researches in the Sylhet Hills, they will be directed to join at Sylhet, or Cherra forthwith.

5. You are requested to report upon the establishment you may think it necessary to employ.

I have the honor, etc.,
W. Grant,
Secretary to the Govt. of Bengal.

So Prof. Thomas Oldham entered upon his duties as 'geological surveyor' in succession to Mr. D. H. Williams, and when his period of five years expired and his services were secured by his re-engagement for a further period of five years, the Honourable Court of Directors of the East India Company wrote as follows (letter, India Public Dept., No. 16 of March 5, 1856):

". . .

Para. 2. The duties of the Geological Surveyor have been greatly enlarged since Mr. Oldham assumed charge of the office and the establishment which he has to control has been likewise increased owing to the simultaneous prosecution of geological researches in different parts of the country. In consideration, therefore, of the greater labor and responsibility thus attaching to the office, and of the experience which Mr. Oldham has now acquired, we sanction the increase of his salary from the present rate of Rs888 to Rs1,100 per mensem.

Para. 3. We observe with some surprise that the President in Council, as one of the reasons for the increase of Mr. Oldham's salary states that he is paid little more than his assistants. . . .

Para. 4. We take this opportunity of observing that we have not received so regularly as we would desire, reports of the progress of Mr. Oldham's labors. We are apprehensive that the operations of the Department may not have been carried out in a systematic and regular plan. We think it desirable that you should direct your attention to the importance of giving such a character to the work on which Mr. Oldham is engaged, as the only means of rending his employment personally useful and we desire that, in communicating to him his re-engagement you call on him to submit a general scheme in which his future investigations should be carried on, and that when a plan of observations shall have received your sanction, it should be adhered to with as little deviation as possible. We desire a full report of his past labors and any maps he may have made be sent to us.

We are your affectionate friends,
. . ."

I think that the correspondence I have quoted and referred to will make it very evident that India owes a great debt to Dr. John McClelland in initiating a Geological Survey and very much more to the Honourable Court of Directors of the East India Company in providing the personnel and in taking a close interest in the establishment of the department on sound lines, also to the Government of Bengal for the consideration they showed Oldham after the losses suffered by the deaths of Williams, Jones and, soon after, Haddon, from the effects of jungle fever. It may be, and has been, claimed that in the century completed by the Geological Survey of India on February 5, 1946, the whole of India should have been thoroughly examined and mapped. That this could have been done only by having a large staff and elaborate equipment will be seen from the fact that an experienced geologist can map about 500 square miles a season on an average. There have been, roughly, a hundred and twenty geologists with average field service of barely eight years each, so that the area that could have been mapped is about 500,000 square miles, which was barely a third of the Indian Empire. This does not allow for all the detailed work that has been carried out, and in spite of which the Geological Survey of India had examined practically the entire region of India, part of Burma and some adjacent countries, by the end of its centenary year 1946. Instead of a cadre of thirty to forty officers, the department was already in need of three hundred to four hundred officers at the outbreak of war in 1939 to conduct a thorough economic exploration and exploitation on the lines which Mr. David Hiram Williams was to follow, to say nothing of the important branch of water-supply and of questions of engineering geology.

THE BRITISH-KENYA MIOCENE EXPEDITION, 1947

ONE of the discussions at the Pan-African Congress on Prehistory, which took place at Nairobi in January of this year, was concerned with the fossil remains of Miocene apes which have been found in Kenya during recent years. Some of the delegates to the Congress also visited Rusinga Island (near the Kavirondo Gulf of Lake Victoria) where Early Miocene deposits particularly rich in such fossils had been discovered by Dr. L. S. B. Leakey and Dr. D. G. MacInnes of the Coryndon Museum, Nairobi. It was here that Dr. Leakey found in 1942 a practically complete mandible of the extinct anthropoid ape, *Proconsul*, originally described on the basis of portions of the jaws and teeth discovered at Koru by Dr. A. T. Hopwood.

The opportunities provided by the Pan-African Congress served to focus attention on the great importance of these Miocene sites, and as a result a British-Kenya Expedition to Rusinga Island was organised with the aid of a grant of £1,500 from the Royal Society supplemented by a gift of £250 from the Aga Khan. The expedition was led by Dr. Leakey as field director, with the assistance of Dr. MacInnes as palæontologist. A very detailed geological study of the Miocene beds in the island was included in the programme, in order to supplement the preliminary survey carried out by Dr. P. E. Kent in 1934–35 (see *Quart. J. Geol. Soc.*, **100**, 85; 1944). The geological work of the expedition was supervised by Dr. R. Shackleton, of the Imperial College of Science and Technology, London. While the expedition concentrated its attention on Rusinga Island, brief reconnaissance work was also carried out at Mwafangano, Karungu, and on the Uyoma mainland, and a few days were spent on the Miocene site at Songhor. Work was begun on July 10 and the season ended on November 13.

The principal aim of the Expedition was to obtain further remains of the Early Miocene fossil Hominoidea, and to collect the associated fossil fauna and flora in as much detail as possible for a correlated study of the contemporary environment. Full reports of the season's work will take some time to prepare, but it is now possible to say that the results have been eminently satisfactory. More than 1,300 fossils have been collected, and these include about thirty more specimens of the fossil Hominoidea (probably representing five different genera). Among the more important hominoid discoveries are the palate and mandible of a medium-sized ape (regarded provisionally as *Xenopithecus*), a part of a mandible (including the symphysis) of an ape considerably larger than *Proconsul*, the left half of a palate of an infant Hominoid probably referable to *Proconsul*, and some fragments of limb bones.

The last are likely to be particularly instructive since almost nothing is yet known of the skeletal anatomy of Miocene apes or of their limb proportions. There are already available from Miocene deposits in Kenya an almost complete femur of a large primate (presumably *Proconsul*), as well as the shaft of the humerus, a portion of the clavicle, and some tarsal bones. These are in course of examination in the Department of Anatomy at Oxford; if their reference to *Proconsul* is correct, they indicate that, while from the size of its jaws and teeth it is apparent that this fossil ape approximated to the chimpanzee in its general size, it was of much lighter build and a much more active and agile creature. The femur shows a remarkable resemblance to the femur discovered at Eppelsheim at the beginning of the last century and commonly regarded as the remains of a large gibbon-like ape of early Pliocene date. The humerus, also, is similar to that of the Miocene ape, *Dryopithecus fontani*, described by Lartet in 1856.

The associated fossils collected at Rusinga during the expedition include (1) the greater part of the skeleton of a member of the Rhinocerotidæ (allied to, but distinct from, *Aceratherium*), (2) a considerable quantity of remains of a giant Hyracoid, probably referable to *Pliohyrax*, (3) a number of specimens of *Myohyrax*, including a nearly complete skull, (4) very numerous fossil rodent remains, (5) remains of carnivores, anthracotheres, chalicotheres, insectivores and Suidæ, (6) numerous plant remains, (7) numerous fossil fish, (8) a large collection of myriapods and gastropods, and some pelecypods. As soon as this rich collection has been sorted out and catalogued, the several groups which it contains will be allocated to different laboratories for detailed study.

That so much important fossil material has been collected in one season's work is a tribute both to the richness of the Miocene deposits on Rusinga Island and to the energy and skill of the members of the expedition. The discovery of remains of Early Miocene apes of a generalized kind is of particular significance, since they are likely to throw important light on the evolutionary radiations of the whole group of the Hominoidea. For this reason, it is earnestly to be hoped that funds may be forthcoming for another season's work in 1948. There is a reasonable certainty that this would procure still more limb bone material of Miocene Hominoids; but it is also of the greatest importance to search for parts of the skull (in addition to the mandible and maxilla, of which some remains have already been obtained).

Another consideration arises from the outstanding discoveries in Kenya of Dr. Leakey and his associates, not only of primitive fossil apes but also, in the field of archæology, of early remains of man and his palæolithic cultures. This is, that they are now attracting the attention of prehistorians and palæontologists in other countries. It has recently been reported in the Press that a well-equipped expedition from the University of California is now on its way to East Africa to operate on sites such as those discovered by British investigators, and no doubt other expeditions of a similar kind may be expected in the future. I would therefore urge the desirability of establishing in East Africa an Archæological Survey, with an adequate staff and appropriate financial resources, to organise facilities for, and to co-ordinate the activities of, expeditions into this territory. It is much to be hoped that serious attention will be given to this urgent problem.

W. E. Le Gros Clark

PHYSICO-CHEMICAL ASPECTS OF CHEMICAL CARCINOGENS

By WILLIAM ANDERSON

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Experimental

SINCE it was first demonstrated that cancer could be induced by a pure chemical compound, the mode of action of chemical carcinogens has been studied from many different points of view and numerous theories have been evolved from the results of controlled experiments on these substances[1,2]. The following observations present yet another aspect from which the problem may be considered.

A large number of the carcinogenic compounds possess no functional group in their molecules and it is therefore difficult to understand how they can bring about the malignant change in a cell by a purely chemical interaction. Furthermore, although the metabolites of many of the substances are derivatives containing hydroxyl groups, the evidence available indicates that hydroxylation causes a diminution of the carcinogenicity of the parent substances[3]. Consequently, some physicochemical explanation of the mode of action of carcinogens was sought. The idea occurred that carcinogenesis by chemical compounds, in particular the polycyclic aromatic hydrocarbons, might have its origin in a chemiluminescence accompanying the hydroxylation of the substances *in vivo*. This concept seemed feasible since it is known that electromagnetic radiations can bring about malignant transformation, and on the other hand, that oxidation of certain organic compounds is accompanied by the emission of radiation. It is also interesting to note that, simultaneously, other investigators have been led to suggest similar ideas[4,5]. It was decided in the first instance to study the reactions of the polycyclic aromatic hydrocarbons under the influence of hydroxylating agents.

Among the reactions accompanied by chemiluminescence described by Trautz[6] are oxidations with chlorine or bromine water of anthracene, phenanthrene and chrysene dissolved in hot alcohol saturated with potassium hydroxide. These reactions were repeated substituting various other hydrocarbons for anthracene, etc., and in each case chemiluminescence was observed. The compounds tested were: naphthacene, 1 : 2 : 5 : 6-dibenzanthracene, 9 : 10-dimethyl-1 : 2-benzanthracene, 20-methylcholanthrene, and 3 : 4-benzpyrene. The luminescence was momentary, due to the fact that an aqueous medium was added to a solution of the substance in alcohol whereby the material was thrown out of solution. The possibility that the radiation might be a crystalloluminescence was not borne out by control precipitation of the substances with water alone. It is likely that these oxidations were due to the formation of hypochlorite or hypobromite, since chemiluminescence could also be produced by adding an aqueous solution of sodium hypochlorite to the substances dissolved in alcohol.

The next reagent used was perbenzoic acid in chloroform solution, since Eckhardt[7] has described reactions between this hydroxylating agent and several hydrocarbons. Attempts to produce chemiluminescence with 3 : 4-benzpyrene using this reagent proved unsuccessful, but when the perbenzoic acid solution was added to a concentrated solution of 20-methylcholanthrene in chloroform, both solu