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On the Differentiation of the Crenated-Folds in the Midgut-Gland of Eulamellibranchia (I)

By

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(*With 19 Text-figures*)

The crenated fold in the main duct of the midgut-gland is an important feature characteristic of Eulamellibranchia. As mentioned in my previous work (1956), *Cristaria plicata spatiosa* has a narrow fold, running from the floor of the stomach into the large duct of midgut-gland in a short range. Such a fold as found in *Cristaria* is simple, short, and should be considered to be of a primitive type, while *Mya* has a complicated one and to be of a specialized type.

In the course of my study, the various degrees of differentiation in the structure of the fold were elucidated in 8 species of Eulamellibranchia. The results of this work are described according to their developmental degrees in the following lines.

Material and method

The species used in this work are listed below. Most marine specimens were obtained in Kanazawa in Kanagawa Prefecture, and the fresh water animals from the Lake Biwa, The stomach was cut open middorsally, and the main ducts of the midgut-gland were dissected open from their openings to the stomach towards the distal ends. The investigations were carried out under the dissecting microscope. The ciliary currents were traced by an India ink suspended in sea water or in tap water.

In this place I wish to express my sincere thanks to Dr. I. Taki for his valuable suggestions and to Messrs H. Itagaki, O. Sato and T. Koyama for the collection of materials.

The list of the material

Ordo	Familia	Species
Schizodonta	Unionidae	*Hyriopsis schlegeli* *Cristaria plicata spatiosa* *Anodonta calipygos*
Heterodonta	Mactridae	*Mactra sulcataria*
	Asaphidae	*Soletellina olivacea*
	Tellinidae	*Macoma anser*
Adapedonta	Myidae	*Mya japonica*
Anomalodesmacea	Laternulidae	*Laternula limicola*

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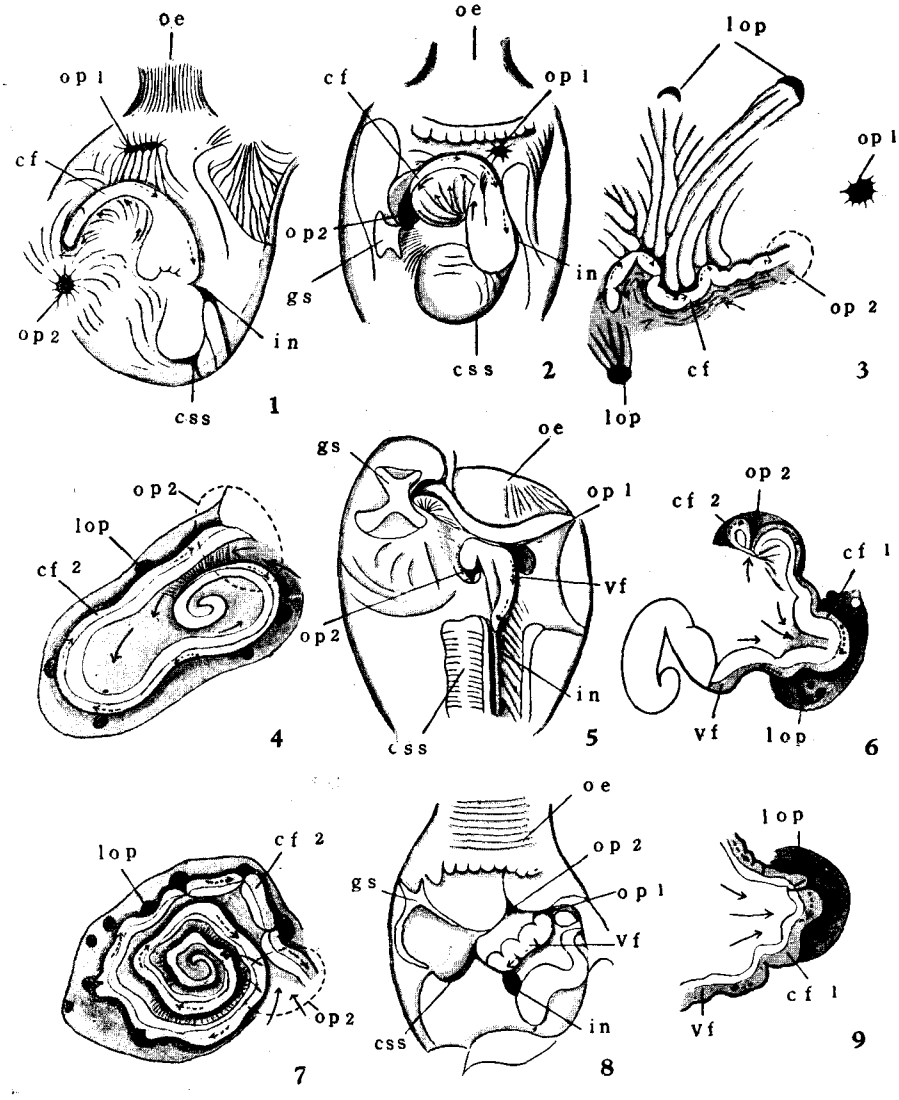
Results

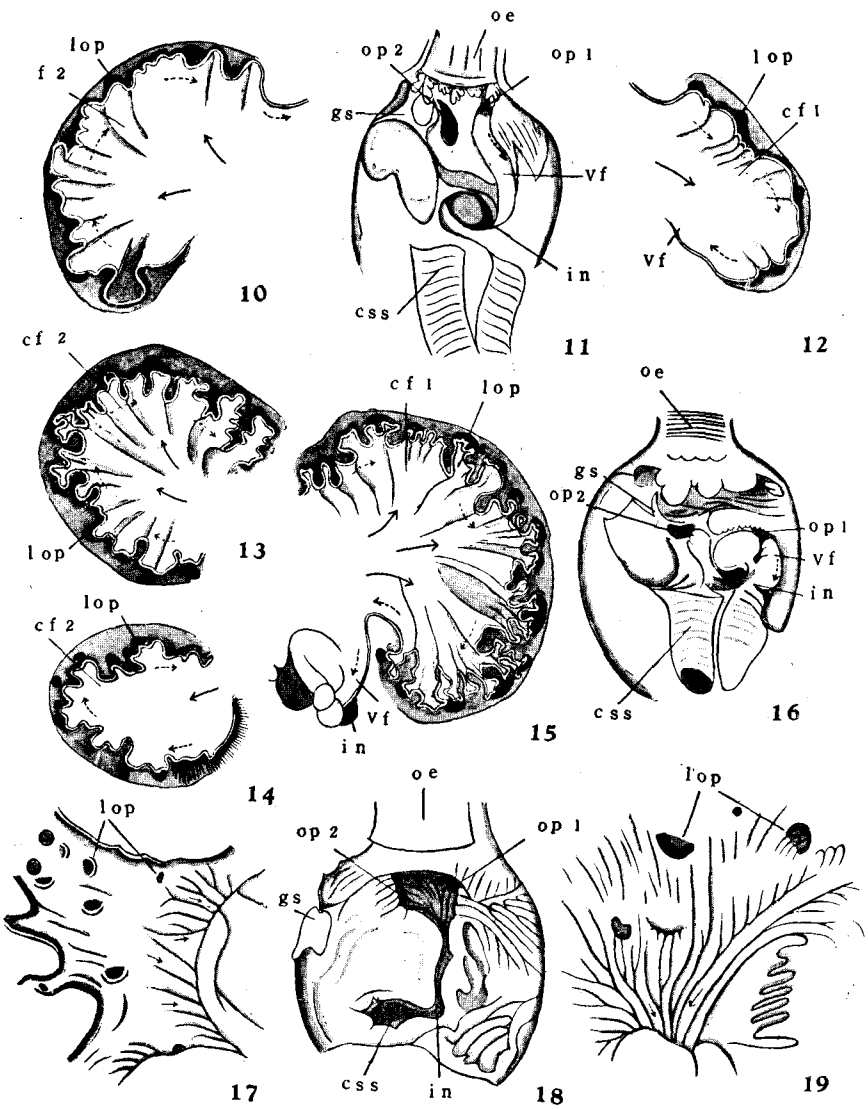
It is obvious that these folds are peculiar to the species and show the degrees of developmental structure in the mode of crenation with reference to their systematic positions.

A) Simple type of fold : fold narrow, short, simple, observed in Schizod-



onta, and should be regarded as a primitive form.

a) *Anodonta calipygos*: fold narrow, continuous with the ventral fold, located on the floor of the stomach, extended to neither of the 2 openings of the ducts, ending at a short distance from the 2nd opening (Fig. 1).



b) *Cristaria plicata spatiosa* : fold ranging from the floor of the stomach into the 2nd duct, as was explained in my previous paper (Fig. 2).

c) *Hyriopsis schlegeli* : fold narrow, winding, running from the stomach into the 2nd duct, intruding far more interiorly than in the case of *Cristaria* (Fig. 3).

B) Coiled type of fold : fold exceedingly asymmetry in each duct; one fold broad, simply crenated, intruding into the 1st main duct; another fold, narrow, coiled, intruding into the 2nd main duct.

a) *Soletellina olivacea* : one fold simply crenated, intruding a little into the 1st main duct; another fold narrow, coiled into 2 whorls in the 2nd main duct (Figs. 4, 6).

b) *Macoma anser* : one fold more crenated than that of the *Soletellina*, intruding into the 1st main duct : another fold coiled into 3 and half whorls with some crenations in the 2nd main duct (Figs. 7, 9).

C) Crape type of fold : fold extensively broad, strikingly craped at the margin, intruding far more interiorly into the main duct.

Mya japonica; fold constructed as similarly as Veneridae, but much more complicated than the latter (Figs. 13–15).

D) Degenerated type of fold : fold completely absent either from the stomach or from the main duct.

Laternula limicola : no fold exists both in the stomach and in the main duct (Figs. 17,19).

Summary and conclusion

1) The 8 species of Eulamellibranchia were studied on the fold of the midgut-gland in their developmental morphology with reference to their systematic positions.

2) Schizodonta have a fold of primitive structure, being narrow, short, simple in form, extending more or less in range in different species from its aperture into the 2nd large duct of the midgut-gland.

3) Tellinacea have asymmetrical folds : one fold broad, and another coiled.

4) The crenated fold is much more developed in *Mya japonica* than in any other family of Eulamellibranchia, and cannot be observed in *Laternula limicola*, that may be reduced due to retrogression.

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Explanation of figures 1-19

Abbreviations used in the figures

cf, crenated fold. cf 1, crenated fold in 1st main duct. cf 2, crenated fold in 2nd main duct. css, crystalline style-sac. gs, gastric shield. in, intestine. lop, opening of lateral duct. oe, oesophagus. op, opening of duct to stomach. op 1, opening of 1st main (large) duct to stomach. op 2, opening of 2nd main (large) duct to stomach. vf, ventral fold.

Figs. 1–2. Interior of stomach of *Anodonta calipygos* and *Cristaria plicata spatiosa*, respectively. Fig. 3, *Hyriopsis schlegeli* : interior of 2nd large duct slit open from its aperture (op 2). Figs. 4-6. *Soletellina olivacea* : Fig. 4, 2nd main duct cut open showing spiral fold. Fig. 5, interior of stomach. Fig. 6, crenated fold in 1st main duct. Figs. 7-9. *Macoma anser* : Fig. 7, 2nd main duct cut open to show spiral crenated fold. Fig. 8, interior of stomach. Fig. 9, crenated fold in 1st main duct.

Figs. 10–12. *Mactra sulcataria* : Fig. 10, crenated fold in 2nd main duct. Fig. 11, interior of stomach. Fig. 12, crenated fold in 1st main duct. Figs. 13–16. *Mya japonica* : Fig. 13, crenated fold in 2nd main duct. Fig. 14, crenated fold continuous with above. Fig. 15, crenated fold in 1st main duct. Fig. 16, interior of stomach. Figs. 17–19. *Laternula limicola* : Fig. 17, interior of 2nd large duct. Fig. 18, interior of stomach. Fig. 19, interior of 1st large duct. (Arrows indicate the ciliary current on the surface, dotted arrows indicate that on the under surface).