ties to cultivate special fields in chemistry formed, so that to-day, apart from the foreign chemical societies, having affiliations in this country, I find some ten additional societies for chemists, requiring in addition to initiation fees, yearly dues exceeding one hundred dollars, and issuing some ten journals, which must be read, or searched, in keeping up with the literature. With such development in a little over twenty-five years, one wonders what the condition will be at the end of this century. Evidently there should be an obvious purpose and an unoccupied field to warrant such additional burden being placed on chemists and the community.

The founders of the American Institute of Chemists recognized that as the practice of chemistry spread a need was created for an organization which should represent and promote the profession of chemistry, as the bar and medical association in various countries represent and promote the interests of the practitioners of law and medicine, while protecting the community by the formulation and proclamation of standards governing practice, procedure and professional conduct, and by certification of professional qualifications. The avowed purpose in the creation of the American Chemical Society was "the encouragement and advancement of chemistry in all its branches," and its record testifies that it has most admirably fulfilled the purpose for which it was created, but from the very nature of its organization it is unsuited to perform the functions for which the institute was created and moreover these are wholly foreign to the purpose for which the American Chemical Society was created. Fortunately, these two organizations occupy quite independent fields, complementing one another to the better advancement of chemistry and the chemist and to the better advantage of mankind whom both serve.

CHARLES E. MUNROE

## OCEANIC CIRCULATION[1]

FOR many years past the Museum of Comparative Zoology and the U. S. Bureau of Fisheries have carried on oceanographic explorations in harmonious cooperation; recently in collaboration with the North American Committee on Fisheries Investigations.

Since 1912, the chief field of exploration of this joint enterprise has been the Gulf of Maine, out to the edge of the continent, with the coastal waters to the east, and to the west and south, of that area. Commenced on the schooner *Grampus*, and continued to date on the fisheries steamers *Albatross*, *Halcyon* and *Fish Hawk*, the exploration has resulted in perhaps as detailed a knowledge of the distribution of temperature and of salinity, regionally, with depth, and with the change of the seasons as can be claimed for any other part of the sea of like area.

A general survey of the plankton, vegetable as well as animal, has also been made. And as its own special province, the Bureau of Fisheries is carrying on a comprehensive study of the biology of the important food fishes, some of the results of which are included in the "Fishes of the Gulf of Maine" (Bulletin, U. S. Bureau of Fisheries, Vol. 40, Part I, 1925).

Besides the Gulf of Maine project, which is a continuing one, explorations of the coast water from Georges Bank to Chesapeake Bay were carried out by the *Grampus* in the warm summer of 1913 and the cold summer of 1916.

The oceanic triangle Chesapeake Bay-Bermuda-Bahamas and the straits of Florida were surveyed oceanographically by the Bureau of Fisheries and the U. S. Coast and Geodetic Survey jointly in the winter of 1914. And in the winter of 1919–1920 observations were taken along the south Atlantic coast and about Cuba by the *Albatross*.

Preliminary statements of the results of these various cruises have appeared in SCIENCE, in the annual reports of the Bureau of Fisheries and in the bulletin of the Museum of Comparative Zoology. A comprehensive account of the oceanography of the Gulf of Maine region nears completion.

During these explorations, it has become increasingly evident that the key to many puzzling phenomena, biologic as well as physical, is to be sought in the circulation of the water on the continental shelf. Problems of special interest are: (1) the extent to which the temperature of the coast water along Nova Scotia and to the southward is influenced by the Polar Stream, popularly known as the Labrador current, on the one hand, and by the so-called "Gulf Stream" on the other; (2) the source of the highly saline water of moderately high temperature which lies on the bottom of the deeper basins on the continental shelf, as, for instance, the Gulf of Maine, and (3) the involuntary drifts of pelagic fish eggs and larvae, and of the plankton.

The circulation of the sea may be studied by indirect methods and by direct; both are being employed.

At the suggestion of the North American Committee on Fisheries Investigation, a comprehensive survey of the surface drifts in Eastern Canadian and United States waters by drift bottles has been carried on by the Bureau of Fisheries and by the Biological Board of Canada since 1922. Some thousands of bottles have been put out along lines calculated either to give cross-sections of known or suspected lines of drift or to delimit the separation between opposite or eddying

[1] Presented at the annual meeting of the American Geophysical Union in Washington, D. C., May 1, 1925.

currents. The number of recoveries (upwards of 20 per cent. for the U. S.) has been so large and they have been so consistent that the results are more significant than could have been expected. And, I may add, they fall directly in line with the circulation deducible from regional inequalities in density and from the distribution of salinity, of temperature and of the plankton.

It is still too early for a general statement. But it seems thoroughly established that the Labrador current exerts only an indirect effect anywhere to the west or south of the Laurentian channel, but that the cold water which floods westward along Nova Scotia in spring and early summer, some of it to enter the Gulf of Maine, is given its low temperature chiefly by ice melting, partly in the Gulf of St. Lawrence, and, more directly, outside the latter in the region of Banquereau and Sable Island Banks.

The circulation in the large basins on the shelf—the Gulf of Maine, for instance, and the basins along Nova Scotia takes the form of anti-clockwise eddies, while the water eddies clockwise around the shoal banks.

The mixture of water taking place along the edge of the continent, in the zone of contact between the cold banks water of low salinity, on the one hand, and the much warmer and saltier water of the open Atlantic, on the other, is heavier than either of its two constituents; hence it sinks, and as it sinks draws in water from either hand toward the sinking zone. This process of cabbeling, now known to take place along the continent from the Grand Banks to Chesapeake Bay, is the source of the so-called "slope water," which, turning to the right under the effect of the earth's rotation, is pumped into the Gulf of Maine as a bottom current by a rather steep density gradient obtaining throughout the year.

Drift bottles and densities combined make it highly probable that it is the draft of surface water toward this sinking zone, with the earth's rotation constantly deflecting it to the right, which is responsible for the southwesterly drift which has often been reported over the outer part of the continental shelf west of Cape Cod, and which was demonstrated by the fact that a large proportion of the bottles set adrift south from Cape Cod were picked up along North Carolina and Virginia.

Studies of the occurrence of pelagic fish eggs and larvae make it highly probable that the eddying circulation of the Gulf of Maine plays a rôle of great importance, in causing extensive involuntary migrations for most of the important food fishes, these taking to bottom far from where they are hatched. As a hint of what we may expect, I may add that while cod spawn abundantly in Massachusetts Bay, towing carried on there last winter suggests that practically all the eggs drift out of the bay before hatching, so that the resultant fry are to be sought perhaps on Nantucket shoals, perhaps on Georges Bank, perhaps even further afield.

The distribution of salinity affords ample proof that the river water flowing into the Gulf of Maine hugs the land as it eddies around anti-clockwise. Thus the nutritive substances washed down from the land should be most abundant close in to the shore—and this is corroborated by the fact that the greatest production of planktonic plants takes place here near land. The inflow of off-shore water into the gulf is into its right hand (eastern) side, so that tropical as well as arctic immigrants are to be expected—and have actually been recorded—more often there than in its western side. Conversely, drift bottles, current measurements and hydrographic evidence combine to locate the outflow from the gulf as along Cape Cod, out past Nantucket Shoals and so westward and southwestward. But the dominant drift divides off Cape Cod, part continuing to eddy eastward toward Nova Scotia, deflected by the rising slope of Georges Bank. And this eastward component, forming the southern side of the anti-clockwise Gulf of Maine eddy, is so well defined that the great majority of the recoveries of drift bottles set out off the coast of Maine and off Cape Ann have been from the west coast of Nova Scotia or from the Bay of Fundy, and after comparatively uniform periods of drift.

Although few measurements of currents by current meters have been attempted from Bureau of Fisheries vessels—being so time-consuming—a very extensive series has been carried out by the U. S. Coast and Geodetic Survey in the neighborhood of Nantucket shoals, in Massachusetts Bay, and along the arc of the southern rim of the Gulf of Maine: and the dominant drifts deducible therefrom prove generally consistent with the bottle drifts.

Although not strictly within the scope of this report, studies of the migrations of the codfish carried on for the past two years by the Bureau of Fisheries, and those on migrations of mackerel planned for the coming summer, have a direct oceanographic bearing, being intimately connected with the problems of circulation.

The work of the International Ice Patrol assumes increasing importance in American oceanography. And as none of the other reports listed for to-day's meeting seem to include this, a brief statement will not be out of place here.

Since the inception of the patrol, the taking of serial temperatures and salinities has been a regular part of the program of the Coast Guard cutters which

maintain the patrol from March to July, as well as a close plotting of the drift-tracks of individual bergs.

The result has been a great increase in knowledge of the interaction of the Labrador and Gulf Stream currents around the Grand Banks, which finally, we hope, will enable the drifts of bergs to be predicted to a much greater extent than is now possible.

Lieutenant Commander E. H. Smith, who has taken the oceanographic records and made the observations on the ice for the past few years, is now working up the hydrodynamic aspect of the results at the Geophysical Institute in Bergen.

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## BRAYTON HOWARD RANSOM

DR. BRAYTON HOWARD RANSOM, chief of the zoological division, Bureau of Animal Industry, United States Department of Agriculture, died in Washington, D. C., at 11:00 p. m., on September 17, 1925, after an illness of about three weeks. He was only forty-six years old, a comparatively young man, but in the short space of that brief lifetime he had crowded more of valuable achievement than most men may hope for in the biblical allotment of three score years and ten. In the scope comprehended in his investigations he was quite unusual and in his grasp of the broad field of veterinary parasitology the writer would rank him next to the illustrious Railliet of Alfort, a much older man, retired from teaching a few years ago at the age of seventy.

It would be difficult to find another man who on the scientific side had done monographic systematic work on parasites and had established basic facts in the life histories of such important parasites as *Ascaris, Haemonchus, Strongyloides, Gongylonema, Habronema, Syngamus* and *Taenia ovis,* and who on the practical side had first found in the United States many of our economically important parasites, had contributed to our knowledge of the true pathological conditions or causes in the case of infestations with *Davainea echinobothrida, Cooperia punctata, Syngamus trachea* and *Ascaris lumbricoides,* had developed measures for the control of stomach worms in sheep and had originated and developed the famous swine sanitation system popularly known as the McLean County System, had developed the basic regulations of the United States Department of Agriculture for the control of parasites, especially trichinae and cysticerci, through the meat inspection service, and had established some of the fundamental facts on which dipping for cattle ticks is based. Such a man has nothing to do with the debates on pure science versus applied science; he sees only the field of science and does well the tasks before him. The investigations noted above are only the high lights selected from those represented in his bibliography of over 160 titles. This represents a quarter century of productive work. His bibliography is devoid of padding. He was not a dabbler. His most prominent characteristics were his extreme thoroughness and carefulness. He was painstaking to a degree, in spite of the fact that the responsibilities of life weighed on him unusually heavily and that he paid an excessive toll of nervous energy for this painstaking work.

Dr. Ransom was born in Missouri Valley, Iowa, March 24, 1879, and educated in the public schools of Bancroft, Nebraska. He received the following degrees: S.B., University of Nebraska, 1899; M.A., University of Nebraska, 1900; Ph.D., University of Nebraska, 1908. It was proposed by the University of Nebraska to confer on him the honorary degree of D.Sc. at the June commencement of this year, but owing to a misunderstanding he was unable to be present to receive the degree at that time. He was a fellow in zoology at the University of Missouri in 1900–1901 and at the University of Nebraska in 1901–1902. In 1902 he came to Washington as assistant in zoology in the Hygienic Laboratory of the U. S. Public Health and Marine Hospital Service and the following year succeeded Dr. Ch. Wardell Stiles in charge of the Zoological Laboratory of the federal Bureau of Animal Industry. In 1906 he was made chief of the laboratory and the laboratory was at that time made the zoological division. As chief of this division he became assistant custodian of the U. S. National Museum.

His sound counsel and scientific achievements were widely recognized among scientific groups. He was U. S. delegate to the Seventh International Zoological Congress, the Fourth Fisheries Congress and the First Pan-American Scientific Congress and a member of the editorial boards of the *Journal of Parasitology* and the *American Journal of Tropical Medicine.* He was a member of the American Microscopical Society (president), American Society of Naturalists, American Society of Zoologists, American Association for the Advancement of Science (fellow), American Society of Tropical Medicine (secretary-treasurer), American Veterinary Medical Association (honorary member), American Society of Parasitologists (councilor), Biological Society of Washington, Entomological Society of Washington, Helminthological Society of Washington (past president), Washington Academy of Sciences (vice-president), Société de Pathologie Exotique (foreign correspondent), Reale Accademia d'Agricoltura di Torino (foreign correspondent), Phi Beta Kappa, Sigma Xi, Beta Theta Pi and the Cosmos Club. In recognition of his work