to meteorological and hydrological conditions, would well repay local naturalists. A very rich mixed plankton of Diatoms, *Ceratia* and Copepoda, was present when the 'red water' invaded Simons Bay; rotifers were feeding upon the ciliates, the dominance of which was beyond question, and other free-living Protozoa were also present. It is hoped that it will be possible to publish a general account of the discoloration of the sea by living organisms in the future.

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July 26.

[1] Cl. Hamburger and von Buddenbrock, "Nordisches Plankton", 13.
[2] NATURE, **132**, 253, Aug. 12, 1933.
[3] W. E. Allen, *Bull. Scripps Inst.*, **1**, No. 15.
[4] R. Hirasaka, *Annot. Zool. Jap.*, Tokyo, **10**, Art. 15.
[5] Hornell, *Madras Fish. Bull.*, **11**, Rept. 2; 1917.

Phylogenesis of the Stridulating Organ of Locusts

IT is an interesting task in palæozoology to reconstruct the lineages on which recent and fossil groups have developed and, at the same time, to trace the general laws of phylogeny. Groups having developed a new and well-defined organ at a certain geological period are especially suitable for investigation from this point of view, if the palæontological record is complete enough. A good example is the evolution of the musical apparatus in the forewings of locusts. A very rich series, composed mostly of forms from the Lower Liassic of England and the Upper Jurassic ('Solnhofener Schiefer') of Bavaria is kept in the collections of the British Museum (Natural History), London. Many of these fossils belong to the Prophalangopsidæ, represented in recent times by a single Indian species which is still insufficiently known since there is only one specimen, *Prophalangopsis obscura*, Walker, preserved in the British Museum.

I have studied forty to fifty fossil relatives of this recent species. This very peculiar family flourished in the Jurassic. It was then that they developed their musical apparatus and gave rise to the modern families of Gryllidæ and Tettigoniidæ. The results of my investigations may be summarised as follows:

(1) The most primitive forms have no organ for producing sounds, though some of them might have had ears in the fore-leg. Their fore-wings have a primitive and variable venation. They lived in the Upper Palæozoic and later. Apart from the Prophalangopsidæ, they developed the Elcanidæ in the Triassic and the Jurassic, and the Gryllacrididæ which have persisted since the Upper Palæozoic. The modern Acrididæ also seem to have branched off here.

These primitive forms, when producing sounds by rubbing the fore-wings against each other, only added a new function to the normal function of the wing, which is flying; the existing organ (the wing) proved to be fit for an additional purpose.

(2) The second stage is represented by the Prophalangopsidæ. They have a musical apparatus *statu nascendi*, covering nearly the whole fore-wing of the male. The veins are strongly curved, and certain areas of the wing are elevated and others depressed, its surface thus being rough and stiff. The Mesozoic and recent Gryllidæ with their more highly specialised venation are doubtless descendants of Prophalangopsidæ. But the latter family also is ancestral to the modern Tettigoniidæ.

In this second stage, the fore-wings are distinctly adapted to the additional function of producing sounds. But still the wing, practically as a whole, served for the two functions; for flying quite naturally and for producing sounds by rubbing the radial, median, cubital and anal parts of one wing against those of the other wing. The wings were laid flat above the abdomen when at rest.

(3) One Prophalangopsid genus, *Cyrtophyllites*, Oppenh. of the Upper Jurassic, shows how the stridulating organ of modern Tettigoniidæ developed from that of the Prophalangopsidæ. The main part of the musical apparatus is restricted to the cubito-anal area, and the latter is the only part covering a corresponding part of the other wing. The fore-part of the fore-wing is folded down the sides of the body.

In the Tettigoniidæ still flourishing, these characters are much more stressed. The cubito-anal area in both fore-wings is highly modified, small and asymmetrical, and is restricted to the very base of the wing. The great advantage of this restriction of the stridulating organ is that—in accordance with the laws of levers—the animals were enabled to intensify the noise without using more power.

In this way, the structure of the fore-wing was consequently improved during geological times and adapted to the requirements of the new function, though the original function of flying was not lost in many of the locusts. But some of them reduced the wings so greatly that only the musical apparatus remained, and in these cases we are entitled to speak of a real change of function of the organ.

Thus the development of the stridulating apparatus of the fore-wing of locusts clearly explains how an organ may change its function and how unnecessary it often is to discuss whether the organ preceded the function or vice versa. If a function (for example, the production of sound) is older than its special organ (musical apparatus) it often can be shown that another organ (the fore-wing) is still older than the function in question and that the special secondary organ developed from this original one after the function had been changed.

Further results:

(1) The ear in the tibia of the fore leg is fully developed in the second (prophalangopsid) stage, and evidently older than the musical apparatus.

(2) The development described above is restricted to the male sex, but, in the Upper Jurassic and later, forms appear in which the females have certain male characters in the fore-wings.

(3) Some reversibility of evolution can be observed in the shape and venation of the wing.

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Sensitivity of Dividing and Non-Dividing Cells to Radiation

IN his reply to the letter of Dr. Love published in NATURE of August 18, Dr. Mottram asks for an experiment which demonstrates the peculiar sensitivity of the premitotic cell to gamma radiation but at the same time disallows the prevention of mitosis as a measure of radio-sensitivity. This is the aspect of the problem to which we have particularly addressed ourselves, and we have found that a cell *in vitro* can be prevented from dividing by a dose of radiation which produces no recognisable effect