aration; to Dr. Maurice Barnes Woodhall, Duke Hospital, Durham, N. C., for a further study of the reaction of central nervous system tissue to transplanted rabbit papilloma, and to Dr. Charles W. Turner, professor of dairy husbandry at the University of Missouri, for work on the relation of thyrotropic hormone of the anterior pituitary to pregnancy and lactation.

DR. HUGH S. CUMMING, formerly surgeon general of the U. S. Public Health Service, has returned to the United States. He attended a meeting of the Committee of the National Health Office in Paris on April 9 and a meeting in Geneva on June 30 of the League of Nations Health Office.

DR. HENRY TEUSCHER, superintendent and chief horticulturist of the Botanical Garden of Montreal, has left to visit the botanical gardens and the main horticultural centers of Europe. He will study the construction of large greenhouses in view of the plans for the greenhouses to be constructed next winter at the Montreal Botanical Garden. The work at the garden is progressing actively. About two hundred and fifty acres are now in course of development.

THE Society of American Bacteriologists will hold its fortieth general meeting on August 30, 31 and September 1, in San Francisco, Calif., at the Hotel Fairmont, under the presidency of Dr. Paul F. Clark, of the University of Wisconsin. The program includes groups of papers in the fields of general, medical, agricultural and industrial bacteriology. Symposia have been arranged on the subjects of nitrogen-fixation, metabolism, filterable viruses and immunity. A joint meeting of all the sections of the society will consider the subject of enzymes in relation to bacteriology. Round-table discussions on the following topics will be held: staphylococci, spirochetes and spirochetal diseases, non-symbiotic nitrogen-fixation and the cross-inoculation of leguminous plants.

THE Massachusetts Institute of Technology announces a conference to be held on September 8 and 9, under the direction of the department of mathematics and the department of economics and social science, on the application of statistical methods to industrial and engineering problems. Addresses and discussions will include a résumé of certain statistical technique needed for effective handling of industrial data, successful applications of statistical methods in the fields of engineering and quality control, contemporary developments in industrial and engineering statistics. Among those who will address the conference are L. H. C. Tippett, of the British Cotton Industry Research Association; Dr. Walter A. Shewhart, of the Bell Telephone Laboratories; and Dr. S. S. Wilks, professor of statistics at Princeton University. The evening of September 9 will be devoted to applications of statistical methods in the fields of biology and medicine. All correspondence should be addressed to the Secretary, Conference on Engineering and Industrial Statistics, Massachusetts Institute of Technology, Cambridge, Massachusetts.

THE International Congress on Rheumatism will meet in New York in June, 1940. Dr. Ralph Pemberton, of Philadelphia, is president. Subjects to be discussed will be the role of infection in rheumatic diseases, nutrition in rheumatism and the social significance of orthopedic work in rheumatic diseases. A symposium on therapy in rheumatism will be arranged.

THE Sheffield Scientific School of Yale University has received bequests amounting to more than a million dollars. They are a residue interest in the estate of Frederick W. Vanderbilt, '76, of New York City, and $664,749 from the estate of Miss Marie Oakes Hotchkiss, of East River, Conn.

LORD NUFFIELD has offered to give £60,000 to the University of Birmingham for the extension of the department of physics. Of this a sum of £40,000 is to be used for the building, the remainder being reserved for equipment and maintenance and for the foundation of a research scholarship. The plans for the new block provide for a professor's room and secretary's office, a staff room and library. The central part is a research hall for high-voltage work, this being flanked by eight research rooms, each about 16 feet by 14 feet. There are to be also a machine-room and workshop, two dark rooms and a basement room for high-energy x-ray work.

DISCUSSION

CHEMICAL CONTROL OF STARFISH[1]

THE common starfish, *Asterias forbesi*, is the most destructive enemy of the oyster along the North Atlantic Coast. Efforts have been made to eradicate it for at least a century, but these attempts have been largely unavailing. The method in present use by oystermen consists in gathering the starfish from the bottom by the use of dredges and special starfish mops and destroying the captured animals by immersion in hot water. This method is slow, however, and the unabated depredations of starfish on the oyster beds attest its inefficiency.

Experiments looking toward the development of a method of chemical control have been carried on by

[1] Published with permission of the U. S. Bureau of Fisheries.

the U. S. Bureau of Fisheries for several years. In early experiments substances such as copper sulfate were used. Although this substance proved lethal to starfish, several disadvantages attended its use. Because of its great solubility large quantities were needed to create a concentration lethal to starfish, a procedure too expensive to be of practical value. A further disadvantage was the fact that many marine organisms besides starfish were killed by the chemical.

Since 1937 experiments on the destruction of starfish by the use of calcium oxide or quicklime have been carried out by the senior author at the Milford Laboratory. The possibility of using calcium oxide for combatting starfish was first suggested by Wood.[2] Recently this substance has been used by the oystermen on grounds located in Long Island Sound.

Under laboratory conditions calcium oxide in powder form proved to be more effective than coarser grades because it covered the bottom more evenly. All starfish in the outside experimental tanks died within 5 to 10 days after being treated with powdered calcium oxide. The chemical was applied at the rate of 300 pounds of powdered substance per acre of bottom.

In the spring of 1938 the experiments were transferred to the oyster beds of Long Island Sound where starfish are abundant. Both powdered and coarse grades of lime were used, the latter having been found to retain its effectiveness longer than the fine. The efficiency of the method on the natural oyster bottoms depends wholly upon the uniform distribution of calcium oxide particles over the treated area and upon the quantity of the chemical used. On 25 acres of starfish-infested oyster bottom treated with calcium oxide at the rate of 480 pounds per acre as many as 80 per cent. of the starfish were found to be affected by the chemical one week after the beginning of the experiment.

The destructive effect of calcium oxide upon starfish is produced by direct contact. Particles of the chemical quickly sink to the bottom, and, falling on the aboral surface of the starfish, imbed themselves in the ciliated epithelium covering the animal. Caustic action of the slaking chemical rapidly disintegrates the delicate skin membrane. The lesions rapidly increase in size, spreading in all directions and involving the branchiae and other surface structures. After several days the lesions penetrate the body wall and the internal organs become exposed. Death usually follows in a short time.

Once spread on the bottom, the chemical retains its effectiveness for some time. Starfish which are not directly hit by the falling particles when the chemical is applied eventually come in contact with it by crawling on the bottom. In the course of time the lower or oral surfaces of the starfish become affected and disintegration begins.

It has been observed that starfish with large lesions are usually attacked by other starfish and crabs which quickly kill and eat them.

The advantages of calcium oxide as a practical weapon against starfish are many. Of special importance is the fact that it does not appear to be very injurious to many other forms of marine life. No mortality has been observed among other bottom forms such as oysters, clams, several varieties of crabs, barnacles or adult flounders. Many of these animals were kept for as long as three months without apparent effect in large experimental tanks to which the chemical had been added. Studies on the effect of calcium oxide on plankton are now in progress.

Being at once effective and easy to apply, the new method is considered especially suitable for practical use. It should be of particular value in exterminating starfish on public or abandoned oyster bottoms, which, as shown by Loosanoff,[3] are the centers of propagation and dispersal of starfish in Long Island Sound.

VICTOR L. LOOSANOFF
JAMES B. ENGLE
U. S. FISHERIES BIOLOGICAL LABORATORY,
MILFORD, CONN.

PREPARATION OF l-GLYCERIC ALDEHYDE

WE have prepared l-glyceric aldehyde in the following way:[1] l-arabinose → l-mannonolactone → l-mannitol → 1,2–5,6-diacetone-l-mannitol → acetone-l-glyceric aldehyde → l-glyceric aldehyde (2,4-dinitrophenylhydrazone m.p. 148°, dimedone compound m.p. 198–200°, $[\alpha]_D^{21°} = -198°$ in alcohol).

The optical rotations of the l- and d-glyceric aldehyde decrease after some time in aqueous solution from –14° to –7° and from +14° to +7°, respectively. However, the aldehyde content of the solution remains unchanged. By evaporating the aqueous solution to dryness, the higher-rotating forms of both aldehydes can be regained. Thus we have a kind of "mutarotation," *but no racemization.* This point seems to be important because of its biological consequences.

A complete report will be published elsewhere.

ERICH BAER
HERMANN O. L. FISCHER
BANTING INSTITUTE,
DEPARTMENT OF CHEMISTRY,
UNIVERSITY OF TORONTO

[2] B. F. Wood, *Rept. State of Conn. Shellfish Comm.*, 94–98, 1908.

[3] V. L. Loosanoff, *Rept. State of Conn. Shellfish Comm.*, 10–14, 1936.

[1] Preparation of d-glyceraldehyde, *cf.* H. O. L. Fischer and E. Baer, *Helv.*, 19, 524, 1936.