years, is not intended to prepare teachers for their profession. The plan is to offer an opportunity to do college work to the 5,000 teachers or more of Chicago. The College will not concern itself with methods of instruction, but only with the subject-matter.

MT. HOLYOKE COLLEGE has received $100,000, bequeathed some time since by the will of the late Charles P. Wilder; one-half of this sum is to be spent in the support and extension of scientific work.

THE new buildings of the medical department of the University of California, built by the State on land presented by the late Adolf Sutro, were formally opened on October 22d. The site, though somewhat remote from the present center of the city of San Francisco, commands a magnificent view, and the laboratories and lecture rooms are excellently equipped.

WE noted last week that eleven architects had been selected in the final competition for plans for the buildings of the University of California instituted by Mrs. Hearst. It appears further that the traveling expenses of these architects are to be paid by Mrs. Hearst in order that they may proceed to California and spend six months in adjusting their plans to the magnificent site of the University.

A CHAIR of physical geography, not yet filled, has been established in the University of Zurich.

THE University of Paris has been given anonymously a fund to allow a French student to study mathematics in Germany.

AT Magdalen College, Oxford, Mr. Horace Middleton and Mr. Harold Hilton have been given fellowships, the former in reference to work in physiology and zoology, the latter with reference to work in mathematics.

M. BOIRAC has been appointed professor of philosophy at Dijon.

THE Council of the University of Paris has nominated for lecturer in experimental psychology as its first choice M. Pierre Janet and as its second choice M. Georges Dumas.

DR. R. LORENZ, electrochemistry, and Dr. K. Keller, zoology, have been made full professors in the University of Zurich.

DISCUSSION AND CORRESPONDENCE.

THE 'BIPOLARITY' HYPOTHESIS.

I HAVE read with interest Dr. Ortmann's remarks in SCIENCE for October 14th on Sir John Murray's views as to the distribution of marine faunas. I agree with Dr. Ortmann that in most cases the supposed 'bipolarity' does not exist, and I may refer him to some remarks of my own published last June, which show very much the same for the Tunicata as he does for the Crustacea. The statements in question appear in a paper on Simple Ascidians from Puget Sound (Trans. Biol. Soc., Liverpool, Vol. XII., p. 248), in which, while pointing out the close similarity between the Tunicata faunas of the west coast of Europe and North America and their possible relation to a northern circumpolar fauna, I criticised Murray's 'bipolar' lists and gave as my opinion that "the distribution of Tunicata as a whole does not lend any support to the bipolar hypothesis." I further stated that "this matter must be settled by specialists in each group of animals stating their opinions as to the genetic affinities of the northern and southern faunas in their own groups, quite apart from and uninfluenced by general lists containing other groups." I am glad to see that this is what Dr. Ortmann and others are now doing.

I would add: There is one thing more we need, and here I am sure Sir John Murray and other naturalists will concur, and that is, more facts, further investigations. There is every prospect now, with the various Antarctic expeditions in the field or proposed, that we shall shortly be in possession of more information from the far South. It is to be hoped that American and British naturalists will see to it that our own polar seas are more thoroughly explored in the near future, both by dredge and tow-net. In advocating Antarctic expeditions we must not forget how much still remains to be done within the Arctic Circle.

W. A. HERDMAN.

UNIVERSITY COLLEGE, LIVERPOOL,
October 22, 1898.

PERIDINIUM AND THE 'RED WATER' IN NARRAGANSETT BAY.

DURING the last two months the inhabitants of Rhode Island witnessed the following remark-

able phenomenon. The water of a considerable portion of the Bay became thick and red, emitting an odor almost intolerable to those living near by. The situation became alarming when, on the 9th and 10th of September, thousands of dead fish, crabs and shrimps were found strewn along the shores or even piled up in windrows.

At the request of the Rhode Island Commission of Island Fisheries, an investigation was made to determine the cause and extent of the unusual color of the water and of the great mortality of the fish. The results of this investigation are briefly as follows

During the last of August, throughout September and a part of October streaks of red or 'chocolate' water were observed from near Quonset Point and Prudence Island, north to Providence, and, on he flood tide, up the Seekonk River, nearly to Pawtucket, a range of about fifteen miles. In other parts of the Bay, as far as could be learned, the phenomenon had not been observed.

On the 8th and 9th o S tember the water became extremely red and thick in various localities from East Greenwich to Providence, and the peculiar behavior of the marine animals attracted much attention. Myriads of shrimps and blue crabs, and vast numbers of eels, menhaden, tautog and flatfish came up to the surface and to the edge of the shore as though struggling to get out of the noxious water. Indeed, the shrimp and crabs were observed actually to climb out o the water upon stakes and buoys and even upon the iron cylinders which support one of the bridges and which must have been very hot in the bright sun. In several instances, on these two days, hundreds of blue-crabs were caught by a single individual in a few minutes' time, at the mouth of the Seekonk.

On the following day, September 10th, and for several days afterwards, hardly a live crab or shrimp could be found. Along the shores, however, in the same vicinity, cartloads of dead shrimp were piled up in windrows, and among them were strewn great numbers of crabs and fish of various kinds, especially menhaden and eels. This singular behavior and alarming mortality of marine animals was reported from nearly every station at which the red water occurred, and from no other station, which indicates that the two phenomena are related as cause and effect.

It was commonly believed that dye-stuffs or other refuse emptied into the rivers at the upper part of the Bay gave to the water its color and unpleasant odor, but microscopic examination showed that the water was swarming with minute organisms, a species of *Peridinium*. The *Peridinium* is reddish brown in color and occurred in such excessive abundance that it gave to the water its peculiar color and odor, besides making it so opaque that one could hardly see a white shell six inches below the surface.

With regard to the systematic position of this organism there is a difference of opinion. It is, in fact, ranked with the animals by some authors and with the plants by others. I have not yet been able to determine the species of our *Peridinium*. It resembles in many respects Carter's *Peridinium sanguineum;* it is much flattened, and the anterior end is distinctly bilobed, like *Peridinium tabulatum*, though the lobes are more rounded. Besides a flagellum extending forward from the ventral groove, a very large flagellum lies in the equatorial sulcus and entirely encircles the body. No cilia could be demonstrated.

After September 9th and 10th, when the great mortality of fish occurred, the *Peridinium* became, for a few days, less abundant, and then increased again until the 23d. There was a heavy rain on the 23d, and on the following day the water was comparatively clear. Since this date it has been more or less in evidence up to the day of writing (October 7th). On September 21st the number of *Peridinium* per cubic centimeter in the Seekonk River was estimated at 5,880. This was enough to give the water a very noticeable red color. Nevertheless, the marine animals appear not to have been seriously affected since September 10th or 11th, though the approach of a streak of red water has, in some instances, interrupted good fishing.

In the Seekonk River the shrimp and crabs gradually returned, and in about three weeks after the sudden mortality were nearly as numerous as before, though the water was at times distinctly colored. On the 23d some shrimp, oysters and small fish (*Fundulus*) were

kept in the water where the *Peridinium* were the thickest, and suffered no apparent injury. In consideration of these facts, it has been doubted whether the *Peridinium* was the immediate cause of the peculiar behavior and death of the fish which occurred on the 9th and 10th of September, especially as the weather had been phenomenally hot for several weeks previous to that date. I believe, however, that the *Peridinium* was the cause of the trouble, and not the hot weather nor manufacturers' waste, for the following reasons:

On the two or three days in which the mortality took place the water was extremely red.

The hot weather was followed by a cold wave a day or two before the mortality commenced.

The phenomena occurred in Greenwich Bay and off Nayatt, many miles from any considerable source of contamination.

Finally, the phenomena in question were noticed by very many persons throughout the whole range of the red water, while in neighboring portions of the Bay, for example, in the Warren River and in Bristol Harbor, where the temperature of the water is quite as high as in the red-water districts, no *Peridinium* and no mortality or unusual behavior of the marine animals was reported, though the regions were carefully canvassed.

There are many recorded instances of salt and of fresh water colored red probably by *Peridinium* of this or a similar species. H. J. Carter, in his account of 'The Red Coloring Matter of the Sea round the Shores of the Island of Bombay,' described the new species *P. sanguineum*, which produces this effect. He points out, also, that Darwin's description of the animalcule which he found to color the sea red, a degree south of Valparaiso, accords exactly with that of *Peridinium*. The animalcules which, according to Salt, produce the red color in the Red Sea, may also be due to this form, and the same cause may perhaps be ascribed to the red color of the sea off Iceland in 1649. Porter quotes "the following passage from an eye witness of a similar occurrence at Porebunder, on the coast of Khattywar, India, where the red water is extremely common, viz.: 'the color of the sea water on Saturday evening last, the 27th of October, 1849, was changed from its usual tint to a deep red, emitting a most foul smell; the fish speedily were all destroyed and washed upon the beach in large quantities, etc.'" Though the narrator believed that this might be due to a submarine eruption of mud, Mr. Carter is inclined to ascribe it to some 'animalcule,' most probably *Peridinium*. He also directs attention to the Mosaic account of the plague of Egypt given in the following verses: "And all the waters that *were* in the river were turned to blood." "And the fish that *was* in the river died; and the river stank, and the Egyptians could not drink of the water of the river; and there was blood throughout all the land of Egypt."

A. D. MEAD.

ZOOLOGICAL BIBLIOGRAPHY.

TO THE EDITOR OF SCIENCE: The report on Zoological Bibliography, summarized in your issue of November 4th, is evidently conceived primarily from the point of view of the bibliographer, but from that of the working zoologist it is open to criticism in several details. Chief among these is rule 3, in which the standpoint is made especially conspicuous from the unwarranted assumption that the publication of the separate papers of a volume before the volume as a whole is issued is 'improper,' while the indefinite delay of their publication is 'proper.' It seems to the writer that the propriety or impropriety really consists in the indefiniteness of date, which may or may not accompany the separate publication. This may be, and should be, avoided in a much more simple and easy manner than the remedy proposed by the committee. It is only necessary that the separates as issued should each bear its own date and that the table of contents issued with the volume should state under each title 'author's copies issued' at such and such a date. For the progress of science, as well as the convenience of workers, it is much more important that separate papers should be promptly issued and distributed to specialists than that the volume should be issued at all. The above method has been employed by the Philadelphia Academy of Natural Sciences, and the method of separate publication of all papers has been adopted by most of the Washington