

GULLMARELLA FAUREI n. g., n. sp.,
A HOLOTRICHOUS CILIATE FROM THE INTESTINE
OF LAMELLIBRANCHS.

by

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Résumé

L'auteur décrit un Cilié Holotriche, *Gullmarella faurei* n.g., n.sp., qui vit dans l'intestin des Lamellibranches *Syndosmya nitida* (Müller), *Syndosmya alba* (Wood), *Cultellus pellucidus* (Pennant), *Venus ovata* Pennant, *Lucinopsis undata* (Pennant) et *Corbula gibba* (Olivi).

Cette espèce a plusieurs caractères communs avec les Ciliés Astomes, mais elle possède en plus une bouche dont la structure montre que l'espèce ne peut pas être incluse dans l'ordre des *Hymenostomida* ou dans des groupes dérivés.

Gullmarella est rangé provisoirement parmi les Ciliés Cyrtophorines (*Gymnostomatida*).

Introduction.

During an investigation of the ciliates which are found in the mantle cavity of marine lamellibranchs in the Gullmar fjord, West Coast of Sweden, an apparently undescribed ciliate was accidentally found in the intestine of *Syndosmya nitida* (Müller). Later, this ciliate was also found in *Syndosmya alba* (Wood), *Cultellus pellucidus* (Pennant), *Venus ovata* Pennant, *Lucinopsis undata* (Pennant) and *Corbula gibba* (Olivi). Further investigations showed that the discovered ciliate is of a very unusual type (2).

Material and methods.

The lamellibranchs harbouring *Gullmarella* were obtained from different localities at various depths. In the laboratory the intestine was dissected out of the host animals and placed in clean sea water. The ciliates were liberated by tearing the intestine apart.

Living ciliates were observed with ordinary light microscope and with phase contrast. Some specimens were vital stained with Janus green.

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(2) My sincere thanks are due to Professor Fauré-Fremiet, Collège de France, for very kindly discussing with me the systematic position of *Gullmarella*.

Specimens were fixed in Bouin's and Schaudinn's fluid for staining with iron haematoxylin, Feulgen and mercuric bromphenol blue (Mazia et al. 1953). The infraciliature was studied by the silver impregnation method of Chatton and Lwoff (Corliss 1953) and with Protargol according to the method of Bodian as described by Dragesco (1962).

The living animal (Fig. 1).

Seen from the ventral or dorsal side the animal is ovoid, the anterior end being pointed. The dorsal side is slightly convex, the

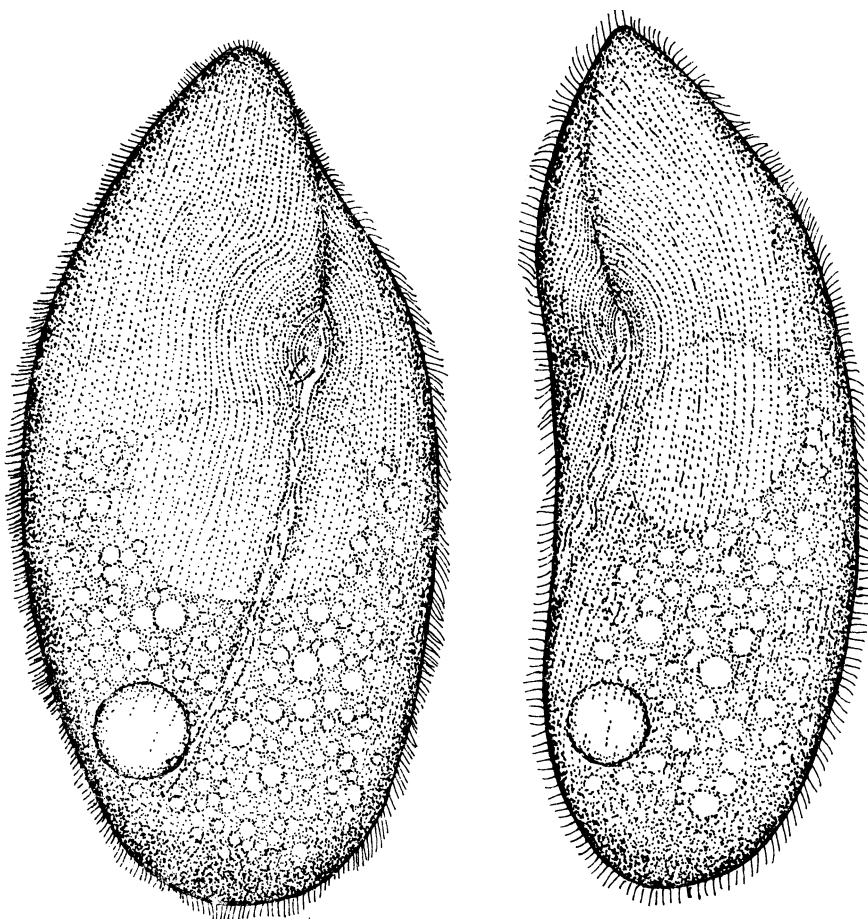


FIG. 1.

Gullmarella faurei n.g., n.sp. The living animal seen from the ventral and ventral left side.

ventral side is flattened with exception of the anterior left side which is depressed. The whole animal is flattened.

The average length of 9 individuals was 193 μ (154-240 μ), the width about 80 μ . Much smaller individuals, which were not measured, have been observed. The very dense cilia are 4-5 μ long.

The movement of the cilia produces metachronal waves moving obliquely over the surface of the ciliate. The animal is flexible, but not contractile.

A contractile vacuole is situated near the posterior right part of the ventral surface. The posterior half of the ciliate is filled with clear feeding vacuoles in which no solid particles were observed.

Underneath the pellicula a dense layer of small granules is situated. Vital staining with Janus green suggests that these granules are of mitochondrial nature. Under this layer another layer of club shaped granules was seen in specimens stained with Protargol. Their nature was not understood.

The ciliature (Fig. 2 A, 3 and Plate I, 1-2).

The ciliature consists of about 180 kineties, 90 on the ventral and 90 on the dorsal side. On the ventral side they run more or less

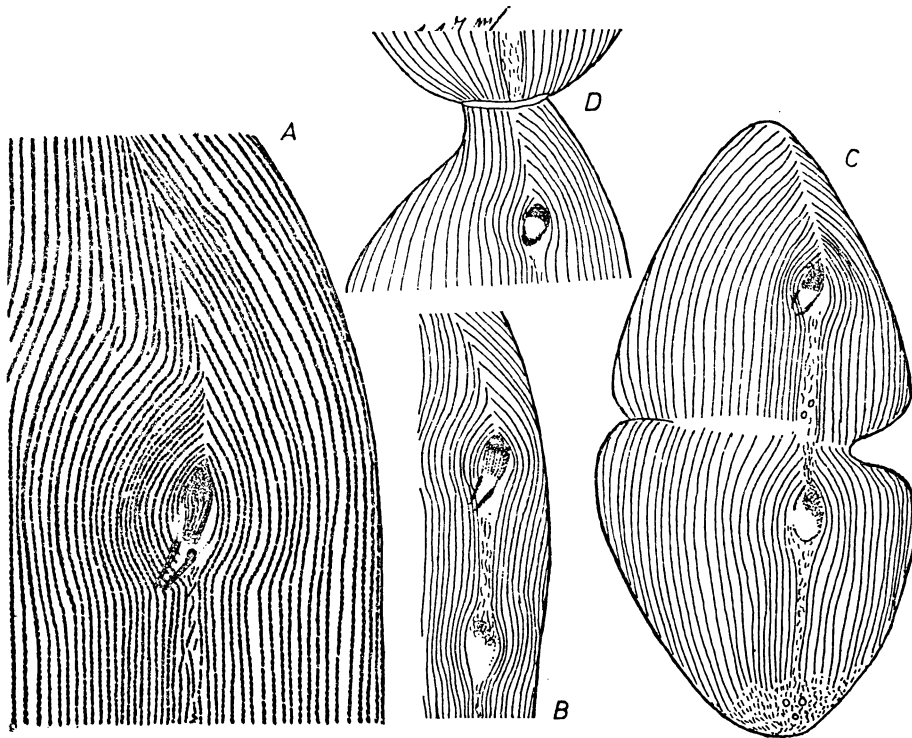


FIG. 2.

The mouth. A: The fully developed mouth. B-D: Three phases of stomatogenesis. All drawn after Ag preparations.

obliquely to the right, on the dorsal side somewhat to the left. The kinetosomes are very dense.

A suture of kineties is situated from the mouth to the anterior rim and along it to the anterior right side. The kineties are often

interrupted. In the posterior end they tend to break up into parts consisting of only a few kinetosomes.

A peculiar band consisting of short pieces of interrupted kineties stretches from the mouth running obliquely to the posterior end.

In the posterior part of this band 3-7 pores of the contractile vacuole are easily seen in silver preparations (Fig. 3).

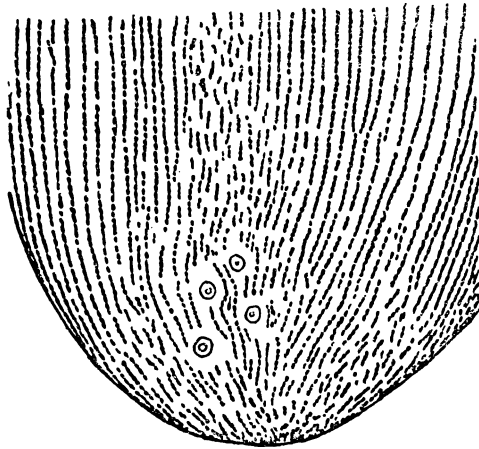


FIG. 3.

The posterior ventral side showing the contractile vacuole pores.

The mouth and stomatogenesis (Fig. 2 and Plate I, 3-4).

The mouth consists of a 5-8 μ long depression which posteriorly is directed a little obliquely to the right. In the posterior end of this depression the cytostome is situated. In the living animal moving cilia occur in the mouth. Silver preparations show that they belong to a band of very dense kinetosomes situated from the anterior to the middle part of

the mouth. In the posterior part of the band the kinetosomes seem to be arranged in 6-8 rows.

In the posterior part of the mouth there are two rods about 3 μ long, one on each side. They can be seen in the living animal, and are stained by mercuric bromphenol blue. They are also seen in *Ag* preparations.

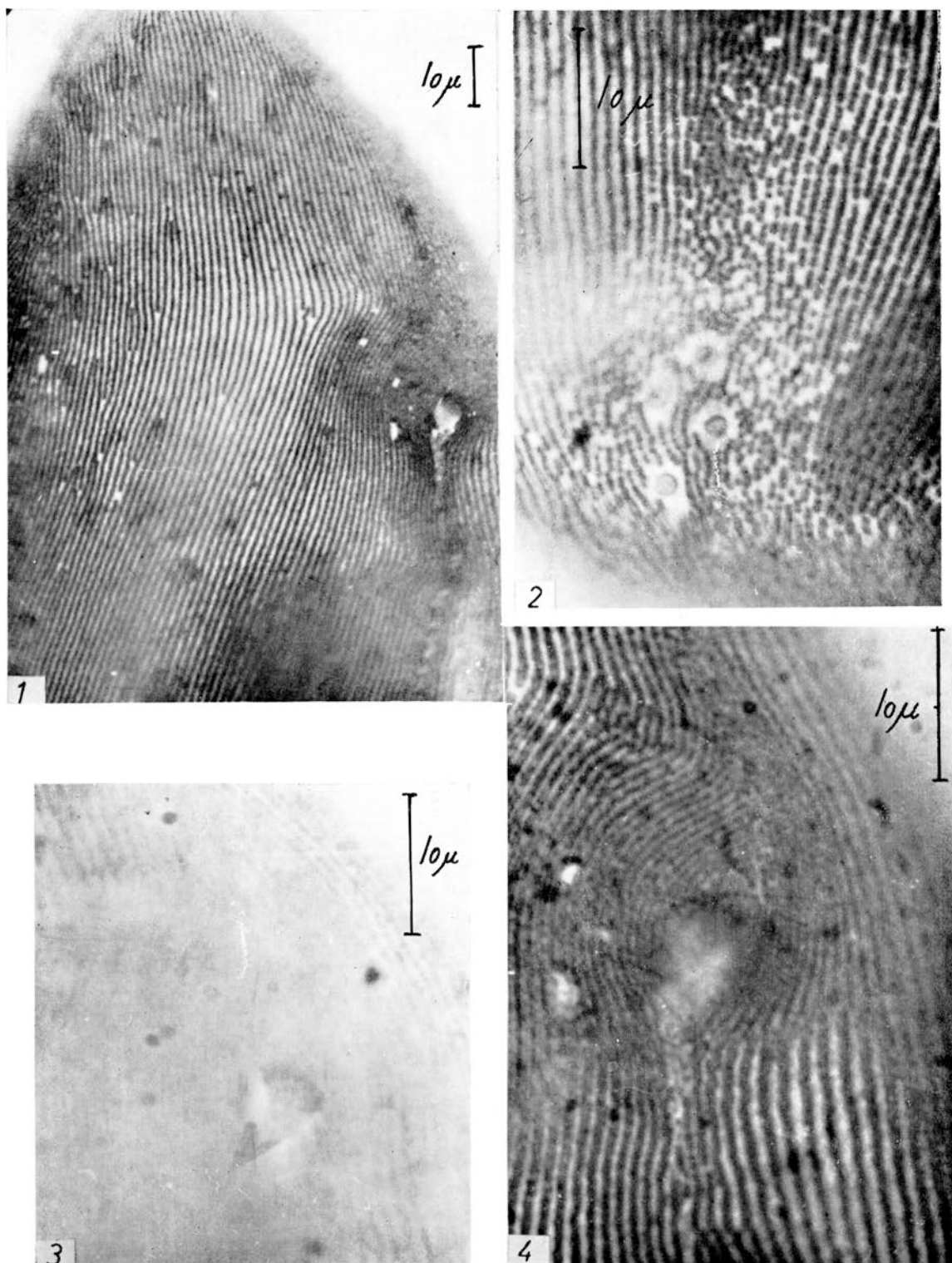
At fission the old mouth is believed to go unchanged to the proter. This could not be confirmed because the mouth of the proter is sometimes seen not to be fully developed. The explanation may be that the animals are undergoing two quickly succeeding fissions.

When the formation of the mouth of the opisthe starts, the somatic rows surrounding the band of interrupted kineties bend to the side around a cluster of dense kinetosomes, which originates from kinetosomal material from the band (Fig. 2 B and C). In a later phase of fission, the kinetosome cluster differentiates into an anterior and a posterior part (Fig. 2 D). The anterior part forms the ciliated band of the mouth. The posterior part forms the two rods. In the fully developed mouth the rods appear homogenous, and it is not believed that they carry cilia.

Sometimes epidemics of divisions were observed. It was then usual to see individuals with several mouth "Anlagen".

Nuclei (Fig. 4).

Neither Feulgen nor iron haematoxylin revealed a micronucleus in *Gullmarella* from any of the known host animals.



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PLATE I.

1: The infraciliature of the anterior ventral side. 2: The ventral posterior end showing the contractile vacuole pores. 3 and 4: The mouth at two depths of focus. In 4 the somatic kineties curving around the mouth are seen, in 3 the ciliated band and the rods. (All *Ag* preparations.)

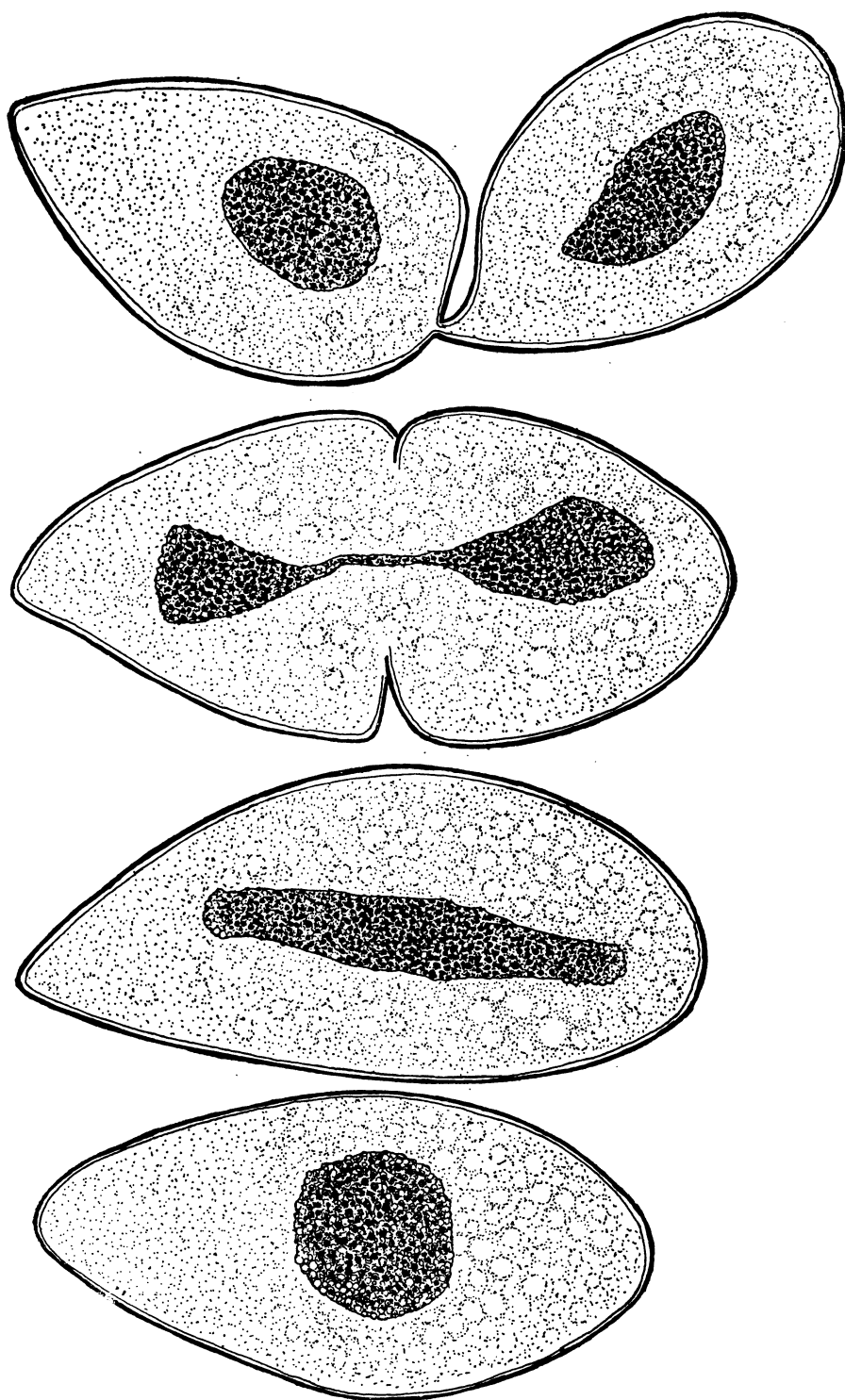


FIG. 4.

The macronucleus in a vegetative individual and in three phases of division.
From specimen fixed with Schaudinn and stained with Feulgen.

The macronucleus is spherical and has a central position. It measures about 40 μ in diameter. It is of the normal type, consisting of a conglomerate of DNA containing granules and Feulgen-negative nucleoles.

Biological remarks.

Syndosmya nitida was examined for *Gullmarella* several times in the period from September 1962 to June 1963. No seasonal variation in size and frequency of the infection was found. The percentage of host animals infected varied from 10 to 80 in the different localities. The highest frequencies were found in dense populations of the host lamellibranchs.

About 100 ciliates in one *Syndosmya* is not uncommon, the space between the faecal pellets then being quite filled with the parasites. Sometimes however, one host specimen may provide only a few ciliates.

In *Cultellus pellucidus*, *Gullmarella* was also found commonly. *Syndosmya alba*, *Lucinopsis undata*, *Venus ovata* and *Corbula gibba* were only examined in a few cases. It seems however that *Gullmarella* is rarer in the two last mentioned bivalves. In the Gullmar fjord the ciliate was never found in different *Nucula* spp. or in *Leda pernula* (Müller) which lives side by side with *Syndosmya* in several localities.

Liberated in clean sea water the ciliate only survives a few hours, in the isolated host intestine they can live for about 24 hours. Cysts were never observed. Losses to the ciliate population due to the defaecation of the host must be considerable. This probably explains the high percentage of dividing ciliates often found. In some cases the majority of individuals showed some sign of fission. In one case three conjugating pairs attached with their ventral sides were observed. Their macronuclei were fragmented, but neither here were micronuclei observed. In all three cases the conjugants were of unequal size.

Systematic discussion.

The systematic position of *Gullmarella* is difficult to decide, and no quite satisfactory solution of the problem was found.

Gullmarella has no real buccal ciliature which can be compared with the tetrahymenal type. Consequently, it can not be included in Hymenostomatida or groups derived from this order.

Also is it difficult to include the ciliate here described in the Trichostomatida according to the definition of this group by Corliss (1961). The oral ciliature of *Gullmarella* is uncomparable to that typical of trichostomes and it has no well defined vestibulum.

The trichostome ciliate *Conchostoma longissimum* described by Fauré-Fremiet (1963) shows some resemblance to *Gullmarella* in the arrangement of the kineties and the oral ciliature. Also *Conchostoma* possesses an armature in connection with the mouth. But according to Fauré-Fremiet (private communication) the mode of fission in *Gullmarella* excludes a relationship with *Conchostoma*.

The genus *Paranassula* Kahl belongs to the cyrtophorine gymnostomes (Fauré-Fremiet 1962) and reminds of *Gullmarella* in the arrangement of the somatic kineties. During the stomatogenesis of both genera, the mouth organelles of the opisthe are formed by a cluster of kinetosomes originating from a postoral kinety. But the oral rods of *Gullmarella* cannot be directly compared with the "nasse pharyngienne" of *Paranassula*, and the oral ciliation of the ciliate here described does not have much resemblance to that of *Paranassula*.

However, it is found most reasonable, because of the arguments mentioned above, which admittedly are mostly negative, at least provisionally to classify *Gullmarella* as an aberrant ciliate belonging to *Cyrtophorina*.

In his memoir on astome ciliates, de Puytorac (1954) advocates that the majority of the astomes are descendants of thigmotrich ciliates.

The discovery of *Gullmarella* with its adaption to intestinal life (flattened body, dense and short cilia, flexibility and reduction, but not complete disappearance of the mouth) shows that holotrich ciliates not related to the hymenostome ciliates may well have given rise to some of the astome ciliates.

Type slides.

Types slides of *Gullmarella faurei* n.g., n.sp. are deposited at the International Collection of Ciliate Types, University of Illinois, Urbana, Illinois, U.S.A.

Summary

A holotrichous Ciliate, *Gullmarella faurei* n.g., n.sp., found in the intestine of the lamellibranchs *Syndosmya nitida* (Müller), *Syndosmya alba* (Wood), *Cultellus pellucidus* (Pennant), *Venus ovata* Pennant, *Lucinopsis undata* (Pennant) et *Corbula gibba* (Olivier), is described.

This species has several characters common with Astomes but presents a mouth, the structure of which shows that the species cannot be included in the *Hymenostomatida* or in derived groups.

Gullmarella is classified, at least provisionally, as an aberrant Ciliate belonging to *Cyrtophorina*.

Zusammenfassung

Der Autor beschreibt einen holotrichen Ciliaten, *Gullmarella faurei* n.g., n.sp., der in den Eingeweiden der Lamellibranchier *Syndosmya nitida* (Müller), *Syndosmya alba* (Wood), *Cultellus pellucidus* (Pennant), *Venus ovata* (Pennant), *Lucinopsis undata* (Pennant) und *Corbula gibba* (Olivier) lebt.

Diese Art hat mehrere Merkmale gemeinsam mit den Ciliaten Astomata, besitzt aber einen Mund, dessen Struktur zeigt, dass diese Art nicht in die Ordnung der *Hymenostomatida* oder davon abgeleitete Gruppen eingeordnet werden kann.

Gullmarella wird wenigstens provisorisch als aberranter Arte den Ciliaten *Cyrtophorina* (*Gymnostomatida*) zugeordnet.

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