

they may be. This single reading of the total amount of *creep* being divided by the number of times the experiment was repeated, and by the given number of degrees of heat through which it had been each time successively raised, and by the original length of the bar, will give the desired coefficient of expansion.

I think that results obtained by this mode of translation will, for minute expansions, be more reliable than those obtained either by Lavoisier and Laplace's method, or by that of Roy and Ramsden.

THOMAS STEVENSON

Baden-Baden, August 26

### Origin of Insects

IN NATURE of December 7, 1871, there is an interesting letter from Mr. B. T. Lowne, on the Origin of Insects, in which the writer refers to Fritz Müller's "Facts for Darwin" in favour of the opinion that "the larval forms of insects are probably derived from imaginal" or perfect forms. I have not at present any opinion to offer on this subject; but, though I estimate very highly indeed the light which Fritz Müller has thrown on the Crustacea, I think nothing can be more unsatisfactory than his remarks on insects. He concludes that the earliest insects resembled the wingless Blattideæ, overlooking, what is obvious enough, that any theory of the origin of insects ought to account for, or at least show the origin of, those most characteristic organs of the class, the wings. I quite agree with Mr. Lowne that "it is extremely probable that insects first emerged from the water with fully-formed wings." I think it scarcely possible to doubt that the wings were originally organs of aquatic respiration. But this does not answer the question of the origin of insect metamorphoses, which, though an evolutionist, I think one of the greatest difficulties of the theory of evolution; it does not answer the question whether the perfect forms with wings and legs have been derived from the larval forms without either, or the converse.

Mr. Lowne goes on to say, "We have still relics of an aquatic winged insect fauna in the hymenopterous genus, discovered by Sir John Lubbock." I cannot think this brings us any nearer to the origin of insects. It could not do so unless the Hymenoptera were at or near the origin of the class, and this will scarcely be maintained. The Hymenoptera are probably the highest of all insects—certainly so if instinct is the criterion. The aquatic Hymenopteron (I do not know its name) is no more a relic of the origin of insects than are the water-beetles; and no one will say that the Coleoptera are near the origin of the class. It is true that the water-beetles are wingless, while the Hymenopteron in question is winged; but the beetles are a winged order, and those which have no wings have lost them. Indeed, it is only in a functional sense that any beetle is wingless, for they all retain the wing-covers, which are modified wings. It is probably true that the origin of all animals whatever was aquatic, but it does not follow that the aquatic members of any class denote the origin of the class. The aquatic habits and structure may be only adaptive. No one would look to the seal or the hippopotamus for the origin of the Mammalia.

JOSEPH JOHN MURPHY

### THE LAW WHICH REGULATES THE FREQUENCY OF THE PULSE

FROM a pamphlet on this subject, recently published by Mr. A. H. Garrod, we extract the following summary of the main features of the circulation:—

"The circulation of the blood is maintained by the repeated contraction of the heart. Each cardiac revolution is divided into three parts—the systole, the diastasis, and the diastole. The following laws hold with regard to the length of these intervals:—

"I. The systole, together with the diastasis—or, in other words, the first cardiac interval—varies as the square root of the whole revolution.

"II. The systole varies as the square root of the diastole.

"III. The diastasis is constant.

"The amount of work that the heart has to perform in maintaining the circulation depends on two sets of changes which may occur in the system: 1. Variations in the blood pressure; 2. Variations in the resistance to the outflow of that fluid from the arteries.

"As the capacity of the arteries, including the ventricles, varies directly as the blood pressure, and as the flow of blood from the capillaries does the same, the frequency of the heart's beats is dependent on the resistance to the capillary outflow, and not at all on the blood pressure; in other words, the heart always recommences to beat when the blood pressure in the systematic arteries has fallen a certain invariable proportion.

"Variations in blood pressure result from: 1. Absorption into, and excretion from, the vascular system of fluids; 2. Changes in the capacity of the arterial system, which occur on the contraction or relaxation of the muscular arteries; 3. Changes in the amount of available blood, which result from the hæmostatic dilatation of some of the yielding vessels on altering the position of the body. As changes in the first of these cannot be very sudden, and those in the latter are never very considerable, the mean blood pressure in health varies but little during short intervals.

"Variations in peripheral resistance result from: 1. Different degrees of tonicity or patency of the muscular arteries; 2. Different resistances in the venous system. The former may occur independently in one or other system of vessels, as the cutaneous or the alimentary; also mechanically from pressure on a part of the body. The latter are insignificant in health.

"The heart depends for its power of doing work on chemical properties in the blood it pumps into the systemic vessels, and as the blood reaches it direct from those vessels, the cardiac intramural circulation varies with the changes in the former; and the length of the systole varying only as the square root of the time of diastole, the degree of cardiac nutrition varies directly as the systematic blood pressure, and as the square root of the diastolic time. The coronary arteries supplying the whole heart, the work done by the right ventricle is governed by that done in the left; thus the supply of blood in the left auricle is always rendered sufficient for the requirements of the systemic circulation; though, as there is no reason for believing that the resistance in the pulmonary vessels varies with that of the systemic, there must be some peculiarities in the former circulation (which may explain the variations in the ratio of the number of pulse beats to respirations in some cases).

"The auricular contraction is a very small force, and its function is most probably to close the tricuspid and mitral valve.

"The heart commencing its systole as a whole, it is highly probable that the impulse for action is given by a force which affects both ventricles; such is found in the coronary circulation and the active diastole produced by means of it."

### THE CONGRESS OF PREHISTORIC ARCHÆOLOGY

THE meeting of the International Congress of Archæology at Brussels was brought to a close last Friday, August 30. On the previous Tuesday General Faidherbe spoke on the Dolmens, of which he had made a special study in Algeria. He believes them to be the work of some people whose traces can be found from Pomerania to the coast of Africa, and of whose migrations they indicate the halts. Mr. Franks, of the British Museum, presided on the afternoon of the same day, when the discussion turned chiefly on the primitive races of Belgium. On Wednesday the last expedition of the Congress took place, Namur and the Camp of Hastedon, distant about two kilometres from Namur, being the places selected. The establishment of this camp, covering an area of from eleven to twelve hectares, is attributed to the men of the Polished-Stone period. It is situated on a high plateau, and the cuttings made through the ancient enclosure were explained by M. Dupont, Director of the Brussels Museum.