fluctuations in the numbers of the ptarmigan, but it is very possible that the reports of the scarcity of the birds were made on the evidence of the summer months, when the birds may have been on relatively high ground. One of the parties of the Cambridge 1932 Spitsbergen Expedition spent some time in the Wijde Bay, and while there, found a considerable number of ptarmigan above the 1,500 ft. level. Only on one occasion, and then towards the latter part of August, were birds found below that height. Similarly in 1933, the Oxford Expedition in the north-eastern part of the Ice Fjord found only one family of ptarmigan during July and August, but in September large numbers of the birds were found in the low valleys, the snow level by that time being at about 600 ft. The reports of number fluctuations may thus, in part, be due to variations in the autumn weather conditions at the time when the ptarmigan are likely to be driven from the high ground by the approaching winter into the valleys, where they are most easily seen.

It is hoped that it may be possible to bring back the skins of certain species required by the British Museum (Natural History). Some collecting will be undertaken with the view of ascertaining crop and stomach contents, and all birds shot will be examined for lice, as the parasites of arctic birds are very little known. All bears and seals shot will likewise be examined for parasites. Every effort will be made, however, to restrict the shooting and hunting to a minimum, as the history of the fauna of Spitsbergen during the last fifty years shows only too clearly the havoc wrought by indiscriminate slaughter, although the efforts of the Norwegian Government during recent years are meeting with a well-merited success.

The general observations will include notes on such subjects as numbers, distribution, time of arrival and time of departure, and as no observations of this kind have yet been made from North-East Land, they may produce some interesting results. The only information brought back during the spring was that gained by Nordenskiöld as a result of his journey with Palander in 1873 along part of the north coast. The first birds to be seen after the winter were some glaucous gulls on March 3, and on April 3 the first snow bunting arrived. By the middle of May millions of sea birds had arrived in the fjords and were breeding on the precipitous slopes of the surrounding mountains, notwithstanding that there was no open water in the near neighbourhood. The length of time to be spent in North-East Land by the present expedition ought to give every opportunity for comprehensive study of this kind.

The remainder of the work will consist of straightforward botanical collecting, and will aim at making as complete an ecological survey as is possible. It is hoped, however, that it will be possible to make a detailed investigation of surface markings, and especially of the polygonal markings which appear to be characteristic of arctic and, to a less extent, of Alpine regions. Various studies have been made of these, and perhaps of greatest interest in this respect is the work which has been recently carried out by Mr. N. Polunin. It seems to be probable that the causes vary from place to place, and that no generally applicable theory can be framed; the investigations of the growth of the polygons over the year may, however, throw some fresh light on the subject.

Weather conditions naturally will control the degree in which the biological programme of the expedition is carried out, although it is much more independent of weather than the survey, for example. With a working period of fourteen months, there is ample scope for varied work. The expedition expects to return during the late summer of 1936.

Cancer and the Theory of Organisers

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THE fundamental fact about cancerous tissue is that it has escaped from the normal growth-controlling agents of the body. The escape often involves a change in histological type. The problems which are raised are clearly connected with those studied in experimental embryology, where again it is the causal mechanism underlying growth and histological change which is under investigation. Experimental embryology has recently made important advances, and the time has perhaps come when it would be profitable to consider the way in which the new embryological theories would formulate the well-known problems of cancer research.

The illuminating researches of Spemann[1] provided the beginning of an answer to the outstanding embryological problem of why one part of an egg develops into one organ and another part into a different organ. Spemann showed that in the amphibian gastrula the developmental path followed by any given piece of tissue is defined by its relation to the blastopore region, which was therefore termed the organisation centre. Further research has shown that one facet of the activity of the organisation centre consists in transmitting a stimulus to the ectoderm which comes to lie above it, causing the latter to develop into the neural plate. This is a two-term reaction, between the stimulus (or evocator[2]), emanating from the organising roof of the primitive gut, and the overlying ectoderm. The ectoderm, it was found, will only react when it is in a reactive, or 'competent'[3], state. Very little is known about the nature of competence or how it is acquired; probably changes are proceeding within the cells from the time of fertilisation onwards, eventually bringing them into an unstable state, when the evocator-stimulus is able to push them into one developmental path or another. The evocator stimulus has been shown to be due (both in the amphibia[4] and in birds[5]) to the presence of a chemical substance, as to the nature of which a great deal of research is being carried on at the present time.

The two concepts of evocators and competent tissues can be applied, with some modification, to the consideration of cancer. There is little evidence that the susceptibility of adult tissue to cancer-provoking agents varies in the same way as the competence of embryonic tissue varies with the passage of development, although the fact that cancer is to some extent an old-age disease may be suggestive in this connexion. But as between different individuals, the genetic differences in susceptibility to cancer may be considered as differences of competence in the genetically different tissues. Again, changes of competence need not be due to internal causes. Thus it has been suggested[6] that the mammary gland must be acted upon by œstrin before it is capable of reacting to the specific lactation hormone. One can phrase this either as a case in which œstrin brings about a change in the competence of the mammary gland, or one in which lactation depends on the consecutive action of two evocators. In dealing with the facts of the inception of cancer, it may be necessary to envisage similar chains of reactions.

Many types of cancer-producing stimuli, or 'cancer-evocators', have been described: viruses, specific chemical substances, spontaneous changes in the metabolism of the cells, general irritating agents, etc. Particular interest is attached to the sterol-like substances recently isolated and synthesised by Kennaway, Cook and their collaborators[7]. The evocator of the amphibian neural plate probably belongs to the same group of substances[8]. In fact the similarity is so close that one at least of the synthetic carcinogenic substances, namely, 1 : 2 : 5 : 6-dibenzanthracene, is probably capable of acting as an evocator when introduced into the amphibian gastrula[9]. The reciprocal experiment cannot yet be made, as the evocator has not yet been purified. Woerdeman[10], some time ago, had the idea that cancer tissue might be able to act as an evocator, and succeeded in confirming the suggestion; but unfortunately it did not occur to him that all adult tissues might have the same capacity, and he made no controls to exclude such a possibility. Later work by Holtfreter[11] and others has shown that this is in fact the case, and it is still unproved that the evocating properties of cancer tissue are any different from those of any other part of the body. Holtfreter also made the very important discovery that the newt evocator is present throughout the whole egg, although it is active only in the region of the organisation centre. In the remainder of the egg it can be activated by any process which coagulates the cell proteins. One immediately searches for some metabolic peculiarity of the organisation centre which might explain the liberation of the active evocator in that region. The most striking feature which has been discovered is the extremely rapid disappearance of glycogen[12]. The activation of the evocator may not be necessarily connected with this glycogen anabolism, but the facts suggest that interesting comparisons may be possible between the metabolism of the organisation centre and that of tumour tissue.

The analysis of development into evocators and competent tissues is only half the story. The organisation centre is not uniform; one part of it stimulates the ectoderm to form the neural plate of a head, while another part induces the formation of the spinal column[13]. These regionally different effects cannot be accounted for by the mere presence of one chemical substance; they necessitate the assumption of a regional distribution of one or more active substances within the organisation centre. The processes by which different parts of the centre induce the formation of different definite organs are spoken of as 'individuating actions', and the organisation centre is said to be the centre of an 'individuation field'[2]. The main characteristic of an individuation field is that all tissue lying within it tends to be built up into a complete embryo, and in any one part of the field all tissue tends to be built up into the organ corresponding to that part.

The individuation field, then, is the agent* which controls the growth of the different parts in a harmonious way so that a normal individual is formed. In later life, the individuation field splits up into smaller separate fields, such as leg fields, head fields, etc. These are the agents from which cancerous growth has escaped. In mammals their effects are normally not very striking; their influence is confined to the control of the minor

* This is a convenient but loose form of expression. The field really expresses the formal properties of the distribution of the unknown growth-controlling agents.

repair growth of the body, and they are probably capable of very little more than this. The adult fields, however, are much more potent in those animals in which regeneration is possible. In the newt, for example, the leg field can mould into a limb any mass of competent tissue either grafted into it or formed as a regeneration bud.

Possibilities of the experimental testing of the action of powerful individuation fields on cancerous tissue immediately suggest themselves. Is there a difference in the susceptibility to cancer between the Urodeles, which have a high capacity for regeneration, and the Anura, which have a low capacity? If there is, is the difference due to the presence of more potent individuation fields in the Urodeles, or to a greater competence of their tissue for proliferation? In some animals there are differences in the capacity for regeneration in different organs; one would like to know whether these differences are correlated with differences in the susceptibilities of the organs to cancer, or with the behaviour of tumour tissue transplanted to the various sites.

Once the problem of the relation of cancer to the individuation fields has been stated, the methods of attack are legion. Some work has already been begun; cancer tissue is being transplanted into embryonic regions where powerful fields are at work, and the influence of carcinogenic agents on regeneration is being investigated. But the embryological approach to the study of cancer has been stated here in the hope that workers whose experience has brought them into closer contact with the facts of the incidence of cancer may be led to see whether this point of view may not enable valuable conclusions to be drawn from the facts which are already known.

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[4] Bautzmann, Holtfreter, Spemann, Mangold, *Naturwiss.*, **51**, 971; 1932. Holtfreter, *Arch. EntwMech.*, **128**, 584; 1933.

[5] Waddington, NATURE, **131**, 275; 1933. *J. Exp. Biol.*, **11**, 218; 1934.

[6] Corner, cit. Robson, "Recent Advances in Sex and Reproductive Physiology", Churchill, 1934, p. 205.

[7] Cf. Review by Dodds, *Lancet*, **1**, 987; 1934.

[8] Needham, Waddington and Needham, *Proc. Roy. Soc.*, B, **114**, 393; 1934. Waddington, Needham, Novinski, Needham and Lemberg, NATURE, **134**, 103; 1934.

[9] Waddington and Needham, *Proc. Roy. Soc.*, B (in press).

[10] Woerdeman, *Koninl. Akad. Wet. Amsterdam*, **36**, 477; 1933.

[11] Holtfreter, *Naturwiss.*, **21**, 766; 1933. *Arch. EntwMech.*, **132**, 307; 1934.

[12] Woerdeman, *Koninkl. Akad. Wet. Amsterdam*, **36**, 189, 423; 1933.

[13] For example, Spemann, *Arch. EntwMech.*, **123**, 289; 1931. Waddington and Schmidt, *Arch. EntwMech.*, **128**, 522; 1933. Mangold, *Naturwiss.*, **21**, 761; 1933.

Obituary

Sir Edward Sharpey-Schafer, F.R.S.

The death of Sir Edward Sharpey-Schafer at North Berwick on March 29, in his eighty-fifth year, will be greatly regretted all the world over. His method of resuscitation of the apparently asphyxiated, for which he was awarded the Distinguished Service Medal of the Royal Life Saving Society in 1909, brought him well-merited fame. Public notices describing the method and placed in conspicuous situations wherever there is danger from death by drowning and gas poisoning, and its use by all first-aid societies and ambulances, have rendered its discoverer the best known of all physiologists so far as the general public is concerned.

Sharpey-Schafer was a genius in the realm of physiological research and teaching. In all his work he was remarkably lucid and arranged his facts in a very interesting and refreshing manner, keeping his lectures alive by frequent reference to the researchers who were responsible for the work under consideration. Both in his discourses and in his writings he fully realised the value of demonstration and used cleverly selected illustrations in abundance. His system of teaching histology serves as a pattern, and his publications in this field include "A Course of Practical Histology", "Essentials of Histology" which has reached its thirteenth edition, and a "Text-Book of Microscopic Anatomy" which forms Part I of Vol. 2 of "Quain's Anatomy", of which Sharpey-Schafer was one of the editors. For his experimental classes he wrote a concise handbook, "Experimental Physiology".

Sharpey-Schafer was educated at Clewer House School and University College, London, where he gained several scholarships, including the first Sharpey scholarship. He served as assistant professor of physiology from 1874 until 1883 when Burdon-Sanderson was in charge, Sharpey the histologist having resigned in 1874; in this year Sharpey-Schafer gained the M.R.C.S. Burdon-Sanderson was appointed to the chair of physiology at Oxford in 1883 and thus Sharpey-Schafer became Jodrell professor at University College, London, in the same year. He occupied this chair until 1899, when he was elected to the chair in the University of Edinburgh. This he retained until 1933, when on his retirement he had completed fifty years of service as a teacher of his science. Thus he came into contact with large numbers of students, scientific and medical, from all parts of the world. During the same period he encouraged and trained many researchers and future professors of physiology. He kept an active interest in research right up to his retirement, and amongst his most recent work was an experiment on nerve function which involved an experimental section of a nerve in his arm. His researches brought him the fellowship of the Royal Society in 1878 when he was only twenty-eight years of age. The same society awarded him a Royal Medal in 1902 and its most coveted prize, the Copley Medal, in 1924.

Another field of research in which Sharpey-Schafer was actively engaged concerned the ductless glands and internal secretion. With Oliver he was a pioneer in the investigation of the function of the suprarenal