

AQUATIC LIFE SUPPORT SYSTEMS (LSS) AND CONTROL OF DISEASES

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REDUCE STRESS



- ▶ Water quality
- ▶ Nutrition
- ▶ Overcrowding
- ▶ Appropriate tank mates
- ▶ Appropriate habitat

WHY SOME PARASITES ARE MORE DIFFICULT TO MANAGE IN CLOSED SYSTEMS?

Direct life cycles

Concentrated infective stages

Concentrated individual hosts

Multiple species of host

Infection susceptibility

Chemotherapeutic intolerance

Introduction of pathogens overtime

Stress

Viruses



Carp Pox



Lymphocystis

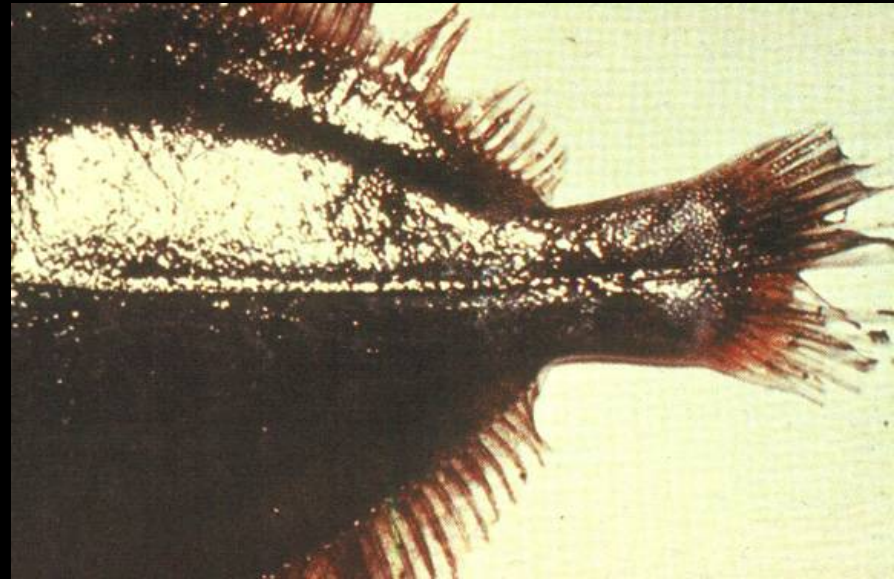


Marine Mammal Viruses

- Herpes virus
- Seal pox
- San Miguel sea lion virus
- *Morbillivirus*

Bacteria

- *Aeromonas*
- *Pseudomonas*
- *Vibrio*



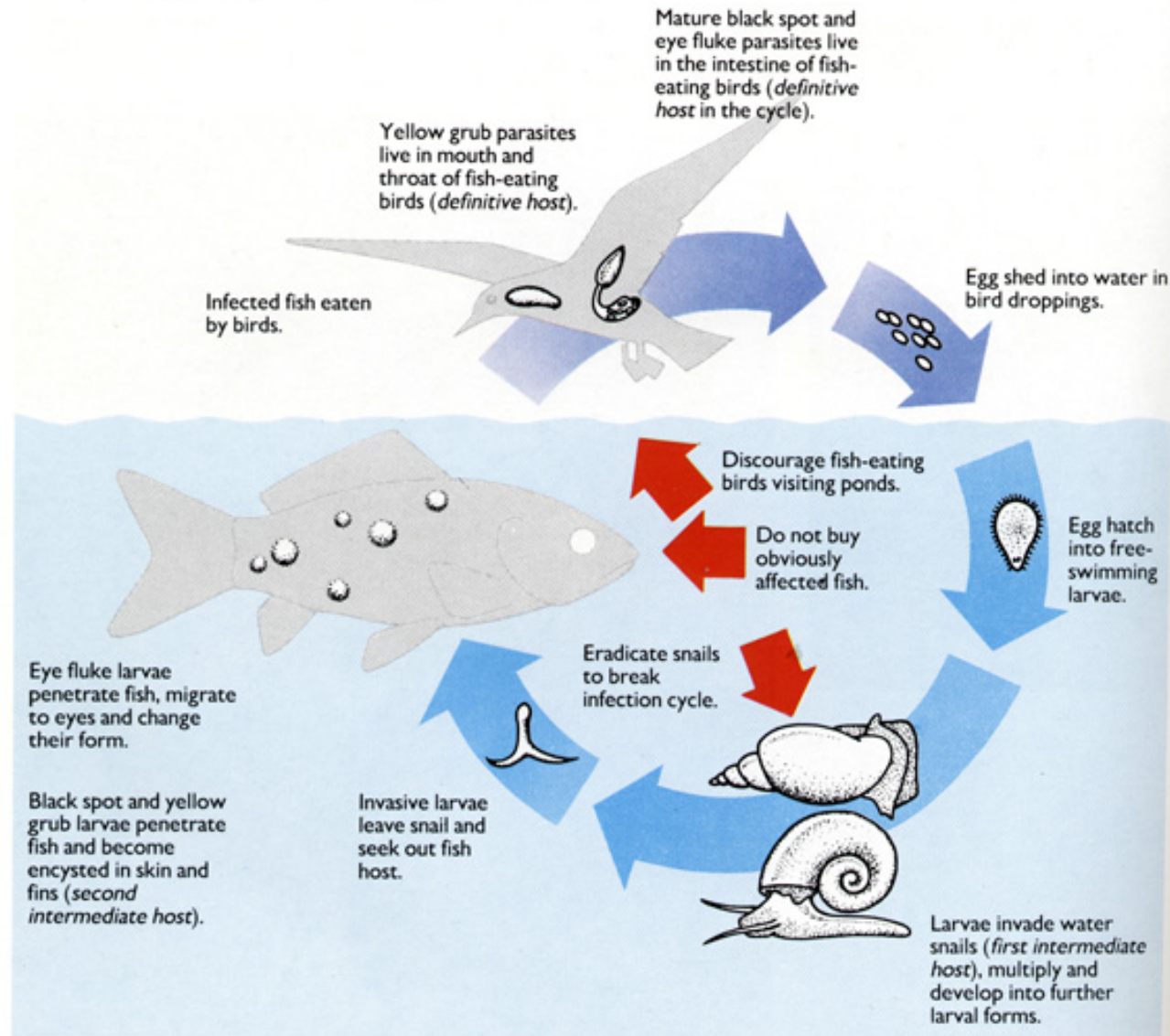
Dropsy or Malawi Bloat

Fungi



Saprolegnia

The generalized life cycle of the digenetic flukes that cause yellow grub, black spot and eye fluke

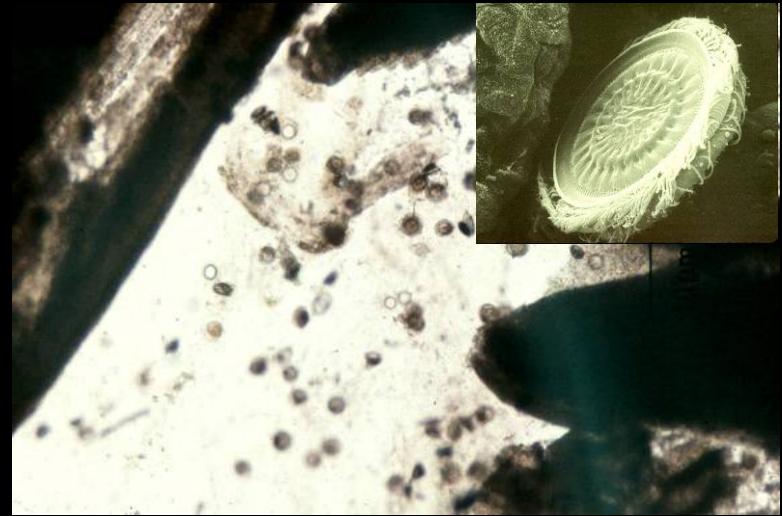


Digenean Life Cycle

PARASITES WITH DIRECT LIFECYCLES

- Fungi
- *Ammylodinium*
- Other flagellates
- Ciliates
- Monogenea
- Hirudinea
- Copepoda/*Argulus*

Protozoans



Trichodina

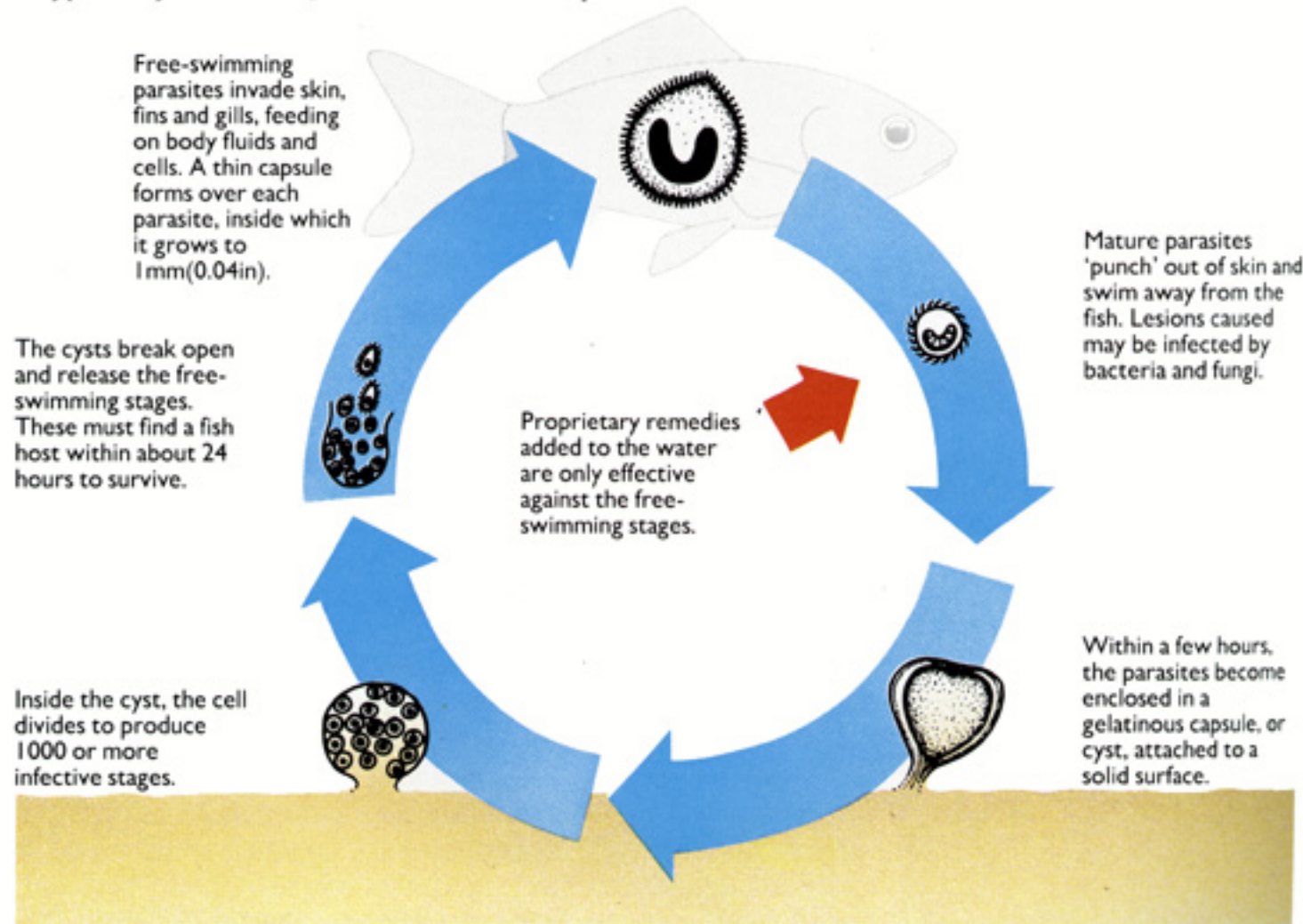


Amyloodinium



Ichthyophthirius

The life cycle of *Ichthyophthirius multifiliis* and *Cryptocaryon irritans*, the cause of white spot disease



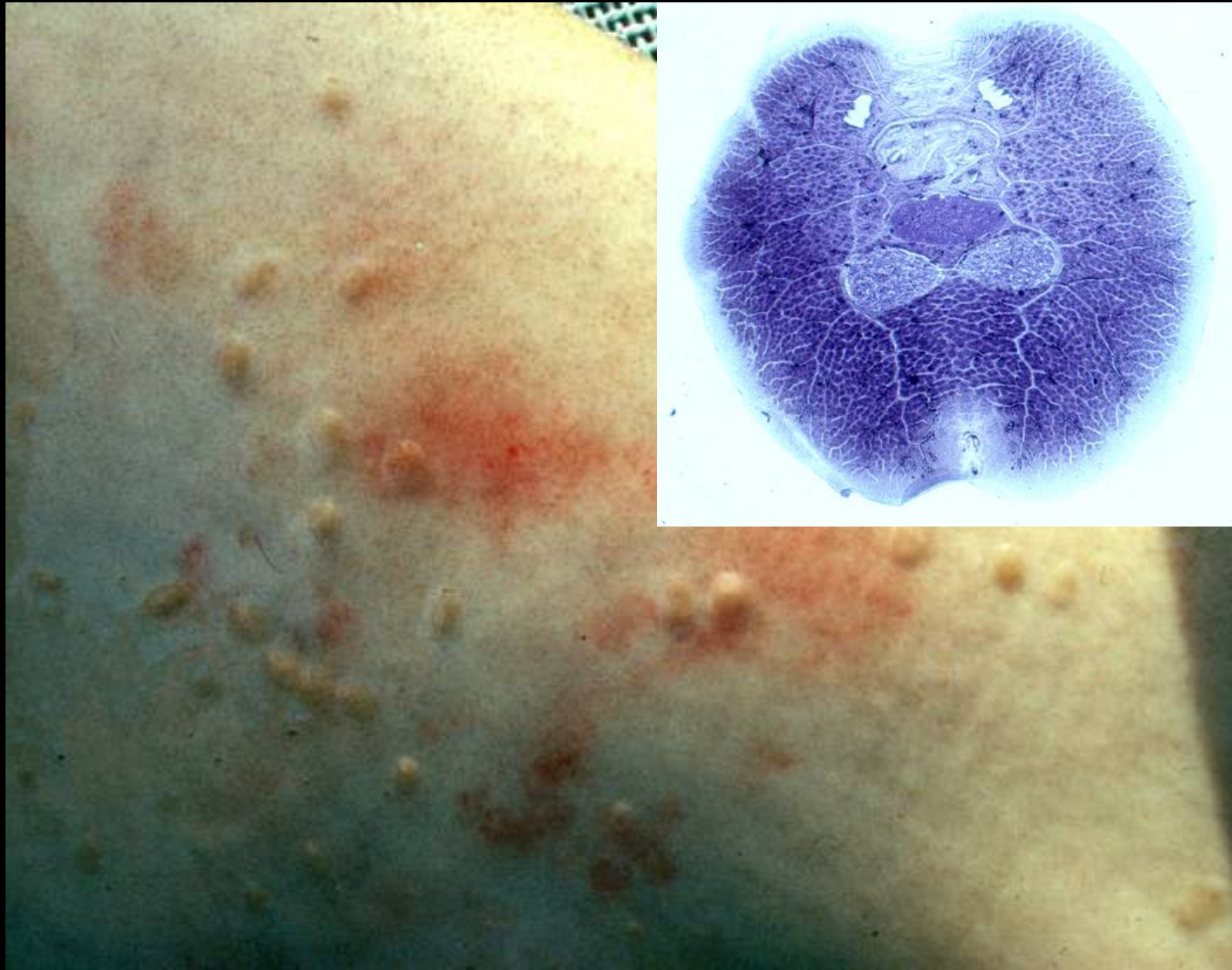
Cryptocaryon & Ichthyophthirius Life Cycle

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Dactylogyrus

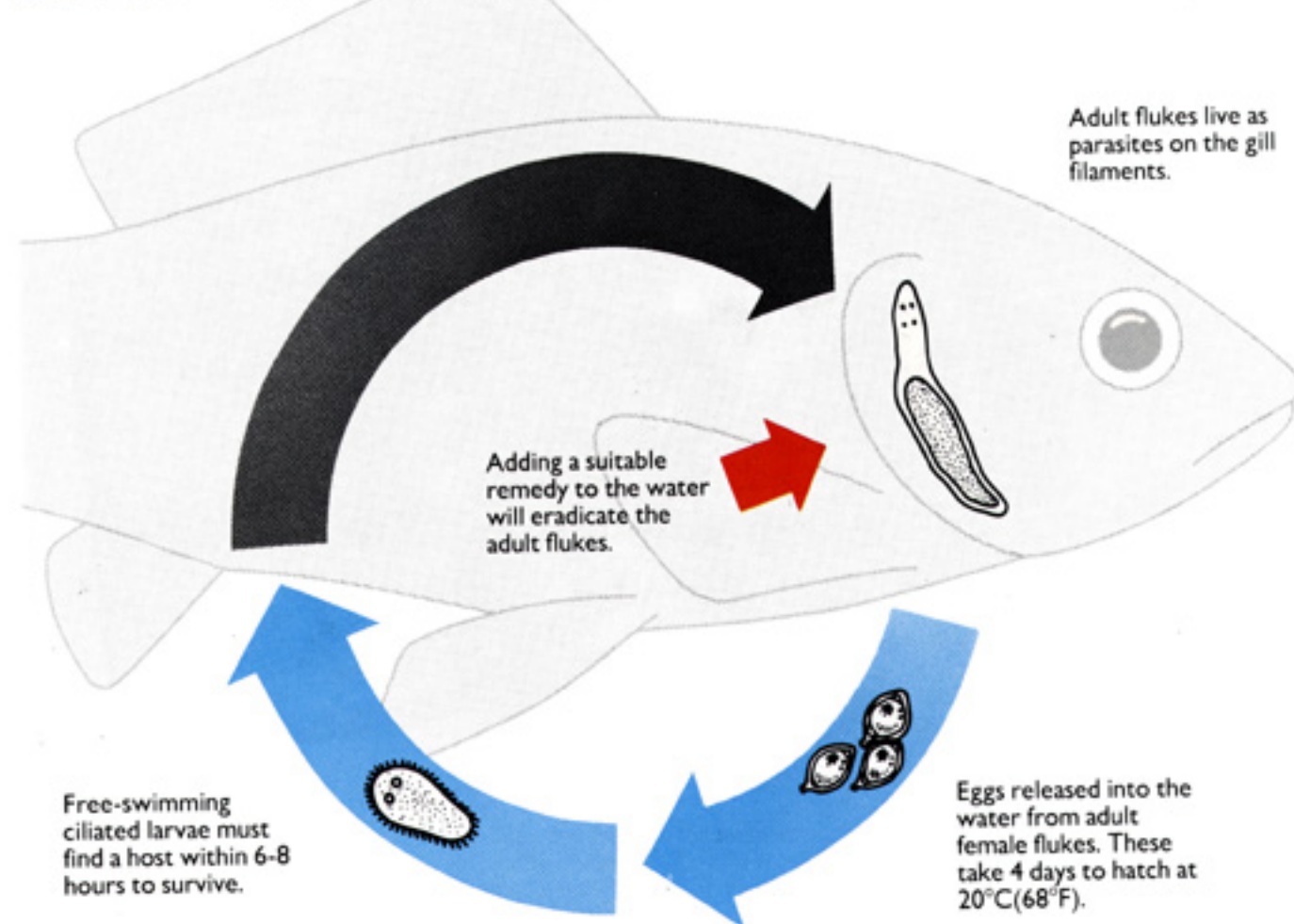


Dermophthirioides



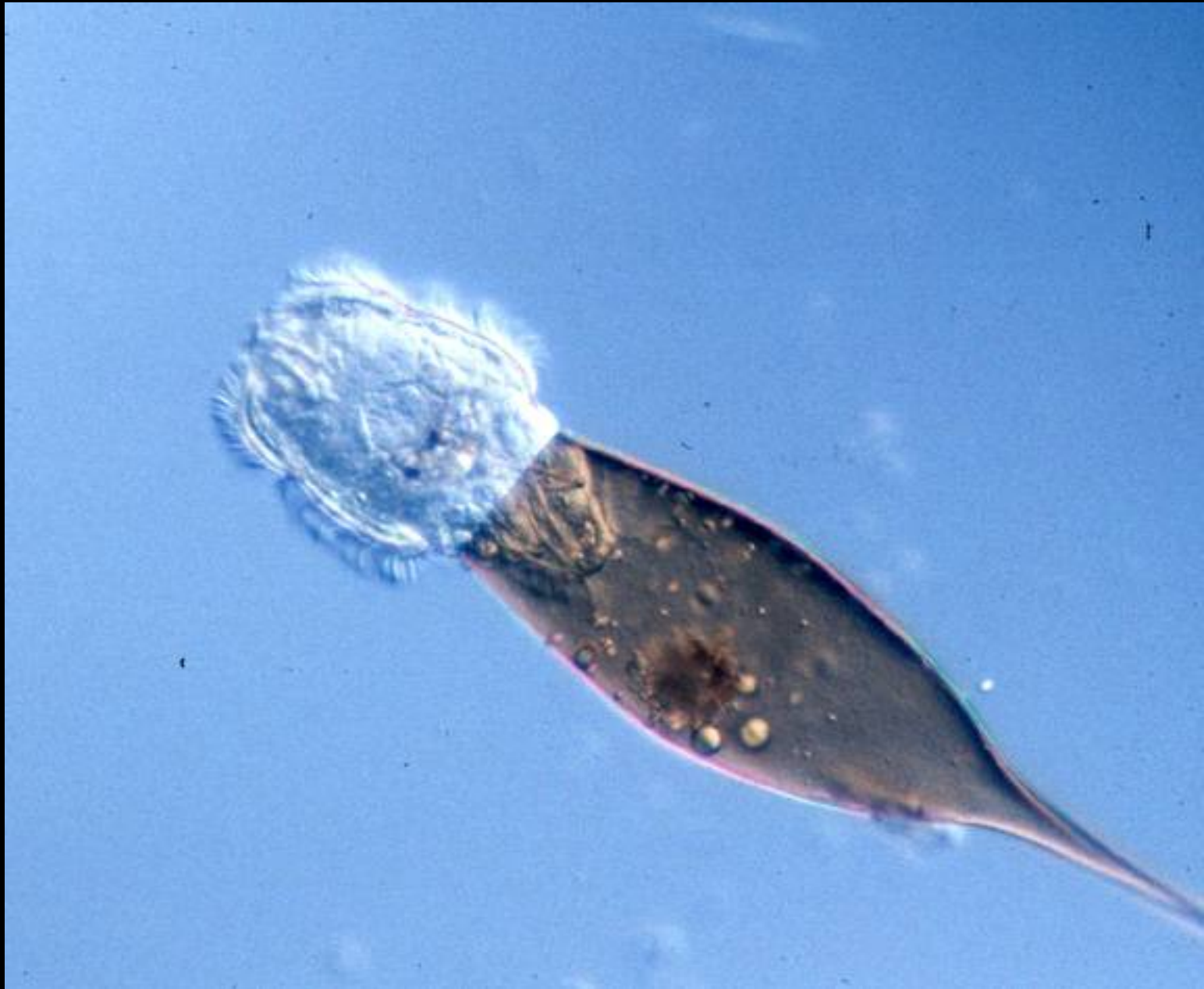
Neobenedenia

The life cycle of the gill fluke (*Dactylogyrus*)



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Monogenean Life Cycle



Microcotyle Hatching

***IN VITRO* STERIZATION OF EGGS**

Treatment	Duration	% Alive
Sanaqua 2X recommended (freshwater)	10 min	39
Sanaqua 2X remmened (salt water)	10 min	62
Calcium hypochloride 5 ppm (freshwater)	1 hr	30
Calcium hypochloride 5 ppm (salt water)	1 hr	79

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Hirudinea



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Crustaceans



Lernaeenicus



Ergasilus



Argulus

MECHANICAL FILTRATION

- Semipermeable membrane filters
- Diatomaceous earth filters
- Cartridge paper filters
- Disk ring filters
- Sand Filters
- Bead Filters
- Drum filters

Semipermeable Filters



Filter out particles down to $< 1 \text{ } \mu\text{m}$
(depends on membrane specification)

Diatomaceous Filters



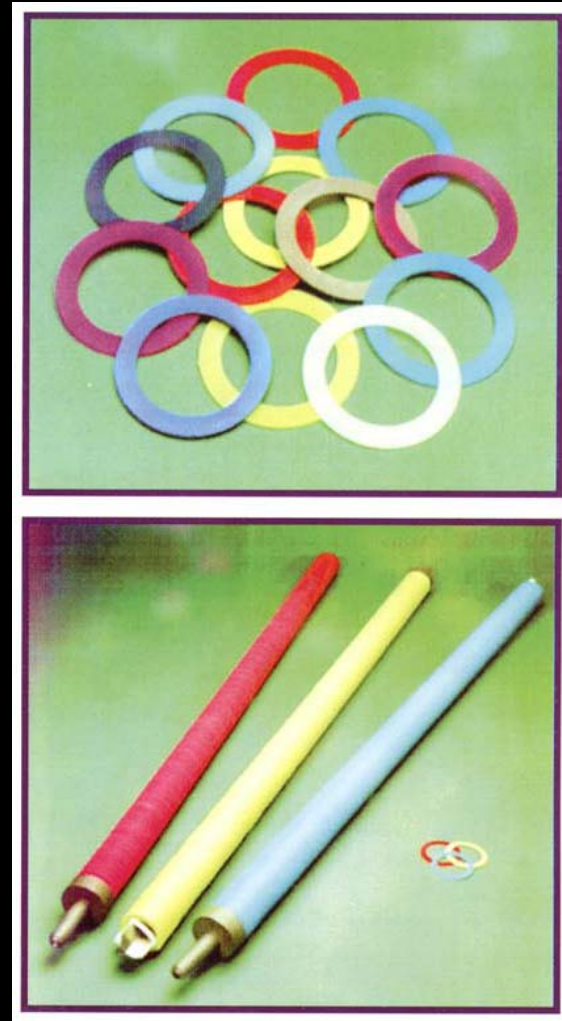
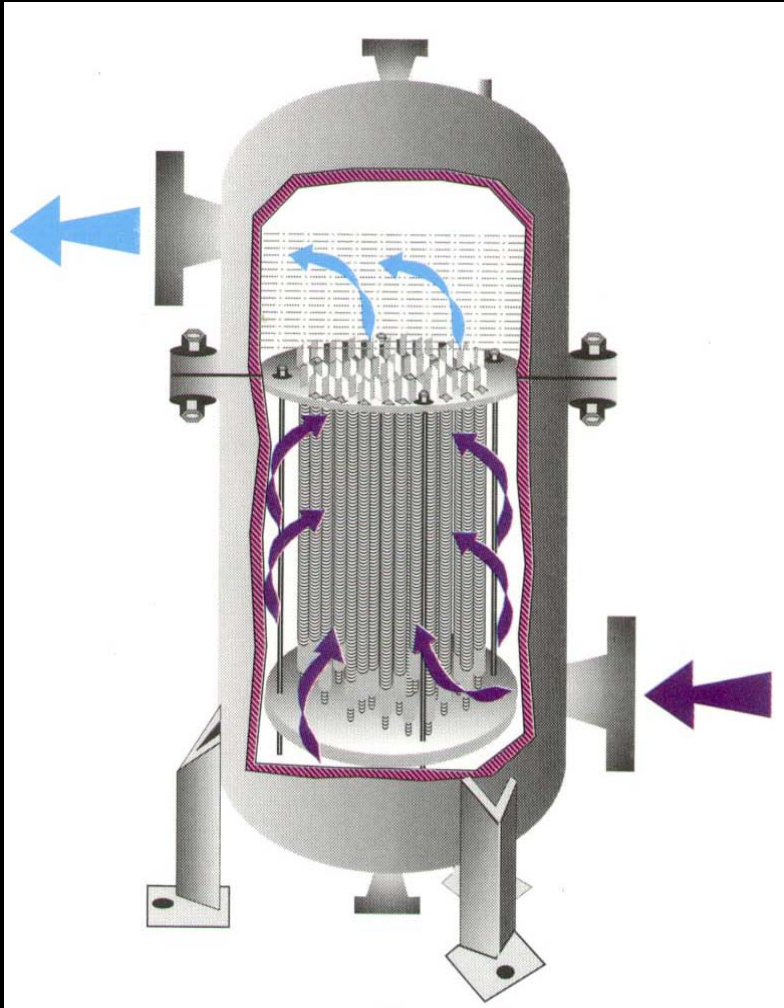
Filters particles $> 1\text{-}5\text{ }\mu\text{m}$

Paper Cartridge Filters



Filters particles $> 1 \mu\text{m}$ (depends on cartridge spec)

Disk Ring Filters



Filters particles $> 5 \mu\text{m}$ (depends on disk used)

High Rate Sand Filters



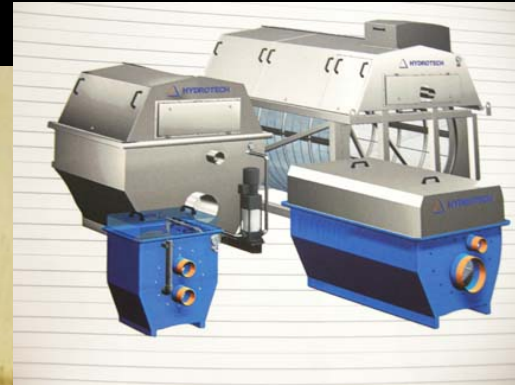
Filters particles $> 30 \text{ um}$ (#20 filter sand)

Bead Filters



Filters particles $> 50 \text{ } \mu\text{m}$ (depends on bead dia.)

Drum Filters



Filters particles $>10\text{ }\mu\text{m}$ (depends on mesh specifications)

Foam Fractionators



Ozone Treatment

Inactivation Mechanism

- Leakage of cell membranes
- Lipid oxidation

Inactivation Concentration

- *E. coli* – Destroyed with 0.02 mg.min/l
- Poliovirus 1 - Destroyed with 0.1-0.2 mg.min/l
- Rotavirus - Destroyed with 0.006-0.06 mg.min/l
- *Giardia muris* cysts - - Destroyed 1.8-2.0 mg.min/l
- *Oncorhynchus mykiss* - >0.1mg/l kills trout

Common Treatments for Monogeneans (skin & gill flukes)

Baslow's solution (formalin & cupric acetate)	Multiple treatments
Copper sulphate	0.2 ppm, 10-14 d
Formalin	250 ppm, 1 hr 25 ppm multiple doses
Freshwater (or reduced ppt)	5-10 min, or longer
Salt water	5-10 min
KMnO ₄	100 ppm, 5-10 min 15 ppm multiple doses
Mebendazole	1-10 ppm 24 hrs 100 ppm 10 min
Praziquantel (Droncit)	1-2 ppm continuous 10 ppm 3 hrs
Trichlorfon	0.5-0.7 ppm, mult doses 50 ppm 4-5 min
Quicklime	25 kg/ha pond

IN VITRO TREATMENT OF MICROCOTYLE HIATULAE EGGS

Treatment	Duration	% Alive
Control	continuous	97
Control	continuous	96
Copper sulphate (2 ppm)	continuous	0
Copper sulphate (2 ppm)	continuous	0
Flubendazole (10 ppm)	3 hrs	60
Flubendazole (10 ppm)	continuous	60
Formalin (250 ppm)	1 hr	83
Formalin (25 ppm)	continuous	31
Mebendazole (10 ppm)	3 hr	84
Mebendazole (2 ppm)	continuous	90
Praziquantel (10 ppm)	3 hr	55
Praziquantel (2 ppm)	continuous	82
Trichlorfon (0.7 ppm)	6 hr	91
Trichlorfon (0.7 ppm)	continuous	87

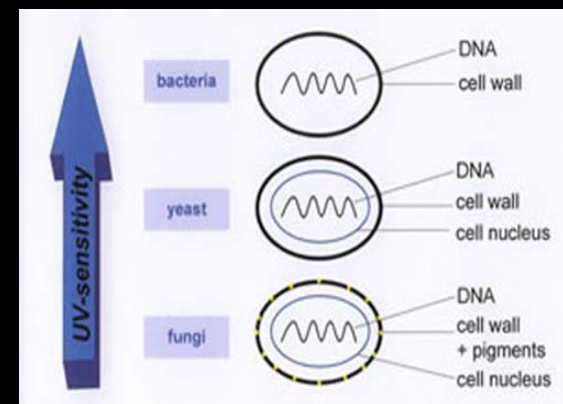
Ultraviolet Radiation

Kills Organisms

- Disrupts DNA
- Production of intra-cellular photo by-products

Pathogen UV dose mWs/cm² (99.9% kill)

• IHNV	1-3
• IPNV	100-150
• Hepatitis A virus	30
• Poliovirus Type 1	30
• Rotavirus SA11	36
• <i>Vibrio cholerae</i>	2.9
• <i>Salmonella typhi</i>	8.2
• <i>Shigella sonnei</i>	8.2
• Yeasts	24
• <i>Cryptosporidium parvum</i> oocysts	<10
• <i>Giardia lamblia</i> cysts	<10



Conclusions

- Pathogen identification & knowledge of its biology are essential
- Mechanical LSS can reduce infective organisms from entrained water
- Monogenean eggs are very resistant
- UV is more effective against viruses and bacteria than eucaryotes
- UV requires filtered water, replacement of bulbs < 1 yr, & is not an oxidant
- Ozone has dual function of sterilization and oxidation
- Organisms that exchange gases in water are very sensitive to residual ozone
- Ozone can breakdown chemotherapeutics
- To treat for pathogens not entrained into LSS, residual ozone, chlorine, & associated by-products and/or chemotherapeutics must be used