whilst for several years the so-called single substances were considered to have been completely investigated, and it was believed that new points of view could only be obtained by the study of more complicated systems, the close study of these single substances has recently become extremely interesting. From the new point of view already reached, the phenomenon of allotropy with all the various phenomena associated with it and the influence of intensive drying can be surveyed.

In conclusion, one among several interesting questions may be put forward here. Consider for a moment a substance such as benzene, which has become an ordinary mixture by intensive dryings. Benzene is one among the large number of substances for which, after drying in the ordinary way, various physical constants, such as critical-point, melting-point, vapour-tension, specific weight, etc., are determined. Now it cannot be said that these constants have no value; on the contrary, they are very valuable, but they are not physical constants of the pure substance but of impure benzene, contaminated by an extremely small trace of water. Before the phenomena to which I have referred above were known, one would have attached little value to this observation, and one would have answered, that such an extremely small contamination cannot have any perceptible influence and can therefore be neglected. This is quite true, speaking of contamination in general, but now we know that water is a very special contamination, for on removing it completely, benzene becomes an ordinary mixture and our physical constants are no longer suitable. Thus the new theory opens up another field for investigations, on which many generations of scientific workers may carry out important research. In future the so-called single substances will be really purified, which means they will also be dried intensively. From the mixtures obtained in this way the components will be separated and studied carefully. Thus the components of a so-called simple substance will be discovered, and no doubt will often cause great surprise, since big and noteworthy differences may exist between the different kinds of molecules.

Sea-birds: Their Relation to the Fisheries and Agriculture.

By Dr. WALTER E. COLLINGE.

UNDER the above title in NATURE of April 8, 1920 (pp. 172-173), I gave a brief résumé of an investigation on the economic status of the commoner species of sea-birds of Great Britain then being carried out under the auspices of the Carnegie Trust for the Universities of Scotland. In that investigation, large series of each species from various localities during each month of the year were examined, and the food content of the stomach was estimated by the volumetric method. The investigation has now been completed, and a final résumé of the more important results may not be without interest. In all, nineteen species were examined, embracing 2309 specimens.

One of the most striking facts shown by this work is the very small percentage of fish consumed by the common gull, the herring gull, the black-headed gull, the common tern, the little auk, and the puffin. Hitherto, it has been generally assumed that all sea-birds feed upon fish, and that this item of their diet constituted the bulk, but such is far from the case. Of the total bulk of food consumed in a year, fish constitutes only 5·16 per cent. in the common gull, 18·20 per cent. in the herring gull, 3·73 per cent. in the black-headed gull, 18·01 per cent. in the common tern, 1·17 per cent. in the little auk, and 22·22 per cent. in the puffin. In the first three species, much of this small percentage of fish is obtained from shore refuse.

The case of the black-headed gull is most striking and significant. As a destroyer of injurious insects it is a most valuable bird, 24·70 per cent. of its food being of this nature, which is more than that consumed by either the rook or the blackbird. It also takes 4·38 per cent. of neutral insects and 0·19 per cent. of beneficial ones. The nature of the insect food is of considerable interest, both on account of the enormous amount that is consumed, and the particular species. Of these latter, it must here suffice to state that upwards of sixty different species were identified.

Respecting the bulk of food, accepting Newstead's computation that each bird feeding upon crane-flies will consume some 4000 per day or 28,000 per week, the total quantity destroyed must be enormous. On the Fifeshire coast we have estimated in passing from field to field that at least 5000 birds were present on the land ten miles south of St. Andrews. Such flocks would consume 140,000,000 insects in a week. This, however, is only on a small area. All along the coast and farther inland the same thing is taking place, so that the amount of insect life consumed must be prodigious. Moreover, it must be borne in mind that the percentage of cereals destroyed by this species is only 0·37 per cent. A similar striking record can be shown for the other five species mentioned.

Of the fish consumed, 27 species were identified. The highest percentage consumed of any one species was 9 per cent. in the case of the greater sand eel, 8 per cent. of the lesser sand eel, 6·5 per cent. of the gurnard, and 6 per cent. each of cod and herring; haddock follows with 5·5 per cent., and then gunnel and sprat each 3·5 per cent.; of flat fishes (all species), only 2·5 per cent. was present. Practically the whole of the food of the cormorant, shag, gannet, goosander, red-breasted merganser, and great skua consists of fish, whilst 50 per cent. of the same item forms the food of the guillemot and the black-throated and great northern divers.

The bulk of the fish-food consumed by the nineteen species of birds investigated consists of species that are exceedingly common and also plentiful. There is no scarcity of these fishes, and were they still more plentiful they would in all probability only form additional food for predaceous fishes, and thereby add to the increase of a factor over which man has little or no control.

Of the 2309 stomachs examined, 422 were empty or nearly so. It would seem that if there is any scarcity or lack of food, the female bird is the one to suffer, for of 97 partly filled stomachs of the herring gull,

70 per cent. were of female birds and 30 per cent. males; whilst of 68 empty stomachs 60 per cent. were of females and 40 per cent. males. Of 123 partly filled stomachs of the black-headed gull 73 per cent. were of female birds and 27 per cent. of male birds, and of 82 empty stomachs 65 per cent. were of females and 35 per cent. of males. Only 16 guillemots were obtained with empty stomachs, and here again 75 per cent. were of female birds and 25 per cent. male. Of the remaining empty or partly filled stomachs of eleven species, namely, thirty-six in all, 62 per cent. were of female birds and 38 per cent. of males.

The range of variation of the food according to locality is interesting. Of the 539 herring gulls examined, 351 were obtained on the coast, or nearby, and 188 were obtained from agricultural districts. In the former, food fishes constituted 13 per cent. of the total food consumed, other fishes 4·7 per cent., and injurious insects 14·1 per cent. Those from agricultural districts gave the figures 9·2 per cent. of food fishes, 7·2 per cent. of other fishes, and 12·5 per cent. of injurious insects, showing that the diet of this species gives only a small range of variation. With the black-headed gull the figures are more striking. Those from the coast show 11·5 per cent. of food fishes, 8·3 per cent. of other fishes, and 24 per cent. of injurious insects. From agricultural areas the percentage of food fishes is only 4, other fishes 2, and injurious insects 32·7.

In all the gulls, annelids, crustaceans, molluscans, echinoderms, etc., figure largely, and in nearly all cases a considerable percentage of this is obtained from shore refuse. In the common gull the percentage is 60·69, the herring gull 48·36, the lesser black-backed gull 39·75, and the black-headed gull 44·04.

For the first time we have a volumetric analysis of the food of the common tern, and the results are all in this bird's favour. The whole of the food is of an animal nature, and 53·70 consists of fish. Of this item 18 per cent. is made up of food-fishes and 35·70 per cent. of non food-fishes. Summarising the figures for the total food content, it is shown that 81·99 per cent. of the food is of a neutral nature, and (if we regard the food-fishes eaten as an injury) 18·01 per cent. injurious. It is very significant that no traces of fresh-water or flat fishes were met with.

As a result of this investigation, and the expression of opinion of those who have devoted a lifetime to fisheries investigation, we are of opinion that no action of sea-birds can produce any appreciable effect upon the plenitude of the fishes of the sea. Moreover, many of the species of birds are exceedingly valuable from an agricultural viewpoint, and their wholesale destruction may be fraught with the gravest possibilities.

Obituary.

PROF. C. J. EBERTH.

PROF. CARL JOSEF EBERTH, whose death occurred in Berlin at the beginning of December, was born in 1835 and completed his ninety-first year last September. His earlier work was carried out in Zürich, but for many years he held the post of professor of pathological anatomy in the University of Halle. Zoology, anatomy, histology, pathological anatomy, and bacteriology were all enriched by his researches, and his published papers include investigations on nematode worms, fœtal rickets, the structure and development of blood capillaries, thrombosis, the histology of the lung and liver, mitosis, and on inflammation.

Eberth's name is probably best known in connexion with the discovery of the bacillus of typhoid fever. In 1880 and 1881 he published papers in Virchow's *Archiv* describing a bacillus which he found present in the spleen and mesenteric glands of cases of typhoid fever. The bacilli occurred in scattered groups, and were not distributed generally in the tissues, and appeared to be characteristic and distinct from other organisms which were occasionally seen. Of 40 cases of typhoid fever investigated, this bacillus was found in 18 only; it was also absent from 24 cases of tuberculosis and other diseases. Koch, about the same time, also noted the presence of a similar bacillus in typhoid cases and published photo-micrographs of it. Gaffky, in 1884, confirmed Eberth's observations, finding the bacillus in 26 out of 28 cases of typhoid fever investigated, and isolated and cultivated the organism, which since has sometimes been known as the Eberth, or Eberth-Gaffky, bacillus.

Prof. Eberth, who had lived in retirement for many years, was created a "Geheimrath," and a *Festschrift*, with excellent portrait, was dedicated to him on the occasion of his ninetieth birthday last year (*Beiträge zur path. Anat.* Bd. 74, 1925). R. T. HEWLETT.

MR. LESLIE D. CURRIE, palæontologist on the staff of the Burmah Oil Company, was drowned while bathing in Burmah on November 9. Mr. Currie had only three weeks before arrived in the country, after a brilliant career in the University of Glasgow, during which he had done some promising research work on some undescribed Silurian Crustacea. His death, at the age of twenty-two years, removes a palæontologist of great promise.

WE regret to announce the following deaths:

Dr. Walther Bremer, Keeper of the Irish Antiquities in the National Museum, Dublin, whose archæological work included the identification of Asturian flints at Island Magee.

Dr. Franz Exner, emeritus professor of physics in the University of Vien a and a member of the Vienna Academy of Sciences, on November 15, aged seventy-seven years.

Dr. James F. Kemp, professor of geology since 1891 in Columbia University, distinguished for his work in economic geology, on November 17, aged sixty-seven years.

Dr. C. L. Withycombe, formerly of the Imperial College of Tropical Agriculture, Trinidad, and recently appointed lecturer in advanced and economic entomology in the University of Cambridge, on December 5, aged twenty-eight years.