

the reviewer scarcely knows how to control his pen so as not to appear unduly laudatory. To say that the book is practically perfection is a mild way of putting it, for, as a matter of fact, it is one that can never be equalled or rivalled so long as the copyright of its illustrations holds good, since no other man is likely to undertake the labour and expense necessary to produce a similar series of pictures from nature, even if he had the energy and patience necessary to the task. How great a debt ornithologists and bird-lovers generally owe to the Messrs. Kearton (for a large number of the photographs have been taken by the author's brother, Mr. Cherry Kearton) it is, indeed, impossible to estimate, and a part of their reward, at any rate, must consist in the pleasure they afford to, let us hope, an ever-widening circle of readers.

Of the photographs of nests and eggs, as well as of those of the parent birds, it is impossible to speak too highly, and where all are on such a high level of excellence it would be almost invidious to select any for special commendation. The one here reproduced has been chosen on account of its size rather than from any other consideration. The plates of eggs are admirable examples of the best style of three-colour process. Taken as a whole, the volume (which is a marvel of cheapness) will probably prove the most attractive natural history book of the year.

#### THE ORIGIN OF "BOTTOM WATERS" IN THE NORTHERN SEAS.

A SERIES of valuable tables and charts, in which the results of a great series of observations made in 1901 by Captain Roald Amundsen in the Arctic Seas are summarised, is contained in a monograph recently published.<sup>1</sup> These observations are supplemented by, and compared with, results published by other observers, chiefly Russian and Norwegian, and as a collection of facts the little volume is certain to prove of great value to all students of oceanography. Dr. Nansen's main purpose in the discussion of the observations has been the scientific explanation of the origin of the intensely cold and heavy "bottom waters" found in the basins of the Norwegian seas and North Polar Ocean. In discussing the scientific results of the Norwegian North Polar Expedition of 1893-6, Nansen had already dealt with this subject, and reached the provisional conclusion "that the cold bottom water of the Barents Sea is divided into two portions; the northern cold water coming from the sea to the North, North East, and East; and the southern cold water having two or three sources, namely bottom currents from the East and North East, and the surface of the sea itself which is cooled during the winter." In the light of more recent and extensive observations, Nansen has revised his opinion, and puts forward a different explanation of the origin of bottom water. This explanation accords with the facts observed, and may be briefly summarised.

The conditions required for the formation of bottom water are that near the surface water shall be found having a salinity of about 34.9 per cent., and that during winter this water may be cooled down to  $-1^{\circ}.3$  C. or  $1^{\circ}.4$  C. Its density may thus be between 28.11 and 28.13, and possibly greater, so that it becomes sufficiently heavy to sink. The

assumed salinity of surface water Nansen thinks will only exist in places where Atlantic water has mixed with Arctic water. Further, he considers that when bottom water is being formed there must be no rapid horizontal circulation which would bring in new supplies of relatively warm water. As the surface water becomes heavier it sinks, and will be replaced by somewhat warmer water of higher salinity, which in its turn will be cooled until it becomes heavier than the previous surface water, when it will sink still deeper, and be replaced by warmer water of still higher salinity from below. The uppermost strata will by this process be gradually increased in salinity, and approach that of the bottom water—about 34.9 per cent. The depth of vertical circulation will increase until it reaches down into the typical bottom water, and at that stage all strata from the surface downwards will have attained nearly uniform temperature, salinity, and density. Subsequent cooling at the surface will produce water so heavy that it may sink far down into the bottom water, or even to the bottom of the sea.

The heaviest sea-water of which Nansen has any knowledge was found at a depth of 120 metres—8 metres above the bottom—off the coast of Nova Zembla in May, 1900; the temperature of bottom water has in some cases approached  $-2^{\circ}$  C., with a salinity exceeding 35 per cent. and a density of 28.33. The observations made extended to depths of 3000 metres, where the temperature was  $-1^{\circ}.1$  C. Amundsen reached 2000 metres, at which the temperature was  $-1^{\circ}.3$  C.

The circulation of bottom water in the Norwegian Sea Nansen describes as follows:—The bottom water is chiefly formed and sinks towards the bottom during the winter and spring in the regions between  $73^{\circ}$  and  $76^{\circ}$  north latitude, and between  $4^{\circ}$  west longitude and  $4^{\circ}$  east longitude. From this region it moves along the bottom and spreads out laterally, producing cyclonic movements in the deep strata of the Norwegian Sea. During this circulation the bottom water is slowly heated from the underlying warmer sea bottom and from the overlying warmer water. In this manner its temperature near the bottom is gradually raised from about  $-1^{\circ}.3$  C. to about  $-1^{\circ}$  C. Nansen estimates that at least two-thirds of the whole basin of the Norwegian Sea is filled with cold bottom water. The renewal of the cold bottom water in the basin of the Norwegian Sea must be an extremely slow process, and it has been established by actual observation that the bottom water does not extend across the ridge anywhere between Iceland and Norway, where the temperature is nowhere below zero. Further, he thinks that it is very improbable that any bottom water with a temperature below  $-1^{\circ}$  C. ever gets across the ridge between Iceland and Greenland.

For the North Polar basin Nansen considers the minimum temperature to be between  $-0^{\circ}.8$  C. and  $-0^{\circ}.9$  C., the salinity being about 35.1 per cent. If existing observations are confirmed, in his judgment the possibility of a communication between the deep North Polar basin and the deep basin of the Norwegian Sea, as well as of their bottom waters, will be finally excluded. In that case he thinks that there are two regions where the bottom waters of the North Polar basin might originate by being cooled down directly through radiation from the sea surface, namely, in the seas north of Spitsbergen and near northern Nova Zembla. Nansen is further of opinion that the renewal of the cold bottom water of the enclosed North Polar basin will occur even more slowly than the corresponding renewal in the Norwegian Sea, so that a much smaller quantity of water

<sup>1</sup> "Northern Waters: Capt. Roald Amundsen's Oceanographic Observations in the Arctic Seas in 1901, with a Discussion of the Origin of the Bottom-waters of the Northern Seas." By Fridthjof Nansen. Pp. 154; 11 plates. (Christiania: Jacob Dybwad, 1906.)

will be required yearly to feed the circulation of the cold bottom water in the North Polar basin.

This brief outline of the contents of this interesting memoir will give some idea of the thoroughness of its scientific methods and the great labour that has been bestowed upon them.

#### THE COMMEMORATION OF LORD LISTER'S EIGHTIETH BIRTHDAY.

THE eightieth anniversary of the birthday of Lord Lister occurred on Friday last, April 5. Many scientific men have had the good fortune to discover the causation of phenomena of immediate practical importance, but to few have been vouchsafed the privilege of seeing the results of their discoveries become in a few years of such enormous benefit to their fellow men as those of Joseph Lister. No man alive has by a single discovery conferred upon the whole of mankind a greater boon than did the surgeon who discovered the causation of the direful but not unusual *sequelae* of a surgical operation, viz. suppuration, septicæmia, secondary hæmorrhage, erysipelas, and hospital gangrene, and who showed that by preventing the access of bacteria to wounds all these diseases could be avoided.

It is just forty years since the first papers of Lord Lister dealing with his discoveries were published in the *Lancet*. How the best skill of the surgeon was baffled by these wound infections and the whole development of surgery prevented may be realised by a quotation from a leading article in the *Lancet* written at the time of the publication of one of Lister's earliest papers in 1867.

The mortality of compound fractures, of amputations and operations and of lithotomy in our larger hospitals, both provincial and metropolitan, is something frightful. And the occurrence of death with symptoms of blood-poisoning is, unfortunately, not confined to cases of serious operation, but happens ever and anon in operations in themselves slight. The risk of blood-poisoning is indeed now the one great opprobrium of surgery. There is no limit to the operative feats of surgeons, but there is a miserable and serious risk in every case, especially in hospitals, of the occurrence of fatal after-consequences, against which—until now at least—we have had little or no power of resistance.

The story of the discovery of antiseptic surgery was briefly told by Lord Lister himself in the third Huxley lecture delivered in 1900. In this lecture Lord Lister explained how by the time he became a house-surgeon at University College he was already endowed with a love of physiology and a first-rate microscope. The former he owed to the inspiration of Prof. Sharpey and the latter to his father, who did so much to raise the compound microscope from little better than a toy to the powerful engine for investigation which it then was. As a young surgeon his attention was immediately turned to the study of those scourges of surgery, suppuration, pyæmia, and hospital gangrene. During the next ten years he made a number of investigations upon the early stages of inflammation and the healing of wounds. He was early led to the conclusion that suppuration and septic diseases were due to a poison acting locally, and again and again he searched with the aid of the microscope the discharges from wounds in the hope of discovering some *materies morbi* of an organised kind.

The idea that wound infections were of parasitic origin, although the parasite escaped detection, was early in his mind, so that when the epoch-making discoveries of Pasteur on the nature of fermentation and putrefaction were published, Lister was prepared

to appreciate the analogy between these phenomena and those of wound infection. Guided by this analogy, he devised methods to prevent the entrance of germs to wounds, and was immediately successful in obviating the evil effects hitherto so generally attendant upon the simplest operation.

The actual methods employed have undergone some modifications and simplification in accordance with the development of knowledge during the last fifty years, but the principle to protect wounds from the access of germs "by means which shall disturb the tissues as little as is consistent with the attainment of the essential object" retains its full value at the present time.

Lord Lister has been the recipient of many honours, bestowed upon him by every civilised community, but it was widely desired that his eightieth birthday should be suitably commemorated. It was considered by some of his admirers that this could best be done by the re-publication, by subscription, of his collected work in suitable form. Invitations were accordingly issued to a number of scientific and medical men, both at home and abroad, to form themselves into a committee for this purpose. The invitations have met with a warm response, and the committee may be described as an international one.

A meeting of this committee took place on Thursday, April 4, at the Royal College of Surgeons, which was presided over by Mr. Henry Morris, the president of the college. It was unanimously resolved to ask Lord Lister to allow the committee to re-publish his scientific papers, and a small editorial committee was chosen to carry out this object. The following letter was sent to Lord Lister from the committee:—

DEAR LORD LISTER,

A desire having been widely felt that the eightieth anniversary of your birthday should be marked in some special manner, a committee of your professional brethren both at home and abroad was formed to consider in what way this could best be done.

This committee met to-day at the Royal College of Surgeons, when it was unanimously resolved to ask you to allow them to commemorate the occasion by collecting and publishing your various scientific papers in book form. In anticipation of your acquiescence, an editorial committee was appointed to carry out such publication.

At the same time, those present at the meeting wished to convey to you their warmest congratulations on this occasion, and gratefully to acknowledge the debt which the medical profession, and, indeed, the whole world, owe to you for the work which you have done. That you have lived to see such enormous advances in surgery and medicine flow from your work must be a source of great gratification to you, and the committee hope that you may be spared to see still many further advances follow therefrom.

I remain, dear Lord Lister,  
Yours sincerely,

(Signed) H. MORRIS.

President, Royal College of Surgeons, Chairman.

Lord Lister replied to the letter as follows:—

DEAR MR. MORRIS,

I duly received your letter yesterday informing me of the decision of the general committee to ask me to allow them to commemorate the occasion of my eightieth birthday by collecting and publishing my various scientific papers in book form.

This proposal is almost overwhelming in its kindness, and I expressed to the deputation which met here in the morning my profound sense of gratitude. This surpassingly generous offer is extremely gratifying to me.

Believe me,  
Very sincerely yours,  
(Signed) LISTER.