenitis with increasing severity: serohemorrhagic, hemorrhagic and necrotic hemorrhagic. In the text of the present MS, reference is similarly made to serohemorrhagic lesions, hemorrhagic lesions and necrotic hemorrhagic lesions. But the table legend and abstract imply that all 42 cases had necrotic hemorrhagic thoracic lymph nodes. Is it correct to say that all 42 were necrotic hemorrhagic? If not, please revise.

31) Related to the above question is the description of mesenteric nodes on page 6, para 1. In addition to the 9 patients with "hemorrhagic necrosis" described there, were there additional patients with serohemorrhagic or hemorrhagic mesentery nodes? The important thing is to compare mesentery and thoracic nodal lesions according to the same criteria so far as possible. Please clarify and revise if appropriate.

32) Table. Several patients are recorded in the table as negative for meningitis even though no information regarding the brain is in your notes for them. In some of these cases your notes say "no brain exam". Please check this point for patients 4, 11, 16, 23, 26, 31, 34, 38, and 42. In cases where you have no information, please replace the minus with a question mark.

33) According to Olga's notes, there should be a minus rather than a plus in the Histology column for patient 36. Please revise if appropriate.

34) Figures. Please make sure the inset is in the intended figure and that the legends match. Also, you may want to crop some of the figures, possibly figure 2.

35) Please add to the Acknowledgements the following sentence: "This investigation was supported in part by a grant from the John D. and Catherine T. MacArthur Foundation to Matthew Meselson for a continuing study of the Sverdlovsk anthrax epidemic of 1979."

As soon as I receive the final MS, I will give it to the editor of the *Proceedings*. It should then appear in print within a few weeks. Thankyou so much for your essential contribution in this amazing study of the 1979 outbreak.

With best regards,

cc: Drs. Abramova, Grinberg and Yampolskaya. Also Drs. Guillemin, Hugh-Jones, Langmuir, and Shelokov.

23 August 1994

Dear Clyde and Tom,

Thank you for your letter of 4 August and accompanying memo of 28 July. In continuing our discussion, I will address four main topics:

- Spatial distribution of dosage for given source strength
- Attack rates
- Dose-response
- Source strength estimates

Dosage distribution. As Tom displays in Figure 1 of his memo, we are in quite close agreement regarding the centerline dosage per unit source strength (D/Q) over the entire range within which the models are empirically validated, *i.e.* out to about 10 Km downwind of the source.

In particular, throughout the interval that includes all of the anthrax patients mapped in my Figure 2 ($0.3 < x < 5$ Km), the D/Q values you calculate using the stability "D" Milly-Calder sigmas are approximately double those I obtained using the stability "D" Briggs sigmas.

Interestingly, the Milly-Calder D/Q values for stability "D" are almost identical to the Briggs values for stability "E". Am I therefore right to think that the difference between your D/Q values and mine comes about mainly because your sigmas are for a puff whereas mine are for a plume? This would be consistent with the crude rule that puff dosages can be approximated by plume dosages calculated for the next higher stability category.

If the release time at Sverdlovsk was short compared with the cloud travel time to a given site, a puff model would be appropriate. The travel time to the ceramics factory is about 10 minutes. Therefore, if the release lasted much less than that, I should have used a puff model. In that case, I would get essentially the same centerline D/Q values within the city that you obtain.

Incidentally, there is an error in your Figure 10. The correct Briggs sigma y curves for "D" and "E" cannot cross, being in the ratio 4:3 for all values of x . But the plot for my model in your Figure 1 is O.K.

Attack rates. The attack rate at the ceramics factory appears to have been about 2% for pipe shop workers and about 0.8% for those who worked in buildings west of the pipe shop. The later include anthrax patients who worked in the tile shop, maintenance shop, and cafeteria.

About a kilometer downwind from ceramics is an automotive maintenance and repair center with three patients (#45, 46, and 62 in Figure 2). From my cursory inspection of the place, I would guess there were 200-300 employees. The corresponding attack rate would be about 1%, subject to errors of sampling and ascertainment.

The area just north of ceramics had a residential population density of 10,000 per square kilometer. The part of it inside the outermost isopleth of Figure 2 covers 0.7 square kilometers. If 10% of the adult (age 21 and older) residents were present at the time of cloud passage, including pensioners, vacationers, sick, absentees, and unemployed, about 500 adults would have been present. Figure 2 shows 10 cases within the area in question, making an average attack rate of 2%. If some of the 8 who resided in the area but who I mapped at their workplaces elsewhere within the high-risk zone were actually at home when exposed, the average attack rate could have been about 3%.

Dose-response. The largest uncertainty we face is not in the spatial distribution of D/Q or in estimates of attack rates but rather in the relation between the number of viable spores inhaled and the probability of contracting inhalation anthrax. In order to illustrate the uncertainty, I used two very different dose-response relations in the manuscript: (1) log-normal with the current U.S. Army estimate of LD50 = 8,000 spores and the Glassman (1966) probit slope = 0.7 based on monkey data of Jemski and (2) independent spore action with LD50 = 45,000 based on monkey data of Druett *et al* (1953).

The log-normal distribution has the virtue of being able to take account of heterogeneity in susceptibility among individuals in the exposed population. This is particularly important at low attack rates like those at Sverdlovsk, where the more susceptible members of the population will be over-represented among those who contracted anthrax.

Considering the complexity of inhalation anthrax pathogenesis, it is reasonable to expect heterogeneity even in a laboratory population of monkeys. I used the Glassman-Jemski value of probit slope because it is based on by far the largest number of monkeys ever tested over a considerable range of dose and because correspondence and visits with Jemski and his former boss Bud Larson attested to the high quality and relevance of the work.

In view of the diversity of age, health status, breathing rate, occupation, and other factors characteristic of an urban-industrial population, one might expect more heterogeneity and a correspondingly lower probit slope for the Sverdlovsk human population than for laboratory monkeys. Nevertheless, there is no reliable way to estimate how much lower. But it should be noted that using a lower slope would have lowered my estimate of source strength.

The independent-action model of Druett is based on the reasonable assumption that spores act independently, not cooperatively. But the model takes no account of heterogeneity of susceptibility within a population. If, as is the case, the LD50 used in this model is measured at high attack rate, the neglect of heterogeneity will cause an

overestimate of the dose giving any given low attack rate. Because of this, I believe that the log-normal function is more appropriate for Sverdlovsk than the independent-action model. I included the latter in the manuscript, along with a high LD50 (45,000 spores), to illustrate an extreme high-end estimate.

Viewing the difference between the two models more abstractly, the independent-action model has only one adjustable parameter while the log-normal has two. A two-parameter function will generally allow more accurate extrapolation outside an experimentally measured range.

Source strength. Using my D/Q values for stability "D", a breathing rate of 30 l/min, and a log-normal dose-response relation with LD50 = 8,000, slope 0.7 probits/log dose, I obtain the following estimates of attack rate for source strengths of 4×10^9 and 10^{12} viable spores, respectively:

	$\frac{4 \times 10^9}{2\%}$	$\frac{10^{12}}{36\%}$	<u>observed</u>
Residential			2-3%
Ceramics factory	1.7%	33%	1-2%
Automotive	1.3%	29%	ca. 1%

The calculated rates for the residential and ceramics areas are for the average dose within each area. A more exact calculation would take the average of the rates rather than the rate for the average dose, but the error involved is not great.

Given the log-normal dose-response relation employed, the data fit well to a source strength of 4×10^9 but very badly to a strength of 10^{12} spores. In particular, 10^{12} spores predicts 700-800 cases at the three sites when there were only about 40.

The Abramovo sheep. Uncertainty in the sheep LD50 and in D/Q at distances much beyond 10 Km makes estimates of source strength based on the apparent sheep attack rate at Abramovo, 50 Km downwind, very untrustworthy. For that reason, I haven't previously made such estimates. Now I have done so and the result surprised me. Let us accept the statement of Young *et al.* (reference #38) that sheep are ten times more sensitive than monkeys, apparently tested in the same laboratory with the same methods. Young does not say what species of monkey he used. Plausibly it was rhesus. Jemski, using much better dosimetry than Young, found a rhesus LD50 of 2,500 spores, so take 250 spores as LD50 for sheep. Using a probit slope of 0.7, the apparent sheep attack rate at Abramovo (2%) then corresponds to a dose of 0.3 spores. Owing to the long travel time to reach 50 Km, a release lasting even as long as an hour is a puff. Therefore use Briggs sigmas for stability "E". For a breathing rate of 7.5 l/min, the corresponding source strength for 0.3 spores on the centerline is 4×10^9 spores!

While I have no confidence in this particular estimate, I do not think

there is any basis for arguing from the sheep data that the source strength was greater than values calculated from the human attack rates.

Question. Do you agree that 10^9 - 10^{10} viable spores, although uncertain, is a better estimate of source strength than 10^{12} - 10^{13} ?

Of course I agree that the weight of a release containing 10^9 - 10^{10} viable spores would be higher than 1-10 milligrams if the spores weigh more than a picogram each or if inviable spores or other materials are present.

Tom, if it is not much trouble, would you send me a plot of total dosage (in spores) for the atmospheric conditions of the plots in your memo but with source strength 10^{10} spores, $0 < x < 5$ Km, $-2.5 < y < +2.5$ Km, and isopleths drawn at 60, 30, and 15 spores? The relevant isopleths on the figures in your memo are too small to allow adequate comparison of your isopleth widths with mine. If your program doesn't let you go down to such small sources, any strength you specify will do just as well. Thanks.

I look forward to hearing from you about the above. Do you think it would be worthwhile to have a workshop on these and related matters, with a small group of experts in diverse fields relevant to assessment of airborne biohazards? If so, I would try to outline a possible agenda for further discussion. The objective would be to identify important uncertainties and to consider ways to resolve them.

Cordially,

Matthew Meselson

cc: Dr. J. Medema
Dr. S.R. Hanna

23 August 1994

Dear Clyde and Tom,

Thank you for your letter of 4 August and accompanying memo of 28 July. In continuing our discussion, I will address four main topics:

- Spatial distribution of dosage for given source strength
- Attack rates
- Dose-response
- Source strength estimates

Dosage distribution. As Tom displays in Figure 1 of his memo, we are in quite close agreement regarding the centerline dosage per unit source strength (D/Q) over the entire range within which the models are empirically validated, *i.e.* out to about 10 Km downwind of the source.

In particular, throughout the interval that includes all of the anthrax patients mapped in my Figure 2 ($0.3 < x < 5$ Km), the stability "D" Milly-Calder D/Q values you calculate are approximately double those I obtained using the stability "D" Briggs sigmas.

Interestingly, your Milly-Calder D/Q values for stability "D" are almost identical to the Briggs values I calculate for stability "E".

Am I right to think that the difference between your D/Q values and mine comes about mainly because your sigmas are for a puff whereas mine are for a plume? This would be consistent with the crude rule that puff dosages can be approximated by plume dosages calculated for the next higher stability category.

If the release time at Sverdlovsk was short compared with the cloud travel time to a given site, a puff model would be appropriate. The travel time to the ceramics factory is about 10 minutes. Therefore, if the release lasted much less than that, I should have used a puff model. In that case, I would get essentially the same centerline D/Q values within the city that you obtain.

Incidentally, there is an error in your Figure 10. The correct Briggs sigma curves for "D" and "E" cannot cross, being in the ratio 4:3 for all values of x . But the plot for my model in your Figure 1 is O.K.

Attack rates. As explained in the manuscript, the attack rate at the ceramics factory appears to have been about 2% for employees of the ceramics pipe shop and about 0.6% for employees who worked in buildings just west of the pipe shop. The later include anthrax patients who worked in the tile shop, maintenance shop, and cafeteria.

About a kilometer downwind from ceramics is an automotive maintenance and repair center with three cases (patients #45, 46, and 62 in Figure 2). From my inspection of the place, I would guess there were 200-300 employees. The corresponding attack rate would be about 1%, subject to errors of sampling and ascertainment.

The area just north of ceramics had a residential population density of 10,000 per square kilometer. The part of it inside the outermost isopleth of Figure 2 covers 0.7 square kilometers. If 10% of the adult (age 21 and older) residents were present at the time of cloud passage, including pensioners, vacationers, sick, absentees, and unemployed about 500 adults would have been present. Figure 2 shows 10 cases within the area in question, for an average attack rate of 2%. If all 6 [ck] who lived in the area but who I mapped at their workplaces elsewhere within the high-risk zone are included, the average attack rate would be about 3%.

Dose-response. The largest uncertainty we face is not in the spatial distribution of D/Q or in estimates of attack rates but rather in the relation between the number of viable spores inhaled and the probability of contracting inhalation anthrax. In order to illustrate the uncertainty, I used two very different dose-response relations in the manuscript: (1) log-normal with the current U.S. Army estimate of LD50 = 8,000 spores and the Glassman (1966) probit slope = 0.7 based on monkey data of Jemski and (2) independent spore action with LD50 = 45,000 based on monkey data of Druett *et al* (1953).

The log-normal distribution has the virtue of being able to take account of heterogeneity in susceptibility among individuals in the exposed population. This is particularly important at low attack rates like those at Sverdlovsk, where the more susceptible members of the population will be over-represented among those who contract anthrax.

Considering the complexity of inhalation anthrax pathogenesis, it is reasonable to expect heterogeneity even in a laboratory population of monkeys. I used the Glassman-Jemski value of probit slope because it is based on by far the largest number of monkeys ever tested over a considerable range of dose and because correspondence and visits with Jemski and his former boss Bud Larsen [ck] attested to the high quality and relevance of the work.

In view of the diversity of age, health status, breathing rate, occupation, and other factors characteristic of an urban-industrial population one might expect more heterogeneity and a correspondingly lower probit slope for the Sverdlovsk population than for laboratory monkeys, but there is no reliable way to take this into account. But it should be noted that using a lower slope would have lowered my estimate of source strength.

The independent-action model of Druett is based on the reasonable assumption that spores act independently, not cooperatively. But the model takes no account of heterogeneity of susceptibility within a population. If, as is always the case, the LD50 used in this model

is measured at high attack rate, the neglect of heterogeneity will act to overestimate the dose causing a low attack rate. Because of this, I believe that the log-normal function is more appropriate for Sverdlovsk than the independent-action model. I included the latter in the manuscript, along with a high LD50 (45,000 spores) to illustrate a high-end estimate.

Viewing the difference between the two models in a more abstract way, the independent-action model has only one adjustable parameter while the log-normal has two. A two-parameter function will generally allow more accurate extrapolation outside an experimentally measured range.

Source strength. Using my D/Q values for stability "D", a breathing rate of 30 l/min, and a log-normal dose-response relation with LD50 = 8,000, slope 0.7 probits/log dose, I obtain the following estimates of attack rate for source strengths of 4×10^9 and 10^{12} viable spores, respectively:

	4×10^9	10^{12}	observed
Ceramics factory	2%	36%	1-2%
Automotive	1.1%	26%	1%
Residential	2%	36%	2-3%

Given the log-normal dose-response relation employed, the data fit well to a source strength of 4×10^9 but very badly to a strength of 10^{12} spores.

Last November, Jan Medema sent me the enclosed letter and some casualty calculations done at TNO. He used an atmospheric dispersion model for a puff and a log-normal dose response with LD50 = 4,100 spores and a probit slope of 0.69. For stability "D", the source strength indicated by the observed attack rates is about 10^9 spores.

The Abramovo sheep. Uncertainty in the sheep LD50 and in the dosage at distances much beyond 10 Km makes estimates of source strength based on the apparent sheep attack rate at Abramovo, 50 Km downwind, very risky. For that reason, I haven't previously made such estimates. Now I have done so and the result surprised me. Let us accept the statement of Young *et al.* (reference #38) that sheep are ten times more sensitive than monkeys, apparently tested in the same laboratory with the same methods. Young does not say what species of monkey he used. Plausibly it was rhesus. Jemski, using much better dosimetry than Young, found a rhesus LD50 of 2,500 spores, so take 250 spores as LD50 for sheep. Using a probit slope of 0.7, the apparent sheep attack rate at Abramovo (2%) then corresponds to a dose of 0.3 spores. Owing to the long travel time to reach 50 Km, a release lasting even as long as an hour is a puff. Therefore use Briggs sigmas for stability "E". For a breathing rate of 7.5 l/min, the corresponding source strength for 0.3 spores on the centerline is 4×10^9 spores!

While I have no great confidence in this particular estimate, I do

not think there is any basis for arguing from the sheep data that the source strength was greater than values calculated from the human attack rates.

Question. Do you agree that 10^9 - 10^{10} viable spores, although uncertain, is a better estimate of source strength than 10^{12} - 10^{13} ?

I of course agree that the weight of the release containing 10^9 - 10^{10} viable spores would be higher than 1-10 milligrams if the spores weighed more than a picogram each or if inviable spores or other materials were present.

Tom, if it is not much trouble, would you send me a plot of total dosage (in spores) for the atmospheric conditions of the plots in your memo but with source strength 10^{10} spores, $0 < x < 5$ Km, $-2.5 < y < +2.5$ Km, and isopleths drawn at 60, 30, and 15 spores? The relevant isopleths on the figures in your memo are too small to allow adequate comparison with mine. If your program doesn't let you go down to such small sources, whatever strength you specify will do just as well. Thanks.

I look forward to hearing from you about the above. Do you think the time has come to have a workshop on these and related matters, with a small group of experts in diverse fields relevant to airborne biohazard assessment? The objective would be to clearly identify important uncertainties and to consider ways of attacking them. If a classified discussion would help such an endeavor, I hold top secret clearance. If you think the possibility is worth pursuing, I would try to outline a possible agenda for further discussion.

Cordially,

encl.

cc: Dr. Jan Medema
Dr. S.R. Hanna

2 September 1994

Dear Clyde and Tom,

Thank you for your fax of yesterday. I hope you succeed in generating enough interest for a working meeting on the infectivity problem. If there is anything I can do to help, either here or possibly through the NAS, I'd be glad to.

Earlier today I mailed to each of you a copy of a note from Ian Medema and some dosage and mortality calculations done at TNO for a puff of 10^{10} spores.

TNO's "yellow book" model for neutral stability predicts higher centerline dosages than does the model I used, over the entire range from 0.1 to 50 Km. The dosage ratio between the two models goes from about 2.5 in the city down to about 1.3 at 50 Km. I suppose that part of the difference is the puff-plume difference we have discussed and part is the slightly lower wind speed TNO used.

Here for your interest is a copy of a letter that came today from Steve Hanna. He offers to put together a list of references to tracer experiments. You had mentioned that you might also do this, so you may wish to get in touch with Steve.

Tom, either I lost your figures 15 and 16 or they did not get transmitted. In any case, they would have been affected by the error in sigmas. Would you mind sending me a set of all the corrected figures?

SCIENCE has accepted our manuscript, subject to a little shortening which can be done without damage. After going the rounds with NATURE, which wanted an unacceptably large cut, I am most relieved now that publication is assured.

I really value the discussion we have got going and look forward to continuing it in hopes of clarifying some of the concepts and data, especially as regards infectivity.

Best regards,

1. WHAT WAS THE HUMAN ATTACK RATE AT GIVEN LOCATIONS?

A. ASSUME EXPOSURE OCCURRED DURING NORMAL DAYTIME WORKING HOURS AND THAT CERAMICS FACTORY PATIENTS WERE EXPOSED AT THE FACTORY. [THIS IS THE ASSUMPTION IN BEST AGREEMENT WITH WHAT WE KNOW.] THE CORRESPONDING RATE IS 1-2%, THE HIGHER VALUE CHARACTERISTIC OF THE PIPE SHOP.

B. ALTERNATIVELY, ASSUME EXPOSURE OCCURRED OUTSIDE OF NORMAL DAYTIME WORKING HOURS AND THAT MOST PATIENTS WERE EXPOSED AT OR NEAR THEIR HOMES. [I KNOW OF NO EVIDENCE FOR THIS ASSUMPTION AND CONSIDERABLE EVIDENCE AGAINST IT.] THE TRIANGULAR RESIDENTIAL NEIGHBORHOOD NORTH OF THE CERAMICS FACTORY HAD A POPULATION DENSITY OF 10,000/SQUARE KM AND AN AREA OF ABOUT 0.5 KM² WITHIN THE OUTERMOST ISOPLETH OF FIGURE 2. TWENTY PATIENTS RESIDED IN THE AREA. THE CORRESPONDING RATE IS 0.4%

CONCLUSION: UNDER THE MUCH MORE WELL-SUPPORTED ASSUMPTION (A), WE OBTAIN A HIGHER SOURCE STRENGTH THAN UNDER ASSUMPTION (B).

2. IN TERMS OF Q, THE SOURCE STRENGTH, WHAT WAS THE INHALED DOSE AT THE PIPE SHOP AND IN THE RESIDENTIAL TRIANGLE?

A. JAYCOR AND MM ESSENTIALLY AGREE IN THEIR ESTIMATES OF DOSAGE AS A FUNCTION OF SOURCE STRENGTH AND LOCATION.

B. TAKE THE DOSAGE AT THE PIPE SHOP WORKERS AND IN THE RESIDENTIAL TRIANGLE TO BE INTERMEDIATE BETWEEN THE TWO ISOPLETHS OF FIGURE 2. ASSUME THE BREATHING RATE TO BE 30 LITRES/MIN. THE DOSE IS THEN $4.4Q \times 10^8$ SPORES.

3. USING THE ABOVE DOSE OF 4.4×10^{10} SPORES AND ATTACK RATES OF 2% AND 0.4%, WHAT IS THE ESTIMATED SOURCE STRENGTH FOR THREE DIFFERENT MODELS OF DOSE-RESPONSE? THE MODELS ARE:

MODEL A: LOGNORMAL WITH LD50 = 8,000, SLOPE 0.7.

MODEL B: INDEPENDENT SPORE ACTION WITH LD50 = 8,000.

MODEL C: INDEPENDENT SPORE ACTION WITH LD50 = 45,000

SOURCE STRENGTH IN MILLIGRAMS

ATTACK RATE	MODEL A	MODEL B	MODEL C
2%	4 MG	100 MG	580 MG
1%	1.7 MG	51 MG	290 MG
0.4%	0.6 MG	20 MG	115 MG

Dear Dr. Hanna,

After some delay, here is the essentially final draft of our manuscript for *Nature* about the epidemiology of the Sverdlovsk anthrax outbreak. I am indebted to you for your advice on its discussion of atmospheric diffusion, as acknowledged at the end of the piece.

If you care to look over the text, I would value your comments, especially on the accuracy, completeness, and wording of the meteorological parts and your advice on a number of specific points:

- 1) Is the choice of atmospheric stability category "D" appropriate for the specified wind speed (5 m/sec), cloud cover (none), and mid-day sun elevation (39°).
- 2) Is the choice of Briggs' open terrain values for the sigmas appropriate?
- 3) Assuming that the 5 m/sec wind speed reported from the airport was measured 10 meters above the surface, should I use 5 m/sec for the diffusion calculations?
- 4) What do you think of my simply ignoring source effects, giving dosage contours only beyond 300 m?
- 5) I enclose a crude sketch of the surface elevation along the plume centerline. The source is on a gentle rise, 20 m above the residential area and about 30 m above the ceramics factory. Then there are gentle ups and downs in the countryside beyond. Do any of these terrain features matter?
- 6) Should I consider looping? Can it be caused by the undulations in surface elevation? Or by patches of snow that may have stood on north-facing slopes?
- 7) I have assumed that deposition was too slight to cause appreciable deposition of the plume out to at least 50 km. Is this reasonable? About half or a third of the path between 10 km and 50 km is pine forest.
- 8) I have included my calculations of dosage and attack rate, in case you want to look them over.

Sincerely,

8)

This is the beginning of microtape 2 and I'll record a little bit of what you already have on microtape 1 from Alexis Shelokov so that there will be some overlap.

...marbled pallor of the skin.

As a rule, small intestinal loops appeared collapsed with characteristic strangulations and diverticuliform dilatations, particularly in the ileum where the intestinal wall is discolored dark red or yellowish green. Sometimes, especially in the jejunum, post mortem invaginations may be found. Rarely there is a scant serous or seroso-hemorrhagic exudate in the peritoneal cavity.

The most characteristic and constant changes are present in the mesenteric lymph nodes. On sectioning, these nodes may resemble a blood clot or a blood-porridge-like mass. Capsules of some lymph nodes may be intact and their border may be more clear cut. In addition some small lymph nodes with turgid grey or grayish-red color may be found; when sectioned, the cut surface appears juicy and grainy.

No such lesions were found in the peripheral lymph nodes. On the basis of morphologic changes, three types of anthrax lymphadenitis can be distinguished: (1) serous and seroso-hemorrhagic; (2) hemorrhagic; and (3) necrotic-hemorrhagic.

1. In serous and seroso-hemorrhagic lymphadenitis, the histological pattern of the affected lymph nodes is indistinct; there is diffuse and sinus edema with marked dilatation of peripheral and to a lesser extent of the intermediate and central sinuses in which macrophages and erythrocytes can be found, which constitutes a picture of what is called sinus catarrh. The lymphatic follicles are absent altogether or are preserved for to survive as little nodules without reactive centers. When the follicles are preserved their center may show cellular necrosis. The cellular elements here may be unusual: macrophages and monocytes predominate, with many less lymphocytes. Capillaries, venules, and veins are full, distended with blood, and with red blood cell casts. The capsule may be intact but somewhat edematous. Almost always anthrax bacilli in variable numbers can be found here, most often extracellularly in the marginal sinuses and less commonly in the cytoplasm of macrophages, and finally only very rarely within the granulocytes.

2. In acute hemorrhagic lymphadenitis the characteristic sign is erythrocyte infiltration of the lymph node with cellular necrobiosis against the background of edema, hyperemia, disruption of the histostructure, and reduction of the lymphoid follicles.

My second sentence of the opening paragraph is something like polynuclear cells and ??? may be found.

Intact erythrocytes seen in places, but in others only their ghosts are seen and in still other places sometimes erythrocytes aggregate

to form an oxyphilic mass in which erythrocyte contours may be traced. Among the degenerating and intact erythrocytes there are macrophages, which comprise a major portion of the cellular component of the lymph node. Some of the macrophages are degenerating and lysed, therefore cell ghosts and chromatin grains may be discerned in the lymph node. The capillaries and veins are dilated, filled with blood with erythrocyte stasis and red blood cell casts. The capsule fibers are disarranged and the capsule is edematous, infiltrated with erythrocytes, and the capsule fibers are deranged. There is periadenitis with edema and slight hemorrhagic infiltration of the adjoining connective tissue.

The anthrax bacilli were seen occasionally, mostly extracellularly in the lumina of sinuses and of blood vessels, and also in the fissures between the tissue layers but rarely in the cytoplasm of macrophages and most infrequently within the granulocytes.

(3) In necrotic-hemorrhagic lymphadenitis there is a complete loss of histological structure of the lymph node; the node becomes a structureless, homogenous, or on the other hand, lumpy oxyphilic mass which may show areas of erythrocytes that have aggregated and have been damaged by alkaline pH (?). There may be seen fibrin threads, nuclear dust, brown pigment (hemerosiderin, hematin, formalin pigment). Cellular elements are totally absent or may appear as small islands of cells. These islands comprise macrophages, lymphocytes, and granulocytes. If routine staining technique is used, the stroma, blood vessels and the capsule of the node will not be seen. Using a stain specific for elastic and collagen fibers, fragments of elastic and collagen carcass can be visualized, which makes it possible to trace markedly dilated and sometimes thrombosed blood vessels with necrosis and ruptures of the vessel walls. Necrotic-hemorrhagic lymphadenitis is constantly associated by marked periadenitis with infiltration of perinodular connective tissue by a hemorrhagic exudate, sometimes mixed with fibrin and leukocytes. Anthrax bacilli are practically never detected in microscopic sections.

Sometimes signs of macrophage regeneration can be seen within the lymph nodes; viz a large number of monocytes and large mature macrophages, within which mitotic and amitotic nuclear division can be absorbed forming multi-nuclear cells, that is symplasts. The cytoplasm of such cells may contain large granules fragmented anthrax bacilli, and erythrocytes.

Lesions the large intestinal tract are found many in the jejunum and ileum and the stomach, and more rarely, the upper part of the large intestine. Lesions are the pharynx and of the root of the tongue were found very rarely, but when present they were characterized by edema and focal hemorrhages. Faucial (palatine) tonsils were not affected. The esophagus, sigmoid colon, and rectum were not affected.

Lesions in the gastrointestinal tract were of two types: more commonly, the pathogenetic process was clearly focal and much less frequently it was diffuse. In focal form in the walls of the stomach, small and large intestines there are numerous dark red rounded (oval?) foci,

measuring from 0.3 to 3.0 and more centimeters in diameter, each with a grayish, centrally depressed carbuncle. Smaller lesions are located in the mucosa and the submucosa while the larger ones penetrate all the layers of the wall of the organ. These focal lesions do not involve the lymphoid network of the intestine.

In the diffuse form, the intestinal wall is edematous, jelly-like in appearance, swollen and with prominent thickened rugae. Against the background of diffuse enterocolitis, small individual dark red lesions may be seen. The stomach contents are hemorrhagic or look like "coffee grounds". The contents of the small intestine is always mixed with blood, is usually scant in amount and is found on the intestinal walls because it sticks to the mucosa. The contents of the large intestine are not abnormal. Intestinal paresis is found only in exceptional cases. When there is widespread involvement of the gastrointestinal tract by focal lesions, mastadenitis may develop with the mesentery of the small intestines appearing edematous, jelly-like, yellowish with enlarged dark red lymphatic nodes.

Histological structure of the lesions in the focal and the diffuse involvement of the gastrointestinal tract is appropriate to the seroso-hemorrhagic and the necrotic-hemorrhagica forms of gastro enterocolitis.

The structural unit of focal necrotic-hemorrhagic gastroenterocolitis is the carbuncle, which comprises (1) a developing necrotic focus that contains anthrax bacilli and (2) a perifocal zone of seroso-hemorrhagic inflammation; the structure (? of the carbuncle) is essentially the same in all segments of the gastrointestinal tract.

In small, more recent foci the necrosis and necrobiosis are limited to the superficial layer of the mucosa without (marked) degeneration within these foci. Outlines of villi and of epithelial cells can be discerned, as well as contours of the blood vessels. Anthrax bacilli can be identified in the lumina of the blood vessels, on the surface of the villi and within the crypts.

In larger foci the necrosis extends to the muscularis of the intestinal wall appearing as an oxyphilic structureless mass with lumps of chromatin and grains of a hematogenous pigment.

Anthrax bacilli can almost always be found within and at the surface of these necrotic masses. Necrosis may even involve almost the entire thickness of the intestinal wall. Such necrotic masses are saturated with a homogenous bloody exudate with grains of a brown pigment. Anthrax bacilli are not found in these areas but can be detected at the periphery of the focus within the fissures between the layers of the edematous mucosa, on the surface of the denuded villi and in the blood vessel lumina. At the periphery of a focus the wall is edematous and saturated with a hemorrhagic exudate which contains degenerating erythrocytes, filamentous, and aggregated fibrin, as well as leukocytes, monocytes and macrophages.

When anthrax carbuncles are found in the intestinal wall, the blood

vessels are affected not only within the carbuncle itself, but well beyond its margins. There is marked dilatation of capillaries, venules, and veins with stasis and aggregation of erythrocytes, as well as fibrinous necrosis and rupture of blood vessel walls, phlebitis and thrombophlebitis.

top page 19??? Acute diffuse catarrhal-hemorrhagic enteritis and enterocolitis are characterized by the presence of edema of the submucosa, sometimes so marked as to make the intestinal wall several times thicker than it should be; the intestinal mucosa is thinned out, the villi are flattened and partially denuded of the epithelium. The edematous and hyperemic intestinal wall is infiltrated with erythrocytes, as well as a few leukocytes, mononuclears, and macrophages. The capillaries and veins are greatly dilated, filled with blood and at times look like "lakes of blood", filled with a homogenous oxyphilic plasma and occasional erythrocytes. There is fibrinous necrosis of arteriolar walls with leukocytes at the periphery (and leukostasis).??

In diffuse enterocolitis, and unlike the focal form of the disease, anthrax bacilli are not commonly detected by microscopic examination of stained preparations. The bacilli are rather seen free on the surface of the denuded villi, in the intestinal lumen in the slough of epithelial clumps and intestinal secretions, within the crypts, in the mucosal stroma, in the edema fluid of the submucosa, and (finally) in the lumina of blood and lymphatic vessels.

Furthermore, in anthrax gastroenteritis there is considerable involvement of myenteric plexi which practically disappear from the area of the carbuncle.

tape 3A:

In the diffuse form of the disease, the intramuscular neuroplexi cannot be detected even in between the individual carbuncles. The filaments of neural ganglia are deranged, the few remaining ganglion cells are undergoing pycnosis and lysis. There is apparent suppression and reduction of the lymphoid tissue with lymphocytic karyorrhexis in the Peyer's patches and solitary follicles. [I'll now make an aside comment - notice that in the Russian text at this point an entirely different typewriter was used, typed at a different time and plastered together because the margins are different and the style and the language completely changes. I would imagine that (he names Russian names).]

Epidemiological investigations of foci of the disease was conducted by epidemiologists from the city and rayon sanitary-epidemiological stations. To help control the disease as promptly as possible, city and factory and newspapers were asked to publish articles suggesting to the citizens of Sverdlovsk to search for and destroy by burning all the meat purchased from the unofficial markets. Similar appeals to the population were broadcast by the local radio station while physicians discussed the means of protection against infection in the settlements (?), industrial concerns and factories.

Police checkpoints were set up on major highways connecting Sverdlovsk with the rayon centers; they were responsible for confiscating from public transport vehicles (trucks) and from individual citizens the meat that was being brought to the city; they were also responsible for burning it at a designated site.

Special (sanitary) brigades were responsible for disinfection of the (known) foci of infection, primarily utilizing disinfecting solutions.

Members of the patients' families were given antibiotics for emergency prophylaxis prescribed in accordance with (official) instructions.

Bodies of the deceased patients were buried in a special section of the (local) cemetery. Burials were conducted in compliance with (official) instructions.

Three of the measures undertaken by the veterinary service proved effective; the quarantine program, disinfection of (known) foci, and mass immunization of animals. No cases of anthrax among domestic or wild animal populations were observed in the ensuing years.

CONCLUSIONS

There are four conclusions:

1) The anthrax outbreak was preceded by an epizootic which affected livestock in 8 villages and certain suburban areas. Animal cases were first observed after they were fed a mixed feed with added meat-and-bone meal. Ten isolates of Bacillus anthracis were obtained from samples of feed collected on farms where cattle had died. The properties of these strains did not differ from the strains isolated from animal carcasses, including dogs, meat, patients, bodies of the deceased patients, and from soil samples collected at the cattle burial grounds.

2) The human outbreak developed slowly and lasted a while between April 4 and May 18 96 cases with 64 deaths (%) were reported. The disease involved adults. Only one child, 6 years of age, became ill. The source of infection was meat purchased at unofficial markets. The anthrax bacillus strains isolated from the meat did not differ from strains isolated from other

3) Meat identified as having been bought on the unofficial market or unofficially brought into the city from other rayons, was confiscated and burned. Cold boxes and other facilities used to store the meat were disinfected with chlorine containing solutions. Kitchens and kitchen utensils lodgings of patients were also disinfected

4) carcasses of dogs that have succumbed to the disease as well as trash and animal wastes were also burned.

mid p 24 signed burgasov maybe. cannot tell.

22 February 1988.

17 references

EPIDEMIOLOGICAL ANALYSIS OF THE ANTHRAX OUTBREAK IN SVERDLOVSK

Prof. I.S. Bezdenejnyh

Prof. P.N. Burgasov

Prof. V.N. Nikiforov

Anthrax is distinguished among animal diseases for its wide geographic distribution and its grave outlook. The disease is often fatal for animals of many wild and domestic species. Anthrax-contaminated soil can create sites that remain unsafe for prolonged periods of time.

Anthrax has been known since ancient times. The Bible (Exodus, the six plague) describes epizootics in horses, donkeys, camels, mules, and goats from an anthrax-like disease, and also human deaths from "malignant black spots" (Sobernheim 1931).

Ancient Greek and Roman writers knew anthrax as "ignis sacer -- sacred fire". Ancient Arab physicians called it "ignis persicus -- Persian fire". According to Homer (The Iliad, book 1), anthrax occurred among the Greek troops and pack animals during the siege of Troy. Ovid (Metamorphoses VII) mentions similar events. Virgil (Georgics) noted that it was "forbidden to skin dead oxen because it was not possible to purify them either with air or by fire. It was also forbidden to shear sheep or use their poisoned wool, or even touch

this spoiled wool (Bashenin, 1955).

The historian Pliny the Senior stated that in the first century of our era, anthrax was common in the Narbonne Gaul (Southern France) from where it was brought to Italy in 164 AD. Two Roman consuls died of this disease. In subsequent centuries, anthrax affected more and more new countries and continents. In 896 and 922 AD, there were epizootics among cattle, sheep and pigs in all the countries of Europe.

Large anthrax epizootics occurred in Germany in 1375-1376. In the 18 century, there were violent anthrax epizootics in Europe and Siberia (Gromashevskiy and Vindrakh, 1947). According to Athanasius Kirsher (1658), some 60 thousand people died of anthrax in 1607 in central Europe (Sobernheim, 1931). In 1649, when a large anthrax epidemic broke out in Moscow, Tzar Alexey Mikhailovich issued a decree forbidding citizens to dump animal carcass into Moscow streets (Metelkin, 1960).

Anthrax is common in many countries of the world. In 1961, anthrax epizootics occurred in 27 European, 17 Asian and in 20 other countries including some in Africa, as well as Australia, the USA, Argentina, Brazil, Uruguay, and Venezuela. In 1962, new foci of infection were also recognized in Greece, Turkey, Iran, France, Italy, and Spain. Thirty European countries including the USSR annually report their animal anthrax outbreaks to the International Epizootic Organization in Paris. During 1971-1980, 13,068 epizootics were reported, of which

3733 were in Greece, 3127 in Turkey, 2607 in the USSR, 643 in Great Britain, and 582 in Italy. The most recent epizootic in the United States occurred in 1976, when 160 cattle and horses died in Texas before adequate vaccination could be accomplished.

Analysis of existing data on the epizootiology and epidemiology of anthrax shows there is a direct relationship between cases in humans and current or preceding epizootics. Such a relationship can be illustrated by examining the anthrax situation in Tsarist Russia during the period of 1900-1914 (Figure 1).

[figure legend: Anthrax morbidity in Russia in humans (1) and animals (2) (Mikhin, 1942).]

Incomplete data for the period 1896-1913 indicate that 267,505 people in Russia contracted anthrax (on the average 15 thousand annually), with about ten percent of the cases being fatal. During the latest, and most intensive anthrax outbreak on record, that of 1924-1925, 31,688 cases were recorded. In subsequent years, anthrax morbidity decreased from 5,500 cases in 1938 to 178 in 1985, as a result of drastic anti-epizootic measures in the villages, and the enforcement of national sanitary-veterinary control of processing and sales of animal products.

Figure 2

Foci of anthrax-contaminated soil occur over much of the Sverdlovsk oblast (area 195,000 square km). From 1936 to 1968, 159 epizootics were recorded in the 34 rayons and cities of the oblast, with 371 confirmed anthrax-contaminated sites. In 41 of these sites epizootics recurred 2-6 times. Hence, the Sverdlovsk oblast may be considered an anthrax-enzootic area.

The concept of "soil infection" has been important in formulating anti-epidemic measures. Certain field and laboratory workers have attempted to prove experimentally that anthrax spores may not only survive but can reproduce in soil; to accomplish this, they experimentally varied soil humidity and organic content at different temperatures. However, once these investigators admitted the possibility of a spore culture vegetating in the soil, they had to accept the possibility of soil autosterilization, in so far as the soil conditions may not satisfy the strict requirements for spore formation within a vegetative population, inevitably leading to extinction of the population.

Usual prophylactic measures in anthrax-contaminated rayons, including the Sverdlosk oblast, include:

- annual immunization of kolkhoz (collective farm) and sovkhos (state farm) animals with live anthrax vaccine;
- annual immunization of the staff of stock breeding farms and

meat packing facilities with the STI vaccine;

- prohibition of animal slaughter outside of specially -equipped sites or without permission from the veterinary control office;

- fencing and registration of cattle carcass burial grounds;

- sanitary-veterinary control of animal slaughter and meat grading (stamping) before sale or processing;

- systematic training in sanitary-hygienic procedures of all personnel responsible for cattle handling, slaughter, and meat processing.

The anthrax outbreak in Sverdlovsk was preceded in the end of March and early April, 1979 by an epizootic involving privately owned sheep, cattle and pigs in eight villages and in a number of adjacent suburban homesteads. Animal cases of anthrax are known to have been caused in Sweden by contaminated meat meal added to the artificial feed, and by a blood meal additive in the USA. Cases of infection transmitted by way of imported bone meal have been recorded in the USA, the Federal Republic of Germany, and Great Britain (Kauker, 1965).

A 1972 analysis of anthrax outbreaks among domestic animals in the mid-west of the United States showed that almost all outbreaks were associated with contaminated feeds. For instance, anthrax bacillus was isolated in Ohio from imported bone meal that was fed to pigs (Shlykhov, en 1957). These outbreaks characteristically began in winter time in sites previously known to be anthrax-free, with cases widely distributed and without secondary cases among pigs or other

animals kept with them.

Piening (1958) believed that a major anthrax outbreak in dairy cows on farms throughout Schleswig-Holstein in January-April, 1958 was caused by an anthrax-spore contaminated bone meal that was manufactured in the Federal Republic from bones procured from many other countries. His supposition was confirmed by the fact that these feeds were used only in Schleswig-Holstein. Furthermore, only those adult animals that were fed the bone meal were affected in the outbreak, while the young animals, which were not given this feed, remained well.

Animal disease in the Sverdlosk oblast appeared following the use of a mixed feed which contained meat-bone meal. This became apparent because mixed feed had been delivered to (affected) farms at intervals of one or two days before disease appeared. Characteristically, there were no animal cases of the disease on adjacent farms that did not receive the mixed feed. On each (affected) farm, usually only one and rarely two adult sheep became ill. During the entire epizootic, only four lambs died. Only a small portion of the contaminated mixed feed was delivered to a sovkhos (state farm). After a breeding bull became ill and died, the mixed feed was confiscated and the epizootic did not spread further.

During the epizootic, and particularly once the population was

informed about the dangers associated with consumption of meat bought from private sources, anthrax appeared among dogs. Dog deaths were due to consumption of discarded contaminated meat. In three cases, the diagnoses was confirmed by autopsy and isolation of three strains of the anthrax bacillus. Carcasses of other dogs were not examined for anthrax.

Meat-and bone meal added to the mixed feed was manufactured from meat processing wastes: bones, blood, intestinal contents. It should be noted that the meat processing plant which produced the meat-bone meal is situated in the rayon known to be at a highest risk of anthrax for farm animals. The meat-bone meal was manufactured there in violation of technical protocol. Grinding of raw materials, heat treatment, sifting and filling of bags with the final product all were done in the same building. The shop had no records of the starting and final temperatures during treatment of the raw materials. Manometers were found at the height of 4 meters above the boilers, making it impossible to read the dials. The uncrushed bone fragments left after sifting of the dried product were loaded back into the boilers. There were two wheel-barrows in the shop used to transport both the raw materials and the meat-bone meal. The meat-bone meal was not tested for vegetative and spore-forming microflora, as is required.

The hypothesis that the combined feed had been contaminated was

confirmed by the isolation of ten strains of the anthrax bacillus from farmstands where animals had died in three of the villages. These strains could not be distinguished from the strains isolated from meat or from patients, fatal cases, dead dogs, and soil from the cattle burial grounds.

At the beginning of the epizootic, there was a notable increase in slaughter of the cattle at privately-owned farms; meat and meat products (ground beef patties, sausage stuffing) appeared for sale at private markets, and were sold directly person to person, especially on the outskirts of one of the rayons. At that time 15 cattle carcasses from a sovkhos that had experienced anthrax cases were delivered to one of the meat processing plants. Most of this meat was sold to workers.

Irregular delivery of meat products to Sverdlovsk at the time, meat shortages, and the approaching May Day holidays caused the population to purchase meat and meat products in advance for cold storage. No association was found between cases of disease and the patient's occupation, contacts, or residence. It was only possible to recognize the high incidence among the population near the periphery of the rayon where the epizootic took place. There was not a single case of the disease among the organized collectives--kindergartens, schools and military units, all which were supplied with centrally controlled meat products. A few cases occurred beyond the city limits and these were attributed to consumption of meat purchased in the city.

Between 1923 and 1940, six outbreaks of human anthrax caused by consumption of meat products have been described in the USSR. The largest outbreak occurred in Yaroslavl in 1927 when 27 people were taken ill and died having consumed boiled sausage which was made at home from contaminated meat.

The first human cases of anthrax in the Sverdlovsk oblast were recognized on April 4. During the outbreak up to May 18, 96 people became ill and 64 died (66.6%). The cause of the outbreak was confirmed by laboratory examination of the living and deceased patients, and by clinical, anatomical and epidemiological studies. The clinical course, the treatment administered, the results of post-mortem examinations, the analysis of the strains of different origins all deserve independent descriptions by specialists.

Epidemiologist who encounter such outbreaks must take keep in mind that in the beginning many patients exhibit merely flu-like symptoms and they should consider hospitalization of suspected cases as a precautionary measure. Observations (during the outbreak) show that the promptness and intensity of anti-biotic therapy, the level of septicemia, and the presence of concomitant disease, determine whether the outcome will be fatal.

The outbreak developed slowly beginning with April 4, 96 people became ill with the cases registered as follows: 4th-5, 5th-5, 6th-5, 7th-7, 8th-7, 9th-6, 10th-10, 11th-9, 12th-7, 13th-5, 14th-4, 15th-4,

16th-1, 19th-1. In May, 20 additional cases were recognized (Figure 3). (daily morbidity)

The distribution of cases by day, taking into account the short incubation period, allows us to exclude infection associated with consumption of meat supplied from centralized sources. Clearly in that case an explosive increase in the incidence of disease would be expected. Instead, the slow evolution of the outbreak was due to prolonged storage of contaminated meat by the population. For instance, in the case of family G it was learned, but only in the course of a long conversation, that the family consisting of a retired couple still had the meat purchased in the beginning of the month. No danger was seen in this meat inasmuch as it had already been boiled in making a galantine. In the case of the family of school teacher S, some of the meat fat was melted for lard and eaten. However, from the meat samples collected from these two families, two strains of the anthrax bacillus were isolated.

Because the population was informed via local radio and the press of the dangers of consuming meat purchased from private sources, it was assumed (by the authorities) that all (contaminated) meat had been turned in or destroyed and that none was left within the households. As a result no further measures to detect and confiscate the (potentially contaminated) meat were taken. At several contaminated sites, it was demonstrated that certain vegetable products stored with

anthrax-contaminated meat could also become contaminated.

There were certain peculiarities in the age distribution of cases. Thus, in the midst of adult cases in April, there was a single child, six years of age. Eleven patients were 20-29 years old, ten 30 to 39, thirty-two 40 to 49 ten 50 to 59 and twelve 60 and older.

Such a distribution can be explained as was found on analysis of 34 families by the fact that children, with but few exceptions, in daytime attend preschool, kindergarten where they are fed. As a rule, on awakening, children refused to eat anything. Their parents did not insist that they eat, knowing that the children would have breakfast with their group. In 8 of the families the morning meals consisted of meat or lard. School children did not consume these products. During the day, they were also fed at school. Usually the evening meal consisted of dairy and vegetable dishes.

Most of the patients were men which can be explained by the common practice of serving the meat to the family head, a worker engaged daily in heavy physical labor.

Human cases were widely scattered over a large area. The common denominator in determining the location of cases was the site where the meat had been bought. Nearly 30% of the cases bought their meat in the factory yard.

Notably, there were no human cases in villages struck by the epizootic. It was found here that the veterinary authorities had

forbidden slaughtering animals at privately-owned farms, and the meat of individual slaughtered animals was confiscated.

The required measures were instituted in the city suburbs only after some delay--unlike (the veterinary services' measures) in the villages.

Mainly laborers were affected by anthrax. No cases occurred among white-collar workers including veterinary and medical personnel.

Only a single employee of kindergarten became ill. There were no cases among military personnel.

That meat was the source of infection, both during the initial and subsequent phases of the outbreak is shown by the results of epidemiological investigation of the foci. For instance, (female) citizen G from Rudnyi village, who had previously worked in a cattle breeding farm noted that one of the sheep did not eat (these animals were being fed the mixed feed). This sick sheep and another healthy sheep were both slaughtered by three of her relatives. All three developed lesions of continuous anthrax. It is probable that the owner G also had cutaneous anthrax because it was reported that she was self treating a lesion on the finger of her right hand. This family did not consume the meat from the sick sheep but they sold it to their neighbors S, Zh, and also in the city. (Male) citizen Ch. frequently visited the (female) citizen Zh. Both of them died of anthrax.

The unusually small number of cases within each of the families consuming contaminated meat (as a rule, a single case) makes this outbreak different from other clustered outbreaks, always seen at slaughter of a sick animal with partitioning of its (contaminated) carcass. In the first case, the possibility of infection and of developing disease was determined by the dose of the pathogen that remains in the cooked meat; by the quantity of meat that was consumed; by the non-uniform disinfection from the periphery to the center of a particular piece of meat (due to the cooking process); by the condition of the mucous membranes of the oral cavity (lesions of a stomatitis, gingivitis, etc.); possible disruption of the mucous membranes of the esophagus, stomach, and the intestines by the meat-containing food (excessive roughage, or on the contrary soft and sparing).

In the second case, the possibility of infection depends merely on the extent of contamination of the meat and the possible disruption of the integument of an exposed subject's hands. Obviously in both cases, specific resistance resulting from vaccination may play a role.

To confirm the concept that anthrax-infected people are not contagious, the bacteriology laboratory tested samples of air from the hospital wards where the patients were kept, air from the patients' lodgings, contents of vacuum cleaners, washings from various household

and hospital objects that had been used by patients. The anthrax bacillus was not isolated from any of these samples.

During the first few days of the epidemic, patients were admitted to various medical care establishments in Sverdlovsk. Subsequently, taking into account the fulminant course of the disease and the need for prompt treatment of all suspected anthrax cases, all patients were hospitalized in a single medical center. The majority of patients sought medical care. House to house rounds to detect new suspect cases of the disease were seldom conducted.

CLINICAL FEATURES AND PATHOLOGIC ANATOMY OF INTESTINAL ANTHRAX

The initial clinical presentation of intestinal anthrax was rather variable. In some cases, the illness began with a feeling of generalized malaise --headache chills, pains in joints and muscles, commonly in the lower back, and only after a while, there appeared excruciating colic in various quadrants of the abdomen, signs of peritoneal irritation, incessant vomiting--at first with bile--and then with "coffee grounds" vomitus and frequent bloody diarrhea. Sometimes this was soon followed by intestinal paresis and clinical obstruction. In other clinical presentations, gastrointestinal symptoms set in with sudden acute abdominal pain, peritoneal irritation and intestinal obstruction.

In either situation, a patient's condition rapidly and catastrophically worsens. The abdomen swells, becomes tender and ascitic fluid may be detected. Fever reaches the maximal levels, as dyspnea, cyanosis, tachycardia, and hypertension set in. Consciousness is often clouded, motor and psychic excitability may be noted or, on the contrary, depression and inactivity. However, in a day or two after the intestinal symptoms first set in, the body temperature drops below normal with signs of decompensated septic shock.

The morphologic essence of anthrax pathogenesis is inflammation--acute seroso-hemorrhagic, and less commonly vibreno-hemorrhagic. In the inflammatory, the leucocytic reaction is either weakly expressed or completely absent. Hemorrhagic exudate results from both increased vascular permeability and from the destruction of blood vessel walls and bleeding.

Postmortem reveals unusually marked rigor mortis and marbled pallor of the skin.

As a rule, small intestinal loops appear collapsed with characteristic strangulations and diverticuliform dilatations, particularly in the ileum where the intestinal wall is discolored dark red or yellowish green. Sometimes, especially in the jejunum, post mortem invaginations may be found. Rarely there is a scant serous or seroso-hemorrhagic exudate in the peritoneal cavity.

The most characteristic and constant changes are present in the mesenteric lymph nodes. On sectioning, these nodes may resemble a blood clot or a blood-porridge-like mass. Capsules of some lymph nodes may be intact and their border may be more clear cut. In addition some small lymph nodes with turgid grey or grayish-red color may be found; when sectioned, the cut surface appears juicy and grainy.

No such lesions were found in the peripheral lymph nodes. On the basis of morphologic changes, three types of anthrax lymphadenitis can be distinguished: (1) serous and seroso-hemorrhagic; (2) hemorrhagic; and (3) necrotic-hemorrhagic.

I. In serous and seroso-hemorrhagic lymphadenitis, the histological pattern of the affected lymph nodes is indistinct; there is diffuse and sinus edema with marked dilatation of peripheral and to a lesser extent of the intermediate and central sinuses in which macrophages and erythrocytes can be found, which constitutes a picture of what is called sinus catarrh. The lymphatic follicles are absent altogether or are preserved for to survive as little nodules without reactive centers. When the follicles are preserved their center may show cellular necrosis. The cellular elements here may be unusual: macrophages and monocytes predominate, with many less lymphocytes. Capillaries, venules, and veins are full, distended with blood, and with red blood cell casts. The capsule may be intact but somewhat

edematous. Almost always anthrax bacilli in variable numbers can be found here, most often extracellularly in the marginal sinuses and less commonly in the cytoplasm of macrophages, and finally only very rarely within the granulocytes.

2. In acute hemorrhagic lymphadenitis the characteristic sign is erythrocyte infiltration of the lymph node with cellular necrobiosis against the background of edema, hyperemia, disruption of the histostructure, and reduction of the lymphoid follicles.

My second sentence of the opening paragraph is something like polynuclear cells and ??? may be found.

Intact erythrocytes seen in places, but in others only their ghosts are seen and in still other places sometimes erythrocytes aggregate to form an oxyphilic mass in which erythrocyte contours may be traced. Among the degenerating and intact erythrocytes there are macrophages, which comprise a major portion of the cellular component of the lymph node. Some of the macrophages are degenerating and lysed, therefore cell ghosts and chromatin grains may be discerned in the lymph node. The capillaries and veins are dilated, filled with blood with erythrocyte stasis and red blood cell casts. The capsule fibers are disarranged and the capsule is edematous, infiltrated with

erythrocytes, and the capsule fibers are deranged. There is periadenitis with edema and slight hemorrhagic infiltration of the adjoining connective tissue.

The anthrax bacilli were seen occasionally, mostly extracellularly in the lumina of sinuses and of blood vessels, and also in the fissures between the tissue layers but rarely in the cytoplasm of macrophages and most infrequently within the granulocytes.

(3) In necrotic-hemorrhagic lymphadenitis there is a complete loss of histological structure of the lymph node; the node becomes a structureless, homogenous, or on the other hand, lumpy oxyphilic mass which may show areas of erythrocytes that have aggregated and have been damaged by alkaline pH (?). There may be seen fibrin threads, nuclear dust, brown pigment (hemerosiderin, hematin, formalin pigment). Cellular elements are totally absent or may appear as small islands of cells. These islands comprise macrophages, lymphocytes, and granulocytes. If routine staining technique is used, the stroma, blood vessels and the capsule of the node will not be seen. Using a stain specific for elastic and collagen fibers, fragments of elastic and collagen carcass can be visualized, which makes it possible to trace markedly dilated and sometimes thrombosed blood vessels with necrosis and ruptures of the vessel walls. Necrotic-hemorrhagic lymphadenitis is constantly associated by marked periadenitis with infiltration of perinodular connective tissue by a hemorrhagic

exudate, sometimes mixed with fibrin and leukocytes. Anthrax bacilli are practically never detected in microscopic sections.

Sometimes signs of macrophage regeneration can be seen within the lymph nodes; viz a large number of monocytes and large mature macrophages, within which mitotic and amitotic nuclear division can be absorbed forming multi-nuclear cells, that is symplasts. The cytoplasm of such cells may contain large granules fragmented anthrax bacilli, and erythrocytes.

Lesions the large intestinal tract are found many in the jejunum and ileum and the stomach, and more rarely, the upper part of the large intestine. Lesions are the pharynx and of the root of the tongue were found very rarely, but when present they were characterized by edema and focal hemorrhages. Faucial (palatine) tonsils were not affected. The esophagus, sigmoid colon, and rectum were not affected.

Lesions in the gastrointestinal tract were of two types: more commonly, the pathogenetic process was clearly focal and much less frequently it was diffuse. In focal form in the walls of the stomach, small and large intestines there are numerous dark red rounded (oval?) foci, measuring from 0.3 to 3.0 and more centimeters in diameter, each with a grayish, centrally depressed carbuncle. Smaller lesions are located in the mucosa and the submucosa while the larger ones penetrate all the layers of the wall of the organ. These focal lesions do not involve

the lymphoid network of the intestine.

In the diffuse form, the intestinal wall is edematous, jelly-like in appearance, swollen and with prominent thickened rugae. Against the background of diffuse enterocolitis, small individual dark red lesions may be seen. The stomach contents are hemorrhagic or look like "coffee grounds". The contents of the small intestine is always mixed with blood, is usually scant in amount and is found on the intestinal walls because it sticks to the mucosa. The contents of the large intestine are not abnormal. Intestinal paresis is found only in exceptional cases. When there is widespread involvement of the gastrointestinal tract by focal lesions, mastadenitis may develop with the mesentery of the small intestines appearing edematous, jelly-like, yellowish with enlarged dark red lymphatic nodes.

Histological structure of the lesions in the focal and the diffuse involvement of the gastrointestinal tract is appropriate to the seroso-hemorrhagic and the necrotic-hemorrhagica forms of gastroenterocolitis.

The structural unit of focal necrotic-hemorrhagic gastroenterocolitis is the carbuncle, which comprises (1) a developing necrotic focus that contains anthrax bacilli and (2) a perifocal zone of seroso-hemorrhagic inflammation; the structure (? of the carbuncle) is essentially the same in all segments of the gastrointestinal tract.

In small, more recent foci the necrosis and necrobiosis are limited to the superficial layer of the mucosa without (marked) degeneration within these foci. Outlines of villi and of epithelial cells can be discerned, as well as contours of the blood vessels. Anthrax bacilli can be identified in the lumina of the blood vessels, on the surface of the villi and within the crypts.

In larger foci the necrosis extends to the muscularis of the intestinal wall appearing as an oxyphilic structureless mass with lumps of chromatin and grains of a hematogenous pigment.

Anthrax bacilli can almost always be found within and at the surface of these necrotic masses. Necrosis may even involve almost the entire thickness of the intestinal wall. Such necrotic masses are saturated with a homogenous bloody exudate with grains of a brown pigment. Anthrax bacilli are not found in these areas but can be detected at the periphery of the focus within the fissures between the layers of the edematous mucosa, on the surface of the denuded villi and in the blood vessel lumina. At the periphery of a focus the wall is edematous and saturated with a hemorrhagic exudate which contains degenerating erythrocytes, filamentous, and aggregated fibrin, as well as leukocytes, monocytes and macrophages.

When anthrax carbuncles are found in the intestinal wall, the blood

vessels are affected not only within the carbuncle itself, but well beyond its margins. There is marked dilatation of capillaries, venules, and veins with stasis and aggregation of erythrocytes, as well as fibrinous necrosis and rupture of blood vessel walls, phlebitis and thrombophlebitis.

top page 19??? Acute diffuse catarrhal-hemorrhagic enteritis and enterocolitis are characterized by the presence of edema of the submucosa, sometimes so marked as to make the intestinal wall several times thicker than it should be; the intestinal mucosa is thinned out, the villi are flattened and partially denuded of the epithelium. The edematous and hyperemic intestinal wall is infiltrated with erythrocytes, as well as a few leukocytes, mononuclears, and macrophages. The capillaries and veins are greatly dilated, filled with blood and at times look like "lakes of blood", filled with a homogenous oxyphilic plasma and occasional erythrocytes. There is fibrinous necrosis of arteriolar walls with leukocytes at the periphery (and leukostasis).??

In diffuse enterocolitis, and unlike the focal form of the disease, anthrax bacilli are not commonly detected by microscopic examination of stained preparations. The bacilli are rather seen free on the surface of the denuded villi, in the intestinal lumen in the slough of epithelial clumps and intestinal secretions, within the crypts, in the mucosal stroma, in the edema fluid of the submucosa, and (finally)

in the lumina of blood and lymphatic vessels.

Furthermore, in anthrax gastroenteritis there is considerable involvement of myenteric plexi which practically disappear from the area of the carbuncle.

tape 3A:

In the diffuse form of the disease, the intramuscular neuroplexi cannot be detected even in between the individual carbuncles. The filaments of neural ganglia are deranged, the few remaining ganglion cells are undergoing pycnosis and lysis. There is apparent suppression and reduction of the lymphoid tissue with lymphocytic karyorrhexis in the Peyer's patches and solitary follicles. [I'll now make an aside comment - notice that in the Russian text at this point an entirely different typewriter was used, typed at a different time and plastered together because the margins are different and the style and the language completely changes. I would imagine that (he names Russian names).]

Epidemiological investigations of foci of the disease was conducted by epidemiologists from the city and rayon sanitary-epidemiological stations. To help control the disease as promptly as possible, city and factory and newspapers were asked to publish articles suggesting to the citizens of Sverdlovsk to search for and destroy by burning

all the meat purchased from the unofficial markets. Similar appeals to the population were broadcast by the local radio station while physicians discussed the means of protection against infection in the settlements (?), industrial concerns and factories.

Police checkpoints were set up on major highways connecting Sverdlovsk with the rayon centers; they were responsible for confiscating from public transport vehicles (trucks) and from individual citizens the meat that was being brought to the city; they were also responsible for burning it at a designated site.

Special (sanitary) brigades were responsible for disinfection of the (known) foci of infection, primarily utilizing disinfecting solutions.

Members of the patients' families were given antibiotics for emergency prophylaxis prescribed in accordance with (official) instructions.

Bodies of the deceased patients were buried in a special section of the (local) cemetery. Burials were conducted in compliance with (official) instructions.

Three of the measures undertaken by the veterinary service proved effective; the quarantine program, disinfection of (known) foci, and mass immunization of animals. No cases of anthrax among domestic or wild animal populations were observed in the ensuing years.

CONCLUSIONS

There are four conclusions:

1) The anthrax outbreak was preceded by an epizootic which affected livestock in 8 villages and certain suburban areas. Animal cases were first observed after they were fed a mixed feed with added meat-and-bone meal. Ten isolates of Bacillus anthracis were obtained from samples of feed collected on farms where cattle had died. The properties of these strains did not differ from the strains isolated from animal carcasses, including dogs, meat, patients, bodies of the deceased patients, and from soil samples collected at the cattle burial grounds.

2) The human outbreak developed slowly and lasted a while between April 4 and May 18 96 cases with 64 deaths (%) were reported. The disease involved adults. Only one child, 6 years of age, became ill. The source of infection was meat purchased at unofficial markets. The anthrax bacillus strains isolated from the meat did not differ from strains isolated from other

3) Meat identified as having been bought on the unofficial market or unofficially brought into the city from other rayons , was confiscated and burned. cold boxes and other facilities used to store the meat were disinfected with chlorine containing solutions. Kitchens and

kitchen utensils lodgings of patients were also disinfected

4) carcasses of dogs that have succumbed to the disease as well as trash and animal wastes were also burned.

mid p 24 signed burgasov maybe. cannot tell.

22 February 1988.

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Dear Nikita,

Here is the essentially final version of the \manuscript I have written about the epidemiological aspects of the Sverdlovsk anthrax outbreak. I would of course greatly value your comments before I make a final draft for submission to *Nature* magazine.

In the acknowledgements at the end of the paper, I would like to thank General Yevstigneyev for discussions. But I do not know whether he would welcome that and I hesitate to put him on the spot by asking. Have you some discrete way to find out and let me know?

I hope to see him and perhaps some of his people again in April, when I will go to Moscow as a member of the US National Academy's committee on BW control to meet with the parallel committedd of the Russian committee. One item on the agenda is possible cooperative study of the pathogenesis of anthrax. Do you have any suggestions or advice for the work of these committees?

On a different subject, Julian hope that you will see your way clear to join the Advisory Board of the Harvard Sussex Program, following my letter ofFor your interst, I enclose a pre-publication copy of the December 1993 issue of our *Bulletin*.

Finally, my standing invitation for you to give a talk at Harvard during term still stands!

Best regards from Jeanne and me

Dear Dr. Smith,

For your interest I enclose a draft of the article I have prepared for *Nature* regarding the epidemiological part of our study of the Sverdlovsk anthrax outbreak.

On pages 3 and 4, I have cited Dr. Grinberg as a source for observations he described to me during his visit here as the result of your joint work. Have I stated the observations correctly? And may I include your name in the citation?

I assume that you have the list I sent to Lev during the summer regarding the occupations of patients as determined from household interviews. Since then, we have learned a little more that might be of relevance to your studies. At the ceramics factory, workers in the shop that made ceramic pipe had an apparent attack rate higher than that of other ceramics factory personnel. The sample is small but it may nevertheless be worth asking if there was anything distinctive on the histological side. The Abramova-Grinberg log numbers of the pipe shop workers are:

1 August 1994

Dr. Med. Zdenek Trnka
Basel Institute for Immunology
Grenz Acher Strasse 487
CH-4058 Basel
Switzerland

Dear Dr. Trnka,

I am writing to ask about some old work for which you and Dr. A.J. Rosenwald are credited in footnote xx of the enclosed paper (Lincoln, *et al. Federation Proceedings* **26**, 1558-15xx, 1967). My question has to do with the LD50 for inhalation anthrax in sheep. According to the unpublished work cited in Table x, it is about 200,000 spores, or about ten times greater than that given in the same table for monkeys.

In contrast, an even earlier paper, (Young, *et al. J. Infect. Dis.* **79**, 233- , 1946), also enclosed, states that sheep are ten times more sensitive than monkeys, presumably tested under the same experimental conditions.

Unfortunately, Dr. Rosenwald is no longer living, so I am writing to you to ask if you can shed any light on the apparent difference of two orders of magnitude between the above two estimates of the sensitivity of sheep relative to that of monkeys. So far as I know, these two papers comprise the entire literature on the LD50 for inhalation anthrax of sheep. If you know of any other published or unpublished work, I would be grateful to be informed of it.

The reason for my interest in this old work will be apparent to you from the enclosed manuscript, which I have recently submitted for publication in *Science* (and which I must ask you not to copy or circulate until it is published). If the conclusion on page 14 regarding the relative susceptibility of sheep and humans is correct and the sheep LD50 was 200,000, the human LD50 would have to be very much greater than any current estimate. In contrast, the statement in the 1946 paper that sheep are about ten times more susceptible than monkeys more or less fits the observations reported in the manuscript if the LD50 for humans and monkeys are about the same, as is generally assumed.

Considering that Lincoln was an author of both papers and that the later paper makes no comment on the apparent discrepancy, I would ask if the 200,000 value in the 1967 paper could be a typographical error? If not, what do you think might explain the apparent contradiction? In particular, what were the experimental conditions (strain, spore preparation, aerosol preparation, dosimetry, etc.) and how they might have differed from those used to measure the LD50 for monkeys.

Sincerely,

Matthew Meselson
Professor of Biochemistry and Molecular Biology

David H. Walker, M.D.
Department of Pathology
University of Texas Medical Branch
Galveston, Texas 77555-0609
Fax: 409-772-3606

8/27/1992

Dear David,

Welcome back from Colorado. Matthew, Alex Langmuir, and I have been working here in Wood's Hole on the first draft of the Ekaterinburg trip report, probably to go to Nature. You, Martin and Alexis will be getting copies of it in a week or two, at which point you can make your comments.

In the meanwhile, here are my remarks on the second draft of your write-up of Abramova and Grinberg's work. They are few, since the paper looks good.

On a general level, I think it is important to be as specific and unambiguous as possible, so that this publication, if it cannot solve all mysteries, at least does not confuse.

1. Page 3, line 12, first sentence: suggest "No published reports or presentations by Soviet physicians have deviated from the intestinal anthrax explanation or offered clinical data to suggest inhalatory anthrax." The 1988 visit of Soviet physicians did make information publicly available in the U.S.; a written version was given to State.
2. Page 3, line 15: add, in order to give the 42 cases a denominator, "(of a total of 96 autopsies performed during the epidemic)"
3. Page 4, line 3,: suggest word reorder "report has the purpose of presenting the major observations"
4. Page 4, line 6: suggest "From June 6-11, 1992, the two pathologists in Ekaterinburg made their materials available to Walker and to Yampolskaya. (In 1979, Yampolskaya was one of three clinicians sent from Moscow to treat victims of the epidemic)." Or something which identifies Olga more clearly.
5. Page 4, line 18, "approximately the sixth day of the epidemic: by what reckoning? Suggest referring to first recorded onset date (4/7) or first recorded admission date (4/8) in this series instead.
6. Page 8, line 12, to top of page 9. Your point about there being no clinical data available is weakened by the list of clinical details that then follows. Suggest adding "From limited clinical notes, we have deduced" or

Guillemin/page 2

something that indicates the qualified source of this information.

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Sincerely,

Jeanne

Guillemin

341 Wood's Hole Road
Wood's Hole, MA 02543
508-540-0086
Fax: (MBL) 508-540-6902
cc:team

Martin Hugh-Jones

Professor of Epidemiology
Department of Epidemiology
and Community Health
School of Veterinary Medicine
Louisiana State University
Baton Rouge LA 70803-8404
fax: 504 346-3295

8/27/1992

Dear Martin,

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341 Wood's Hole Road
Wood's Hole MA 02543
Fax: (508) 540-6902

cc:team

David H. Walker, M.D.
Department of Pathology
University of Texas Medical Branch
Galveston, Texas 77555-0609
Fax: 409-772-3606

8/27/1992

Dear David,

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In the meanwhile, here are my remarks on the second draft of your write-up of Abramova and Grinberg's work. They are few, since the paper looks good.

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Martin Hugh-Jones
Department of Epidemiology
and Community Medicine
School of Veterinary Medicine
Louisiana State University
Baton Rouge LA 70803
Fax 504-346-3295

September 1, 1992

Dear Martin,

I just received your fax of August 31.

About the number 96 for total autopsies (page 3, line 15), this comes from notes on Grinberg's presentation on Friday, June 5, as noted by me and by Matthew. Have you anything different in your notes? Perhaps we should check this directly with Grinberg and Abramova.

About pinpointing the beginning of the epidemic (page 4, line 18), I meant that it might be wiser to stay with Abramova and Grinberg's recorded onset or admission dates, rather than reifying April 4, on which there is no information in the article. The phrase "approximately the sixth day" might be thought too off-hand, given the ambiguities about onset in this kind of anthrax, and especially coming from physicians. April 3-5 may indeed turn out to mark the start of the epidemic, or not. If not, people will ask, "So why did you write six days if you didn't have the facts?" and then they begin to wonder what other guesses were hazarded.

I'm glad to know you made it through the storm and hope the machines are all working again.

Jeanne Guillemin

cc:team

21 April 1993

Dear Lev, Olga and David,

Under separate cover I have sent 150 reprints of your PNAS article for yourselves and for Abramova, along with some press clippings further to those I sent earlier. I have also sent reprints and clippings to Alexis and Martin.

Sometime before mid-June I hope to send everyone a draft of our paper for Nature. I find a rather surprising result upon modeling downwind travel of an aerosol under various conditions. If the available dose-response data for monkeys is relevant for humans, as few as 10^{10} anthrax spores released at the military facility could account for the downwind pattern of fatalities. The dose-response data, from old Fort Detrick experiments, is surprising in that the response falls off only very slowly with decreasing dose.

Lev and David, as you continue to examine the materials could you let me know of any changes or additions in the diagnosis?

In particular, have you found bacteria resembling *B. anthracis* or any immunological evidence of anthrax in tissues of any of the 7 patients previously not scored as positive for anthrax bacteria? These are:

NIKOLAEV, F.D.
JELEZNYAK, B.A.
MOCHALOVA, T.P.
LYAKHOVA, N.I.
SPIRINA, K.M.
KLYESTOV, I.E.
DAYAMNOV, F.Z.

Conversely, is there any new data that would lead you to question the diagnosis of anthrax for any of the other 35 patients?

Also, have you found bacteriological or other evidence of anthrax in any of the 54 patients listed by Lev in his message to David of 7 December 1992? If so, please let me know the names and other available information about such cases.

In this connection, the age listed by Lev in December for BUCHELNIKOV (41 years) is in agreement with the inscription on the grave marker bearing the name Vitalii Aleksandrovich Buchelnikov. We had thought his age was 21, but upon checking my photograph of the marker, I find that the birth date recorded when we visited the cemetery was in error by 20 years.

In another case, that of Lyzlov, the age of 48 listed by Lev differs from the birthdate of 20 October 1940 on the grave marker for Vladimir Pavlovich Lyzlov.

Comparing photographs of the markers with our original notes made at the cemetery, I found recording errors for a few other victims as well, as indicated on the enclosed sheets.

Best wishes to all,

Sincerely,

Matthew

cc: Alexis
Martin

David H. Walker, M.D.
Department of Pathology
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Galveston, Texas 77555-0609
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cc:team

22 January 1992

Dr. Alexei V. Yablokov
State Counselor on Ecology and Health Care
Moscow
FAX (7-095) 134-44-21

Dear Dr. Yablokov,

I was very glad to read in an English translation of the November 13 issue of Literaturnaya Gazeta that you have undertaken an official study of the origins of the 1979 epidemic of anthrax in Sverdlovsk, now Yekaterinburg.

I am writing to ask if I might discuss this problem with you in Moscow, to be of whatever assistance I can to your study and also because of my own long-standing interest.

I could come to Moscow nearly any time in the month of June that might be convenient for you. On the same trip I would also like to visit Yekaterinburg itself. If you should be in the U.S. before June, I would be most grateful for the opportunity to talk with you in this country.

Actually, we have already met -- when delegations from the Soviet and US academies met to discuss biological arms control in Washington and Maryland in May 1988. I am afraid that I particularly remember the very loud jazz music that made conversation impossible when some members of the group went for dinner to the "Blues Alley" in Georgetown!

If I come to Russia in June, I would like to bring two or three colleagues who have also studied the anthrax problem, and in whom I have high confidence as thoughtful and objective scholars. One of them, Dr. Alexis Shelokov, was also a member of the US National Academy delegation during your 1988 visit and was with Drs. Burgasov, Nikiforov and Sergiev when they visited the U.S. in April 1988. Dr. Shelokov is Director of Medical Affairs of the Salk Institute Government Services Division, in Swiftwater Pennsylvania. I would also be accompanied by Professor Jeanne Guillemin, of the Department of Sociology at Boston College, who is also my wife. She too participated in the 1988 visit of the three Russian physicians and specializes in medical sociology. The third colleague is Dr. Martin Hugh-Jones, Professor in the Department of Epidemiology and Community Health,

School of Veterinary Medicine, Louisiana State University. Dr. Hugh-Jones is Director of the World Health Organization Collaborative Center and a member of the WHO Working Group on Anthrax Control and Research. I have a small grant from the MacArthur Foundation to study the 1979 epidemic from which I will be able to cover our travel expenses and ordinary living expenses in Russia for a week or two.

Whatever your response to this proposal, I am very glad to know that you are doing this work, since a true understanding of what happened will require not only access to records and personal testimony but also a sound knowledge of a broad combination of scientific disciplines. Many published claims about the epidemic, on both sides of the controversy, suffer from ignorance of the relevant microbiology, ecology, epidemiology and pathology of anthrax specifically and of infectious disease outbreaks generally. Anthrax is still a serious hazard in many countries. An understanding of the 1979 outbreak, whatever its cause may have been, is therefore certain to be of much value.

I look forward to your reply. My FAX number is (617) 495-8308.

With best regards

Sincerely,

Matthew Meselson
Professor of Biochemistry and
Molecular Biology

3 March 1992

Dr. Alexei V. Yablokov
State Counselor on Ecology and Health Care
Moscow

Dear Dr. Yablokov,

Thank you for your cordial letter of 5 February.

I agree with you that there may not be much scientific evidence remaining from the 1979 outbreak of Anthrax in Ekaterinburgh. Nevertheless, specialists truly familiar with the pathology and epidemiology of anthrax and who have experience in epidemiological investigation may be able to reach scientifically valuable conclusions regarding the 1979 outbreak on the basis of discussions with physicians, officials, surviving patients, and others who were involved with the outbreak. In addition, there may be relevant records and other materials that were not previously available.

The recent articles in Izvestia, Komsomolskaya Pravda, Literaturnaya Gazeta, and other journals leave important questions unanswered and in some respects are uncritical and at variance with knowledge of human anthrax. While being fair to the journalists, one must nevertheless recognize the difficulty of understanding what happened in this case when it is reported by persons without the relevant scientific background.

Therefore, if we would be welcome, we would like to visit Moscow and Ekaterinburgh for approximately two weeks at the beginning of June. You mentioned in your letter that we would need someone in Moscow who could take responsibility for the organization of our visit. During his recent visit to Boston, I discussed the problem with Dr. Evgeny Sverdlov, who you know and who also took part in the meeting of academy delegations at which you and I met in 1988. Dr. Sverdlov expressed his willingness to help us with the necessary organization in Moscow.

He and I also discussed the need to identify an individual to help organize matters in Ekaterinburgh.

May I therefore ask if you would be willing to meet with Dr. Sverdlov, at which time he would be able to explain our ideas at this stage of

how to approach the problem and to obtain your advice regarding how our group might be of assistance in studying the scientific aspects of the 1979 outbreak. I have provided Dr. Sverdlov with a preliminary outline of what we might attempt to accomplish in Moscow and Ekaterinburgh, along with some other materials.

For your possible interest, I include with this letter two VHS video cassettes of the April 15, 1988 meeting I organized at the American Academy of Arts and Sciences in Cambridge during which Drs. P.N. Burgasov, V.N. Nikiforov and V.P.Sergiev gave presentations and participated in subsequent discussion with a number of American specialists.

With kind regards,

Sincerely,

Matthew Meselson

Professor A.V. Yablokov
Counsellor to the President of Russia for Ecology and Health
Moscow, Kremlin
FAX: (095) 206-09-41

Dear Alexey,

I am sorry to report that the two referees to whom I sent the article by Klevezal, et al. did not think it was suitable for publication in the *Proceedings of the National Academy of Sciences*.

In consequence, I have sent the article to the editors of two more specialized journals, namely: *Radiation Physics and Chemistry* and *Applied Radiation and Isotopes*. I should hear from them by the end of the month and will contact you then.

I hope to send our article about the 1979 Sverdlovsk outbreak to *Nature* by the end of the year. It awaits the completion of publication-quality figures and the addition of some additional information that I hope to receive. I would be glad to fax you a copy of the current, nearly final draft. Let me know if you wish me to do so.

I would like to ask for your assistance in obtaining some information that would be useful in preparing the last draft of the article, but only if it is no inconvenience for you. We do not have the dates of death of 6 of the victims in the current list from Mishustina. It would be helpful in describing the course of the epidemic to know the missing dates, especially if any of them are particularly early or late. But my friends in Ekaterinburg were told at ZAGS May I ask you, if it is not much trouble, to send an inquiry to ZAGS in Ekaterinburg or to any other appropriate archive to obtain the missing 6 dates? The numbers of the patients on the Mishustina list and their names, dates of birth and 1979 addresses are as follows:

- 8 TARASENKO, Ekaterina Yakovlevna, 1919, Zvezdnaya 5-12.
- 19 MYASNIKOVA, Anastasia Ivanovna, born 1979. Predelnaya 22-13.
- 32 TEPIKIN, Gennadi Vasileyvich, 1939, Pobed 64, Nishniy Sergi.
- 66 SERGEEVA, Galina Pavlovna, 1924, Agronomicheskaya 36a-20.
- 67 ZHELNIN, Aleksandr Mikhailovich, 1953, Sovremennikov 27-40.
- 68 TISCHENKO, Valentina Ivanovna, 1947, Sovremennikov 27-37.

On another matter, I plan to be in Moscow during the week of 18 April, as a member of our Academy delegation to the next Russian-US Academy discussion of cooperative measures to enhance confidence in the Biological Weapons Convention of 1972.

y and ours will sponsor a meeting of