

our Knowledge of Prehistoric Birds", there were only two other papers on this subject, "Moa Deposits on Pyramid Valley Swamp, New Zealand", by Dr. R. Murphy (United States), and "Eine Rekonstruktion des Schädels des *Archæornis siemensii* Dames" (with demonstration), by Dr. A. Kleinschmidt (Germany). Dr. E. Sutter (Switzerland) on "Wachstum und Differenzierung des Gehirns bei Nestflüchtern und Nesthoekern" was the sole contributor on bird anatomy.

There was a larger number of papers on systematics and evolution, including "Der Einfluss philosophischer Naturbetrachtung auf die ornithologische Systematik" by Prof. Erwin Stresemann (Germany), "Bird Speciation" by Dr. Ernst Mayr (United States), "Systématique des Turdidés" by J. Dorst (France), "On some Phylogenetic Trends in *Garrulus glandarius* and *Dendrocopus major*" by Dr. J. M. Harrison (Great Britain), "Races of the Bean Goose (*Anser fabalis*) in Western Europe" by R. A. H. Coombes (Great Britain), and "Nomenclature, Genetics and Classification in Guinea Fowls" by Prof. A. Ghigi (Italy).

Bird migration and orientation were the subjects of no less than twenty papers, including a general review of bird migration by Prof. Rudolf Drost, director of the Vogelwarte, Heligoland. The Section on Population Dynamics, which opened with a paper on "Population Ecology" by Dr. David Lack, had fourteen other papers, ranging from "Control of the Herring Gull and the Cormorant on the New England Coast" by Dr. A. O. Gross (United States) to "Census of Swedish Rookeries" by T. Malmberg (Sweden).

Dr. N. Tinbergen (Holland) opened the Section on Bird Behaviour with a report on recent advances in this subject, and was followed by six papers, three of which were illustrated with films.

An innovation was a full-day round-table conference on bird ringing presided over jointly by Dr. A. Landsborough Thomson (Great Britain) and F. C. Lincoln (United States). The quality and types of rings, methods of presenting reports of recoveries, and closer collaboration between ringing organisations were among the points discussed, and a permanent committee was set up to facilitate the exchange of ideas.

At the opening meeting of the Congress an introduction to Swedish ornithology was given by Prof. Sven Horstadius, and colour films of Swedish wild life were shown by Bertil Haglund.

Every evening, films on various aspects of ornithology were shown, those of the most outstanding interest being one of the rediscovered *Takake* (*Notornis*) by Dr. R. A. Falla (New Zealand), which was shown on his behalf by R. B. Sibson, and Prof. A. A. Allen's colour film of the bristle-thighed curlew.

During the Congress various excursions were made, one by boat to the archipelago off Norrtälje, and another, starting at midnight, to the forests of Uppland. Linnaeus's house at Hammarby, and old Uppsala, were also visited. A final banquet, given by the Svenska Ornitologiska Förening in the Great Hall of the Vasa Castle, presided over by the Governor of the Province of Uppsala, Mr. H. Kjellman, followed by Swedish student songs and folk dances performed by the students of the University, was an occasion of unique charm and impressiveness that will never be forgotten by the many foreigners present.

Both before and following the Congress, most efficiently organised field excursions were made to various parts of Sweden, some members going to Kiruna and Abisko in Lapland, others to the mountains and lakes of Jamtland, and to Narke and Varmland in the lake district of central Sweden, while yet others visited the islands of Götland and Öland. The recently established ringing station at Ottenby on the island of Öland showed the great work being done in this direction by Swedish ornithologists.

The Eleventh International Ornithological Congress will be held in Switzerland in 1954, under the presidency of Dr. A. Landsborough Thomson, who is president of the British Ornithologists' Union.

CHESS-PLAYING MACHINES

AN article entitled "Programming a Computer for Playing Chess", by Dr. C. E. Shannon, of the Bell Telephone Laboratories, which appears in the March issue of the *Philosophical Magazine* (41, 256; 1950) will doubtless interest many chess players as well as those concerned with electronic computing. The paper was originally presented at the National I.R.E. Convention in New York in March 1949 and deals with the theoretical problem of constructing a computing routine or 'programme' for a modern general-purpose computing machine. Dr. Shannon himself was one of the contributors to the recent symposium on information theory held in London during September 26-29.

It will be recalled that in recent years Dr. D. W. Davies, of the National Physical Laboratory, built an electro-mechanical machine for playing the game of noughts-and-crosses¹, and this machine was exhibited at the Royal Society conversaciones of 1949. But though machines for chess and noughts-and-crosses may be of theoretical interest only, the theoretical problems involved are of similar nature to those which would occur in designing machines for more practical purposes, such as those which have already been seriously proposed, namely: for the routing of telephone calls based on individual circumstances rather than by fixed patterns; for the performance of symbolic (non-numerical) mathematical operations; for translating from one language to another; for making strategic decisions in simplified military operations; and for the orchestration of a melody. Machines of this type are, as Dr. Shannon points out, an extension over the ordinary use of numerical computers in several ways, for the entities dealt with represent not numbers but chess positions, mathematical expressions, words, etc. Something of the nature of judgment is involved, and the solutions are not merely right or wrong but choose some form of quality between the best and worst solution.

Chess-playing machines are not new, and Dr. Shannon refers briefly to the considerable literature on the subject. He mentions the Maelzel chess automaton invented by von Kempelen, which was undoubtedly operated by a concealed chess master. The chess-playing machine made in 1914 by Torrès y Quévedo², the director of the Laboratorio de Automática in Madrid, was an honest attempt and could play an end-game of king and rook against king. This involves a comparatively simple problem, since in this particular end-game any one of the opponent's moves can be countered by the machine by one of five basic moves.

With chess, Dr. Shannon states, it is, in principle, possible to play a perfect game or to construct a machine to do so; but even with the high computing speeds of modern electronic calculators it is not a practicable proposition, since, taking an average game of about forty moves, there would be 10^{120} variations to be calculated from the initial position. This would require some 10^{90} years for the calculation of the first move. The problem is therefore not of designing a machine to play perfect chess, or even legal chess, but a skilful game comparable to that of a good human player. Dr. Shannon outlines several possible 'strategies', that is, the processes for choosing a move in a given position, and discusses the methods of programming for them. He contrasts clearly the advantages and disadvantages of a machine over the human player. The machine can perform individual calculations at extremely high speeds; it is free from errors and laziness and does not suffer from nerves, but it lacks the flexibility, imagination and inductive and learning capacities of the human mind. No machine can learn from its mistakes—to improve the play the programme must be improved; but the speed and accuracy of the computer is such that a little careful selection in the 'strategy' goes a long way toward improving on blind trial and error.

¹ Davies, D. W., in "Science News. 16" (Harmondsworth: Penguin Books, Ltd.).

² Byard, S., in "Science News. 16" (Harmondsworth: Penguin Books, Ltd.).

ROYAL PHOTOGRAPHIC SOCIETY ANNUAL EXHIBITION

THE ninety-fifth annual exhibition of the Royal Photographic Society was opened in London on September 15 for one month and will be in Newcastle from October 25 for a further month. The exhibition consists of seven sections, including pictorial, scientific, nature and record photography, with a total of 705 exhibits.

There were only some dozen or so exhibits of general scientific interest, the remainder in this section being of medical or biological application. An excellent series of exhibits is shown by the National Physical Laboratory, among which are a number of radiographs obtained by means of the Van de Graaff X-ray generator to illustrate its value for this type of work. The apparatus has an extremely small focal spot and enables enlarged radiographs to be made simply by placing the film some distance behind the subject, instead of close to it as in normal procedure. The images obtained were sharp, and in addition had a higher contrast than normal due to the smaller effect of scattered radiation. Also from the National Physical Laboratory are some Schlieren photographs taken of an aerofoil in a supersonic wind tunnel; by the application of polarized light, a pair of transparencies illustrate how compression or shock waves can be distinguished from rarefied waves by a change in colour of the air-wave images. Photographs of a scale model of the Bankside Power Station and St. Paul's Cathedral in a low-velocity wind tunnel show how the original height of the smoke stack had to be increased in order to prevent damage to the dome of the Cathedral by continued action of the smoke.

The perfection of the surface of small objects, such as steel ball bearings, is illustrated by the use of the

Linnik interference microscope. The actual depth or degree of any scratches or other imperfections can more readily be estimated by observing the displacement of interference fringes than by simple microscopical examination.

The use of the ultra-violet microscope (2536 Å.) in the three-dimensional study of human chromosomes, by E. W. Mitchell, is well shown in a series of photomicrographs of the same subject taken at 0.5-micron steps through its depth. At the very small depth of field possible with the wave-length used, a series of images, each in its own plane and each slightly different from the next, is produced, thus enabling a solid model to be pictured.

A number of aerial photographs submitted by Hunting Aerosurveys, Ltd., illustrate how these can aid ground survey in the interpretation of geological structure and land utilization.

The greater part of the medical exhibits are concerned with the illustration of pathological conditions, but three entries from the University of Zurich concerned with photographs of the eye deserve special mention, particularly one illustrating detachment of the retina.

As one passed into the Nature Photography Section, one could not but be impressed by the fact that the technical excellence and artistic merit of the majority of exhibits might well admit them to the Pictorial Section, apart from their value as biological studies. A surprisingly large number of exhibitors appeared to prefer owls as their favourite subject-matter. One could not, for example, fail to enjoy the series "Little Owls" by R. Jones and observe the pithy mood, the haughty mood and finally the furious mood shown by these youngsters. There are several exhibits showing the life-history of various insects, the "Transformation of Painted Lady Butterfly" by Gordon F. Woods being a good example. The pictures of a "Green Grass Snake swallowing a Toad" in four stages (O. C. Edwards) can scarcely fail to induce a touch of indigestion in the observer. D. P. Wilson's "Scallops escaping from Starfishes" makes an excellent example of Nature's perpetual struggle. One of the ugliest animal pictures must be "Bull and Sea Elephants" by Niall Rankin, but the cumbersome appearance of these animals offsets to an extreme the daintiness portrayed in such a picture as "Fallow Deer" by W. Farnsworth.

In the Record Section of the exhibition, first mention must be given to L. E. Day, for his entry "Morse to the Bishop's Cope, Norwich", for which he was awarded a Royal Photographic Society medal. The Record Section is subdivided into archaeological and architectural, news, advertising and industrial sub-sections. Among the 'news shots' is a fine night scene, "London's Bailey Bridge Falls Down", by F. Greaves; and the photograph "Family Group", by H. R. Matthews, provides a fine study in light and shade as well as advertising a set of glazed earthenware jugs. In a picture like "Forging the Link", by W. A. Wood, one cannot fail to be impressed by the concentration of the craftsman working in steel, which provides a worthwhile example of industrial photography.

Finally, half a dozen of William Henry Fox Talbot's original 'calotypes' are exhibited, most of which must have been about a hundred years old, and which make a very fitting standard by which to assess the changes that have occurred in the progress of photography since his day.