here that the authors do not deny. If a kinesis is called 'high', the obvious implication is that it is a stronger reaction than one that is 'low'. It requires a mental effort to recall that 'high' is used quite differently here, to indicate the *sense* or '*sign*' of the reaction with reference to the stimulus. The authors fear that even greater confusion would arise if high kinesis were called positive kinesis. A positive photo-kinesis, for example, can lead to aggregation in darkness, but this has been called photo-negative behaviour in the past. The argument raises a wider issue than mere nomenclature.

Besides clearing up confusion among reactions, recent work has helped to clear up another source of past confusion. It has sharpened the distinction between the two planes on which behaviour may be studied. On one plane are the reactions of single animals to single stimuli, the *units* of behaviour. On a higher plane are the spatial re-distributions and average activity changes that appear when a mass of animals is subjected to a whole system of stimuli. It follows that the laws governing the units of behaviour must underlie, but cannot be the same as, the laws governing organized systems of those units.

Fraenkel and Gunn do not make that qualitative distinction. For example, they describe aggregation in temperature gradients and average activity changes under continuously changing temperature. They show how such behaviour has been misinterpreted in the past by treating it as equivalent to simple reactions or metabolic effects. Having gone so far, they return to the analysis of reactions, as if mass behaviour comprised no more than a sum of reactions. They do not emphasize that mass behaviour has its own laws requiring separate study. Instead, they argue that a term like 'photo-negative' should be applicable to kineses, taxes and aggregations alike. This confuses different reactions; and more, it confuses phenomena on two different planes.

The following usage is suggested as more logical. Terms like 'photo-negative' should be confined to the description of taxes. This removes any justification for the awkward expression 'high kinesis'. The sense or 'sign' of reactions should be indicated uniformly, using positive and negative for both kineses and taxes. Thus, in the case of a positive kinesis, strengthening the stimulus leads to greater activity, and weakening it leads to weaker activity. In a gradient of stimulation intensity, aggregation would occur where the stimulus was *weakest*. In the case of a positive taxis, of course, aggregation occurs where the stimulus is strongest. In a negative kinesis, strengthening the stimulus leads to weaker activity, and weakening it to greater activity. In a gradient, aggregation will be where the stimulus is *strongest*. In a negative taxis, aggregation occurs where the stimulus is weakest. This usage should serve to sharpen the distinctions drawn above and so help to consolidate the gains of recent years.

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WHEN writing the book referred to by Dr. Kennedy, we were frequently faced with the alternatives of inventing new technical terms (which are often resented by the people who have to learn and use them) and of using common words in newly defined ways (which causes trouble because it is difficult to exclude from one's mind some of the common implications of the words). If Dr. Kennedy, who has studied insect activity and aggregation in the field as much as anyone, has to make an excessive mental effort with 'low' and 'high' kinesis, then the generality of zoologists must find them very troublesome indeed. The advantage of the broad use of 'photo-negative' is that it can be applied to a particular reaction before one knows which type of behaviour is responsible for aggregation in the dark. 'Positive' photo-kinesis can lead to photo-negative behaviour. If this awkwardness of signs is generally thought to be preferable to the ambiguity to which Dr. Kennedy directs attention, then let us use his modification of the system of terms.

Dr. Fraenkel and I did not write much about the plane of integrated behaviour, because we set out to deal with the elements of behaviour; apart from learning in Arthropods, reviewed by Thorpe[1], I doubt if enough is yet known to justify a treatise on invertebrate behaviour in this plane. We were, however, able to deal with some aggregations in which animals react to components of a situation other than each other.

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[1] Thorpe, W. H., *Brit. J. Psychol.*, **33**, 220; **34**, 20 (1943).

Moulting Fluid of Woodlice

IT is well known that in insects during the process of moulting or ecdysis there is a thin plasma or moulting fluid. "When the epidermal cells separate from the old cuticle and begin to secrete the new, the space between the two cuticles is occupied by a thin plasma. In the later stages of moulting this space is filled by an abundant fluid, the moulting or ecdysial fluid, first clearly demonstrated by Newport. There can be little doubt that much of this fluid, which extends also throughout the tracheal system, arises by exudation from the epidermal cells; indeed, this has sometimes been its sole source. But the epidermis of the majority of insects contains numerous glands which become active only at the time of moulting and certainly contribute to the secretion of the fluid."[1]

In the literature on moulting of the woodlice, I have failed to find in the writings of Schobl, Friedrich, Leichmann, Němec, Schönichen, Herold and others any reference to such a fluid in these isopods. Recently, I have had occasion to mount small pieces of the exuviæ recently cast by *Armadillidium vulgare* (Latr.), and I noticed that they seemed to adhere to the glass slide; on being removed a faint film was noticeable where each fragment had been. In longitudinal sections of *Porcellio dilatatus* Brandt, the epidermal cells show numerous glandular ones, which, I suggest, may give rise to this plasma. Moreover, in the space between the cuticle and the epiderm there is a uniform, thin streak of non-cellular matter. This was present in all the sections. Finally, exuviæ, in alcohol, show a thin glistening substance on their inner side.

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[1] Wigglesworth, "Principles of Insect Physiology", 25 (1939).