Meagre: Parasites and non-infectious diseases

Dr. Pantelis Katharios

Hellenic Centre for Marine Research

Meagre workshop, October 9, Barcelona

Outline of the presentation

Parasites

1. Sciaenacotyle panceri
2. Diplectanum sciaenae
3. Other parasites

Non-infectious diseases

1. Systemic granulomatosis
2. Chronic Ulcerative Dermatopathy

Sciaenacotyle panceri

- Gill monogenean (Polyopsithocotylea)
- Highly host-specific
- Direct life-cycle
- Large size (up to 10 mm)
- Blood-feeding
- Can propagate in extremely high numbers
- Cause gill hyperplasia, anemia and eventually death
- Mortalities can be severe esp. in large fish (reaching commercial size)


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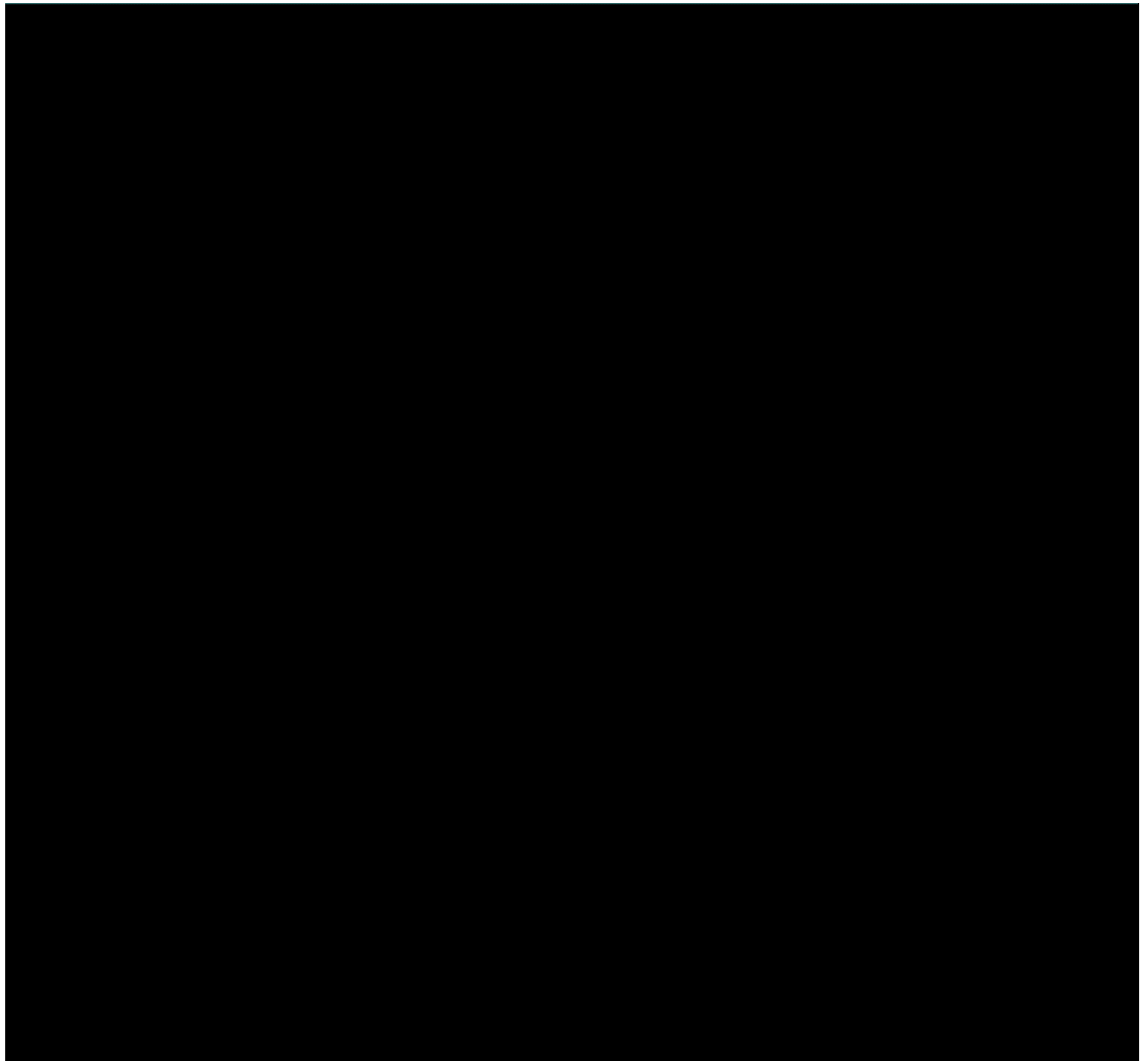
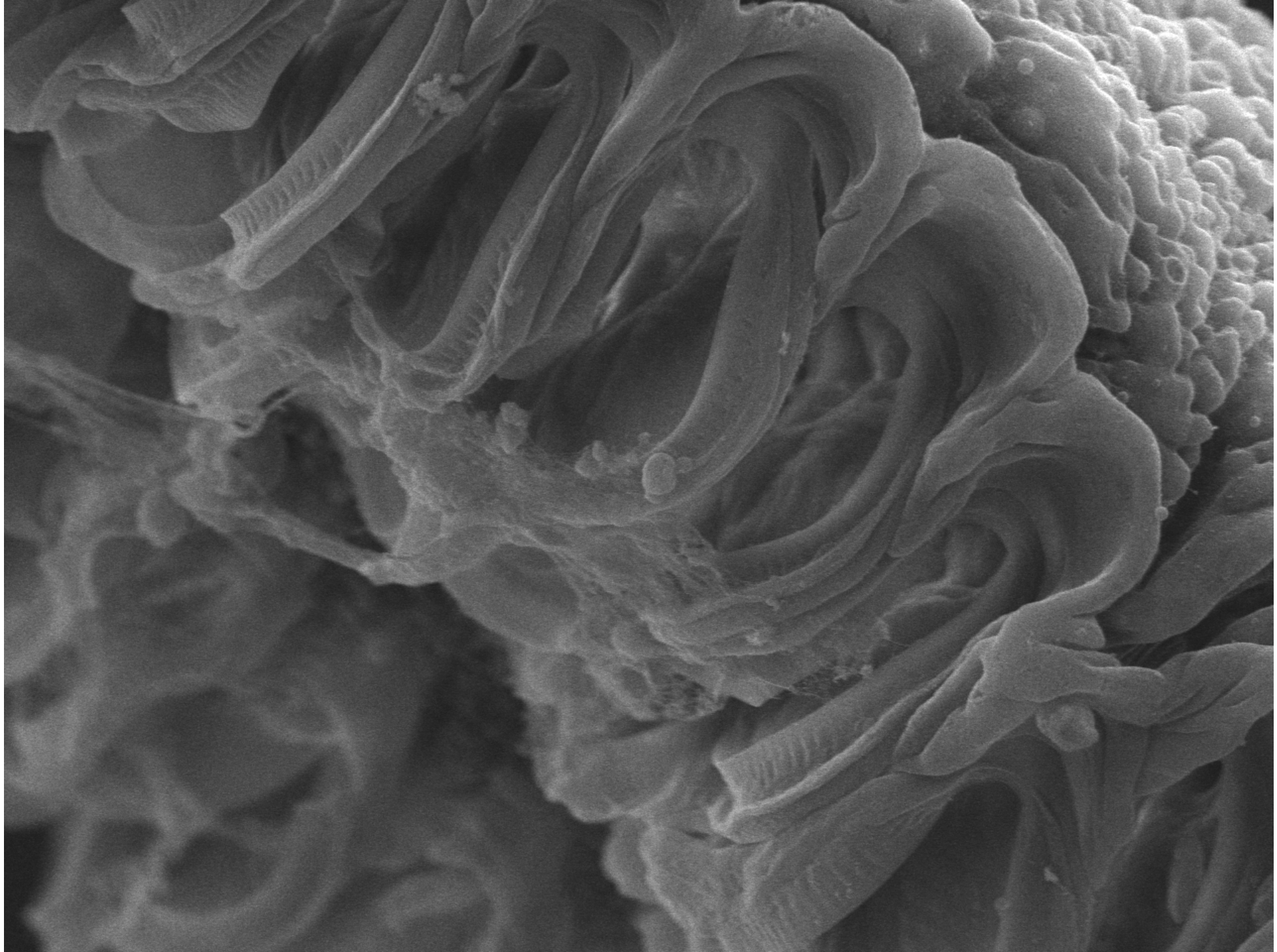
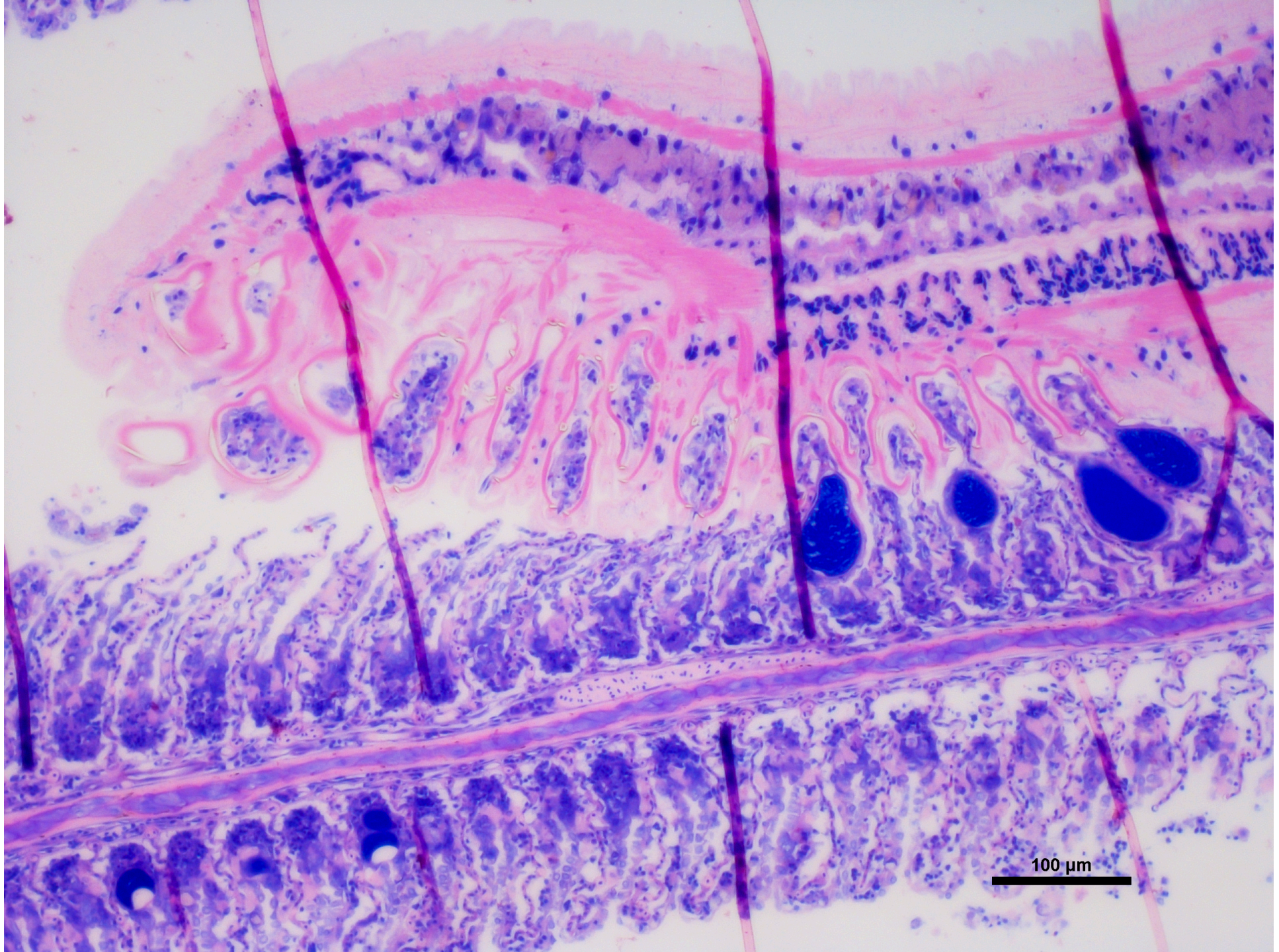
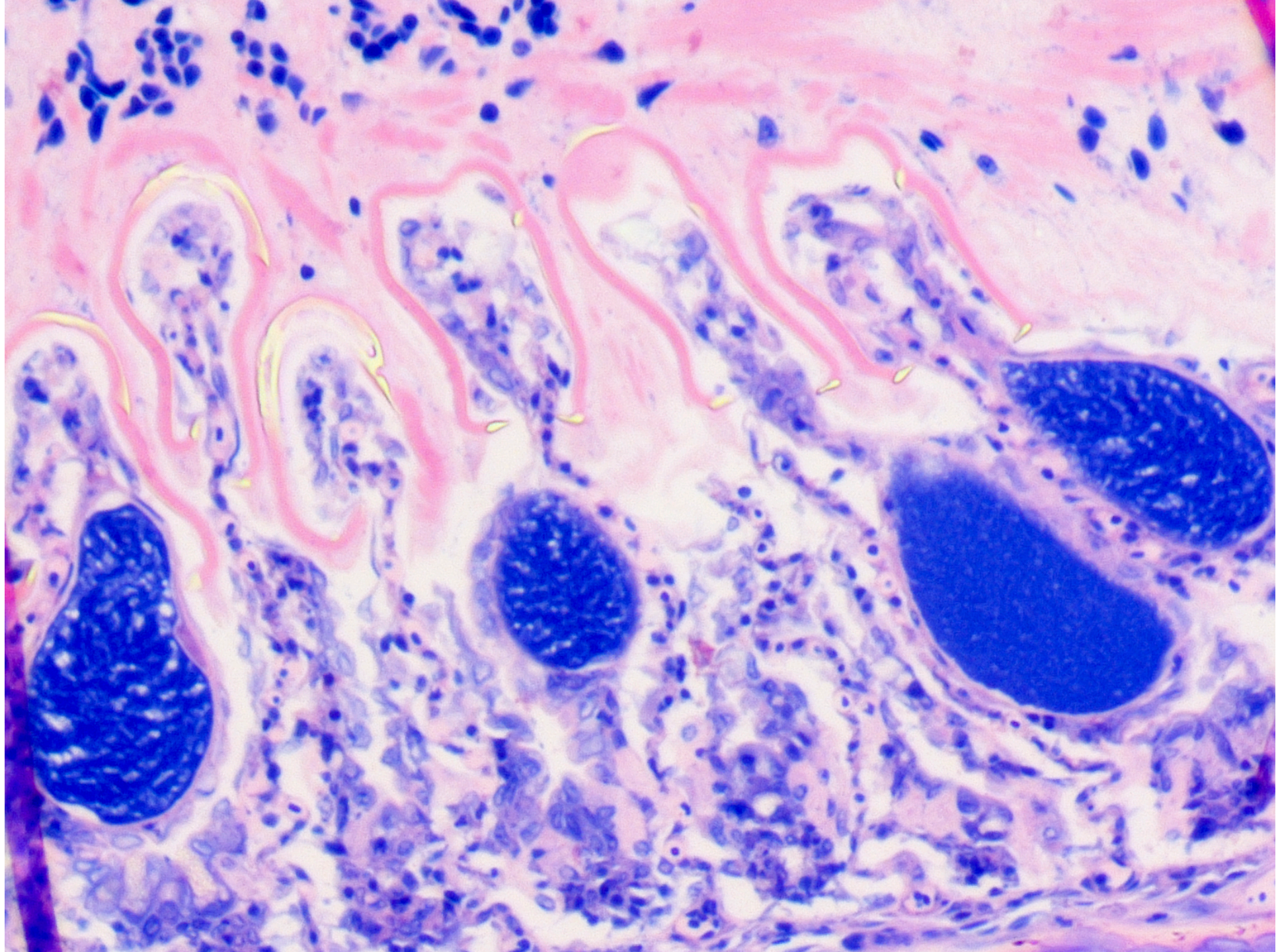
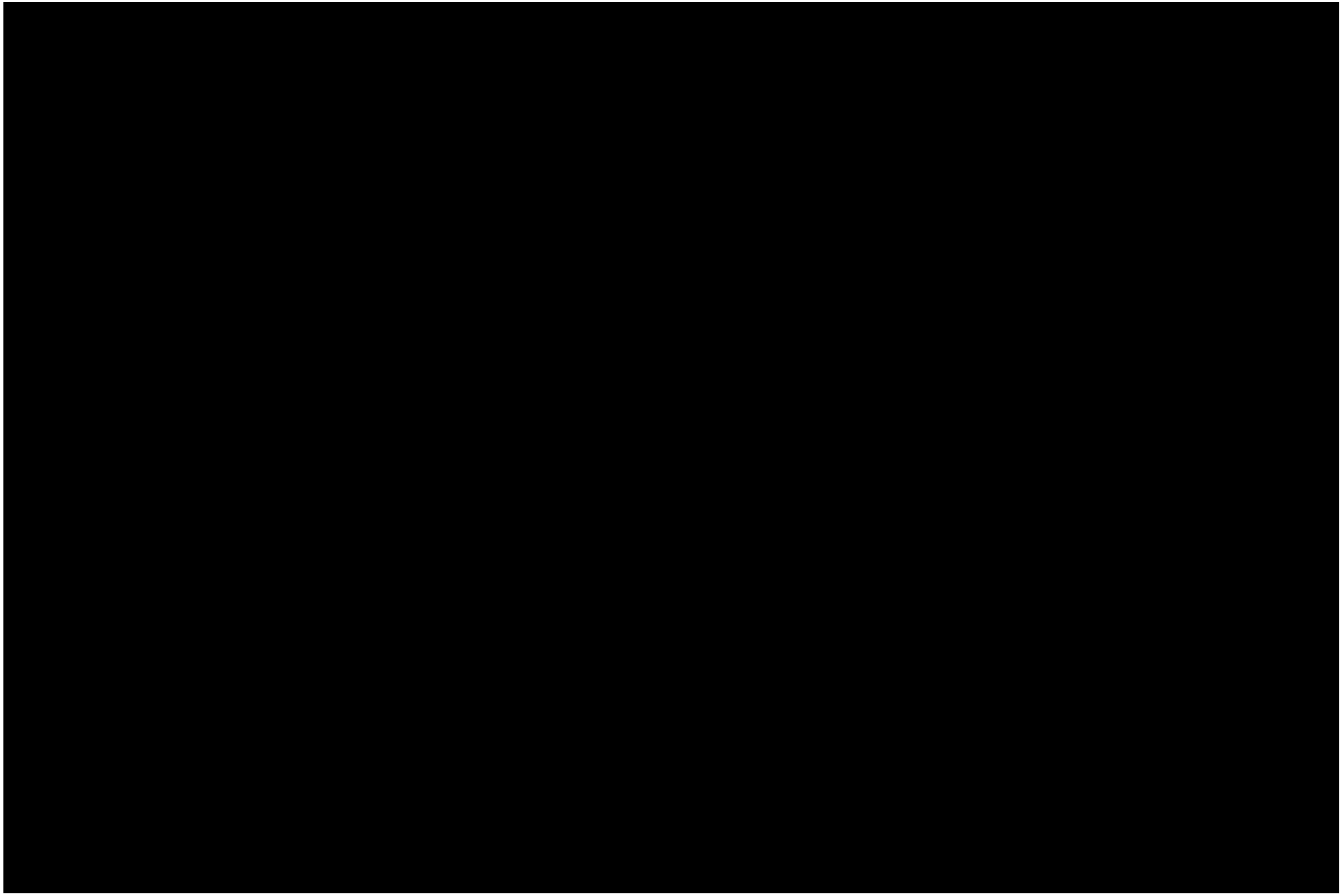


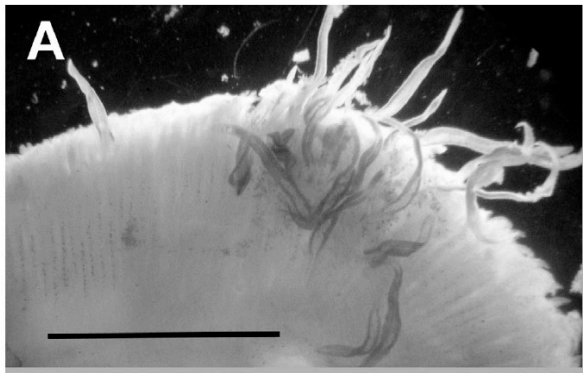


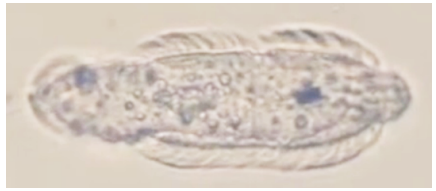

100 µm

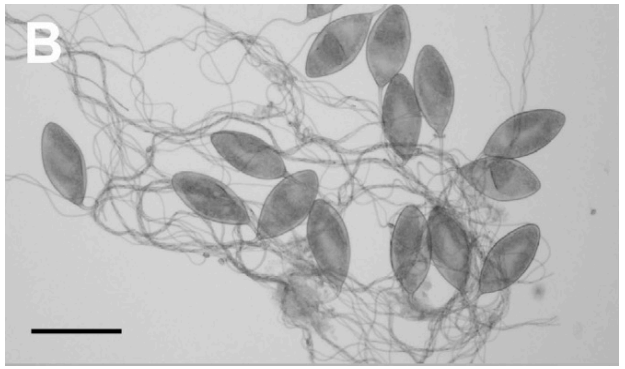




Life cycle







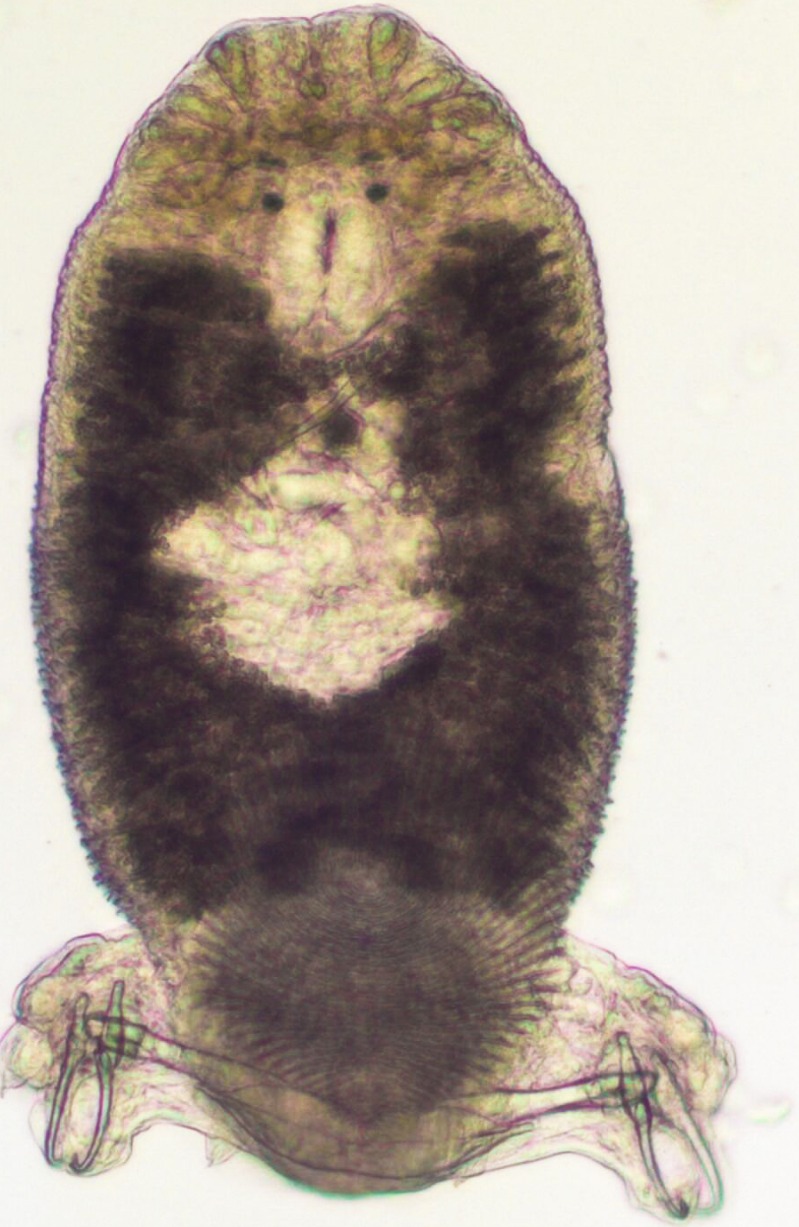
Photos from:
Merella, P., Cherchi, S., Garippa, G., Fioravanti, M.L., Gustinelli, A. and Salati, F., 2009. *Diseases of aquatic organisms*, *86*(2), pp.169-173.

Parasite management

- Break the life-cycle
- Adults and oncomiracidia are susceptible to treatments, eggs NO
- Two to three consecutive treatments with 15-20 days interval
- All stocks should be treated simultaneously
- Formalin treatment ineffective
- Praziquantel very effective, but not licensed
- Peroxide?
- Cinnamon as a feed additive showed promising results (IRTA)
- Monitoring

Diplectanum sciaenae

- Gill monogenean (Monoopsithocotylea)
- Host specific
- Direct life-cycle
- Mucous-feeding
- Can propagate in extremely high numbers
- Cause gill hyperplasia, secondary infections and eventually death
- Mortalities have been recorded in broodstock



200 µm

100 µm

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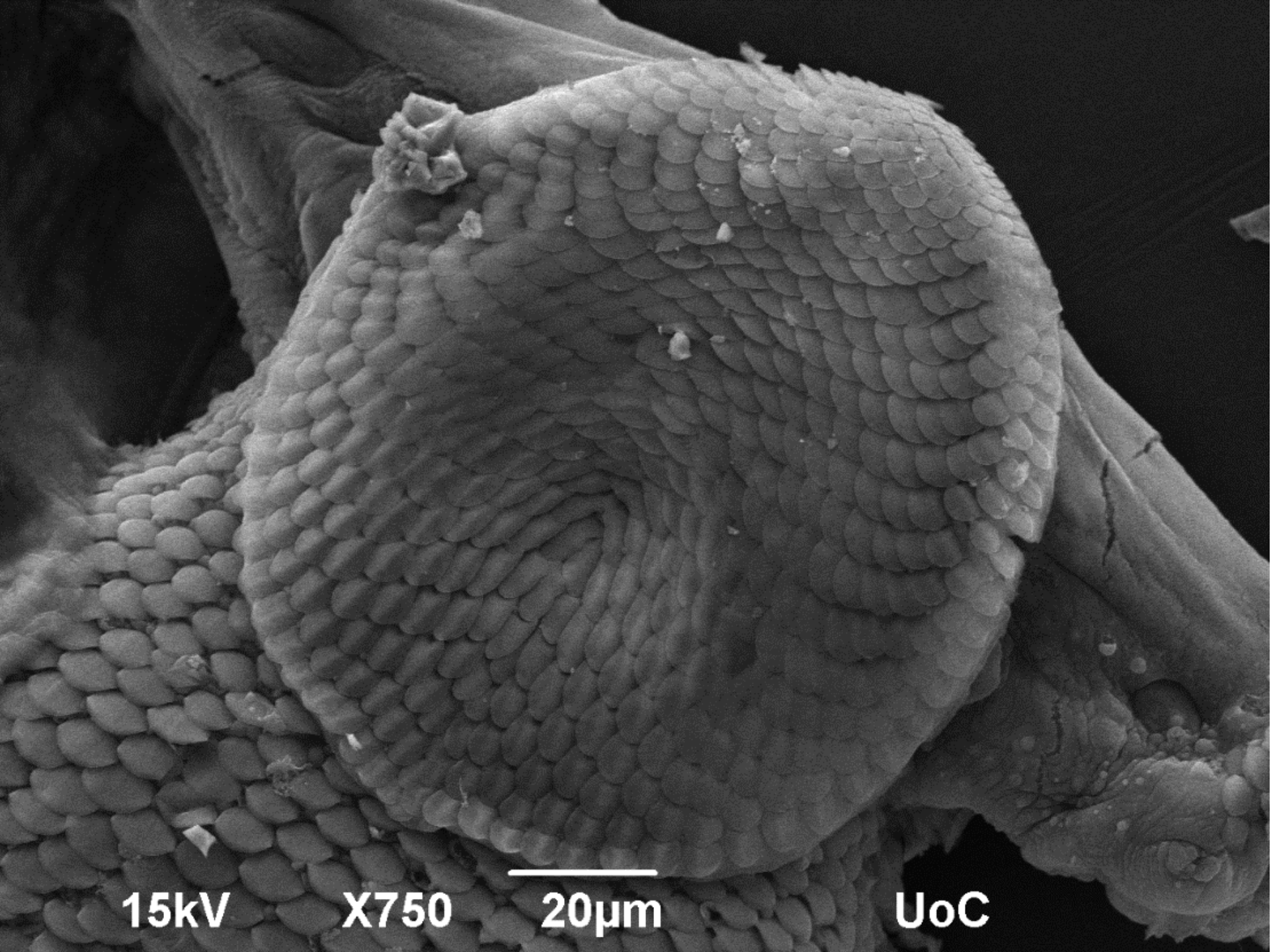
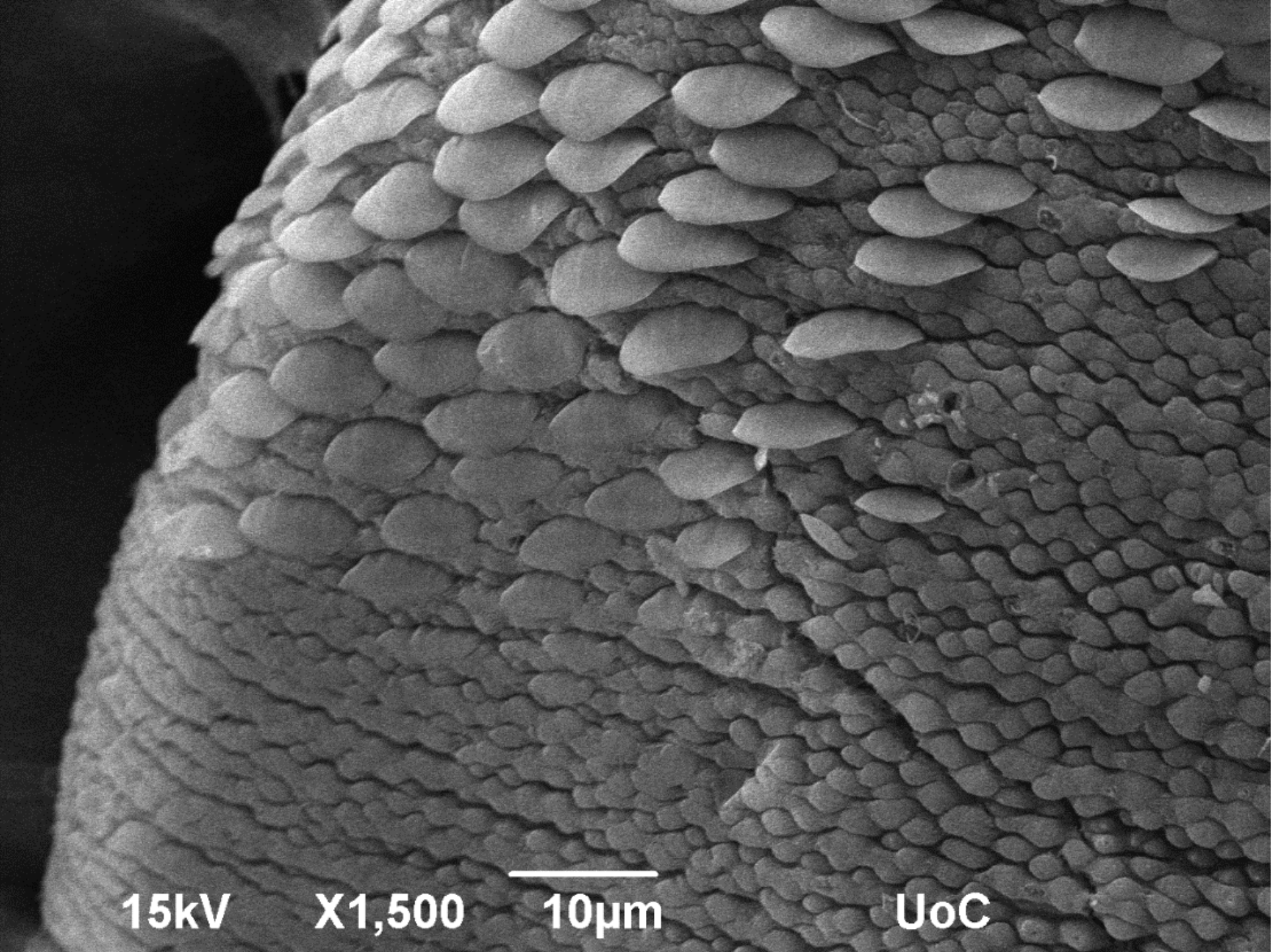


Squamodisc has scale-like structures.
Half of the body is covered by scales


15kV
X1,500
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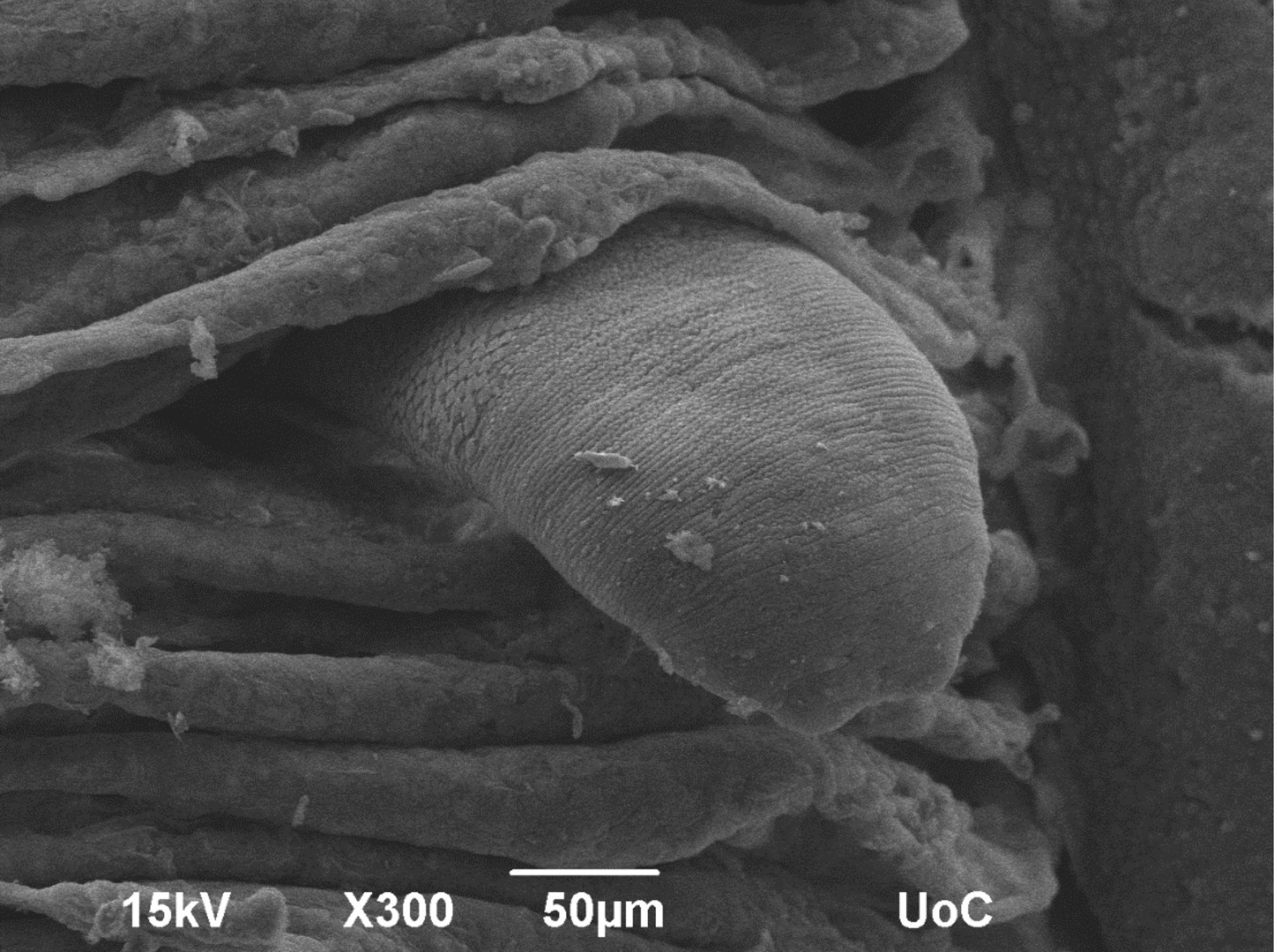
UoC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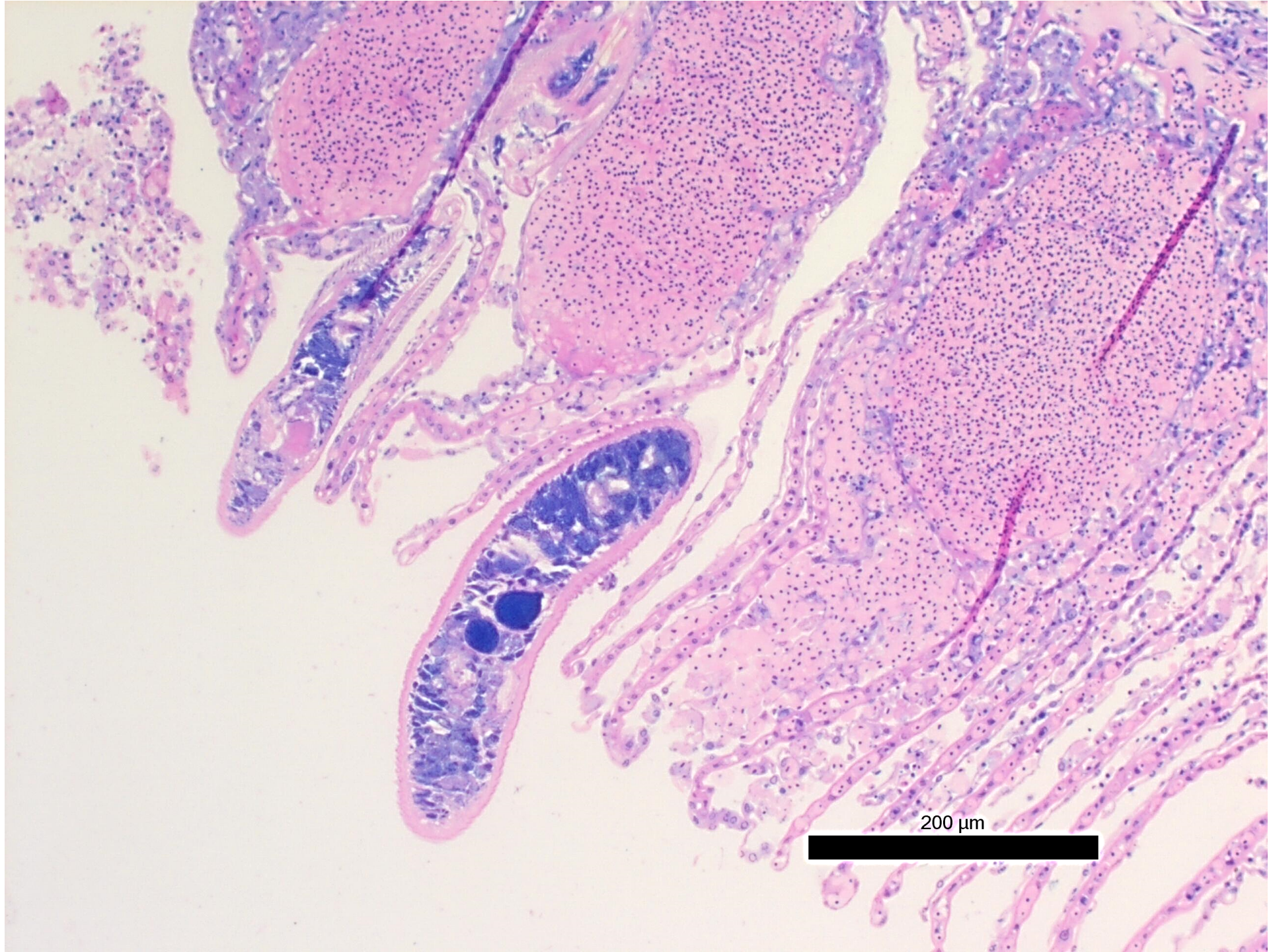
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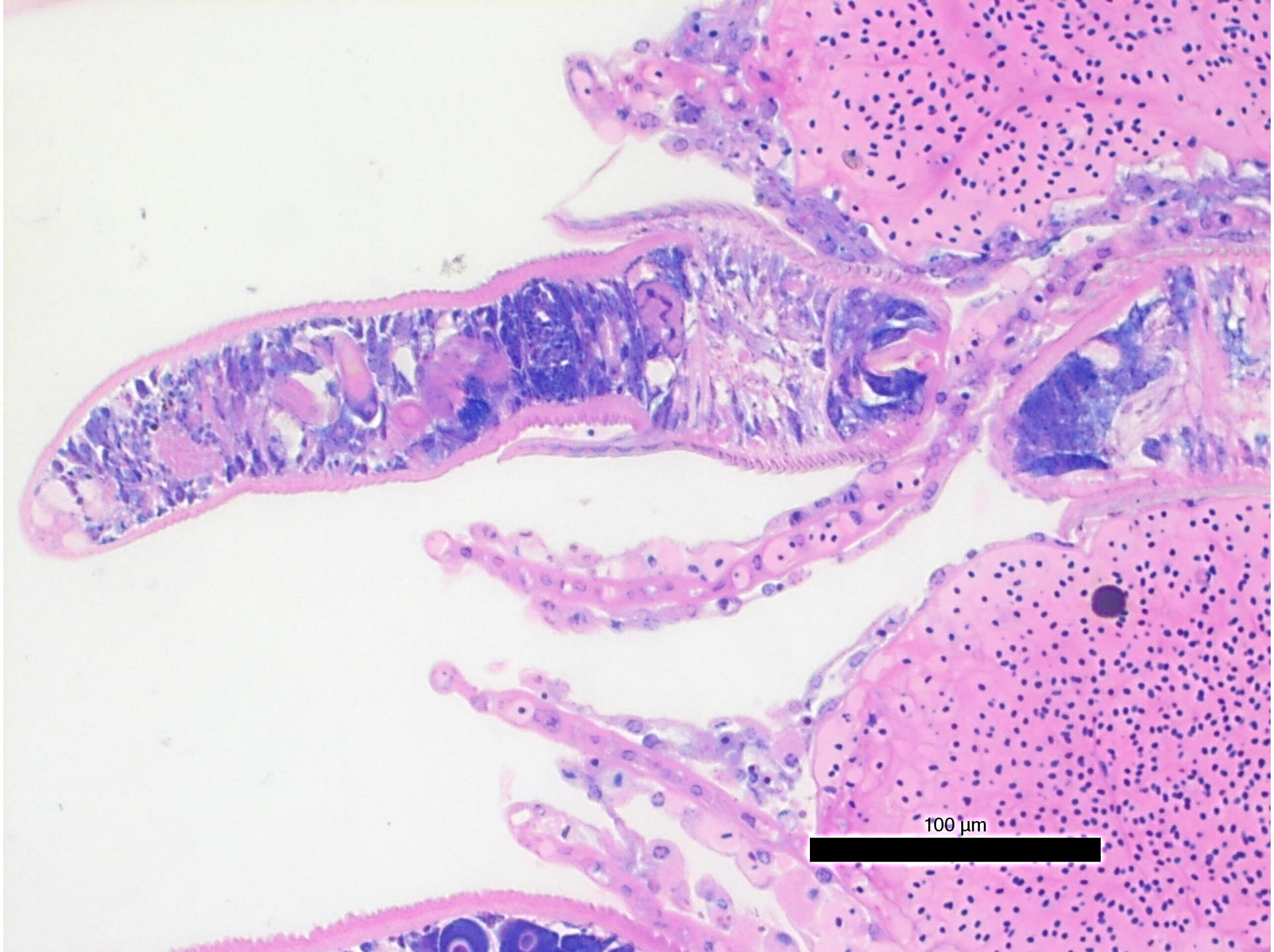
100 µm

Parasite management

- Break the life-cycle
- Adults and oncomiracidia are susceptible to treatments, eggs NO
- Two to three consecutive treatments with 15-20 days interval
- All stocks should be treated simultaneously
- Formalin treatment is effective (100 ppm for 1h)
- Monitoring of broodstock

Other parasites

- *Benedenia sciaenae* (Turkey)
- *Amyloodinium ocelatum* (Portugal)

Systemic granulomatosis

- Bottleneck for meagre production
- Disease of unknown aetiology
- Affects 100% of the population
- Severity: from very mild (undetected) to…..you will see
- Major task for WP24


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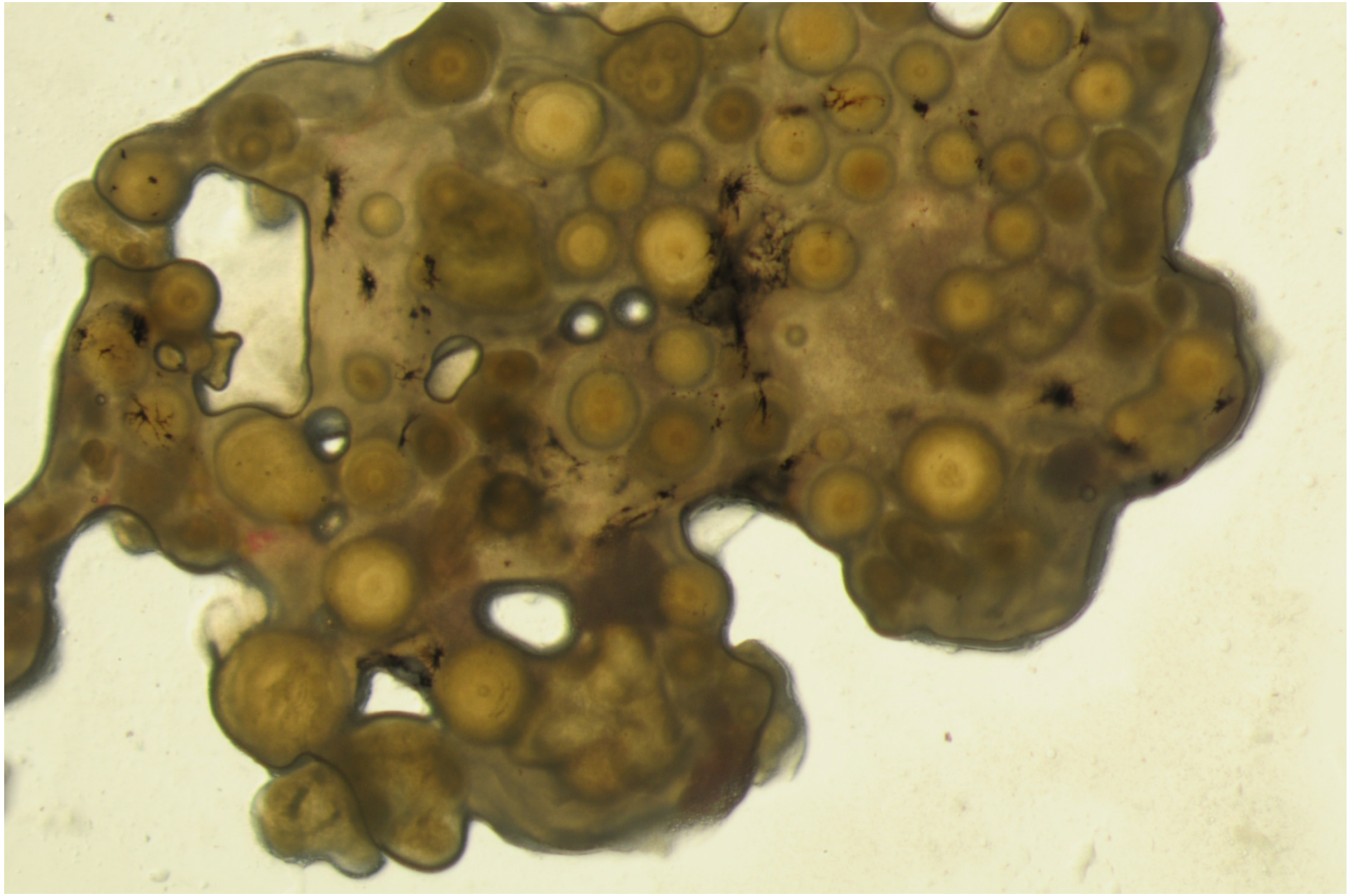
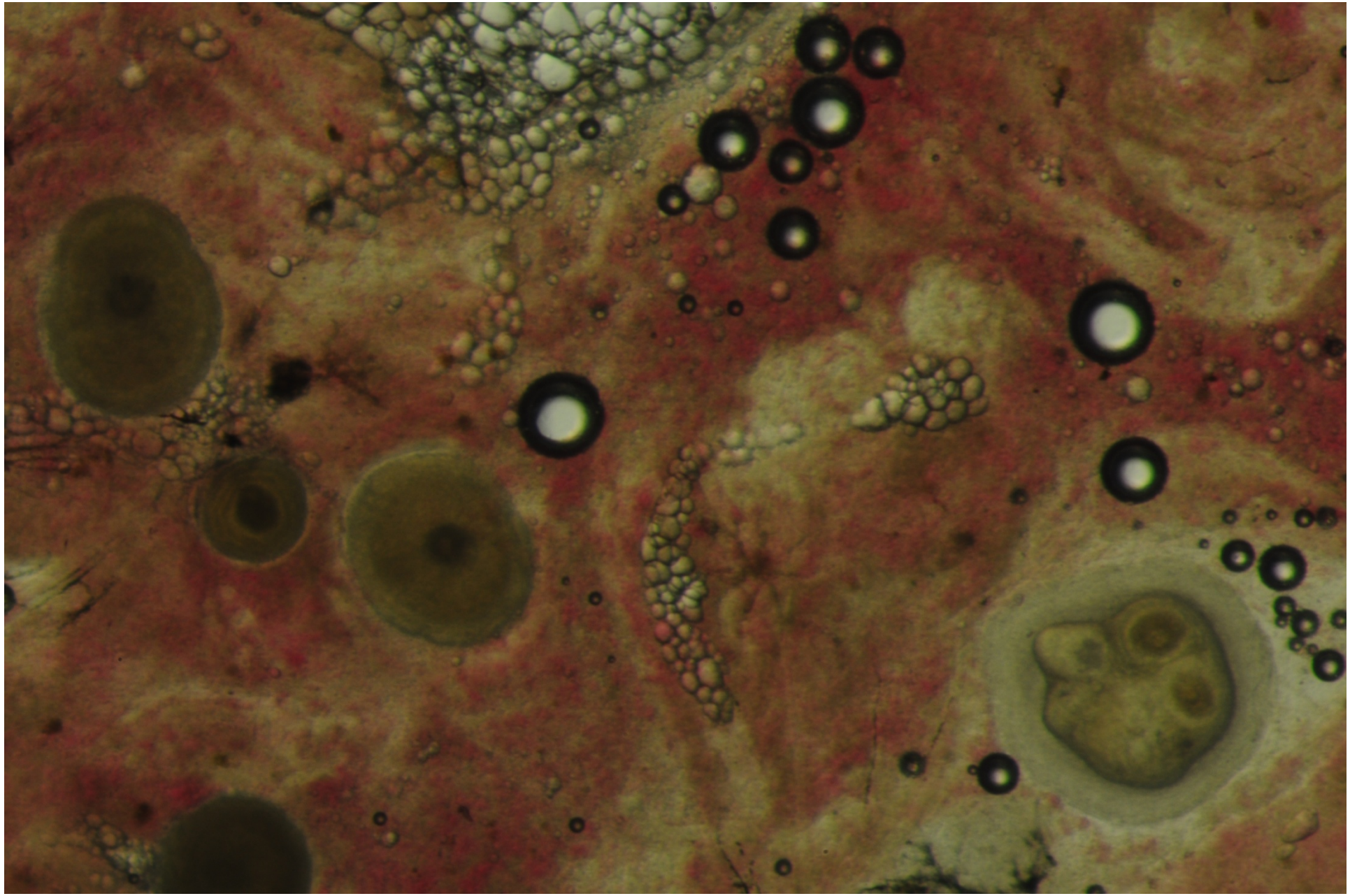
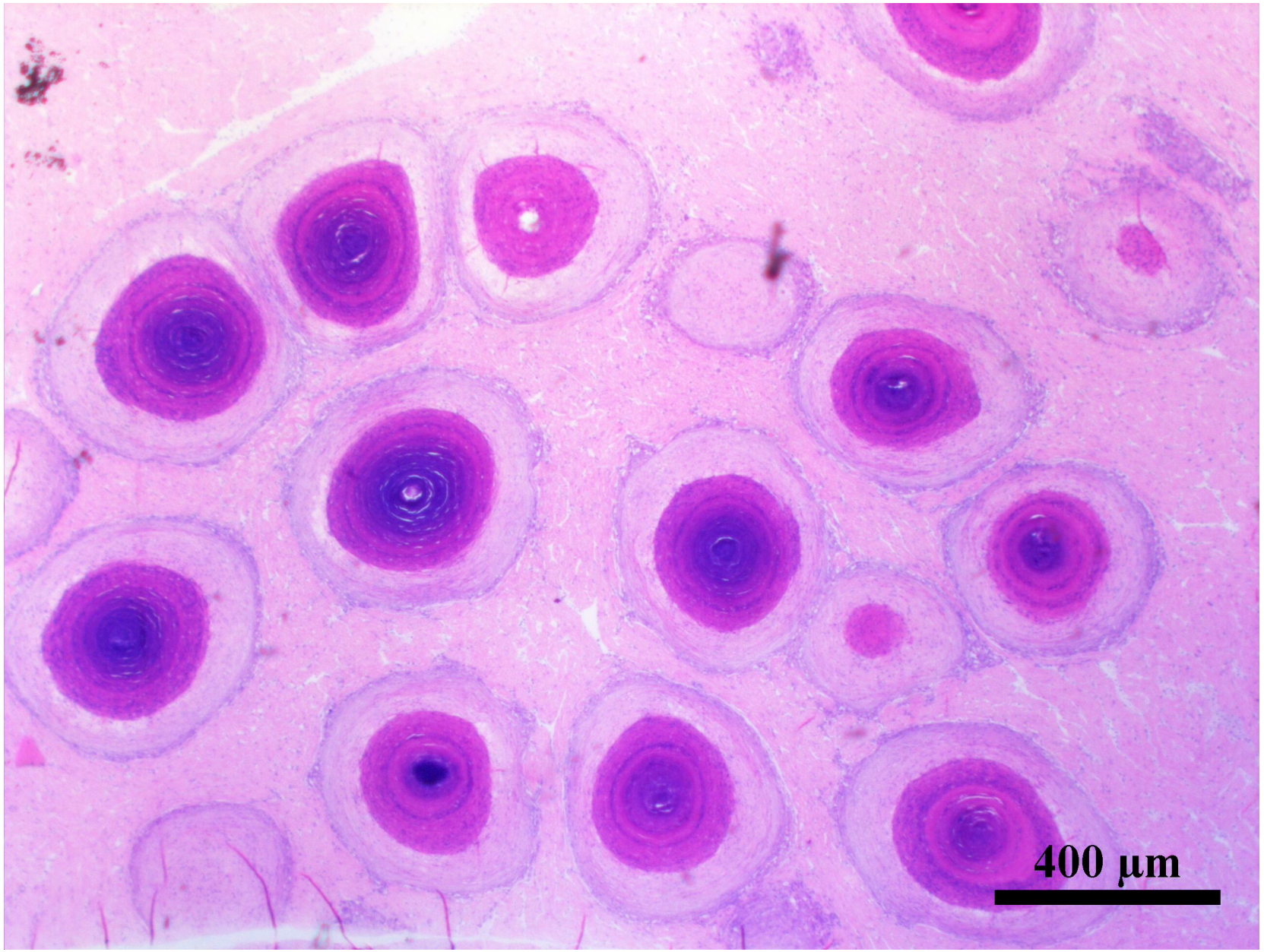
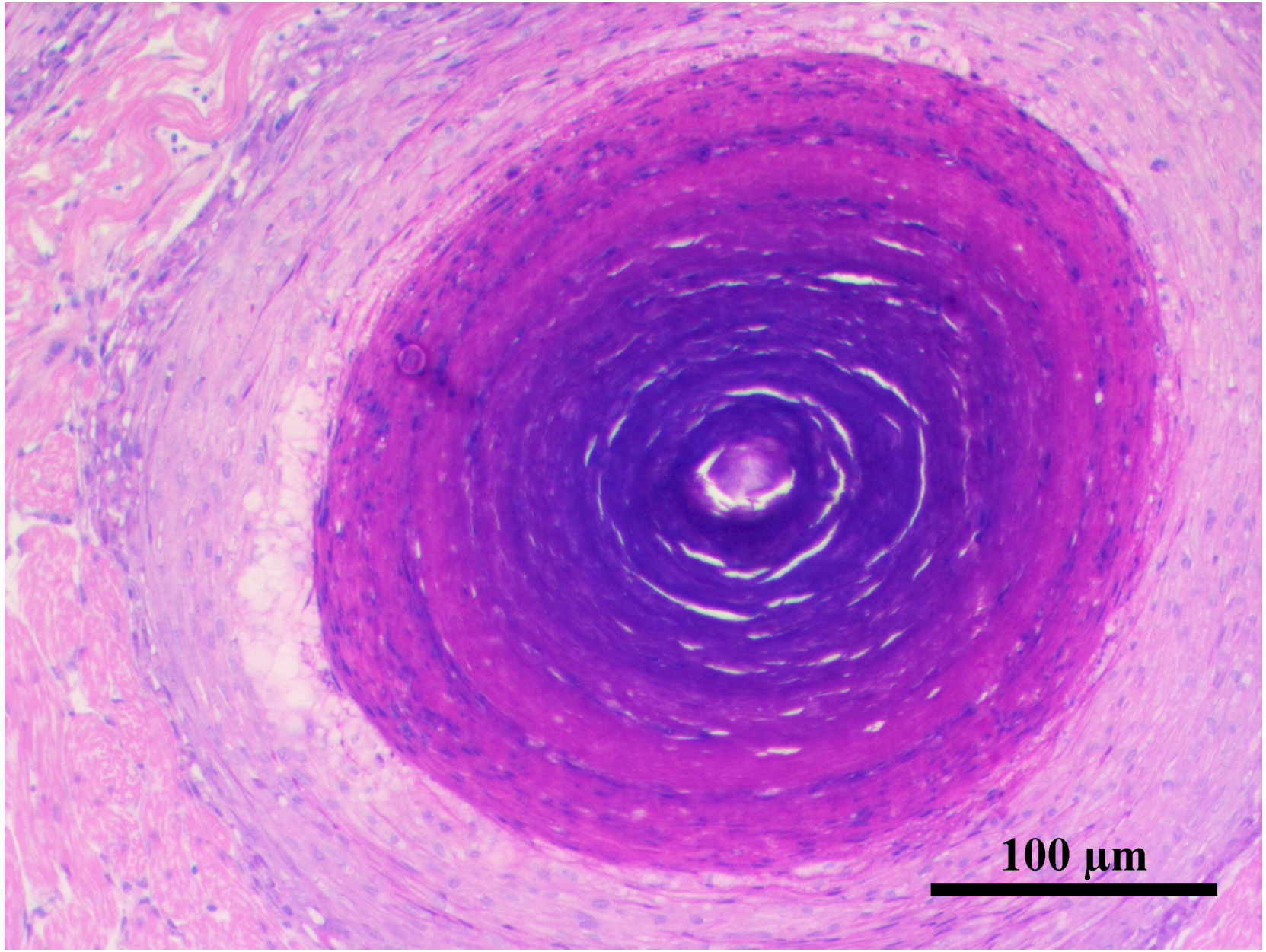
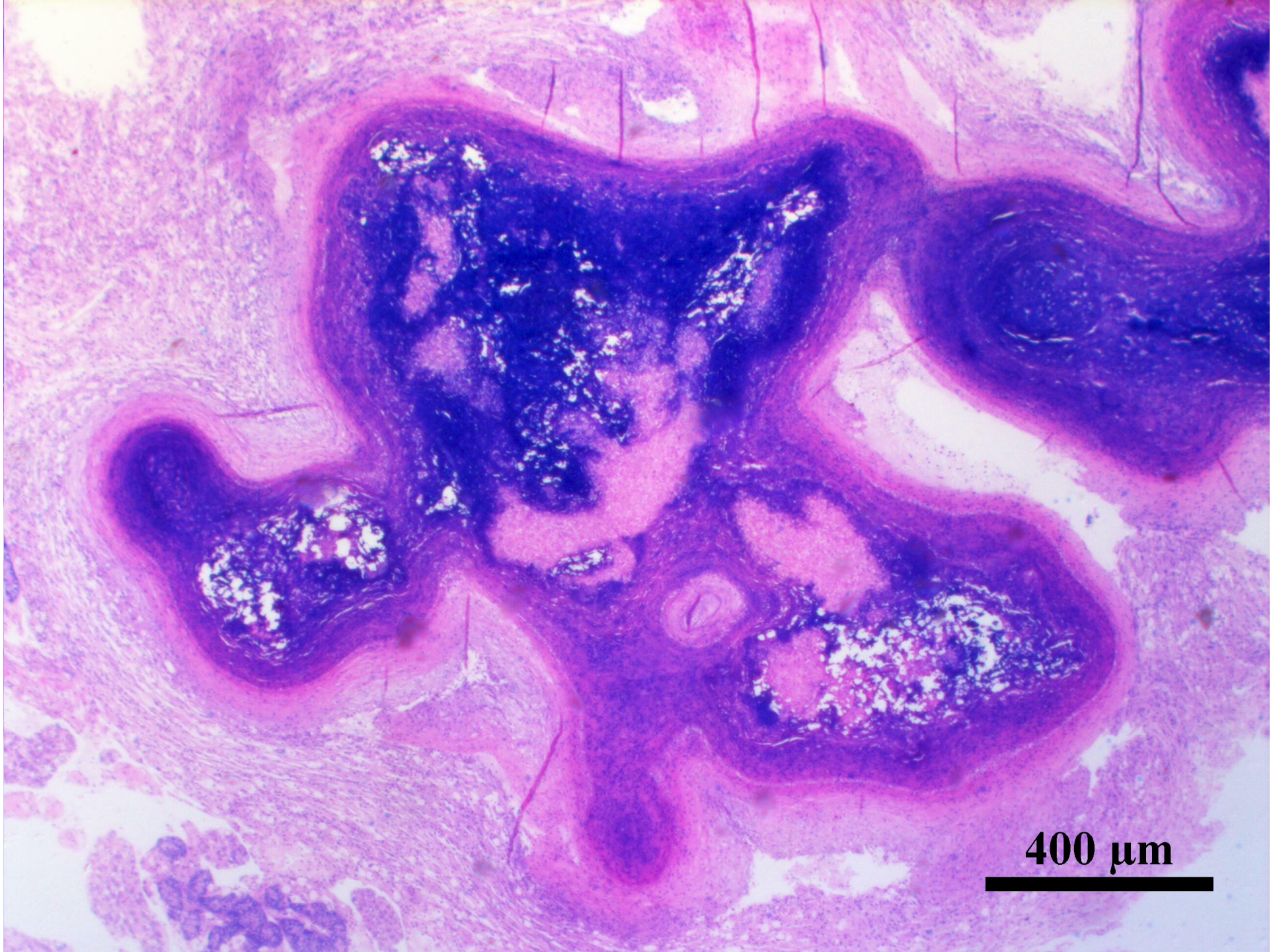
PRINT






400 µm


100 µm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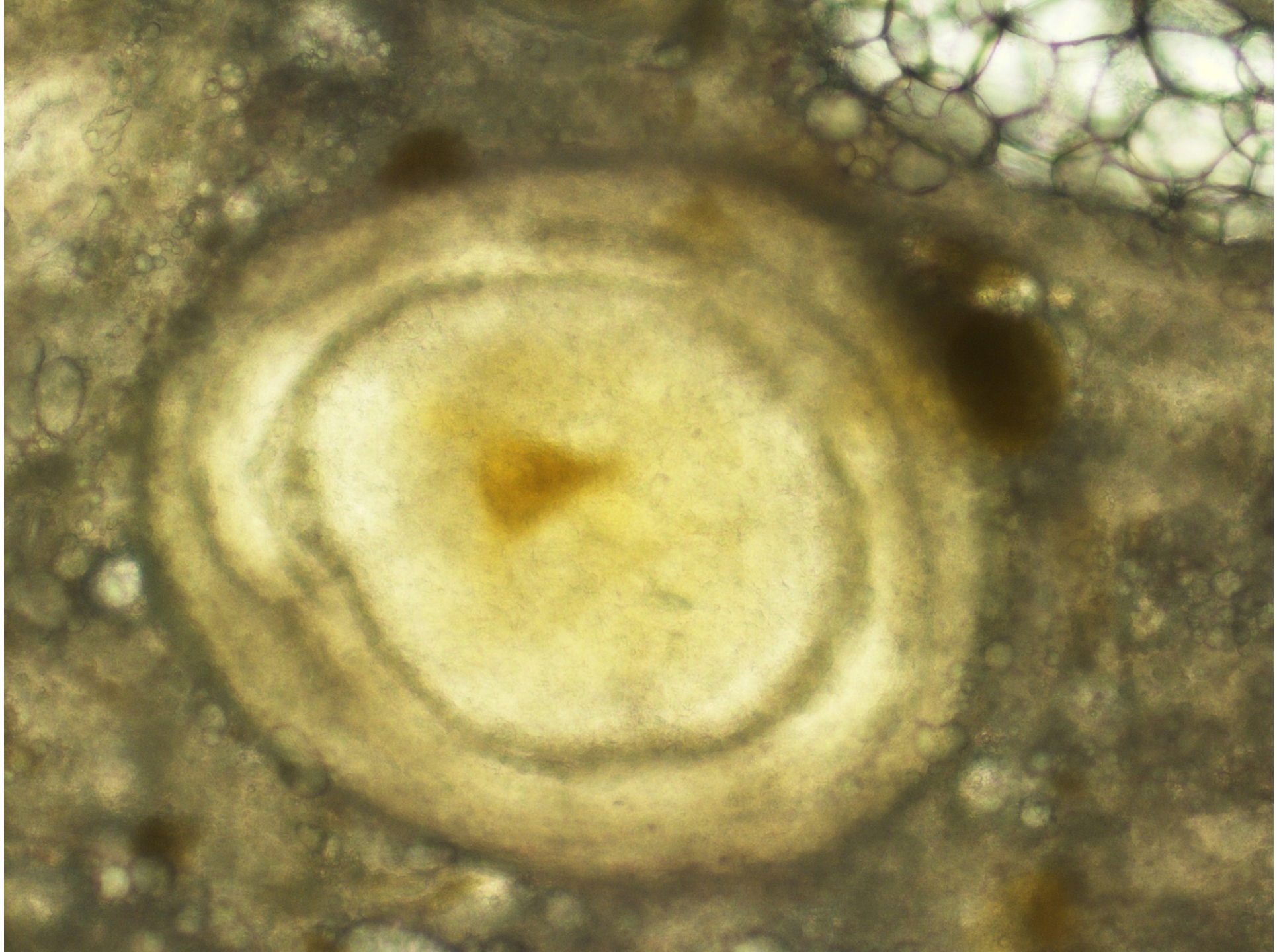
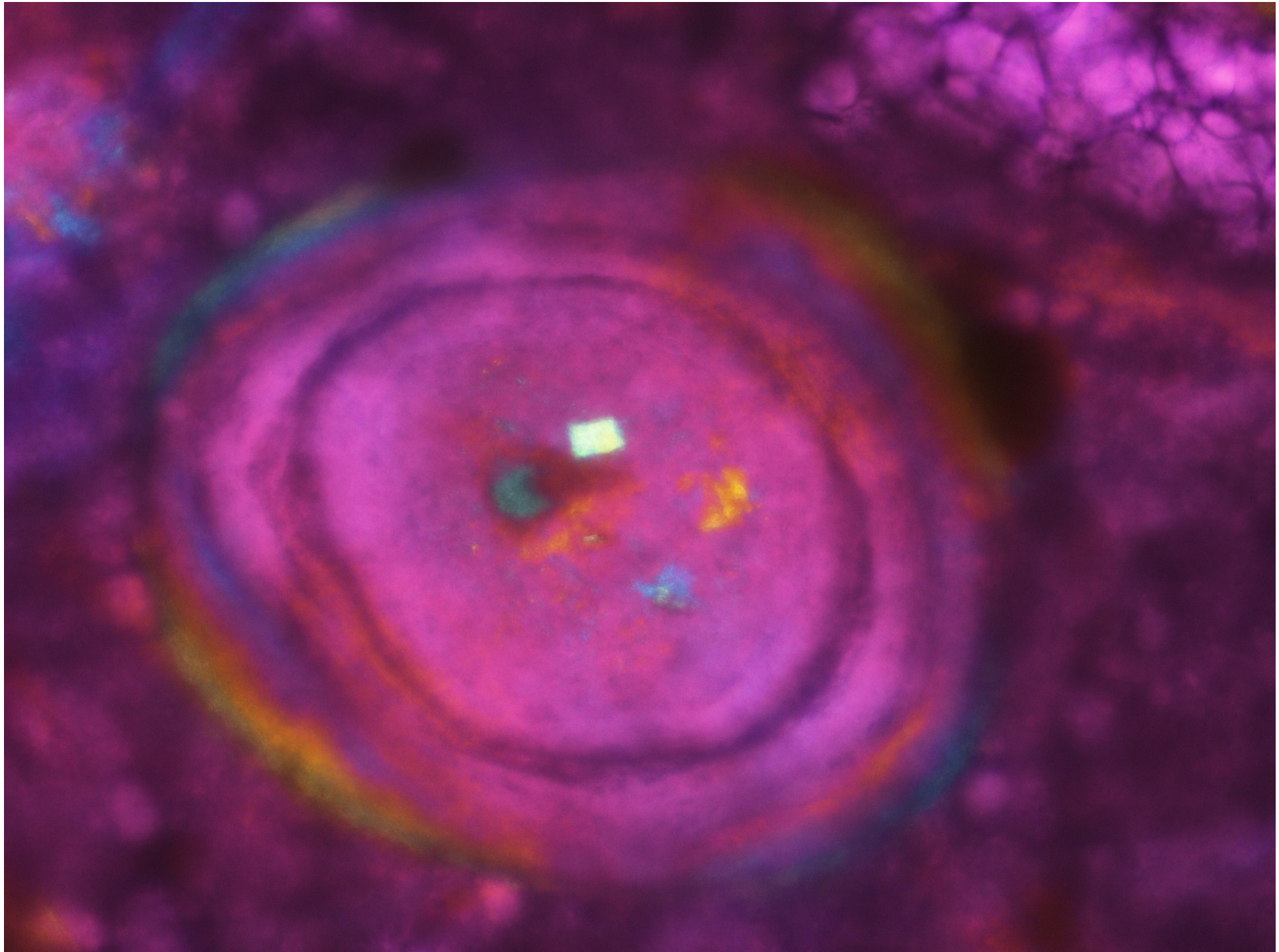
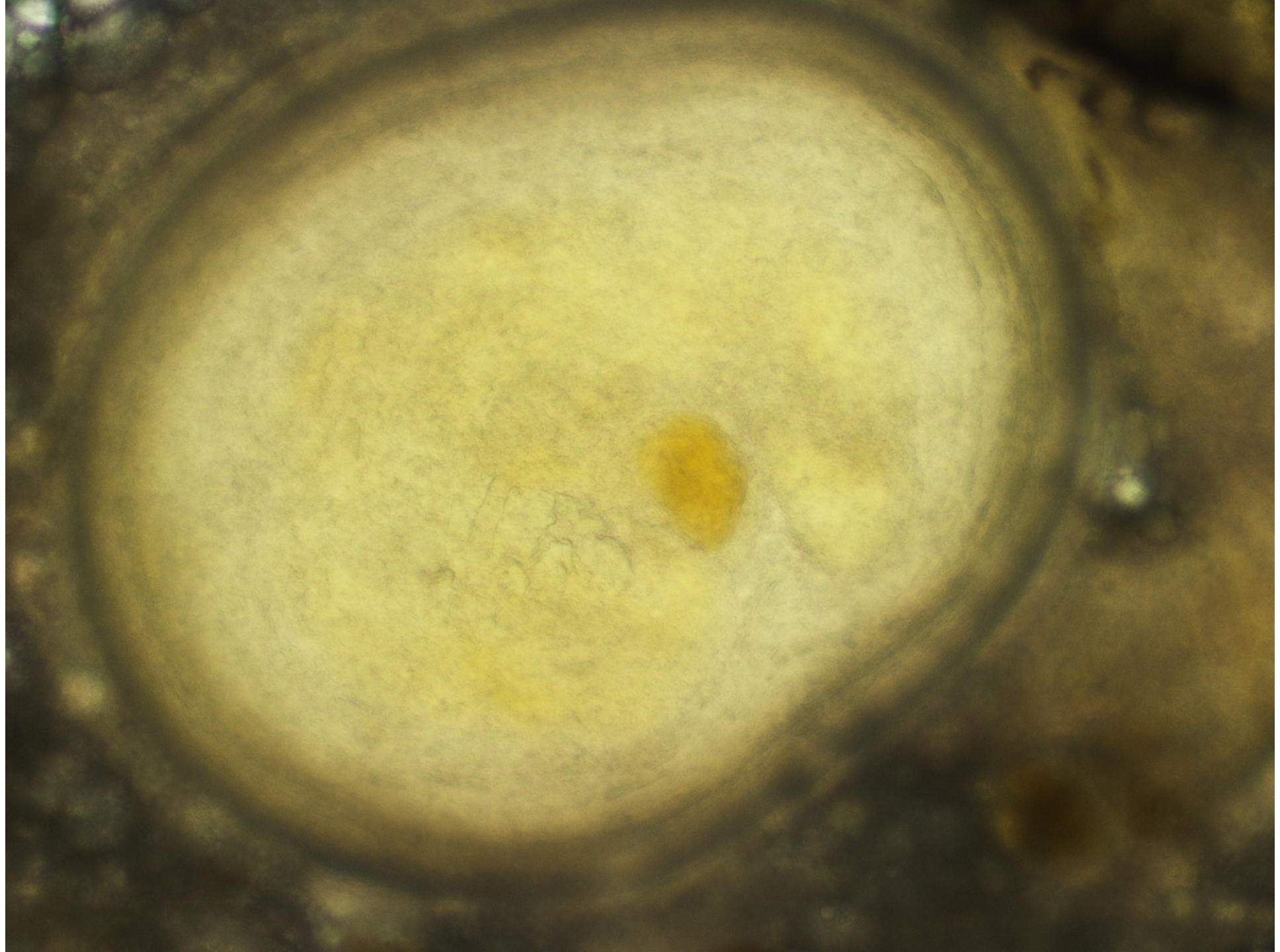
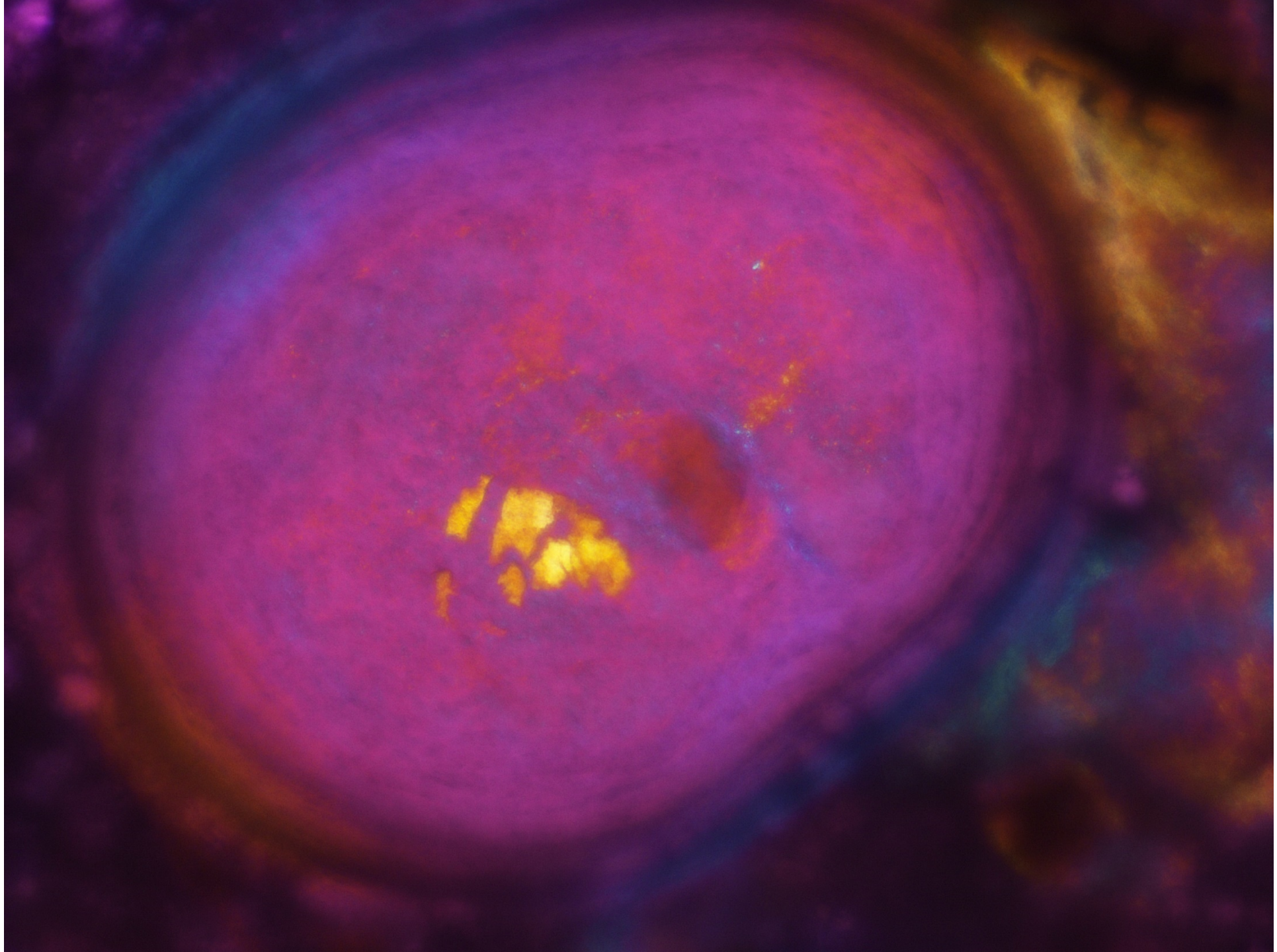
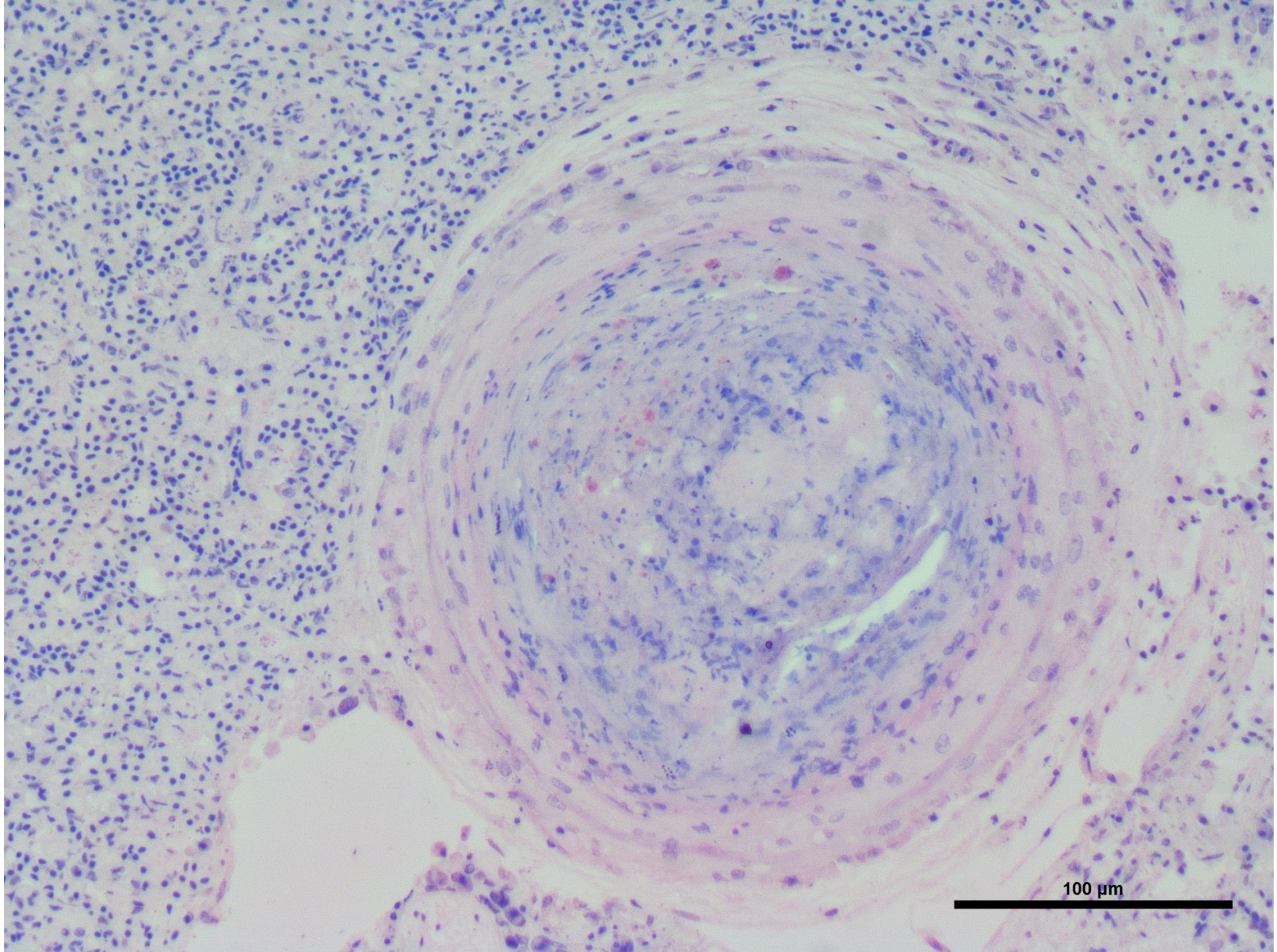









100 µm

Hypotheses

Nutritional (metabolic?) disease

- Visceral granulomas in sea bream-hypetyrosinaemia
- Visceral granulomas in brook trout
- Renal granulomas in turbot
- Some reports in cichlids and goldfish

Disease caused by pathogens

- Nocardia/mycobacteria
- Other granuloma-inducing pathogens (fungi, bacteria, intracellular parasites…)

Hypothesis #2
Infectious agent

Journal of Fish Diseases 2012 doi:10.1111/jfd.12015

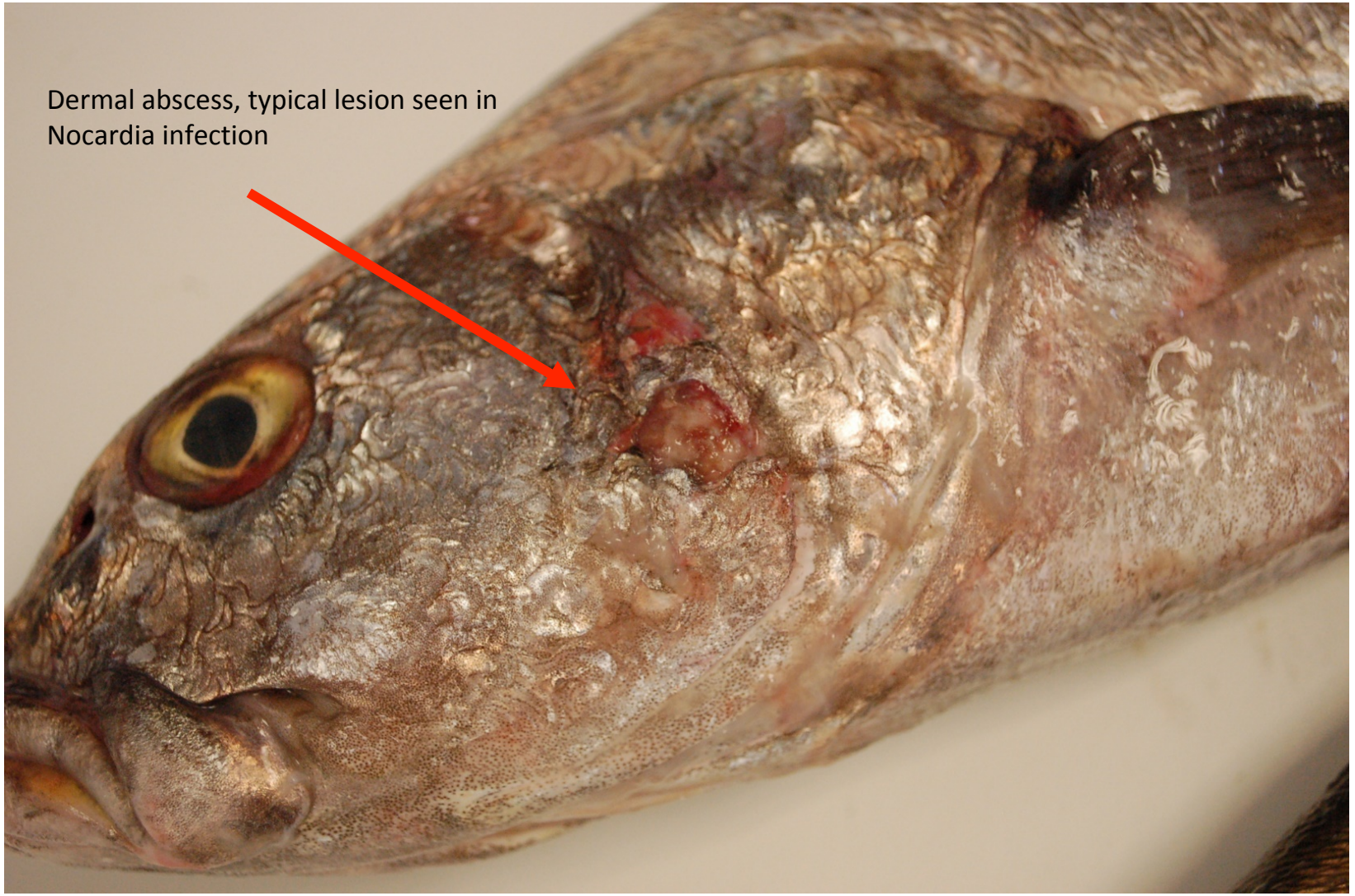
Systemic nocardiosis in a Mediterranean population of cultured meagre, *Argyrosomus regius* Asso (Perciformes: Sciaenidae)

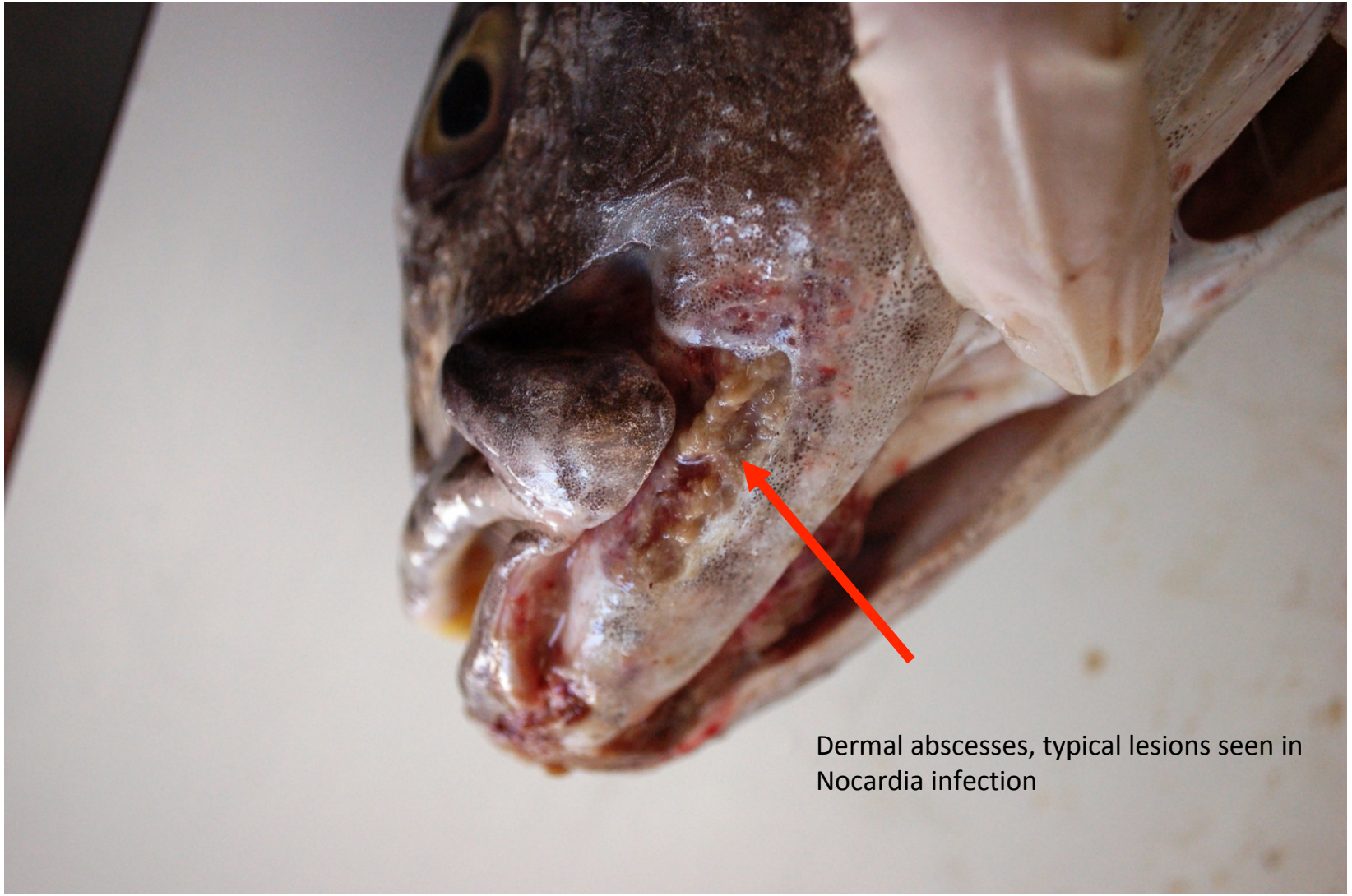
A Elkesh[1], K P L Kantham[2], A P Shinn[1], M Crumlish[1] and R H Richards[1]

1 Institute of Aquaculture, University of Stirling, Stirling, UK
2 Nireus S A, Hiliadou Doridos, Focida, Greece

After 3 years we finally have it!!!

Severe ulceration of the skin


Dermal abscess, typical lesion seen in
Nocardia infection

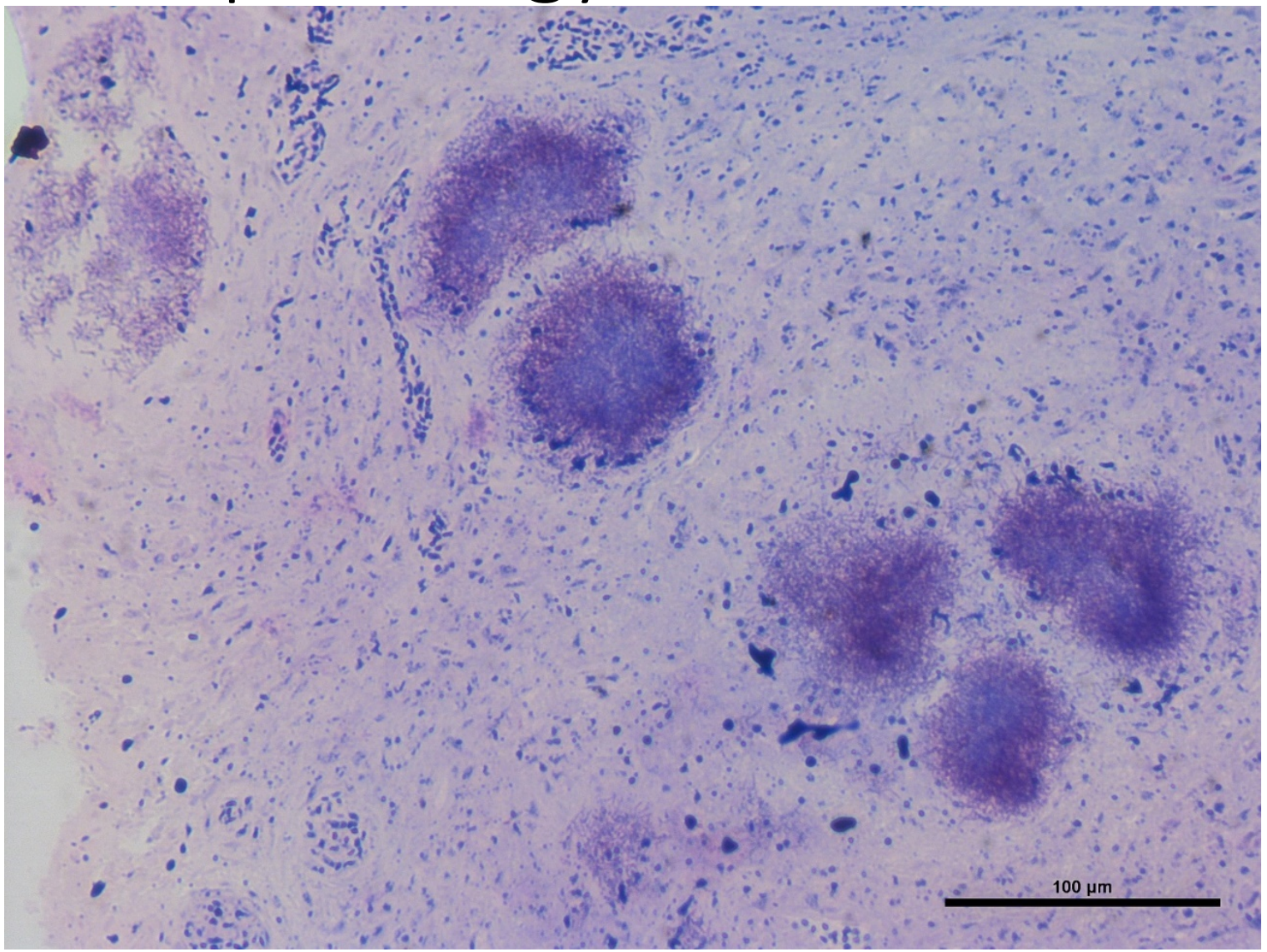


Dermal abscesses, typical lesions seen in Nocardia infection

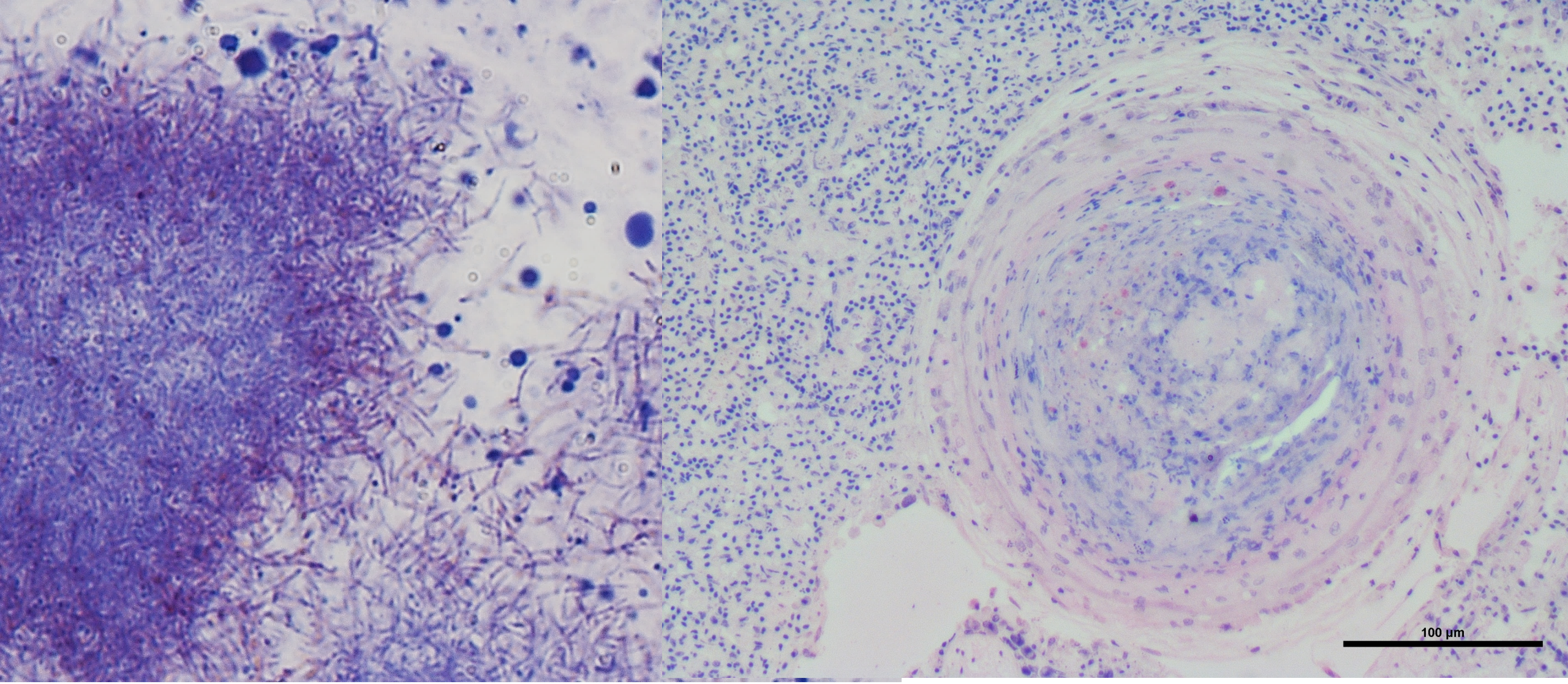
Molecular identification of the pathogen

- DNA extraction from the tissue
- PCR with primers designed for Nocardia
- Sequencing
- *Nocardia seriolae*

Histopathology



Section of dermal lesion showing bacterial colonies.
Ziehl Neelsen stain



Higher magnification of the previous picture, showing acid-fast elongated and branching bacteria, consistent with the typical morphology of *Nocardia* spp.
Ziehl Neelsen stain

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journal homepage: www.elsevier.com/locate/aqrep

The aetiology of systemic granulomatosis in meagre (*Argyrosomus regius*): The "*Nocardia*" hypothesis

M.I. Tsertou[a,b,1], M. Smyrli[b,1], C. Kokkari[b], E. Antonopoulou[a], P. Katharios[b,*]

[a] *Laboratory of Animal Physiology, Department of Zoology, School of Biology, Faculty of Sciences, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece*
[b] *Institute of Marine Biology, Biotechnology and Aquaculture, HCMR, Former American Base of Gournes, Heraklion 71003, Crete, Greece*

DIVERSIFY WP24 feeding trials

HCMR

- Effect of Vitamin D
- Effect of Ca/P ratio
- Effect of plant proteins

FCPCT

- combined effect of vitamins E, C and carotenoids
- effect of Se, Mn and Zn

Ramon Fontanillas

SKRETTING
a Nutreco company

General conclusions

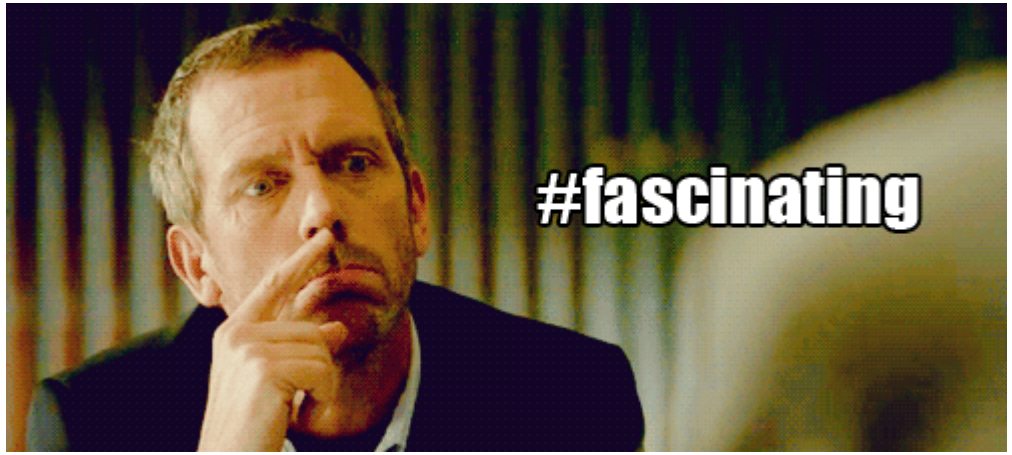
- Vitamin D_3 supplementation did not affect the development of the SG,
- High P content in the diet seems to improve the condition
- Plant protein replacement affects negatively the progression of the SG.
- High dietary content of the antioxidants vitamin E and C increased the incidence and number of fish with lower severity of SG
- The addition of Zn, Mn and Se did not ameliorate the granuloma incidence or severity.
- Nocardiosis is present in Greece, most probably in a confined geographical region; however it is not the cause of SG.

Recommendations

- A combined diet with high percentage of fishmeal (60%) and high dietary content of P (15gkg^{-1}) and antioxidants vitamins E and C.
- Since there is no data available about the reversibility of SG we recommend to start feeding with this diet when the fish weight is about 2g.

Further hypothesis for granulomatosis

- Other nutritional metabolic factors
- Genetic background (diversity of broodstock)
- Unknown and invisible pathogen

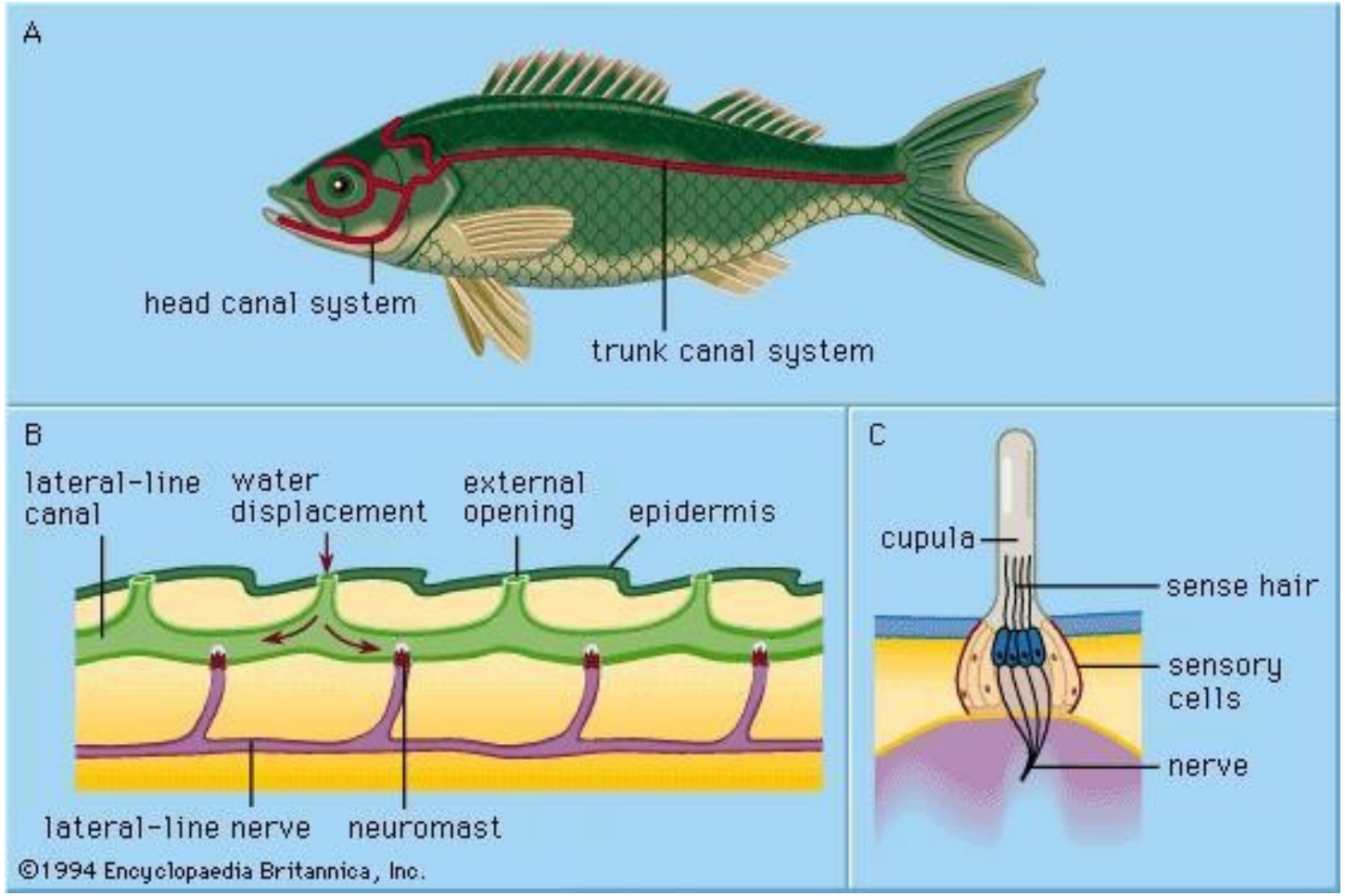


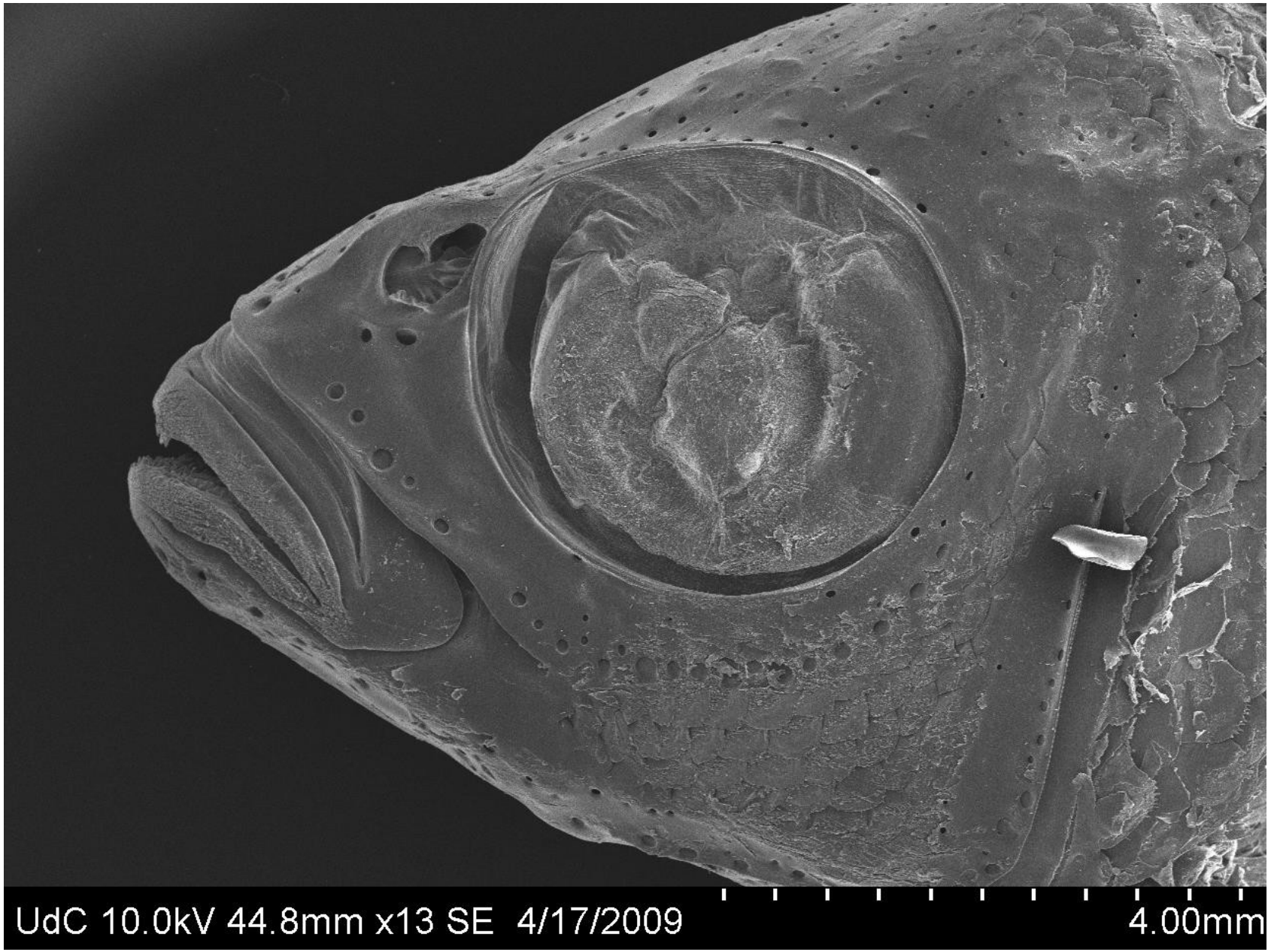
Chronic Ulcerative Dermatopathy: The disease

Murray cod, freshwater

Sharpsnout seabream and meagre in seawater

The lateral line organ

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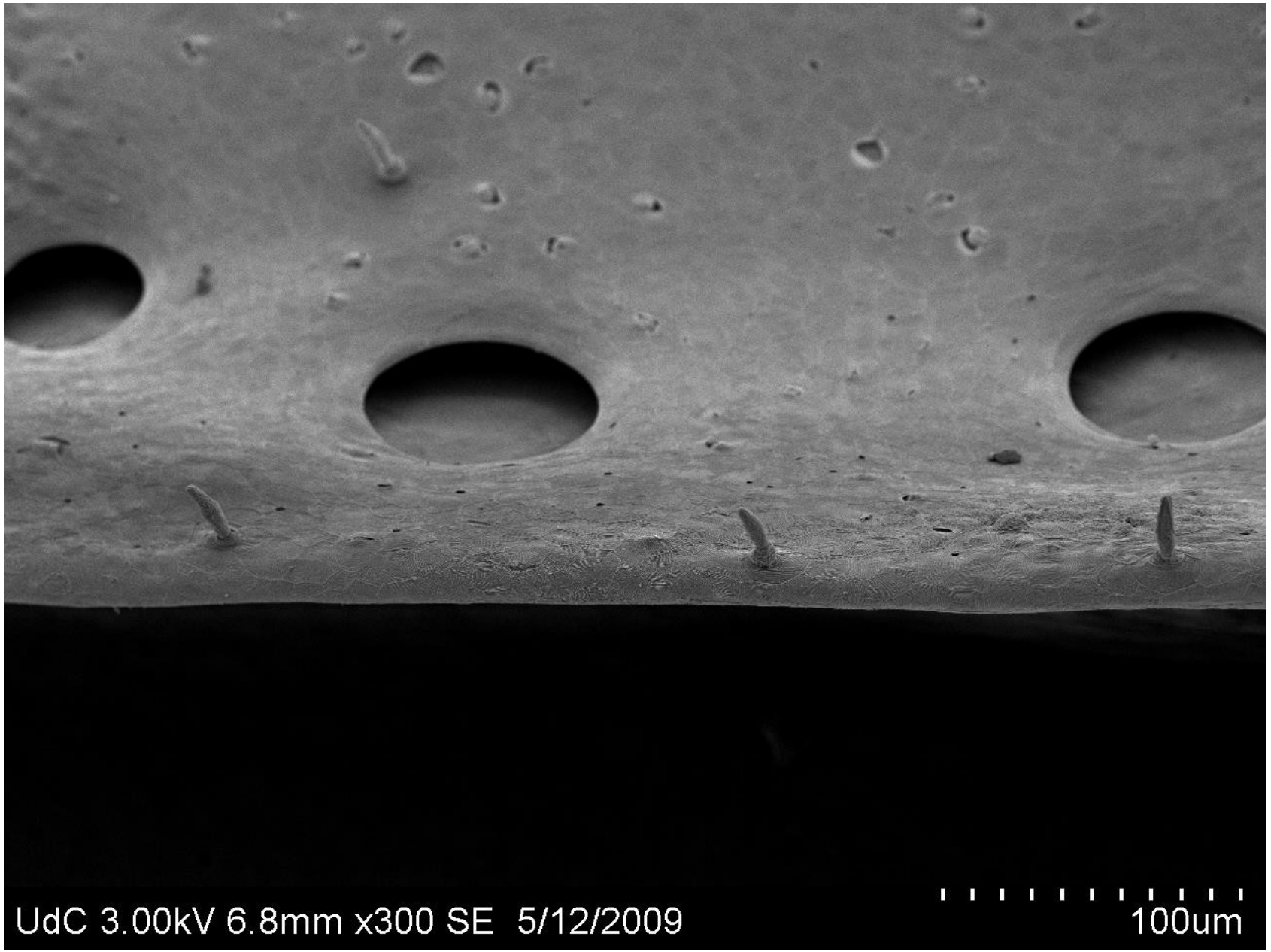
4.00mm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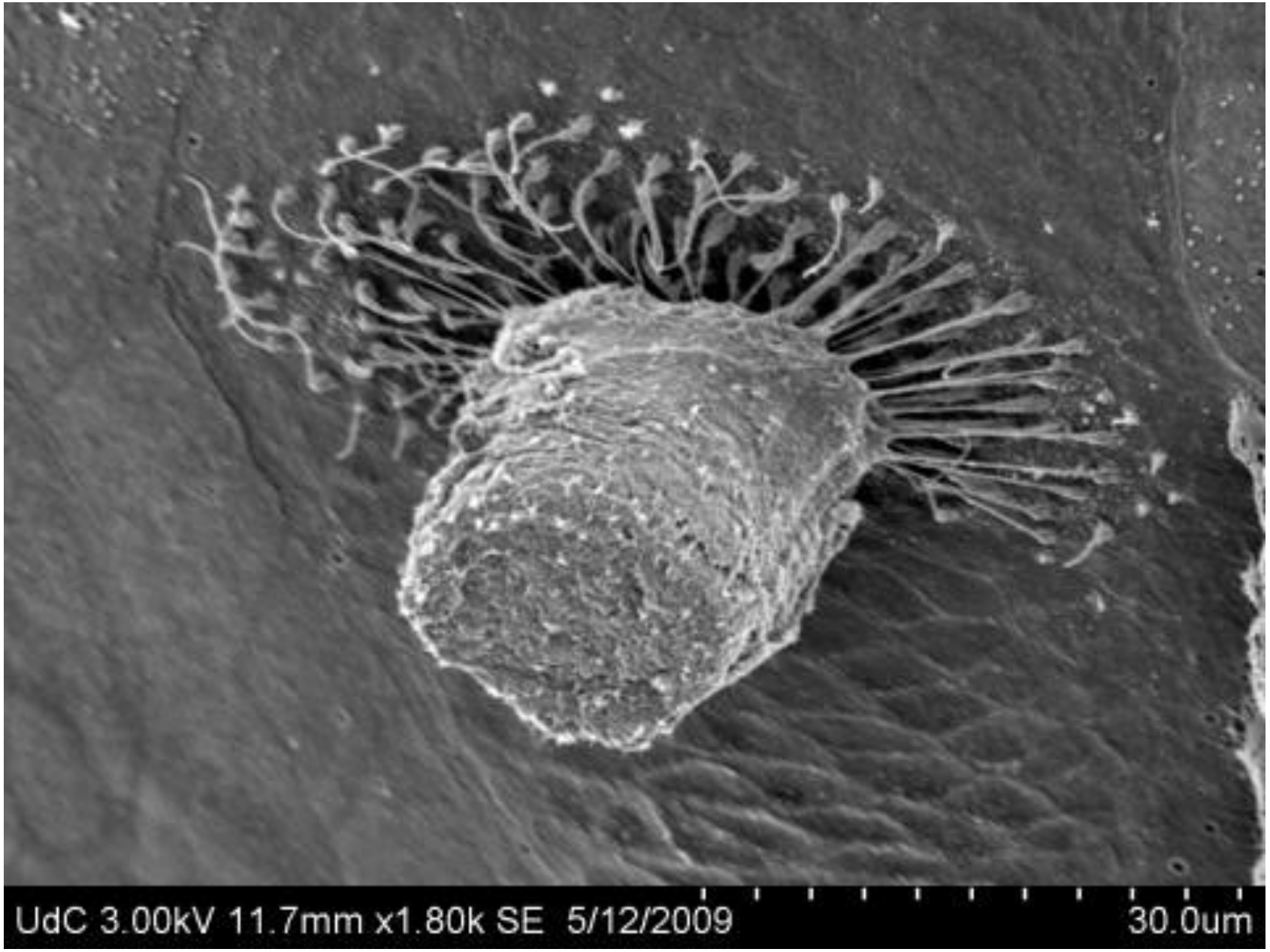
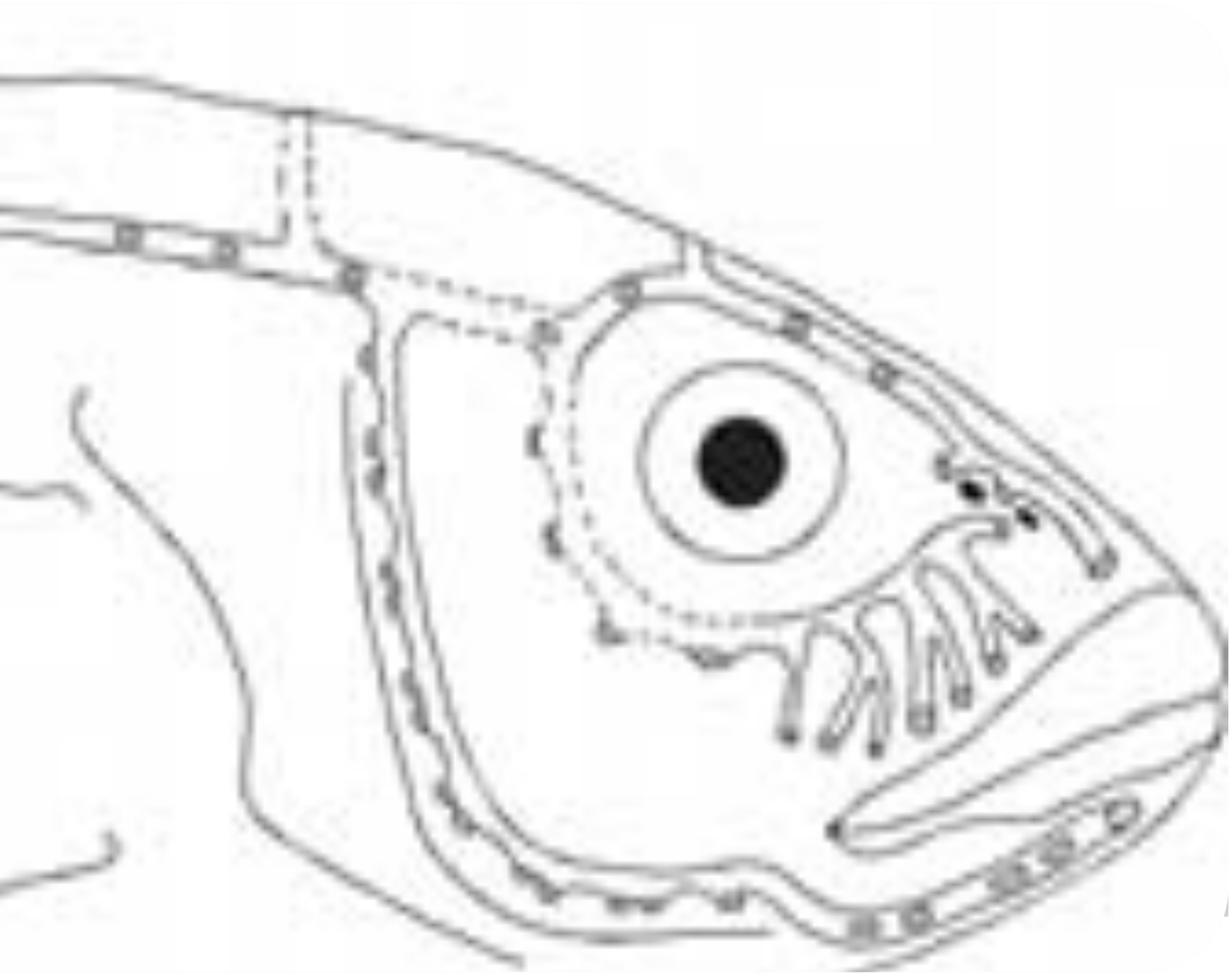
100um


UdC 3.00kV 11.7mm x1.80k SE 5/12/2009
30.0um



What do we know about the disease

- It is non infectious
- It is directly connected to borehole (ground) water
- It affects a wide range of fish species both in fresh and seawater

- **Hypothesis**
- Increased enzymatic activity at the lateral line canals (possibly osteoclast activity)

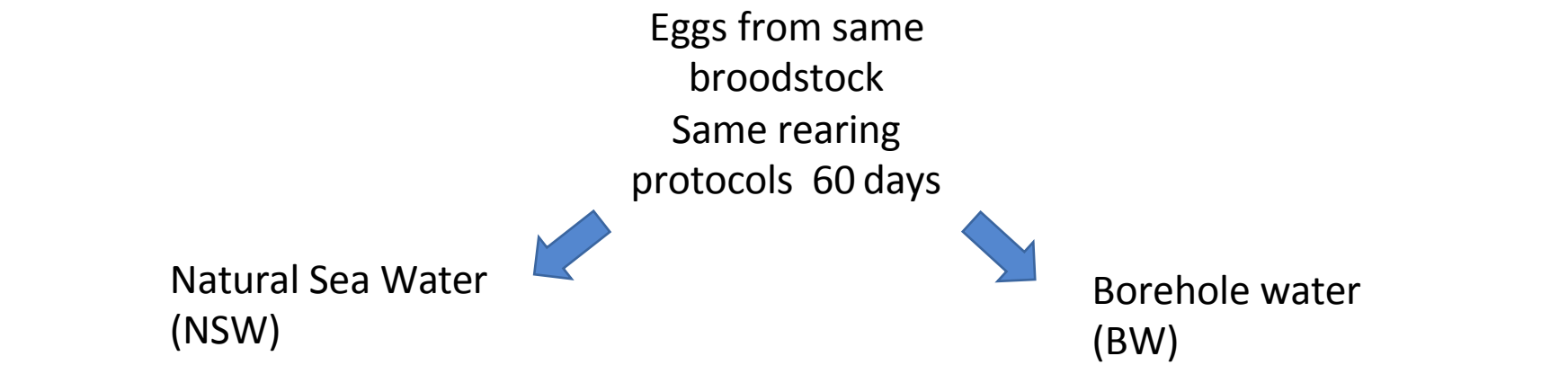
- Katharios, P., Papadaki, M., Ternengo, S., Kantham, P.K., Zeri, C., Petraki, P.E., Divanach, P., 2011. Chronic ulcerative dermatopathy in cultured marine fishes. Comparative study in sharpsnout sea bream, Diplodus puntazzo (Walbaum). J. Fish Dis. 34, 459–474.

Aims of the task

- Development of the lateral line organ
- Study of Chronic Ulcerative Dermatopathy in meagre through:

1. Histology
2. SEM
3. Gene expression of genes related to osteoclast/osteoblast activity (TRAP, cathK, vATP)

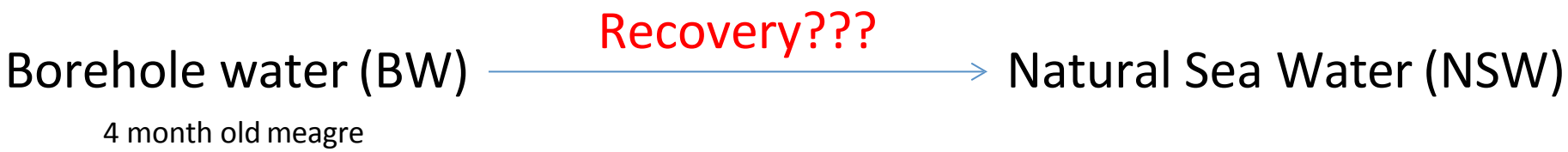
Experimental design (1/2)



Samplings: 1, 2, 3, 4, 5, 6, 7, 9, 11, 13, 15, 17, 19, 21, 26, 31, 36, 41, 46 and 51 dph

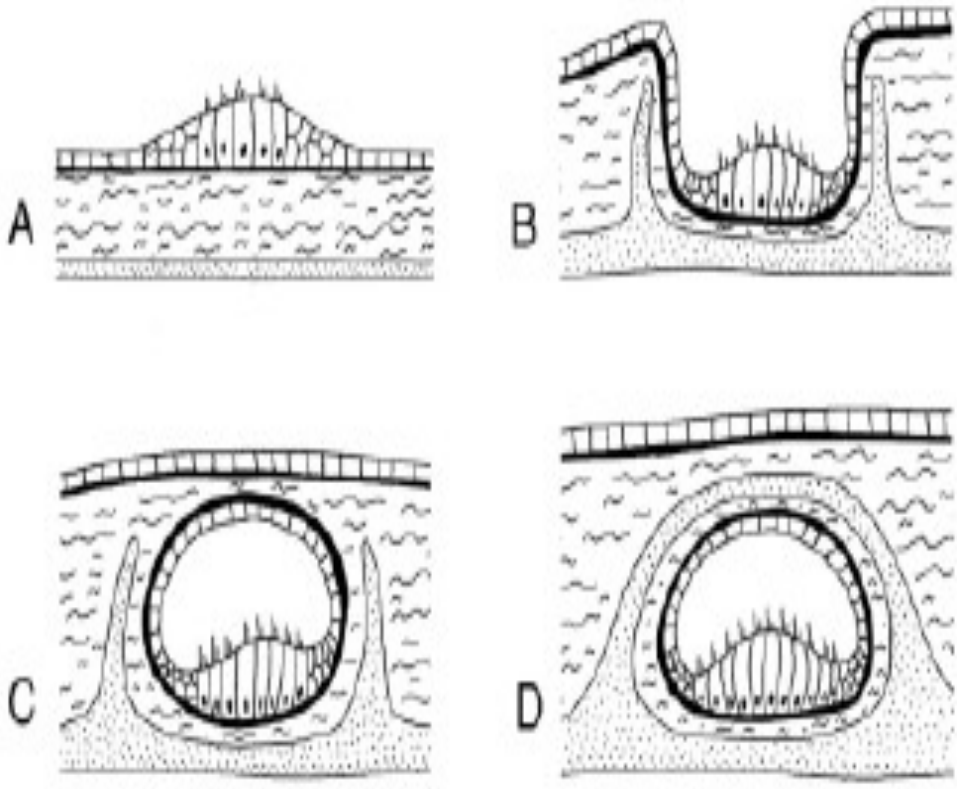
Histology, SEM, qPCR

Experimental design (2/2)



Macroscopic observations

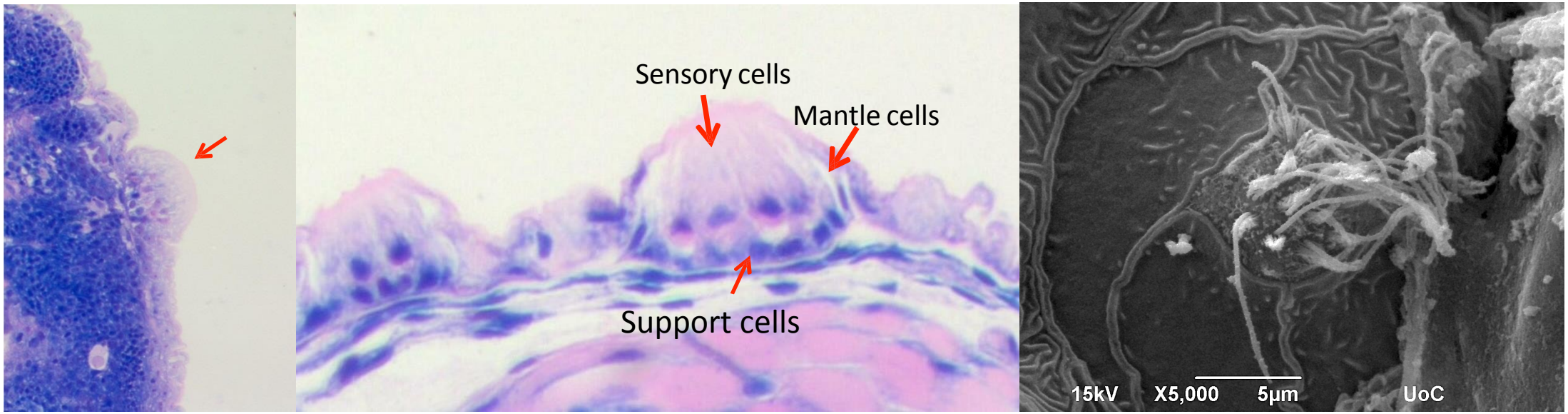
Ontogeny of the lateral line



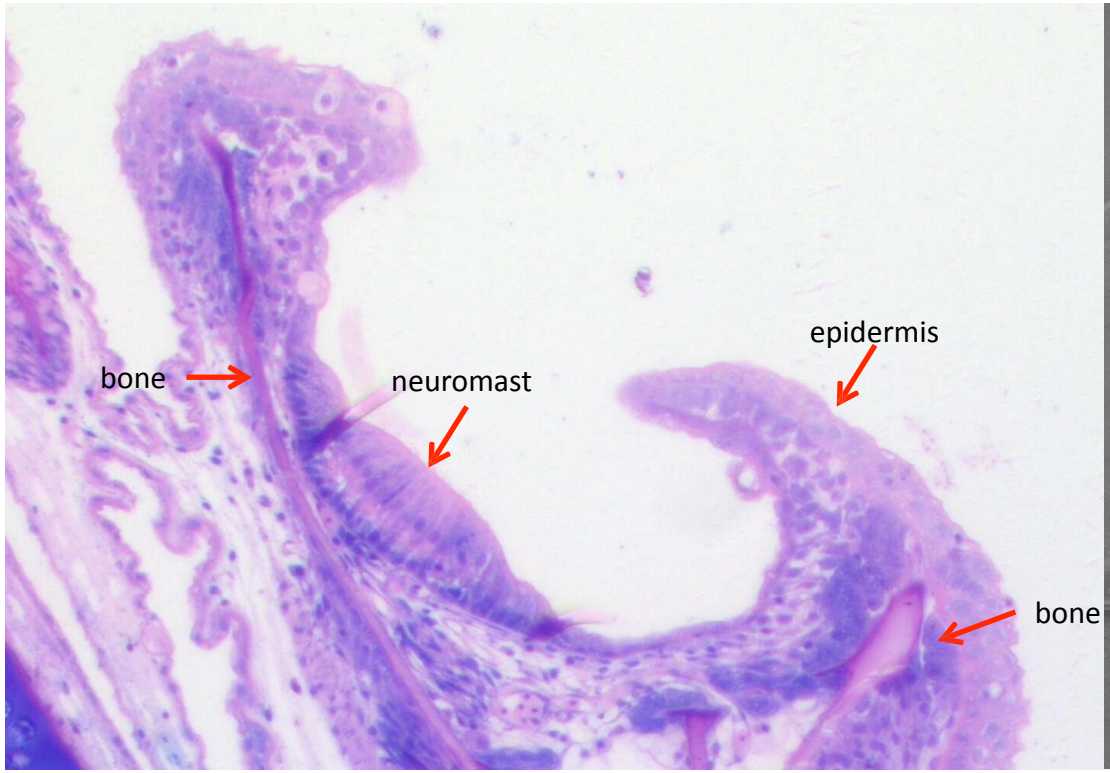
Tarby, M.L., Webb, J.F., 2003. Development of the supraorbital and mandibular lateral line canals in the cichlid, Archocentrus nigrofasciatus. J. Morphol. 255, 44–57. doi: 10.1002/jmor.10045

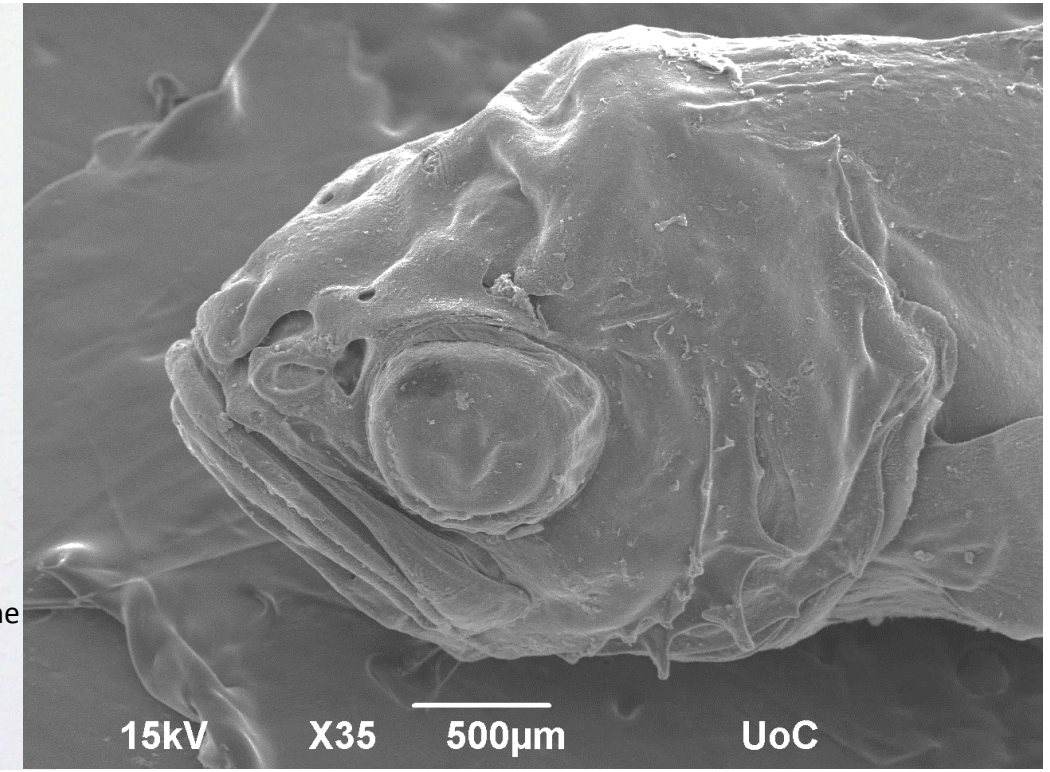
Ontogeny of the lateral line in meagre

Neuromasts on the skin of meagre larvae (1-3 dph)

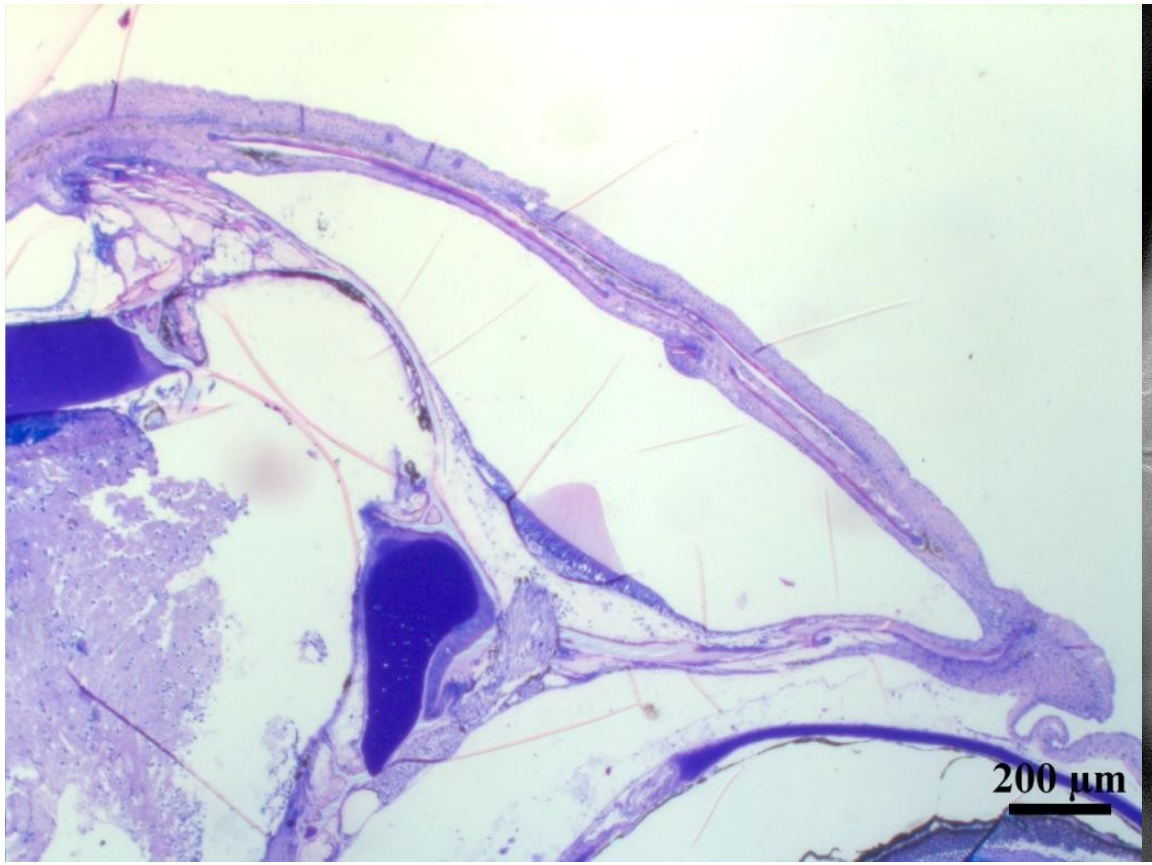


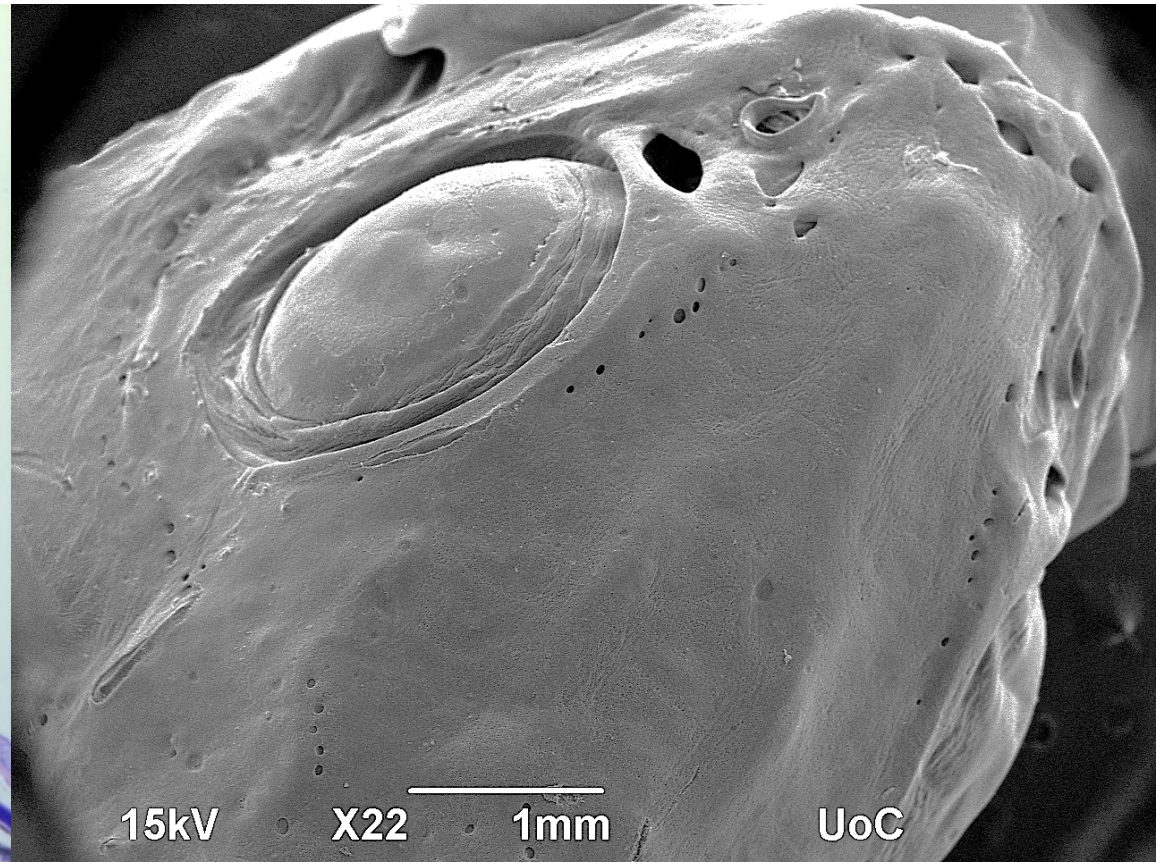
17-25 dph (TL: 5.7-13.7 mm) : formation of the basic lateral line canals of the head (infraorbital, supraorbital and mandibular)





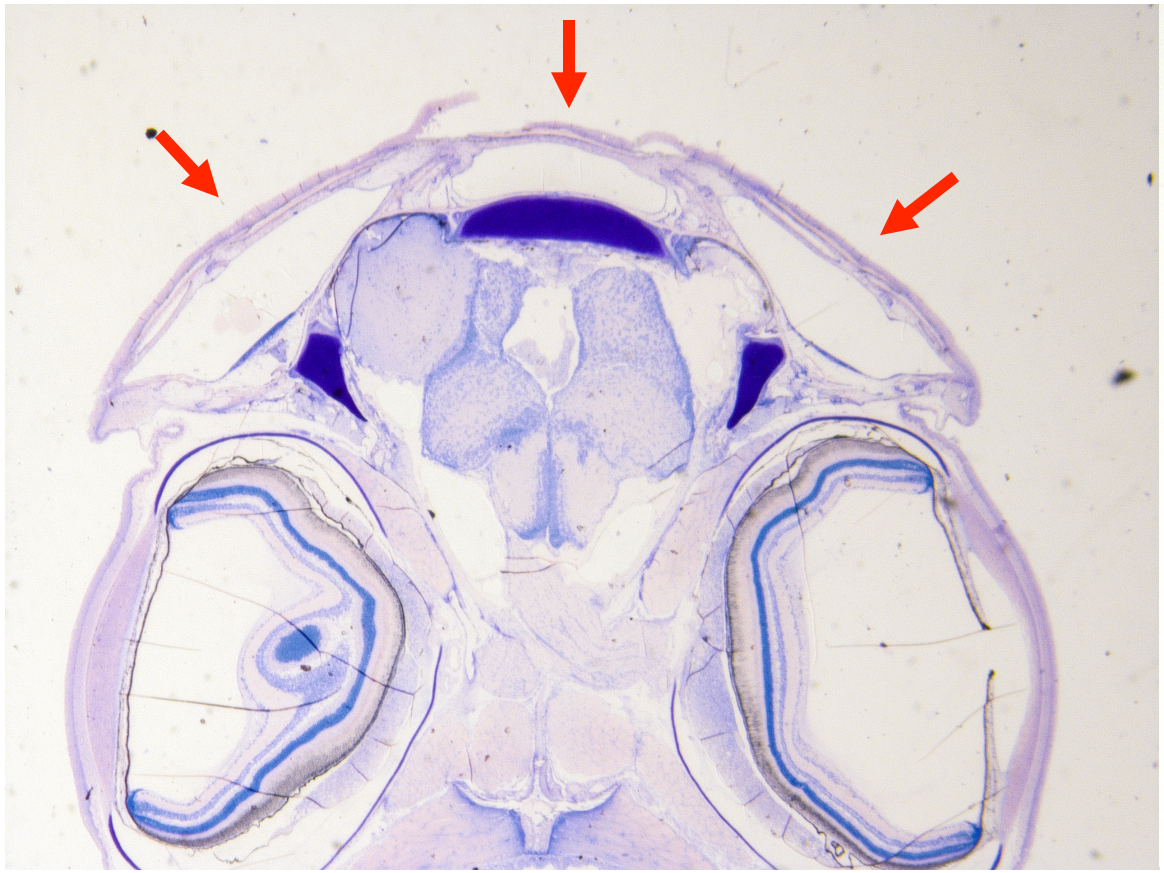
40 dph (TL: 35 mm) : completely developed lateral line

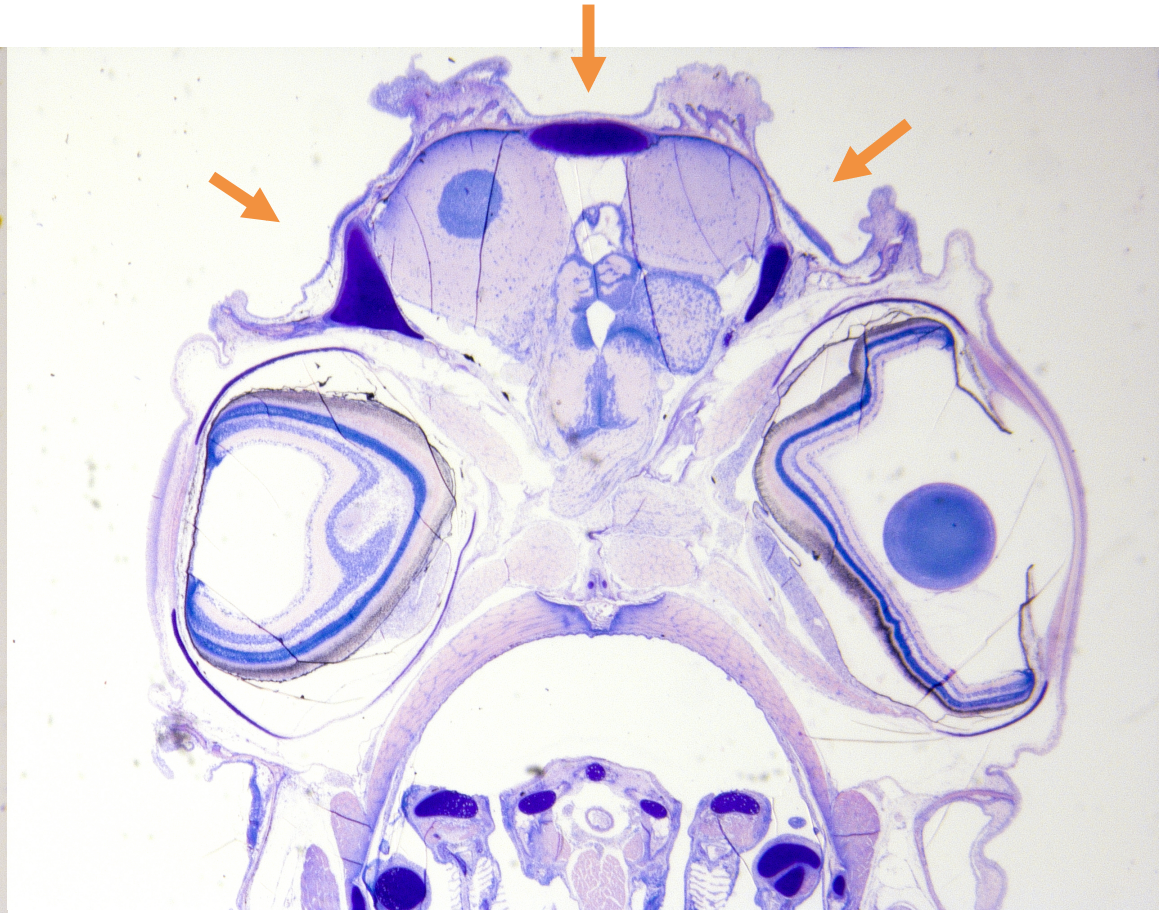




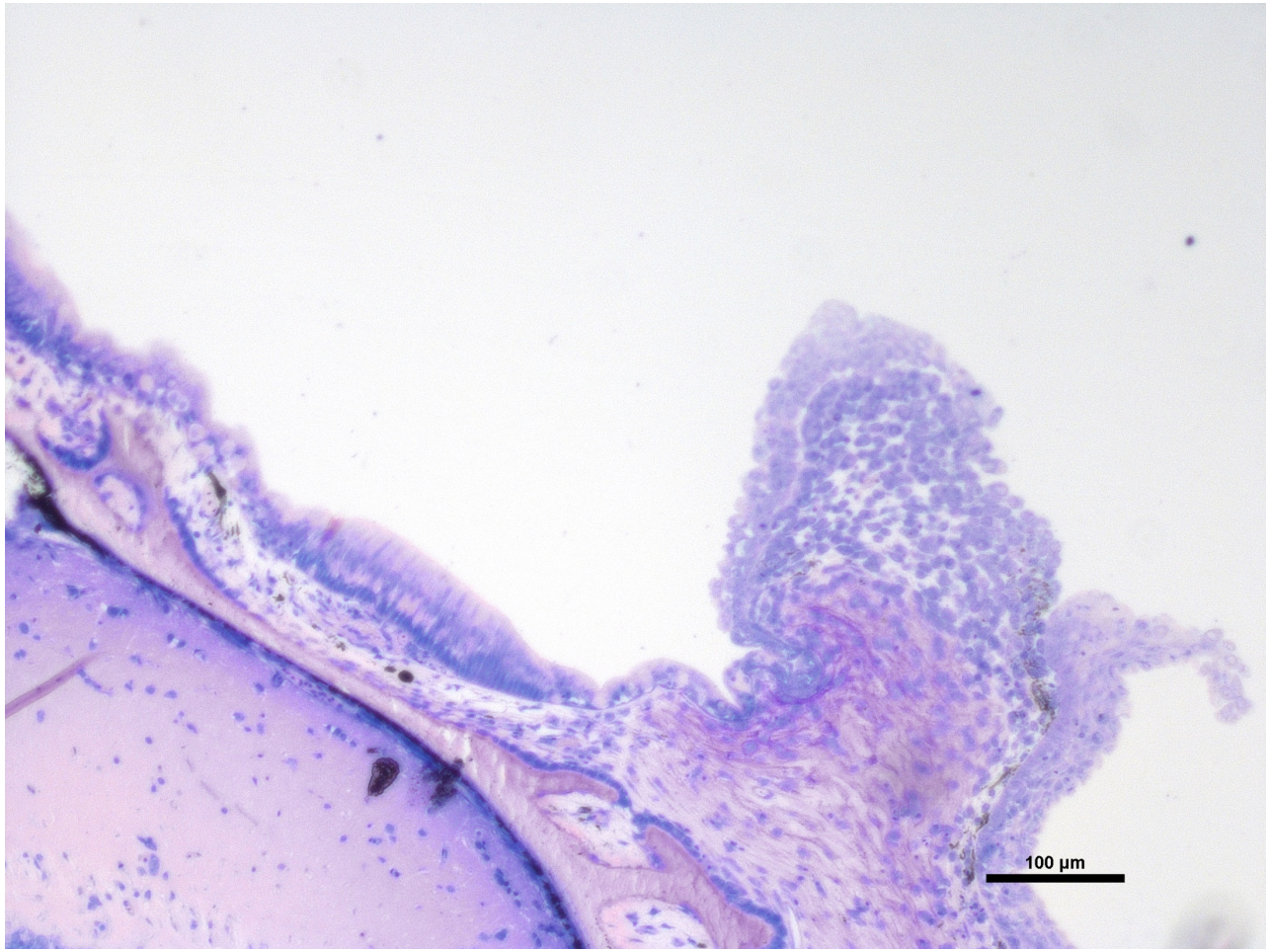
First signs of the disease (46 dph)

First signs of the disease (46 dph)

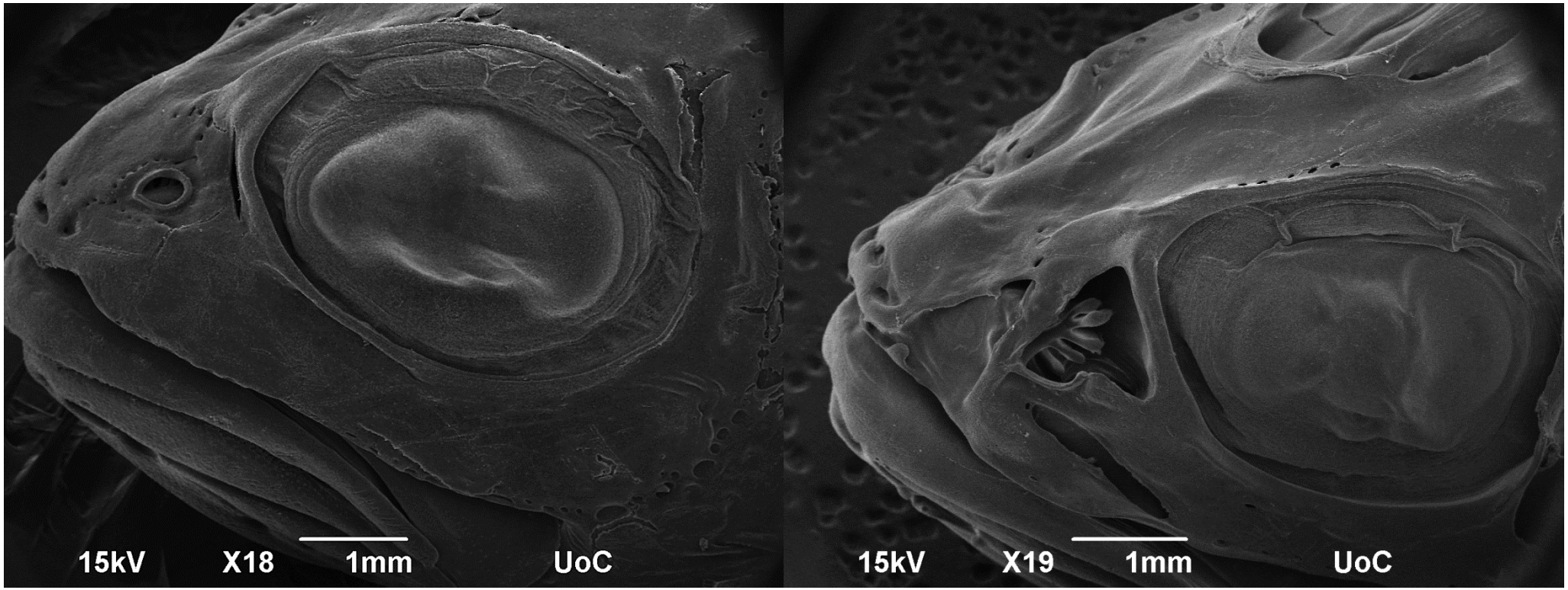




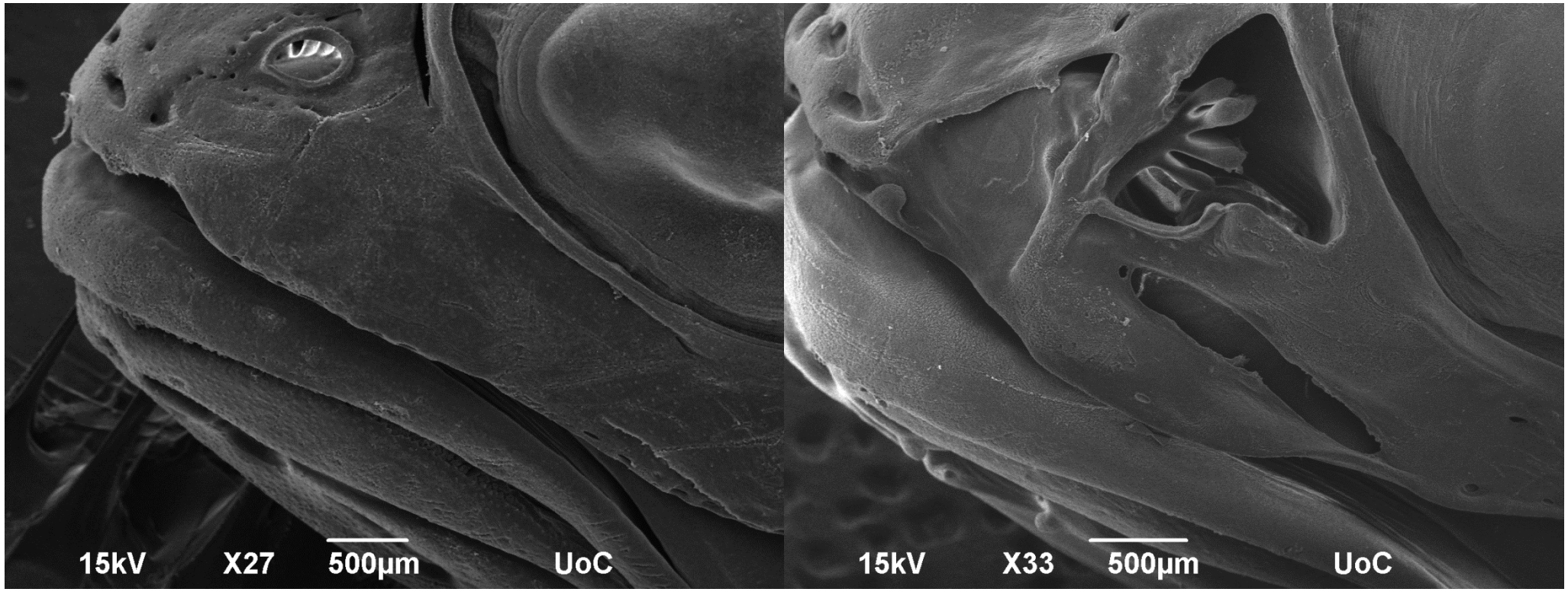
Histopathology



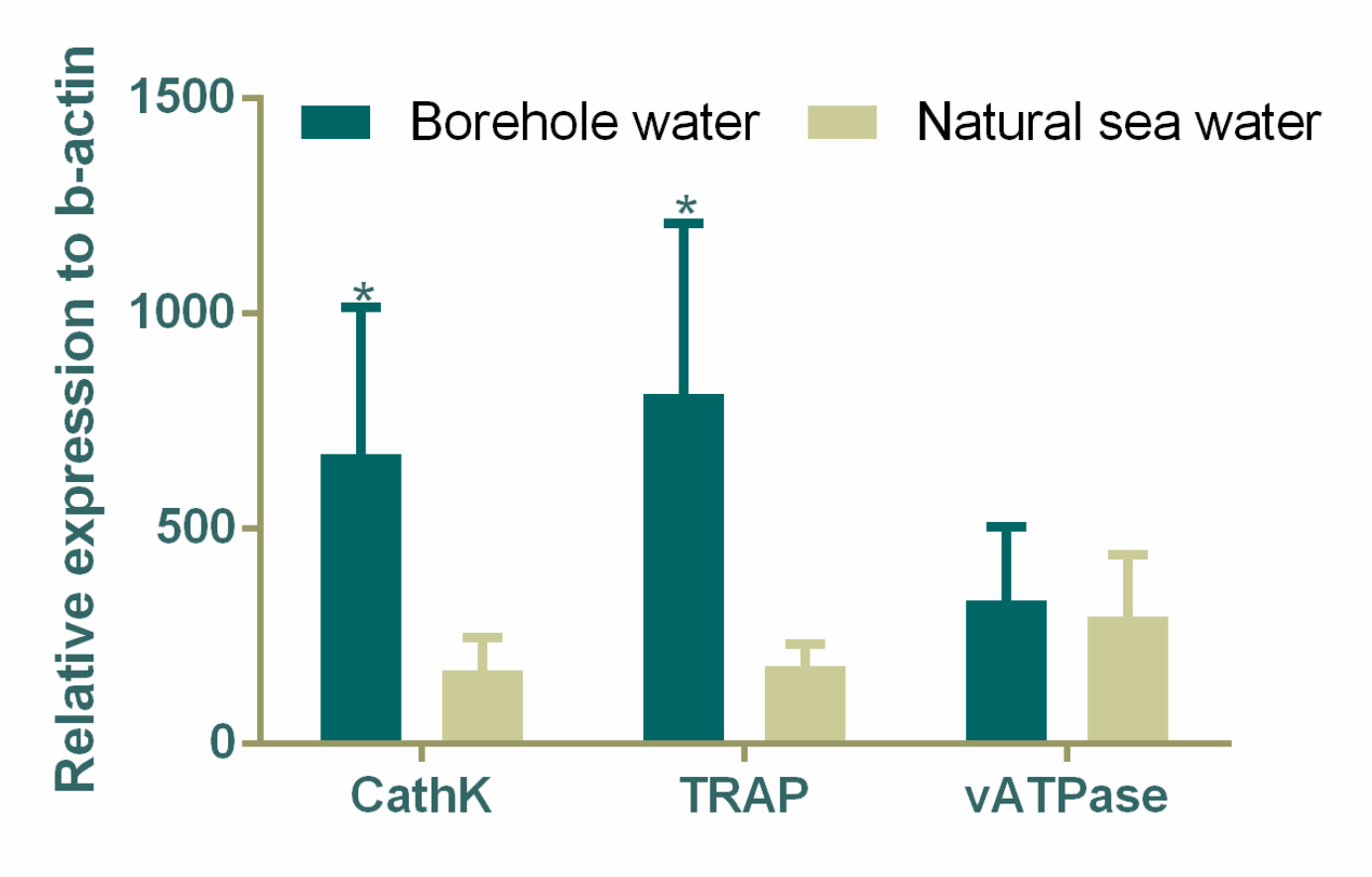
SEM



SEM



Gene expression (56dph)



Recovery

8 month fish: Borehole water

Natural seawater

Conclusions

- CUD affects meagre when grown in borehole water
- It causes severe disfigurement of the fish
- Mechanism involves osteoclastic activity
- Reversible if fish are transferred to natural seawater

- Take home message for the producers:

Do not grow fish in borehole water for more than 2 months

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