REPRODUCTION AND DEVELOPMENT OF POLYCHAETES: AN OVERVIEW

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Abstract

A subphylum of annelida phylum known as polychaete mainly found in marine habitats and showing physical morphology with bristles and a complete nervous system is reviewed in this paper.it contains the physical and internal anatomy and development of polychaete also its reproduction have been explained in this paper.

Keywords:polychaete, annelida, polychaete-reproduction, development of polychaete

INTRODUCTION

Among the Polychaeta (sand worms, tube worms, and/or clam worms), the Scolecida, the Aciculata (including the Amphinomida, Eunicida, Distribution of species of Namanereis (Nerededidae)&Stratiodrilus (Histriobdellidae) were recognised as the three most important groups. Reproduced with Chris Glasby's gracious permission.

The Polychaeta subphylum of the Annelida phylum has more than 14,000 species, the majority of which live in or near the ocean[1]. Polychaetes are segmented worms with bristle-like features connected to the outermost section of the body, which are responsible for movement&defence, varying in length from less than a millimetre to several metres[2,3]. Two pairs of parapodia (singular: parapodia) are found at each segment, where bristles (chaetae), siliceous&chitin-calcareous, can be found [4]. Sedentary&errant kinds are the most common[5]. They have evolved in this way to fit their environments&lifestyles. To find polychaetes, look for them digging into the sand or constructing calcareous reef formations beneath the surface of a body of water, whether it freshwater, terrestrial, or deep sea. Some polychaetes are pelagic, or live as parasites or commensals in the water column[6].

In *Eunice aphroditois*, polychaetes are worms having that can range in length from 1 mm (0.04 inches) to 3 m (10 feet) in length. Brightly coloured, dazzling,&luminous varieties are possible. Several species of worms have parapodia that are paddle-like &highly vascularized, which are utilised for locomotion also, in many cases, represent the worm's primary respiratory surfaces. Chaetae, which are bundle of bristle, protrude from the parapodia. [7]

The Nereidae are ubiquitous polychaetes occurring in coastal&estuarine settings. Species such as Nereisdiversicolor may dwell in such regions at concentrations up to 3700 m2 [23].They can adopt a multitude of eating techniques including proactive predatory, herbivory, suspended&deposited feed [24; 25].

Polychaetes, on the other hand, can show a broad diversity of body shapes that deviate from this generalised pattern. Those that crawl along the bottom are the most common polychaetes, but others have evolved to a wide range of biological niches, including burrowing&swimming, as well as pelagic life&tube-dwelling or digging.In comparison to other annelids, the prostomium, or head, is relatively highly developed. As a result, the animal's mouth is situated on its bottom. Although some species are blind, the average skull has two to four eyes. Alciopids have complex eyes that rival those of cephalopods &vertebrates[8]. Antennae, tentacle-like palps,&"nuchal organs," pits lined with cilia, are all found on the skull. These appear to be chemoreceptors, which aid in the worm's ability to locate food [7].

PHYLOGENETIC RELATIONSHIP

Polychaetes were traditionally divided into two groups: the 'Errantia'&the 'Sedentaria.' Rather than using evolutionary reasoning, this divide was based on a system of convenience [10]. Polychaetes may now be divided into two major clades, Scolecida&Palpata, according to cladistic investigations of the Annelida& other taxa [9]Scolecida, a tiny genus of burrowing worms with bodies resembling earthworms, with less than 1000 recognised species. Palpatapolychaetes make up the bulk of polychaetes. Aciculata&Canalipalpata are two sub-groups of the Palpata. Aciculata, which includes the majority of the old taxonomic category Errantia, is home to half of the polychaete species. They have well-developed eyes&parapodia with internal supporting chaetae (or aciculae) enabling quick mobility in the phyllodocids&the Eunicida. There are around 5000 species in the Canalipalpata genus, which is known for its lengthy, grooved palp structures, which are utilised for eating. There are three sections of Canalipalpata: the Sabellida, the Spionida,&the Terebellida sections. Palps are used by most of these groups to feed in a variety of ways.

DEVELOPMENT OF POLYCHAETE

External anatomy

There are three parts to a polychaete's head: the pharynx; the prostomium;&the peristomium. Often, the prostomium is the first pre-segmental component of the body before the mouth,&it may or may not be retractable. The antennae have sensory organs, while the palps may be sensory or employed as feeding appendages, depending on their function.

The prostomium of certain species has one or two eyes. An important part of the peristomium, which is a postprostomal area or segment around the mouth, is that it comprises the proboscis&the tentacled cirrus (particularly in the case of Ciliary feeders). Chaetae, pals,&even chitnous jaws can be seen on the latter. Pharynx, the first section of the digestive tract, is utilised for eating&burrowing,&is generally eversible.

Segmentation of the trunk or body is a common occurrence. A ganglion&a pair of nephridia are typically found in each segment for excretion purposes (figure 1). On both edges of each segment are a pair of flatlike extensions called parapodia. Locomotion&gas exchange occur via the parapodia. Many polychaetes have unjointed segmental extensions of the body wall known as parapodia, although not all do. Clitellata&Echiura are the only other taxa without them. Chaetae are commonly carried by parapodia, which are armed with musculature derived mostly from the circular muscle layer. The dorsal notopodium&the ventral neuropodium are the two primary structural components of parapodia, which can vary in shape. Notopodia&neuropodia can feature a variety of cirri&gills in addition to the chaetae bundles. Each segment's parapodia movement is controlled by oblique muscles that go from the midventral line to the parapodia [figure 1]. Large fleshy lobes that serve as paddles can be found in busy crawling or swimming organisms. This kind of parapodia is known as an uncini,&it is seen on polychaetes that burrow or are tubicolous in their habit of burying themselves. For example, each parapod has bristle-like bristles that aid in motility, feeding,&the construction of tubes. They can be simple, compound, chaetic, capillary, bifurcated or trigonal, pinnate, harpoon, pectinate or spatulate, as well as capillary, bifurcated or trifurcated. A dorsal or terminal anus can be found in the posterior body part of the tail, which is truncated or tapered. Cirri is another possibility to consider. Gills can be seen on several polychaetes. The Aeolosomatidae feature a wide, lobe-like prostomium that is almost entirely ciliated ventrally&includes lateral ciliated grooves that have been interpreted as nuchal organs. Myofunctional pharynx is located in periosteum. There appears to be external segmentation on the trunk, but it is actually a chain of zoids formed by fragmentation (paratomy). There are no parapodia,&chaetae are almost always present as four bundles per segment. They normally consist entirely of capillaries, however sigmoid hooks or even just hooks are not uncommon. The cells of the epidermal glands are responsible for the vibrant hues of the human body. Vacuoles in each gland cell are packed with a variety of coloured liquids; the gland cells' functions remain a mystery (11).

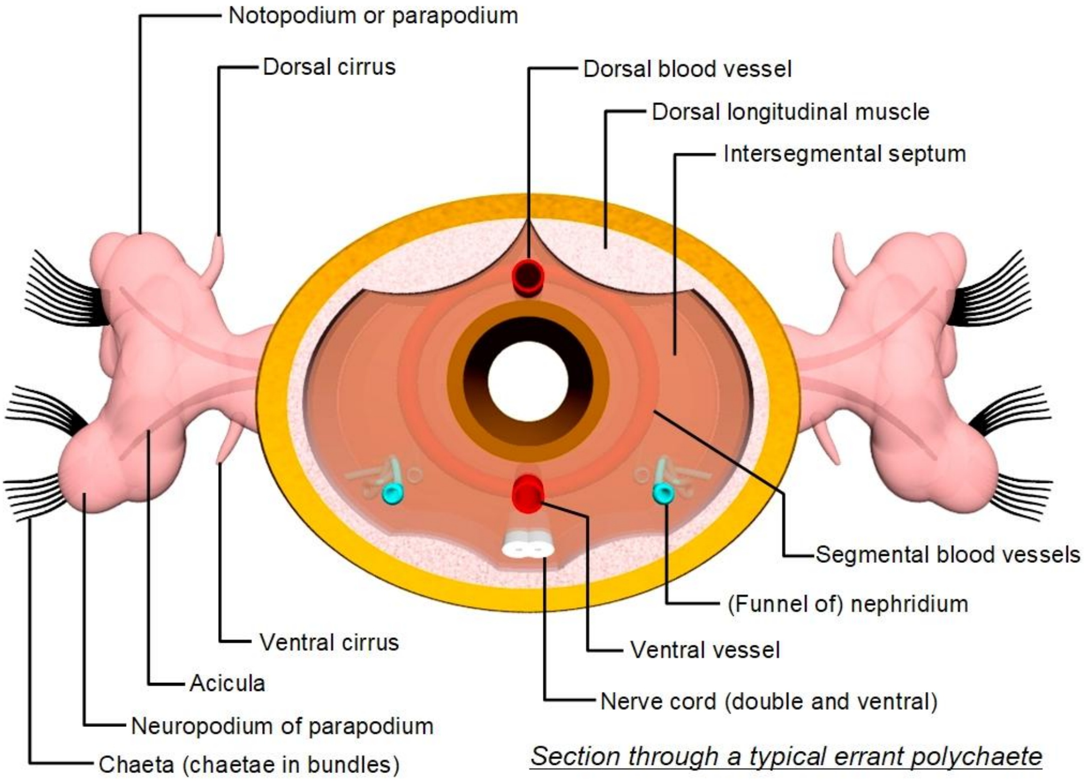

Figure 1: Cross sectional diagram of a polychaete segment

The Aeolosomatidae&Potamodrilidae are close relatives. In Potamodrilidae, the peristomial portion is restricted to lips because the prostomium is united to the peristomium, which is flattened&frontally blunt. Nuchal organs appear as paired sensory papillae instead of antennae or palps. There are no tentacles, dorsal or ventral cirri in the parapodial structures of any of the segments. All of these features, as well as gills&other external features like as epidermal papillae&piggy-back cirri, are missing. The chaetae are all formed like hair. External and internal anatomy of segemented worms in class polychaete is given below in figure 2

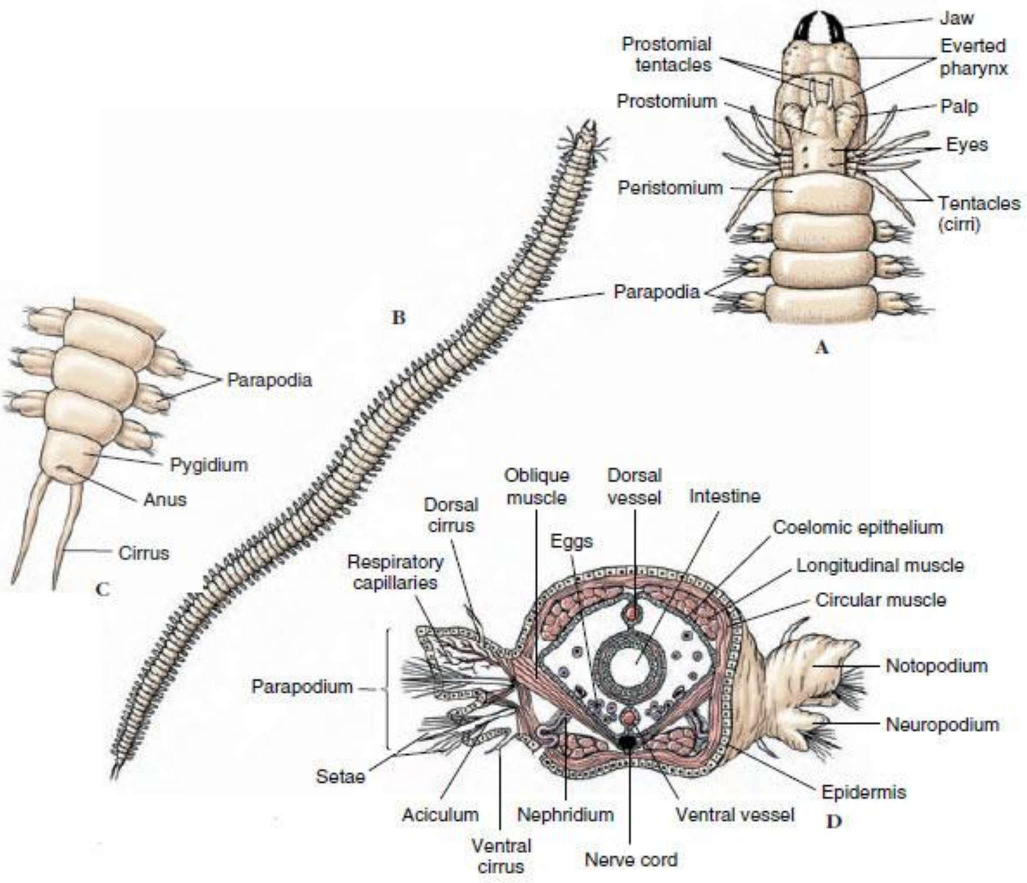

Figure 2:Anatomy of different polychaete worms

Internal anatomy

Polychaetes have a body wall that is both circular&longitudinal in shape, making them unique in the animal kingdom cellulosic cuticle around the dinal muscle fibres an epidermal epithelium secretes. As with other annelids, polychaetes are equipped with a brain or cerebral ganglion that is located in the head. Sessile or burrowing species have simple brains with limited differentiation, while mobile active forms' brains are the most sophisticated. Circumpharyngeal connectives, which run along either side of the pharynx, connect the brain to the ventral nerve cord. For the most part, this nerve cord is made from two cables that are bundled together. Variable thicknesses&dilation of the nerve cord result in segmental nerves passing out to the body wall (muscles)&the gut (gastrointestinal system). The digestive system of polychaetes consists of a foregut, a midgut,&an aftergut, Stomodeum, throat,&anterior oesophagus make up the foregut. When present, the jaws are made of cuticular protein&the cuticle. Absorption occurs farther back in the midgut than enzyme secretion, which occurs in the midgut's more anterior sections. The anus, located on the pygidium, serves as a conduit connecting the midgut with the external through a small hindgut.

Among polychaetes, there are six main types of sensory structures. There are a number of different types of organs&structures found in animals. Many polychaetes have antennae&palps on their heads. Palps are employed for feeding in certain cultures, whereas sensory perception is the norm in others. Satocysts are sensors for balancing the body's internal chemistry. Chemosensory nuchal organs are innervated from the back of the brain&have ciliated, paired structures[9].They might be an apomorphy for Polychaeta based on their presence in practically all polychaetes. According to some writers, the absence of nuchal organs in Clitellata/Oligochaeta may be an apomorphy for the Annelida,&that they may have been lost in these two species [12]. A wide variety of epidermal sensory cells exist in Polychaetes, some of which are sensitive to light&others which are not (such as lateral organs). Both the circulatory system&the coelom are involved in excreting waste materials in most polychaetes. Nephridia are the ducts that allow this excretion to take place,&they are generally referred to as such. The maturation of gametes in the coelom necessitates the use of gonoducts or coelomoducts, which are essentially the same thing. Segmental organs are used to describe the two types of ducts since distinguishing whether one is present is difficult. Most polychaetes&Echiura have a closed circulatory system, as do many clitellates. Closed vascular systems in certain polychaetes are restricted to main blood arteries, whereas distal capillaries are absent in other polychaete populations Many tiny polychaetes lack a circulatory system. Some taxa have protonephridia&mixed proto-and metanephridia in their polychaete excretory organs.

There are just two metanephridia per segment in most polychaetes; their nephrostome (internal end) opens into a coelomic compartment. The nephrostome receives the coelomic fluid,&the nephridial duct undergoes selective resorption.

Reproduction

Most polychaetes are not hermaphroditic, but rather have different sexes. There are gonads in every segment of all but the most rudimentary species; nevertheless, most species show some degree of specialisation. Immature gametes are expelled from the gonads into the body cavity, where they mature. Through ducts or apertures that differ across species, or in certain circumstances, by the total rupture of the body's wall, gametes are released into the surrounding water (and subsequent death of the adult). Only a few species reproduce sexually, but the vast majority rely on external fertilisation to complete the life cycle of their eggs.

Trochophore larvae, which float among the plankton, normally hatch from fertilised eggs&subsequently transform into adults by adding segments. Only a small number of species have larvae that hatch into adult-like forms&many of those that do produce larvae survive only on yolk from the egg.There are several methods that polychaetes reproduce&distribute themselves in the world. Sexual reproduction is the most prevalent form of reproduction, however certain animals have exceptional asexual reproductive ability as well.

Sexual&asexual

All fresh-water polychaetes copulate sexually, despite the fact that several oceanic polychaetes do so asexually. However, there are several crawling&swimming species of polychaetes that are hermaphroditic. Marine variants have a free-swimming larval stage, but all fresh-water organisms do not. The freshwater polychaetes lack permanent sex organs&frequently have different sexes. Gonads, which emerge as swellings in the peritoneum&shed their gametes into the coelom, make up the reproductive system, which is a straightforward structure. The gonoducts, metanephridia, or the body wall can then transport the gametes to the outside. There is no internal fertilisation.

Asexual transverse fission is the most common method of reproduction for aeolosomatids (paratomy). When the worm reaches a certain number of metameres, reproduction begins (depending on the species). There are several zooids at this stage, which are cloned from the parent zooid&detach within a few days of each other (fragmentation). It just takes one to four days for the Aeolosomatidae to multiply [13]. Using this method of reproduction, populations can grow fast. Only a few species have been documented to have sex in the wild [14]. There is just one species known to reproduce entirely by sexual reproduction, *Aeolosomasingulare* [15].

Polychaete species that live on hard substrata might also have varying reproduction methods at various depths. It is possible that seasonality is more pronounced in deeper habitats as a result of intense interspecific competition. In contrast, animals in the shallowest zones are able to reproduce indefinitely. Because of the high levels of physical stress in these areas, it's reasonable to interpret this as a requirement for a constant supply of larvae. [16]

Polychaete*A. hemprichi*&*Aeolosomavariegatum* require a temperature range of 20–30 degrees Celsius for growth&reproduction, while at 10 degrees Celsius, reproduction ceases [17]. Aeolosomatidae, particularly A. hemprichi, have been found in large numbers by a number of authors at wastewater treatment plants where they help reduce sludge [18].

Diversity&sitribution

As a subfamily within Naredidae, the 37 species in three genera (Lycastoides, Namanereis,&Namalycastis) recorded from freshwater, semi-terrestrial,&reduced-salinity settings [19]. Water-filled tree holes in Papua New Guinea&wet leaf axils of Pandanus trees in Fiji have provided the source for Namanereiscatarractarum. PolychaeteNamanereiscavernicola is found at 1650m above sea level&176km from the Pacific coast in a freshwater pool in a Mexican cave. Groundwater samples from the Sultanate of Oman also contain Namanereisaraps [20]. There is a global distribution of the family Aeolosomatidae, which is primarily freshwater, but may also be found in shallow brackish waters (21). Decomposed plant debris has been gathered from ponds, lakes,&rivers (22). Figure 3 below shpws two worms living in harsh conditions

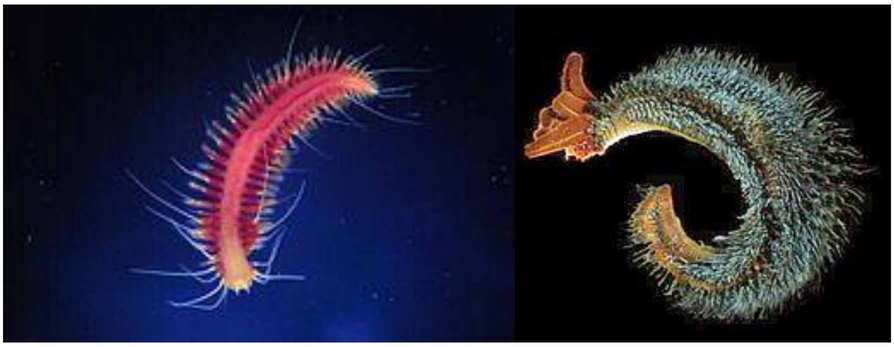

Figure 3 Left : Hesiocaecamethanicola **right :** Pompeii worm

CONCLUSION

The polychaete is very widely distributed around the globe and this wide distribution have lead researchers to study about them. Due to their ability to survive in harsh enviornments from that live 80 degree to Hesiocaecamethanicola that lives in great depths of mthane ice their reproductive system and development is need to be understood for futute researchers to utlize this for the betterment of society. There is more and more there which is not understood questions lying unanswered in the world of science these can be only answered when we climb step by step.

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