able to the analysis and understanding of both normal and pathological aspects of motor activity.

A general session on Education in Biophysics elicited considerable interest and delegates discussed the problems associated with the evolution of biophysics as a discipline in their respective countries.

As an experiment, the meeting was organized with invited speakers only; more than 100 papers were presented. Although this procedure evoked considerable criticism, the meeting was undeniably stimulating and provided some excellent discussions.

L. D. HARMON
Bell Telephone Laboratories, Incorporated, Murray Hill, New Jersey
F. M. SNELL
State University of New York, Buffalo

Aquatic Pollution

The pollution of marine waters was the subject of a symposium held by the Aquatic Biology Group at the meeting of American Society for Microbiology in Washington, D.C., 5 May 1964.

Robert Littleford (U.S. Public Health Service) severely criticized the increasing pollution of our waters and called for new approaches to the problem. He said that dumping waste into the marine environment and forgetting it as it floats away nullifies responsibility. Over the years the pollutants have increased 1000-fold, and the variety from almost every industrial organization has also increased. Pollution, an environmental problem, is also a biological problem, yet biologists have shirked pollution study. He called for studies by virologists of the shellfish hepatitis problem, and emphasized the need for a critical overhaul of microbiological techniques. The methodology for other ecosystems cannot simply be adapted for the marine environment. Littleford called for a coordinated approach to pollution study—one in which biologists, oceanographers, sanitary engineers, and other specialists would work as a team. There should be an end to projects that do not consider the whole environment, especially the life in these polluted waters. These studies should take into account the interaction of organisms and environment, the spread of infective agents arising from sewage and other man-made wastes, and the negative and positive effects of treated sewage on the

growth and viability of the phytoplankton of the offshore fisheries and shellfish areas. (Littleford remarked that he spoke as an individual and that his opinions were not necessarily those of the U.S. Public Health Service.)

Ross F. Nigrelli (Osborne Marine Laboratories, New York Aquarium) agreed on the need for unified studies of pollution. In commenting on the recent mass killing of fish in the Mississippi Delta, he asserted that such mass kills have taken place during the past 25 to 30 years. The most recent occurrence has been blamed on pesticides; however, pesticides were not being used at the time of earlier kills. This points up the need to separate subtle biological kills from pollutional kills—a task requiring team studies.

An analysis was made by Galen Jones (Boston University) of the effect of chelators on the growth of *Escherichia coli*. Using both synthetic and natural sea water he has demonstrated that chelation increased the longevity of an *E. coli* population. The bactericidal action of natural sea water varies with season, temperature, and location; such fluctuations reflect residual organic matter and organic nutrients locally produced. When questioned about the reliability of *E. coli* as a pollution indicator, he agreed that small traces of chelators in the test system or in the natural waters would alter the *E. coli* count, and that the amount and type of chelator (for example, amino acids and other natural or synthetic organic substances) could vary appreciably. He thought that the present standard bacteriological techniques were not reliable. Questions from the audience brought out the fact that the New York City Health Department, the New York State Department of Health, the Interstate Sanitation Commission, and the U.S. Public Health Service all use different systems for estimating fecal pollution and the percentage of dissolved oxygen. Hence there has been great confusion as to the safety of bathing beaches.

Iron-oxidizing bacteria, said Donald G. Lundgren (Syracuse University), are associated with the acid drainage that causes a serious pollution problem in coal mining areas. The high acidity of these waters is the result of sulfuric acid. Corrosion caused by acids and iron precipitates is an additional pollution problem. Fundamental knowledge on iron-oxidizing bacteria is needed before pollution control can be achieved by the sanitary engineer. Lundgren

described *Ferrobacillus ferrooxidans*, which oxidized ferrous iron for energy, and fixed carbon dioxide as the sole source of carbon. A system was described for growing ferrobacilli in 160-liter batches in order to obtain enough cell material for analysis. Both gross and fine structures of these bacteria were studied with electron optics; results revealed a cell envelope, two-layered cell wall, a layered cytoplasmic membrane, polyribosomes, and circular organelles of unknown function. A model for iron oxidation and acid production was described. It was determined that ferrobacilli assimilated carbon dioxide by the conventional autotrophic route, the Calvin scheme.

L. W. Slanetz (University of New Hampshire) reported that he has used membrane filters to enumerate fecal streptococci; the method was direct, reliable, and reproducible. While the number of fecal streptococci was lower than the number of coliforms, they were comparable to the numbers of *Escherichia coli* and, in some samples, to the number of fecal coliforms in the test samples. Fecal streptococci were good indicators of sewage or fecal contamination of sea water.

George Cowherd (Interstate Sanitation Commission) discussed Raritan Bay. The commission is charged with the control of pollution of the interstate tidal waters in the New York metropolitan area. Cowherd said that at certain seasons the waters of Raritan Bay do not meet the commission's requirement of an average dissolved oxygen concentration of not less than 50 percent saturation. It has started to determine when, where, and why these low oxygen values occur. They have integrated six investigatory techniques:

1) Sampling of waste waters from the 133 treatment installations in the control district and from the many plants, particularly along the heavily industrialized Arthur Kill which discharges into Raritan Bay.

2) Using the Army Corps of Engineers' hydraulic model at Vicksburg, Virginia, to determine how waste water moves within the New York harbor complex.

3) Surveying fish populations.

4) Monitoring *p*H, chlorides, temperature, and dissolved oxygen continuously by means of an automatic water-analysis device which transmits information by leased telephone wire to the commission's New York office.

5) Direct sampling in Raritan Bay.

6) Studying the effects of secondary

treatments on the phytoplankton population and dissolved oxygen in Raritan Bay. This latter work is done by the Haskins Laboratories for the commission.

Cowherd mentioned the commission's interest in the "harbor taste" of fish from Raritan Bay. The commission, he said, has produced a taste similar to this, within a week, by exposing fish of the same species to one part per million of a petroleum product. He said the commission is requiring waste treatment by industry to eliminate toxicity and taste problems. Cowherd was asked by Warren Litsky (University of Massachusetts): "Why bother with all this when we know it's oil that contaminates the Arthur Kill and eventually the Bay?" Cowherd replied that the contamination was caused primarily by discharges from chemical and petroleum industries. The discussion elicited a further comment by Litsky: "We know that the big pollutant is oil. Everybody knows that. Just stick your toe in the Arthur Kill, and don't light a match" (laughter). It was asked whether ships discharging bilges could be at fault. Cowherd said they were partly at fault, "But we do police the refineries and find they discharge oil into the Arthur Kill, too." Ships, he added, are not easy to police.

John J. A. McLaughlin (Haskins Laboratories, New York) presented data from 1000 Raritan Bay samples collected over a 5-month period. Analyzing these samples for phytoplankton by the standard Sedgwick-Rafter method for concentration of such material gave erroneous results; this sand-filtration technique recommended by the American Public Health Association failed to trap the dominant phytoplankton, *Nannochloris*, a tiny alga. This organism grew to densities of 1,000,000 cells per milliliter during July and August, and constituted 99 percent of the population. This bloom persisted well into October. Temperature drops in October and November caused massive death of these organisms. The bloom of this genus in Raritan Bay paralleled its blooming in the duck excreta-enriched Great South Bay of Long Island. The organism was thought to have destroyed the clam industry in that area. McLaughlin stressed the cumulative effect on oxygen and carbon dioxide balances of massive phytoplankton death, and pleaded for studying the phytosociological aspects of the harbor ecosystem.

John Burke (St. Francis College,

Brooklyn), an oyster epicurean, made many in the audience uneasy. The concentration by shellfish of phytoplankton dinoflagellates, such as *Gonyaulax catenella* and *G. tamarensis*, has led to the death of some consumers of raw clams or raw oysters. These flagellates produce a potent neurotoxin concentrated by the filter-feeding shellfish. Eating these shellfish may mean paralysis or death. Analysis of the two toxins derived from laboratory cultures indicates that they are quite similar physiologically (paralysis leads to death in mice), but chemical identifications are still lacking.

The consensus of the symposium was that understanding how pollution affects the marine environment is obtainable only by joint efforts of scientists who have widely diverse training, and that the "standard" methods developed for other environments were inadequate.

JOHN J. A. MCLAUGHLIN
Haskins Laboratories, 305 East 43 Street, New York, New York

American Association of Physical Anthropologists

The American Association of Physical Anthropologists held its 33rd annual meeting in Mexico City 20–25 June. Louis S. B. Leakey from Kenya described and analyzed the fossil hominoid remains called *Zinjanthropus* and *Homo habilis*—the former with huge teeth and jaws and the latter with dental and other features that place it in the genus *Homo*. Besides U.S., Canadian, and Mexican scholars, James M. Tanner and N. A. Barnicot from England, José Pons and Miguel Fusté from Spain, J. Tacoma from the Netherlands, Juan Munizaga from Chile, and Hertha de Villiers from South Africa also participated.

Much interest centered on Mexican problems, especially James E. Anderson's demonstration of human skulls up to 87 centuries old from Tehuacan. But, besides studies in Mexico, the pattern of the tapestry of the "human fabric" (as the species was described in one presentation) was shown to repeat itself in various parts of the world by studies of American Indians, Canary Islanders, Melanesians, Southeast Asians, East Africans, and others. This worldwide view of the human species belonging to a genus with a history millions of years deep influenced the clos-