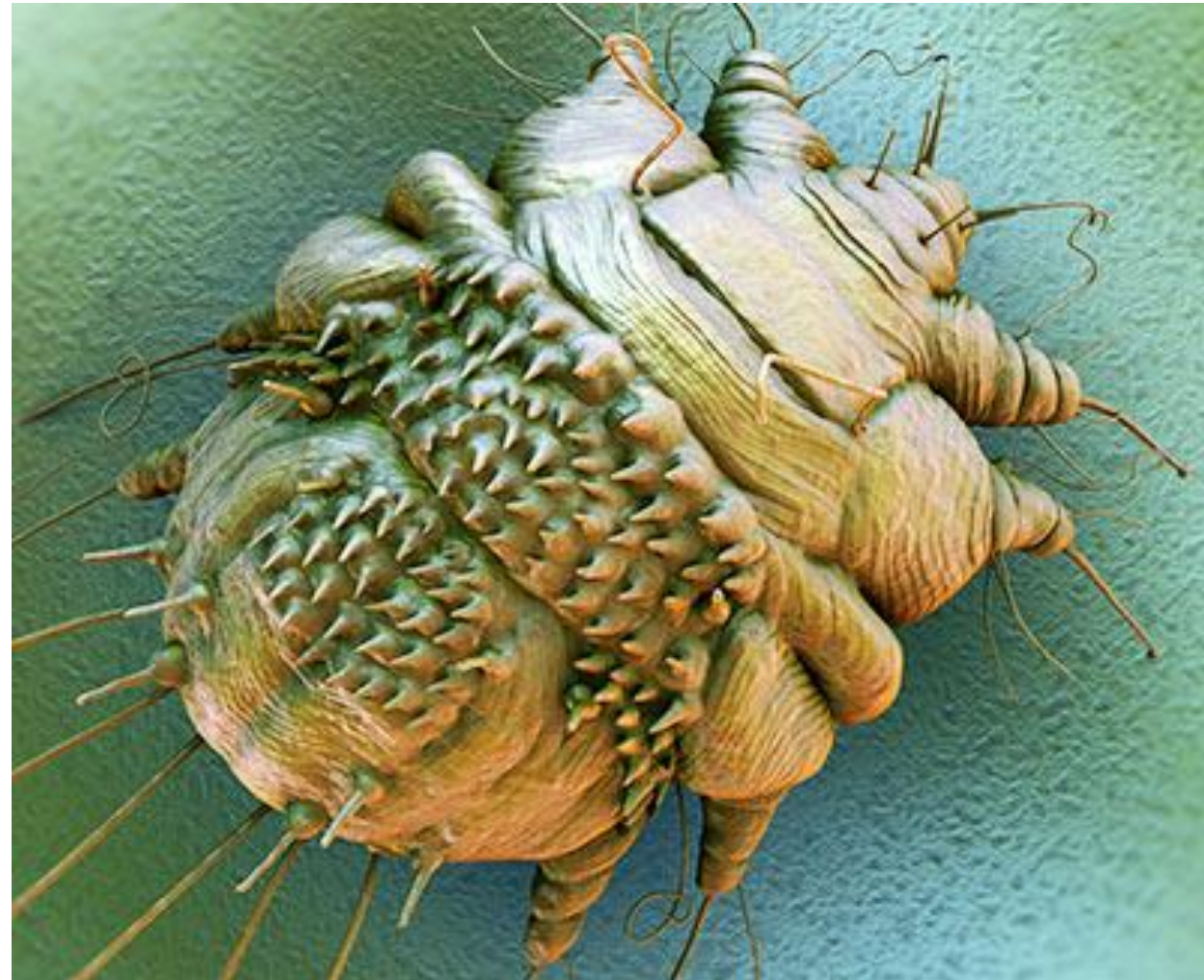


# Advanced Parasitology

(ZOO 510)







# LECTURE (4)

**Protozoan parasites**  
**Myxosporidian parasites**



# Lecture contents

1 **Fish parasites**

2 **Phylum Myxozoa and classification**

3 **Description of fresh spores and transmission of myxozoa**

4 **Life cycle of myxosporidian parasites**

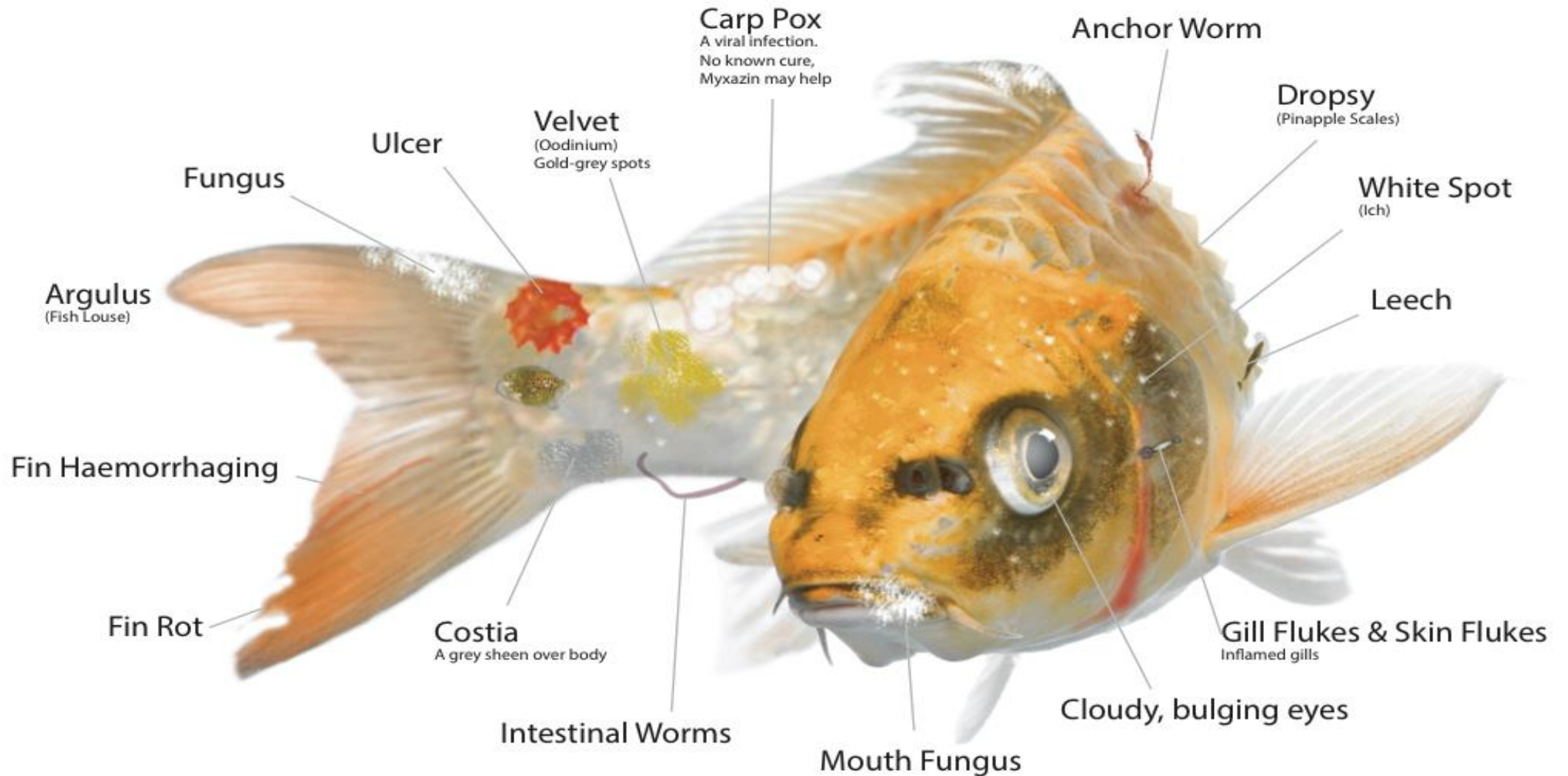
5 **Host immune response against myxosporean infection**

6 **Chemotherapy of myxosporea**

7 **Examples**

# Fish parasites

Fish are important members of aquatic ecosystems and an important source of human food. Parasitism as well as industrial effluents discharged directly to water by various sources have been found to cause heavy fish mortality.



## Phylum Myxozoa

Myxosporidian are mainly parasites of fish with a few representatives in amphibians, reptiles and some invertebrates causing serious or fatal infection.

**There are two forms of Myxozoan parasites:**

### 1- Coelozoic species

inhabit the body fluids such as gall bladder and urinary tracts. Trophozoites may have cytoplasmic holdfast outgrowths or moving pseudopodia and usually contain two spores.

### 2- Histozoic species

infect various tissues, mostly intercellular and rarely intracellular. Trophozoites are immobile and contain usually high numbers of spores.

### Plasmodia

Small cysts with indistinct demarcation between parasite and host tissue were observed containing early and advanced sporonts of fish. Mature spores were located centrally, while the developmental stages were peripherally arranged inside plasmodia. There is a thin layer of the host connective tissue encapsulated the plasmodia.



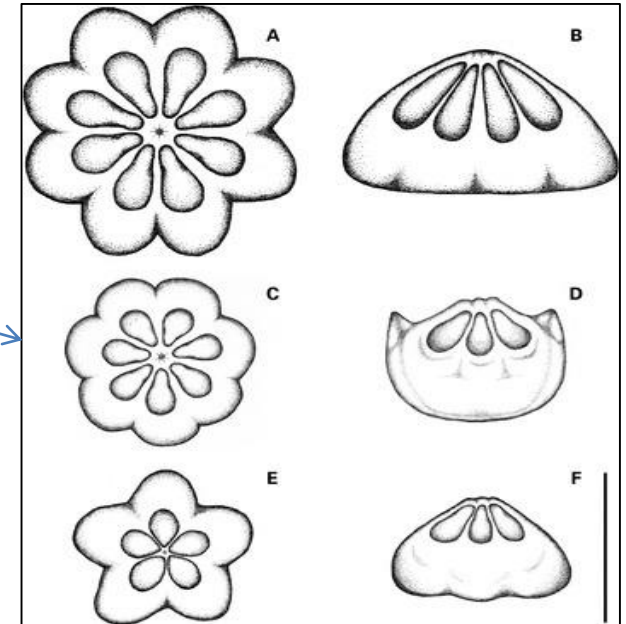
- Phylum I. Sarcomastigophora
  - Subphylum 1. Mastigophora
    - Class (1) Phytomastigophorea
    - (2) Zoomastigophorea
  - Subphylum 2. Opalinata
    - Class (1) Opalinatea
  - Subphylum 3. Sarcodina
    - Superclass 1. Rhizopoda
      - Class (1) Lobosea
      - (2) Acarpomyxea
      - (3) Acrasea
      - (4) Eumycetozoea
      - (5) Plasmodiophorea
      - (6) Filosea
      - (7) Granuloreticulosea
      - (8) Xenophyophorea
    - Superclass 2. Actinopoda
      - Class (1) Acantharea
      - (2) Polycystinea
      - (3) Phaeodarea
      - (4) Heliozoa

- Phylum II. Labyrinthomorpha
  - Class (1) Labyrinthulea
- Phylum III. Apicomplexa
  - Class (1) Perkinsea
  - (2) Sporozoea
- Phylum IV. Microspora
  - Class (1) Rudimicrosporea
  - (2) Microsporea
- Phylum V. Ascetospora
  - Class (1) Stellatosporea
  - (2) Paramyxea
- Phylum VI. Myxozoa
  - Class (1) Myxosporea
  - (2) Actinosporea
- Phylum VII. Ciliophora
  - Class (1) Kinetofragminophorea
  - (2) Oligohymenophorea
  - (3) Polyhymenophorea

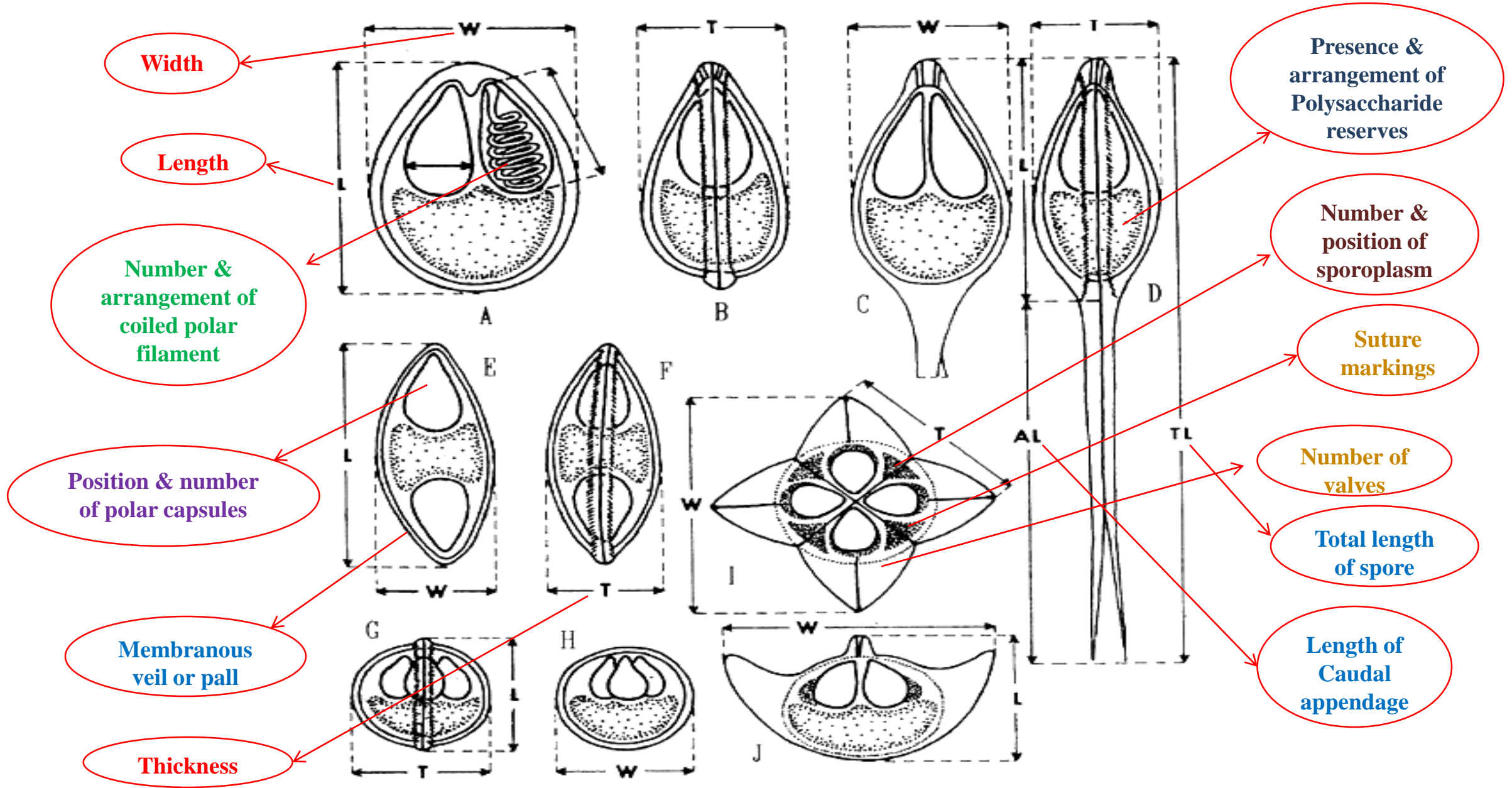
### Order Bivalvulida



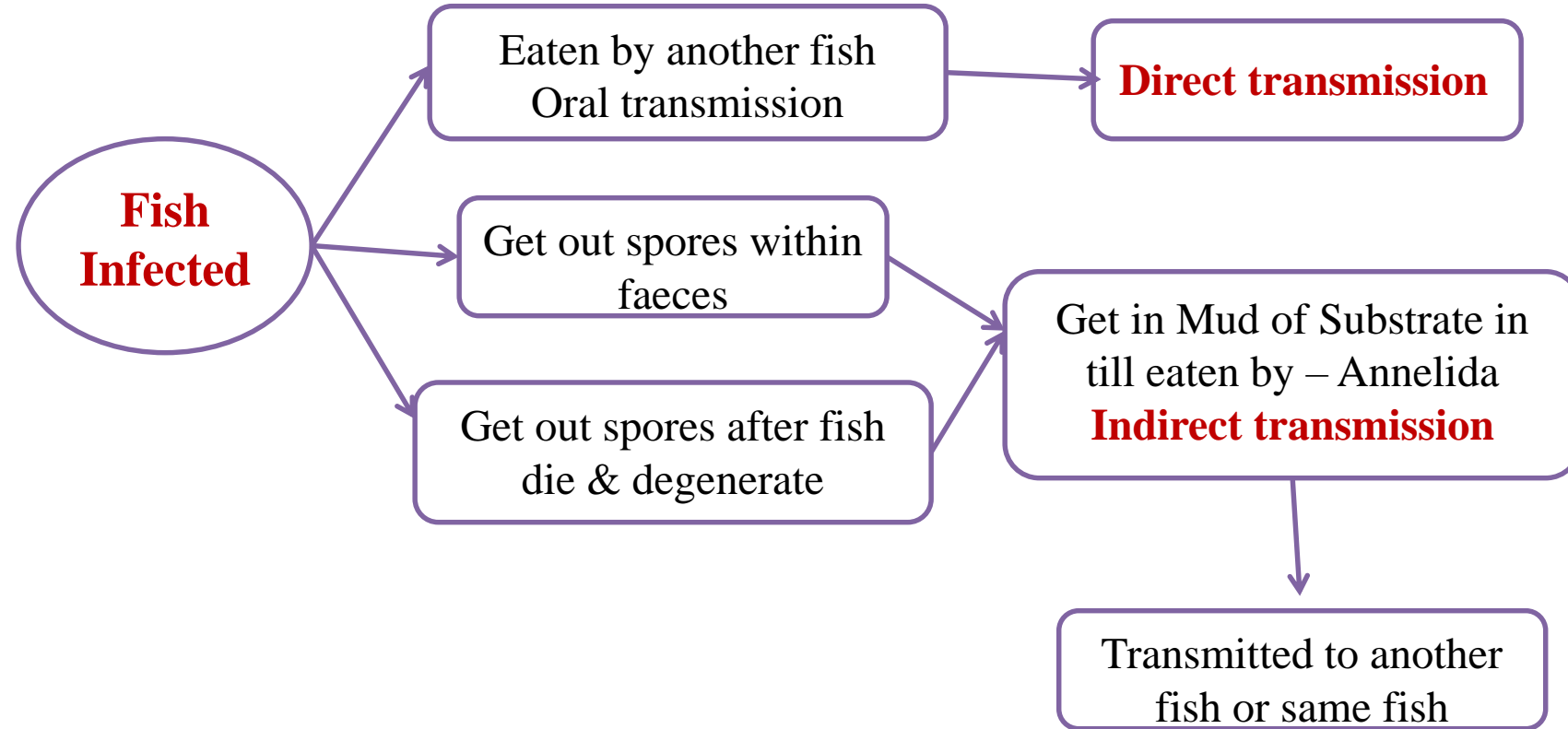
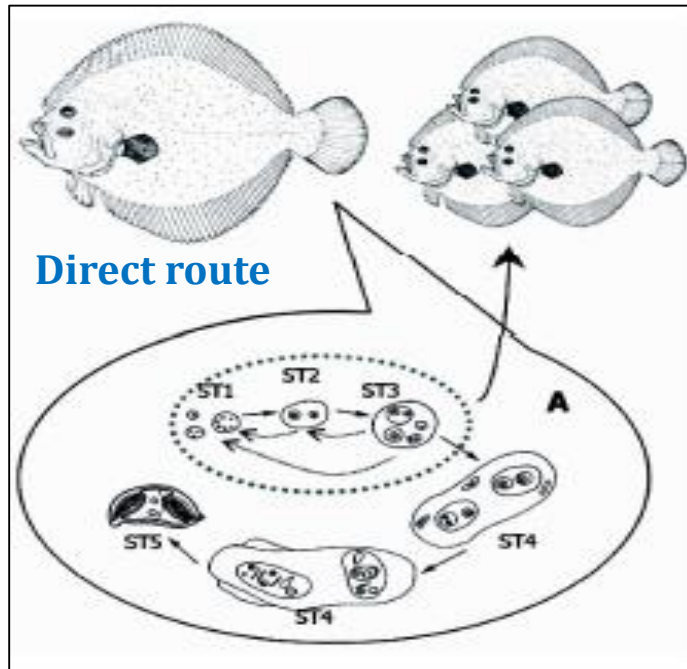
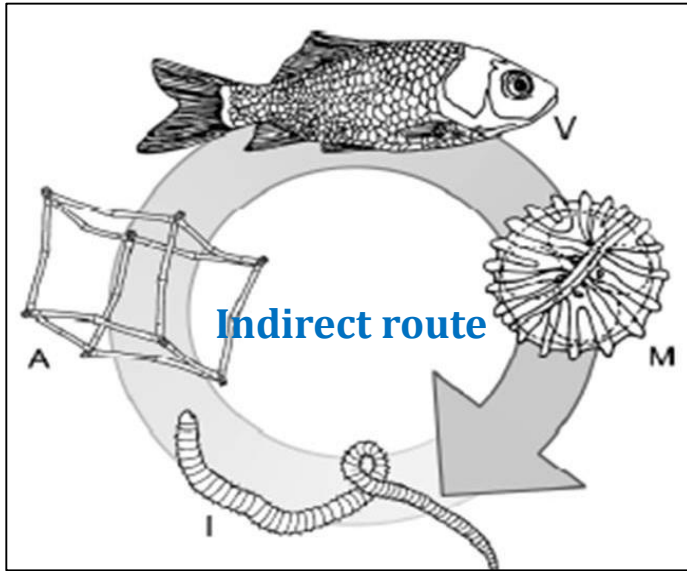
### Order Multivalvulida



# Identification and characterization of myxosporidian spores



# TRANSMISSION OF MYXOZOA



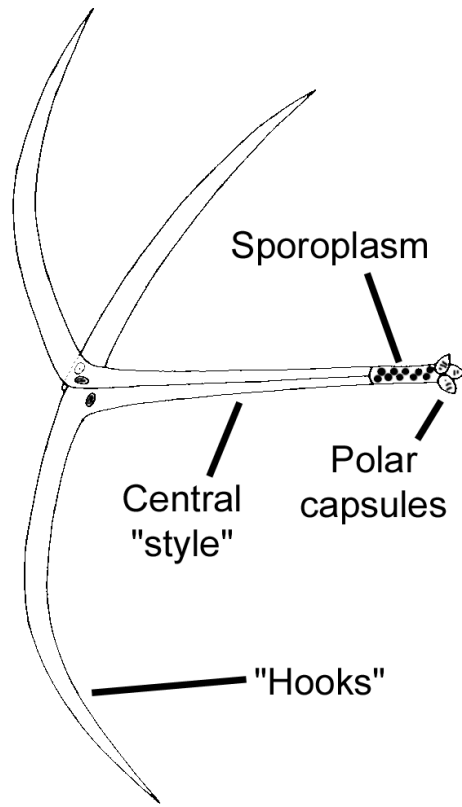


## Spore Morphology

They have many diverse stages ranging from single cells to relatively large spores.

### 1- Triactinomyxon stage

It consists of three processes or "tails". A sporoplasm packet at the end of the style contains 64 germ cells. There are also 3 polar capsules, each of which contains a coiled polar filament which rapidly shoot into the body of the host, creating an opening through which the sporoplasm can enter.

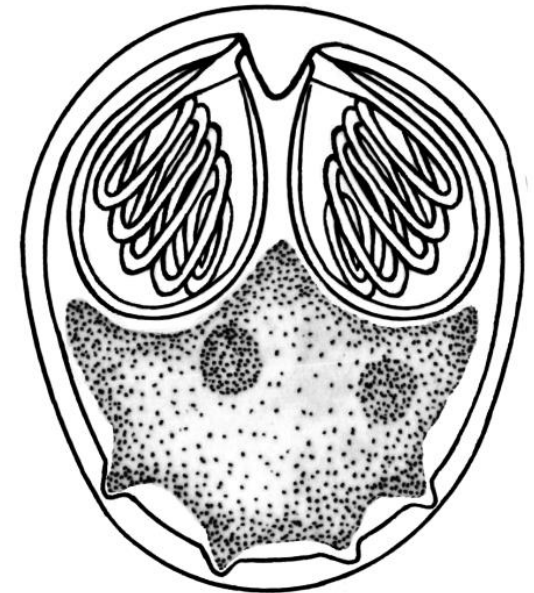


### 2- Sporoplasm stage

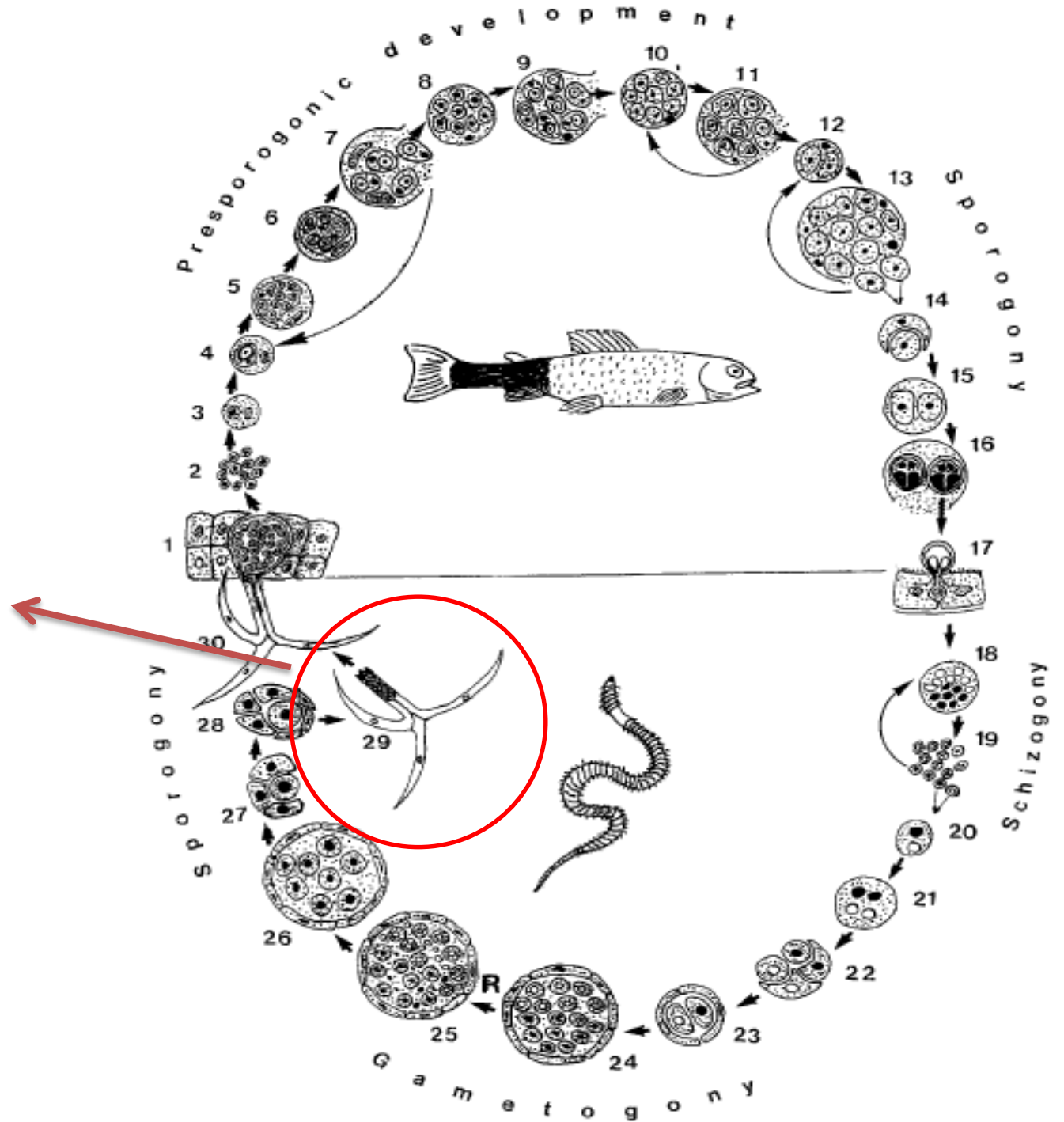
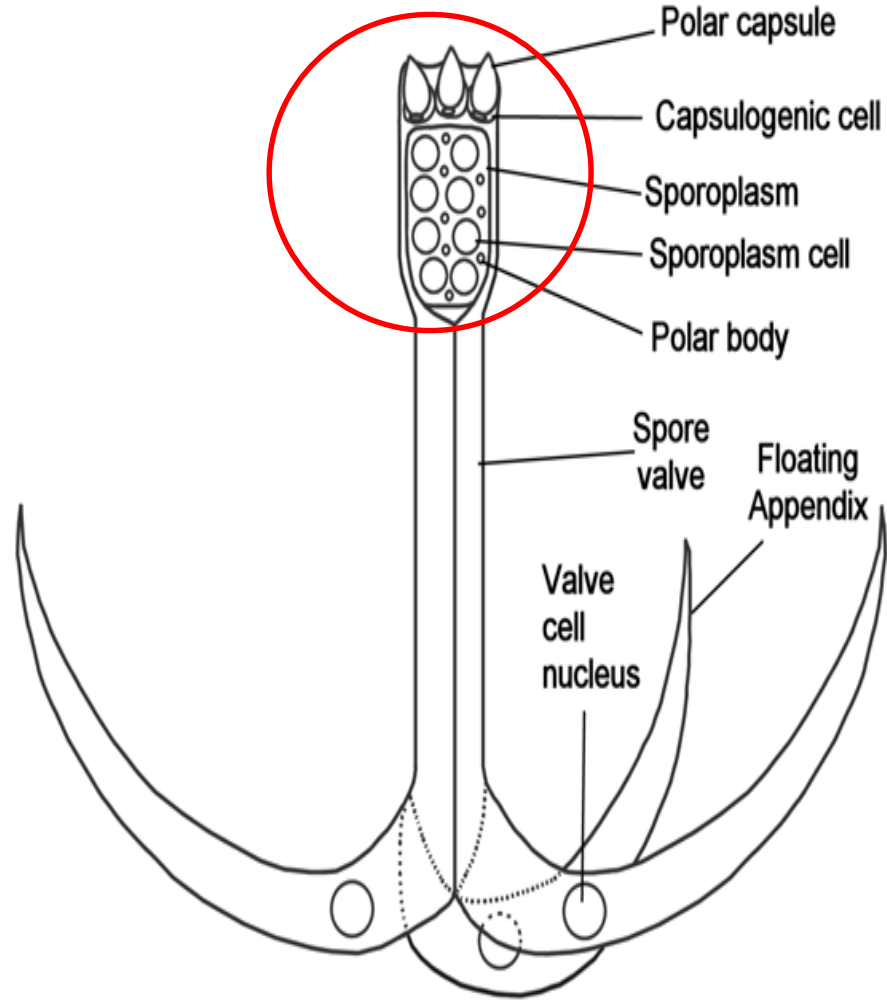
In fish hosts sporoplasm undergoes mitosis to produce more amoeboid cells, which migrate into deeper tissue layers, in order to reach the cerebral cartilage. Followed by storage of metabolic reserves and acquisition of aerobic metabolism which, under the proper stimulus, could provide energy necessary for exsporulation and establishment of the sporont within a new host

### 3- Myxosporean stage

Myxospores, which develop from sporogonic cell stages inside fish hosts, are lenticular. They are made of six cells. Two of these cells form polar capsules, two merge to form a binucleate sporoplasm, and two form protective valves.



# Indirect life cycle of Myxozoa



# **Pathogenicity and economic importance:**

**Myxosporea can cause severe pathological changes to their hosts. Depending on:**

- Type of the fish host
- Species of the myxosporean
- Mode of development
- Intensity of the infection

**Claimed to be agents causing degradation of infected tissue:**

- Heavy mortalities
- Anaemic fish
- Swollen kidneys
- PGD “Proliferative Gill Disease”
- PKD “Proliferative Kidney Disease”
- Whirling behavior
- Rapid muscle & Connective tissue deteriorations “Post-mortem signs”



## Whirling disease

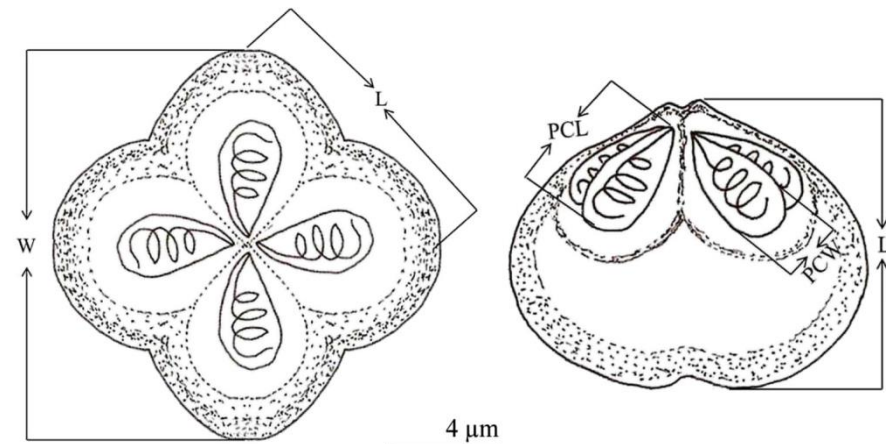
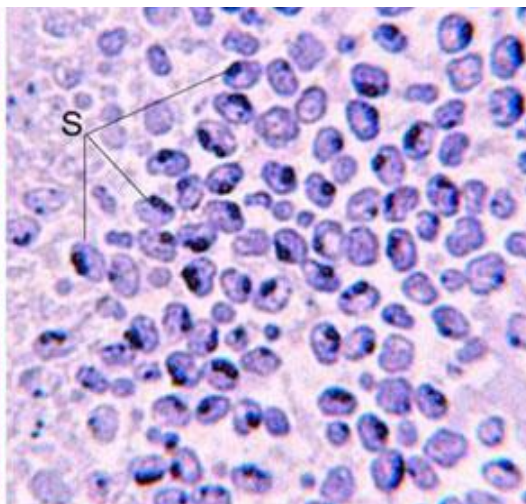
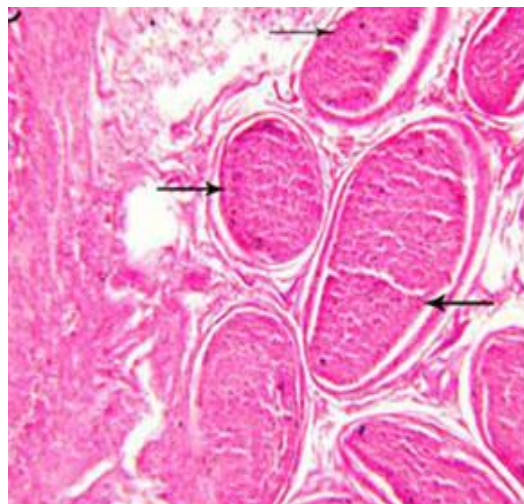
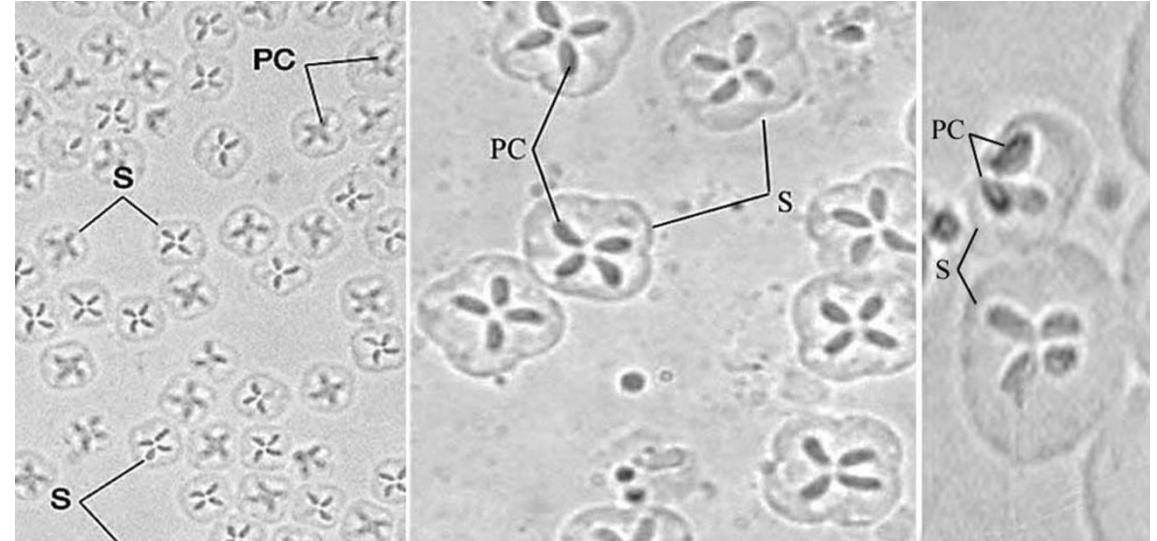
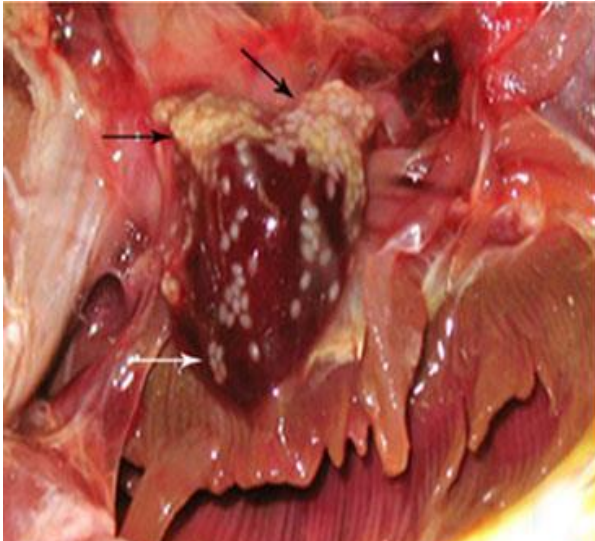
Whirling disease "tail-chasing" is a parasitic infection of trout and salmon by Myxosporean protozoan *Myxobolus cerebralis*. This parasite has selective tropism for cartilage; infection can cause deformities of the axial skeleton and neural damage that result in "black tail". Heavy infection of young fish can result in high mortalities or unmarketable, deformed individuals.



ORIGINAL PAPER

## Morphological re-description and molecular characterization of *Kudoa pagrusi* (Myxosporea: Multivalvulida) infecting the heart muscles of the common sea bream fish *Pagrus pagrus* (Perciformes: Sparidae) from the Red Sea, Egypt.

Abdel-Ghaffar F, Abdel-Gaber R, Maher S, Al Quraishy S, Mehlhorn H.



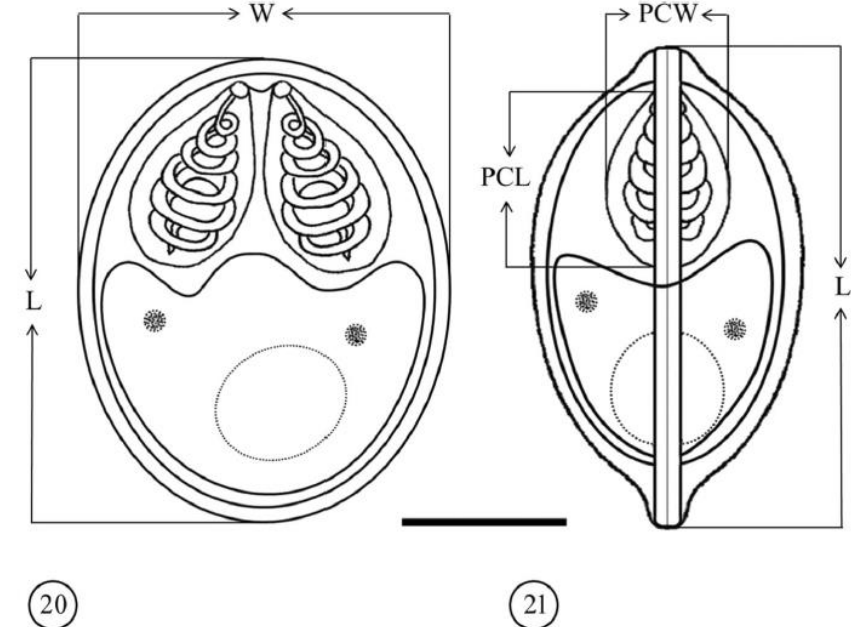
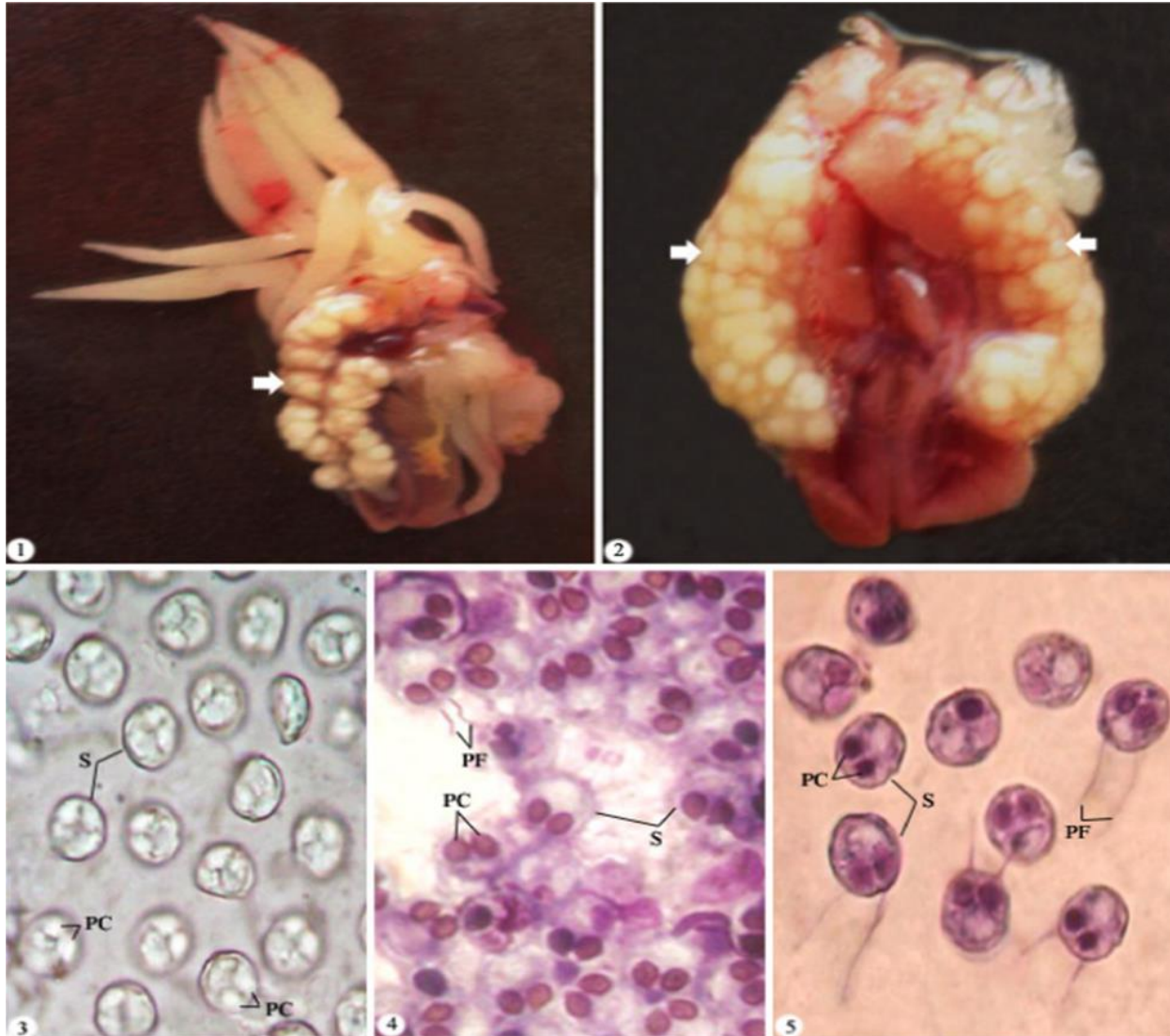
**Causing myoliquification**



ORIGINAL PAPER

## Morphological and ultrastructural characteristics of *Myxobolus ridibundae* n. sp. (Myxosporaea: Bivalvulida) infecting the testicular tissue of the marsh frog *Rana ridibunda* (Amphibia: Ranidae) in Egypt

Fathy Abdel-Ghaffar 1 . Rewaida Abdel-Gaber 1. Sherein Maher 2. Nashwa El Deeb 2,3. Reem Kamel 2. Saleh Al Quraishy 4. Heinz Mehlhorn 5



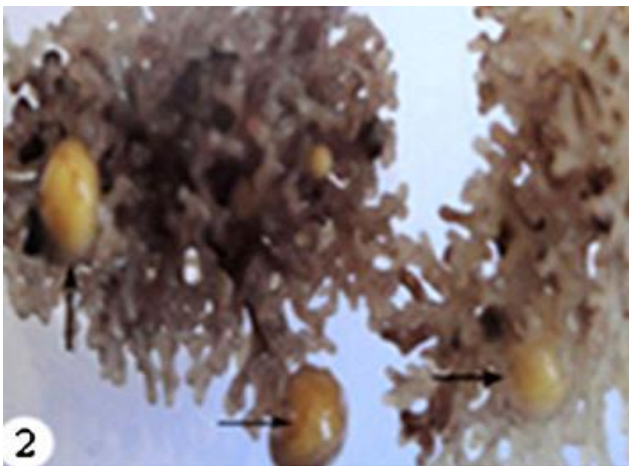
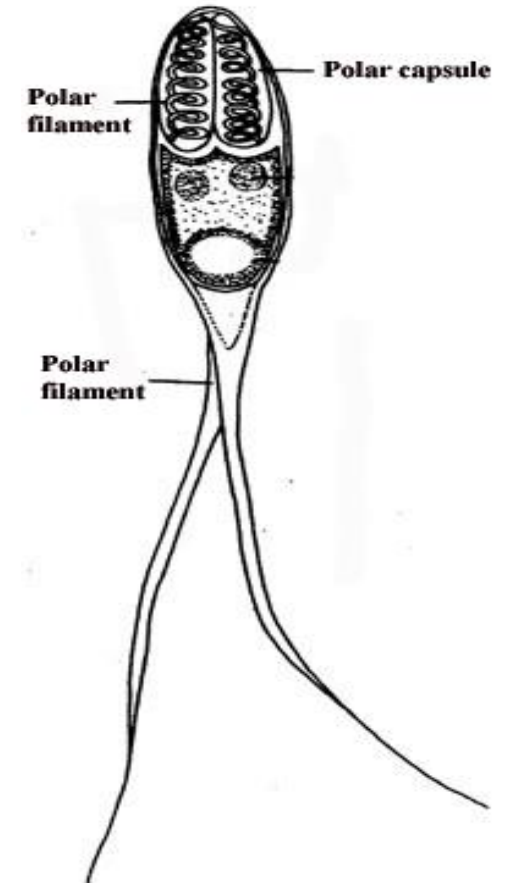
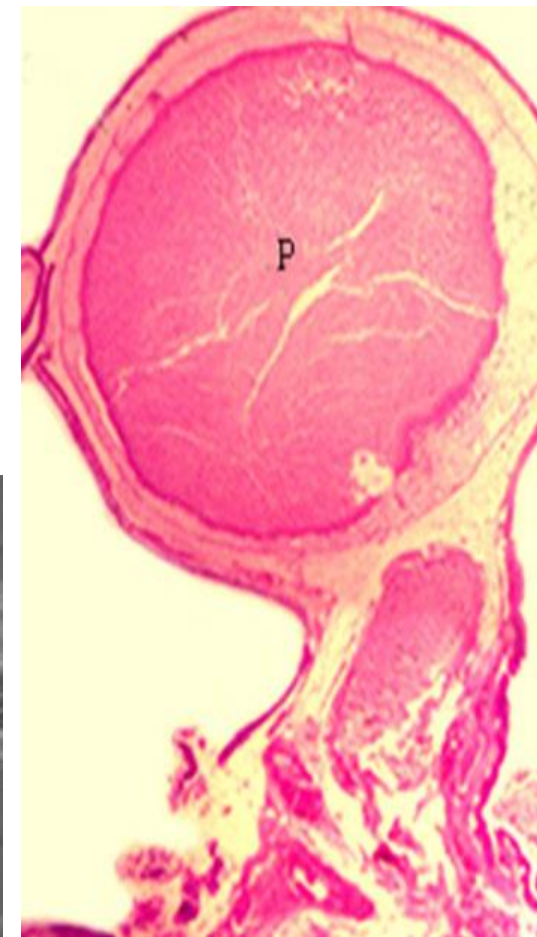
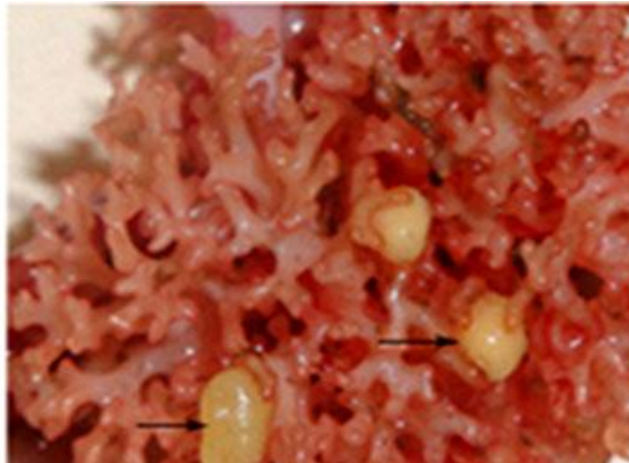
Causing dysfunction of genital organs



ORIGINAL PAPER

Morphology and small subunit ribosomal DNA sequence of *Henneguya suprabranchiae* (Myxozoa), a parasite of the catfish *Clarias gariepinus* (Clariidae) from the River Nile, Egypt.

Morsy K, Abdel-Ghaffar F, Bashtar A-R, Mehlhorn H, Al Quraishy S, Abdel-Gaber R.



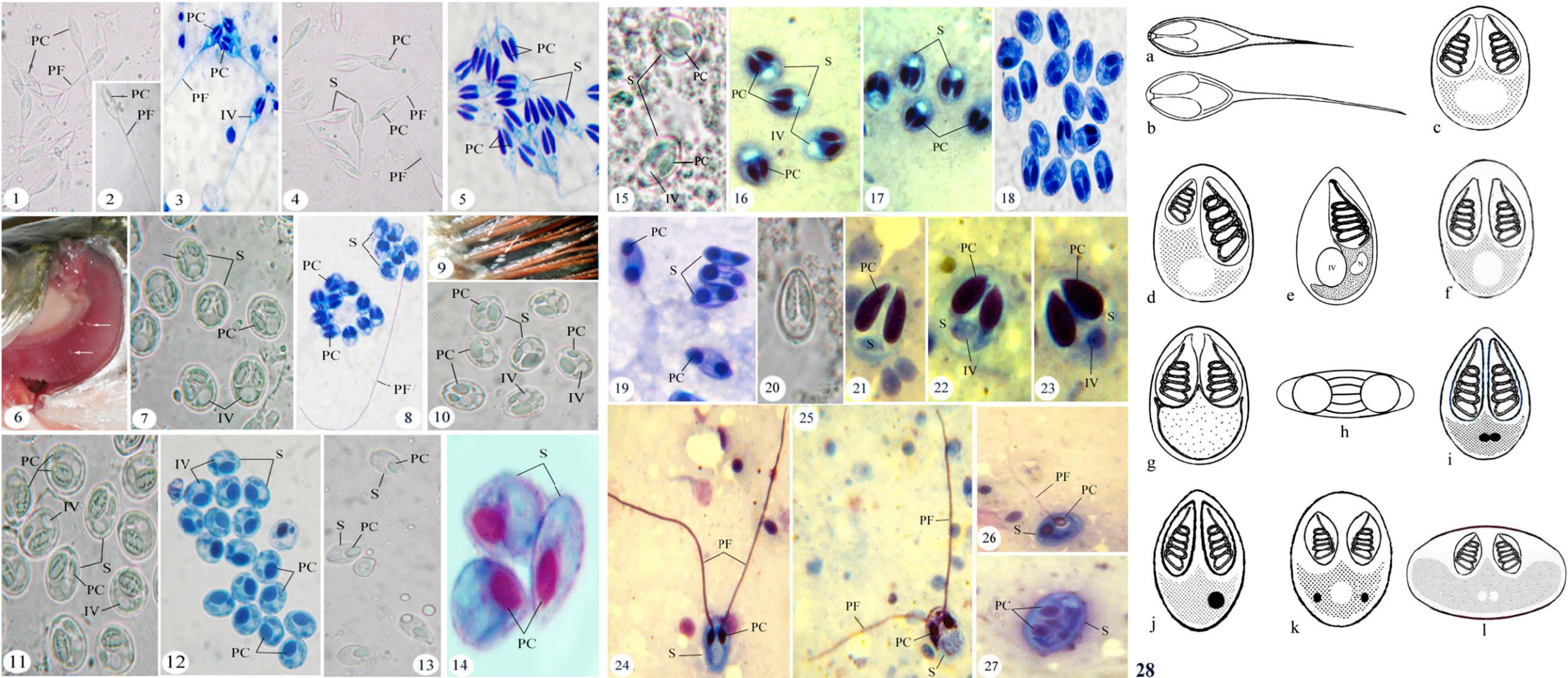
Causing destruction of gills, hypoxia and death of fish.



ORIGINAL PAPER

# Twelve myxosporean species of the family Myxobolidae infecting freshwater fishes of the River Nile, Egypt, with the description of four novel species

Abdel-Ghaffar F<sup>1</sup>, Morsy K, El-Ganainy S, Ahmed M, Gamal S, Bashtar AR, Al Quraishy S, Mehlhorn H.



## Host immune response against myxosporean infection

**The immune response of host against myxosporean infections is manifested in several reactions:**

- Inflammation
- Phagocytosis
- Melanization
- Forming pseudocyst

## Chemotherapy of Myxosporea

**Few drugs are known to control fish myxosporidian parasites.**

- Stovarsal
- Furazolidone
- Toltrazuril



*Thank you*