at least two fundamentally different kinds. If we approach the series from one end, and watch the successive conquests of microscopical technique, or if we consider the phenomena of immunity over the whole series, we are tempted to assume that all the viruses will ultimately be revealed as independent organisms. If we approach from the other end, or consider analogies from other examples of a transmissible alteration of metabolism, we may be tempted to doubt the significance of the evidence provided by the microscope, and to conclude that all viruses are unorganised, autogenous, toxic principles. If we take the cautious attitude of supposing that both are right, and that viruses belonging to both these radically different types exist, where are we going to draw the line ? Is the test to be one of unit dimension ? If so, what is the lower limit of the size of an organism ? Are we to suppose that inclusion bodies can only be produced by viruses which are independent organisms ? And if so, does this conclusion also apply to the ' X ' bodies associated with the infection of plant cells by certain viruses ?

If we try to form an estimate of the lower limit of size compatible with organisation, I think we should remember that particles which we measure by filters of known porosity, or by photomicrographs, need not be assumed to represent the virus organisms in an actively vegetative condition.

They may well be minute structures, adapted to preserve the virus during transmission to cells in which it can resume vegetative life. Attempts to demonstrate an oxidative metabolism in extracts containing such a virus, separated from the cells in which it can grow and multiply, and to base conclusions as to the non-living nature of the virus on failure to detect such activity, must surely be regarded as premature.

Our evidence of the vitality of its particles is, as yet, entirely due to their behaviour after transmission. They may accordingly contain protein, lipoid and other molecules in a state of such dense aggregation that comparisons of their size with that of the heavily hydrated molecules of a protein in colloidal solution may well give a misleading idea of their complexity.

Apart from their known function as the agents transmitting many of the best known among the acute infections, it is impossible, to anyone having even a slight knowledge of the recent developments which began with the work of Rous and Murphy, to doubt that in the advance of knowledge concerning the nature of the viruses in general lies the brightest hope of finding a clue to the dark secret of the malignant tumours. In unravelling what is still such a tangle of contradictions, the animal biologist needs all the help that can be given by concurrent study of the analogous phenomena in plants.

Eels and Conger Eels of the North Atlantic.

By Prof. Johannes Schmidt.

IN the course of the Danish investigations on the life-histories of the fresh-water eels (1904–1931) important data about the congers have been obtained. I hope it will be possible some time to give a more detailed picture of the history and distribution of the fresh-water eels and congers of the various oceans. Referring to my earlier publications,[1-8] I propose here to deal with the relation between the European and the American conger, which is generally referred to the same species as the European one. The investigation is mainly based upon a study of the larvæ and their distribution.

In the North Atlantic area, we obtained about 2500 larvæ belonging to the genus *Conger s. str.* By counting the myomeres we found that the material falls into two distinctly separate groups (Fig. 1). In the former, the number of myomeres varies between 154 and 163 with an average of 158·16, in the latter between 140 and 149 with an average of 144·63. So there is no overlapping of the two groups.

On marking the distribution of the larvæ of the two groups upon a chart, we find that the larvæ with the high myomere number occupy quite another and a much larger area than those with the smaller number. As shown by the charts (Figs. 2 and 3), the distribution is much like the one I have found in the case of the larvæ of the European and the American fresh-water eel respectively. Simi-
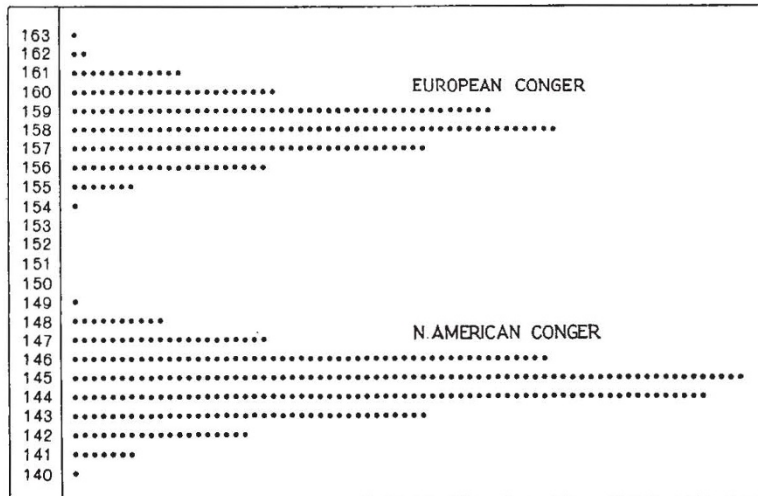

Fig. 1.—European and North American Conger (*Conger vulgaris* and *Conger oceanicus*). Number of myomeres in larvæ: *Conger vulgaris* (top graph), average of 201 specimens, 158·16; *Conger oceanicus* (lower graph), average of 288 specimens, 144·63. (Countings by Miss Esther Hansen.)

larly, there is in both cases an overlapping of the areas.

We have determined the number of vertebræ in several hundred adolescent and adult specimens of the European conger (*Conger vulgaris*) and have found values between 153 and 161 (average between 157 and 158), which corresponds well with the above-mentioned values of myomeres in the group of larvæ with the higher number, the number of myomeres of the larvæ being a little higher than the number of vertebræ of the adult fish. This fact also holds good of the fresh-water eels and other murænoids.

As to the number of vertebræ in adult specimens of congers from North America, my material is much smaller than that for the European conger. Through the kindness of the United States Bureau of Fisheries, however, I received in 1922 four adult specimens originating from Woods Hole, Mass. A determination of their number of vertebræ gave the following figures : 143, 144, 144, 145, which is in complete agreement with the values of the group of larvæ with the smaller number.

In the circumstances, it is clear that the American conger is a species differing from the European one, and that it ought to be given a specific name. For want of types, I have applied for advice to American colleagues, namely, Prof. H. B. Bigelow and Mr. A. E. Parr, who think that the name used by Mitchell (*Jour. Ac. Nat. Sci. Phila.*, p. 407 ; 1818), namely, *Anguilla oceanica*, should be chosen. The fish in question being stated by Mitchell to occur " off New York ", there is scarcely any doubt that he really had before him the American species with the smaller number of vertebræ. So we name the North American species *Conger oceanicus* as distinct from the European *Conger vulgaris*. However, I wish to direct attention to the fact that the name does not apply to the conger occurring in South America (Argentine), which by our investigations has proved to be different from the North American species.

The distribution of *Conger oceanicus* is not nearly so wide as that of *Conger vulgaris*. We know that it occurs off the Atlantic coast of the United States, but we know little more. In the West Indies we have found quite tiny larvæ, a fact that permits us to conclude that here is the breeding place of the species. The appearance of these tiny larvæ agrees with the corresponding stages of development of *Conger vulgaris* described and pic-
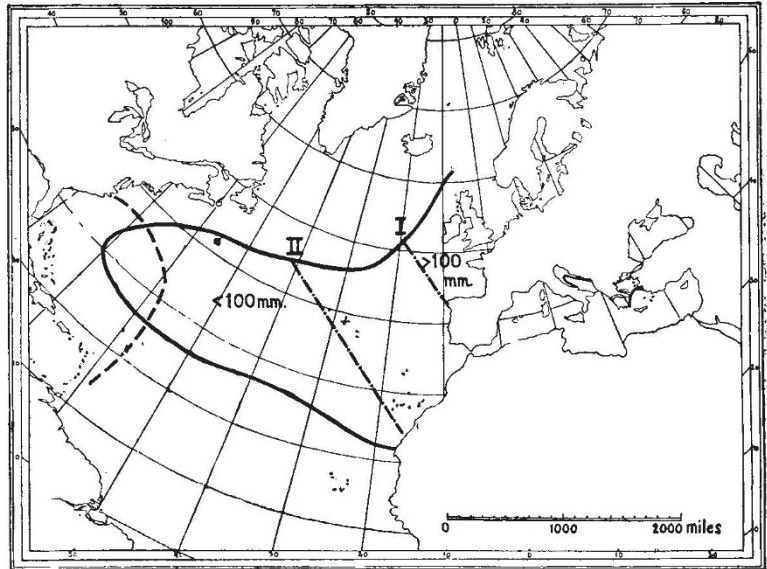

Fig. 2.—Distribution of unmetamorphosed larvæ of the European and North American species of congers (*Conger vulgaris* and *Conger oceanicus*). *Conger vulgaris* : East of line I all larvæ were more than 100 mm. long, west of line II all were less than 100 mm. in length, according to Danish investigations, 1904–1931. The American species indicated by *broken*, the European by *unbroken* curves. In contrast to the fresh-water eel, *Conger vulgaris* breeds in the Mediterranean and in the Eastern Atlantic.
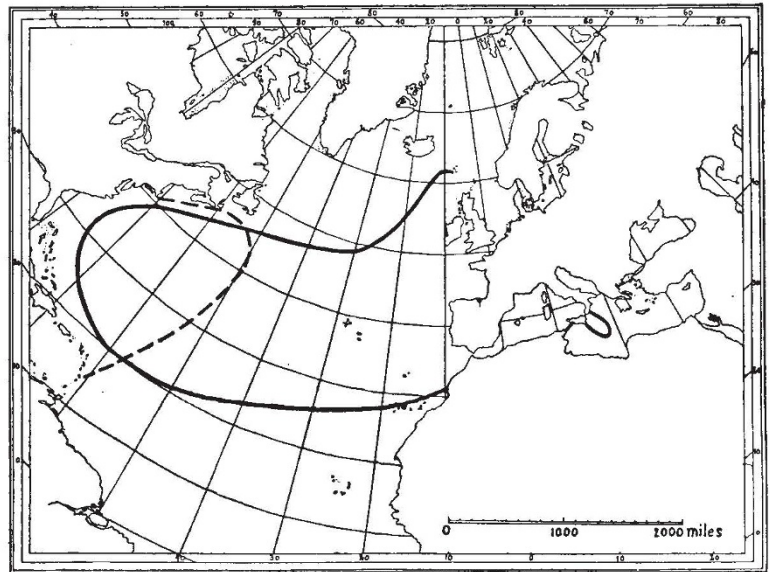

Fig. 3.—Distribution of unmetamorphosed larvæ of the European and North American species of fresh-water eel (*Anguilla vulgaris* and *Anguilla rostrata*). The American species indicated by *broken*, the European by *unbroken* curves. *Anguilla vulgaris* only breeds in the Sargasso Sea west of long. 50° W.

tured by me in 1912 [4] and 1913.[6] The tiny stages, however, which Eigenmann (1902) hatched from pelagic eggs taken by the schooner *Grampus* south of Nantucket lightship, do not belong to *Conger* but to an *Ophichthys* or a closely related form, a fact to which I have already directed attention.[5]

I have already mentioned that there is a striking

agreement between the distribution of the larvæ of the two *Conger* species and those of the two *Anguilla* species. It is especially interesting to compare the two European species, *Conger vulgaris* and *Anguilla vulgaris*, which, as shown by the maps (Figs. 2 and 3), are both distributed over a zone across the North Atlantic and the Mediterranean, a distance of about a quarter of the circumference of the globe. But while the fresh-water eel breeds only in the western Atlantic, from which place its larvæ, increasing in age and size, spread towards the north-east and the east over an area similar to the one taken up by the conger larvæ, matters are different as to the conger. For our investigations have shown that the European conger must have breeding places along the whole extent of the area from the Sargasso Sea to Egypt, because throughout this extent—always over great oceanic depths—we have found tiny larvæ, only 10 mm. in length.

The full-grown larvæ measure about 140–160 mm. in length. If we make a closer examination of the distribution of the larvæ of *Conger vulgaris* according to size, we find :

1. In the south-eastern part of the larvæ area, that is, from the Azores and eastwards between about lat. 30° and 40° N. to Gibraltar and onwards through the Mediterranean to Egypt, all sizes of larvæ from tiny to full-grown ones were found. This fact shows that we are dealing here with local conger populations.

2. From Cape Finisterre a line has been drawn on the map (Fig. 2) in a north-westerly direction (I) ; north of this line, that is, in the north-eastern part of the larvæ area, only older larvæ more than 100 mm. in length have been found. From this fact we may conclude that the conger populations of north-western and northern Europe, including the British Isles, are *not* of local origin, but originate from more distant regions of the Atlantic situated to the south and west.

3. From a point a little south of the Canary Islands a line has been drawn in a north-westerly direction passing a little west of the Azores and limiting the western part of the larvæ area (II). West of this line, that is, in the Sargasso Sea, we only found tiny (10 mm. in length) or half-grown larvæ, but none attaining a length of 100 mm. As the adolescent conger lives in shallow water, these larvæ must be the offspring of conger populations that have undertaken very long migrations to the breeding places. The origin of the *Conger vulgaris* breeding in the Sargasso Sea cannot be determined for certain at present. Since the tiny larvæ of *Conger vulgaris* occur in the Sargasso Sea together with the tiny larvæ of our European eel, and the larvæ, like those of the eel, increase in size from this place towards the north and north-east, I think it very probable that they migrate along the same routes to north-western and northern Europe, and that they are the offspring of the conger populations living there.

I can sum up as follows : it is a common feature of the eels and conger eels of the North Atlantic that both genera have an eastern (European) and a western (American) species, *Anguilla vulgaris* and *Conger vulgaris*, and *Anguilla rostrata* and *Conger oceanicus*, respectively. Both the eastern species have a higher number of vertebræ and a far wider distribution of the larvæ than the two western species. (Fig. 1.)

The adolescent European eel and European conger have, in the main, the same distribution, and this also holds good of their larvæ, when no account is taken of the age (size) of the latter. (Figs. 2 and 3.)

The European eel breeds in the western Atlantic and only there, in a limited area of the Sargasso Sea. The European conger has a much wider breeding area, as it breeds in the Mediterranean, in the eastern Atlantic between the Azores and Gibraltar, and in the west Atlantic (the Sargasso Sea).

So *Conger vulgaris* is not a biological unity like the fresh-water eel. It comprises different populations with different breeding places, breeding time, and migratory tendencies.

¹ *Rapp. Proc. Verb. Conseil perm. intern. l'Explor. de la Mer* Copenhagen, 1906.
² *Med. Komm: Havunders., Fiskeri*, Bind 3, No. 3, Copenhagen, 1909.
³ NATURE, March 9, 1911.
⁴ *Vidensk. Medd. Dansk naturh. Foren.*, Copenhagen, Bd. 64, 1912.
⁵ *Intern. Revue Hydrobiol. Hydrogr.*, Bd. 5, Leipzig, 1912.
⁶ *Med. Komm. Havunders., Fiskeri*, Bind 4, No. 2, Copenhagen, 1913.
⁷ British Association, Hull Meeting, 1922.
⁸ *C.R. Acad. Sci.*, Paris, t. 179, Oct. 20, 1924.

The Clerk Maxwell Centenary Celebrations.

THE University of Cambridge celebrated, on Oct. 1–2, the centenary of the birth of the first Cavendish professor of experimental physics, James Clerk Maxwell.

On Sept. 30, before the celebrations opened in Cambridge, memorial tablets to Faraday and Maxwell were unveiled in Westminster Abbey. The tablets are of the same size as that which marks Kelvin's resting-place, and they lie on the opposite side of the Newton floor-slab. There could be no more appropriate site. The short service was conducted by the Dean, and was attended by about four hundred members and delegates from the Royal Institution, delegates of the Maxwell celebration, and members of the University of Cambridge. The Master of Trinity unveiled the memorial, and in a short address emphasised the links between Faraday and Maxwell and their claims to such memorials.

The celebrations opened in Cambridge on Oct. 1, with the old Maxwell wing of the Cavendish Laboratory as its headquarters. About eighty official delegates had been nominated by the principal academies and learned societies of the world and by the home universities. Capt. J. Wedderburn Maxwell represented Maxwell's family, and there were present also some fifty guests, including at least twelve of those who had worked with Maxwell or sat at his lectures in the first days of the Cavendish Laboratory and many of those who have since helped to build up the school of experimental physics in Cambridge. A luncheon to the official