The Phylum Ctenophora

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ABSTRACT

In this paper we have investigated some characteristics of the phylum Ctenophora. This phylum is an animal phylum. This phylum is more complex than sponges, about as complex as cnidarians, and less complex than bilaterians. Ctenophores have no brain or central nervous system, but they have a nerve net. Adults of most species can regenerate tissues that are damaged or removed. Almost all species are hermaphrodites. Development of the fertilized eggs is direct. Locomotion, feeding, excretion and respiration are other subjects that we have investigated in this paper.

1. Introduction

Ctenophores (Greek for "comb-bearers") have eight "comb rows" of fused cilia arranged along the sides of the animal, clearly visible along the red lines in these pictures. These cilia beat synchronously and propel ctenophores through the water. Some species move with a flapping motion of their lobes or undulations of the body. Many ctenophores have two long tentacles, but some lack tentacles completely (Figure 1).

Ctenophores, variously known as comb jellies, sea gooseberries, sea walnuts, or Venus's girdles, are voracious predators. Unlike cnidarians, with which they share several superficial similarities, they lack stinging cells. Instead, in order to capture prey, ctenophores possess sticky cells called colloblasts. In a few species, special cilia in the mouth are used for biting gelatinous prey.

The phylogenetic position of ctenophores has been, and still is, in dispute. Ctenophores have a pair of anal pores, which have sometimes been interpreted as homologous with the anus of bilaterian animals (worms, humans, snails, fish, etc.). Furthermore, they possess a third tissue layer between the endoderm and ectoderm, another characteristic reminiscent of the Bilateria. However, molecular data has contradicted this view, although only weakly. Therefore, this is an active area of research [8].

In this paper we will study and investigate some characteristics of the phylum Ctenophora as an animal phylum. Section 2 is titled "about Ctenophores" and we will study some characteristics of this phylum in this section. In section 3 we will discuss about feeding, excretion and respiration in ctenophores.

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Section 4 is dedicated to ctenophores' locomotion.
Section 5 is about ctenophores' nervous system and senses.
In section 6 we will study about reproduction and development. In this section we will also discuss about regeneration ability in most species of ctenophores.
At the end of the paper conclusion is placed.

2. About Ctenophores
Ctenophores form an animal phylum that is more complex than sponges, about as complex as cnidarians (jellyfish, sea anemones, etc.), and less complex than bilaterians (which include almost all other animals). Unlike sponges, both ctenophores and cnidarians have: cells bound by inter-cell connections and carpet-like basement membranes; muscles; nervous systems; and some have sensory organs. Ctenophores are distinguished from all other animals by having colloblasts that capture prey by squirting glue on them, although a few ctenophore species lack them. [1][2]

Like sponges and cnidarians, ctenophores have two main layers of cells that sandwich a middle layer of jelly-like material, which is called the mesoglea in cnidarians and ctenophores: more complex animals have three main cell layers and no intermediate jelly-like layer. Hence ctenophores and cnidarians have traditionally been labeled diploblastic, along with sponges. [1][3] Both ctenophores and cnidarians have a type of muscle that, in more complex animals, arises from the middle cell layer, [4] and as a result some recent text books classify ctenophores as triploblastic, [5] while others still regard them as diploblastic. [1]

3. Feeding, excretion and respiration
When prey is swallowed, it is liquefied in the pharynx by enzymes and by muscular contractions of the pharynx. The resulting slurry is wafted through the canal system by the beating of the cilia, and digested by the nutritive cells. The ciliary rosettes in the canals may help to transport nutrients to muscles in the mesoglea. The anal pores may eject unwanted small particles, but most unwanted matter is regurgitated via the mouth. [5]

Little is known about how ctenophores get rid of waste products produced by the cells. The ciliary rosettes in the gastrodermis may help to remove wastes from the mesoglea, and may also help to adjust the animal's buoyancy by pumping water into or out of the mesoglea. [5]

4. Locomotion
The outer surface bears usually eight comb rows, which are used for swimming. The rows are oriented to run from near the mouth (the "oral pole") to the opposite end (the "aboral pole"), and are spaced more or less evenly around the body, [1] although spacing patterns vary by species and in most species the comb rows extend only part of the distance from the aboral pole towards the mouth. The "combs" (also called "ctenes" or "comb plates") run across each row, and each consists of thousands of unusually long cilia, up to 2 millimeters (0.079 in). These normally beat so that the propulsion stroke is away from the mouth, although they can also reverse direction. Hence ctenophores usually swim in the direction in which the mouth is pointing, unlike jellyfish. [5]

It is uncertain how ctenophores control their buoyancy, but experiments have shown that some species rely on osmotic pressure to adapt to water of different densities. [6] Their body fluids are normally as concentrated as seawater. If they enter less dense brackish water, the ciliary rosettes in the body cavity may pump this into the mesoglea to increase its bulk and decrease its density, to avoid sinking. Conversely if they move from brackish to full-strength seawater, the rosettes may pump water out of the mesoglea to reduce its volume and increase its density. [5]

5. Nervous system and senses
Ctenophores have no brain or central nervous system, but instead have a nerve net (rather like a cobweb) that forms a ring round the mouth and is densest near structures such as the comb rows, pharynx, tentacles (if present) and the sensory complex furthest from the mouth. [5]

The largest single sensory feature is the aboral organ (at the opposite end from the mouth). Its main component is a statocyst, a balance sensor consisting of a statolith, a solid particle supported on four bundles of cilia, called "balancers", that sense its orientation. The statocyst is protected by a transparent dome made of long, immobile cilia. A ctenophore does not automatically try to keep the statolith resting equally on all the balancers. Instead its response is determined by the animal's "mood", in other words the overall state of the nervous system. For example if a ctenophore with trailing tentacles captures prey, it will often put some comb rows into reverse, spinning the mouth towards the prey. [6]
6. Reproduction and development

Adults of most species can regenerate tissues that are damaged or removed, [7] although only platyctenids reproduce by cloning, splitting off from the edges of their flat bodies fragments that develop into new individuals. [5]

Almost all species are hermaphrodites, in other words they function as both males and females at the same time – except that in two species of the genus *Ocryopsis* individuals remain of the same single sex all their lives. The gonads are located in the parts of the internal canal network under the comb rows, and eggs and sperm are released via pores in the epidermis. Fertilization is external in most species, but platyctenids use internal fertilization and keep the eggs in brood chambers until they hatch. Self-fertilization has occasionally been seen in species of the genus *Mnemiopsis*, [5] and it is thought that most of the hermaphroditic species are self-fertile. [2]

Development of the fertilized eggs is direct, in other words there is no distinctive larval form, and juveniles of all groups generally resemble miniature cydippid adults. In the genus *Beroe* the juveniles, like the adults, lack tentacles and tentacle sheaths. In most species the juveniles gradually develop the body forms of their parents. In some groups, such as the flat, bottom-dwelling platyctenids, the juveniles behave more like true larvae, as they live among the plankton and thus occupy a different ecological niche from their parents and attain the adult form by a more radical metamorphosis, [5] after dropping to the sea-floor. [2]

At least in some species, juvenile ctenophores appear capable of producing small quantities of eggs and sperm while they are well below adult size and adults produce eggs and sperm for as long as they have sufficient food. If they run short of food, they first stop producing eggs and sperm, and then shrink in size. When the food supply improves, they grow back to normal size and then resume reproduction. These features make ctenophores capable of increasing their populations very quickly. [2]

7. Conclusion

In this paper we investigated some characteristics of the phylum Ctenophora as an animal phylum. We discussed about ctenophores' feeding, excretion and respiration then we got into locomotion in ctenophores. After that we studied about their nervous system and senses. Reproduction and development was the last subject that we investigated.

References