THE SCIENCES AND SOCIETY

THE PREJUDICE AGAINST animal vivisection remains one of the most serious obstacles to the progress of medicine and surgery. This prejudice has been attacked—or, rather, exposed—with commendable skill in a recent pamphlet issued by the New York City Cancer Committee of the American Society for the Control of Cancer. Entitled *On Health's Highway, Progress in Relation to Cancer Control* (obtainable from the Committee, 150 East 83 St., New York City, at 50 cents), this pamphlet consists of 14 attractive picture charts showing the vital rôle played by animal experimentation in the fields of anatomy, surgery, physiology, drugs, bacteriology, cancer research, and animal diseases. Among the numerous examples given the following may be cited:—

Surgery: Many hitherto fatal diseases of the intestines and the stomach have been made operable only through knowledge obtained by experimentation on animals, including dogs. The same is true of chest and breast ailments, notably cancer, and we owe to monkeys (as well as Pavlov's dogs) the surgeon's skill in performing the most delicate operations upon the brain. Malignant pigmented tumors of the eye now yield to the knife only because of carefully controlled animal experiments, which have also facilitated the technique of skin grafting.

Physiology: Our knowledge of the mechanism of respiration, circulation, of neural and muscular action would not have been possible without animals. Claude Bernard, one of the greatest of the moderns, initiated the physiology of metabolism—especially in the digestive tract—through researches on dogs: thanks largely to which also, Ivan Pavlov obtained the Nobel Prize in 1904.

Drugs: Among the important drugs whose medical value is due to animal experimentation are: amyl nitrite (angina pectoris), digitalis (heart stimulant), chenopodium (hookworm), insulin (diabetes), and viosterol (rickets). It is also a fact that all modern drugs for producing sleep and reducing fever owe their efficacy to a careful study of their effects upon animal units.

Bacteriology: Without the most prolonged and exacting research on animals, many an anti-vivisectionist and his children would have died from infective diseases. Setting aside such insect-borne maladies as the Black Death, yellow fever, and malaria (there seems to be small objection to experimenting on fleas, lice, and mosquitoes, despite their scavenging rôle in the scheme of things!), we may note diphtheria, brought under control through the animal experimentation of Klebs, Loeffler, Roux, and Yersin; tuberculosis, the bacillus of which was discovered by Koch and the modern dietary treatment of which was developed by Trudeau through experiments on rabbits; hydrophobia, conquered by Pasteur. Pneumonia, smallpox, infantile paralysis, and tetanus, or lockjaw, could not have been understood, let alone controlled, without extensive use of animals, and the dreaded *spirochæta pallida*, bacterium of syphilis, yielded up many of its lethal mysteries through Mechnikov's experiments on monkeys.

CANCER RESEARCH, however, has been among the most notable examples of the dependence of medical progress on animal experimentation. In every instance—particularly in connection with what is known as 'industrial cancer'—liberal use was made of rabbits, guinea pigs, and the ubiquitous laboratory rat. The results, though far from solving the basic problems of cause and origin, are so impressive that any attempt to enforce the absurd and inverted 'humanitarianism' of the anti-vivisectionist would terminate in a social calamity worse than war. It is to

such organizations as the American Society for the Control of Cancer—working in close coöperation with the great medical and biological research foundations—that we are indebted for the kind of knowledge by which eventually we may hope to conquer the scourge of suffering and disease.

AN INTERESTING—if far from cheerful—picture of the unholy alliance between science and war is presented in a recent issue of *Army Ordnance*, official organ of the (American) Army Ordnance Association. Alden H. Waitt, a captain in the Chemical Warfare Service of the U. S. Army, in an article 'Europe Looks at Chemical Warfare,' has assembled the views of a number of high-ranking military authorities on the rôle of poison gases and other chemicals in the rapidly approaching Second World War. The following extracts are sufficiently eloquent to require little comment:—

Major Paul Murphy, former director of experiments of the Chemical Defense Experimental Station, Porton, England: 'Of the many chemical substances discovered during the War to have value for military purposes, the most striking was . . . mustard gas. So rapid was its advance as a weapon that the supply figures toward the end of the War show clearly that it was rapidly overtaking even high explosives as a charging for artillery shells and other projectiles. Moreover, unlike the other gases it was never adequately countered by defense. Add to this that subsequent research has shown *far more effective methods of employing it and is still unable to provide a wholly effective defense against it*, and its potentiality for military purposes will be apparent to all.' (Emphasis in original; Captain Waitt adds, 'Major Murphy might have gone even further in his claims for mustard gas.')

Dr. Rudolph Hanslian, author of 'one of the most complete, conservative, and accurate books on chemical warfare' (German authority): 'The extraordinary superiority of the airplane, compared with the gun, as a means of transporting poison gases lies especially in the fact that the airplane is able to bring the poison combat substances to the target in a much more favorable weight ratio to casing. . . . Much more favorable for the airplane does this figure become with the spray method from tank containers . . . in which case there is no projectile casing whatever.'

Italian 'Instructions on Defense against the Combat Chemicals' (Rome, 1930): 'Aviation will certainly be employed with great frequency . . . especially against troops in masses, columns in march, and reserves . . . The combat chemical may be sprayed in the form of drops from an airplane flying at low altitude, rendering untenable or impassable sections of the country that have been laid out in reference to the plan of attack or defense that the enemy intends to develop.' In blunt English, this means, 'In chemical warfare you can't win.'

'IN THE SOVIET UNION,' Captain Waitt tells us, 'the chemical and air arms are very closely related.' In proof of this he offers the book, *Military Chemistry*, by Commandant Y. M. Fishman, chief of the Military Chemical Administration of the Red Army. 'This work,' he writes, 'is of especial interest since it is the only published statement that exists to-day covering the complete tactical doctrine on chemical warfare of a major Power.' Commandant Fishman thus describes one of the chemical methods whereby the Soviet Union is prepared to defend itself against attack: those who are disposed to shudder at the ferocity of this description would do well to remember the unchallenged record for peace and disarmament of a country that is, nevertheless, superbly equipped 'for labor—and defense':—

Discussing the possibilities of mustard gas or lewisite, Fishman writes: 'The essence of infecting a locality consists in spraying and throwing on the surface of

the ground the persistent poisons, especially those of vesicant action, in consequence of which sections of the locality are made very dangerous for the troops that are there . . . The vesicant agents, which work through ordinary clothing and shoes, make it impossible to remain in the poisoned sections unless provided with masks and special costumes; even if these latter might be technically and economically available in large quantities for the troops, they would occasion enormous inconvenience in movement and would cripple the fighting qualities of the men.'

Not to be outdone in chemical ingenuity, the openly belligerent Italian Fascist régime has developed 'four methods of creating mustard-gas zones. The first is called terrestrial spraying, using hand or vehicle devices, and is employed for zones just in advance of the front lines. The next is called "mustard poisoning by fire" and is accomplished by the artillery generally of small or medium calibre. It is used for infecting ground at some distance from friendly troops, which the enemy must traverse. The third method is "aërial spraying" by planes flying at low altitudes and is used to the rear of the enemy as well as near one's own front. The fourth method is by "aërial bombardment" with mustard bombs. It is intended for deep in the rear of the enemy.'

Captain Waitt concludes, 'The shouting and tumult over miraculous possibilities of the new arm have finally died away, and we find the nations accepting the chemical as a logical, useful, and necessary weapon . . . While recognizing the limitations of gas, they must not lose sight of the great potentialities of this weapon, which is universal in that it applies to all arms. A discussion as to which is superior, high explosive or gas, should not cause military men to forget that together they form a perfect team.'

Great potentialities of this weapon . . . a perfect team . . .

One is reminded of the title of Plivier's terrible novel of post-war Germany, *The Kaiser Goes—the Generals Remain* . . . For how much longer?

SCIENCE EDUCATION is supposed to be one of the characteristics of the present day—especially in the high schools and colleges. That this is somewhat too favorable a view is made clear by certain facts presented in a recent study on *Science and the Public Mind* by Benjamin C. Gruenberg (New York, McGraw-Hill Book Co., $2.00). Dr. Gruenberg analyzes figures published in the 1934 *Handbook of Adult Education in the United States* and shows that, for the 16 institutions studied, 'the ratio of science courses to total offerings ranged from 0.6 to 22.2 per cent and the ratio of enrollments in science to the total enrollments ranged from 0.2 to 15 per cent.' Taking the averages, we find that, out of a total of 5,637 courses offered, only 4.4 per cent (or 262) were in the sciences, while of a total registration of 119,380, only 6,036, or 5.3 per cent, elected science courses.

These far from impressive figures are enforced by the record of high schools and popular lectures. It is shown that 'the mean percentage of work in science taken by the graduates' of six well-known high schools in five American cities declined from 17.7 per cent in 1890 to 10.1 per cent in 1930, while for the field of adult education we have the following statement by Miss Winifred Fisher, executive secretary of the New York Council of Adult Education (period of 1933–34):—

'Out of 9,642 adult education offerings, 9 per cent are in the field of science; 7 per cent of the offerings in occupational training are also in the field of science, such as engineering. The chief items offered to the layman in science are in the realm of health and hygiene and mathematics.'

Conditions are little better in the field of workers' education. Thus we find that at the well-known Rand School of Social Sciences in New York City, only 6 per cent of the total registrations for the period 1925–28 were in definitely scientific

courses. For the United States as a whole the place of science in workers' education was down to 3 per cent of the total courses over the period 1920–27—and the subject 'health' ranked at the very bottom, with 1.5 per cent. (The most popular subject was 'language and expression,' with 30 per cent, and psychology trailed well behind with 6.7 per cent.) Similar ratios obtain for evening high schools and for the one correspondence course (University of Oklahoma) studied—and all this despite the superficial growth of science education in this country during the past generation.

THINGS ARE NOT much better abroad. Dr. Gruenberg cites the figures on science education for Cambridge University (local lectures) and for Oxford and London Universities (extension courses). In the period from 1887 to 1926 the percentage of science courses offered declined as follows: for Cambridge, from 50 to 14; for Oxford, from 27 to 10; and for London University, from 42 to 4. These institutions represent the élite of Great Britain—what is the situation for the workers? According to the Workers' Educational Association of England, of 1,683 classes offered in England, Scotland, and Wales in the period 1927–28, only 64—or 3.8 per cent—were in the natural sciences. On the basis of actual time given to such a subject, an analysis of 20 workers' schools in various countries gives the very low figure of 5.6 per cent; 14 of these schools gave no science at all, while at the other extreme we have 10.2 per cent for a German and 15.6 per cent for a Swedish institution. In New Zealand the number of workers studying science was only 3.2 per cent of the total (5,489) enrolled in 1926.

From such figures as these it is not difficult to understand why the economically lower brackets of society are confused with the intellectually inferior—or why Dr. Dewey Anderson, in the article to which we referred last month, challenges the claim that America's official 'rulers' are in any way representative of the educational or occupational level of this country. Dr. Gruenberg's book—despite its tone of labored optimism as to the future—provides eloquent evidence of that 'frustration of science' so ably discussed in the little book of that title recently published here (by the W. W. Norton Co., $2.00).

THE SOCIAL RESPONSIBILITIES of science formed the subject of a recent article by the eminent British scientist, Professor Hyman Levy, who has made a name for himself also as one of the keenest critics of present social trends. Quoting from the abstract of this article in *Nature:*—

'The pursuit of science is essentially a coöperative activity and is therefore socially conditioned. It is directed to an end, and that end is its social purpose, but, since the direction that scientific investigation takes is in this way socially determined, science itself becomes one of the determining factors of society. It improves the technical level of production; it introduces new factors into the way of living for the population; it affects their cultural interests; it creates new needs and therefore arouses new hopes and new desires.'

Pointing out the existence of recognized 'laws of detailed social behavior on which action is based,' Prof. Levy concludes, 'Are we not therefore entitled to expect corresponding regularities, perhaps deeper and more far-reaching, on a large scale and, as a consequence (since society is dynamic), a logic of social change? Since science is itself a motivating factor in that change, its study becomes a social responsibility.'

A sentiment with which everyone heartily agrees—but that no one, apparently, is able to make effective.

—Harold Ward

AS OTHERS SEE US

Japan on America's Navy

THE misgivings aroused in Japan by the American naval-building programme and the recent fleet manœuvres in the Pacific are well expressed in the editorial columns of *Nichi Nichi*, popular Tokyo daily:—

Of late there has been a marked increase in the desire for larger armaments in the United States. The militaristic tendency of the Americans is fast becoming pronounced. Evidence of this is seen in the huge shipbuilding programme of the United States Government and in the reported opening of negotiations with the Panama Republic for the right to construct a new canal. On April 26 the House of Representatives adopted the naval appropriations bill. Passage of the measure means that the keels of 24 new warships will be laid down in the next fiscal year. A total of 44 ships has been laid down in the present fiscal year. The building plans of Japan, France, and Italy are nothing by the side of those of the United States. Even Britain, which has the same ratio as the United States, lags far behind. The ships that Britain has started to build in the present and will lay down in the next fiscal year total 32.

Not content with the big-building programme, the United States planned naval manœuvres on a large scale to cover an area extending from Hawaii to the North Pacific. American warships, numbering 137, assembled off San Pedro, California, for the event, were inspected by Rear Admiral Joseph Mason Reeves, commander of the combined American fleet, and on April 29 they started action.

It goes without saying that the United States has a perfect right to effect a large increase in its navy, stage large-scale naval manœuvres, and plan the construction of a new canal. These activities are in a different category from Germany's rearming in violation of treaties. But it is easy to fathom the motives of the United States in extending its navy, staging manœuvres, and negotiating the construction of a new canal from statements made in American official circles, to the effect that the United States is desirous of seeing the naval-disarmament conference called during the present year but that the new situation in Europe has diminished these prospects. Before a session of the House committee on naval appropriations, Rear-Admiral W. H. Standley, chief of naval operations, intimated that, if the United States navy builds many more destroyers and submarines, it will be able to invade enemy waters and achieve decisive results. Chairman Carl Vinson, of the House naval affairs committee, during the debate on April 25, said that the United States did not intend to build beyond the 5:5:3 ratio. However, he went on, the United States must not abandon that ratio.

It is clear that the United States has laid down a policy of building up to full strength. It is also clear from a study of the statements of Rear-Admiral Standley and Mr. Vinson that the strength to which the United States intends to build is such as will enable it to engage in an offensive war. This is the reason why we regard the present naval-building plan of the United States as undesirable from the point of view of maintenance of world peace.

It is satisfying to note that there are thinking Americans who do not look with favor on the desire for more armaments in their country. One of them is Senator Gerald Nye, chairman of the Senate committee for investigating the munitions industry and one of America's outstanding advocates of disarmament. Speaking at the dinner of the American