so that rich catches are assured for several years more.

There is a Russian saying, "There is no evil without some gain in it," the truth of which has just been demonstrated by the effect of the war on fish.

I wish to mention in conclusion that an analogous case is cited in the history of Russian fisheries by Danilevsky, namely, that having investigated the fisheries of the Sea of Azof he was surprised at the large catches of fish during several years following the Crimean War (between Russia, Great Britain and France) in 1854–56.

The Sea of Azof lay within the field of naval war operations and, of course, there was no fishing there during two seasons, or in the mouths of two rivers, the Don and the Kuban, which flow into it. This was sufficient to guarantee good catches of fish during several years following the Crimean War in all this fishery district.

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SCIENTIFIC BOOKS

The Hemiptera, or Sucking Insects. By W. E. BRITTON, Ph.D., with the collaboration of Herbert Osborn (Parasitica), E. P. Van Duzee (Fulgoridae), D. M. DeLong (Cicadellidae), W. D. Funkhouser (Membracidae), L. A. Stearns (Cercopidae), W. T. Davis (Cicadidae), Edith M. Patch (Psyllidae and Aphididae), H. F. Wilson (Lachnini), A. C. Baker (Callipterini), A. C. Maxson (Pemphiginae), J. F. Abbott (Corixidae), H. H. Knight (Miridae), H. G. Barber (Lygaeidae), J. R. de la Torre-Bueno (Aquatic Heteroptera), H. M. Parshley (Terrestrial Heteroptera). 783 pages and XX plates. State Geological Natural History Survey, Hartford, 1923.

THE present volume is one of a series of guides to the insects of Connecticut prepared under the direction of Dr. W. E. Britton, state entomologist. It deals with an order of insects, the Hemiptera, which has been rather generally neglected in America. This is really the first serious attempt to treat in a systematic way the whole order from any given region.

Yet no order of insects is more directly connected with the welfare of the human race than the Hemiptera. The Parasitica all live upon mammals, sucking their blood, and include some of the most important pests of man and the domestic animals. The Homoptera all suck the juices from the leaves or twigs of plants, many species being markedly injurious. Thus the members of the family Cicadellidae feed upon the leaves and are known as "leaf-hoppers," those of the Membracidae feed upon the stems and twigs and are called "tree-hoppers," the Fulgoridae or "lantern flies" are usually on the stems or leaves of herbaceous plants or shrubs. The Cercopidae, known as "frog-hoppers" or "spittle insects," make frothy masses on the stems of grasses or the twigs of trees and shrubs. The members of the Cicadidae, or "harvest flies," are larger than those of the families just mentioned and apparently with all the species the immature forms are subterranean and feed upon the roots of trees: the adults suck sap from twigs and branches, and lay their eggs in them. The best known and most destructive species in this family is the "periodical cicada" or "seventeen-year locust." The Psyllids, or "jumping plant lice," occur on the stems and leaves of woody plants, and only a few species are considered as pests. The aphids, or "plant lice," are very abundant as regards species and individuals and are common to nearly every plant species. They are usually found on the under surface of the leaves or on the tender shoots, often doing great damage. The Aleyrodids, or "white flies," are few in number of species, and occur on the under side of leaves. Only two or three species in our range are considered of economic importance. The Coccidae, or "scale insects," occur on the bark and leaves of trees, the stems and leaves of herbaceous plants and shrubs, and certain species are found in the nests of ants: they are fairly abundant and include a number of important pests.

The Hemiptera, or Heteroptera, include a number of families like the Tingidae or "lace bugs," Minidae or "leaf bugs," Lygaeidae, Coreidae and Neididae, the members of which feed upon plant tissues, and certain species are well-known and important pests. Other families, like the Reduviidae, or "assassin bugs," Phymatidae, or "ambush bugs," Nabidae or "damsel bugs," Veliidae or "water striders," Belostomatidae or "giant water bugs," Corixidae, "water boatmen," Notonectidae, "back swimmers," and it is believed the Aradidae or "flat bugs" are predatory on insects and other small animals. The Cimicidae, or "bed bugs," attack warm blood animals. Other families, like the Pentatomidae, "stink bugs," contain certain species which are plant feeders, while others are predatory upon insects.

Though the insects of most of the families are terrestrial, the species of Veliidae, Nepidae, Saldidae, Nerthridae, Belostomatidae, Corixidae and Notonectidae are aquatic.

In general, the plant-feeding species, as well as those attacking the higher animals, are regarded as injurious, while the predatory species are called beneficial because they attack and destroy many individuals of noxious species. But they are perhaps just as apt to devour harmless or even beneficial species, should such be at hand. From certain species of Coccidae in the Orient is obtained the lac of commerce, and certain other species of the same family formerly supplied the brilliant red dye, cochineal. Thus the Hemiptera as a whole contains many species which are considered injurious, and some beneficial ones: few or none are parasitic on other insects, though many are predatory.

Some 20,000 species of Hemiptera have been described over the whole world; there are about 5,000 species in

North America and over 870 species are known to occur in Connecticut. In number of species, the order is exceeded, at least in Connecticut, only by the Coleoptera (beetles) Lepidoptera (butterflies and moths), Hymenoptera (ants, bees and wasps), and possibly by the Diptera (flies).

Obviously, a work contributed by so many workers can not be entirely uniform in treatment. But as a rule the various families are provided with keys to the genera and to the species. The keys are usually followed by brief descriptions of the species with host plants together with records of distribution. While most of the descriptions are clear and concise, they are somewhat brief for present-day purposes. Nevertheless, one must concede something to the limits of time and space, and the high cost of printing paper; and acknowledge that it would be somewhat difficult to crowd more into the 700 odd pages.

Such a publication, of course, has a much wider application than to the state of Connecticut alone. In general, it may be said that this work applies to most of the northern states east of the Mississippi River. The treatment of the family Cercopidae by Stearns covers the entire United States. The treatment of the family Meridae by Knight is a practical revision of the forms from eastern North America. The treatment of the Cicadellidae by DeLong, the Membracidae by Funkhouser, the Psyllidae and Aphididae by Miss Patch, the Aleyrodidae and Coccidae by Britton, the Lygaeidae by Barber and the Pentatomidae by Parshley, seem to be especially full and complete.

Beginning students and others will welcome numerous illustrations, especially the figures illustrating anatomical details of the various families where the nomenclature has not been standardized. The plates of typical Hemiptera, chiefly by B. L. Walden, are beautiful examples of what may be done in illustrating small insects by photography.

An extended use of the keys in several families has revealed no errors save very minor ones, and the whole work shows many unmistakable evidences of careful attention to details. Zoologists who seem to be inclined to ignore taxonomy or to condemn all working systematists might do well to consider carefully such a volume as the Hemiptera of Connecticut, for here we have the joint work of sixteen authors put in such form as to be readily available to any serious student. Here one will find marshalled a vast array of suborders, families, subfamilies, tribes, genera and species in a manner to commend respect.

Students of Hemiptera will owe a debt to Dr. Britton and his collaborators for many years to come for the excellent manner in which they have carried a difficult task to a successful conclusion.

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SPECIAL ARTICLES

THE ORIENTED WEDGE THEORY OF EMULSIONS AND THE INVERSION OF EMULSIONS[1]

FOR the formation of an emulsion the presence of an emulsifying agent is essential, except in the case in which the emulsion is very dilute. Of the typical soluble emulsifying agents sodium oleate may be cited as an example. At the interface between water and benzol the surface tension is about 35 dynes per cm. If sodium oleate is added to the aqueous phase to give a concentration of 0.01 normal or more, the interfacial tension is reduced to about two dynes per cm. According to the theory that the molecules in surfaces are oriented in such a way as to give the maximum lowering of surface energy, it is to be expected that the sodium ions, and the COO^- groups to which they are attracted, are turned toward the water, while the hydrocarbon chains are oriented toward the oil (benzol).

If the two phases are now intimately mixed, as by an egg beater at high speed, a concentrated emulsion of benzol in water is formed. While the drops of benzol have different sizes, about 20 per cent. are found to be close to 1.94 microns in diameter. Each of these drops is, according to the theory, surrounded by a film of oriented molecules of sodium oleate, and this film serves to stabilize the drops. The orientation theory was applied to emulsions in a paper from this laboratory (Harkins, Davies and Clark, *J. Am. Chem. Soc.*, 39, 592–4 and 587 (1917)), and evidence in its favor has recently been obtained by Griffin, who finds the amount of sodium oleate adsorbed at the surface of the drops to correspond to a monomolecular film, within the limits of the experimental error.

It is to be expected that the sodium oleate in the film will ionize to a certain extent, thus leaving a film which consists of some negatively charged oleate ions in addition to the salt. This leads to the idea that the oil drops should be negatively charged, and cataphoresis experiments indicate that their potential is about -0.060 volts with respect to the aqueous phase when any paraffin oil is emulsified by sodium, potassium or caesium oleate. The charge upon the droplets of oil is undoubtedly of great importance in giving stability to the emulsion.

It is known that sodium oleate is somewhat hydrolyzed in aqueous solution, so some free oleic acid and also some acid oleate (McBain) are present. They may be expected to influence the interfacial tension and also the size of the drops in the emulsion. One

[1] A paper which gave some of the data of this paper in preliminary form was presented at the Milwaukee meeting of the American Chemical Society, September, 1923.