evidence. For instance, with reference to the jaw under discussion Pengelly adds the remark, "Nothing of the kind was subsequently met with in or under the Granular Stalagmite" (*loc. cit.*, p. 221).

A. R. HUNT.

Torquay, September 16.

MR. HUNT is under a misapprehension regarding my criticism of Prof. Boyd Dawkins's communication at the Anthropological Section of the British Association at Dundee. In making the important announcement that the remains of Neanderthal man had been discovered in England, Prof. Dawkins exhibited merely a rough sketch of a fragment of a human jaw—not the actual specimen itself. So far as the sketch went it showed none of the usual Neanderthal characters. Further, he was unable to say from which stratum of the floor of Kent's Cavern the original specimen had been derived. My criticism of "ridiculous" and "unscientific" applies merely to the fact that the meeting was asked to accept the discovery of Neanderthal man in England on a specimen which was absent and of uncertain origin. From Mr. Hunt's communication it is clear that the exact origin of the specimen could have been ascertained. I firmly believe that the remains of Neanderthal man will be discovered in England—it may be that Dr. Duckworth is right regarding the specimen from Kent's Cavern—but the discovery cannot be accepted unless the evidence is produced. A. KEITH.

EXPERIMENTAL RESEARCHES ON VARIATIONS IN THE COLOURING OF LEPIDOPTERA.[1]

THIS is a very comprehensive treatise by Dr. Pictet, a former treatise by whom on a cognate subject was reviewed in NATURE in 1905 (vol. lxxii., p. 632). It begins with a *résumé* of previous researches by various authors, classified under several heads, and proceeds to describe the author's own researches and the conclusions he draws from them. Many of the details are highly interesting, and his observations upon them are of much weight.

Lepidoptera, Dr. Pictet tells us, with few exceptions, vary in only two directions, melanism and albinism; the law laid down by Oberthur may be thus summed up: Any part of the wing of a butterfly can become separately darker or lighter than it is normally; in the former case, whatever its colour (except green) it can darken sufficiently to become brown, and even of so deep a brown as to have the appearance of blackness, leading in all the parts so darkened to melanism; in the latter case these same parts can become lighter, sufficiently to become tawny (*fauve*), yellow, and even of a yellow so pale as to appear white, leading, in like manner, to albinism.

The dark markings of the wing can spread or be displaced, or merge in neighbouring parts, or mask them more or less completely, or they can contract, become partly effaced, or even disappear, giving place to the light markings of the ground colour (*fond*). In other cases certain markings may become darker, and others lighter, or the general colour may become darker or lighter without altering the pattern. Opposite exciting causes, *e.g.* heat and cold, may produce the same result, this being caused, not by the special quality of the abnormal factor, but by the fact of the passing of the individual from a normal environment to that which does not suit it.

Among the exciting causes M. Pictet includes, but apparently with some doubt, electricity and mechanical vibration (*trepidation*)—the last, I believe, has been abandoned.

As regards the mechanism of variation, this has its principal seat in the scales, all of which, whether red, yellow, white, brown, or black, as well as the blue and violet ones, are striated on the surface so as to be capable of displaying the optical colours, and most of which are more or less filled with pigment in a granular form. The optical effect is related to the quantity of pigment in the scale, the intensity of the iridescence growing in inverse proportion to the pigment. In many cases the basal part of a scale is less filled with pigment than the distal part. Where the colours of the wing are light, the scales generally contain less pigment than where the colours are darker. There are, however, white pigment scales, as in the Pierids.

There are various ways in which melanism may be caused:—(1) The contained pigment may be greater in quantity; (2) it may be more strongly oxidised, which darkens it; (3) where there are both light and dark scales the latter may increase in number; (4) the scales may become so numerous as to overlap each other, and thus reinforce the darkness; (5) the scales may be enlarged, which increases the overlapping; (6) dark hairs may increase in number—like the scales, these are susceptible of change in their colouring matter; (7) one face of the wing may appear darker if, owing to the small quantity of pigment in its scales, the darker opposite face of the wing shows. Converse considerations apply to the causation of albinism; as regards (5), a very frequent cause, the scales may so diminish in size that instead of overlapping they scarcely touch, and leave empty spaces; they may diminish in size on both sides of the wing, which thus becomes transparent. (6) They may curl up at the sides, producing similar consequences to those numbered (4) and (5).

There is a very interesting chapter on cases where the optical and the pigmentary effects are combined. Green in the Pierids is not caused by green pigment, but by a mixture of yellow and black scales having *reflets bleus*; and in *V. io* the violet and green is caused by red and yellow scales mixed with white scales having *reflets bleus*.

The cause of variation may be generally stated thus. An individual which in the course of its ontogeny makes less pigment than its congeners, albinises; inversely, it melanises if it makes more pigment than is normal; the quantity of pigment

[1] "Recherches Experimentales sur les Mécanismes du Mélanisme et l'Albinisme chez les Lepidoptères." By Dr. Arnold Pictet. Mémoires de la Societe de Physique et d'Histoire naturelle de Geneve, vol. xxxvii. Pp. 111–278+5 plates. (Geneve: George & Cie.; Paris: G. Fischbacher, 1912.)