still confined to Bohr's model and Heisenberg's principle. The debt which psychology owes to Köhler had already been a large one before he investigated figural after-effects; his work in this field has almost certainly made him one of the greatest figures in psychology. It is curious and a little piquant to realize that the concepts which Köhler uses to account for figural after-effects are similar in many ways to those used by Pavlov to account for the facts of conditioning. That this should be so, in spite of the fact that not so very long ago Köhler and his colleagues founded the *Gestalt* school as an express antithesis to Pavlov's 'atomistic' and associationistic theorizing, illustrates the relative unimportance of the critical parts of the contribution made by schools in psychology, and the much greater importance of their positive and experimental contributions. We have fortunately now left behind to a large extent this era of rivalling schools, and it is fortunate that Köhler survived into and indeed partly originated this new period. The reader interested in the history of science can do no better than read through Dr. McEwen's monograph to discover both the promise of the present situation and also the severe birth-pains to which it is giving rise.

H. J. EYSENCK

IRON ORE IN THE SOVIET UNION

"THE iron ore deposits of the Kursk magnetic anomalies, both as regards their concentration and their quality, have no rivals in the world"—so writes P. Y. Antropov, the Minister of Geology in the U.S.S.R. (*Priroda*, 7, 16; 1958). Magnetic anomalies were first discovered during a topographic survey in the region of Kursk in 1783. Before the 1917 revolution, E. E. Leist, professor in the University of Moscow, made a careful survey of magnetic anomalies and concluded that they are due to the presence of magnetite ores at great depths below the cover of sedimentary rocks. The results of the 1919–26 survey were rather disappointing; only rather poor iron ores were found and at a considerable depth. Renewed explorations during 1930–34 and the construction of an experimental shaft (flooded and ruined in 1938) revealed rich ore, but again at a great depth and in a very difficult geological setting. Exploration, on a much wider scale, was resumed after the Second World War. This detailed survey revealed two important features of the geological structure of this region:

(1) Below a cover, varying in thickness from 40 to 500 m. or more, the pre-Palæozoic floor revealed a gigantic anticlinal fold, or rather a packet of such folds forming a belt about 150 km. × 250 km. in extent stretching in a north-west–south-east direction, with the line Orel–Kursk–Belgorod as its diagonal. This pre-Palæozoic massif was buried under a cover of Palæozoic, Mesozoic and Tertiary sedimentary rocks, and was made of Proterozoic schists, ferruginous quartzites and gneisses.

(2) The rich iron ore was not found among the Proterozoic ferruginous quartzites but in a secondary iron ore formed as a crust of weathering immediately above the Proterozoic floor. This secondary iron ore was formed through an almost complete leaching out of silica from the ferruginous quartzites and a transformation of magnetite into martite (hæmatite pseudomorphs after magnetite). The maximum thickness of this ore deposit occurs in the Belgorod district, where it reaches 350 m. Elsewhere, it varies from 30 to 50 m. The best-quality ore occurs in the Yakovlevsky district, where it contains on average iron 61·4 per cent, silicon 5 per cent, sulphur 0·1 per cent and phosphorus 0·02 per cent.

The reserves of ores in the Belgorod region alone are 12 milliard tons, that is to say, five times the reserves of the Krivoy Rog iron ore deposit, until now the largest known in the U.S.S.R. The total reserves of the iron ores in the region of the 'Kursk magnetic anomalies' may be as high as 15–20 milliard tons.

The winning of these ores has already begun by means of shafts and open-cast quarries in the Lebedinsky, Mikhailovsky and Yakovlevsky districts. Thus in the Lebedinsky district the open-cast extraction amounted to 6 million tons in 1956; the Mikhailovsky district is planning to extract 6½ million tons per annum, and the Yakovlevsky district 15 million tons. Thus the total production of these three districts by 1966 is estimated at 27½ million tons per annum. These figures suggest that the total extraction of rich iron ore in the whole region may be estimated at 70–80 million tons per annum. This amount of ore would correspond to 30–35 million tons of cast iron per annum.

In this connexion it is important to note that in 1957 the total production of iron ore in the Soviet Union was 84·2 million tons and the total production of cast iron 37 million tons per annum.

S. I. TOMKEIEFF

EMPLOYMENT OF SCIENTISTS AND TECHNOLOGISTS IN THE UNITED STATES

ACCORDING to a preliminary report from the National Science Foundation, American industry in January 1957 employed 738,000 engineers and scientists (about two-thirds of all those in the United States), of whom 58,000 were employed as administrators of scientific and engineering activities. The largest occupational group was 528,000 engineers, chemists (72,000) coming next, followed by medical, agricultural and biological scientists (16,600), geologists and geophysicists (14,200), physicists (12,100), mathematicians (12,400) and metallurgists (10,800). Of the total, 92,900 were employed in the electrical equipment industries, 84,900 in the aircraft and parts industry, 79,200 in chemicals and allied products industries, 74,100 in machinery, 50,700 in petroleum products and extraction, 30,200 in fabricated metal products and ordnance, 29,500 in primary metals, and 24,600 in the professional and scientific instruments industry; 29,000 more chemists were employed in chemical industry than in any other industry.

Almost one-third (228,000) of these engineers and scientists were engaged in research and development, and two-thirds of these were employed in the aircraft, electrical equipment, machinery or chemical industries. Nearly three out of every five physicists, but fewer than one out of three of the engineers, mathematicians and biological scientists and two out of every five chemists were engaged in research and development. Nearly 600,000 technicians worked with scientists and engineers in all activities, and of these, 160,000 were engaged in research and development, the largest numbers in the electrical equipment, aircraft, machinery, chemical and fabricated metal parts and ordnance industries. During 1954–57 employment of engineers rose by 27 per cent, of chemists by 16 per cent and of biological scientists and physicists by about 60 per cent. In these three years 70,000 first degrees in engineering were awarded by American engineering ; the proportion of engineers and scientists employed in research and development rose from 28 to 31 per cent, and employment in such activities rose by more than 45 per cent, whereas in the same period research and development costs rose from 3,700 million to 6,400 million dollars.

CHEMOTHERAPY OF PARASITIC DISEASES

A MEETING of the Parasitology Group of the Institute of Biology was held at the Institute's rooms in London on October 24, when two speakers were invited to read papers on the chemotherapy of parasitic diseases.

Dr. Ann Bishop (Molteno Institute, Cambridge) described some aspects of resistance to drugs in parasitic Protozoa. The fact that parasitic organisms can become resistant to drugs in the course of the therapeutic treatment of the host was discovered in Ehrlich's laboratory, early in the present century, by Franke and Röhl while studying the effect of parafuchsin upon *Trypanosoma brucei* in mice. Trypanosomes have since been made resistant to a wide variety of chemical compounds.

The fundamental problems in the study of resistance to drugs are the nature of the changes which organisms undergo in becoming resistant and the means by which these changes are brought about. In trypanosomes, resistance to drugs may be associated with changes in permeability and with changes in the enzymes present in the cells. Drug resistance in these organisms may be a very stable character and persists after the transmission of the parasite through the insect vector. The spontaneous development of resistance, in the absence of the drug, has been described both in trypanosomes and in *Toxoplasma gondii*.

Malaria parasites also can be made resistant to certain compounds, including proguanil and pyrimethamine, which are used in the treatment of the disease. Resistance persists after transmission of the parasite through the insect vector, in which, unlike trypanosomes, the malaria parasite undergoes a sexual cycle of development.

A study has been made of the development of resistance to metachloridine (2-metanilamido-5-chloropyrimidine) in pure lines of *Plasmodium gallinaceum* in chicks. No difference in the rate of development of resistance was observed in these lines. The rate of development of resistance was not related to the size of the dose of drug, but was affected by the size of the inocula producing the infections exposed to the action of the drug. The suddenness with which resistance appeared in some of the strains studied, and its stability in the absence of the drug and after the sexual development of the parasite, suggested that it arose by mutation, the mutation being of a low frequency.

Dr. O. D. Standen (Wellcome Laboratories of Tropical Medicine, London) outlined an approach to the experimental chemotherapy of helminthiases. The diseases of man and animals caused by the presence of helminth parasites are particularly important in the tropics, and are often responsible for the low level of efficiency and uneconomic production of stock animals in rural areas. The eventual control of these helminthiases will depend on a fuller knowledge of their epidemiology, but also presents problems which can only be resolved by the use of drugs.

The number of even moderately efficient anthelmintics in use at the present time is small, and most are toxic to the host. There is thus an urgent need for drugs which could be used in mass treatments of man and animals.

The discovery of new drugs requires the close collaboration of biologist and chemist. Two methods of approach may be used. An empirical method is one whereby large numbers of compounds of unknown activity are tested, in order to determine their effects on the parasite. The selective approach is one in which chemicals of known anthelmintic potency are modified in order to improve their action, and this method may be used with substances discovered by the empirical method. The ultimate aim is to discover the relation between the molecular structure of the drug and its anthelmintic activity and toxicity to the host.

The selection of helminths to be cultured in laboratory animals is of great importance. The number which can be cultured in this way is small, and of these the species pathogenic to man and animals are few. It is thus necessary to test drugs using helminths which are the natural parasites of laboratory animals. The successful maintenance of a parasite in all the stages of its life-history in laboratory animals often requires a long period of fundamental research before a sufficient supply of material is assured for routine investigations, for which an abundance of material is required since hundreds or even thousands of tests may be necessary before an effective drug is discovered.

The use of a multiple helminth screen, employing a wide range of species living in different habitats, yields interesting results. Thus, basic work with *Aspicularis tetraptera* in the mouse has contributed materially to the development of piperazine for the treatment of ascariasis and oxyuriasis. More recent chemotherapeutic tests, against *Nippostrongylus muris* in the young rat, provided the basis for the development of salts of bephenium that are efficient in the treatment of nematodiriasis in sheep and ancylostomiasis in man and dogs.

The experimental chemotherapy of helminthiases necessarily demands many species of helminths in all