

A scenic symbol of Russia—
the Kremlin from across the Moskva River.

Notes on a Trip to the Soviet Union

BY JAMES AND INGELORE BONNER

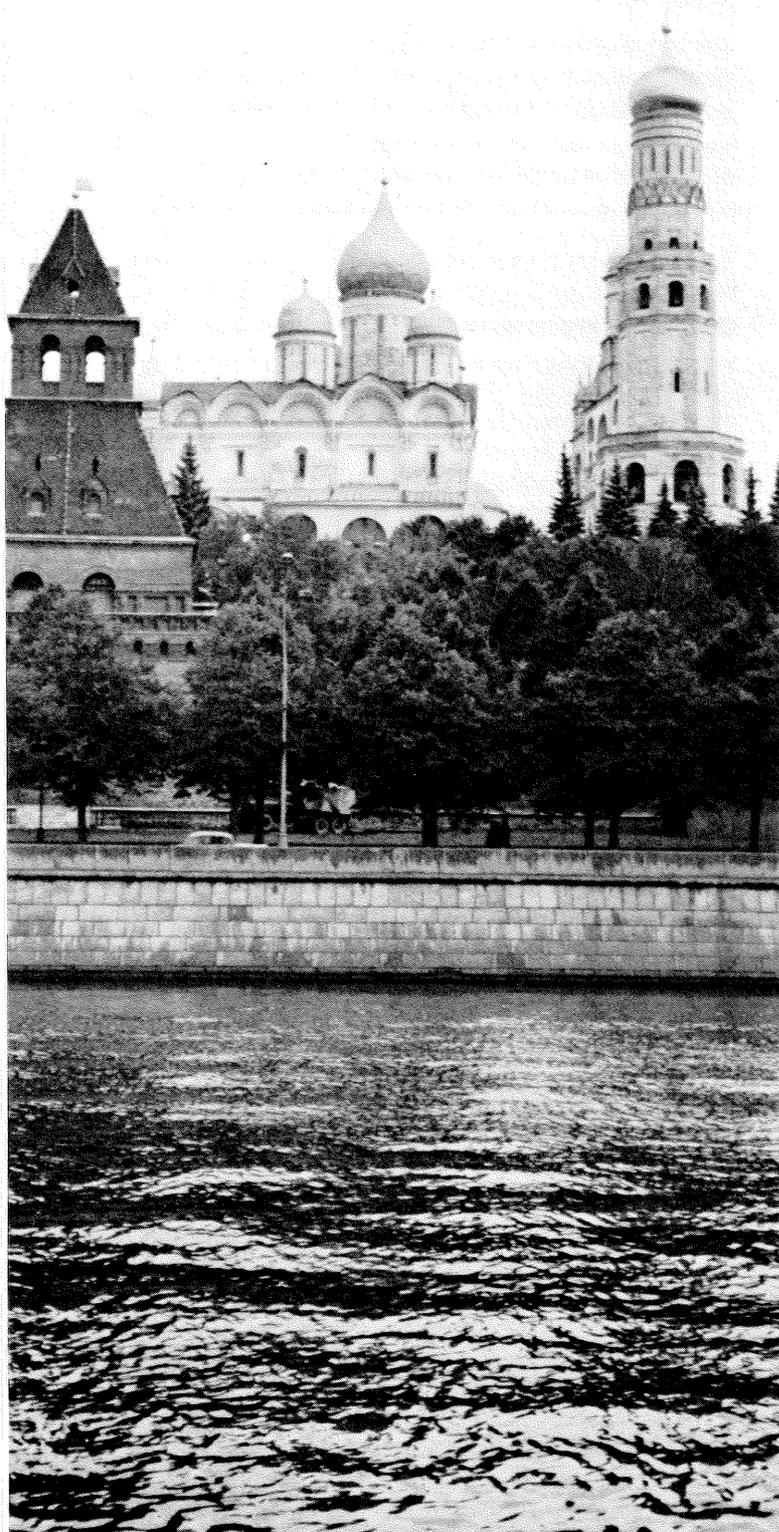
When Academician Keldysh, president of the Soviet Academy of Sciences, visited Caltech with a group of Russian scientists in October 1972, he expressed the hope that a group of Caltech people would be able to visit his country as guests of the Soviet Academy. That hope soon became a formal invitation, and this fall 16 members of the Caltech community took a two-week trip to Russia. The party included 9 trustees and faculty, and 7 wives—Arnold and Mabel Beckman, James and Nancy Glanville, William Keck, Lawrence Williams, Harold and Colene Brown, John and Ellen Pierce, John and Edith Roberts, Gerald and Naomi Wasserburg, and James and Ingelore Bonner. "Notes on a Trip to the Soviet Union" is adapted from the Bonners' travel diary.

FRIDAY, SEPTEMBER 14

Up at 8 a.m., Ingelore and I pack, pack, pack and are off to the airport by 11:30. We are to catch TWA flight 760. It is very full, but Harold Brown scuttles around and gets us all seats—in the very rear, to be sure. The plane is full, crowded, noisy, but it's only ten hours nonstop to London, where we arrive at 7 a.m. On our plane are Harold and Colene Brown, Jerry and Naomi Wasserburg, the John Pierces, and us. In London we get off at airport 3—the foreign flights airport—and are transported to airport 1—the one for European flights. Then we wait for several hours.

We buy Russian phrase books, etc. Trustees Larry Williams and Bill Keck meet us there. They have cleverly come the day before to London and have spent the night there. We are also joined by Jack and Ethel Roberts. Then we go on to Moscow by British European Airlines, which has now been renamed British Airlines. This flight—on a British Trident, which is their analog of a Boeing 727—is also full. The plane is delayed in take-off for one hour by fuel spilled on the tarmac around the plane. ("We have to soak up the spilled gasoline before we can start the engines.") Then 3.25 hours to Moscow.

It is raining in Moscow. Our group is picked up in a special bus, taken to a VIP lounge by a committee consisting of a vast number of notables, including varied officers of the Soviet Academy of Sciences. Here too we meet our interpreter, protector, guide, and constant companion, Mr. Yuriy Reznikof. Yuriy is totally bilingual in Russian and English, can make jokes in English (and does all the



time), and is furthermore a nice guy. He is an employee of the Soviet Academy of Sciences, not of Intourist.

From the airport we proceed to the Hotel Rossia; this is the largest hotel in Russia and is said to be the largest in the world. It has 3,000 rooms, 6,000 beds. It is adjacent to the Kremlin and has marvelous views. It is a very nice hotel, but it is cold. Our room is only 14°C—about 58° Fahrenheit. In some respects it has good service, but it is only because Yuriy Reznikof and our other Academy helpers order everything ahead of time. Our group has its own table in the restaurant, with a little American flag on it.

Thence to a short sightseeing tour of Moscow. Moscow has changed in the 12 years since I was last there. Many new buildings, everyone better dressed, many more cars on the street. Then to bed.

SUNDAY, SEPTEMBER 16

Up late and to a nice sightseeing tour of Moscow. We go in the evening to a formal reception—dinner in the Praha Restaurant. It is cold as an ice cave—10°C. Little speeches by Keldysh and Harold Brown. Then I talk about differences between females and males. (Females have two X chromosomes, males only one X and a Y . . . Intelligence is not concentrated in the X chromosome, or the Y either; therefore we are all equal but different . . .) It is a great success.

President Keldysh, an aerodynamician, is an important man in the U.S.S.R. As President of the Soviet Academy of Sciences, he is a member of the Presidium of the Supreme Soviet of the Soviet Union. Thus he has a direct input into political, fiscal, and all other aspects of the cutting up of the economic and fiscal pie of the Soviet Union. Science and development is taken seriously in our host country.

MONDAY, SEPTEMBER 17

Our initial duty on this day is a visit to the Presidium of the Academy of Sciences in the U.S.S.R. Our host is Academician M. V. Keldysh. All of our group is present, plus a distinguished group of Soviet Academicians, plus our omnipresent interpreter and aide. Academician Keldysh outlines the organization of the institute and makes a sort of semi-formal speech.

In general the Academy has paid attention to the establishment of institutes and sciences of importance to the development of the Soviet Union. Keldysh mentions in particular chemistry and more recently bio-organic or biochemistry. Also many of the institutes of the U.S.S.R. which have to do with atomic energy were initially born in Lebedev Institute of Physics of the Academy. Academician Keldysh said, "In the last ten years we have pushed forward in molecular biology, particularly in Moscow and Pushino. The results are very successful, both in the study of protein structure and in the study of nucleic acids, peptides, etc.

"The Academy has sent expeditions to each republic to set up permanent scientific bases there. Each republic has been helped to form its own Academy. Some of these have become centers in particular fields for all of the Soviet Union, as has astronomy in Armenia.

"There are four sections of the Academy—Physics and Mathematics, Chemistry and Biology, Earth Sciences, and Social Sciences and Humanities. Each section has a vice president in charge of it—thus Y. R. Ovchinnikov is the vice president of the Academy for Chemistry and Biology. Each section is divided into departments." Finally Keldysh closed by saying, "As is the fashion now, the Academy also has a swarm of scientific councils and committees."

In the p.m. to the Institute of Natural Products Chemistry. I go with Arnold Beckman, Jack Roberts (who is an old friend of Ovchinnikov, the director of the Institute), and Larry Williams. This Institute was established in 1959, as part of the effort to start biology going again in the Soviet Union after its previous hard times. The main directions in the Institute are the study of biopolymers, regulatory biology, protein chemistry, peptide chemistry, synthesis of DNA molecules, and the study of steroid and peptide hormones, the study of antibiotics—especially peptide antibiotics, and the plant-growth hormones. They have two Beckman sequenators, and a Beckman peptide synthesizer—which is present but not yet installed. It is waiting for Majid, the Beckman service engineer, to come from Palo Alto to finish its installation. Majid is a hero in the Soviet Union, a hero of the installation of many, many sequenators—and of many, many wild parties. He is a Beckman service man, and previously a Spinco service engineer in our group at Caltech, a really good guy.

Everyone in the Soviet Union wants a Beckman instrument— a scintillation counter, a Spinco centrifuge

This is a big laboratory. They have 250 professional people, PhD's, and 500 helpers of various kinds, including a few graduate students. It's all broken down into groups of 10 or 12 PhD's per group or lab. It's a first-class place, and the best instrumented biology laboratory that I saw in all of our trip to the Soviet Union.

On our tour, each group explained its work in English, and very well. This is a very impressive place. They are good people and they do good work. Each program is reviewed every three to four years, and each individual's work is assessed. If he doesn't measure up, it is policy to get him a job in industry or in an academy of agriculture or medical sciences—which are of lesser value than the Academy of Sciences itself. Dr. Khoklov, the vice director, says that the Institute is so good because of the vigor and ability of the director, Academician Ovchinnikov.

It is noteworthy that in a land supposed to be full of Women's Lib, and in which we saw many women in construction jobs, etc., we saw very few around this Institute, and these few were concerned with things like hanging up our coats. No women scientists.

In the evening to the ballet, *Swan Lake*. This is the best *Swan Lake* we have ever seen, and entirely different. It has two endings. The first is sad, for the heroine turns back into a swan. Then, after a short intermission, they have a second ending where the hero saves her and turns her back into a human—really neat.

It is interesting that our Soviet hosts don't understand what trustees are, and treat them rather differently from the faculty, but Arnold Beckman is honored in the Soviet Union. Everywhere we go, as soon as our hosts recognize that he is the Beckman of Beckman Instruments, they kowtow to him. Everyone in the Soviet Union wants a Beckman instrument—a scintillation counter, a spectrophotometer, a Spinco centrifuge.

Arnold Beckman is full of businesslike activity, he visits everything, he arranges for better ways for Beckman servicemen to come from West Germany or Vienna to service his instruments in the Soviet Union, and he arranges to set up a school to train Soviet engineers to be Beckman servicemen in the Soviet Union.



The Cathedral of St. Basil and a section of the Kremlin wall and Red Square form a backdrop for James Bonner and Yuriy Sivolap, a Russian friend and former Caltech Postdoc.

Beckman is a hero in the Soviet Union. At a meeting at the new science city of Pushino, about 120 kilometers outside Moscow, at a lunch given for us by the director of these institutes, Academician Scryabin, the director of the Institute of Photosynthesis, Professor Ustaniev, got up and gave a toast to Arnold Beckman, saying: "In 1947 I was fortunate enough to come into the possession of a Beckman DU spectrophotometer. With this instrument I made my PhD thesis. With this instrument I made my DSc degree. With this instrument I became a professor and a director of the Institute of Photosynthesis. After 27 years, the instrument is not quite perfect for the last year, but will soon be perfect again. I toast Dr. Arnold Beckman and his instruments."

TUESDAY, SEPTEMBER 18

Today's exercise is a visit by Arnold Beckman, Larry Williams, and myself to Pushino. We drive there in two rather new Volga sedans; the Volga was restyled three years ago and looks pretty good. It has a four-speed, four-on-the-floor transmission, and can go up to 180 kilometers per hour, which we do on the crowded two-lane highway. Spooky! Only thing to do is close your eyes and relax! The drivers are all very good—no catastrophe happens. There are no seat belts.

Pushino has a population of about 15,000 people and is about five years old. It's on top of the hill, overlooking a river, and away out in the country—a very beautiful setting. A mall about 200 yards wide, planted with trees and grass, separates the academic institutes on one side from the apartment buildings which house the scientists and service personnel on the other side. It's a nice sort of setting for people who like this sort of setting—sort of an Oak Ridge-type existence.

Scryabin is apparently the general manager of the whole complex and is also director of the Institute of Biochemistry and Physiology of Micro-Organisms. He explains to us that Pushino is an experiment in a new style of science organization. The whole thing belongs to the Soviet Academy of Sciences and it is divided into groups—molecular biology, biochemistry, and physiology of micro-organisms; a laboratory of bioenergetics, and institutes of

biophysics, photosynthesis, and agrochemistry and soil research. There is also a computing center and a department for the development of instrument design.

Academician Scryabin explains that "there was a different situation in biology about 10 to 20 years ago, and when this situation was undone, it was decided to establish several new institutes for modern biology such as those in Pushino." What he is referring to is the end of the Lysenko center and the beginning of the new era. Each of the institutes has of the order of 500 to 1,000 people in it.

Scryabin tells us about the organization of the institutes and says that he has just been told that he has had five million rubles a year added to his budget, and he doesn't know what to do with it. I suggest to him that he give it to me as a research grant. He replies that this is not possible, but I can move to Pushino. There I can have a big lab—50 people will work with me, and I can buy lots of Beckman instruments. They have a modern European hotel almost finished in which I can live. It is less than two hours drive from Moscow, provided you drive up to 100 kilometers per hour in the Volga sedan.

The organization is typical of that of most research institutions. Each institute is broken up into actual research groups of about 15 to 30 people. The whole place seems to be wide open for growth and work. However, this was a less than totally satisfying visit. It was basically a run-through of labs—led by Scryabin talking, and with little conversation with other people.

The Biophysics Institute of 1,000 people, 300 PhD scientists, is mainly concerned with neurophysiology. Since we had no lab tour, I don't know what they do. We didn't visit the Photosynthesis Institute but the director asked me in an aside to please tell Academician Keldysh how important photosynthesis is to study. He's afraid that it is not properly appreciated either by Keldysh and the upper echelon of the Academy of Sciences or by Scryabin. He is probably right. Even so, the Photosynthesis Institute is a

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large place with about 250 PhD scientists and 700 people. It must be the largest photosynthesis institute in the world.

We return from Pushino at risk of our lives again, and then to the circus—which lasts three hours. In Moscow the circus is really good. It's in a new building which looks like a permanent tent, but designed by a really imaginative architect. After the circus, and all starving, we go to dinner in the hotel.

WEDNESDAY, SEPTEMBER 19

In the a.m. our entire party goes to Moscow University. There we are met by the rector, R. V. Hoholov. The rector describes the structure of the University, which is basically an independent institution with a consultative council composed of members of the Academy, etc. It has a population of about 40,000 students and involves itself in all branches of science, social sciences, and the humanities.

Professor Kost, chairman of the Department of Chemistry, describes the organization of a typical department. It is organized into inorganic, organic, and physical chemistry divisions. There are 32 full professors, but many other staff members who are re-selected every three to five years. They have about 280 entering freshmen each year in chemistry, and 60 to 80 new graduate students in chemistry each year.

Back to the hotel, lunch, and a little bit of shopping. We go shopping in the dollar store or Berioka. It's not just a dollar store—any kind of hard currency will do, but one can't buy anything in it for rubles. There are such stores in every major hotel, in the airport, and everywhere in the Soviet Union where foreigners might appear. The idea is to sell all the good things that Russia has to produce for hard currency. The Russians are not permitted in them except as guests of foreigners. All of the good things we bought in the Soviet Union are in these dollar stores, but there is not much to be bought.

I buy Ingelore a mink hat because I have suddenly come into the possession of about 500 dollars in rubles—royalties which the Russians have saved up from publication of two of my books in Russian. Jack Roberts and John Pierce each get considerable

amounts of royalty. We can't find any way to spend all of the royalties in rubles, but Colene has a suggestion. We give all our rubles to Jim Glanville, who acts as banker, uses the rubles to pay the trustees' expenses in Russia, and will pay us back in dollars when we all get home. Good idea!

In the late afternoon Ingelore and I go to the Institute of Molecular Biology. Director W. Engelhardt remembers me from previous meetings. All of his laboratory directors are present; I give a seminar, many questions, all very stimulating.

I returned there on Monday, September 24, and we spent a lot of time talking about how we could have better exchange between Soviet and American scientists, both interpersonal and by communication.

I asked my friend Gyorgy Georgiev, a corresponding member of the Academy, to tell me about how he came to the U.S. last year. He said it took him almost two years of hard work. He thought up a good experiment that he wished to do and corresponded with Renato Dulbecco, who said it was a good experiment and could be done only in Dulbecco's lab at the Salk Institute. Georgiev then asked the Soviet Academy for permission to go to work in Dulbecco's laboratory. It took 1.35 years before he received permission to make this visit. His application was then turned down by the United States on the basis that San Diego is an area closed to Soviet citizens. Harrison Brown learned of this impasse and took up the matter. It still took six months on the U.S. side for Georgiev to gain permission to go to San Diego. All in all, it took him a full two years. His recommendation is to find some way to speed up the whole process. I hope that by our talks with Keldysh and others we have done something along this line.

Now as to scientific exchange. Sending preprints is not so easy from the Soviet Union. In the first place all manuscripts have to be screened by a censor before they are permitted to be sent abroad, either to international journals or anywhere else. Anyway, Georgiev says such permission is not so hard to get. The main problem is that he can't send preprints to everybody because the Xerox machine they have—which is an honest-to-God U.S. Xerox



Ingelore Bonner

machine—does not work very well. It breaks down and cannot be fixed because Xerox service men do not come. We made an arrangement. He will send me one carbon copy of any article destined to be published in an international journal. He will also send me a list of people he wants preprints sent to. I will Xerox preprints and send them out. Sounds like a good arrangement and I hope we can make it work. I also promised to send him reprints on various things.

Then at midnight to the Red Arrow Express which goes from Moscow to Leningrad in eight hours, overnight. It must be one of the plushest trains left in the world. We have a large, very comfortable compartment and sleep away the miles.

THURSDAY, SEPTEMBER 20

We arrive in Leningrad promptly at 8:15 a.m. and are whisked off to the Leningrad Hotel, an absolutely beautiful new hotel overlooking one of the many canals—almost rivers—that divide the seven islands on which Leningrad is built. The Leningrad Hotel is a very cosmopolitan place, full of tourists from all over the world, and from our room we look directly across the canal at the cruiser *Aurora* which is kept as

a national shrine, and from which the signal shot was fired to start the storming of the Winter Palace in the October Revolution.

After a quick breakfast, off to the Institute for the Study of High Molecular Weight Compounds. This is an Institute of the Academy of Sciences. First a formal meeting with the director and the deputy director. The general areas of work in this Institute are the synthesis of carbon carbon, and heterocyclic and metal carbon polymers. They also study polymerization of all kinds, and the properties of each kind of polymer which they make.

In the evening, a tour of the city—first to Peter and Paul Fortress, the first building built by Peter the Great when he established Leningrad. Then to Saint Isaac's Cathedral, which Larry Williams has always wanted to see and now sees, and a tour of the cruiser *Aurora*. Dinner in the hotel.

FRIDAY, SEPTEMBER 21

Up early and with John Pierce and Arnold Beckman to the I. P. Pavlov Institute of the Academy of Sciences. This is about 30 kilometers outside Leningrad on a large estate. The original Pavlov laboratory building is still standing, although it is no longer used for active research. Scattered through the woods of the estate are his doghouses, each the size of a modest family home, and these too are no longer used. We were met by L. Chistovich, the director, who is a lady, and the only slim middle-aged lady that I saw during our entire visit to the Soviet Union. She was accompanied by her husband, Dr. Kozshevnikov. The portion of the Institute in which they work directly is a division on speech perception and speech production. Dr. Chistovich works on perception, the psychophysiology of speech. They try to combine knowledge of speech perception from neurophysiology with all electronic knowledge, and are moving toward the study of how speech signals are processed in the central nervous system. In speech perception humans depend mainly on amplitude peaks in voice sound. These are cut off by something like lateral inhibition in seeing. They have made an electro-mechanical model of the basilar membrane. It has 100 narrow band pass filters. It acts

very much like a basilar membrane. Each unit consists of a nonlinear rectifier, an amplitude adapter which includes the cut-off, and finally the narrow band pass filter which reduces the input sound frequency to a single neuron signal.

John Pierce is very excited. Dr. Chistovich says it would have been easier to model the whole thing on a computer but they don't have a computer with capability to do so. I asked John Pierce later what sort of computer it would take. He said, "Maybe a PDP-10 or possibly a PDP-11 at the most. Fifty thousand dollars' worth of computer would have saved them all that trouble."

In the p.m. a tour of the Hermitage Museum—which, as it stands, is a combination of the old Winter Palace, the Old Hermitage, the new Hermitage, and the new, new Hermitage. This complex of four buildings is now one huge museum with about 35 kilometers of walking. Trustee Bill Keck tells me that he once spent two days walking the halls of the Hermitage and didn't finish a fraction of what is to be seen. He says it's the most wonderful museum in the world. Anyway, we get a three-hour tour by the Deputy Director for Research. We start first on the gold ornaments. The oldest are from about 600 B.C. on, all the way up through the collections of the Czars. It's a really high-class collection and fills room after room. Then, by popular vote, we go to the French Impressionist art collection. These were collected by two Leningrad private collectors from about 1895 to 1912. The collection was nationalized after the October Revolution. There are rooms full of Matisse, Picasso, Gauguin, and others. There are more of Matisse and Picasso than I have ever seen anywhere. There are lots and lots of good Gauguins also. There is a great collection of Renoir and of other less famous French Impressionist painters. The Picassos are good—they're from his least nutty period. All these paintings were saved during the siege of Leningrad which lasted 900 days; although the Nazis never actually entered the city, they did a great deal of destruction by bombing. The Museum was pretty badly beat up, but has since been restored to its original condition. All of the art work in the Museum was

The Red Arrow Express from Moscow to Leningrad must be one of the plushest trains left in the world

evacuated by the director, who commanded the last train out of Leningrad and sent the whole collection to a safe place in the Far East. This is true of the Summer Palace and of the Peterhof Palace also. Each room in the museum and in the palaces that we saw contains a photograph of how it looked in 1944 when it was recaptured from the Nazis. They all looked awful. One can understand why the Russians hate the Germans so much and why they're so worried about the possibility of being overrun again by someone.

In the evening to *Swan Lake*—a very different production from that in Moscow. Good, but softer and less interesting.

SATURDAY, SEPTEMBER 22

Up bright and early and to Pushkin and Paul's estate (Pavlovsk). This used to be the Summer Palace of the Czars. Pushkin grew up here and loved the place very much. It was named after him on the 100th anniversary of his birth. The palaces are all very grand. They were occupied by the Nazis and destroyed but have been rebuilt. In the late p.m. a little shopping. We buy a gift for Bill Keck at the dollar store and present it to him. He is, I think, touched. Then to two antique stores—no good antiques—nothing.

In the evening Ingelore and I try to get dinner on our own in the hotel instead of going to the circus. The maitre d' is snooty and there is a long, long wait to get a table. Finally at 9:30 p.m. we do get a table, modest dinner and wine, 3.1 rubles each, not expensive. After dinner Ingelore gets sick from all the tension and commotion!

SUNDAY, SEPTEMBER 23

In the a.m. by hydrofoil to Peterhof, or, in Russian, Petrodvorets. This was the

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summer home of Peter the Great, and although it was made more complex by the later czars it's basically a simple place. His own retreat is on the shore of the Gulf of Finland, a small oak-paneled house right on the waterside, very plain but nice. Oak paneling, Dutch blue tiles (he was really big on Holland, where he went to learn how to build ships) lots of art, mostly of ships. There are also 1,000 fountains of every description. Water is brought by conduit from some kilometers away, all downhill. The palace and the fountains were laid out about 1700 and they still work. Peter the Great also started the main huge palace which was rebuilt continuously until 1917. It's extremely grand.

In the p.m. our group takes a tour of the Russian State Museum. Ingelore and I rest and then we all go to dinner in the evening at the Sadko Restaurant, very nice and different, and then to the Red Arrow Express at midnight and thus back to Moscow.

MONDAY, SEPTEMBER 24

I spend the day at the Institute of Molecular Biology as noted. In the p.m. we have dinner and leave for the airport at 9:45. We get an 11:20 flight to Tashkent. It's not a nice four-motor jet as advertised, but a four-motor prop-jet of the Electra generation. It's an Ilyushin 18, and they have been in service for almost 20 years—noisy, cramped, and very uncomfortable. We get to Tashkent at 4:30 a.m., by which time it has magically turned into 7:30 a.m. in Tashkent. The flight is full, very crowded, but we all sleep. Great! Get off at the airport—VIP treatment—and with our new guide, interpreter Vladimir Plachenko, to the Hotel Tashkent.

TUESDAY, SEPTEMBER 25

Tashkent was shaken by an earthquake in 1966 and many buildings fell down. To hear people in Tashkent talk about "The Earthquake" one would think it was the biggest thing that ever happened. It turned out it was only of magnitude 5.5 and buildings fell down because they are made of adobe bricks, sun dried. Luckily the earthquake happened at night in the summer and most people were sleeping outdoors. Nobody was killed, but there was vast destruction. Now new reinforced



Lawrence Williams, touring trustee, and a local resident find a handy place to rest.

concrete superboxes are being built everywhere, and also several very beautiful new buildings of nice design, like the new library and the new circus.

First we go to the museum of the Republic of Uzbekistan. Really good history of Uzbekistan from 6000 B.C. to 1924. The museum contains a history of successive incursions into Uzbekistan, the Greeks, Alexander the Great, etc., about 300 B.C., then the Arabs in the sixth, seventh, eighth centuries A.D., bringing Islam with them; then Ghengis Khan at the end of the thirteenth century; then the Turks, then Timur, or Tamerlane, at the end of the fourteenth century. It remained a Turkish society (even though it was captured by Catherine the Great) until 1924, when the Republic of Uzbekistan was established by the Soviet Union as a member republic, and vigorous modernization took place. Today one person in seven in Uzbekistan is a Russian, from the north, and the rest are Uzbeks, Tajiks, Kazaks, Iranians, Afghans, etc. It's the melting pot of Europe and Asia, a really interesting society.

Our party, which now is composed of Dr. and Mrs. Beckman, Jerry and Naomi Wasserburg, Larry Williams, and us, goes on to the Seismological Institute. This is an Institute of the Uzbek Academy of Sciences, and the officials are all Uzbeks. Their earthquake of 1966 was small, but it created great interest in seismology. The

new institute building was built directly over the epicenter of the 1966 earthquake. They have 1,100 empty places in the institute, but they have quite a large staff already. They have studied wave propagation in different kinds of soil. Silt is the worst for buildings. I think that's been found out at Caltech also. The water content of the soil makes some difference in the extent of damage to surface structures. They have mapped all the faults, and studied the plate movements—India is still going north. They have displacement gauges, and they adjust high buildings during construction on every other floor by vibrating them and determining their resonance frequencies. They have a large set of field seismometers out. They get about 2,000 earthquakes per year of magnitudes 3 to 4. It seems an excellent place and Jerry Wasserburg assures me that it is.

WEDNESDAY, SEPTEMBER 26

We stay in the Hotel Tashkent over Tuesday night and early Wednesday take the plane to Bukhara—an ancient city with an ancient and honorable tradition. It was destroyed by Alexander the Great about 300 B.C. It was destroyed again by Ghengis Khan after having been rebuilt, and was destroyed again by Timur in the late fourteenth century. The ancient, domed market stalls still exist; ancient gravesites from the sixth and seventh centuries are still to be found standing outside the city. It's a cold and miserable day, but we take pics and sightsee, and Jerry Wasserburg buys a karakul cap. The Hotel Bukhara is just as awful and primitive and unplumbed as it was 12 years ago so we don't stay there—we take an evening plane to Samarkand and spend the evening of Wednesday in the Hotel Samarkand. This is a nice new hotel, but already beginning to fall apart.

THURSDAY, SEPTEMBER 27

In the a.m. we visit the Institute of Archaeology of the Uzbek Academy of Sciences and are met by the director. He has a nice office, but the thing that immediately strikes us is a very gorgeous carved stone Buddha about two and a half feet tall. It is the most beautiful one I have ever seen, and the director tells us that it is the oldest. It's from the first century B.C. and was discovered in an archaeological dig of a Tibetan stupa in the Pamirs near the bor-

Back in Moscow our room had been warmed up to 19° C

der of the Soviet Union and the Sinkiang Province of China. They have photographs showing the carved Buddha lying on his face inside the partially ruined stupa, and a photograph of the discoverers turning the Buddha right side up in amazement at the perfect preservation of the stone carving after 2,000 years. I ask for permission to photograph it, but this is immediately denied. It is a new find; it has had nothing published about it, etc., etc. During the day we hear a message from the dig in the Pamirs that eight more Buddhas have been discovered there.

We take a trip through the museum of the Archaeological Institute. They have remains from all ages, Old Stone Age, New Stone Age, beginnings of agriculture 8,000 years before the present right up to 1924. It's really impressive. Every mound in the region of Samarkand must be suspected of being an ancient city or temple of some kind. We then make a trip to visit the observatory of Ulan Bek. He was Timur's grandson and became king of Tamerlane's kingdom after Tamerlane's decease. His real interest was astronomy and he built this observatory; also a huge madrasah, a mosque for teaching muezzins, but in this mosque he taught people astronomy. The conservative clergy became very opposed to his practices and declared that he must take a trip to Mecca to cleanse himself. He started on the pilgrimage but a few miles outside of Samarkand was waylaid and beheaded. The observatory was destroyed. It was not rediscovered until close studies by a Soviet archaeologist determined its location, I think in the 1930's. It has not been restored; one can see about one-quarter of the original sextant, which is the main instrument. Since Ulan Bek was in communication with other astronomers all over Europe and since he wrote profusely and his writings have been preserved, we know the exact structure of the original observatory and it would be really interesting to rebuild it to its original condition. This is being considered by the Uzbek

Academy of Sciences. Ulan Bek cataloged exact positions of over 1,000 stars, the biggest effort in this direction up to that time.

Then we make a very colorful trip to many of the points of interest of Samarkand, a beautiful city—perhaps one of the most interesting in the world—and full of history. In the evening, back to an Ilyushin 18, back to Moscow, and back to the Hotel Rossia. They've warmed it up to 19° by this time. That's neat!

FRIDAY, SEPTEMBER 28

During our visit to the university we met a Dr. Valiry Soyfer, who is an official in the Academy of Agricultural Sciences. Valiry Soyfer was a classmate both of Yuriy Sivolap at Moscow State University and of Garick Panosyan and knows them both well. He said that he would arrange for them to come to Moscow to visit us on this day, and sure enough, Yuriy Sivolap appears, but not Garick. Both of them have gotten a lot of mileage out of their trip to the U.S. (They were postdocs in our lab.) Garrick is just about to become a Professor in Yerevan State University as well as Deputy Director of the Armenian Academy of Sciences. Yuriy looks fine. He is Director of the Institute of Molecular Biology of the All-Union Academy of Agricultural Sciences, and has his laboratory in Odessa. We spend all day with him and inquire discreetly while walking outdoors what happened to him when he returned to the Soviet Union. Nothing happened to him, he said. He had a bad cold when he left and it turned into pneumonia and he was hospitalized for a while, but when he recovered he wrote to us. He has nothing but good to say of his trip to the United States and his visit to Pasadena. I must remember to send him preprints, etc. We spend the day talking, buying each other gifts, etc. In the evening we have a formal supper in the restaurant of the west wing of the Hotel Rossia. The supper falls a little flat because Harold Brown is in bed with intestinal flu and Academician Keldysh is in the hospital with pneumonia. Anyway, we have a fine supper, and thus to bed.

SATURDAY, SEPTEMBER 29

Off to the airport with all ceremony. We

get on the bus to go to the plane, but they don't let us on the plane. Instead, they return us to the airport. We wait an hour and a half and again get on the plane. It's an Ilyushin 62, a four-engine jet which looks just like an English VC10. It takes off, flies three hours toward Frankfurt, circles Frankfurt two hours because of the air controller's slowdown, and finally lands. There we find out we have missed our connection to the U.S. and must stay the night in Frankfurt. We go to the Frankfurt Airport Hotel, very luxurious, very nice. Ingelore dials our house direct—you just call 0-100-213-797-7194. Bell rings twice and there's Joel Gottesfeld on the phone. We explain our delay. We have a nice supper with the Beckmans who are wise enough to have arranged in advance to stay overnight. Larry Williams is glad to stay overnight too. The next day we go to the Frankfurt airport, catch our Lufthansa flight—which is a 707, and fly nonstop Frankfurt to Los Angeles, arriving about 7:30 p.m., a really nice flight and a good end to an exhausting but interesting trip.

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