is slightly acid. So far this particular difficulty has not been overcome, and the effect of thyroxin on the vital activities of Paramecium remains uncertain. It is to be hoped that future workers in the field will identify the species with which they work, and that this note will serve to correct an erroneous identification by the writer.

WALDO SHUMWAY
DEPARTMENT OF ZOOLOGY,
UNIVERSITY OF ILLINOIS

THE SMELT IN LAKE MICHIGAN[1]

ATTENTION has been called to the fact that the smelt (*Osmerus mordax*) originally introduced in 1912 into Crystal Lake, Michigan, from Green Lake, Maine, has spread to Lake Michigan.[2] The first specimen came from off Frankfort in 1925, and others have been identified since, coming from Big Bay de Noc, Delta County, and Charlevoix, Michigan. Increase in numbers has been noted each year and unverified reports of its capture have come from other North Michigan ports as far as the Straits of Mackinac.

The first specimen collected from Lake Michigan had a stomach content consisting of a young specimen of the Lake-herring (or of some other species of the whitefish family) and crustaceans (*Mysis oculata*), which caused some apprehension since the smelt in the shallow waters (12–20 ft.) of Crystal Lake eat large numbers of small fishes, mostly *Notropis atherinoides*.

This was enhanced by the writer's discovery that the yearling smelt from Howe Lake (Lake Superior watershed) were at this small size feeding almost entirely upon their own young and the young of perch (*Perca flavescens*).[3]

In the spring of 1928 ten smelt were collected from Lake Michigan from water twenty to twenty-five fathoms deep off Empire, Michigan. They were mouthed in the large-meshed gill nets of the commercial fishermen which were taking nearly all whitefish and a very few lake trout. Their stomachs were entirely filled with *Mysis oculata*. The fact that the smelt can exist upon such a diet when in deep water further emphasizes the fact that this fish can range throughout the Great Lakes and seems destined to become one of the most abundant fishes of these lakes. In the deeper waters of Crystal Lake the smelt likewise feeds mostly upon *Pontoporea affinis* and *Mysis oculata* in contrast to its extensive fish diet in the shallow water. The smelt is therefore an enemy of all smaller fishes, including the young of the commercial species, as well as a competitor for the food of the adults of the larger species. The abundance of food, however, renders this competition less important.

A study of the growth of these smelt as determined from their scales after the standard method[4] and based on an unpublished fish-length, scale-length curve computed from a large series of smelt from Crystal Lake gave these average lengths: 88.7 mm for the first year; 149.3 mm for the second year, and 168 mm for the third year. Crystal Lake smelt averaged 92 mm in length for the first year; 156.9 mm for the second, and 171 mm for the third. Nine of the specimens were three years old and one two years old.

The three-year-old fishes were the most abundant size collected in the spawning run at Crystal Lake in 1923 according to the final determination, rather than the two-year-old size as preliminarily reported.

It is to be regretted that the smelt has become inexorably established in waters where it can not be limited or controlled. There is little chance to utilize it commercially except at the developed spring spawning runs and with ice lines in a few favorable locations. Gill nets of small mesh are impracticable because of their capture of a large number of immature commercial fishes.

This establishment of the smelt is another instance emphasizing the need for very close control of all experiments in the introduction of any kind of animal into a new location. Even with a very thorough knowledge of the life-history of a fish in its native waters little can be predicted as to the place it will assume in the readjustment to the new environment. Careful control, therefore, during such experiments is an imperative matter.

CHARLES W. CREASER
COLLEGE OF THE CITY OF DETROIT

1 Contribution from the University of Michigan Biological Station and the College of the City of Detroit.

2 C. W. Creaser, "The Establishment of the Atlantic Smelt in the Upper Waters of the Great Lakes," Paper Mich. Acad. Sci. V.: 405–424, 1925.

3 C. W. Creaser, "The Food of Yearling Smelt," Paper Mich. Acad. Sci. VIII, 1928.

4 C. W. Creaser, "The Structure and Growth of the Scales of Fishes, etc.," Univ. of Mich., Museum Miscellaneous Pub., No. 17, 1926.

QUOTATIONS

HUMPHRY DAVY

SIR HUMPHRY DAVY, who died one hundred years ago, was one of three men—Thomas Young and Michael Faraday being the other two—who by sheer force of native intuition made the Royal Institution, and with it this country, an unsurpassed center of scientific light and leading in the earlier part of last century. He was little more than a boy when he was drawing crowds to hear his lectures and witness his experiments. Before he was thirty he had won a European reputation by investigations which give him a permanent place among the great chemists of the world. He was only fifty when he died, but bad health, and perhaps it must be added marriage and a fortune, marred his latter years, and if he had not lived beyond forty his fame would have stood as high as it does. When he began his work chemistry was entering on a new era. It had all but cut itself free from the doctrine of phlogiston, that mysterious principle of fire, sometimes ponderable, sometimes imponderable, and sometimes even possessed of negative weight, which had dominated it for more than a hundred years. Lavoisier had shown that in the explanation of combustion and kindred processes the final appeal must be to the balance, and gradual progress had been made towards establishing the conception of the chemical elements that still holds, even though the atom is no longer regarded as the ultimate unit of matter, and has become itself a complex microcosm of electrons whirling round a still more complex central nucleus. With the invention of the voltaic battery a new and potent instrument of research was put into the hands of experimenters, and Davy seized eagerly upon the possibilities it offered. Using it to direct chemical theory into fresh and unexplored channels, he not only demonstrated the compound character of many substances which previously had been accepted as elementary, but also forged a link between chemical and physical phenomena, and thus entitled himself to rank as a pioneer of the electric theory of matter.

If a certain impetuosity of temperament, coupled with an ambitious desire for "the honorable meed of the applause of enlightened men," sometimes betrayed his flashing intellect into the hasty publication of insufficiently verified hypotheses which the steady glow of Faraday's genius would have avoided, he always had an exalted view of the dignity and the importance of science no less in its utilitarian than in its moral and intellectual aspects. He realized that, in his own words, the prosperity and the riches of a country are intimately connected with the progress of the arts and sciences, and that no people has attained any considerable degree of civilization independent of the chemical arts, and—taking science as *illustrans commoda vitæ,* in the Lucretian phrase which serves as the motto of the Royal Institution where most of his work was done—he could turn to the study of the practice of tanning, the application of chemistry to agriculture, or the construction of a safety lamp for miners, with as much zeal and enthusiasm as he displayed in the abstract inquiries of the laboratory. Some of his contemporaries held a high opinion of his capacity as a poet, but time has not endorsed their judgment. The poetic and imaginative quality of some of his prose writings may be admitted, but his excursions into verse are forgotten, and it is as a natural philosopher that his fame endures.—*The London Times.*

SCIENTIFIC BOOKS

The Nature of the Physical World. By A. S. EDDINGTON. The Macmillan Company, New York, 1928. xvii + 361 pages, $3.75.

THIS book contains substantially the course of Gifford Lectures delivered by Professor Eddington at the University of Edinburgh during the first three months of 1927. Intended for the general public, it is written in popular style without recourse to mathematical symbolization. Nevertheless in his aim to show how recent scientific developments have provided new material for the philosopher the author has not shirked the more recondite aspects of scientific discovery and the reader will find that the reasoning in many places demands his closest attention.

The subject-matter covers the great changes in our concept of nature that have taken place during the last twenty-five years, especial attention being paid to the relativity theory and to the new quantum dynamics of Heisenberg, Dirac and Schrödinger. As a pure exposition in non-mathematical language of these recent developments in physics Professor Eddington's book certainly has no equal in the English language. The author proves himself a marked exception to the rule that the scientist lacks the capacity to write entertainingly and in terms which are intelligible to the reader who is not a specialist. The seriousness of the argument is relieved by apt illustrations and the reader's chuckles are aroused by flashes of humor and striking epigrams. Nothing excited the reviewer's delight more than Professor Eddington's emendation of the first law of motion: "Every body continues in its state of rest or uniform motion in a straight line, except in so far as it doesn't."

The author's object, however, is far more than mere exposition. His real interest lies in the philosophical implications of modern physics and in the light thrown by scientific discoveries on such questions as the conflict between the ideas of free-will and predestination. After showing that science forms a closed cycle he investigates those values in human experience which lie outside the domain of the scientific method. The ripples on a moonlit lake conform in their scientific aspects to the equations of hydrodynamics, but the romance of the summer night can never be expressed by a differential equation. Even the scientist loves and sometimes hates. After all, science can not evaluate its own purposes. The motive force back of scientific investigation is something which transcends science itself.