

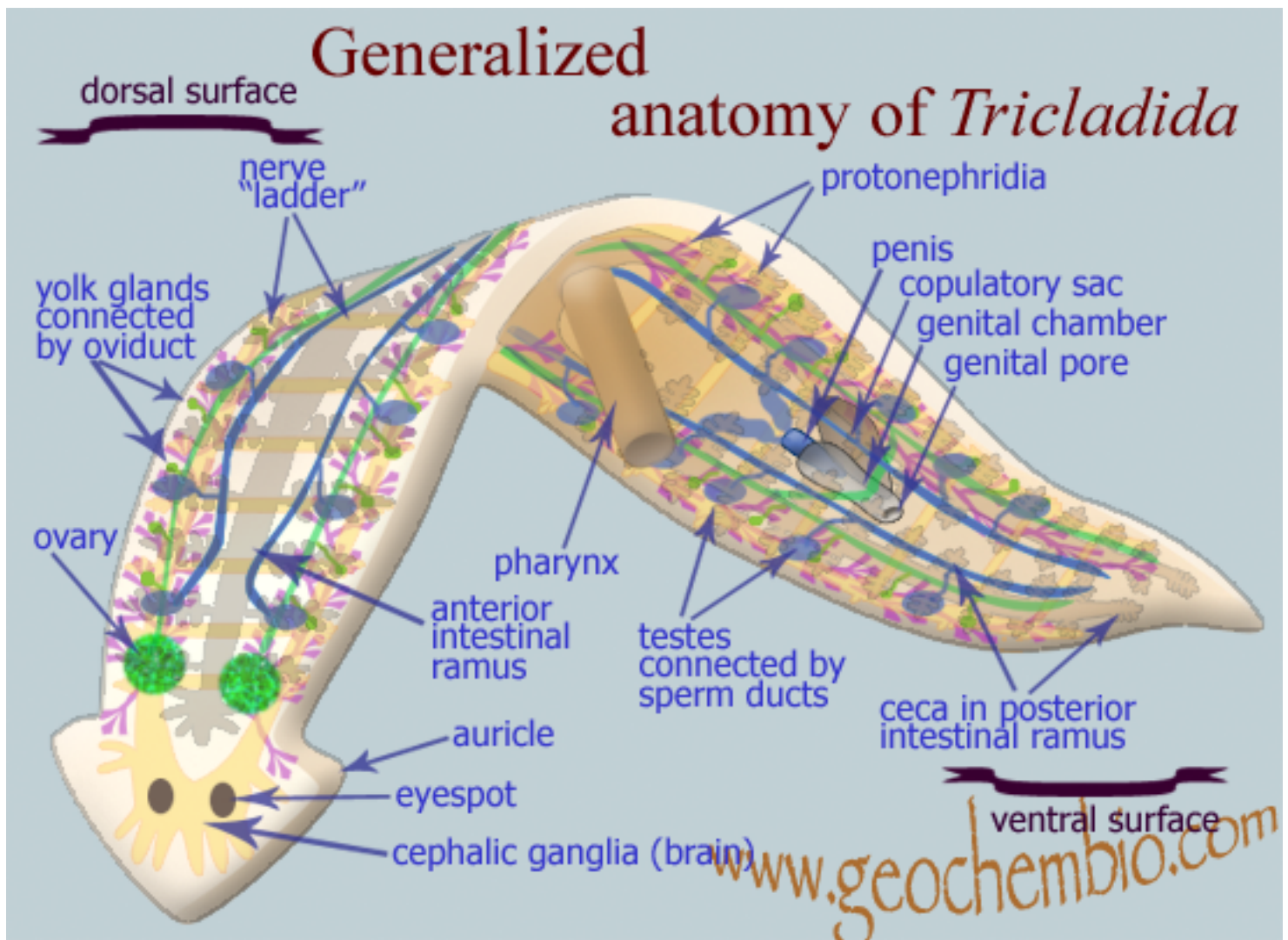
<http://www.GeoChemBio.com>:

## ***Schmidtea mediterranea***

- [Taxonomy](#)
- [Brief facts](#)
- [Life cycle](#)
- [Tissues](#)
- [References](#)

### **Taxonomy**

cellular organisms - Eukaryota - Fungi/Metazoa group - Metazoa - Eumetazoa - Bilateria - Acoelomata - Platyhelminthes - Turbellaria - Seriata - Tricladida - Paludicola - Dugesiidae - Schmidtea - Schmidtea mediterranea



## Brief facts

- *Schmidtea mediterranea* is a fresh-water, non-parasitic flatworm of the phylum *Platyhelminthes*.
- *Schmidtea mediterranea* is used extensively as a model organism to study development and regeneration for more than 200 years.
- Recently these species has emerged as the species of choice for modern molecular biological and genomic research due to its diploid chromosomes and existence in both asexual and sexual strains.

## Basic morphology/anatomy

- Planarian body is bilaterally symmetrical.

- Planaria have 3 germ layers: **ectoderm**, **mesoderm**, and **endoderm** (triploblast tissue organization).
- Planaria possess a centralized nervous system which consists of a primitive "brain" and sensory organs located at the organism's anterior (cephalization), as well as of two ventral nerve cords running along the body from "head" to "tail". Decapitated planarians can completely regenerate a new brain.
- Planarians have a solid body with no **coelom** (body cavity).
- The digestive system consists of a mouth, pharynx, and a branched intestine. The food, sucked by the muscular mouth, passes the pharynx and gets distributed into the intestinal branches where it is digested and absorbed.
- Planarians receive oxygen and release carbon dioxide by diffusion.
- Planarians have a dedicated excretory system which consists of many tubes, and pores. Specialized excretory cells (**flame cells**) remove unwanted liquids and metabolites.
- Planaria have both testes and ovaries.

## Tissue plasticity

- Planarians are best known for their capacity to regenerate complete individuals from minuscule body parts unlike other widely used model organism, *Caenorhabditis elegans*. For instance, a small fragment removed from the flank of a planarian is capable of re-specifying its parts to regain bilateral symmetry and dynamically reset positional values of cells to produce normal, properly proportioned animal. This extraordinary regeneration capability is enabled by existence of somatic stem cells, called **neoblasts**, that are distributed throughout of the planarian body.
- Planaria can survive prolonged starvation which turns on complex mechanisms of selective destruction and de-differentiation of body organs with gradual decrease in body size of the organism. During the course of many months, a full grown adult (~20 mm in length) can shrink to a size that is smaller than when it hatched from the egg capsule (~1 mm).

## Life cycle

*Schmidtea mediterranea* exists as both sexual worms that reproduce as cross-fertilizing hermaphrodites and asexual worms that reproduce strictly by transverse fission.

- sexual

in sexual mode of reproduction, hermaphroditic planarians mate with a partner, cross-fertilize and then deposit egg capsules, in which 1-20 planarians embryo develop, depending on the species

- egg

- fertilized egg

- embryo

- hatching

- juvenile

undersized worm, which did not developed reproductive organs

- adult

fully-developed grown worm; the life span of individual planarian can be as long as 3 years, likely due to the ability of neoblasts to constantly replace aging cells

- sexually competent adult

- asexual adult

- asexual

in asexual mode of reproduction the worm adheres to

the substrate while the anterior part pulls away; the worm stretches itself, becoming longer and thinner, until the fission event occurs in the posterior two-thirds of the animal; two fragments are generated, each of which will regenerate the missing tissue, thereby producing two worms; the fission is stimulated under conditions of low population density, at higher temperatures, and occurs predominantly in the dark; individual animals in clonal lines of some planarian species replicating by fission have been maintained for over 15 years

## Tissues

- digestive

- pharynx

pharynx is a muscular, protrusible tube housed in a spacious **pharyngeal cavity** which opens to the exterior via the **mouth**; the proximal end of the pharynx opens into the **intestine**; during feeding, the pharynx lengthens many times of its resting length and is extended out of the mouth to reach the food

- intestine

intestine immediately divides into one **anterior ramus** and two **posterior rami** (the name *Tricladida* alludes to the presence of the three rami); each ramus ends blindly and bears **ceca**, or **diverticula** which provide effective diffusion of food throughout the body

- excretory system

- **protonephridium**

a network of dead-end tubules lacking internal openings

- **flame cell**

cells located in the bottom of the tubules; by beating their cilia the cells create an outward going current which pull waste fluids from inside of the animal; the waste fluid is led then through the tube, formed by the **canal cells**, and exits the animal through a small opening, **nephridiopore**

- **reproductive system**

the worms are **hermaphrodites**, *i. e.*, individual organism has both female and male reproductive organs

- **female genital**

- **oviduct**

after the planarian separate, the sperm leave the **copulatory sac** and swim up to the oviduct to fertilize eggs as they are discharged from the ovaries; the eggs then pass down the oviducts where yolk and shell are formed before eggs pass out through the **genital pore**

- **ovary**

planarians often have only one pair of ovaries located at the anterior end of the

worm, close behind eyes; here the eggs are produced

- **yolk gland**

or **vitelline gland**, or **vitellarium**; vitellaria form yolk and eggshell components (in contrast, in most higher animals the yolk is part of the egg)

- **male genital**

- **testis**

planarians have numerous testes connected by **sperm ducts (vas deferens)** to the penis; the penis protrudes into **genital chamber** and often is armed with stylet

- **penis**

some free-living flatworms perform a type of copulation known as **hypodermic impregnation**, whereby the penis of one animal pierces the epidermis of another and injects sperm into the tissues; alternatively, the penis is protruded out of **genital pore**, and is inserted into the **copulatory sac** of the sexual partner

- **nervous**

- **brain**

the brain of planaria consists of two **cerebral ganglia** (clusters of nerve cells) that are joined by a **commissure**; planaria are highly

cephalized, with a brain to body mass ratio close to that of a rat

- **nerve cord**

longitudinal nerve cords extend from the brain and run along the body; they are connected by transverse commissures; smaller, lateral nerves which extend from the cords end with peripheral nerve plexuses

- **sensory system**

planaria have advanced sensory systems, capable of detecting light, chemical gradients, vibrations, electric fields, magnetic fields, and gamma radiation

- **eye**

or **eyespots**, also called **ocellus**; planaria have two dark eyespots located on the head; eyespots consist of photoreceptors that are able to detect the intensity of light

## References

### PubMed articles

- Sánchez AA. The freshwater planarian *Schmidtea mediterranea*: embryogenesis, stem cells and regeneration. *Curr Opin Genet Dev.* 2003 Aug; 13(4):438-44. **PMID: 12888018**
- Newmark PA, Sánchez AA. Not your father's planarian: a classic model enters the era of functional genomics. *Nat Rev Genet.* 2002 Mar; 3(3):210-9. **PMID:**

**11972158**

- Sánchez AA. , Kang H. Multicellularity, stem cells, and the neoblasts of the planarian *Schmidtea mediterranea*. *Exp Cell Res*. 2005 Jun 10 **PMID: 15925584**  
**[Full text here](#)**
- 



Last updated 03/15/09  
nemose@live.com

©Nemose 2008 - 2009 All rights reserved