in the first few hours there was an inhibition of ribosomal protein synthesis, and experiments with artificial messenger polynucleotides suggested that there was a decreased stability of attached messenger RNA in addition to a direct damage to the ribosomes. A few hours later the incorporation markedly rose often far beyond the normal level. The stimulatory effect was mainly due to an increased sensitivity of hepatic cells to the systemic level of corticosteroids. Hultin suggested that chemical liver carcinogenesis was characterized by a pronounced adrenal dependence.

Some of the newer concepts in enzyme regulation were discussed by S. Numa (Munich, Germany), B. C. Goodwin (University of Edinburgh), and V. R. Potter (University of Wisconsin). Numa emphasized that the carboxylation of acetyl-CoA to form malonyl-CoA is the first step and the rate-limiting step in the biosynthetic sequence in the overall conversion of acetyl-CoA to fatty acids. He reported that acetyl-CoA carboxylase was strongly inhibited by addition in vitro of long-chain acyl-CoA derivatives and that prolonged fasting or diabetes decreased the enzymatic activities. It was found that this biotin-containing enzyme was activated by citrate or other tri- and dicarboxylic acids. He suggested that conformational changes of the enzyme protein may play a role in the regulation of its activity.

Goodwin emphasized that the essential control processes of cells involve continuing oscillatory activity, so that the cell is constantly cycling through a set of states with periods determined by rates of fundamental biochemical activities, such as macromolecular synthesis and enzyme-catalyzed metabolic transformations. Detailed dynamic analysis of feedback repression and the equations describing the dynamics of such processes defined nonlinear biochemical oscillators. Goodwin developed the viewpoint that the dynamics of enzyme regulation in cells is intrinsically oscillatory and that this oscillatory activity represents a type of biological energy.

V. R. Potter discussed the implication of these concepts and presented enzymatic evidence that cellular processes are intrinsically rhythmic. However, the enzyme behavior in hepatomas fails to respond to the biological timing signals.

The symposium was sponsored by Damon Runyon Memorial Fund, Inc., Indiana University School of Medicine, American Cancer Society Institutional Grant, the Burroughs Wellcome Co., Merck Sharp & Dohme, and the Upjohn Co. The full text of the papers, edited by George Weber, will be published in the spring of 1965 as volume 3 of *Advances in Enzyme Regulation* (Macmillan, New York; Pergamon Press, Oxford). Volumes 1 and 2 of this series of conferences on enzyme regulation in mammalian tissues were published in 1963 and 1964 and presented the proceedings of the first two symposia.

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Diffusion in Oceans and Fresh Waters

Of the 20 papers presented at the symposium on diffusion in oceans and fresh waters sponsored by and held at the Lamont Geological Observatory, Palisades, New York, from 31 August to 2 September, 12 were directly concerned with diffusion of dyes. The remaining papers covered topics from sodium vapor trails in the upper atmosphere to the diffusion of radon-222 near the sea bottom.

C. G. Gunnerson (U.S. Public Health Service) discussed the physical and chemical properties of rhodamine-B and Pontacyl Pink-B dyes and gave loss rates due to oxidation, photochemical decay, and absorption. A significant result was that, in the presence of suspended solids, as much as 85 percent of these dyes can be lost by absorption, thus necessitating *in situ* field calibration for loss rates. Greatly appreciated was the recounting by D. W. Pritchard (Johns Hopkins University) of practical lessons learned from years of field experience at Chesapeake Bay Institute. These ranged from cautions against sampling rhodamine-B through rubber, Tygon, or copper tubing to description of techniques which increase the sensitivity of fluorometers, thereby permitting the use of less dye, reducing the cost of the tests, and producing "cleaner," more easily interpretable data.

Three papers dealt with pollution dispersion in rivers and estuaries. J. F. Wilson, Jr., and W. E. Forest (U.S. Geological Survey) presented results of time-of-travel studies in the Potomac River; C. C. Kisiel (University of Pittsburgh) gave results of dye experiments in the Ohio River; and D. O'Connor (Manhattan College) gave results of studies on pollutant dispersion in estuaries. O'Connor commented on the magnitude of the pollution problem relative to the present crude level of theory; in New York City alone, the cost of needed new sewage plants is about $100 million. One general result of sewage dispersion studies is that outfall design is not strongly affected by order of magnitude variations in eddy diffusion coefficients, and that advective circulation is a significant factor about which more knowledge is needed.

Six papers were presented concerning dye diffusion studies in coastal and oceanic waters. R. Reinert (New York University) discussed surface diffusion from a continuous point source in coastal waters. A phenomenon observed by Reinert (as well as by other workers) was the tendency of dye to form elongated bands and streaks in the direction of the wind and waves, with dye being closer to the surface and more concentrated on the leeward side of the patch and deeper on the windward side. The width of the dye plume as a function of downstream distance exhibited neither linear nor square-root dependence as predicted by theory. T. Ichiye (Lamont Geological Observatory) gave results of diffusion experiments in which dye techniques were used in coastal waters; offshore observation of dye patches again yielded elongated, irregular patterns with banding and heavy striations. The patches also showed consistent large curvatures which Ichiye related to Ekman spiral formation; similar observations in the southern hemisphere gave reverse curvatures. In discussion, Pritchard presented data from the Cape Kennedy region showing similar Ekman spiral effects. If these effects are indeed attributable to Ekman spiral flow, then we have the unusual situation of discovery of a long sought-after classical and analytical phenomenon by means of experiments designed to give information about turbulent, random phenomena.

J. E. Foxworthy (University of Southern California) reported on dye diffusion experiments to determine eddy diffusion in California coastal waters, using a Los Angeles offshore outfall as a real pollutant source. From longitudinal and lateral dye-dispersion data, a three-dimensional model was constructed and compared with theoretical results of Gifford (as extended by Okubo). Dispersion was observed to be anisotropic; however, the model yielded reasonable results. Analysis of data for vertical diffusion shows, inconclusively, that there may be a critical wind speed at which vertical diffusion increases rapidly; this is a point for future work.

Dye experiments on the Bahama Banks, where the water depth is about 5 meters over an area of some 30,000 square kilometers, were reported by M. Costin (Lamont Geological Observatory). Results showed less irregularity then in other coastal work, diffusion was slower and, typically, elongations and elliptical patterns were observed.

A. Okubo (Johns Hopkins University) presented a theoretical model of diffusion of dye patches which accounts for the elongations and elliptical patterns observed in field work. Using a model in which large-scale eddies are considered to be in a quasi-steady state, while small eddies are random and statistically isotropic, he predicted elliptical concentration patterns and related angular orientation and time variation of elongation to observable quantities such as shear and rotation in the mean flow. Application of data to theory yields good results. The model also predicts the observed windward-leeward depth dependence of dye patterns.

In a theoretical paper, D. Kirwan (New York University) used variational calculus techniques to estimate magnitudes of horizontal and vertical eddy diffusivities. When applied to Antarctic Intermediate Water data, acceptable estimates of the variation of salinity with depth were obtained. This work should revive interest in efforts to ascribe physical meaning to theoretically derived eddy coefficients and mixing lengths.

Three speakers were concerned with diffusion in the deep ocean. T. E. Pochapsky (Hudson Laboratories) described diffusion studies in the deep ocean [also reported in *Tellus* **15**, 352 (1963)] by means of floats designed to have neutral buoyancy at depth; the floats are tracked acoustically. Pairs of floats were observed to separate both vertically and horizontally, indicating float motion due to a complex interaction of internal waves, random turbulent motion, and inertial "bobbing" of the floats. The presence of vertical stratification and velocity shear causes difficulty in applying isotropic turbulence theory. M. P. Wennekens (Office of Naval Research) gave results of continuous profile measurements of sound velocity, temperature, and pressure in California continental borderland waters. A general structural pattern has emerged in which there is a "noisy" zone (about 200 to 800 m depth) where temperature fluctuates by about 0.5°C over depth changes of 10 to 50 m. The data have been interpreted as thin layers (or lenses) of water undergoing shear motion, with blobs of water apparently moving along constant density surfaces. Attempts to do dye or particulate diffusion studies in such waters would require precise knowledge of injection depths. W. Broecker (Lamont Geological Observatory) discussed large-scale oceanic diffusion determined by radiochemical methods. Since red clay bottom sediments in deep oceans are strong sources of radon-222, and the atmosphere represents an infinite sink for Rn^{222}, measurement of vertical profiles of decaying Rn should give information on eddy diffusion near the bottom. Although results to date on four such profiles are not conclusive, these preliminary results agree well with theory in the range of eddy diffusion coefficients from 5 to 500 cm^2/sec. Such new techniques should be of interest to physical oceanographers.

In one of two special lectures on atmospheric diffusion, H. E. Cramer (Massachusetts Institute of Technology) pointed out similarities and relations between atmospheric and oceanic diffusion phenomena. A significant and fortunate result in atmospheric physics is that Lagrangian and Eulerian statistics can often be used interchangeably. Another result which may be useful in oceanic research is that wind direction fluctuations (and spectra) are good indicators of the originating turbulent process. O. R. Coté (Geophysics Corporation of America) gave results of experiments on turbulent diffusion in sodium vapor trails in the upper atmosphere by means of rockets. He noted features qualitatively analogous to those observed by Wennekens, namely, large shears and direction reversals over short vertical distances; these results have possible implications for large rocket launches.

The papers read at this meeting showed in general that concerted attempts are being made to use classical, analytical models instead of statistical ones. The strong roles of both stratification and advection on turbulent processes are being recognized, and the importance of non-isotropy and vertical motion must be considered; in many oceanic situations there is an inextricable interweaving of effects of turbulence, internal gravity waves, and shear motion. There is a feeling that energy flow in cascade processes can occur in both wave number directions; this phenomenon should be looked for experimentally. Interactions between mean flow and turbulent flow should be investigated more fully. Finally, there was an appeal from several sources that engineers present data in both English and metric units; the difficulty of doing this is usually small compared to the difficulty of mentally converting units during a lecture.

The proceedings of the symposium are expected to be published by the end of this year.

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Forthcoming Events

December

21–23. American **Physical** Soc., Berkeley, Calif. (W. Whaling, California Inst. of Technology, 1201 East California St., Pasadena)

21–23. **Biology of Marine Microorganisms**, conf., Univ. of California, Berkeley. (R. Newton, Letters and Science Extension, Univ. of California, Berkeley 94720)

26–29. Society of **Systematic Zoology**/American Soc. Zoologists/Herpetologists' League, annual, Univ. of Tennessee, Knoxville. (J. G. Rozen, Jr., Dept. of Entomology, SSZ, American Museum Natural History, Central Park West and 79th St., New York, N.Y.; A. G. Richards, ASZ, Dept. of Entomology, Univ. of Minnesota, St. Paul 55101; J. M. Legler, HL, Dept. of Zoology, Univ. of Utah, Salt Lake City)

26–31. **American Assoc. for the Advancement of Science**, annual, Montreal, Canada. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C.)

The following 44 organizations will meet in conjunction with the AAAS annual meeting in Montreal, Canada, 26–31 December:

Academy Conference (J. T. Self, Dept. of Zoology, Univ. of Montreal, Montreal)

Academy of Psychoanalysis (M. Ullman, Maimonides Hospital, 4802 Tenth Ave., Brooklyn 19, N.Y.)