calosoma beetles, praying mantes, skunks, crows, snakes and other misunderstood creatures by feeding them in public during certain announced hours of the day.

This is what has been done at the Rhode Island Insect Zoo, and the result has been amazing. People never before interested in small wildlife, or interested only superficially, have come to the insect zoo and spent hours in its perusal. By displaying live examples of the only four types of poisonous snakes in North America, respect and appreciation of all other snakes has been encouraged. By displaying the one species of poisonous lizard in the United States, the same is done for lizards. Local insects lose their horror when the few pain-givers—those which sting and those which cause a rash when handled—are represented by live specimens. Exhibiting the black widow spider and the tarantula, and explaining that they alone—of all spiders in Rhode Island—are dangerously poisonous, the lives of many other harmless and beneficial spiders are being spared.

To-day the insect zoo and nature center has become first port of call for many farmers and gardeners who are suffering from insect and other pests. Specimens are brought in for identification and for comparison with other specimens in the exhibit cases. Questions on insect control are incessant. The statement is repeatedly heard made by the departing visitor, "Well, I won't be killing them any more."

In the eight summer months which the zoo has been in operation, over 600 species of live insects and insect-eaters have been on display. Many more have been identified and added to the type collection of Rhode Island insects which is being kept for scientific reference. Over 105,000 visitors have attended. The zoo is situated twenty-three miles south of Providence, R. I., Route No. 3. It is open daily from 10:00 A.M. to 10:00 P.M. until October 2. The state cooperates in the matter of site and advertising, but leaves it to the fifteen-cent entrance fee to pay running expenses. Its purpose is educational. Members of the American Association for the Advancement of Science are always welcome, particularly if their attitude is critical.

BRAYTON EDDY

REGULAR POLYHEDROIDS

THE readers of SCIENCE may be interested to know that the results in the article by E. R. Bartlam entitled "On the Properties of Rectilinear Figures of n Dimensions" (SCIENCE, July 1) are special cases of those found by Stringham[1] in his exhaustive study. Stringham extended Euler's polyhedral theorem to n-dimensional space and showed that regular self dual $(n+1)$-hedroids analogous to the tetrahedron exist in any n-dimensional Euclidean space and that the number of regular elements of different dimensions, triangles, tetrahedra, etc., which bound these polyhedroids, are given by the expansion of $(1-1)^{n+1}$, excluding the first and last terms.

He showed that dual (2^n)-hedroids and $(2n)$-hedroids analogous to the dual polyhedra, the octahedron and cube, also exist in any n-dimensional Euclidean space and that the number of regular elements of different dimensions, triangles, tetrahedra, etc., or squares, cubes, tesseracts, etc., which bound these polyhedroids are given by the expansion, in direct and reverse order, respectively, of $(2-1)^n$ excluding the last term. Bartlam's table gives special cases of this theorem.

Stringham showed that no other real regular polyhedroids can exist in n-dimensional spaces when $n>4$. In three-dimensional space there are of course in addition the two dual polyhedra, the dodecahedron and the icosahedron.

Stringham finally showed that in four-dimensional space there exist also a self dual (24)-hedroid whose boundaries are regular octahedra, and two dual polyhedroids, a (120)-hedroid with dodecahedral boundaries and a (600)-hedroid with tetrahedral boundaries.

L. B. TUCKERMAN
NATIONAL BUREAU OF STANDARDS

[1] W. I. Stringham, *Am. Jour. Mathematics*, 3: 1, 1–14, March, 1880.

QUOTATIONS

SCIENCE IN PRACTICE AND THEORY

ONE of the prime functions of the annual meetings of the British Association is to serve as a reminder to the nation at large of the basic importance and interest of natural science, alike in its philosophical bearings, its practical results, and its social implications; and the president, in his address, has an unrivalled opportunity of crystallizing this aspect of the association's work. This year's president, Lord Rayleigh, distinguished scientific son of a distinguished scientific father, has taken full advantage of this opportunity, He has discussed not only certain recent advances in pure knowledge and numerous remarkable practical applications of such knowledge, but also some of the ethical problems as well as the philosophical puzzles arising from recent scientific advance. The ethical problem concerns the relation of science in general and the individual scientist in particular to war and the preparations for war. The present time is exceptional in the wide divergence of opinion on the subject. In earlier periods men of science found themselves in no dilemma. In general, either they were not asked to put their knowledge to military use, or, if asked, they did so unquestioningly. The increasing importance of applied science in warfare is now, we see, assisting the virtual conscription of scientific knowledge for military purposes; and the resultant increase in the horrors of war, together with the growing realization of war's futility and wastefulness, has caused new heart-searchings among scientific workers.

Lord Rayleigh confines himself in the main to pointing out that science can not be blamed for the horrors of war. Those inventions which have made modern warfare more horrible, including mustard gas and incendiary bombs, are almost without exception applications of old scientific discoveries, made with no military objective. As he rightly concludes, science is the outcome of the urge to explore the unknown, and its results can not be divided into sheep and goats. Science is of its nature ethically neutral; what good or evil use is made of its discoveries depends on society at large. The problem remains, however, as to the conduct of individual men of science in putting their knowledge at the service of the war machine. Opinions are bound to differ on this subject. The view accepted by most scientists seems to be that this is a matter of individual conscience just as much as readiness to serve in any other direct or indirect military capacity. It is true that the man of science has greater potentialities for good or evil as a technical adviser than as a private or even as a colonel: but this does not alter the nature of the problem.

There is finally the question whether we can do anything in the matter. Lord Rayleigh is frankly sceptical, but allows a modest ray of hope in the proposal to establish a division of the association for the study of the social relations of science. So far as there are likely to be immediate results, scepticism is undoubtedly justified. But in the long run perhaps a more hopeful view may be taken. The scientific study of human nature, especially in its social aspect, is only in its infancy. As Dr. Glover forcibly pointed out a few years back, the causes of war are at least as much psychological as economic. Repression and frustration in early life engender unconscious cruelty whose natural outlet is violence, and mass suggestibility, under the influence of propaganda, generates an irresistible mass hysteria, a neurosis of society. Theoretically, at least, it is possible to plan a system of education which would allow the natural impulses to be expressed instead of repressed, thus removing the dangerous because unconscious mainspring of violence, and making it possible to harness the deep psychological forces to construction instead of destruction; and one which, instead of fostering suggestibility and material respect for authority as such, would encourage critical reflection and a healthy distrust of propaganda. A society educated thus would be a new kind of society, of its very nature much less inclined to make war than ours. Admittedly this is remote; but is it more remote than was our electric age from the age of Galvani or of Ampère, or even of Faraday? To apply scientific method to the study and control of human nature, new techniques and a new approach are necessary; but there is no reason to suppose that it can not be done, and many reasons for supposing that in doing so lies the world's chief hope of emerging from chaos and frustration.—*The Times, London.*

SCIENTIFIC BOOKS

QUANTUM MECHANICS

The Fundamental Principles of Quantum Mechanics. With Elementary Applications. By EDWIN C. KEMBLE. McGraw-Hill, New York and London, 1937. xviii + 611 pp. $6.00.

THE classical or Hamiltonian dynamics arose from celestial mechanics, especially the study of the motion of the solar system under gravitation. It provided a consistent mathematical system of equations representing these motions very accurately. Exact solutions of these equations can only be obtained in simple cases; and it is still doubtful over how long a period of time the approximate solutions can be applied. There are still unsolved mathematical difficulties involved in the long time solution of the problem of three bodies. Classical electrodynamics arose from physical experiment. It provided a consistent system of equations representing the action of electric and magnetic forces on matter in bulk regarded as generally continuous. It was applied to give a consistent theory of radiation moving with the velocity of light in empty space. Classical statistical mechanics applied classical dynamics to the motion of chemical molecules. There were three principal but not exclusive methods of attempting to surmount the mathematical difficulties; that associated especially with Maxwell, assuming "continuity of path"; that especially due to Boltzmann, using collisions and the H-theorem; and that of Gibbs, using from the beginning an "ensemble" of states taken by the assemblies of molecules with various probabilities. These methods arrived at essentially the