

Male

Macroscopic staging versus histology



Scomber scombrus

STANDARD	MATURE/ IMMATURE	WALSH	WKMATCH	MALE	MALE HISTOLOGY (Brown-Peterson et al. 2011)
1	Immature	1. Inmature	1.Immature	Gonads small. Males pale, flattened and transparent	Only Sg1 present. No lumen in lobules. No Sz
2	Mature	2. Maturing	2. Developing	Gonads occupying 1/4 to 3/4 body cavity. Testes off-white, milt not running	Spermatocysts evident along lobules. Sg2, Sc1, Sc2, St and Sz can be present in spermatocysts. Sz not present in lumen of lobules or in spermiducts. GE continuous throughout.
2	Mature	3. Maturing	2. Developing	Gonads occupying 3/4 to almost filing body cavity. Testes creamy white	
3	Mature	4. Spawning	3. Spawning	Testes filling body cavity, milt freely running	Sz in lumen of lobules and/or sperm ducts. All stages of spermatogenesis (Sg2, Sc, St, Sz) can be present. Spermatocysts througout testis, active spermatogenesis. GE can be continuous or discontinuous.
3	Mature	5. Spawning	3. Spawning	Gonads occupying 3/4 to < 1/4 body cavity. Testes with free running milt and shrivelled at anus end	
4	Mature	6. Spent/Recovery	4. Regressing/Regenerating	Gonads occupying 1/4 or less of body cavity. Testes opaque with brownish tint and no trace of milt.	<i>Regressing:</i> Residual Sz present in lumen of lobules and in sperm ducts. Widely scattered spermatocysts near periphery containing Sc2, St and Sz. Little to no active spermatogenesis. Spermatogonial proliferation and regeneration of GE common in the periphery of testes. <i>Regenerating:</i> No spermatocysts. Lumen often no existent. Proliferation of spermatogonia througout testes GE continuous througout Small amount of residual Sz occassionally present in lumen of lobules and in sperm ducts.

Proposed combination of the Walsh maturity scale into the standard scale WKMSMAC,2007

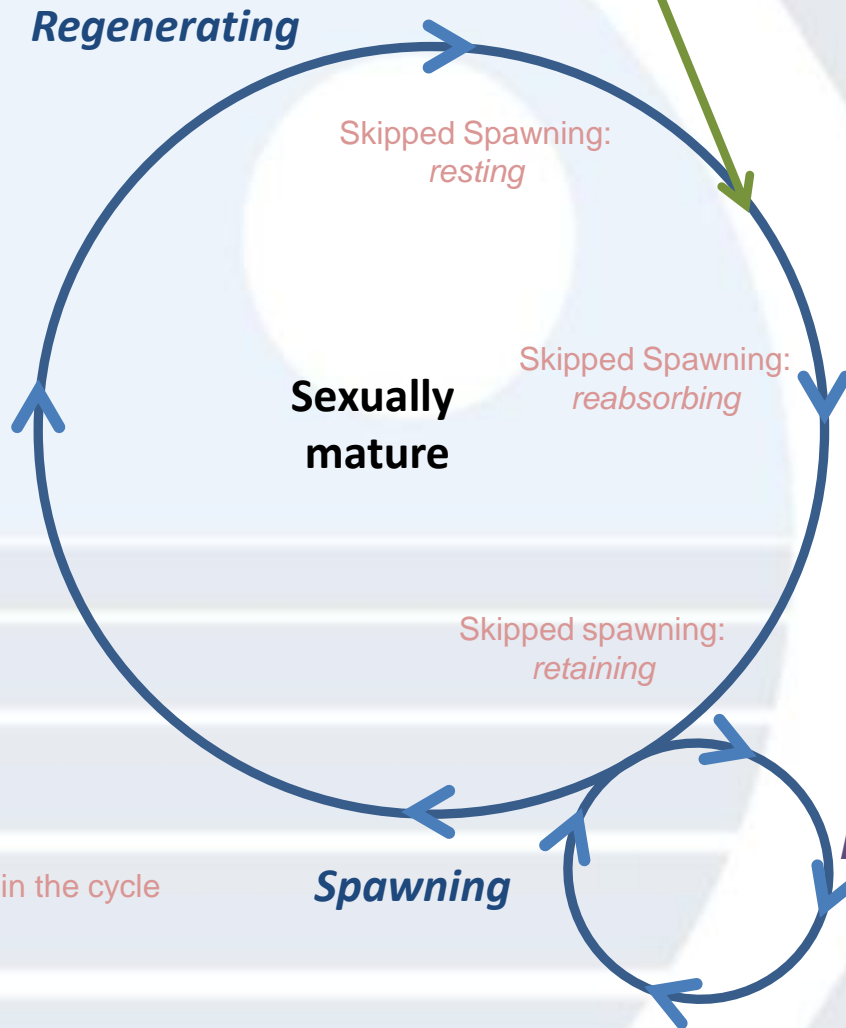
STANDARD	WALSH	MATURE/ IMMATURE	STATE	FEMALE	MALE
1	1	Immature	Immature	Gonads small. Ovaries wine red and clear, torpedo shaped	Gonads small. Males pale, flattened and transparent
2	2	Mature	Maturing	Gonads occupying 1/4 to 3/4 body cavity. Opaque eggs visible in ovaries giving pale pink to yellowish colouration, largest eggs without oil globule.	Gonads occupying 1/4 to 3/4 body cavity. Testes off-white, milt not running
2	3	Mature	Maturing	Gonads occupying 3/4 to almost filling body cavity. Ovaries yellow to orange. Largest eggs may have oil globules	Gonads occupying 3/4 to almost filling body cavity. Testes creamy white
3	4	Mature	Spawning	Ovaries characterized by externally visible hyaline eggs no matter how few or how early the stage of hydration. Ovary size variable from full to 1/4	Testes filling body cavity, milt freely running
3	5	Mature	Spawning	Gonads occupying 3/4 to < 1/4 body cavity. Ovaries slacker than in stage 3 and often bloodshot	Gonads occupying 3/4 to < 1/4 body cavity. Testes with free running milt and shrivelled at anus end
4	6	Mature	Spent/ Recovery	Gonads occupying 1/4 or less of body cavity. Ovaries reddish and often murky in appearance, sometimes with a scattering or patch of opaque eggs	Gonads occupying 1/4 or less of body cavity. Testes opaque with brownish tint and no trace of milt.

Proposed common scale for maturity staging WKMATCH, 2012

	CODE	NAME	SUBDIVISIONS
Sexually immature	1	Inmature	
Sexually mature	2	Developing	2a. Developing but functionally inmature 2b. Developing and functionally mature
	3	Spawning	3a. Actively spawning 3b. Spawning capable
	4	Regressing/Regenerating	4a. Regressing 4b. Regenerating
	5	Ommited spawning	
	6	Abnormal	

Abnormal
It can occur at any time in the cycle

Regressing



**Sexually
immature**

Immature

Regenerating

*Skipped Spawning:
resting*

*Skipped Spawning:
reabsorbing*

**Sexually
mature**

Developing

*Skipped spawning:
retaining*

Spawning

Batch spawners

*Spawning capable
Actively spawning*

Walsh scale

1_Inmature: Gonads small. Males pale, flattened and transparent

Common scale (WKMSMAC, 2007)

1_Inmature:

Proposed common scale (WKMATCH, 2012)

Sexually immature

1

Immature

Standardized terminology (Brown-peterson et al., 2011)

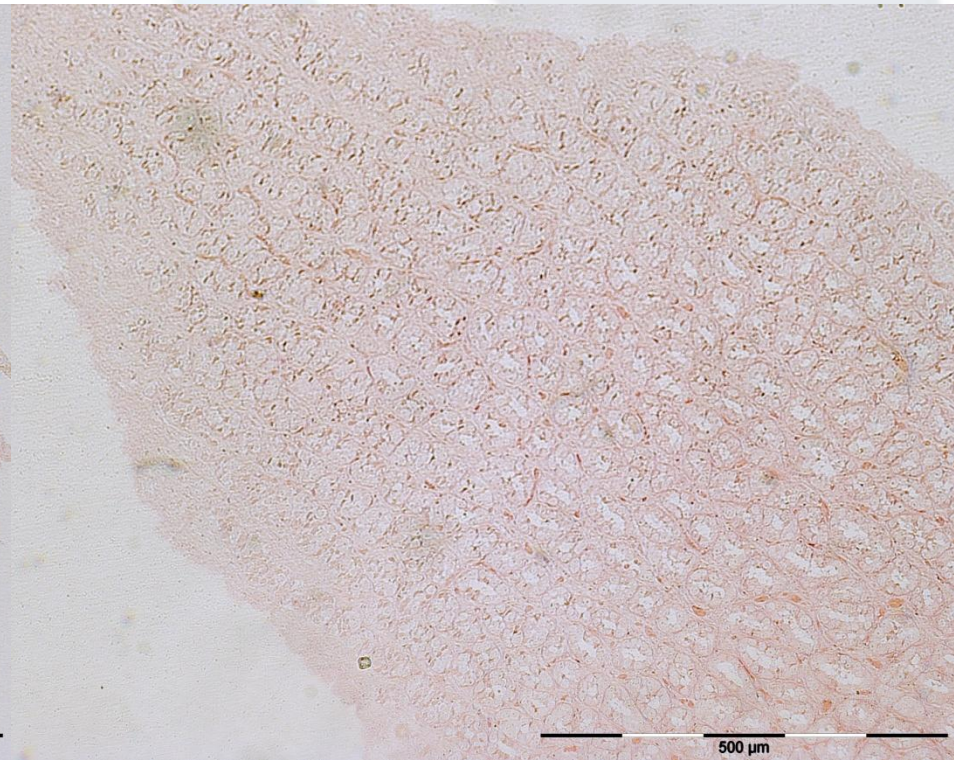
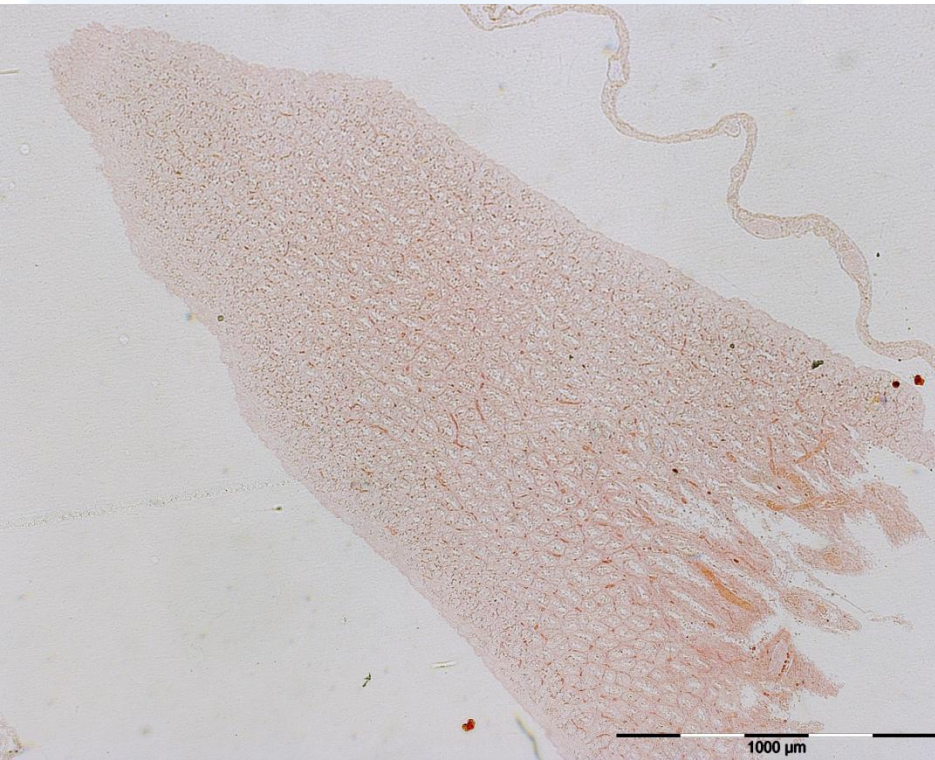
Inmature (never spawned)

Small testes often clear and threadlike (filiforme)

Only Sg1 present. No lumen in lobules

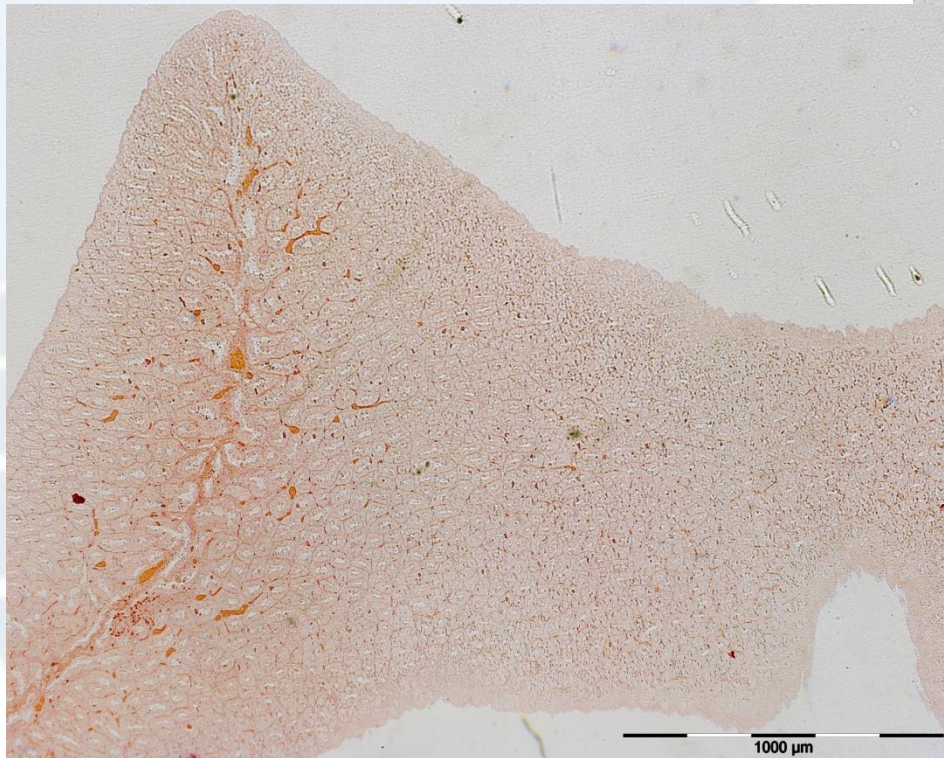
Inmature

Walsh 1



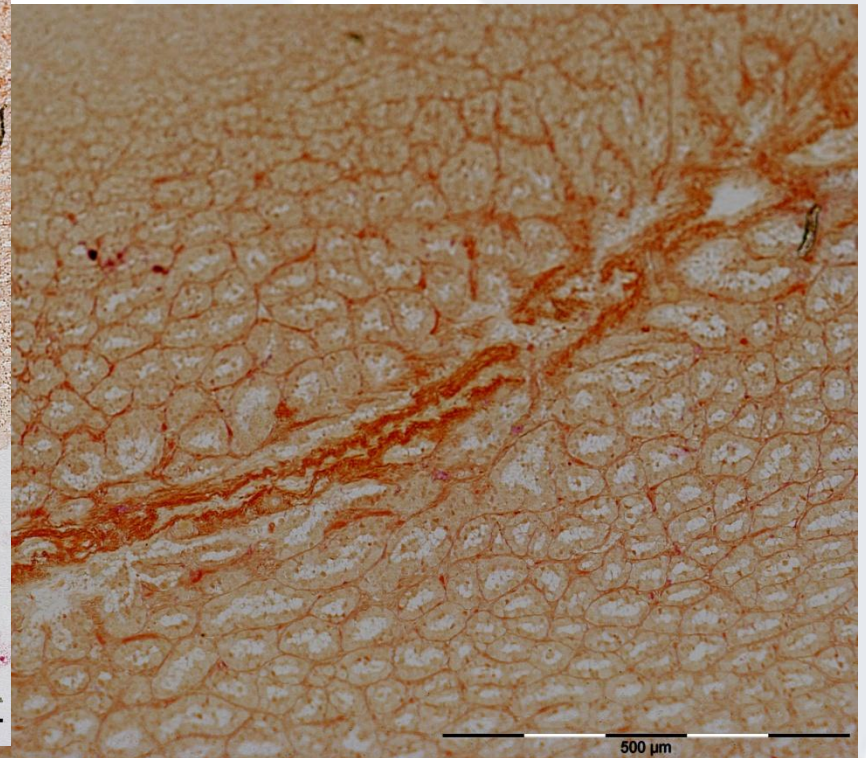
Inmature

Walsh 1



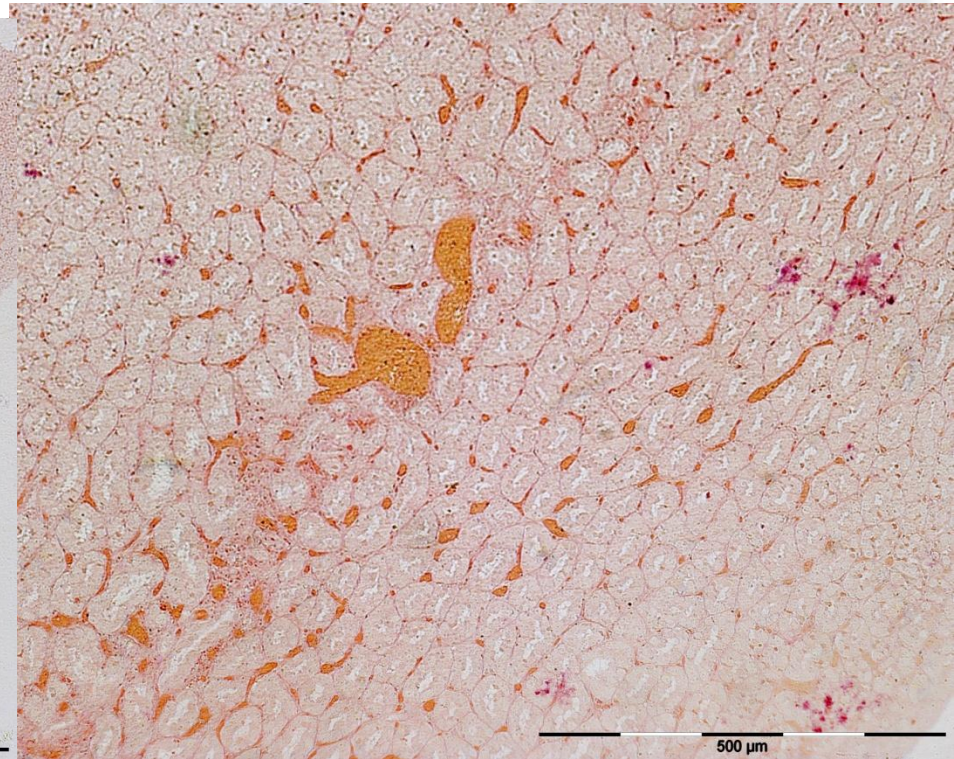
Inmature

Walsh 1



Inmature

Walsh 1



Conclusions for stage 1

- Histology **do not** corroborates the maturity stage macroscopic asignation
- Histology corroborates the maturity stage macroscopic asignation

Walsh 2 and 3

Developing (testes beginning to grow and develop)

Small testes but easily identified.

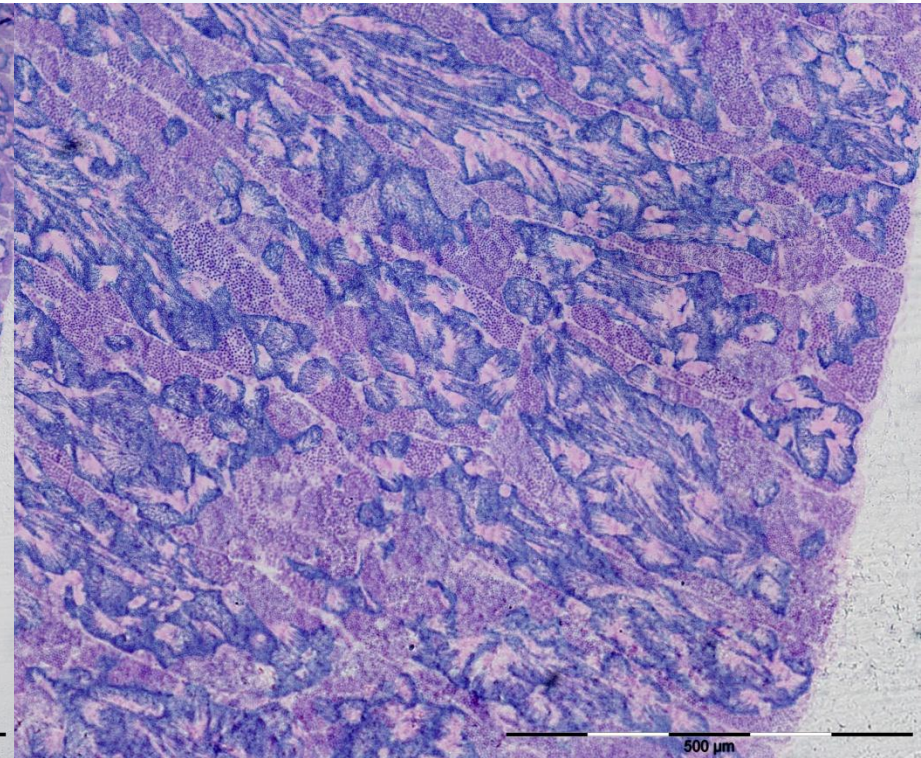
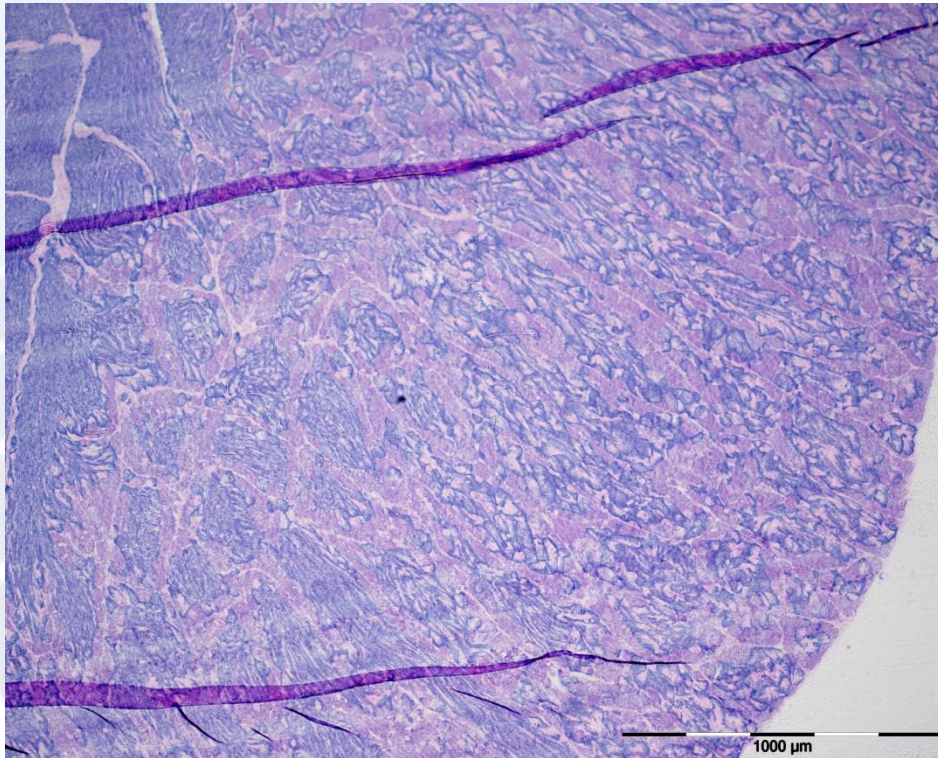
Spermatocyst evident along lobules.

Sg2, Sc1, Sc2, St and Sz can be present in spermatocysts

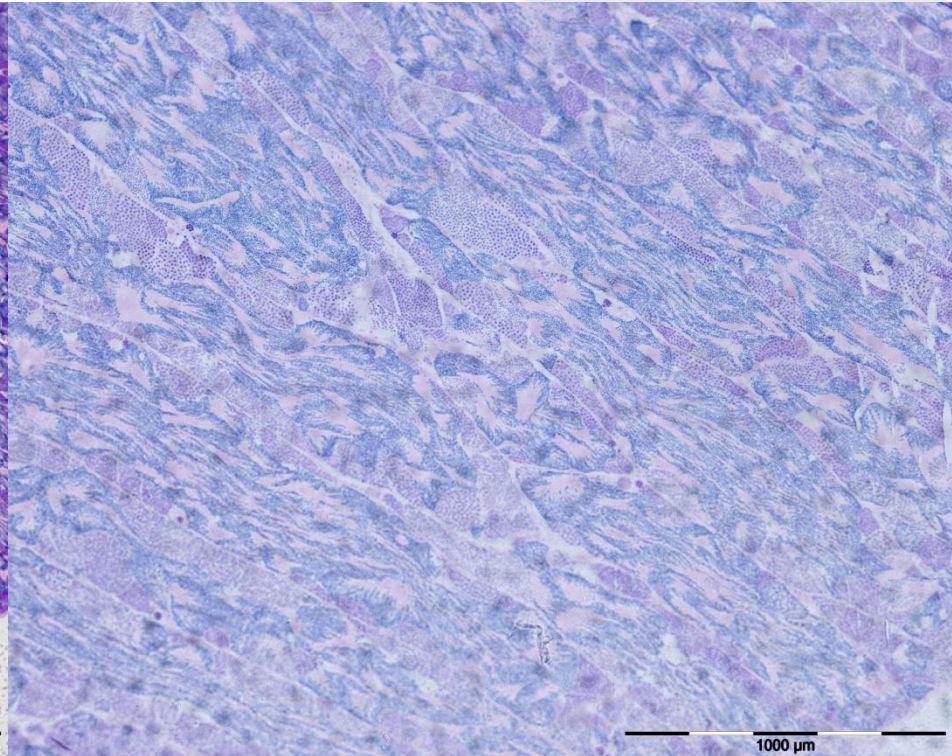
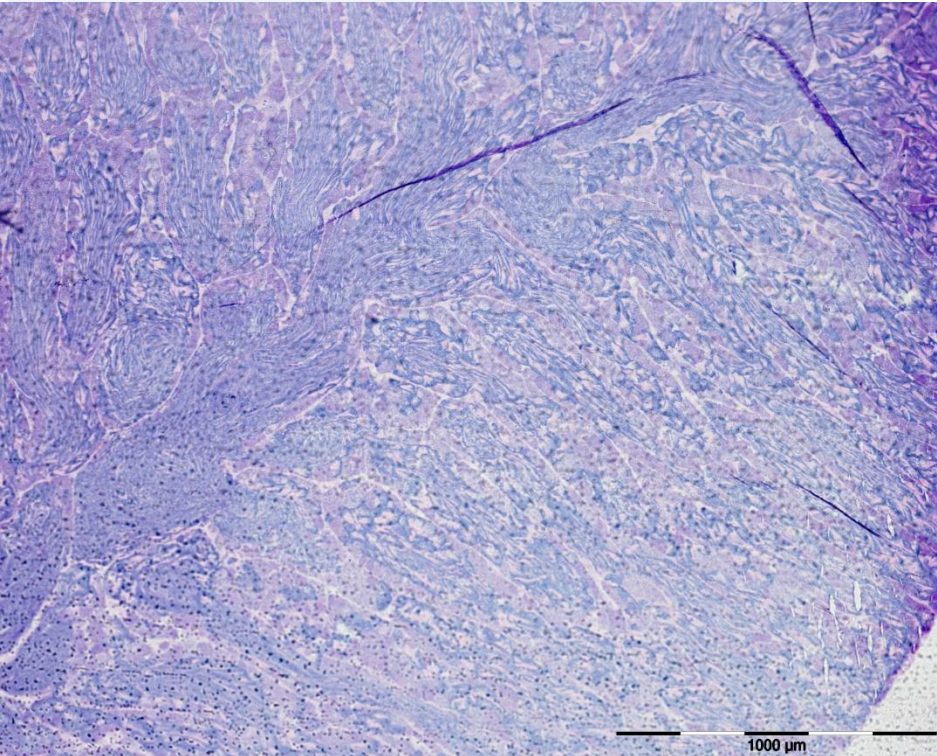
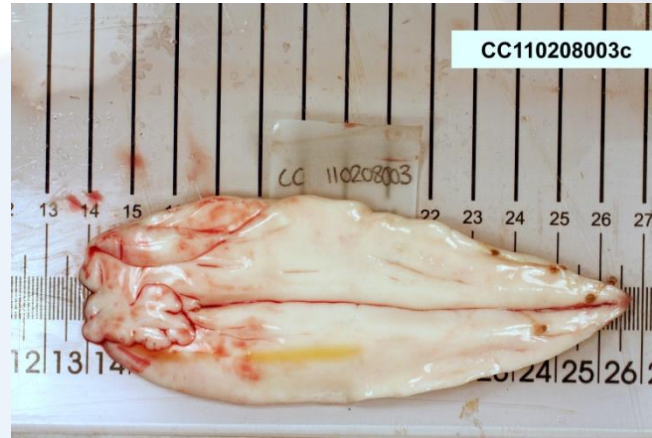
Sz no present in lumen of lobules and/or sperm ducts.

GE continuous throughout.

Desarrollo
Walsh 3



Desarrollo
Walsh 3



Conclusions for stage 2-3

- Histology **do not** corroborates the maturity stage macroscopic asignation
- Histology corroborates the maturity stage macroscopic asignation

Walsh 4 and 5

Spawning capable (fish are developmentally and physiologically able to spawn in this cycle)
Large and firm testes.

Sz in lumen of lobules and/or sperm ducts.

All stages of spermatogenesis (Sg2, Sc, St, Sz) can be present

Spermatocyst throughout testis, active spermatogenesis

GE can be continuous or discontinuous

Actively spawning subphase (macroscopic): milt released with gentle pressure on abdomen

Histological subphases based on structure of GE.

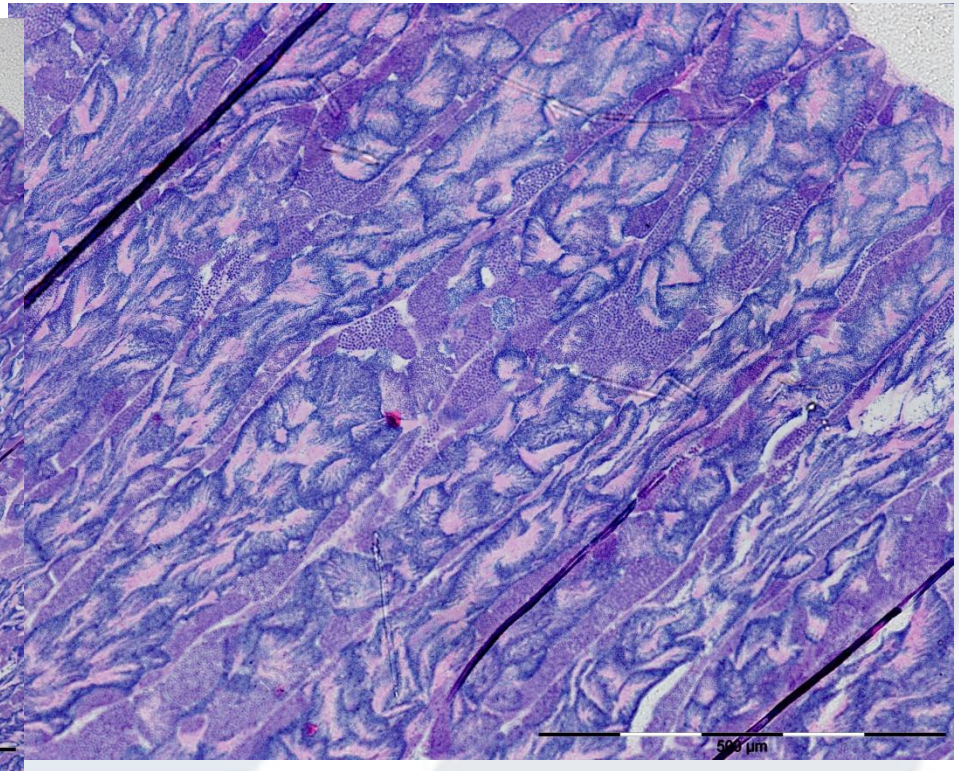
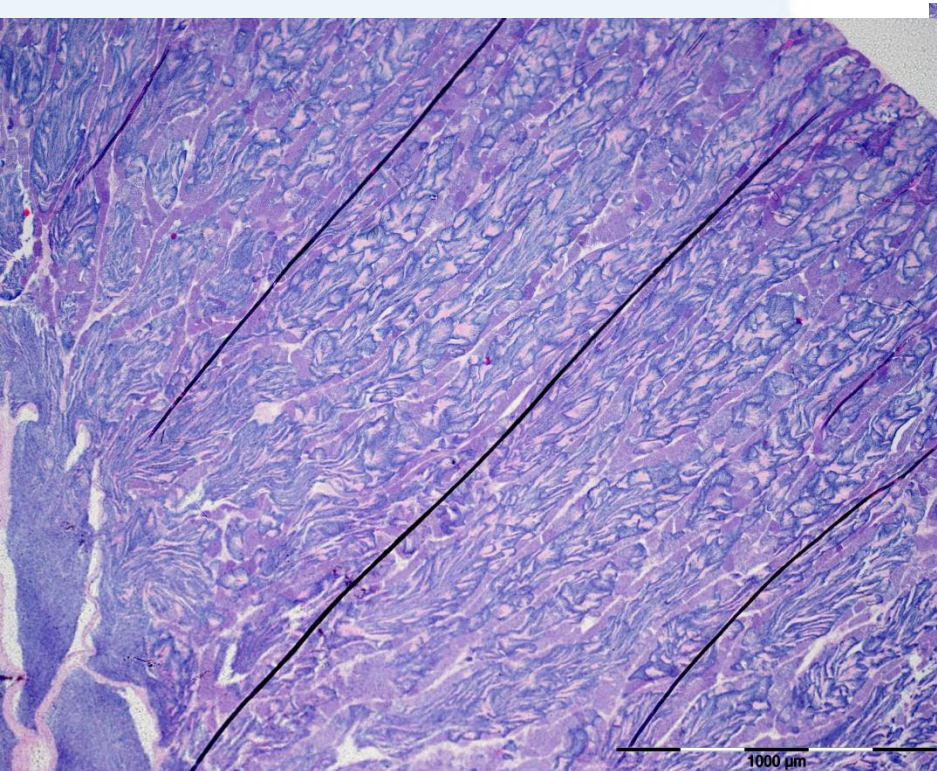
Early GE: continuous GE in all lobules throughout testis.

Mid-GE: continuous GE in spermatocyst at testis periphery,
discontinuous GE in lobules near ducts.

Late GE: discontinuous GE in all lobules throughout testes.

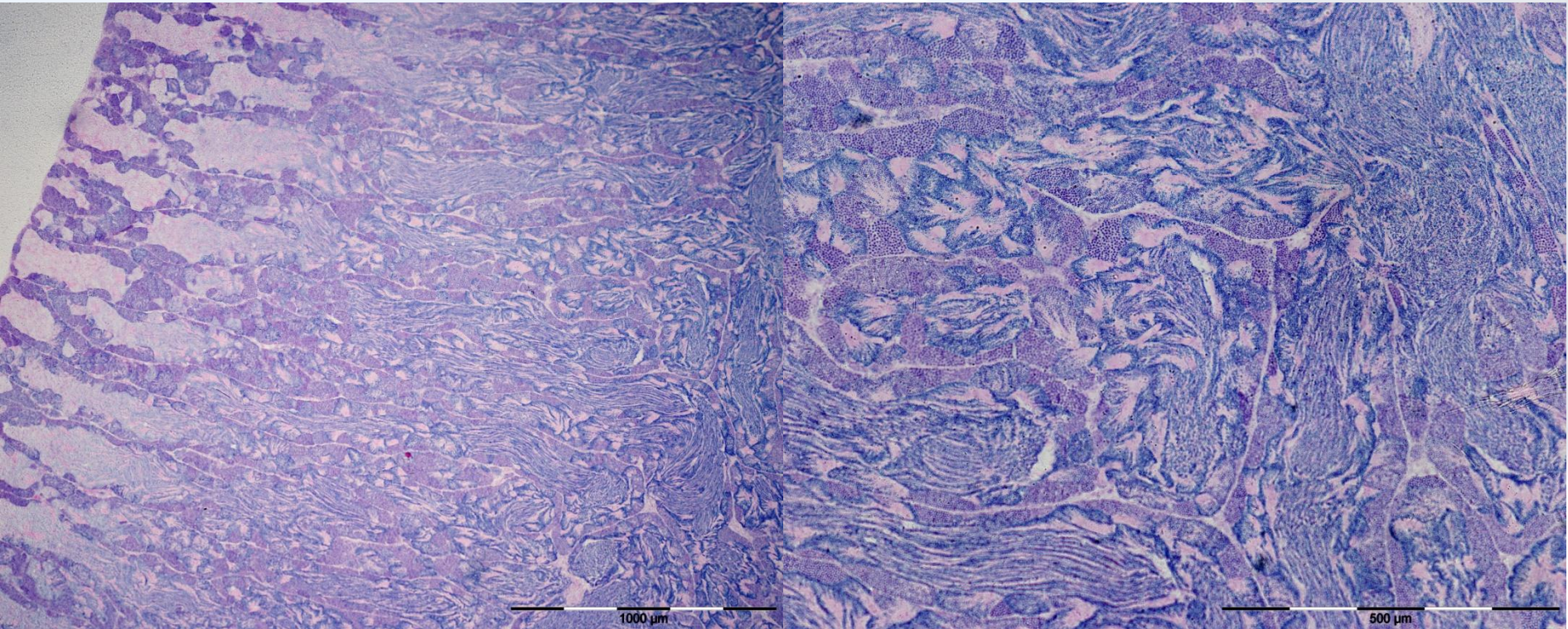
PUESTA

Walsh 4



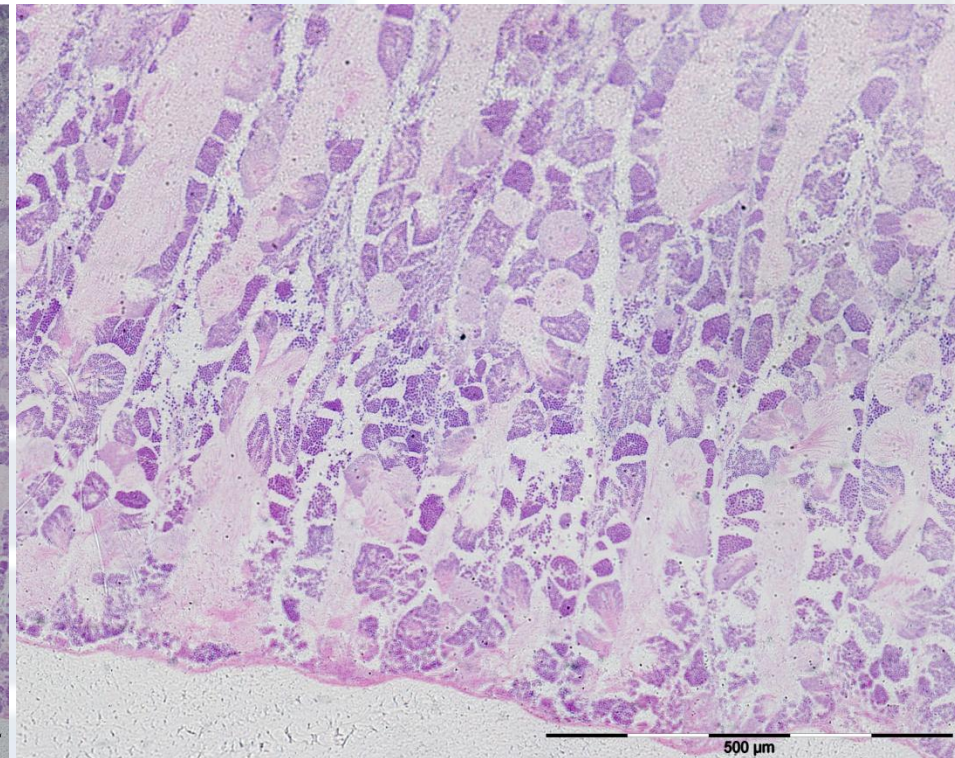
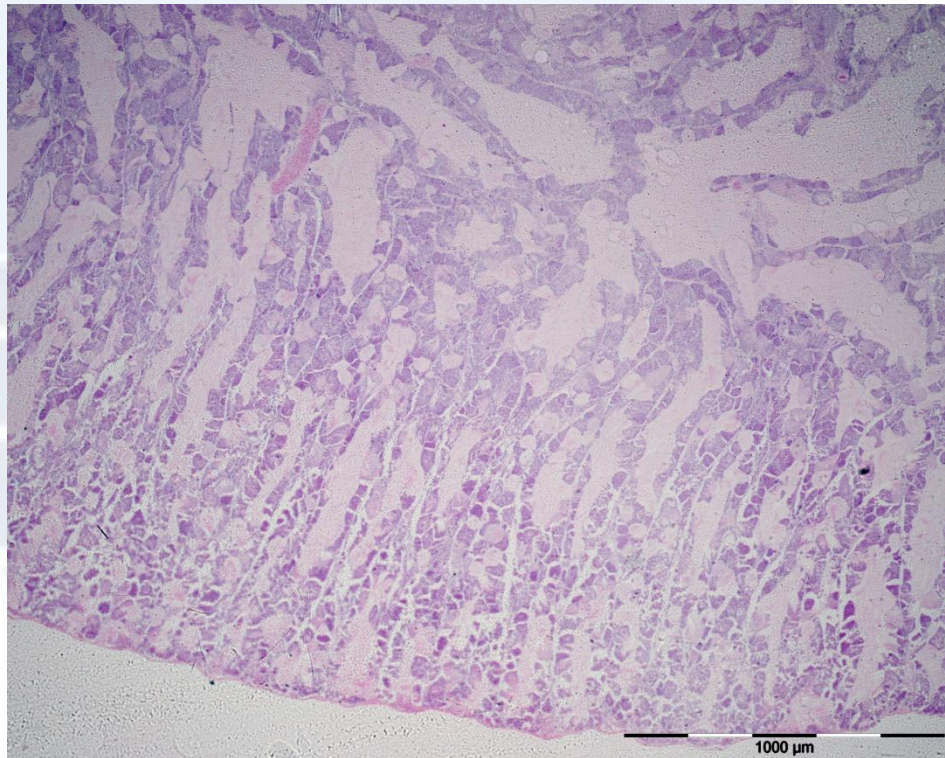
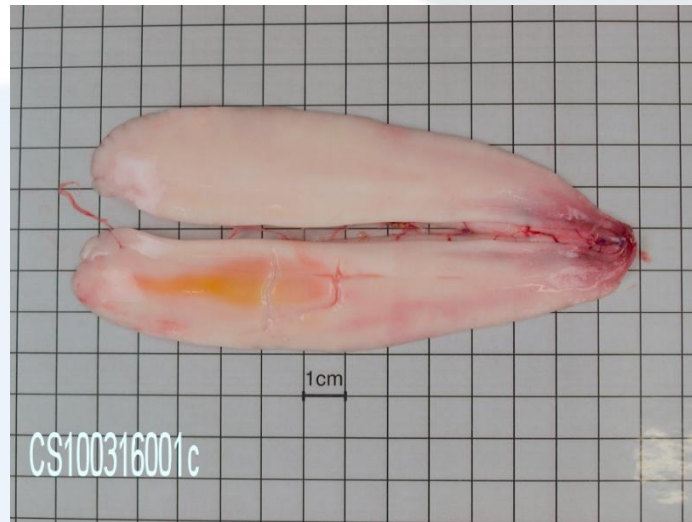
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Walsh 4



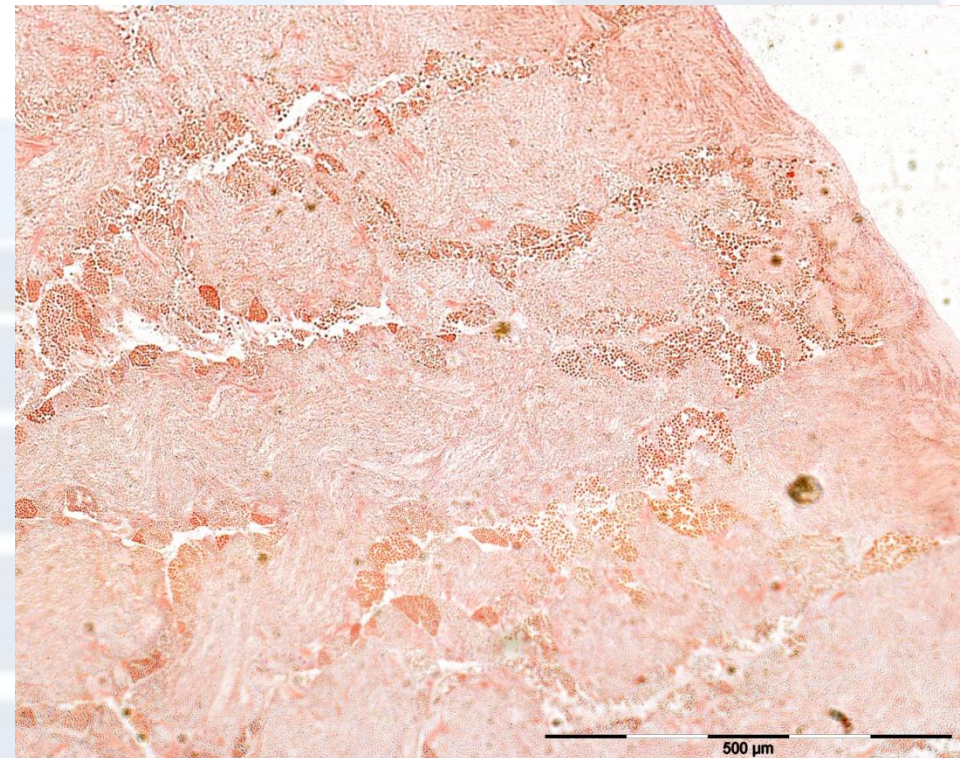
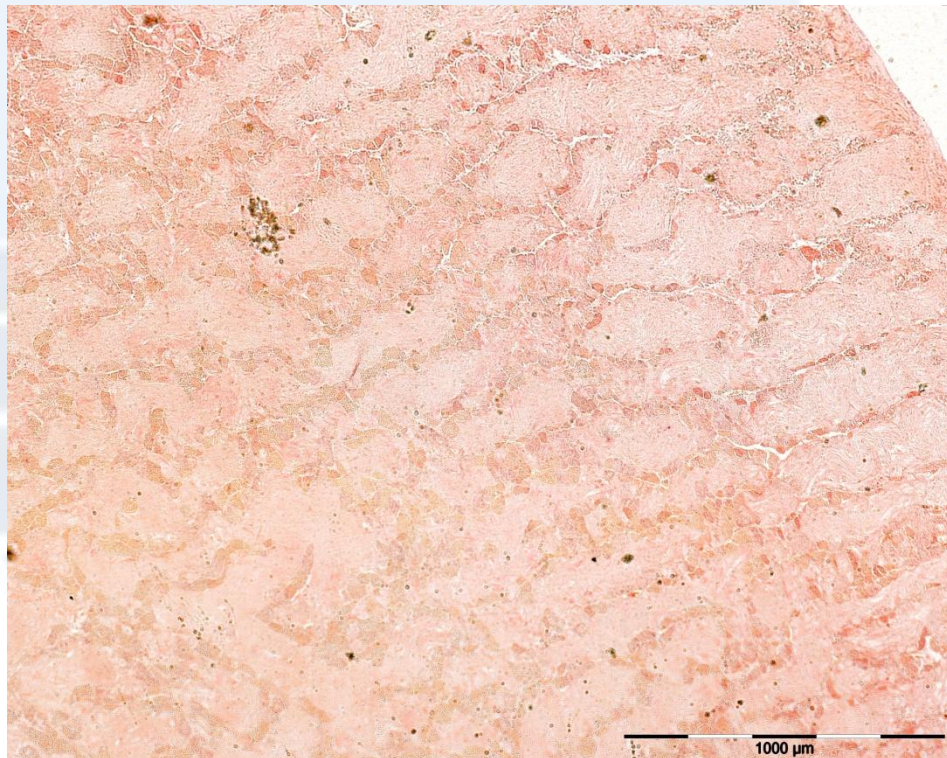
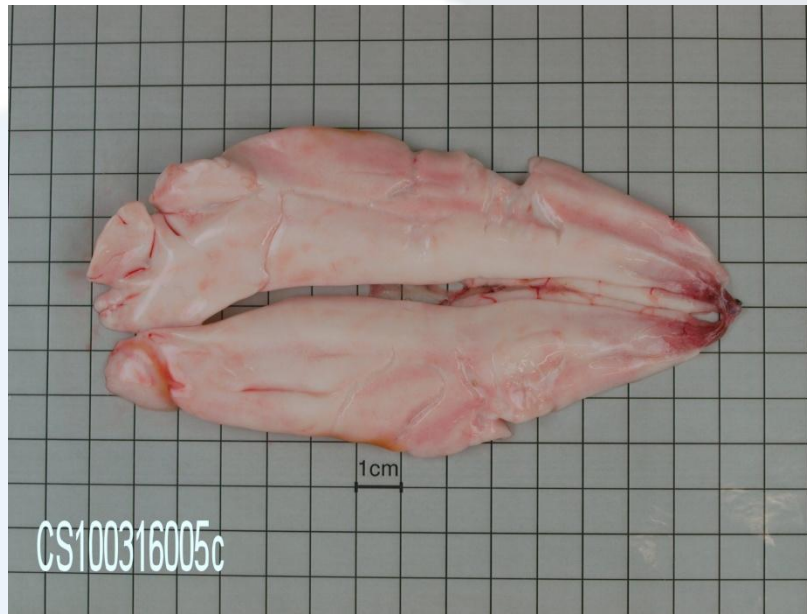
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Walsh 4



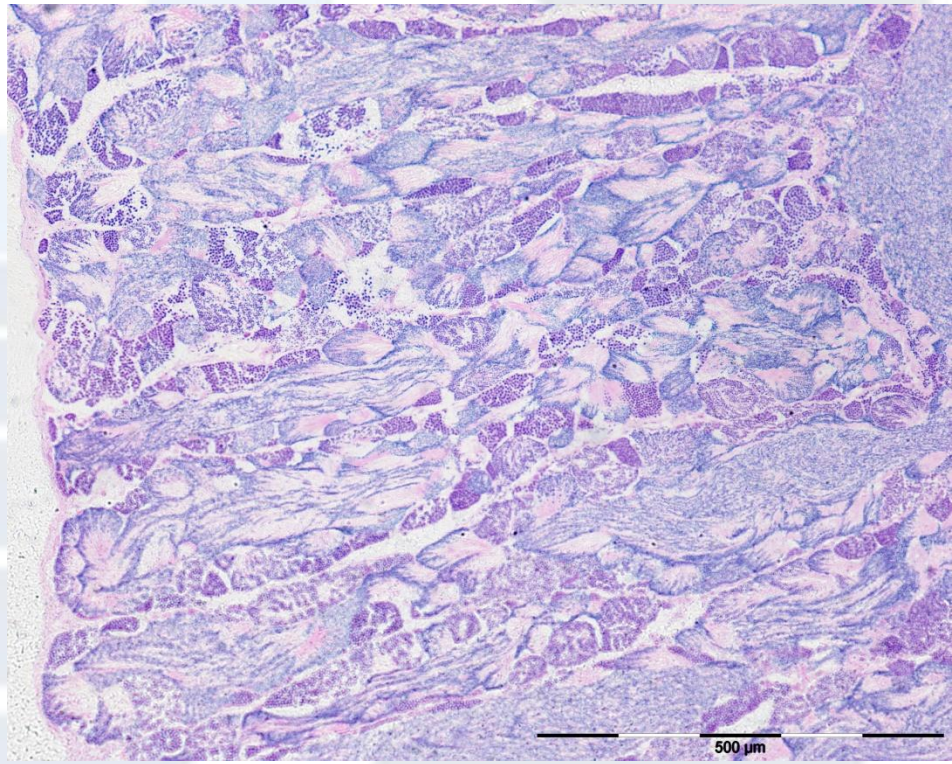
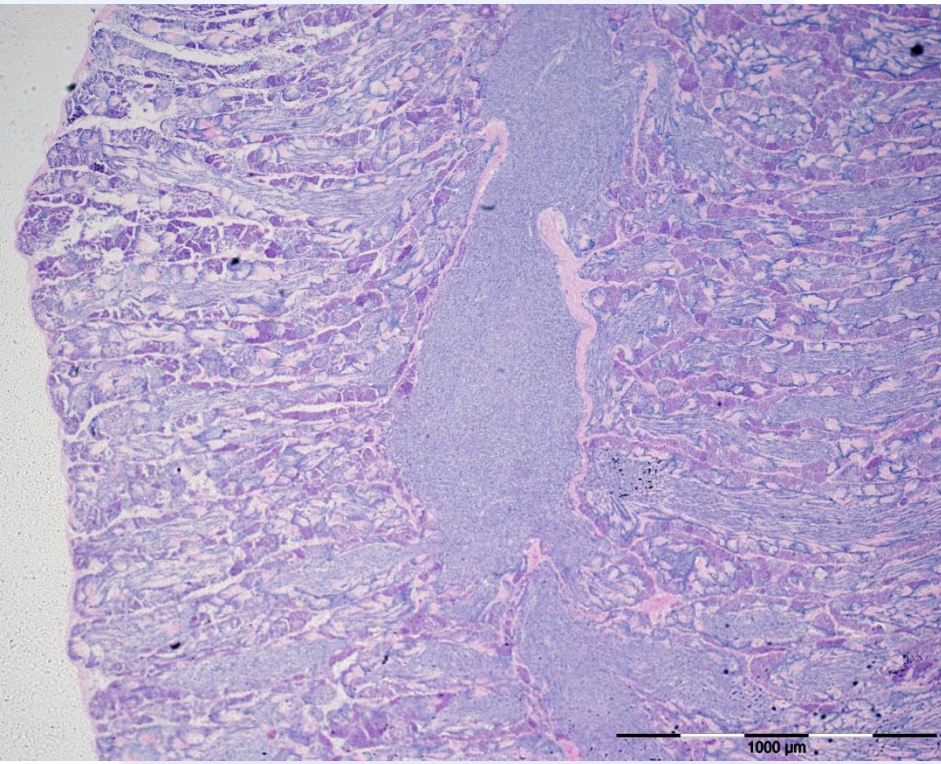
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Walsh 4



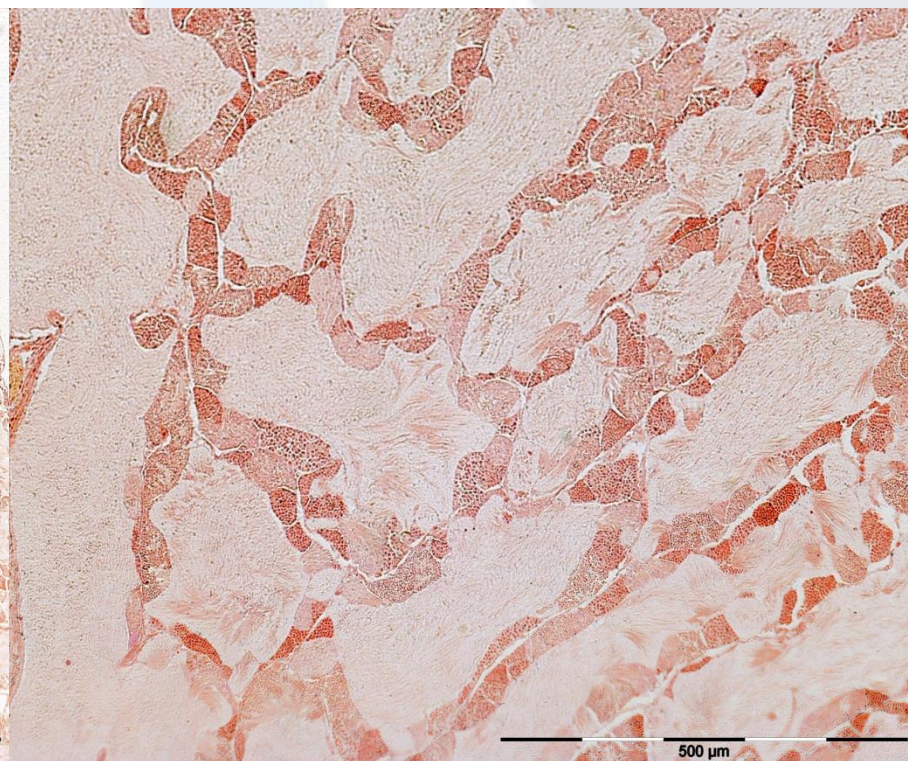
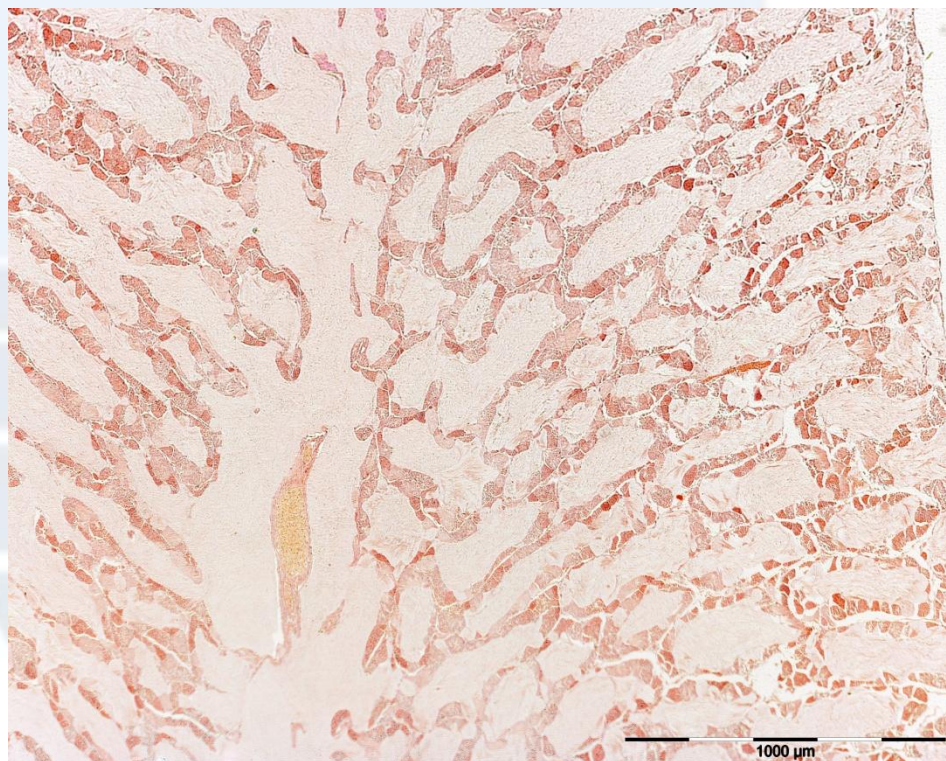
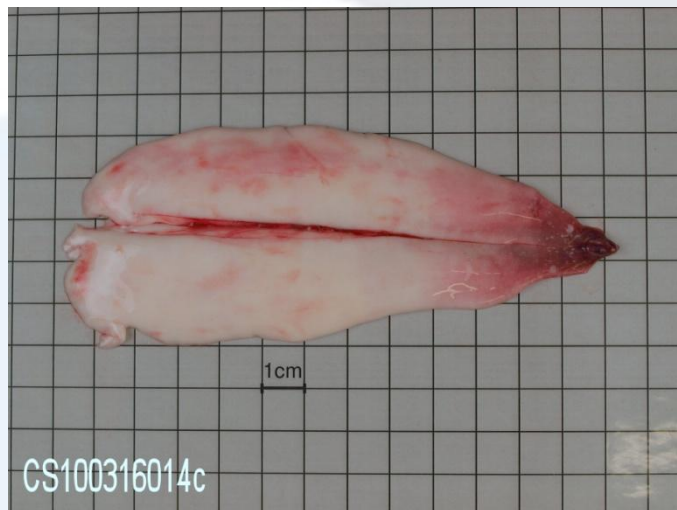
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Walsh 4



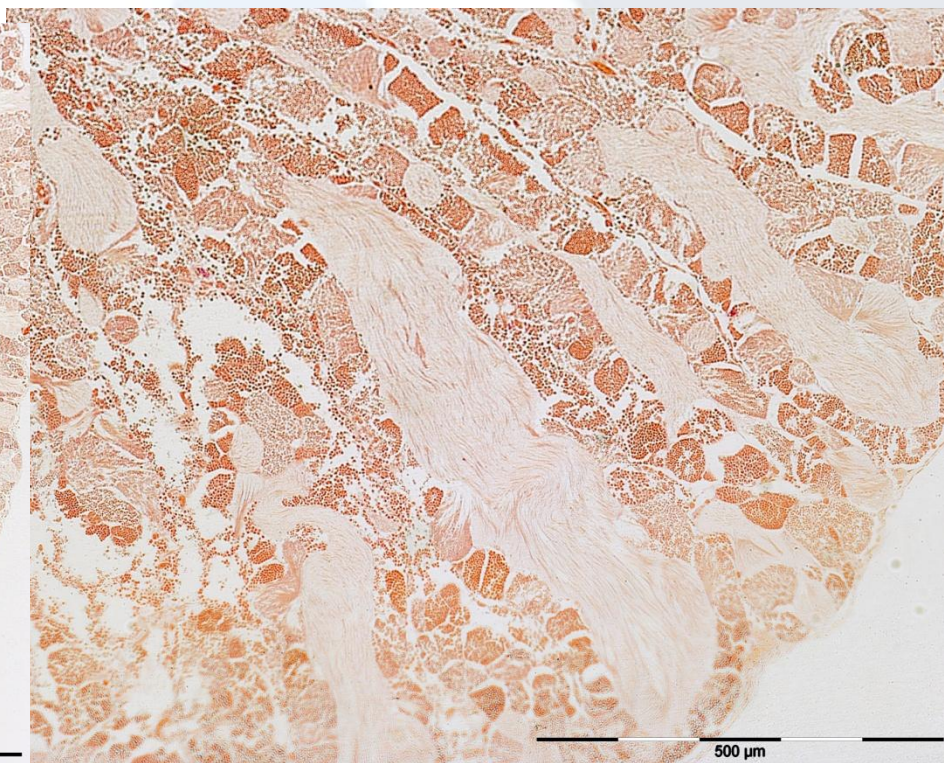
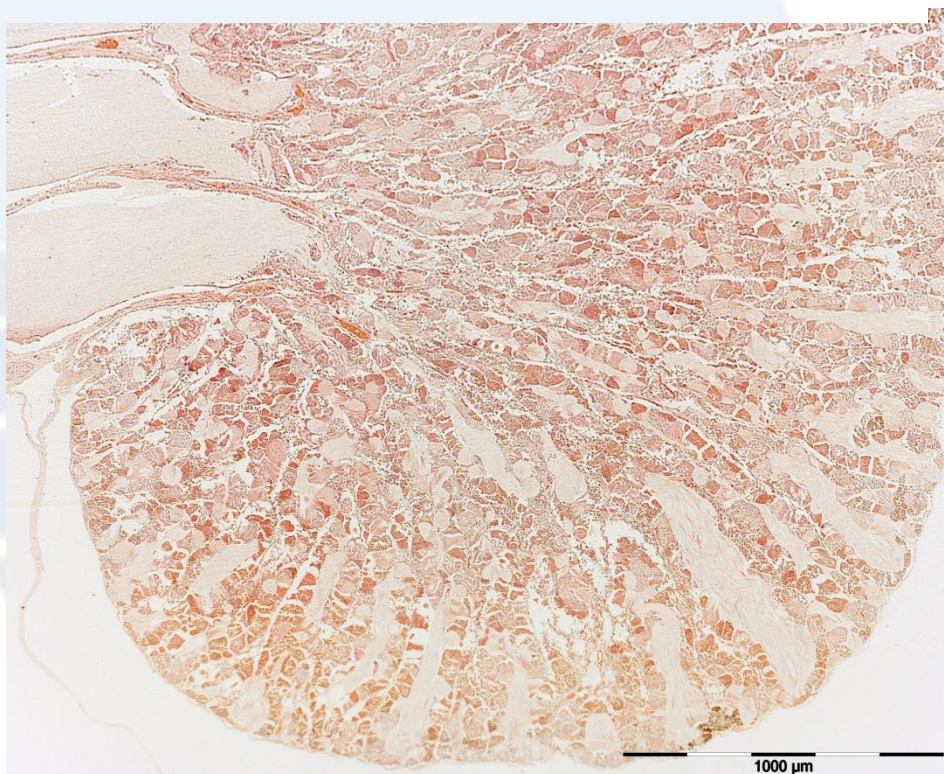
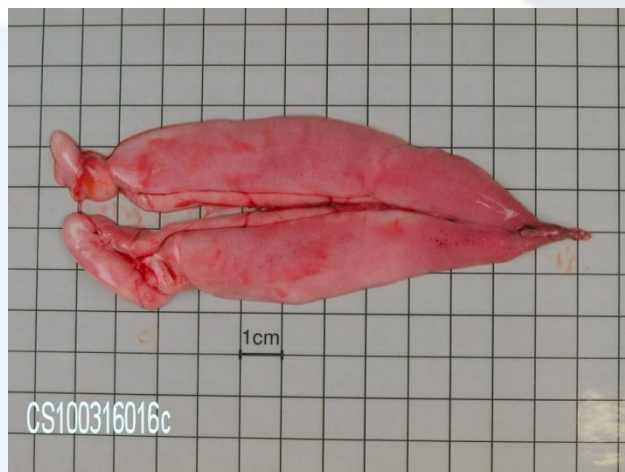
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Walsh 5



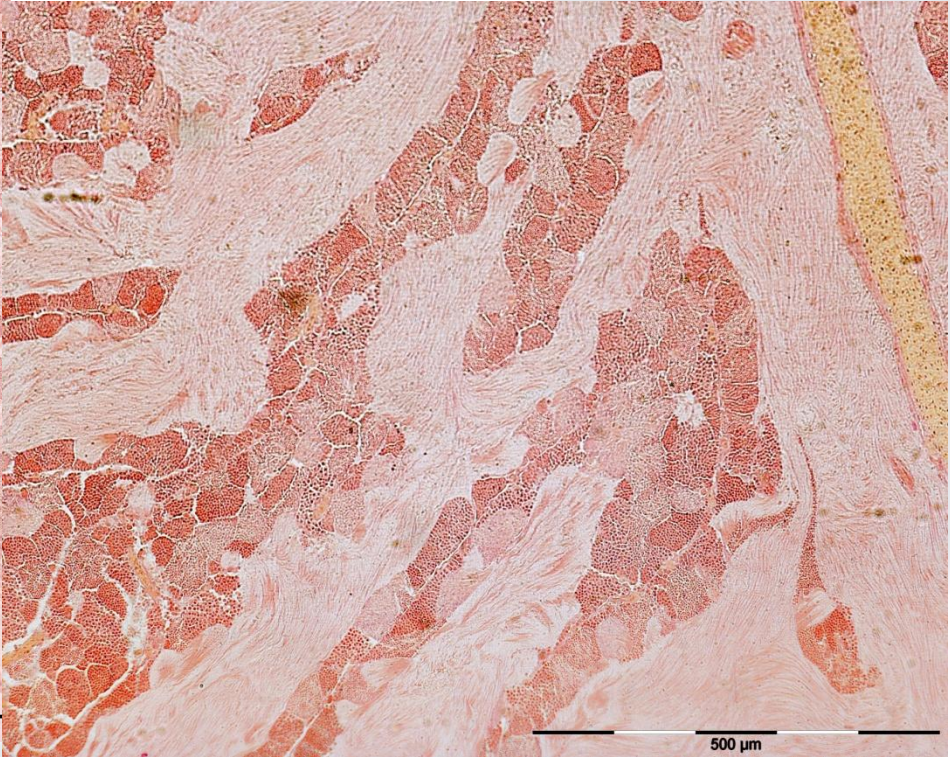
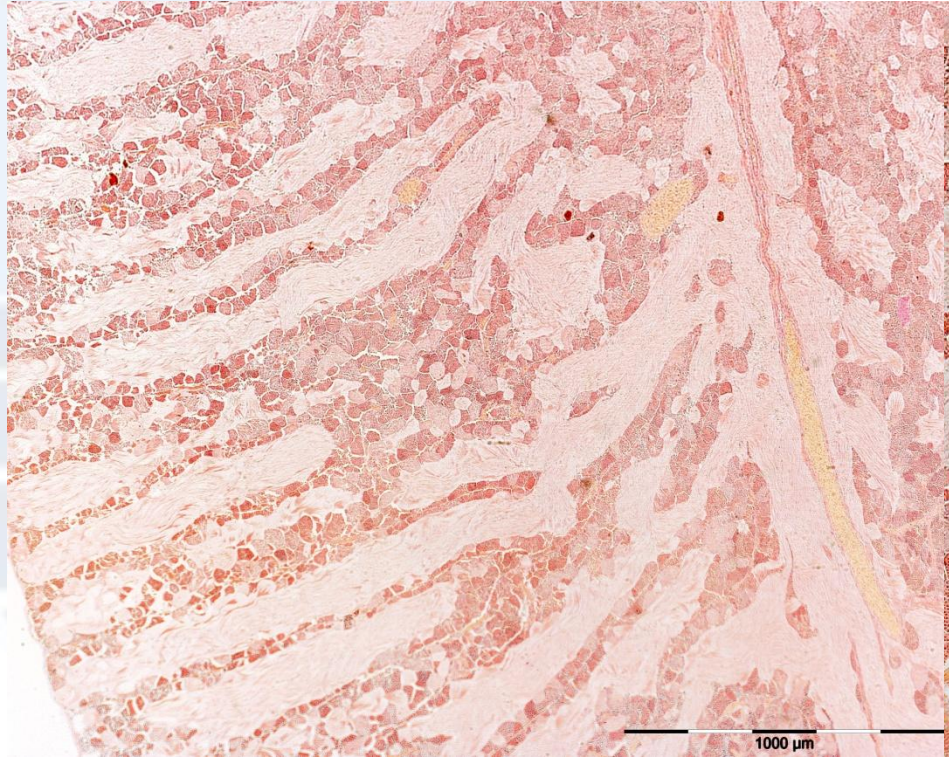
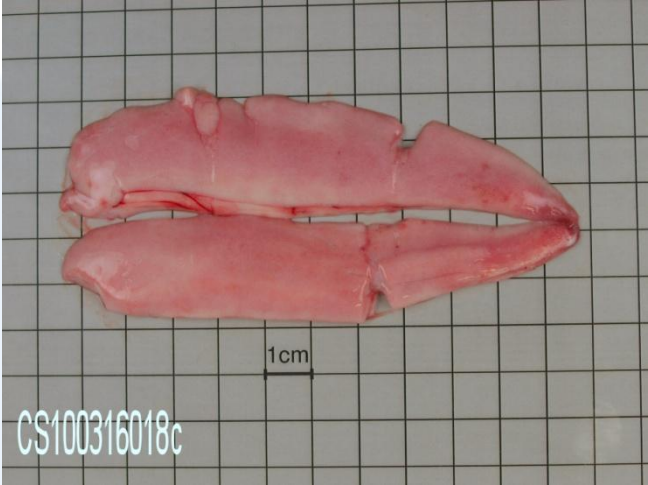
puesta

Walsh 5



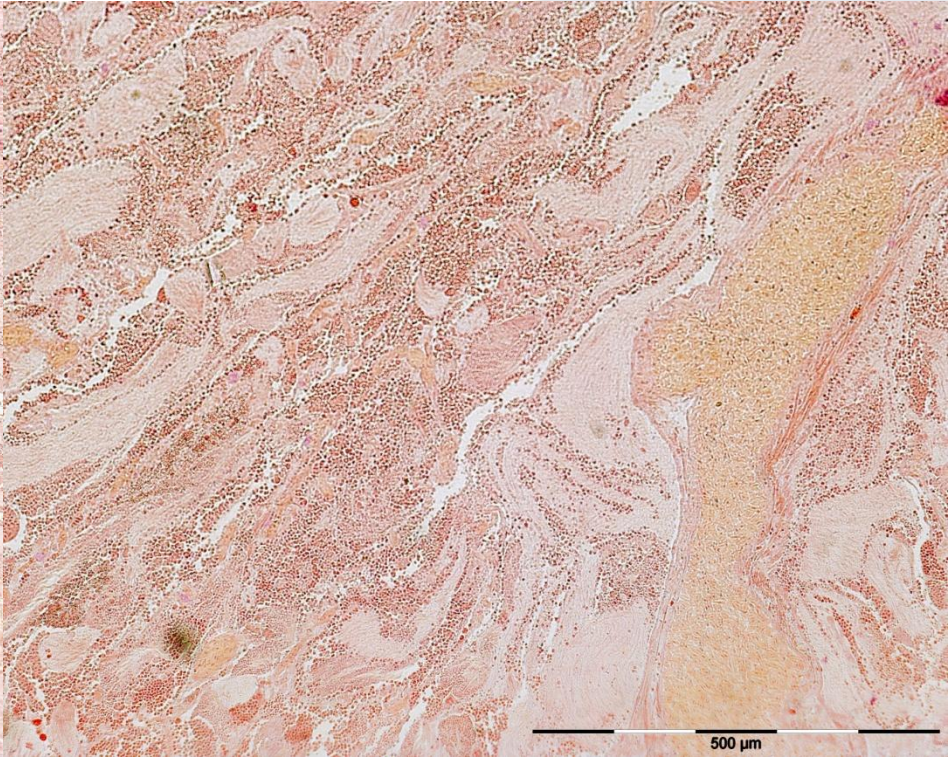
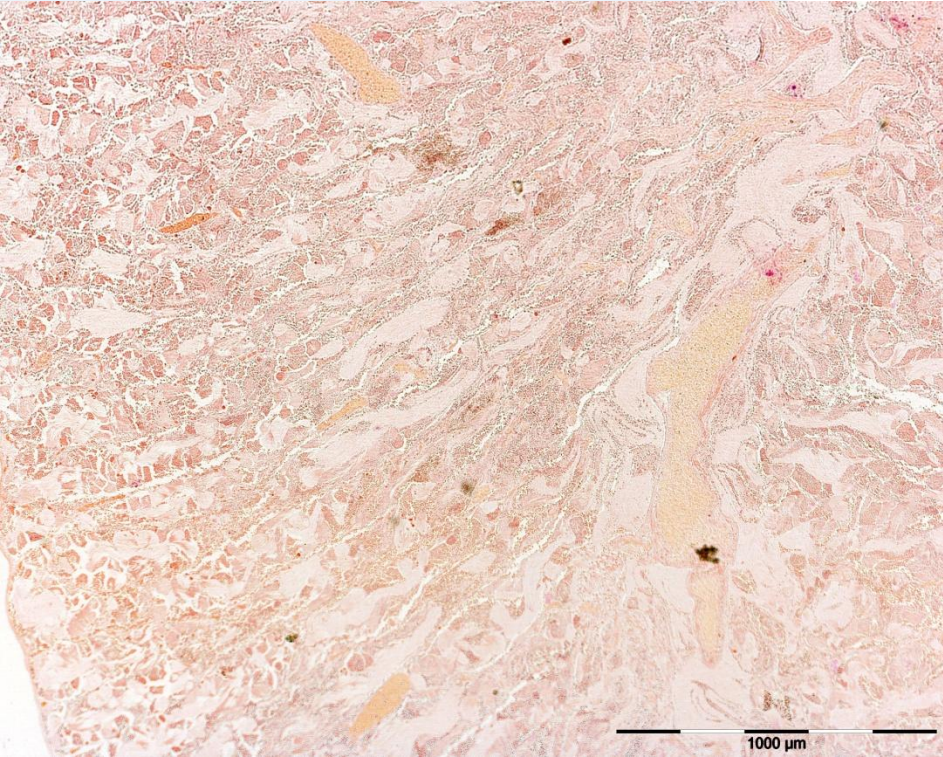
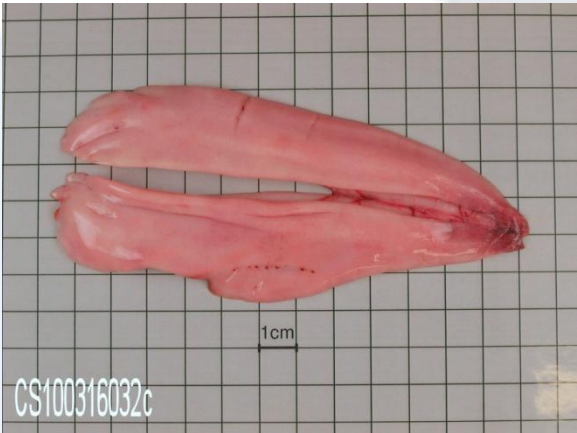
puesta

Walsh 5



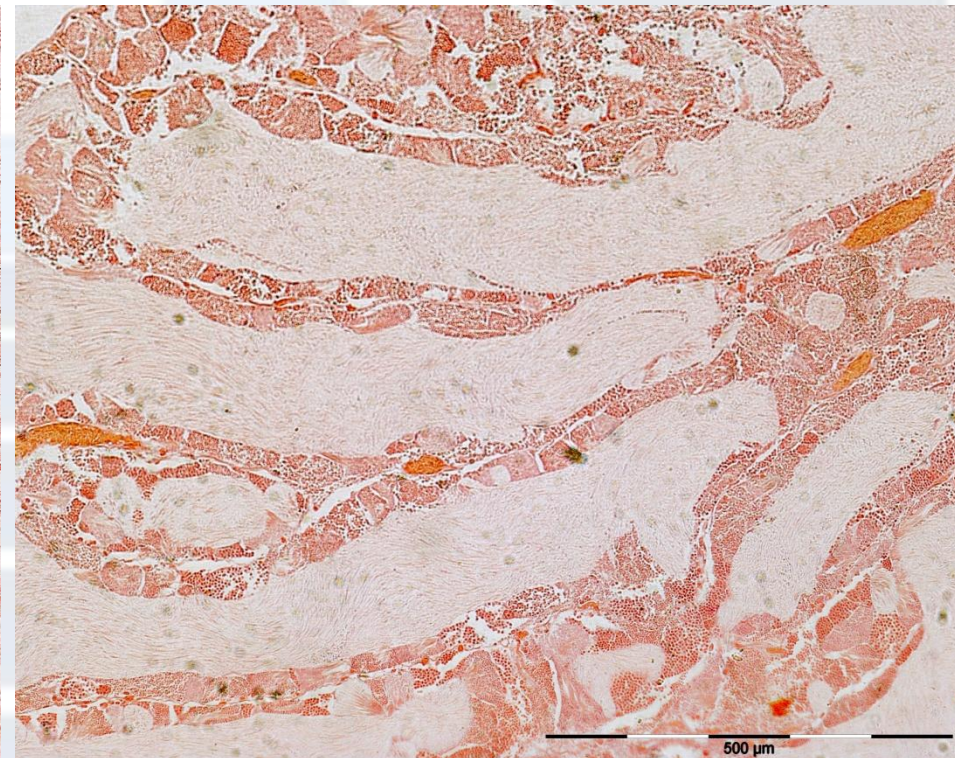
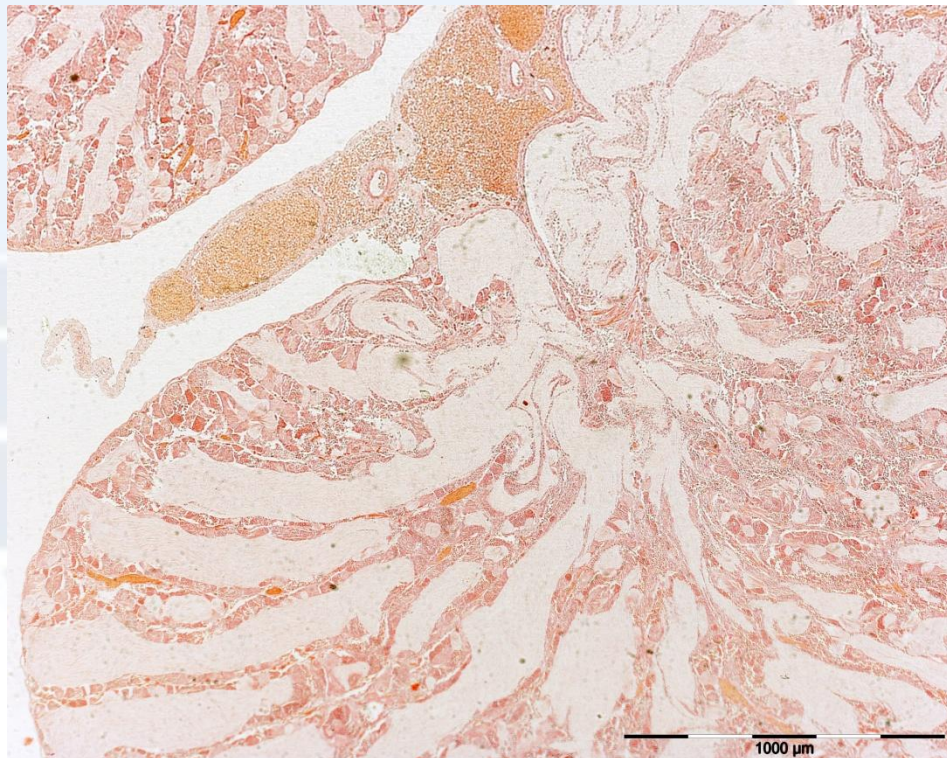
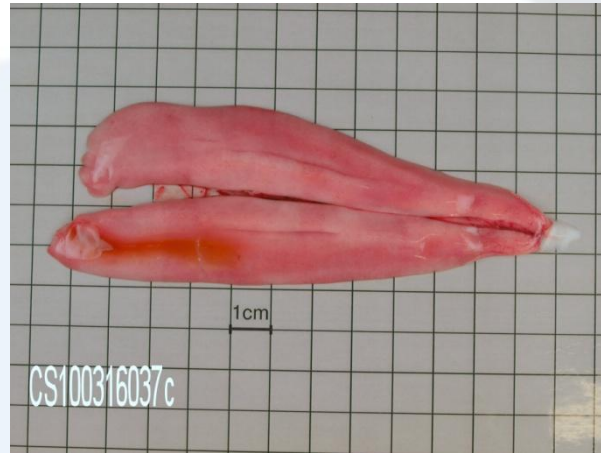
puesta

Walsh 5

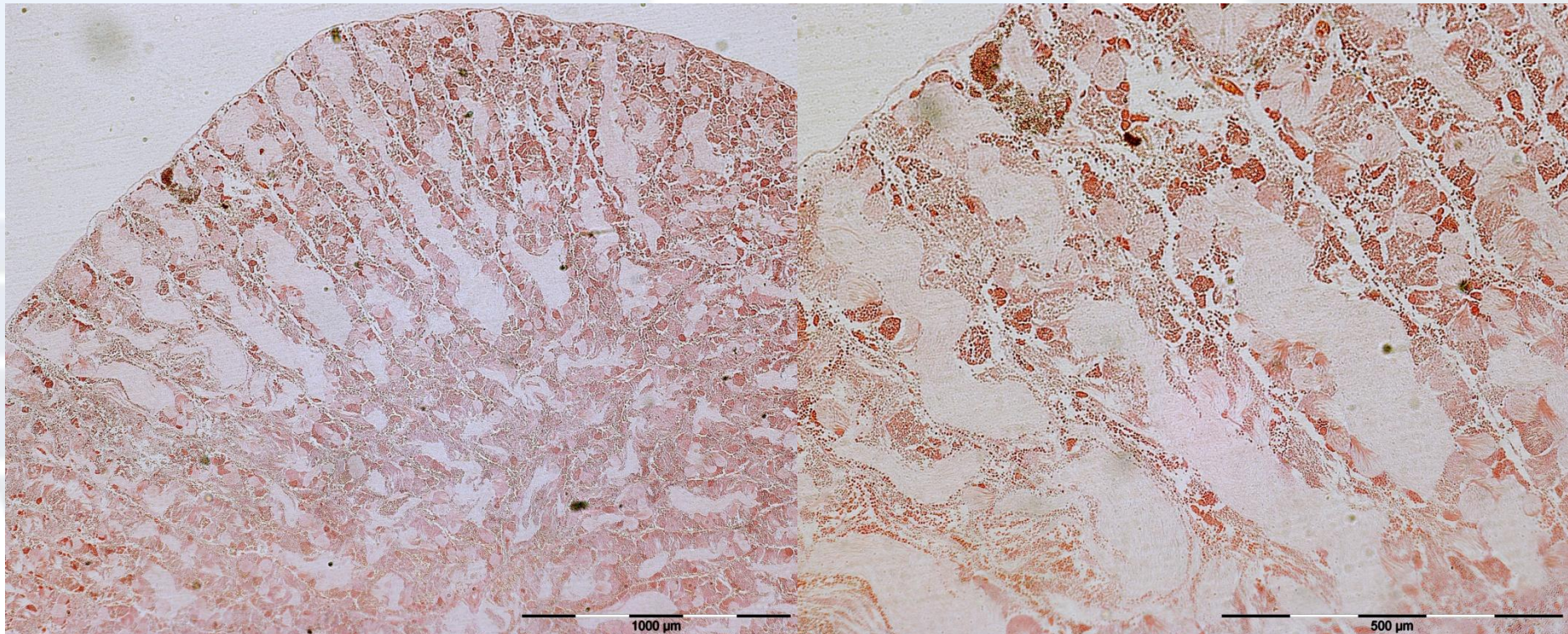
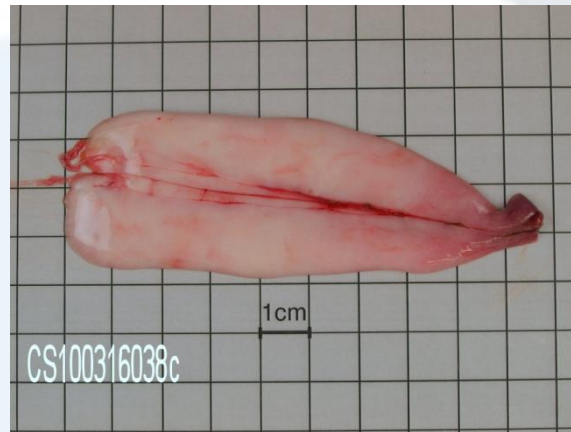


puesta

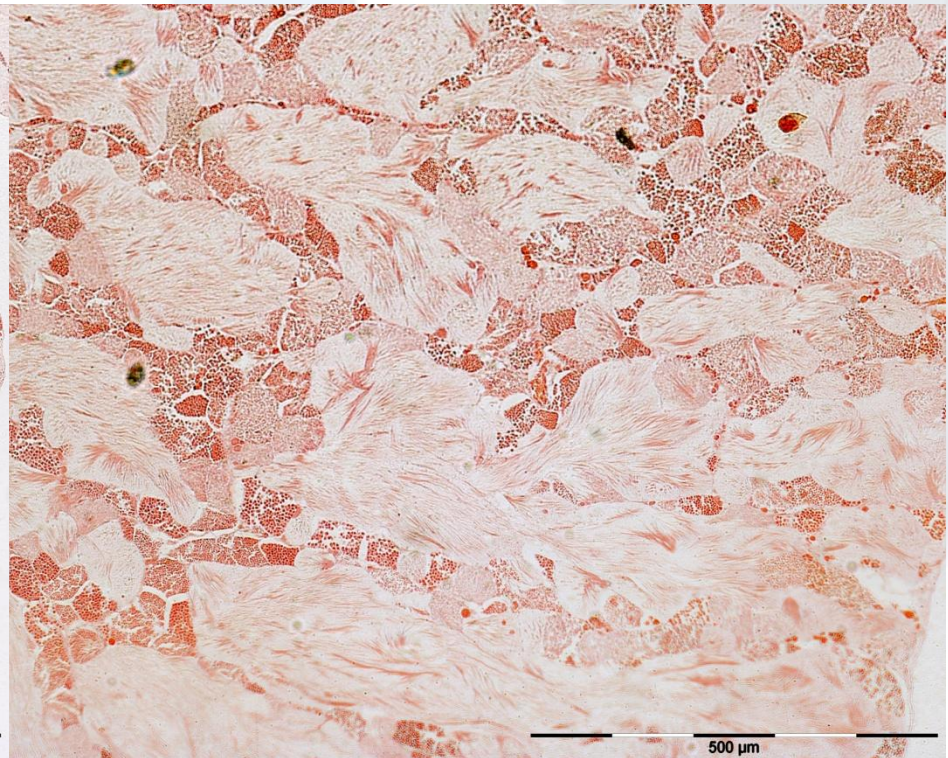
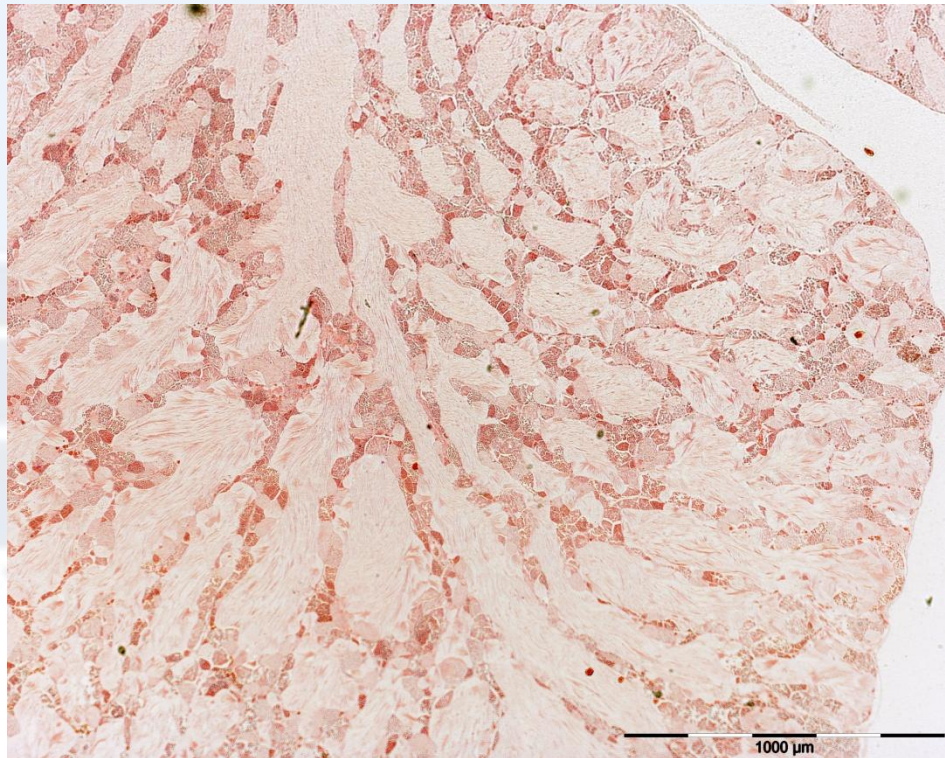
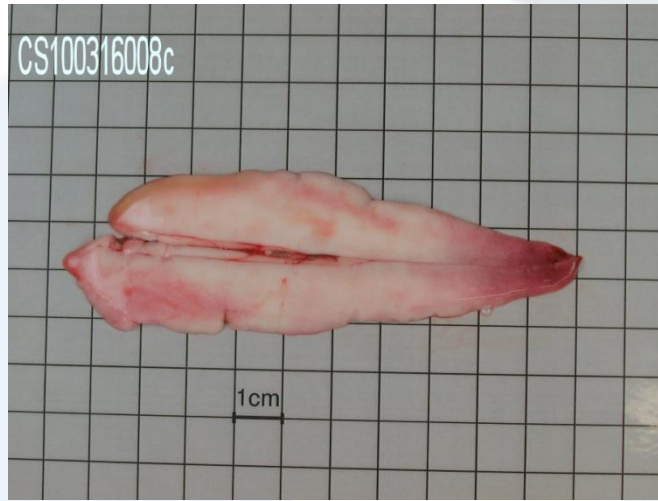
Walsh 5



Dudoso 3-5



puesta
Walsh 5



Conclusions for stage 4-5

- Histology **do not** corroborates the maturity stage macroscopic asignation
- Histology corroborates the maturity stage macroscopic asignation

Walsh 6

Regressing (cesation of spawning)

Small and flacid testes, no milt released with gentle pressure

Residual Sz present in lumen of lobules and in sperm ducts.

Widely scattered spermatocyst near periphery containing Sc2, St, Sz.

Little to no active spermatogenesis.

Spermatogonial proliferation and regeneration of GE common in peryphery of testes

Regenerating (sexually mature, reproductively inactive)

Small testes, often threadlike.

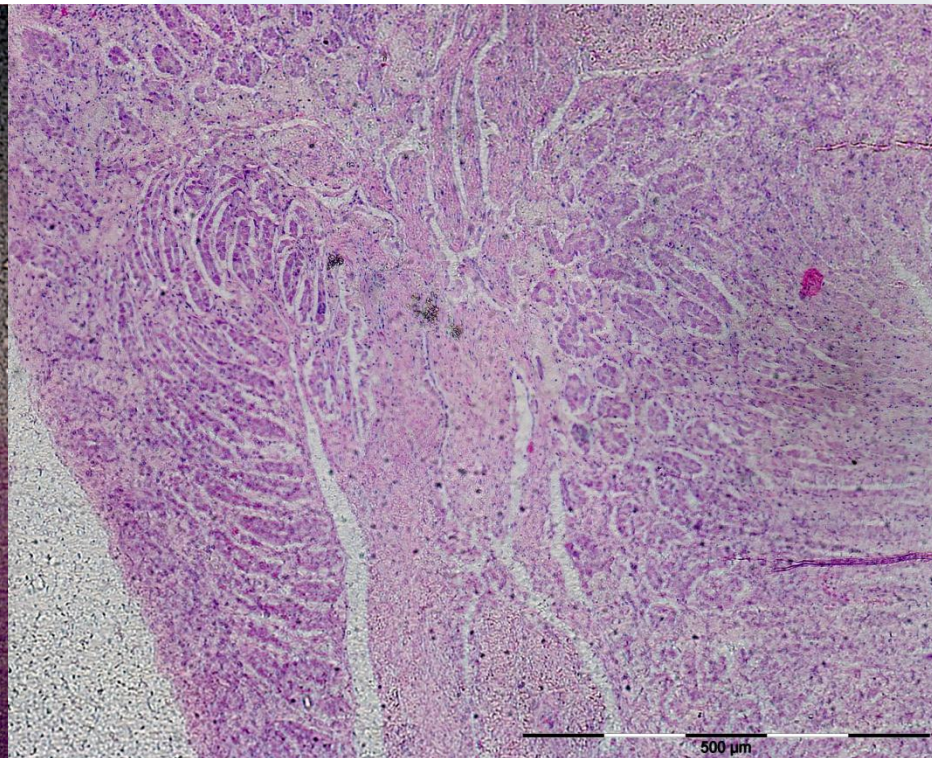
No spermatocyst. Lumen of lobule often nonexistent.

Proliferation of spermatogonia throughout testes.

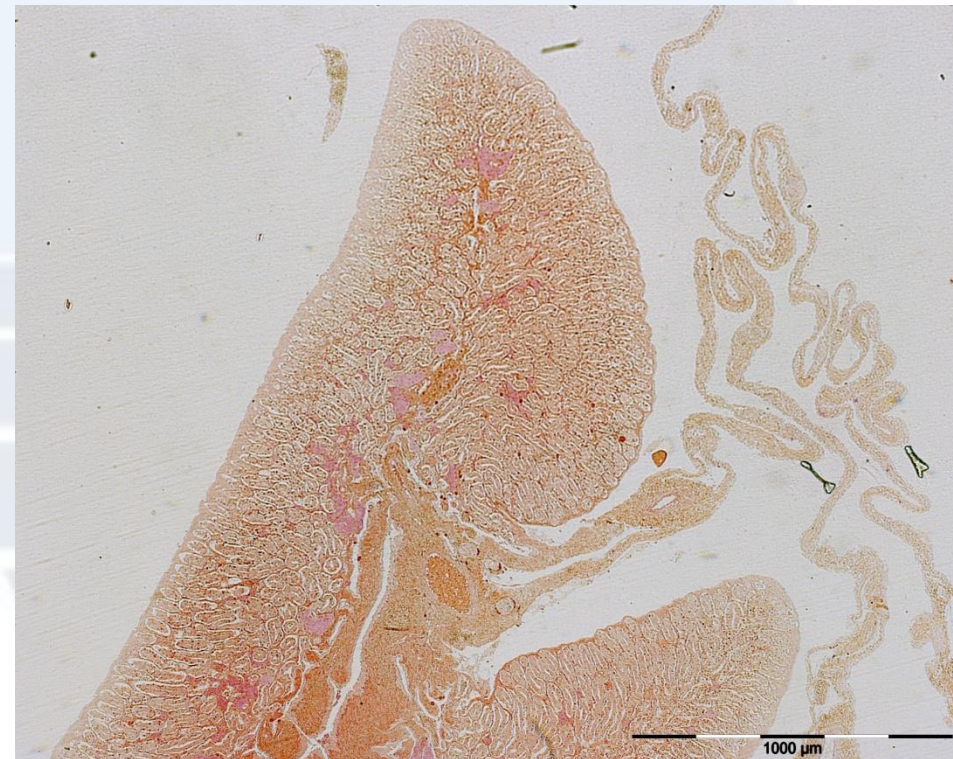
GE continuous througout

Small amount of residual Sz occasionally present in the lumen of lobules and in sperm duct

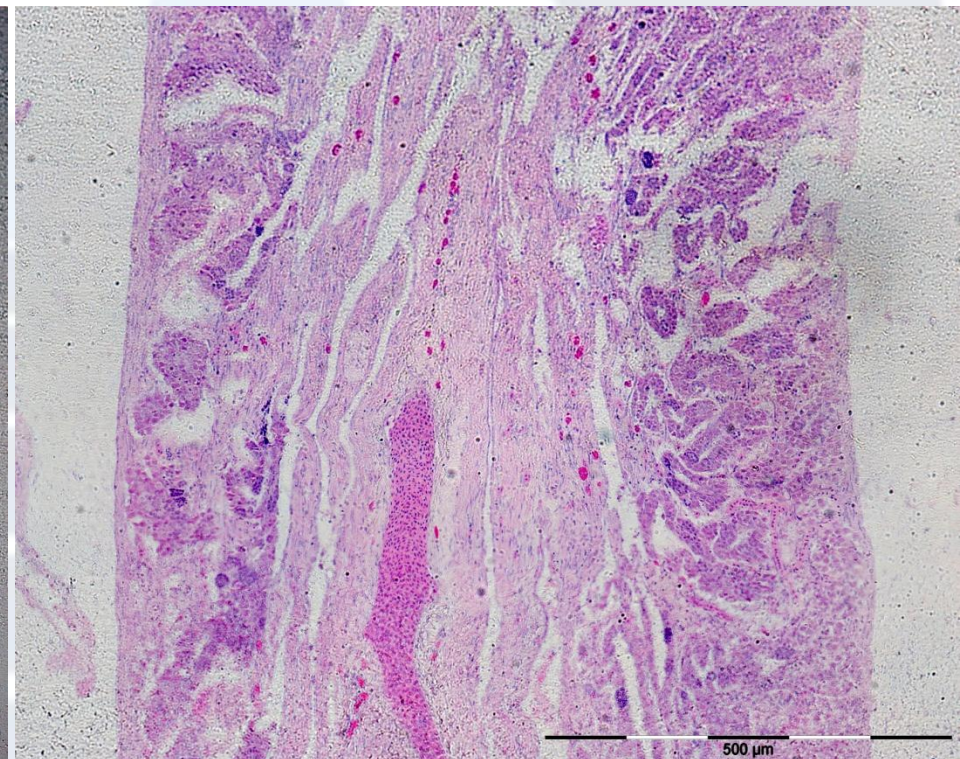
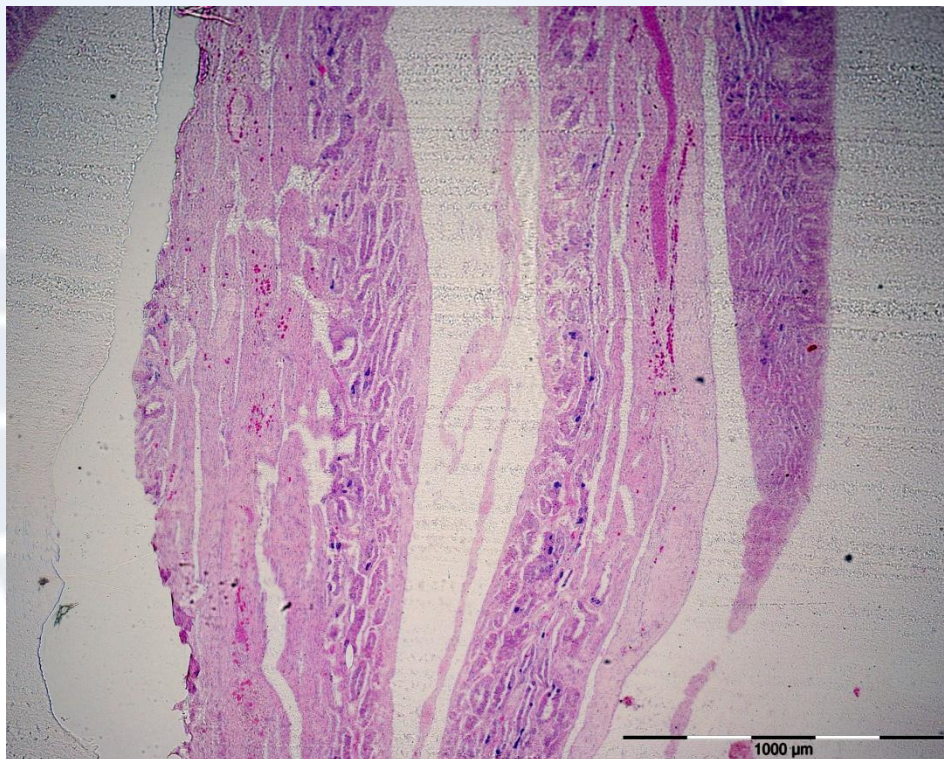
Walsh 6



Walsh 6



Dudoso
Walsh 6-1



Conclusions for stage 6

- Histology **do not** corroborates the maturity stage macroscopic asignation
- Histology corroborates the maturity stage macroscopic asignation

