lowest minimum possible; for water vapour has, on the coiled filaments of such lamps, a specific and recognised action that gradually and sometimes rapidly weakens and destroys the ignited filament, by thinning it down at one place and thickening it in another; the action, once begun, tending to go on more and more rapidly, since the thinner part gets automatically more heated and the thicker part more cooled. The action is described by Mr. Paterson as follows:

"Molecules of water vapour left in the bulb are decomposed into hydrogen and oxygen in contact with the hot parts of the filament. The oxygen immediately combines with some of the tungsten atoms at the hottest spots with the formation of tungsten oxide. This tungsten oxide is deposited on to a neighbouring cooler part of the filament where reduction of oxide can take place, [since] the cast-off hydrogen atoms can again claim their oxygen from the tungsten oxide. The tungsten atoms thus left coalesce with the filament at its cool point, with consequent thickening of the filament. Meanwhile the molecule of water vapour, now re-formed, is free to attack again the hotter part of the filament. This point becomes continuously hotter by virtue of its diminishing diameter. Thus the molecules of water vapour act much as ants, carrying particles of tungsten from one place and building them up in another, and become available over and over again as the carriers of tungsten atoms. Hence the potency of water vapour as a destructive agent. The quantity must be reduced to vanishing proportions if it is not to cause wastage and growth in this way during the long high-temperature life of a gas-filled lamp."

That water should act as a catalytic poison, in this way, is rather in accordance with the pronouncements of Prof. H. E. Armstrong about the influence of water and of traces of impurity in chemical reactions generally; for under other conditions traces of other substances may be acting in a similarly unstable or top-heavy way. In fact, Mr. Paterson elsewhere says that "in gas-filled lamps, and before gas-filling takes place, every possible trace must be removed of water vapour, because this acts in relation to the gas filled lamp filament as cancer does in the animal body, and causes alternate local growths and wastage." He further points out that at the high temperature of a lamp "chemical reactions are extraordinarily vigorous, and many of them unexpected—water vapour is not the only vapour or gas which must be guarded against."

Whether there is likely to be any impurity in the blood or tissues that under vital conditions might act in a catalytic manner and build up local growths at the expense of tissue elsewhere, even in the absence of any microbe or customary disease agent, it is for biologists to decide. The idea may have occurred to them; but an actual instance occurring in the physical laboratory may cause them to pursue the idea further. I will only say this: The activity of an electrolyte capable of dissociation in a liquid—as in many saline solutions—is known not to be very different from the activity of the free molecules of a gas.

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Hereditary Choice of Food-plants in the Lepidoptera and its Evolutionary Significance.

THE problem of the practical differentiation of species in Nature stands so much in need of experimental work, that the recently published paper by Dr. J. W. Heslop Harrison on an apparently successful attempt to influence the hereditary instincts of a sawfly (*Proc. Roy. Soc.*, Series B, vol. 101, pp. 115-126) will be read with interest, and I am induced to offer one or two critical remarks.

This sawfly, *Pontania salicis*, is stated to feed on many species of Salix, but in any given locality to restrict itself habitually to some one (not the same) species, although several others may be equally plentiful. I do not dispute the statement, but in the whole of the Lepidoptera I have never heard of a similar instance. Salix, in particular, supports a large number of Lepidoptera, but in general the only discrimination made is between the rough- and smooth-leaved species (probably influenced by touch rather than taste), and again the choice of *S. repens* by certain species seems due rather to the superior shelter afforded by the dwarf habit. Also the Pontania is a gall-maker; and the case of gall-producers, where complicated reactions ensue between insect and plant, may be specially difficult to understand. In the experiments the change was produced immediately, and was completely established in three years; there must be some quite unusual element here.

From this single and quite exceptional case, however, Dr. Harrison proceeds to deduce what he calls a new principle of evolution, which I understand to be that in phytophagous insects (for example) pairs of allied species are produced by the accidental transference of larvæ from the usual food-plant to an adjacent allied plant, or even to one usually associated with it but not allied. Several pairs of species of Lepidoptera are instanced as suitably associated "in Britain," as, for example, *Cerura bicuspis* and *C. furcula*, but this argument is wholly fallacious, involving the assumption that one of the species originated here; both range over the whole of northern and central Europe and Asia, and the circumstances of their origin are entirely problematical. But is there anything new in the principle? All lepidopterists are aware that not merely pairs, but also whole groups of species, tend strongly to feed on allied and associated plants, and this would appear to be probable on any theory of the mechanism of evolution; and microlepidopterists in particular have long ago suggested that the closely similar species in such genera as Phthorimæa and Lithocolletis, each attached to its own food-plant, originated as phytophagic races.

The trouble is that no one has yet evolved a new species by this means; and I shall be very much surprised if, when this is accomplished, it proves to require only three generations of the insect. But even this achievement will not go very far to explain the formation of species in the Lepidoptera. A very large proportion of these (such as most of the very common British Caradrinidæ) have larvæ which feed either on grasses generally or on miscellaneous low plants almost indiscriminately, and without any variation resulting except perhaps of size; and a further large class feed on dead wood and dry vegetable refuse. The same influences which have resulted in the multiplication of species in these groups must be supposed equally efficient in the groups which are more specialised in their tastes; and, subtracting their effect, not much will remain for that of the food-plant. I have even recorded ("Exotic Microlepidoptera," vol. 2, p. 521) the case of two Indian species of Bactra, separable with difficulty, known only from series reared together from larvæ feeding on the same individual plants in the same way at the same time.

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