causing little damage to adults. Pregnant females that continue to carry virus in the blood after clinical recovery transmit the virus to their embryos. The mechanism of intrauterine infection is unknown. Traub speaks of a possible "growth" through the placenta.

Bacterial Infection of Mammalian Fetal Membranes

In natural infection through the placenta the chorionic epithelium is in at least one bacterial disease the susceptible rather than the resistant membrane, and its infection determines the picture of the fetal disease that eventuates in abortion. This selective susceptibility of the chorionic epithelium was demonstrated by Theobald Smith in bovine fetal membranes infected with *Brucella abortus*. Only the chorionic membrane is involved, but it is markedly altered by the fact that practically every cell of certain areas is distended to the point of rupture with densely packed masses of the tiny bacilli. It seems probable in this disease that the bacilli enter the utero-chorionic space by way of the blood vessels in the uterine wall and then become phagocytosed by the chorionic epithelium in the cytoplasm of which they find a stimulating medium for their growth. It is quite possible that focal areas of infection of the uterine mucosa serve as distributing centers from which the bacteria gain access to the utero-chorionic space.

Some such peculiar susceptibility of the chorion or other placental cells probably permits the multiplication of the virus of mare abortion, although this has not been demonstrated.

Thus it appears that instead of acting as a barrier to infection the fetal membranes might offer especially favorable conditions for both bacteria and viruses of certain kinds. This fact emphasizes the importance of a consideration of the cells of the membranes, especially the chorionic epithelium, in relation to their relative susceptibilities with respect to specific infectious agents that may attack the pregnant mother.

The fact that the fetal membranes can be grafted on the chorioallantois and inoculated in this detached situation offers an opportunity for the study of specific resistance and susceptibility hardly possible in the intact host, especially in the human host.

Most human mothers are actively immune to the great contagious diseases, which now are largely infections of childhood; and because the fetal chorion is in immediate contact with maternal blood, it is a fortunate circumstance for fetal health that immune bodies readily pass through the placenta in protective amounts to the offspring. In those mammals whose placental structure does not permit passive immunization of the fetus, resistance of the new-born may result from an absorption through the gastro-intestinal tract of immune bodies conveyed by the colostrum and to a less extent by the milk.

Owing to the obvious importance of the placental union in determining whether or not infection of the fetus takes place, it is rather surprising to find so little knowledge concerning placental infection, and the relative specific resistance of placental and fetal membranes.

Our experimental observations concerning the inoculation of human fetal membranes grafted on the chorioallantois of chick embryos indicate that the human chorionic epithelium is naturally a resistant membrane to a number of viruses, and the relative rarity of fetal infection by the active agents of the great contagions leads one to conclude that it is resistant to others which it was not practicable for us to test.

SCIENCE AND WAR

By Dr. PETER L. KAPITSA

MEMBER OF THE ACADEMY OF SCIENCES OF THE U. S. S. R.

War demands maximum effort of the belligerents—not only of the army but of the whole organism of the country. Our industry, transport and agriculture must give their utmost; for the greater our output of agricultural produce, munitions and armaments, the swifter our advance to final victory.

War demands unusual effort by creative, scientific thinkers. For instance, factories must simultaneously increase their output and cut down the number of their workers, at the same time that they lose some of their sources of raw materials. Thus, to raise labor productivity by improving technology and the process of production acquires particular importance. Hence, the exceptional value and need of inventive work.

The need to relieve the burden of the transport system makes it essential to harness local resources to serve industry. This in turn necessitates a search for new sources of raw materials or, in the absence of such sources, a search for substitutes. In this field the principal task falls to science.

Finally, armaments too must be constantly improved. The creation of new types of weapons and the perfection of old ones confront science with a whole series of urgent questions that must be answered.

That is why, both in our country and in the countries allied to ours, the war has faced scientific workers with many problems urgently requiring solution.

The whole Soviet people, including the scientists, understands well enough that only by straining ourselves to the utmost can we drive out the hated invaders with least damage to our country. We understand that the struggle now going on is one of life or death, and that the yoke of Fascism would not only turn the collective farmer into a serf under a German landlord, but would deprive the Soviet scientist of his freedom for creative work and of the joy of serving his country and world culture. It is this realization that powerfully spurs our scientists onward.

In peacetime it may occasionally have been possible to censure our scientists for not being invariably able to direct their work into channels most useful for the practical needs of our national economy. It may have been possible to reproach them for that academic abstraction, a hangover of the past, which sometimes marked the scientific work of some researchers. But now the threat to their freedom and their desire to save their country has inspired our scientists and directed their efforts toward the solution of present-day tasks. They are all striving urgently to supply answers to the questions put to them by the war.

Thus, several of our mathematicians who before the war occupied themselves with profound and abstruse problems of mathematical theory, that held meaning only for a small number of contemporary persons, have now successfully centered their attention on immediate problems. One such problem is the application of the conclusions of the modern mathematical theory of probability to the calculation of trajectories of projectiles in flight, thereby improving the accuracy of gunfire.

The wartime work of Soviet scientists may be classified by trends. Some are engaged on problems of broad national-economic significance—the study of sources of raw materials, of substitutes, of utilization of waste products, etc. This work is of particular importance now when we have temporarily lost some of our raw material sources and have had to shift our principal industries far to the east. A special commission of the Academy of Sciences, working at Sverdlovsk, has already achieved important results in this field.

War conditions limit the utilization of some of our resources and prevent importation of many raw materials. To make up the deficiencies with substitute materials is a huge task, mainly handled by our chemists. As an example I cite balsam salve. It is well known that importation of Peruvian balsam—an important component of the Vishnevski curative salves familiar to thousands of our wounded men—involves many difficulties. At present, one of the institutes of the Academy of Sciences is experimenting with a synthetic substitute of which there is no shortage. There is reason to believe its curative properties are not inferior to those of Peruvian balsam.

In another field, our scientists are giving counsel to industry to help it bring its productive forces into full play, to improve the technology of production, to increase output and make more rational use of resources of raw materials. This work comprises no small part of the efforts of our scientists, who frequently pay consultative visits to factories. The scope and multiformity of this work are so great that its full significance is often difficult to appreciate.

Lastly, our scientists are directly participating in the improvement of armaments and defense methods. Stalin has said that our tanks and airplanes are not inferior to the tanks and planes of the enemy. This fact by itself is extremely significant. It is well known that our aircraft industry is still quite young, having been practically non-existent before the Revolution. At first we naturally had to study and copy the achievements of the west in this domain. But we rapidly passed beyond the copying stage, and our aircraft industry long since stepped out on the path of independent, creative enterprise.

To say that Soviet scientists played a decisive role in the success of our aviation is not an exaggeration. After all, the qualities of a modern airplane depend almost entirely on the ability to calculate the profile of the wings and fuselage so that in flight the craft will present least resistance to the air. Experience shows that the slightest deviation from theoretically calculated profiles can considerably reduce flying qualities. These calculations are among the most exacting and interesting of modern aerodynamics. The theoretical work done in this regard by the group of young Soviet scientists produced by the school of Zhukovski and Chaplygin has in many respects left Western European researchers considerably behind. Without these achievements our planes, which have enabled our airmen to beat off the enemy's best squadrons so successfully, could never have existed.

Our scientists are well aware that in producing armaments they must not rest on their laurels for a single moment, that only constant improvement of our weapons brings the hour of final victory nearer and reduces the number of sacrifices that must be made before it is achieved. Boundless possibilities open for scientific thought in this domain. Our science is making use of these possibilities, enhancing the defensive strength of our country. It would be difficult to enumerate all the major and minor undertakings launched in this field and which are already yielding results, even if it were possible to talk about them now.

It is interesting to note that there is not a single field of scientific thought that can not be of value in modern warfare. There is no specialty whose representatives can not put their attainments at their country's service. Physiologists are confronted with such new problems as improving the sight of observers and studying the effects of certain diets and drugs. A peaceful study such as the deciphering of cuneiform inscriptions proved to be of service when it was shown in the last war that experts in cuneiform and hieroglyphic writing were best equipped to decode secret enemy ciphers. Our botanists are working out rules for camouflage, taking account of seasonal changes in vegetation. Our historians are successfully helping fight the unprincipled pseudo-scientific propaganda of the fascists.

The struggle now being waged is giving an exceptional stimulus to scientific thought. The strain and tension caused by war are exposing the weak spots in our economy, technique and organization, showing the points where the state must first of all be assisted, and clearly formulating the demands which society makes on science. Although the war demands great sacrifice and causes much devastation, the upsurge of scientific work which is taking place in our country, and which must develop still more, will not lose its value after the war. The new war-revealed possibilities for unified development of our technique and economy will continue evident in the post-war period as well. History proves that this is true.

It is generally known, for instance, that when the Continental blockade cut France off from the colonies which had supplied it with cane sugar, Napoleon ordered his scientists to search for new sugar sources. Systematic work by French scientists led to the discovery of the method for extracting sugar from sugar beets, now the most widely used method. During the war of 1914–18, the process of nitrogen fixation was introduced and used on a large scale in Germany, which had suffered an acute nitrate shortage. The inventor Haber had not been able to find an industrial application for his discovery before the war. Germany was saved from speedy defeat and, after the war, the synthesis of ammonia spread throughout the world, serving as a basis for obtaining one of the best agricultural fertilizers.

In the course of the present war a number of similar achievements may undoubtedly be expected. For obvious reasons it is impossible to indulge in concrete discussion of the scientific work being carried on in the Soviet Union at the present time. It is already clear, however, that the war will lead to further improvement of our air fleet, will make for better motors, will teach us to achieve high productivity in industry with less workers, and will bring our theoretical, creative thought closer to the practical needs of the country. The sum total of the achievements of our Soviet land will have a tremendous bearing on the development of scientific thought serving world civilization.

OBITUARY

FRANK SMITH

1857–1942

FRANK SMITH, professor emeritus of zoology at the University of Illinois, died at St. Petersburg, Florida, on February 3, 1942, at the age of eighty-five years. He was born at Winneconne, Wisconsin, on February 18, 1857, son of Samuel Franklin and Aurelia Shepard Smith. The parents were of English origin, their ancestors having come to New England at a very early date. When the boy was two years of age his parents moved to New England. His early education was secured in public and private schools of Trenton, New Jersey. In 1870 the family returned to Wisconsin, and until the age of eighteen he attended the Winneconne village school. A marked mathematical turn of mind manifested itself at a very early age. At the age of twenty-one he began earning money to finance a college education. During the years 1879–1885 he was a student, first, in the preparatory department and, later, in the college department of Hillsdale College, Hillsdale, Michigan, receiving the Ph.B. degree in 1885, also the graduating prize in mathematics. While a student in this college he taught mathematics in the preparatory department during the years 1882–1886. A part of the summer of 1886 and the summer of 1887 were spent at the Marine Biological Station at Annisquam, Massachusetts, and the summer of 1891 at the Marine Laboratory of Alexander Agassiz at Newport, Rhode Island.

Following graduation he was appointed professor of chemistry and biology at Hillsdale College, occupying this position during the period 1886–1892. On September 8, 1887, he was married to Edith M. Fox, who died on November 15, 1888. One child, Donald Fisk Smith (1888–1905), was born to them. On July 12, 1890, he was married to Isadora Stamats, who survives him.

Finding his interest in biology growing and feeling the need of further training he did graduate work at Harvard University for a part of the years 1891 and