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Studies on Reptilian Chromosomes
VII. Chromosomes of a turtle, *Clemmys japonica* (TEMM. & SCHL.).

By

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With 10 Text-figures

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Material and method

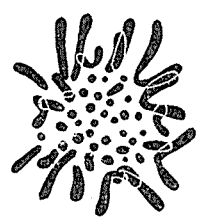
Most of the individuals used as the material for the present study were caught in the months from April to October. In the specimens taken in April, only spermatogonial divisions were found, while in the other specimens an abundance of division figures of all cell generations were observed.

For fixing chromosomes CHAMPY's mitochondrial fixative in the original formula and its modifications, concentrated 1.5 and 2 times as strong as the original formula, were employed. Spermatogonial chromosomes were very successfully preserved in any of these fixatives while for tetrads the most concentrated formula was preferable. However, I have not succeeded in fixing dyads in the second maturation division, as they adhered to one another so badly that it was difficult to count them.

Observation

The behavior of the chromosomes of this turtle seems to be, in essential respects, identical with that of snakes and lizards. So only the number and shape of the metaphase chromosomes in spermatogonial and the first maturation division will be described.

Spermatogonial chromosomes are 52 in number and they seem to be sorted into macro- and micro-chromosomes as in some other reptiles. The macro-chromosomes are 22, of which we can dis-



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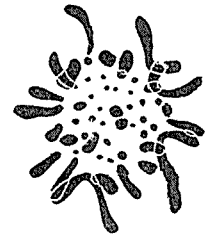

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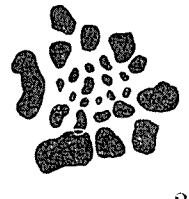
Text-figs. 1 and 2. Polar views of the spermatogonial equatorial plates.

tinguish two pairs of large and two pairs of small centromitic and seven pairs of telomitic chromosomes. Of the centromitic chromosomes the four larger ones are almost V-shaped and lie with the apexes of V's toward the centre of the equatorial plate. The smaller ones are also V's, but they sometimes have the arms of the V so far apart that they appear almost like curved rods. Among the telomitic chromosomes the two longest pairs can be distinguished from the others which are of intergrading sizes. The micro-chromosomes are mostly small dots and spherical, but some are larger and oval. In the equatorial plate they are in radial arrangement; the macro-chromosomes form an outer circle and enclose the micro-chromosomes which are scattered in the central area.

The first maturation division shows 26 tetrads in the equatorial plate. Often they are condensed into black masses; but in materials fixed with the most concentrated fixative fine structures of the tetrads are well preserved (Text-figs. 9 and 10). As in the previous divisions the tetrads fall into two groups, 11 macro- and 15 micro-



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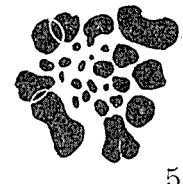

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Text-figs. 3-10. Polar views of equatorial plates of the first maturation divisions.

tetrads. Of the former the largest two are centromitic and multiple-ring tetrads somewhat flexed at the point of the spindle-fibre attachment. Others are double or single rings, V's or horse-shoes, or bipartite bodies. Of these some two of the V's or horse-shoes should represent pairs of the small V-shaped spermatogonial chromosomes; but they cannot be recognized. The small tetrads are bipartite and spherical dots. As in the spermatogonial division, most of the macro-tetrads are arranged in the periphery of the equatorial plate and the micro-tetrads in the centre.

Conclusion

Our knowledge of the chromosomes of turtles is very meagre. As far as I know, JORDAN (1914) was the first to investigate chelonian chromosomes. He gives a very brief account of the chromosomes of *Chrysemys marginata* and *Cistudo carolina*, and states that the haploid number of chromosomes is 17 in the former and 16 in the latter. JORDAN's study, however, has since been discussed fully by MATTHEY (1931). This author reports in *Emys europaea* 50 spermatogonial chromosomes which consist of four centromitic or V-shaped and 46 rod- and dot-like chromosomes. He does not sort them into the macro- and micro-groups as he has done in some lizards, but the demarcating line may be drawn between 20 larger and 30 smaller chromosomes. The chromosomes of *Clemmys japonica* are 52, and they may be divided into 22 macro- and 30 micro-chromosomes. The macro-group consists of four large and four small V's and 14 rods. This complex shows some degree of similarity to that of *Emys*, as there are in both the complexes four large V's and 30 small chromosomes. Other than these chromosomes *Emys* has 16 rods, while *Clemmys* has four small V's and 14 rods. Of the chromosome-complexes of nearly related animals it has often been found that a certain V in one form corresponds to two rods in the other. However, the above discrepancy in the chromosome-complexes in the two turtles can hardly be explained so simply.

The tetrads in *Clemmys japonica* are identical in structure with those commonly found in some snakes and lizards. In other stages also the chromosomes of this turtle do not seem to be different from those of the snakes and lizards. But to confirm this, further observation is necessary.

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