Scientific Intelligence Report

LONG-RANGE CAPABILITIES OF THE SOVIET UNION 1962-72

MONOGRAPH VII

MEDICAL SCIENCES

NOTICE

The conclusions, judgments, and opinions contained in this finished intelligence report are based on extensive scientific intelligence research and represent the final and considered views of the Office of Scientific Intelligence.

OSI-SR/62-24
31 July 1962

CENTRAL INTELLIGENCE AGENCY
OFFICE OF SCIENTIFIC INTELLIGENCE

~~CONFIDENTIAL~~ Nº 127

SCIENTIFIC INTELLIGENCE REPORT

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PREFACE

This Scientific Intelligence Report on Soviet medical sciences is one in a series of monographs on long-range Soviet scientific capabilities. This monograph covers the period 1962–72. It highlights those areas of research and development of potential or immediate concern to Soviet national security but does not attempt to give a balanced and comprehensive picture of all aspects of Soviet medicine. The estimates and conclusions are evaluated in terms of Soviet intentions and goals in medicine, which may differ from those of the United States.

Other fields of science discussed in the related monographs of the series are the biological and agricultural sciences; chemistry; the control sciences; electronics; the geophysical sciences; mathematics; metallurgy; physics; policy, organization, planning, and control of science and technology; and scientific and technical manpower.

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LONG-RANGE CAPABILITIES OF THE SOVIET UNION 1962–72

MONOGRAPH VII

MEDICAL SCIENCES

CONCLUSIONS

1. In 1959, significant contributions from Soviet medical research were estimated to be at least as far away as 1969. Today, after changes in organization; in availability of instruments; in use of more physics, chemistry, mathematics, and engineering with medical research; and in appreciation for the fundamental side of biomedical research, significant contributions are estimated to be accomplished by 1967.

2. Soviet medical care will continue to be effective. Soviet therapeutic services will continue to meet the needs of the Soviet people and to be far superior to those available in most of the world. The Soviet concept of medical care includes all preventive as well as therapeutic services. At present, these services to mothers and children are at a high level of effectiveness in both rural and urban areas throughout the country. During the next 10 years, services to middle-aged and older people will be raised to an equally high level. The Soviet concept of medical care will be broadened to include total maintenance throughout life of maximum physical and mental fitness, but implementation of this broadest part of the concept will make only slow progress.

3. Facilities for medical research and care are expanding and will continue to do so. During the next 10 years, the USSR will devote more of its instrument-building capacity to medical instrument building. As a result, it will close some of the gap between the USSR and the United States in medical research equipment and probably will introduce some notable automation for diagnosis and therapy. Nevertheless, instrument supply will continue to be a more limiting factor in Soviet medical research than in U.S. research.

4. The USSR will increase its lead in numbers of medically trained persons to the point where the USSR will have twice as many physicians as the United States in proportion to its population. At present, however, neither the majority of persons in medical care nor the majority in research are trained up to Western standards. By 1972, weaknesses in undergraduate preparation, especially for

medical care, will be eliminated. Weaknesses in postgraduate training, especially for medical research, will continue to be significant.

5. The USSR will continue to decentralize authority in medical matters. Soviet policy now favors delegation of authority, once concentrated in the Ministry of Health, USSR, to republic, regional, and district components. This will permit greater initiative and flexibility in the solution of both research and practical problems.

6. By 1972, the USSR will be well prepared for medical defense against small-scale attack by special weapons. The level of actual preparation is not now high, but the USSR has sources of strength in a high physician-to-population ratio, the national organization of its medical services, the assignment of medical defense responsibilities in advance, and a continuing program of education for the whole population. The level of Soviet medical preparation will have little effect in unlimited nuclear warfare, but by 1972 the Soviets will be well prepared medically to cope with small-scale use of chemical, biological, and radiological weapons.

7. The USSR will increase its use of various kinds of medical assistance as instruments of foreign policy. During the next 10 years, the USSR and its European Satellites will intensify their medical programs in underdeveloped areas. Communist medical assistance will continue in underdeveloped countries of Asia and the Middle East, undoubtedly will increase in Africa, and possibly will have some extension into Latin America. One objective of this assistance will be to give the masses a favorable image of communism to prepare their minds for political action. Another objective will be involvement of leaders in dependence on Bloc aid and trade as an influence on political decisions.

SUMMARY

Until 5 years ago, most Soviet medical research was directed toward the solution of immediate practical problems, often by putting into practice in the USSR the fruits of Western creativity. In this, the Soviets enjoyed a large measure of success. Only since the mid-1950's has the USSR been making a major effort to do its own basic medical research. Understandably, the tightly programmed approach and the tendency to equate quantity with quality, so much in evidence in the Soviet attack on immediate practical medical problems, has carried over into their basic research. Under these circumstances and in the absence of strong traditions of independence and objectivity, authoritarianism and a tendency to build too much theory on too little fact were sure to flourish. It is the Soviet style to establish large groups to do tightly programmed medical research, with most of the personnel having only limited training, being given only limited assignments, and working only limited hours. All these things considered, it is not surprising that up to now the Soviets have met with success only in their efforts to put into Soviet practice the fruits of Western creativity.

Until 1959, significant contributions from Soviet medical research were estimated to be at least as far away as 1969. Although there is room for debate on the pace of change, the Soviet effort to solve more immediate, practical problems appears to have been effective and precisely those shortcomings that should be corrected are being corrected.

The Soviet way of doing medical research probably works better for the Soviet Union than it would for the United States. More important, the tightly programmed approach is giving way to flexibility, speculation is decreasing, objectivity is increasing, and the current attacks on authoritarianism probably mean more opportunity for young people in the future. Perhaps most important, the Communist regime now shows a greater

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appreciation for basic biomedical research. Everywhere, change seems to be in the right direction.

Cardiovascular research and treatment are carried on in a framework of considerable theoretical assurance that hypertension and, more recently, arteriosclerosis result from disturbances in the central nervous control of bodily processes. Definitive research by Soviet scientists on their neurogenic theory of hypertension should be possible during the next decade. Critical research by Soviet scientists on their neurogenic theory of arteriosclerosis seems farther away. Cancer research is directed, as in the West, along multiple lines with chemotherapy and virus etiology receiving the greatest emphasis. Soviet cancer search will be held back, until the end of the decade, by deficiencies in important underlying disciplines such as biochemistry and genetics.

Medical care will continue to be effective. In the USSR today, health problems cause neither national weakness nor popular dissatisfaction. In fact, an enormous improvement in health during the first 40 years of Communist rule was a necessary condition for the rise of the USSR as a world power, and the present level of medical care in the USSR is a source of pride and satisfaction to the overwhelming majority of its citizens.

Detailed appraisal indicates that Soviet therapeutic services still are such that most of the improvement to date in Soviet health has been achieved by the extension of the simpler medical services, especially preventive services to mothers and children, throughout the USSR. Their bid for further improvement will be based on a refinement of the simpler services, which they can do; an extension of subtler and more specialized services to middle-aged and older people, which they can do but will be more difficult for them; and a broadening of the concept of medical care to include total maintenance of maximum physical and mental health, which they probably can not achieve within the period of this estimate.

Cardiovascular diseases now are the most frequent cause of death in the Soviet Union. Efforts to treat the early forms of hypertension and arteriosclerosis through improvements in living and working conditions (designed to remove stress on the central nervous system) will continue, regardless of the results of critical research. Efforts to treat the more advanced forms of these diseases will continue to use the measures recommended in Western countries.

Cancer is now the second most frequent cause of death in the Soviet Union. Treatment is directed, as in the West, toward early detection, primarily by clinical means but aided by radiology and cytology, followed by total removal primarily by surgical means but aided by radiation and chemotherapy. The Soviet Union has the basic resources, such as physicians and hospitals, to mount a maximally effective treatment program. The program will be delayed, however, until the second half of the decade by deficiencies in certain specialized resources, such as radiology and cytology.

Infectious diseases now rank third behind cardiovascular diseases and cancer as causes of death in the Soviet Union but remain as the leading cause of temporary disability. The incidence of infectious diseases is decreasing and will be further reduced in the Soviet Union during the next decade. As in the past, prevention will be sought along two lines: (i) mass administration of live vaccines that can be taken orally or by inhalation and (ii) stronger environmental sanitary and hygienic measures. As in the past, the latter will probably be more effective than the former.

Soviet objectives in medical care include a sound program of physical fitness, regulation of physical and mental activity, rational nutrition, regular medical examinations, and popular health education. The Soviets are particularly concerned about the promotion of health in fully automated industry. The ultimate success of this program will depend on the production of a sufficient amount of material resources and the sustained cooperation of the population. Although the program is already being carried out on a limited scale in large population centers, the internal economic conditions of the USSR will prob-

ably not allow for a nationwide effort until 1965 at the earliest. Those Soviet citizens who are participating, especially children, will probably benefit from the program. With the exception of their paramilitary physical fitness program—"Ready for Work or Defense"—the execution of positive health programs will remain fragmentary during the period of this estimate.

Western scientists describe Soviet laboratory facilities and hospitals as inadequate because of antiquated, poorly built, and crowded buildings. This situation, although inconvenient, does not necessarily preclude high-caliber research. Frequent reference is made to planned improvement in quality and quantity of medical buildings.

During the past 10 years, the supply of instruments for medical care has been occasionally a limiting factor; the supply of instruments for medical research has been often a limiting factor. Reliance had to be put on technical information collected from all over the world, the small quantity of finished instruments that could be imported from the West in the face of strict regulation by the NATO countries, and a larger quantity of finished instruments from European Satellite factories. Unless a much higher priority is given to the Soviet effort or unless the increasing complexity of such instruments brings out some advantage in their way of doing things, instrument supply will continue to be more of a limiting factor in Soviet than in U.S. medical research. The Soviet Union will continue to want to collect all available technical information from the West and generally to want to import more finished equipment.

Brain research is an area in which instrumentation will be particularly important. This is an area in which Soviet physiologists and their mathematical collaborators will get very high priorities for new instruments.

The Soviet Union has more trained professional and semiprofessional workers in medical care than does the United States, and it also has more being trained. The Soviet Union has about the same number of scientific workers in medical research as does the United States. Soviet education prepares its people well for medical care, less well for research. The numbers of persons available are adequate for both, but medical care suffers from problems of distribution and research suffers from problems of quality. In outlying areas, positions for general physicians now are being filled by recent graduates; specialists positions still go unfilled. Positions in medical research are filled by persons with fair training and excellent incentive. Their productivity, however, is sapped by working conditions—lack of equipment, lack of communication, and lack of freedom. The outlook is for gradual improvement in the distribution of specialists and in the working conditions of researchers.

There are 303 medical research facilities in the Soviet Union, the majority of which are probably inadequate for their assigned tasks. The lack of space is a major inconvenience; the lack of equipment is a serious limitation. At present, the best facilities are very heavily concentrated in Moscow and Leningrad. The number of facilities is expanding. A major effort is being made to strengthen the basis of medical research by introducing more physics, chemistry, and engineering—and by welcoming advice from certain Western experts.

The regime now favors delegation of responsibility and authority in medical care to the 15 ministries of health of the union republics, to the 105 regional councils of national economy (Sovnarkhozes), and to the approximately 1,000 medical districts.

The principal channels for the feedback of information from peripheral medical organs to central medical authority will be statistical reporting systems—of the Ministry of Health and, possibly, of the Central Statistical Administration as well.

In medical research, the regime now favors greater initiative on the part of learned medical councils of the 15 republic ministries of health and on the part of the 303 working research institutes.

In the USSR, there are problem-oriented central mechanisms for planning and coordination. At present, the Academy of Medical

Sciences (AMS), USSR, has a scientific planning commission, 50 problem commissions, and 50 head institutes. The principal channel for expression of initiative will be the detailed plan submitted by each working group as its part of the overall master plan.

Medical aspects of civil defense will play only a very limited role in any nuclear war that might occur in the next decade. At the present time, in any country, the majority of the injured would have to do without effective medical care. This probably will continue to be true throughout the period of this estimate even if increased medical preparations are attempted. The Soviet Union engages in some research, training, planning, and stockpiling, but how much is not known.

Medical aspects of civil defense could play a larger role in limited attacks by chemical, biological, or radiological means. At the present time, the Soviets probably could not detect attack by these means until they began to suffer casualties. They evidently believe that a breakthrough in this field is possible and a major effort to develop means of physical detection is worthwhile. On the other hand, new means of physical detection of chemical, bacterial, and radioactive aerosols would have other applications in industry, in public health, and in space.

For protection, treatment, and decontamination following a limited attack, the Soviet Union is relatively well organized and has strength in numbers. The medical chain of command for civil defense is clear and, generally speaking, the knowledge is at hand for mass immunization, water purification, waste disposal, scrubbing down with steam, use of antibiotics, and so forth. Soviet authorities evidently believe that this kind of preparation, at least in key areas, is worthwhile.

By 1972, the Soviet Union probably will be medically well prepared to cope with small-scale chemical, biological, and radiological attack.

Soviet exploitation of medical aid and trade for foreign policy purposes will increase. The Soviet Bloc will try to demonstrate its good will, its accomplishments, and the applicability of Soviet-style solutions to Asian, African, and Latin American problems. Persistant local publicity campaigns, construction of impressive buildings, opportunities for Bloc personnel to work in foreign countries and for foreign personnel to train in Bloc countries, and fostering dependence on the Bloc for continued supply of drugs and equipment will continue to be the method of operation. The object will be to give the masses a favorable image of communism, preparing the ground for political action, and to give the leaders a feeling of dependence on the Soviet Bloc, adding to the factors that influence political decisions.

DISCUSSION

ORGANIZATION, PLANNING, AND CONTROL

The Soviet regime now favors delegation of responsibility and authority in medical care from the Ministry of Health, USSR, to the 15 republic ministries of health, the 105 regional councils of national economy (Sovnarkhozes), and the approximately 1,000 medical districts.

The Ministry of Health, USSR, is divided into administrations, departments, and inspectorates for planning, finance, interrepublic affairs, external relations, and so forth. Military medicine is an administration under the Ministry of Defense. Less is known about the 15 republic ministries of health. Statistical reporting of medical matters goes through channels to the Ministry of Health; statistical reporting of most other matters goes through channels to the Central Statistical Administration.

The 105 regional councils of national economy are a new type of unit that has come into the picture since 1956. They are intended

to be rational, relatively self-sufficient economic units that can manage many of their own affairs. Their effect on the organization of medical care has not yet been felt but they are of the greatest potential importance. The 1,000 or so medical districts under the 15 republic ministries are still the operating units for medical care. A Soviet medical district serves an area of 100,000 to 300,000 people. It has a dual directorship, a physician-in-charge and an administrator-in-charge. On paper, this dual directorship has authority over all of the medical care facilities in its district—polyclinics, sanitary-epidemiologic stations, rural medical centers, pharmacies, and the 200- to 300-bed district hospital. In practice, the subdivisions of the republic ministries of health have tended to make most of the decisions. A medical microdistrict serves an area of 2,000 to 3,000 people. The building of 20- to 30-bed microdistrict hospitals is now discouraged. General practitioners and specialists are rotated between district inpatient and microdistrict out-patient services to give them experience in both.

In the past, neither district nor microdistrict medical personnel have had much administrative authority. For medical administrative decisions they have had to depend on the republic or union ministries of health. District personnel are now taking more initiative, using as guides the instructions already laid down by higher authority. At present, there is less dependence on higher authority for detailed implementation. Problems for which guides have not been provided, and action requiring the cooperation of nonmedical organizations, continue to be sources of difficulty. When decisions were made at the Ministry level, the cooperation of lower level, nonmedical organizations was compulsory. When decisions are made at the Sovnarkhoz level, cooperation between medical and nonmedical people—in hospital construction, water supply, sewerage, and so forth—will be voluntary, not compulsory.

Authority over a large part of medical research rests with the Academy of Medical Sciences (AMS), which is an integral part of the Ministry of Health, USSR, and depends on the military for its fiscal support. AMS members are powerful men, scientists elected by their peers. Election is by secret ballot but there is no open campaigning and no open contest. As of May 1961, there were 108 active and 124 corresponding members. The AMS is a policymaking group; its operational arm is its Presidium. Among the organs which report directly to the Presidium, AMS, are the Scientific Coordination Council, the Scientific Planning Commission, the "head" institutes, the problem commissions, republic learned medical councils, AMS institutes, and medical societies. The leading organ is the Scientific Coordination Council; it is headed by A. N. Bakulev and has 72 members. The Scientific Planning Commission is headed by I. V. Davydovskiy.

There are 50 problem commissions—one for each of the 50 most important biomedical problems set forth in the Soviet Seven-Year Plan for the Medical Sciences, 1959–65; the head of each commission is a member of the Presidium, AMS. There are also 50 head institutes. In addition to being responsible for fulfilling its own institute research plans, a head institute is responsible for planning the work of the corresponding problem commission. Directors of head institutes are chairmen of corresponding problem commissions. Head institutes carry on direct scientific-organizational liaison with all institutions which are working on themes included in the problem assigned to it.

The AMS also maintains liaison with the Academy of Sciences, USSR, the academies of sciences of the union republics, the scientific institutes and societies of the USSR, and foreign countries. This liaison is effected through committees, conferences, and individual Academy members who hold positions in non-Academy institutions. The AMS has no counterparts in the union republics. Liaison is also maintained between the AMS and the military medical services of the Armed Forces.

Medical research is also conducted in the following: institutes of the Academy of Sciences, USSR; institutes under the Ministry of

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Health, USSR, but not subordinate to the Academy of Medical Sciences; and in institutes of the 15 union republics.

The Soviet plans for medical research have always appeared as parts of Soviet national planning. As was the national Five-Year Plan, 1956–60, so was the Medical Research Plan, 1956–60, suddenly withdrawn in 1958 and replaced by a Seven-Year Plan for 1959–65. A change in priority appeared in the new plan. Diseases of what they called an endogenous nature (cancer, heart diseases, and problems of aging) were for the first time ranked ahead of diseases of exogenous nature (primarily infectious diseases). The Plan, largely drawn up by organs of the AMS, was set forth as a policy matter by the Ministry of Health, USSR. A change in approach was also in evidence: instead of assigning specific problems to one or a few institutes, problems were stated in more general terms, allowing for more choice of approach, and allowing for more institutes to participate.

A recent decree by the Soviet Ministry of Health established the "Plan of Scientific Medical Research in the USSR for 1961–62" which was the result of the work of the Scientific Coordination Council. The text is not available, but this 2-year plan seems to differ from all previous plans in three respects: (i) the 2-year plan, rather than consisting of generalities, consists of the most important research projects which have been accepted; (ii) the list is comparatively small, realistic, and capable of being fulfilled, although perhaps not in the time allotted; (iii) contained in this plan is a list of the executors of the priority research projects.

There is dual Academy and Party control over medical research in the USSR. First, problem commissions draw up the research tasks and monitor the research progress to see that it is aligned with the original tasks set forth. Unannounced spot-checks at various institutes also take place. Second, the Communist Party maintains direct control of the AMS through the Party organization within the Presidium of the AMS, its Secretariat, and of all its subordinate organs down to the institute level.

The three key figures in Party control of the Presidium, AMS, are the president, the academician secretary, and the secretary of the Communist Party Bureau. These three officials are generally Party members. In the past, the presidents of the AMS have also been deputies to the Supreme Soviet; it is not known whether the current president is a deputy.

There is a third less formal control over medical research. Because so many major medical research institutes are close together in the Moscow and Leningrad areas, a small group of important investigators are able to exert a disproportionate influence over the broad range of medical research. This control will diminish as new medical research facilities are established in the republics and as greater numbers of competent medical scientists become available to staff them. In addition, the delegation of responsibility for solving regional medical problems to the geographical areas concerned will lessen this control. Three kinds of centralized control with generally enforced conformity to assigned tasks probably will continue during the period of this estimate.

EXTENT AND ADEQUACY OF PRESENT AND FUTURE RESEARCH FACILITIES AND EQUIPMENT

Between 700 and 800 medical and biological research facilities, societies, local academies, and other organizations appear on most master lists of Soviet medical facilities. Three hundred and three important medical research facilities are believed to be in the Soviet Union. The location and affiliation of these are shown in table 1. The other 400 to 500 are either primarily educational (a separate function in the USSR) and only distantly related to medicine or not of recognized importance. The facilities with the most prestige, best men, and best equipment are concentrated in or near Moscow and Leningrad. Of those honored by affiliation with the Academy of Medical Sciences, 28 facilities out of 32 are in these two cities; of those

honored by affiliation with the Academy of Sciences, 22 facilities out of 26 are in these two cities.

The number of medical research facilities in the USSR is expanding and will continue to do so. Most of the expansion will be in new facilities for the application of physical, chemical, and electronic methods to medical and biological problems.

In some cases, a Soviet medical research "facility" consists only of a skeleton staff in makeshift quarters with very little equipment. The majority probably are inadequate for their assigned task. Many laboratories are housed in prerevolutionary structures originally built for other purposes. Only a few are in new buildings. Some of the new buildings are not well built. The laboratory housing shortage is, at the very least, a major inconvenience to investigators. An unknown number of new laboratory buildings are being built. This number probably is not very great, and the priority assigned to medical research construction certainly is less than that of heavy industry and probably less than that assigned to apartment house construction. Most of the new medical laboratory construction is believed to be in Moscow, Leningrad, or Novosibirsk—the new Siberian science center.

The inadequacy of facilities is officially recognized in the Soviet Union. There are repeated public demands for a "strengthening of the material-technical base of medical research." Most proposals call for three things: first, the introduction of more physics and chemistry into biology and medicine; second, the assignment of more instrument-building capacity to biomedical problems; and third, the narrowing of the gap between the best known methods and the most used methods. As an important part of the implementation of these general recommendations, Western experts are encouraged to come to the Soviet Union and make specific suggestions. Although the impetus for strengthening medical research would continue in the absence of East-West contact, the Soviet Union probably will continue to regard East-West contact and trade in the medical sciences as potentially profitable for them.

The equipment shortage is a more serious limitation on investigators. Although some laboratories were noted to have received considerable new equipment of Soviet and Satellite manufacture in the late 1950's, many are believed to depend still on equipment sent to them under the UNRAA programs of 1945–48.

QUANTITY, QUALITY, AND EFFECTIVE UTILIZATION OF MANPOWER

The Soviet Union in 1961 had 1,880,000 professional and semiprofessional workers in public health and medical care; 422,000 of these were physicians. The USSR reported 520 inhabitants per physician in 1961 which is approaching the lowest ratio in the world. Comparable figures for 1958 were Israel, 420; USSR, 580; Czechoslovakia, 610; Austria, 670; Hungary, 680; West Germany, 730; Switzerland, 740; Bulgaria, 760; and the United States, 790. The 85 Soviet medical schools are admitting students at an annual rate that has increased from 20,400 in 1950 to 33,300 in 1961. Not more than 25 percent fail to graduate and by 1972 there probably will be 600,000 practicing physicians in the USSR. The Soviet Union in 1961 had 35,000 medical research workers, about 16,000 of whom hold the Kandidat degree and 3,000 of whom hold the Doktor degree.* The 16 institutes for the advanced training of physicians are training increasing numbers, some of them to the level of Kandidat of Medical Sciences. These figures indicate that the Soviet Union has more trained personnel available for medical care in proportion to its population than does the United States. The Soviet Union probably has about the same number of trained persons engaged in medical research as does the United States. These numbers of Soviets engaged in both care and research are probably adequate for the achievement of their stated objectives.

* The ordinary Soviet physician, known as a *vrach*, has had 6 years of medical school but does not hold an academic degree. The Soviet Kandidat is roughly equivalent to the Doctor of Philosophy; the Soviet Doktor degree requires additional experience and has no precise U.S. equivalent.

Location
Moscow
Leningra
Kiev
Tbilisi
Khar'kov
Minsk
Baku
Tashken
Sverdlov
Novosibi
Odessa
Yerevan
Alma-At
Gor'kiy
Ashkhab
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Table 1

Number of Medical Research Institutes of the USSR, by Affiliation

Location	AMS USSR	AS USSR	Ministry of Health USSR	Ministry of Health Republics	AS Republic or Affiliate	Ministry of Defense	Ministry of Ag.	Ministry of Social Security	Total
Moscow	24	14	22	14	–	3	1	2	80
Leningrad	4	8	2	15	–	3	–	–	32
Kiev	2	1	–	15	2	1	–	–	21
Tbilisi	1	–	1	16	1	–	–	–	19
Khar'kov	–	–	2	10	–	–	–	–	12
Minsk	–	–	–	10	1	–	–	–	11
Baku	–	–	–	10	–	–	–	–	10
Tashkent	–	–	1	8	–	–	–	–	9
Sverdlovsk	–	–	–	7	1	–	–	–	8
Novosibirsk	–	3	–	4	1	–	–	–	8
Odessa	–	–	–	6	–	–	–	–	6
Yerevan	–	–	–	6	–	–	–	–	6
Alma-Ata	–	–	–	5	–	–	–	–	5
Gor'kiy	–	–	–	5	–	–	–	–	5
Ashkhabad	–	–	–	4	–	–	–	–	4
Frunze	–	–	–	4	–	–	–	–	4
Kazan	–	–	–	3	1	–	–	–	4
Lvov	–	–	–	4	–	–	–	–	4
Rostov-on-Don	–	–	–	4	–	–	–	–	4
Nefa	–	–	1	3	–	–	–	–	4
Vilnyus	–	–	–	3	–	–	–	–	3
Others*	1	–	5	34	2	2	–	–	44
Totals	32	26	34	190	9	9	1	2	303

* This includes 8 cities with 2 institutes and 28 cities with 1 institute each.

According to qualified Western observers, the clinical faculties at most Soviet medical schools are competent, and the curriculums are very like the United States or Western European. Research, however, is not done, as it is in the West, in medical schools. Research is done in separate institutes. Members of research institutes may work part time as members of teaching faculties; but, unlike the best research institutes, the medical schools are not concentrated in Moscow and Leningrad. The medical schools get little help from the best research institutes. The Soviet physician is about as qualified for his clinical duties as education can make him; he is less well prepared for an eventual research career.

In 1960, 75 percent of Soviet physicians were women. Because only 50 percent of medical students were women, the proportion of women will tend to decrease during the next 10 years. Because 95 percent of all Soviet physicians are actually employed in their profession, neither women nor men are likely to leave this kind of work. Although Soviet women do not leave the profession, their productivity is less than a man's because they work less overtime, take maternity leave, and retire at a younger age.

The normal work week for a Soviet physician is 36 hours. Many male physicians, however, have an extra half-time job, bringing their actual work week to 54 hours. Often a small clinic is allowed 1.5 pediatricians, 0.5 radiologists, and so forth. The problem of maldistribution of Soviet medical manpower takes the form, in some instances, of extreme difficulty filling these fractional positions for specialists in outlying places.

At the time of graduation, the new Soviet physician is offered a choice of employment. He must choose, however, for his first 3 years

of work an assignment in an outlying place. There is less difficulty filling positions for general physicians than for specialists in outlying places. After 3 years' service there are opportunities to return to the big cities for specialized training and to compete for employment in a major institute. One may spend 3 years as an *ordinat* in an approved institute and become certified as a medical specialist. One may spend 3 or more years as an *aspirant* and eventually defend his dissertation for the degree of Kandidat of Medical Sciences. The first course produces clinical specialists; the second course produces academic specialists.

Approximately one-third of Soviet physicians combine practice with managerial and administrative functions. Even for the other two-thirds, the burden of paper work is heavy. Women are eligible for administrative and supervisory posts. Among heads of institutes, departments, and laboratories, 57 percent are women.

Although the number of persons engaged in medical research is adequate and about the same as it is in the United States, the results of their work have been small—much smaller than in the United States. Soviet medical personnel receive a secondary education that is in some respects better, and a university education that is in many respects similar to that of West Europeans and Americans. The Soviet Union has long offered considerable financial incentive for persons to go into medical research. A medical scientist receives five or ten times the income of an ordinary citizen; a medical practitioner receives about the same as an ordinary citizen.* The relative paucity of results in Soviet medical research may reflect not any lack of quality in their manpower but solely the fact that they started late. Until the middle 1950's, most of what was called research in the Soviet Union was directly applicable to public health and sanitation and might not have been called research in the West. Working conditions after graduation—not only shortages of equipment, but also overcentralization of authority, lack of choice of problems to work on, bureaucratization, compartmentalization, and lack of contact with foreigners—eventually may sap the potential strength of the Soviet medical researcher. The present outlook is for gradual improvement in these working conditions during the next 10 years. Western impressions of the quality of Soviet medical research manpower will probably become more favorable.

* At the 22nd Party Congress (October 1961), physicians were among the several occupation groups for whom substantial pay raises were proposed by Chairman Khrushchev.

SOVIET OBJECTIVES, MAJOR ACHIEVEMENTS, TRENDS, AND FUTURE CAPABILITIES IN MEDICAL CARE AND MEDICAL RESEARCH

Health Promotion

Soviet medicine places more emphasis on prevention of disease than on cure. The development of the "Communist man," who is supposed to be physically superior to other nationals, calls for a health protection program more extensive than is customary in Western countries. In addition to generally accepted concepts of public health and preventive medicine, the objectives of the Seven-Year Plan for 1959–65 include improvement of national physical examinations; mass sports and physical exercises tailored to all age groups and occupations; the systemization of rational nutrition covering all geographic and occupational conditions; and operation of preventive psychological services aimed at insuring a high level of mental health. Provision for total maintenance and improvement of the health of the individual Soviet citizen throughout his lifetime is referred to as "positive health" or "health promotion."

In the development of Soviet youth, physical training is considered to be extremely important and receives much attention in the formative years. Virtually every phase of the modern Soviet young person's life is being organized and almost all organizations are concerned with either active physical fitness programs or health education work. An attempt is made to have one pediatrician follow the child from birth to the age of 15 or 16 years.

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An integrated program of health education and preventive medicine is provided through the pediatric services to all children of these ages. The youth organizations and sports societies also sponsor suitable physical training, athletics, summer camps, and related activities. The early and continuous physical training, frequent medical checkups, and implanting of a sound hygienic consciousness are bound to result in an increase in the general well being of Soviet youth and probably in a decrease in morbidity from some diseases.

The system of good health habits, regular checkups, and organized physical culture extends into adult life, including industrial hygiene, agricultural and rural life, and the military. On-the-job calisthenics and factory-sponsored athletics and recreation are increasing in the USSR. All-expense vacations to recreational areas where further physical culture can be offered are a further positive factor in worker health.

Rural areas do not enjoy the urban level of medical care or health promotion, but many have been strengthened considerably in recent years by increasing attention to positive health on collective farms and great emphasis on health education campaigns at the village and farm level.

One of the more important Soviet health concepts is to insure that all able bodied persons both in and out of the armed services will be in acceptable physical condition in the event of a national emergency. The organization called "Ready for Work and Defense" develops physiques of all able bodied persons age 13 and older. Regulations and norms provide physical tests which must be passed with satisfactory ratings.

With the exception of this military physical fitness concept, which will probably be standard within the period of this estimate, execution of health promotion programs is slow and fragmentary and will not be attained by 1972. In spite of inherent difficulties, the increase of public awareness of the value of health improvement is marked and of unquestionable benefit to the State.

Cardiovascular Diseases

Cardiovascular diseases have increased in relative importance in the USSR and will probably continue to do so. This fact has received ample recognition in Soviet medical research planning. During the late 1950's, there were changes in Soviet research planning which permitted greater scope and depth of research on cardiovascular diseases. At present, a larger number of institutes are permitted to initiate projects on some of the basic aspects of the problem.

Among economically advanced nations from which adequate figures are available, the death rate from cardiovascular diseases varies from about what it is in the United States down to about half as much. Adequate figures are not available for the Soviet Union. In fact, medical statistics often are classified as State secrets. No country has as high a death rate from this disease as the United States, lending a note of plausibility to Soviet claims that their incidence is only 55 to 60 percent of what it is in the United States.

Soviet medical scientists have long favored a neurogenic theory of hypertension; more recently they have come to favor a neurogenic theory of arteriosclerosis. There is a substantial body of evidence to support the theory that in the pathogenesis of hypertension cerebral disturbances are primary; much of it is older evidence and much of it is of Soviet origin. There is a smaller body of evidence to support a theory that in the pathogenesis of arteriosclerosis cerebral disturbances are primary.

Although Soviet scientists seem to believe that psychic strain is the key factor in the cause of cardiovascular diseases and that there is less of this type of strain in the USSR, they have, thus far, published only one good study that attempts to portray an integrated picture of such other factors as age, sex, diet, and physical exercise. The Soviets now have the capability to publish more good epidemiologic studies on cardiovascular diseases.

For the control of hypertension and arteriosclerosis, Soviet medical scientists and practitioners will continue to emphasize improve-

ments in living and working conditions designed to reduce "psychic strain." There is not now and probably will not be during the next decade any firm scientific basis for this approach. The effort to provide better conditions for persons with early forms of hypertension and arteriosclerosis probably will continue, although it probably will not be possible, during the next decade, to evaluate this approach scientifically.

Because greatly improved methods for the study of brain functions now are available in the Soviet Union and in the West, important results concerning the role of the nervous system in hypertension should appear from both sources in the next decade. Important results concerning the role of the nervous system in arteriosclerosis seem somewhat less likely to appear.

Cardiovascular surgery is a field in which the Soviets have great admiration for Western accomplishments and a great desire to excel. During the late 1950's, they rapidly adopted and brought into wide use in the Soviet Union these techniques of closed heart surgery developed in the West in the late 1940's and early 1950's. They have been slower to get into the field of open heart surgery. Soviet work in open heart surgery has been delayed by a lack of instruments, especially a workable heart-lung machine of Soviet origin. Soviet work on diagnostic computers began in connection with diagnosis of heart disease. Their work on machines to monitor the condition of the patient during surgery refers especially to operations on the heart. Although the field of open heart surgery has been delayed in the Soviet Union by shortages of some kinds of instruments, it is also a field in which Soviet medical scientists and engineers are cooperating on some very advanced type of instrumentation.

Cancer

The Soviet Seven-Year Plan for the Medical Sciences, 1959–65 was the first of the Soviet's plans to put considerable emphasis on the fight against cancer. For their proposed effort in early diagnosis and treatment the Soviet Union has a sound foundation. They have a network of general hospitals, clinics, and dispensaries that are located at or near places of employment. Therefore, these are well situated to do early diagnostic and preventive work. For their proposed effort in cancer research, the Soviet Union does not have a sound foundation. Although they have a few outstanding people who are working on cancer, they do not have an adequate number of either trained scientists or equipped laboratories.

During 1955–61, Soviet scientists completed their first survey of the true incidence of cancer in the different parts of the USSR. The Soviets will use these data to study the role of occupation, diet, climate, nationality, and other factors in cancer. They will also use these data to try to plan the more efficient use of specialists and specialized equipment in the diagnosis and treatment of cancer.

The Soviet medical system has the basic resources (physicians, hospitals, and clinics) to make maximum use of existing knowledge in the fight against cancer. There is some evidence that these basic resources—which have been directed primarily to problems of infectious disease, infant mortality, and maternal welfare—are being only slowly re-directed to the cancer problem. The Soviets are in the process of establishing mass programs for the early diagnosis of cancer but these programs are now growing very rapidly and are not of very good quality. Deficiencies in important specialties, such as exfolliative cytology and medical radiology, have held them back. Present programs will probably correct these deficiencies by 1965 and the mass programs should be much improved by 1970.

The main directions of Soviet cancer research are the same as in the West: chemotherapy and virus etiology receive the most attention. The Soviet Union has a large program for the screening of new chemicals for anticancer action. This program is about one-fourth the size of the very large U.S. program. As in the West, the program has been largely empirical and the results have been small in proportion to the investment. Since the 1930's, Soviet scientists have emphasized

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work on the virus etiology of cancer, but deficiencies in the important underlying basic disciplines held them back. They do not now have an adequate supply of either trained scientists or well-equipped laboratories in such basic underlying fields as biochemistry, genetics, immunology, endocrinology, and radiobiology. Present programs probably will correct these deficiencies but not until 1970. The Soviet Union is not ready to participate in the great discoveries that seem likely to be made in the field of cancer etiology in the early 1960's.

The Soviet Union has even less capability than the United States for screening for substances that might cause cancer, the thousands of new chemicals that are introduced into the environment each year. Soviet medical scientists are now openly advocating a stricter attitude toward use of such substances. In general, new facilities in the USSR are probably designed to minimize pollution of the environment but relatively little is done about existing sources of danger.

Infectious Diseases and Problems of Immunity

The development and mass application of both live and killed vaccines continues to be the chief means for combatting infectious diseases in the USSR. At this time, necessary supplemental environmental sanitation and vector controls remain inadequate, although improvement in these fields now is in process. The most significant trend in Soviet vaccine research and development concerns the extensive Soviet work with combined and associated live vaccine combinations administered to large groups via cutaneous, oral, or aerogenic routes. Although the oral and aerogenic approaches have great potential for facilitating routine and emergency mass immunization, present evidence indicates that no Soviet vaccine of domestic origin would meet the standards of safety and efficacy followed in the United States. There appears to be minimum red tape or lag between the time when the key investigator decides that the biological is efficacious to its certification by the Soviet Vaccine and Sera Commission and its use in a mass trial or public health program. As a rule, U.S. authorities would not permit the routine use of Soviet-produced vaccines and sera in humans on the basis of data and conclusions used by Soviet investigators. Their live tularemia vaccine, although efficacious, is not safe. Their live influenza vaccine is safe but not efficacious. Their live brucellosis vaccine probably is neither safe nor efficacious. The value of their live anthrax vaccine awaits verification. The most promising Soviet live vaccine program is the use of a live polio vaccine developed in the United States.

Within the next 5 years the USSR will have field trialed combined and associated live viral and bacterial vaccines in large segments of the Soviet population. By 1972, aerogenic vaccination will have become a standard route of inoculation for a variety of Soviet vaccine combinations. Standards for safety and efficacy for most Soviet biologicals (particularly vaccines, sera, and antibiotics) will begin to reflect recognized international codes. By 1967, most unsafe vaccines will have been removed from production because of improved quality control measures.

Soviet epidemiological studies are mostly practical observational assessments of existing epidemic situations. Supplementary experimental studies include transmission dynamics, preservation of pathogens in nature, and the role of seasonal, ecological, and socioeconomic factors of all infectious diseases of military and economic importance in the USSR. Diseases such as malaria, smallpox, cholera, plague, and typhus are well controlled. In recent years, the incidence of poliomyelitis, brucellosis, tularemia, diphtheria, helminthic diseases, and whooping cough appears to have significantly declined.

Because many of the problem diseases in the Soviet Union already have been controlled in the United States and other Western nations, these Soviet reductions in morbidity can be compared only with the previous massive extent of diseases in the USSR. The extensive Soviet antiepidemic system is neither well equipped nor well manned, but it appears to have been of some value in dealing with re-

Table 2

Soviet Classification of Infectious Diseases

Infectious diseases which largely require better use of known measures

Tuberculosis	Brucellosis
Venereal diseases	Typhoid fever
Diphtheria	Q fever
Poliomyelitis	Tetanus
Tularemia	Botulism

Infectious diseases which require substantial research and development in support of present practice

Bacillary dysentery	Glanders
Measles	Melioidosis
Mumps	Mycotic infections
Pertussis	Arthropod borne virus encephalitides
Streptococcal infections	Exotic typhus fevers
Rabies	Exotic parasitic diseases
Anthrax	

Infectious diseases for which research and development must provide new procedures

Respiratory virus diseases	Hemorrhagic fevers
Influenza	Infectious mononucleosis
Viral hepatitis	Herpes
Enteric virus diseases	Viral etiology of cancer
Adenovirus diseases	

cent epidemic emergencies, more adequately in the European USSR but much less effective outside of the areas of Moscow, Leningrad, and Kiev. The USSR still maintains a low standard of routine sanitary-hygiene facilities and practice, particularly outside of the major European centers. This deficiency is reflected in the continuing high morbidity of infectious diseases related to housing, food, occupational, and other environmental sanitary hazards. Within the next 5 years, the USSR will improve methods for epidemiological analyses and processing of infectious disease statistics. Gradual open publication of reliable medical statistics will be restricted to specific infectious and other disease morbidity which show decided improvement.

By 1972, a strong environmental sanitary-hygiene code will have been enforced with subsequent benefit to the public health in most urban areas of the USSR.

In general, virology in the USSR is 2 to 3 years behind the West in the application of newer methods pertinent to virus disease research problems. This situation, however, is well recognized by responsible Soviet investigators, and some work with the newer physicochemical methods now is being encouraged.

Experimental replacement of limbs and vital organs of human beings has great significance for military as well as civilian purposes because of its application to wound and other traumatic surgery. The Soviets are intensively engaged in such research and they possess the technical excellence in surgery necessary to performing vital transplants. Their attempts to transplant whole organs, however, have not resulted in permanent replacement and their grasp of the immunological problems involved is not on a par with that of U.S. investigators. No major advances in transplantation immunity have been made in the USSR.

Soviet basic research in antibiotics is well advanced largely because of Soviet exploitation of Western products and literature, but the research is not yet quantitatively comparable to U.S. studies. Soviet versions of most of the commonly recognized antibiotics of choice are available in the USSR—for example, penicillin, streptomycin, chloramphenicol, and tetracyclines. Nevertheless, the quantity and quality of available preparations often are not up to U.S. standards. The USSR is attempting to neutralize serious deficiencies in processing and production technology associated with its vaccine production and antibiotics industry.

There will be a trend toward the application of modern physicochemical principles to microbiology in the USSR. A greater proportion of physicochemical investigators will be supporting priority biomedical research programs. This trend is particularly evident in recent immunochemical and biophysical research publications. A growing interest is already evident in studies concerning basic mechanisms of bacterial and viral multiplication, studies of the structure and characteristics of bacterial and viral entities, physicochemical approaches to microbial genetics, and the increased use of advanced methods based on modern concepts in physics, chemistry, and mathematics. A wide range of biophysical studies using microbiological systems are in progress in the USSR. These include the following: aerosol and hydrosol particulation studies; ultraviolet, infrared, fluorescent, luminescent and electron microscopy techniques; isotope tracer studies; and the effects of ultrahigh frequency and ultrasonic forces on microorganisms. It is doubtful whether major advances will come from original Soviet research on basic microbiological and viral processes within the next 5 years or more. The Soviets will continue to seek substantial aid from Western investigators in theoretical research areas, but a 5- to 10-year training program is an absolute requirement for the Soviets to meet their minimum needs for personnel with major capabilities in fundamental biomedical research. Most fundamental biomedical research in the USSR will be done by newly trained, younger investigators rather than those who now are established.

A portion of the manpower and facilities of various Soviet biomedical and astrophysical institutes have been marshaled in support of diverse studies concerned with extraterrestrial forms of life and potential hazards derived from spaceflight to other planets. "Cosmic biology" or exobiology areas of greatest interest include the following: origin of life comparative studies between earth and other planets (for example, Mars); exobiological safety problems of man-in-space flight as well as potential terrestrial and extraterrestrial biological disruption hazards; and development of life support systems for man in space and other alien environments. Various bacteria, viruses, phages, yeasts, algae, and other cellular specimens have been sent along with manned and unmanned flights. At this time, no firm quantitative data are available on the results of Soviet analysis of returned specimens or those derived by remote monitoring. Generalizations by various Soviet investigators indicate no major genetic or physicochemical changes because of flight stresses or cosmic radiation.

The desultory effort made to decontaminate the Soviet moon shot has convinced expert observers that the spacecraft was, in fact, not sterilized. U.S. authorities currently are preparing to train several Soviet investigators in modern sterilization methods in an attempt to insure noncontamination of the moon and other planets scheduled as targets for spaceflights. A major program for design and development of biodetection devices suitable for remote monitoring of organic and inorganic matter is now underway in the USSR. Exobiological projects include remote-controlled identification of microorganisms during spaceflights and after impact on extraterrestrial bodies. The present direction of this development is toward photoelectric sampling devices incorporating high-speed photographic, television, and fluorescent microscopic equipment with telemetered transmission arrangements.

By 1972, the USSR will have accumulated copious data concerning the condition of microorganisms and other cells during spaceflight and in alien environments. By 1967, the Soviets will have developed a major germ-free research program and, as a natural extension of this, will have a capability for decontaminating or sterilizing space vehicles equal to that of the United States. By 1967, the Soviets will have prototype models of remotely monitored biodetection devices and samplers suitable for shots to the moon. By 1972, sophisticated devices of this type will have become standard equipment on all Soviet extraterrestrial space probes.

Medical Aspects of Civil Defense

Nuclear Defense — There are sources of strength in the present state of medical aspects of civil defense in the USSR. First, there is strength in numbers. The USSR has the largest number of physicians and auxiliary medical personnel in proportion to its population of any other country in the world. Such personnel, although not all of the highest professional caliber, could render acceptable emergency service on a large scale. Under the concept of triage now accepted in the USSR, the best trained personnel could devote their time to priority sorting of mass casualties and to definitive treatment where most indicated. Second, there is strength in organization. For each administrative subdivision of the USSR, there is a single civil defense officer and under him a single medical civil defense officer.

The position of medical civil defense officer is usually filled by the man who is also the chief peacetime public health official for the subdivision. This medical official, powerful in his own right, has to assist him a small group of men, each of whom is important in his field of medicine, surgery, medical supply, and so forth. Thus responsibility for peacetime preparation is charged to those who are normally influential and able to move things. Responsibility for wartime action has been assigned in advance. In the event of heavy casualties, alternates have already been named for the position of medical civil defense officer and all other important positions.

Under their system of organization, the numerical strength of the Soviet medical civil defense is further augmented by paramilitary organizations. Just as the civil defense officer commands the whole paramilitary civil defense organization (DOSAAF) in his region, so the medical civil defense officer commands partly trained medical contingents within DOSAAF. There is now a continuous program of education of the whole populace in matters of civil defense. The program stresses antinuclear defense but also contains information about chemical and biological warfare. At present, the average Soviet citizen seems to be more knowledgeable of certain specialized problems of chemical, biological, and nuclear warfare than his U.S. counterpart—although less exposed to general discussion of nuclear warfare.

There is a source of weakness in the present state of medical aspects of Soviet civil defense. Most medical facilities outside of the biggest cities are only minimally equipped for their peacetime mission and probably have no surplus of materiel and equipment to draw on in an emergency. For the treatment of thermal burns and radiation sickness, two of the kinds of injury seen after a nuclear attack, only a few Soviet institutes are now adequately equipped. The Soviets are aware of these deficiencies but progress is slow. Efforts are devoted to increasing the storage life of whole blood, finding satisfactory blood substitutes, and building up industrial capacity in many drugs and antibiotics currently in short supply in the USSR. At the present rate of progress, the Soviet Union may catch up to the United States by 1972 in blood storage and blood substitutes but probably will still lag in antibiotic development and drug supply.

Although responsibility for civil defense preparation seems to be in the hands of those most able to do something about it, they do not seem to have done very much. Each medical organization has an emergency mission already assigned and each organization supposedly is well prepared for this mission. There is, however, little external sign of this preparation. Perhaps too much authority is

concentrated in the hands of the Ministries of Health and Defense in Moscow and not enough delegated to the people who must do the work. Perhaps not much priority is actually given to medical civil defense preparations.

Chemical Warfare Defense — Soviet objectives in the medical aspects of CW defense are to provide protective equipment, prompt treatment, and speedy decontamination. Although neither the equipment nor the treatment presently available are ideal, both could play an important role in any attack limited to chemical warfare (CW). For treatment and decontamination following limited attack, the Soviet Union is relatively well organized and has strength in numbers. The medical civil defense chain-of-command is fairly clear. The general level of Soviet knowledge in matters of CW defense is higher than in the United States. The Soviets apparently feel that preparation against chemical attack, at least in key areas, is worthwhile.

Against the anticholinesterase type of CW (nerve gases), atropine is a partial antidote and can be lifesaving if given quickly enough and in large enough doses. During 1957–60, Soviet scientists published many reports of their unsuccessful search for atropine-like drugs. The better aldoxime-type drugs (a-PAM is in this group) were discovered in the West and now this family of chemicals is the main subject of Soviet interest. The Soviets have manufactured considerable atropine and will now, presumably, manufacture aldoximes. Their pharmacological research, however, will probably not result in an original antidote for a new type of CW agent by 1972.

Biological Warfare Defense — The Soviet civilian medical defense program for bacteriological warfare (BW) depends on existing public health organizations. The Medical Service of the Local Civil Defense Organization (MS MPVO) is superimposed upon and integrated with the public health system and administers the network of therapeutic, sanitary, and laboratory establishments during BW emergencies. The antiepidemic service has the major role in identification, isolation, and protection against BW agents, and the sanitary-hygiene services are chiefly concerned with decontamination, disinfection, and the protection of perishable products.

Soviet civil defense and military medical authorities are encouraging public health programs to tighten up existing sanitary hygiene and antiepidemic programs; intensification and evaluation of mass immunization; observation of potential routes of spread of infectious disease; geographic location and typing of potential rodent and arthropod reservoirs and vectors; and systematic investigations of airborne microflora in cities.

The wide geographic disposition of antiepidemic facilities, the experience of Soviet personnel with mass outbreaks of infectious diseases, and the numerous special medical missions and teams which now operate in the USSR could help the Soviets to deal with BW attacks. If BW agents are undetermined at the time they are used or if BW agents are in overwhelming dosage or are unknown mutants for which no vaccines have yet been developed in the USSR, present Soviet recommendations call for reliance on broad public health and sanitary control measures and available antibiotics. It is doubtful, however, whether the present level of public health practice will be able to cope with massive BW attacks, although the Soviets could contain and neutralize limited or isolated outbreaks.

Also, the USSR might have great difficulty in providing early and rapid identification of BW agents, at the present time. Laboratory support for the clinician is poor in the USSR. Furthermore, the more recently developed rapid diagnostic schemes, techniques, kits, and equipment are either not generally available or limited to various major research installations.

At least part of the Soviet public health research and development program is allied to or directly concerned with BW defense needs and is aided and abetted by military elements. Coordination between authorities and installations servicing the BW defense mission appears to be erratic, and too much dependence on opportune developments in Soviet medical research is apparent. The major

institutes contributing data and techniques for purposes of medical defense against BW are Military Medical Academy imeni S. M. Kirov (MMAK), Rostov-on-Don Antiplague Institute, Institute of Epidemiology and Microbiology imeni Gamaleya (IEpMi), AMS, the Tarasevich Vaccine and Sera Control Institute and the Ivanovskiy Institute of Virusology.

In the event of biological warfare, the USSR intends to conduct mass inoculations in military and civilian populations under attack, using available vaccines and/or sera. A number of polyvalent vaccines, which include permutations and combinations against various agents with BW potential, are under development at MMAK, the Tarasevich Institute, the Gamaleya Institute, and other establishments in the USSR. However, no polyvalent vaccine useful for BW defense, developed under Soviet military medical or public health auspices, has been confirmed to be safe or effective against highly virulent mutants of nonindigenous strains.

Certain Soviet bacteriological air sampling studies, experimental epidemiological investigations, and aerosol studies are applicable to BW research and development. But no known Soviet air sampling device is more advanced than those available in the United States. Part of the aerosol and air sampling research at the MMAK, Leningrad, is almost certainly for BW purposes. The Soviets have accumulated respiratory challenge data, primarily from experimental animals but in some cases from humans, which are useful for BW purposes. Anthrax, plague, brucellosis, tularemia, glanders, pathogenic fungi, tuberculosis, pyrogenic cocci, botulinus toxin, influenza, spring-summer encephalitis, psittacosis, dengue, yellow fever, and Q-fever are among the pathogens whose aerosol characteristics are of interest to Soviet investigators. In addition, the intensive Soviet program to evaluate existing antibiotics and to find new antibiotics that are therapeutically effective probably has resulted in identification of antibiotic-resistant strains of potential BW value and has demonstrated the therapeutic limitations of available antibiotics against cases of natural human respiratory infection with brucellosis, anthrax, plague, tularemia, and Q-fever.

In recent years, Soviet military and civil defense authorities have shown increased concern about the necessity for defensive preparation in the event that the United States should use viral BW agents. Although available information indicates that Soviet military medical personnel are interested in research and development applicable to viral biological warfare agents, the major Soviet viral laboratories are capable of supporting a BW research effort only at a further sacrifice to the already overburdened investigators and facilities.

Currently the Soviets are concerned over the danger from BW agents and natural bacterial and viral infections during the aftermath of nuclear and/or CW–BW attack. Military and civilian investigators have been conducting several lines of research related to the effects of radiation on immunity and infection and have maintained surveillance of Western work in this field.

The MPVO is supposed to be an integral part of the nationwide air defense (civil defense) system. With regard to defense against BW attack, it is supposed to work with medical, military, paramilitary, and industrial authorities. For instance, the Soviet paramilitary organization (DOSAAF) is responsible for organizing and training medical auxiliary units. At present, the military and civilian authorities are not cooperating in practice exercises; the defense and regular medical authorities are not cooperating in the best preparation of facilities. By 1965, however, a new master plan for medical defense against special weapons will have been formulated; and by 1972, the USSR will have resolved its present organizational difficulties. Before 1972, the training program for BW medical defense will have begun to concentrate on specialized courses for highly skilled professional and key medical administrators. By 1972, practice exercises in rapid detection and identification of BW agents will have been held in key medical laboratory installations. Rotating refresher stockpiles of critical pro-

phylactic, therapeutic, and decontamination equipment and preparations will have been allocated to key facilities and areas according to standardized plans.

By 1967, mass immunization with living, univalent and polyvalent vaccines for pathogens with BW potential will have been attempted in large segments of the Soviet population, using conventional, oral, and aerogenic routes of inoculation. By 1972, aerosolized vaccines and sera will be the biologicals of choice for emergency prophylaxis against natural epidemics or outbreaks caused by BW agents. By 1972, air samplers, rapid detection kits for bacterial and viral agents, and the more sophisticated agent isolation and identification procedures will be available to all medical microbiological research laboratories as well as those of the major oblast hospital centers and antiepidemic stations. By 1972, more efficacious drugs of choice for potential bacterial agents will be available in the USSR in adequate quality and quantities for large-scale outbreaks. If a breakthrough in specific viral therapy occurs before 1972, such preparations will become available to USSR investigators within 1 year of the find. By 1972, the Soviet military medical component will have developed a strong infectious disease oriented research and development capability independent of the civilian public health organization. A major portion of this effort will be directed to applied problems related to biological warfare emergencies.

Biomedical Instrumentation

The Soviet Union has depended on Western sources for much of its technical know-how in biomedical instrumentation. The Soviets have a worldwide program for procurement of technical information. They are also interested in obtaining finished equipment from Western countries. They have paid high prices and have used devious channels to avoid the NATO restrictions on East-West trade. They constantly fear that they are missing useful information, and generally they are desirous of obtaining more finished equipment.

There are still major shortages and deficiencies in the equipment of many medical research institutes. Only the very top institutes presently are well equipped, and many of the institutes, even in Moscow, Leningrad, and Kiev, are in need of a great variety of modern equipment. Institutes in other Soviet cities are correspondingly less well equipped. Because the specialized biomedical instrument institutes have not been able to supply their needs and because of the increasing complexity of biomedical instrumentation, the Soviets have started to channel more of their effort in electronic, optical, and mechanical engineering toward biomedical requirements.

In the period immediately following World War II, the import of finished equipment from the West made an important addition to Soviet biomedical research capability. Since the advent of the cold war, the NATO countries have severely restricted this trade. Rather than permit biomedical research to deteriorate further, the Soviet Union turned to Eastern European sources. As its own capabilities increased, the Soviet Union has turned more to its own sources. Under the Council for Economic Assistance (CEMA), however, Czechoslovakia and East Germany are still functioning as the only producers, within the Bloc, of certain biomedical instruments.

The Red Banner of Labor Medical Instruments Plant in Leningrad is the oldest specialized institution of its type in the Soviet Union. It is an important supplier of instruments to military as well as civilian medical installations. The All-Union Scientific Research Institute of Medical Instruments and Equipment, founded in 1944, achieved little more than to provide surveillance of Western developments and to copy finished instruments. Thus a new institute, the Scientific Research Institute of Experimental Surgical Apparatus and Instruments, was founded in 1951 to stimulate original native Soviet developments in the surgical field. This latter Institute has been responsible for a number of the well-designed, original, and useful Soviet instruments that have appeared since about 1956. Other organizations, such as the Scientific Research Institute of the Radio-Engineering Industry (MRTP) and the Scientific Research Institute of the MRTP and Optico-

Mechanical Industry have been responsible for other types of equipment necessary in the biomedical field, such as ultracentrifuges and electron microscopes. Only since 1958 have the Soviets demonstrated an ability to make their own models of many of these instruments. Not until August 1961 were the Soviets able to display a native ultracentrifuge—quite good but only a prototype. Occasionally, instruments or improvements are developed by individuals. Examples of this are the "toposcope," an electroencephalograph with up to 200 leads, and the fine electrodes for single cells, developed by M. N. Livanov and P. G. Kostyuk, respectively. The former is going into serial production.

During the late 1940's, the Soviet Union obtained a few electron microscopes built in the United States. By 1950, East Germany and Czechoslovakia were able to supply some of this need. By 1958, the Soviet Union was able to go into limited production (about 10 or 20 per year) of three high-resolution models of its own. Even in 1961, however, the Soviet Union ordered ten high quality electron microscopes from Japan and for 1962 plans to import all of East Germany's production (about 100). Evident attempts at betterment can be noted in the design and development of domestic electron microscopes. The major biomedical research institutes and electron microscopy laboratories also use domestic and foreign models of ultraviolet phase contrast and luminescent microscopes. Soviet biomedical studies utilizing special microscopy are still undistinguished but improvements in the scope, quality, and quantity of such research are in process.

In recent years, Soviet military and civilian biomedical investigators have demonstrated increased interest in the development of experimental equipment for the study of artificial bacterial and viral aerosols. Several hermetically sealed chambers have been devised, and various methods suitable for quantitative and qualitative detection and analysis have been adopted and modified from the work of U.S. investigators. More than 15 bacterial and viral air sampler types now are in use in the USSR; all generally follow patterns of U.S. and British sampling devices.

The Soviet Union is already using computers in medical research. Three general-purpose digital computers (all URAL-2's) are known to be installed in medical institutes and available full time. An unknown number of machines may be available part time. Some instrument development in the computer field is now underway in special cybernetics or electronic laboratories in Moscow, Leningrad, and Kiev medical research institutes. A greatly increased amount of computer time is expected to become available to medical researchers during the next decade.

During the next 10 years, the Soviet Union will continue to be concerned about collecting technical know-how information and will continue to be interested in buying finished precision medical equipment from Western countries. Their degree of actual dependence on Western sources will probably tend to decrease. It is not clear whether the Soviet Union is concerned about its present dependence on Satellite instrument sources. Although the Soviet Union will upgrade its own domestic capability, this will not deter the continued progress of Czechoslovakia and East Germany in design development and production of precision biomedical instrumentation. By 1972, the Soviets will be providing new ideas on instruments and equipment, but the number of such new ideas will remain lower than that of the United States. The Soviet production and distribution facilities will be operating much more smoothly and adequately, but many Soviet medical research institutes still will lack modern equipment.

Brain research is an area in which instrumentation, physiology, and cybernetics may begin to interact during the period of this estimate. There is already governmental pressure on Soviet physiological scientists and their mathematical collaborators to arrive at a much better model of the brain. On the one hand, an improved model of the brain might provide the basis for predictive control of the human individual and group behavior. On the other hand, an improved model of the brain might provide the basis for improvements in computer design. In the absence of

any clear-cut idea of how to implement such a program, the present Soviet effort is broadly based.

The rate at which data acquisition can proceed on such a basis will depend on the availability of appropriate computer hardware. This is one kind of biomedical instrumentation that evidently is receiving a relatively high priority in the USSR. The rate at which ideas can be generated will depend on the degree of cooperation between mathematicians, engineers, and biologists. The Soviets have powerful traditions of excellence in mathematics and certain branches of neurophysiology; organizational steps have already been taken to improve cooperation between the two.

At the present time, Soviet research has not proceeded to the point where knowledge of brain function can be used to control behavior or to design computers. It is not likely that they will reach this point during the period of this estimate. On the other hand, the present Soviet effort is much greater than the U.S. effort in some of the same areas and the Soviets may succeed, during the period of this estimate, in laying the groundwork for later progress that could be of great significance.

Soviet Exploitation of Medical Assistance as an Instrument of Foreign Policy

Soviet exploitation of opportunities for extending various kinds of medical assistance, which was first noticeable in 1947, accelerated rapidly after 1955, and will increase during the next 10 years. This Soviet program was first concentrated in Asia and the Middle East. In recent years, medical support continues in those areas as in Ethiopia (1947), Egypt (1956), and Sudan (1958). With the advent of independence for many African countries, Soviet attention focused sharply on this continent. Bloc medical assistance spreads in Africa: Ghana (1957), Guinea (1959), the Somalia Republic (1961), and the Central African Republic and Mali (1962). Exports of medical materiel and supplies and offers of scholarships or grants for the study of medicine in the USSR or the Satellites are the major types of activity in Latin America to date. The USSR, Czechoslovakia, and Bulgaria have a sizable corps of physicians, inured to unsatisfactory living conditions, who are being detailed to developing countries.

Communist medical assistance will continue in underdeveloped countries of Asia and the Middle East and will undoubtedly increase in Africa, with some possible extension into Latin America. Soviet success and Free World failures, real or exaggerated, will be well publicized in all of these areas. Medical aid will be extended where it will have an impact on a large number of people, as a sample of what things are claimed to be under communism. Health programs that involve some degree of dependence on the Soviet Bloc will continue to be facilitated by training Bloc personnel for service abroad, training indigenous personnel in Bloc schools, and supplying drugs and equipment through Bloc channels. One objective will be to give the masses a favorable image of communism to prepare their minds for political action. Another objective will be involvement of leaders in dependence on Bloc aid and trade as an influence on political decisions.

The Soviet Union will intensify its efforts to gain more influence in international biomedical councils including the World Health Organization. The placement of more Soviet personnel in key international health positions would facilitate the Soviet program for penetration of politically important world councils and underdeveloped areas.

APPENDIX

SELECTED MEDICAL RESEARCH INSTITUTES UNDER THE ACADEMY OF MEDICAL SCIENCES OR THE ACADEMY OF SCIENCES, USSR, AND THEIR DIRECTORS

Academy of Medical Sciences, USSR	*Director*
Institute of Biological and Medical Chemistry, Moscow	V. N. Orekhovich
Institute of Biophysics, Moscow	A. V. Lebedinskiy
Institute of the Brain, Moscow	S. A. Sarkisov
Institute of Epidemiology and Microbiology i/n N. F. Gamaleya, Moscow	O. V. Baroyan
Institute of Experimental and Clinical Oncology, Moscow	N. N. Blokhin
Institute of Experimental and Clinical Therapy, Tiflis	N. N. Kipshidze
Institute of Experimental Biology, Moscow	I. N. Mayskiy
Institute of Experimental Medicine, Leningrad	D. A. Biryukov
Institute of General and Communal Hygiene, i/n A. N. Sysin, Moscow	N. N. Litvanov
Institute of Gerontology and Experimental Pathology, Kiev	N. N. Gorev
Institute of Hygiene of Children and Adolescents, Moscow	T. Nikolaeva
Institute of Infectious Diseases, Kiev	I. L. Bogdanov
Institute of Labor Hygiene and Occupational Diseases, Moscow	A. A. Letavet
Institute of Neurology, Moscow	N. V. Konovalov
Institute of Neurosurgery i/n Burdenko, Moscow	B. G. Yegorov
Institute for Neurotropic Infections, Moscow	M. P. Chumakov
Institute of Normal and Pathological Physiology, Moscow	V. V. Parin
Institute of Nutrition, Moscow	A. A. Pokrovskiy
Institute of Obstetrics and Gynecology, Leningrad	N. L. Garmasheva

Academy of Medical Sciences, USSR (Contd.)	*Director*
Institute of Oncology, Leningrad	A. I. Serebrov
Institute of Pediatrics, Moscow	O. D. Sokolova-Ponomareva
Institute of Pharmacology and Chemotherapy, Moscow	V. V. Zakusov
Institute of Psychiatry, Moscow	D. D. Fedotov
Institute for the Search of New Antibiotics, Moscow	G. F. Gauze
Institute of Surgery i/n Vishnevskiy, Moscow	A. A. Vishnevskiy
Institute of Therapy, Moscow	A. L. Myasnikov
Institute of Thoracic Surgery, Moscow	S. A. Kolesnikov
Institute of Toxicology, Leningrad	S. N. Golikov
Institute of Tuberculosis, Moscow	N. A. Shmelev
Institute of Virology i/n D. I. Ivanovskiy, Moscow	V. M. Zhdanov
Laboratory of Experimental Physiology for Resuscitation following Clinical Death, Moscow	V. A. Negovskiy
Scientific Research Institute of Medical Radiology, Moscow	G. A. Zedgenidze

Academy of Sciences, USSR	Director
Institute of Animal Morphology i/n A. N. Severtsov, Moscow	G. D. Smirnov
Institute of Biochemistry i/n A. N. Bakh, Moscow	A. I. Oparin
Institute of Biology, Novosibirsk	(Unknown)
Institute of Biophysics, Kiev	A. A. Gorodetskiy
Institute of Biophysics, Moscow	G. M. Frank
Institute of Botany i/n K. L. Komarov, Leningrad	P. A. Baranov
Institute of Chemical Physics, Moscow	N. N. Semenov
Institute of the Chemistry of Natural Products, Moscow	M. M. Shernyakin
Institute of Cytology and Genetics, Novosibirsk	Yu. Yu. Kherkis (?)
Institute of Cytology, Leningrad	A. S. Troshin
Institute of Evolutionary Physiology i/n I. M. Sechenov, Leningrad	A. G. Ginetsinskiy
Institute of Experimental Biology and Medicine, Novosibirsk	Ye. N. Meshalkin

Academy of Sciences, USSR (Contd.)	*Director*
Institute of Genetics, Moscow	T. D. Lysenko
Institute of Higher Nervous Activity and Neurophysiology, Moscow	V. S. Rusinov
Institute of High Molecular Compounds, Leningrad	M. M. Koton
Institute of Microbiology, Moscow	A. A. Imshenetskiy
Institute of Physics i/n P. N. Lebedev, Moscow	D. V. Skobel'tsyn
Institute of Physiology i/n A. A. Bogomolets, Kiev	Makachenko
Institute of Physiology i/n I. P. Pavlov, Leningrad	V. N. Chernigovskiy
Institute of Plant Physiology i/n K. A. Timiryazev, Leningrad	A. L. Kursanov
Institute of Radiation and Physico-chemical Biology, Moscow	V. A. Engel'gardt
Laboratory of Physiological Chemistry, Moscow	B. N. Stepanenko
Main Botanical Garden, Moscow	N. V. Tsitsin
Physiological Laboratory, Moscow	E. A. Asratyan
Radium Institute i/n V. G. Khlopin, Leningrad	V. N. Vdovenko
Scientific Research Institute of Fertilizers and Insectofungicides i/n Samoylov, Moscow	FNU Vol'fkevich
State Optical Institute i/n S. I. Vavilov, Leningrad	Ye. N. Tsarevskiy