mals, the phenomena seem to have practically disappeared.

Correlated with this backward orthogenesis is the forward progress in the development of the iris reaction—the familiar dilation in dim light and contraction in strong light of the pupil of the eye. In the fishes the pupil is practically stationary; in the amphibians it expands and contracts within narrow limits; in reptiles the response is about the same as in amphibians, while in the mammals and man the response is very rapid and very extensive. Ophthalmologists are agreed that the chief function of the pupil reaction is to protect the sensitive retina from too strong light and to make available to the retina all the illumination possible in dim light.

Arey[5] has summed up the surmises of previous workers, added his own and evolved an inclusive theory of the adaptive significance of the photomechanical changes based on this very idea—the protection of the sensitive and delicate rods by the pigment and the exposure of the color-perceptive cones in strong light.

It seems to me that we have here one of the not infrequent instances of the replacement of one mechanism by another of similar function through the course of evolution. Certainly the rapid pupil reaction, measured in seconds, is a decided improvement over the sluggish pigment and cell movements whose minimum reaction time at best, in certain fishes, is many minutes.

It must be admitted that the situation in nocturnal animals where both kinds of phenomena are lacking, and in the birds, where both kinds of phenomena are present to a marked degree, is disturbing to this suggestion, but the nocturnal animals have little or no need for either mechanism, and the eyes of birds are so aberrant in many respects that perhaps we are safe in dismissing them in this instance.

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EGG LAYING OF IXODIPHAGUS CAUCURTEI DU BUYSSON IN LARVAL TICKS

IN connection with experiments in rearing and liberating the French tick parasite (*Ixodiphagus caucurtei* du Buysson) at the Hamilton Laboratory of the Montana state board of entomology, the junior author, who is locally in charge of the work, in conducting an incidental and minor experiment uncovered surprising facts.

Both *I. caucurtei* and *Hunterellus hookeri* Howard, so far as is known, develop only in the nymphal stage of their host ticks, and effective egg-laying in certain experiments conducted by Dr. E. Brumpt, of Paris, and H. P. Wood, of Dallas, Texas, was found to occur only in the nymphs of ticks. Following such egg laying, development has always been found to be immediate and continuous.

Having at hand an abundance of fed larvae of *Dermacentor andersoni* Stiles and a plentiful supply of fresh adults of *I. caucurtei*, the junior author placed about 350 of the former with about ninety of the latter (mixed males and females) in a small glass jar at "room temperature" and in the direct sunlight on August 20, 1927. They were left thus for a period of three hours, when the fed larval ticks were placed in a thermal cabinet at 19° C. for incubation, which is our usual method in rearing ticks. By September 22 all the fed larvae had "molted" to the nymphal stage and the resulting "flat" nymphs were placed in a longevity tube out-of-doors in the "tick yard" under conditions simulating nature. On November 11 these nymphs were placed on a rabbit in the laboratory for feeding and seventy-eight fed nymphs were later recovered. These fed nymphs were placed in a thermal cabinet at 19° C., after which they were examined from day to day. On December 5 it was observed that a few showed the usual mottled appearance characteristic of parasitism, and thirty-two nymphs or 41.02 per cent. of the whole number were eventually isolated as parasitized. From these, nine yielded adult parasites in due time. Nine out of thirty-two is an unusually small proportion to come through to the adult condition and there may or may not be special biological meaning in the small number, since a loss of adult parasites is rather common, especially if the conditions of moisture and temperature are not correct, particularly the humidity.

From the foregoing it is shown that (a) under the conditions stated *I. caucurtei* will deposit eggs in fed larvae; (b) that, while in the case of eggs deposited in nymphal ticks, development of the parasites begins promptly and in suitable temperatures will proceed to the maturing of the parasites, in the case of eggs deposited in fed larval ticks development is delayed; (c) that the living parasite is carried through the quiescent period of the fed larva and is alive in the next stage; (d) that the parasite may remain alive through a resting period of the unfed nymphs prolonged for fifty days (September 22 to November 11); and finally (e) that on the nymphs being fed the parasites will develop to maturity.

These findings suggest the possibility of a more or less established adaptation which had not been suspected.

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[5] Arey, L. B., 1919, *J. Comp. Neur.*, Vol. 30.