different in different geographical communities and at different periods. All the subsidiary factors which have been variously regarded as primary causes of the decline of oyster populations may represent such a flux of environment. In addition, depressions over a period of years of the seasonal temperatures of the water on the northern outskirts of the oyster habitat, the silting up of estuaries and the accumulation of soft mud, may be suggested as other environmental changes. But whatever the trends have been, the oyster seems to have been incapable of reorganising its genotypes and hence to have become unfit for survival.

Thus overfishing and reduction of stock may have reduced the variability and adaptability of the remaining population.

Another effect consequent upon overfishing is the reduction in the chances for outcrossing between small and isolated populations. Sewall Wright[7] has shown that "the smaller the population size the more rapid is the scattering of the variability and the eventual attainment of genetic uniformity". He sums it up further as follows: "extreme reduction in numbers, bringing a tendency towards random fixation of one or another combination which is almost certainly less adaptive than the previous type, should result in a degenerative evolution even before there is time for appreciable effect of mutation pressure".

We suggest that the oyster fits well into this category. It may be argued against this view that commercial dredging was abandoned on oyster beds at a time when it became unprofitable for the fishermen, but before the population had become reduced to the extremely small numbers envisaged by Wright. However, the position of the remaining population probably deteriorated as a result of the scattering of the breeding oysters due to thinning out of the stock, for this must have greatly reduced the chances of successful fertilization[8]. Owing to the immobility of oysters, mass fertilization can be effected only by a relatively high density of the breeding population, whereas it is facilitated in many other animal groups by mating or migration to spawning grounds.

Also, the chances for outcrossing between different oyster colonies have become disproportionately reduced by the decline of population initially brought about by overfishing. If reproduction within a community even under favourable temperature conditions is very slight when the stock has become numerically weak and dispersed[3], the chances of fertilization between gametes of two separate colonies are very remote. A renewal of stock by spat from one colony settling among individuals of another colony is also unlikely owing to the short duration of the pelagic larval stage and the hazardous drift by tidal streams and currents to which the larvæ are subject.

Thus overfishing has increased the isolation of the oyster populations; and though it may have stopped short of extreme reduction in numbers, it has probably caused an extreme reduction in the effective size of the breeding populations.

Conclusions

If those considerations are correct we may conclude that the remaining oyster populations, natural and cultivated, have become genetically too uniform on each isolated ground, and thus (*a*) on the average less adapted to present conditions, and (*b*) less adaptable to long-term environmental changes.

So far, much of the breeding stock and most of the young oysters laid out for fattening in Britain, Holland and Norway have been imported from the south of France. Thus contrary to agricultural practice, the stock was transferred from a warmer to a colder climate to which it was not adapted. No wonder that the susceptibility of the oyster to low temperature has become a major stumbling-block for reproduction in northern waters. As a result of the reduced adaptability of the remnants of the original stocks and the imports of equally unadaptable southern stocks, the northern limit of the oyster habitat seems to have withdrawn considerably farther south than it was a hundred years ago.

The following practical conclusion arises from these considerations. There are probably a number of quite different variants of the European oyster in different localities, which if interbred and selected would yield more variable stocks. In recent years sustained efforts have been made to cultivate and breed oysters, both on suitable natural grounds and in tanks, and it is possible that by taking into consideration the genetical factors involved their chances of success would be considerably improved.

We suggest that institutions concerned with oyster culture should attempt, as part of a long-term rehabilitation programme, to build up, by hybridization and selection, a vigorous and adaptable breeding stock. Dr. G. Pontecorvo, with whom we have discussed this problem and whose comments and criticisms have helped us in clarifying the arguments put forward in this note, suggests a mass-hybridization of at least twenty varieties from different geographical communities, and particularly from northern rather than southern communities. Such a stock might not only yield better results when cultivated, but might also increase in numbers on suitable grounds and lead to a gradual repopulation of our coasts.

[1] Orton, J. H., Buckland Lectures for 1935, London.
[2] Korringa, P., *Arch. Neerland. Zoologi*, **5**, 1 (1940).
[3] Orton, J. H., *Mem. Mus. Roy. Hist. Nat. Belg.*, Ser. 2, **3**, 997 (1936).
[4] Orton, J. H., *J. Mar. Biol. Assoc.*, **13**, 1 (1923).
[5] Elton, C., "Animal Ecology" (London, 1927).
[6] Dobzhansky, Th., "Genetics and the Origin of Species", 2nd ed. (New York, 1941).
[7] Wright, S., "The Statistical Consequences of Mendelian Heredity in Relation to Speciation", in "The New Systematics", ed. by J. Huxley (Oxford, 1940).
[8] Spärck, R., *Rep. Dan. Biol. Stat.*, **33**, 60 (1927).

OBITUARIES

Sir Upendranath Brahmachari

WITH the death on February 6 of Sir Upendranath Brahmachari, India lost one of her most distinguished medical scientists. Sir Upendranath was best known to the world in general as the discoverer, and introducer as a therapeutic agent, of one of the most successful anti-leishmanial drugs, urea stibamine; but those interested in medical research work in India knew him as an original and tireless investigator with a wide field of interest.

He was the son of a medical man, his father, Dr. Nilmoney Brahmachari, being in the railway medical service. He took his B.A. at Hoogly College in 1893, winning a medal for standing first in mathematics, and in 1894 he took his master's degree in chemistry at the Presidency College, Calcutta. Both these earlier interests were reflected in his later activities in medical research. He took the Calcutta M.B. in 1898, the M.D. in 1902 and Ph.D. in physiology in 1904.

Brahmachari entered the provincial (Bengal) medical service in 1898, and his outstanding abilities soon attracted attention, so that at an early date he was appointed teacher in pathology and materia medica at the Dacca Medical School, and shortly afterwards teacher of medicine at the Campbell Medical School, Calcutta. During the twenty years that he held this post he did his best work. When he retired from the provincial medical service he became physician to the Medical College Hospitals and later professor of tropical medicine at the Carmichael Medical College, Calcutta.

Not inappropriately, Brahmachari's main interest was kala-azar. He was a Bengali, and in his early days of practice this disease was probably killing an average of at least 100,000 of his countrymen each year. There was at that time no specific treatment, and a 95 per cent death-rate was claimed for the disease. Intravenous tartar emetic in the treatment of kala-azar was first used in India in 1915 by Sir Leonard Rogers and Dr. E. Muir, and Brahmachari immediately saw the possibilities of developing the chemotherapeutic use of antimony. His first attempts were to prepare antimony analogues of the then comparatively new arsphenamine group of drugs. These were not very successful, and he soon turned his attention to the pentavalent antimonials, especially the *para*-amino-phenyl stibinic acid group that Prof. Hans Schmit was developing so successfully in Germany. One of his earliest successful preparations was 'urea stibamine'. He worked for many years with a grant from the Indian Research Fund Association, but later when he had accumulated considerable wealth—a by-product of his medical research work—he financed his own researches.

Brahmachari's contributions to medical literature were very numerous. He published at an early date a useful book on kala-azar that went through several editions in India and formed the basis of his most important book, "A Treatise on Kala-azar", published in London in 1928. He contributed the chapter on kala-azar in Mense's "Handbuch der Tropenkrankheiten" and that on infantile biliary cirrhosis in the "British Encyclopædia of Medical Practice". In addition to the numerous medals and prizes that he won in his early days, he was awarded the Sir William Jones Medal by the Royal Asiatic Society of Bengal and the Minto Medal; the latter is presented by the Calcutta School of Tropical Medicine to an Indian who has done outstanding medical research work during the year.

His interest in medical education and scientific research was reflected in the numerous important posts that he held; among these were dean of the faculty of medicine, dean of the faculty of science, and president of the board of studies of medicine, of the University of Calcutta, vice-president of the governing body of the Presidency College and vice-president of the National Institute of Sciences of India; president of the Indian Science Congress in 1936 and president of the medical section on two other occasions, and president of the Royal Asiatic Society for three terms. He was also vice-president of the Indian Red Cross Society and of the St. John's Ambulance Association, Bengal Provincial Centre. Official recognition of his services has been marked by the presentation of the Kaiser-i-Hind Gold Medal and the conferment of the title of Rai Bahadur early in his career, and later by a knighthood.

Few Indians have done more to further medical research in India than Sir Upendranath. His success with urea stibamine was an example and encouragement not only to medical research workers and research chemists, but also to the chemical industry in India, which in the last two decades has made enormous strides. He always had the interest of his countrymen at heart, but he was never a politician; he was always loyal to his British teachers and to the governments he served. His death at a relatively early age is a sad loss to India and medical science.

L. Everard Napier.

Prof. J. V. Dubský

Dr. J. V. Dubský, professor of analytical chemistry at the Masaryk University of Brno, Czechoslovakia, died on March 25, at the age of sixty-four. His loss will be felt all the more because he was the senior professor and the only mature and well-known chemist remaining at Brno; for Prof. J. Baborovský (aged seventy-two) has retired and Prof. Frejka has been called to Prague, while Profs. Simek and Kužma were executed by the Germans in 1942 (see *Nature*, 152, 69; 1943).

Dubský was not only a good lecturer and analyst, but also had done much to advance the use of organic reagents in the detection and estimation of metals, especially in the field of micro-analysis. In this connexion he wrote admirable surveys of the literature dealing with the various substances available as reagents for each metal. These reviews were published in the two Czech chemical journals, *Chemické Listy* and *Chemiky Obzor*. To English colleagues Dubský is best remembered for his papers in the *Collection of Czechoslovak Chemical Communications* (1929–38) dealing with the reactions of oximes, of thio-derivatives like thiouramine, and of glycocoll, and with his own original contributions to quantitative analysis.

G. Druce.

We regret to announce the following deaths:

Prof. E. G. Coker, F.R.S., emeritus professor of civil and mechanical engineering, University of London, on April 9.

Mr. Frank Crowther, chief plant physiologist, Sudan Government, on April 11, aged forty.

Prof. J. E. S. Frazer, emeritus professor of anatomy in the University of London, on April 15, aged seventy-five.

Prof. Amadeus W. Grabau, chief palæontologist of the Geological Survey of China and professor of palæontology in the National University of Peking, on March 20, aged seventy-five.

Lieut.-Colonel S. P. James, C.M.G., F.R.S., past-president of the Royal Society of Tropical Medicine and Hygiene, on April 17.

The Right Hon. Lord Keynes, C.B., F.B.A., the well-known economist, on April 21, aged sixty-two.

Sir Harold Stiles, emeritus regius professor of clinical surgery in the University of Edinburgh, on April 19, aged eighty-three.

Prof. Ralph Stockman, emeritus professor of materia medica and therapeutics in the University of Glasgow, on February 27, aged eighty-four.

Mr. Harold Wright, chief metallurgist to Messrs. Dorman, Long and Co., Ltd., who received the Bessemer Gold Medal of the Iron and Steel Institute in 1945, on March 28, aged seventy-seven.