many of the organisms present in manure are not associated with the production of malodorous compounds.

Reference is made (p. 145) to *Bacterium acidi lactici* in some cases and then again to *Bacterium lactis acidi,* when evidently the same organism is meant. This is apt to confuse not only the beginner, but even the more advanced student.

Numerous typographical errors as misspelled words, "dropped" lines, etc., occur, but these are not so serious in a way, as they can readily be recognized, but textual errors as noted above are less easily perceived by the student.

Science should teach a student to be exact and definite, but when texts are placed before him that contain so many slips of the pen, it sets a standard that makes for inferior work.

H. L. Russell

SPECIAL ARTICLES

NOTE ON THE CHROMOSOMES OF NEZARA. A CORRECTION AND ADDITION

In my preceding accounts of the chromosomes in *Nezara hilaris* (1905–06) I described the idiochromosomes as being of equal size and failed to recognize a dimorphism of the spermatid-nuclei. I have recently discovered that this was an error; and it is one that I wish to correct in advance of a more detailed description because *Nezara* now stands as the original representative of that type of insects in which neither a dimorphism of the spermatozoa nor a quantitative difference of chromatin between the sexes can be seen.

That type was first based on the single case of *Nezara hilaris,* but I afterwards added to it the lygæid species *Oncopeltus fasciatus* on the strength of Montgomery's earlier observations on the male and my own unpublished ones on both sexes. I was led to reexamine *Nezara hilaris* because of the discovery that in the closely allied southern species *N. viridula* there is a typical and very unequal pair of idiochromosomes, which show the usual relation to sex. The reexamination, in comparison with *N. viridula,* proves that in my earlier account the idiochromosome pair was incorrectly identified, and that in *N. hilaris* there is in fact a slightly unequal pair of idiochromosomes. This is, however, not the smallest pair (which is common to the two species) as both Montgomery and I were led to believe from the size-relations seen in other forms, but one of the largest; and in the second division it does not lie in the outer ring, as the small one does (a very exceptional position for the idiochromosome pair, as I pointed out) but occupies the typical position at the center of the group. The inequality of this pair in *N. hilaris* may readily be overlooked, since it is but slightly marked—far less than in *N. viridula,* and perhaps even a little less than in *Mineus,* as heretofore described. Moreover, both idiochromosomes are more elongated than the other chromosomes and often of nearly the same diameter, but differ in length. In polar views, therefore, the inequality often can not be made out, though in side views it constantly appears. My former figure of such a view actually shows an inequality of this pair, but insufficiently, the smaller member being represented a little too long and thick. The inequality is often more marked than in the particular specimen there figured.

Nezara can, therefore, no longer stand as a representative of the "third type" recognized in my paper of 1906, and *Oncopeltus* must probably take its place. I say "probably" because the case of *Nezara* shows how readily a dimorphism of the spermatozoa may escape detection when only a slight size-difference between the idiochromosomes exists. Renewed studies upon *Oncopeltus* (a very favorable object) shows that a slight inequality of the idiochromosomes may in fact often be seen at every stage of the spermatogenesis, from the pre-synaptic period onward. Quite as often, however, they appear equal, and the size-variation appears to lie within the range of variability in the other chromosome-pairs. A final decision in regard to this species is reserved for a future more detailed account.

A second point of interest, formerly overlooked, is the existence in the second division

of both species of *Nezara* of a quadripartite chromosome, composed of two somewhat unequal components and having exactly the form of a butterfly with wide-spread wings. This element, always lying in the outer ring and in constant position with respect to the spindle-axis, divides equally into two double elements. Each spermatid-nucleus thus receives six single chromosomes (including one idiochromosome) and one double element; though the duality of the latter is often obscured in the later anaphases. This phenomenon may indicate that a change in the chromosome-number is in progress, the double element representing either the initial stages in the separation of one of the "autosomes" into two (as appears to have occurred in case of the X-chromosome of *Syromastes, Fitchia,* etc.) or the final stage of a fusion of two into one.

EDMUND B. WILSON

THE STRUCTURAL CHARACTERISTICS AND RELATIONS OF THE APODAL FISHES[1]

THE characteristics and relations of the Apodals (Apodes) have been involved in much uncertainty even to the present hour. Nevertheless, no order appears to be really more trenchantly differentiated when a sufficient number of skeletons is at hand. Their chief characteristics of ordinal value may be given as follows:

Order Apodes

The order of eels or apodals is composed of fishes with a skull specialized especially by its extension forwards and the coalescence of the ethmoid, vomer (and premaxillaries?) into one piece which projects and is clamped laterally and more or less backwards by the maxillaries, the fusion with the vomer (?) or loss of the premaxillaries, the slight development of the palatal and pterygoid systems, the junction of the parietal bones, the presence of a chain of suborbital bones, the single cotyloid condyle for the articulation of the vertebral column, the freedom and reduced development of the shoulder girdle (and in some the complete loss), the single coraco-scapular plate in which are ossified the hypercoracoid and hypocoracoid, the mesocoracoid being lost, the brain of the ordinary teleost type but with secondary olfactory lobes in front of the principal ones, the great development of the branchiostegal apparatus, and the development of a pneumatic duct between the air-bladder and alimentary canal, and the loss or abdominal position of the ventral fins. The species propagate in the sea and pass through a peculiar stage known as the *Leptocephalus* or *Atopichthys* form, a ribbon-like translucent condition from which develops a later eel-like stage.

All the known species have the familiar eel-like form in varying degrees, some being much stouter and others excessively elongated, but the form is not an ordinal character, although in this case to a large extent coordinated with such characters. The absence of ventrals which gave name to the order (Apodes) is falsified by extinct representatives of the family Anguillavidæ, although justified by all the living species.

Inasmuch as much difference of opinion has prevailed respecting the homologies of the supraoral dentigerous bones, and as silence respecting them might be interpreted as the result of ignorance or undue disregard of others, some explanation seems to be called for here. By many of the old anatomists, the upper lateral dentigerous bones were considered to be palatines, but that view, for the most part, has been long abandoned. Recent high authorities, however, have regarded the bones in question as not homologous for the Murænids compared with the rest of the Apodals. While the upper bones of the Anguillids and other platyschistous eels have been admitted to be maxillaries, the lateral dentigerous bones of the Murænids have been homologized with the palatines or pterygoids. In other words, according to one author, the Murænids have the "maxillaries absent, replaced by the palatopterygoid, the mouth bordered by the latter and the ethmo-vomer," according to another, by "the toothed ethmo-vomer and pterygoids." Such an interpretation implies that the dentigerous bones, so much

[1] Abstract of a communication to the National Academy of Sciences, April 21, 1910.