

we usually say that the forcing influence ought to be in tune with the natural frequency of the system. In every case the natural  $q$  is  $\sqrt{n^2 - f^2}$ , but we find the critical  $q$  to be either  $n$  or  $\sqrt{n^2 - 2f^2}$ .

This is probably known to mathematicians, but it is certainly not known to electrical engineers; it is a most important matter for people engaged in telephony, and especially for persons engaged in wireless signalling.

JOHN PERRY.

#### Inheritance of Paternal Characters in Echinoid Hybrids.

IN the Journal of the Marine Biological Association for October, 1911, we published a "Preliminary Notice on the Experimental Hybridisation of Echinoids." It comprised the results up to date of an investigation which had been carried on at the Plymouth Laboratory during 1909, 1910, and 1911. The forms experimented on were *Echinus esculentus*, *E. acutus*, and *E. miliaris*. Certain characters were studied in the hybrids, which appear in the late larvæ and do not vary in the parental forms. As the result of three years' work, we came to the conclusion that the inheritance of these characters was always strictly maternal.

The work has been repeated this year, but our results differ from those of previous years in several important points. It may, therefore, be of interest to other workers in this field if we give a brief statement of these new results at once.

The outstanding feature of this year's investigation has been the fact that *E. miliaris* eggs, when fertilised with their own sperm, have only been raised with great difficulty to a late stage. In previous years this species has always grown more healthily and developed more rapidly in the laboratory than either *E. esculentus* or *E. acutus*. This fact, we have suggested in our preliminary paper, is possibly due to *E. miliaris* being a shore form, the conditions of growth in the laboratory being more favourable to it than to the other species, which are deep-water forms. This year, however, *E. miliaris* has developed less readily under laboratory conditions than *E. esculentus*, *E. acutus*, or any of the hybrid crosses. Evidently some condition of the environment which was not present in previous years has affected the germ cells of *E. miliaris* this season.

Hybrids between *E. miliaris* ♂ and *E. esculentus* and *E. acutus* ♀ were obtained this season with ease and were, as before, strictly maternal. The crosses with *E. miliaris* ♀, on the other hand, could only be made with the greatest difficulty. Probably, then, it is the eggs and not the sperm of *E. miliaris* which are at fault. The hybrid larvæ in all the cultures of the cross *E. acutus* ♂ × *E. miliaris* ♀ turned out to be strictly paternal and not maternal, as in previous years. With one exception all the cultures of *E. esculentus* ♂ × *E. miliaris* ♀ have also been paternal with regard to the inheritance of the posterior ciliated epaulettes and the green pigment masses. The *E. miliaris* egg this year seems to be unable to transmit its characters to the hybrid offspring, as in previous years. The exception mentioned above was in the case of the only cross between *E. esculentus* ♂ and *E. miliaris* ♀, in which a large percentage of the eggs fertilised. In cultures from this fertilisation the hybrids were maternal with regard to the above-mentioned characters. Thus in the only hybrids with *E. miliaris* ♀, in which a large number of the eggs fertilised, we found the usual maternal inheritance.

CRESSWELL SHEARER,  
WALTER DE MORGAN,  
H. M. FUCHS.

Laboratory of the Marine Biological Association,  
Plymouth, June 22.

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#### Taste or Smell in the Laughing Jackass (*Dacelo*).

WHEN experimenting on the palatability of insects, I have often noticed that birds appear to be able to tell whether an object is nice or nasty by merely holding it between the extreme horny tips of the bill. From this observation I inferred that actual contact with the tongue or soft palate was unnecessary for the purpose.

A case came under my notice to-day, however, which not only strengthened this conclusion, but suggested that some birds at all events are able to ascertain the distastefulness of some insects without actually pecking them. I offered the larva of the small Eggar moth (*Eriogaster lanestris*)—a velvety black hairy grub, ornamented with brown spots and yellow streaks—to a laughing jackass (*Dacelo cervina*). The bird was preparing apparently to take it, but when the tip of his beak was about an inch away, he drew back his head and shook it, and opened and shut his beak, exactly as I have seen birds do when tasting an unpleasant flavour. Every time the caterpillar was presented to him he behaved in the same way, and nothing would induce him to touch it. I repeated the experiment with two examples of *Dacelo leachii* and *Dacelo gigantea*, with precisely the same result.

The birds' behaviour so forcibly suggested a keen olfactory sense that, despite the distance the larva was held from their nostrils, and despite the usually accepted belief that the sense of smell is defective or absent in most birds, I do not know how to emend the keeper's remark, "They don't like the smell of it." It appeared to me, indeed, that they "smelt" the larva with the mouth, if such an expression may be used, and considering the intimate connection in ourselves between taste and smell, I think this explanation is possibly correct, although to me the larvæ individually have no appreciable scent.

A large number of the larvæ of this moth were sent to me for experiment by Mr. F. C. Woodforde, and I was able to try them with many species of birds. There is no doubt that they are, on the whole, unpalatable, but not very highly so. Some of the birds refused to touch them, others pecked them once or twice, others persevered for a long time, beating and shaking them about on the ground, generally giving them up in the end, but in one or two cases eating the mangled remains. None, however, behaved towards them as the laughing jackasses did.

Zoological Society, June 16.

R. I. Pocock.

#### Rearing *Asterias rubens*, L.—Larvæ with Double Hydrocoele.

THE note may be of interest that some young *Asterias rubens* have recently completed their metamorphosis here, while others are at present in the stage of sucker fixation.

The successful culture was one of several made by me in April last at the Millport Marine Biological Station, from a good supply of healthy starfish put at my disposal by the Superintendent of the station. All the cultures were taken up to Glasgow that same evening, and two days afterwards the swarming larvæ were transferred to small vessels holding about half a gallon of sea water and provided with an arrangement for securing gentle and continuous internal circulation.

In a week or so, the larvæ were fed with a culture of *Nitschia*. Two weeks afterwards a considerable number from the best jar were transferred to a second hatching vessel, and, a fortnight later, selected specimens from these were brought into a third vessel of the same type. The result was thus obtained with an expenditure of about two gallons of sea water, although a good deal more was actually employed in