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FACULTY OF VETERINARY MEDICINE
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The Impact of Electrical Pulses on Benthic Invertebrates

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Gasoil consumption

3 L per kg fish sold

€ >30% of earnings

Discards per kg fish sold

1.5 kg dead fish

3 kg benthos



Bottom contact

Tickler chains penetrate up to 8 cm in the seabed

Pulse fishing on shrimp

Bobbin rope is not very selective and non-target species are caught

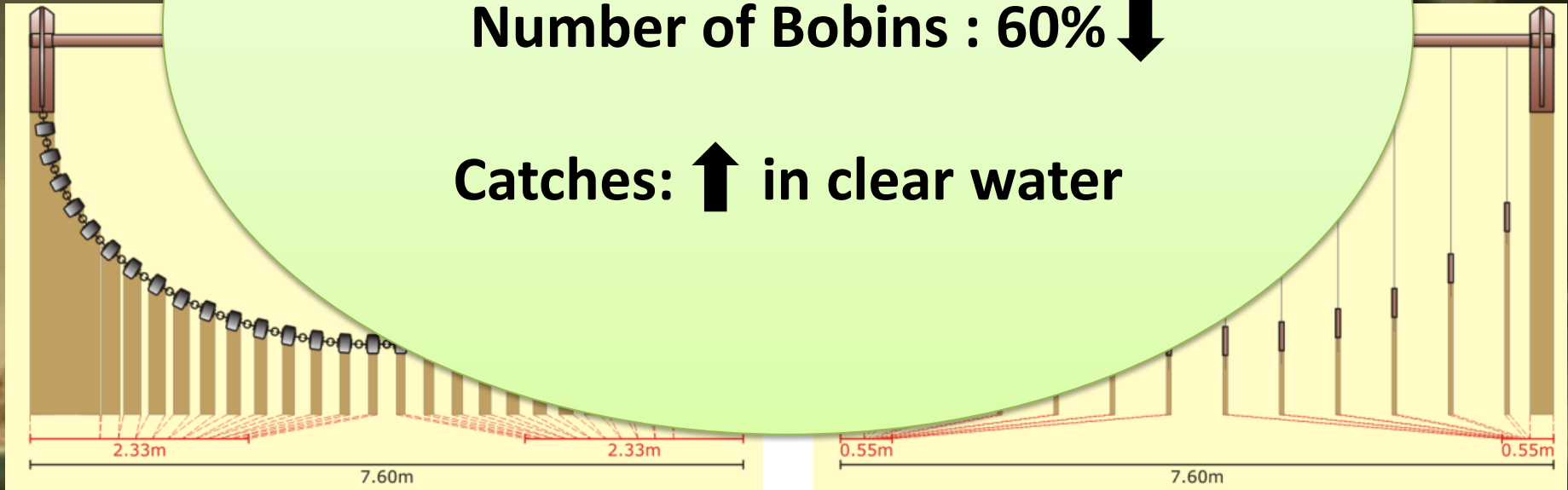
Startled shrimp are caught in the net

Discard Volume: 75% ↓

Number of Bobbins : 60% ↓

Catches: ↑ in clear water

non-target species are caught in the net underneath



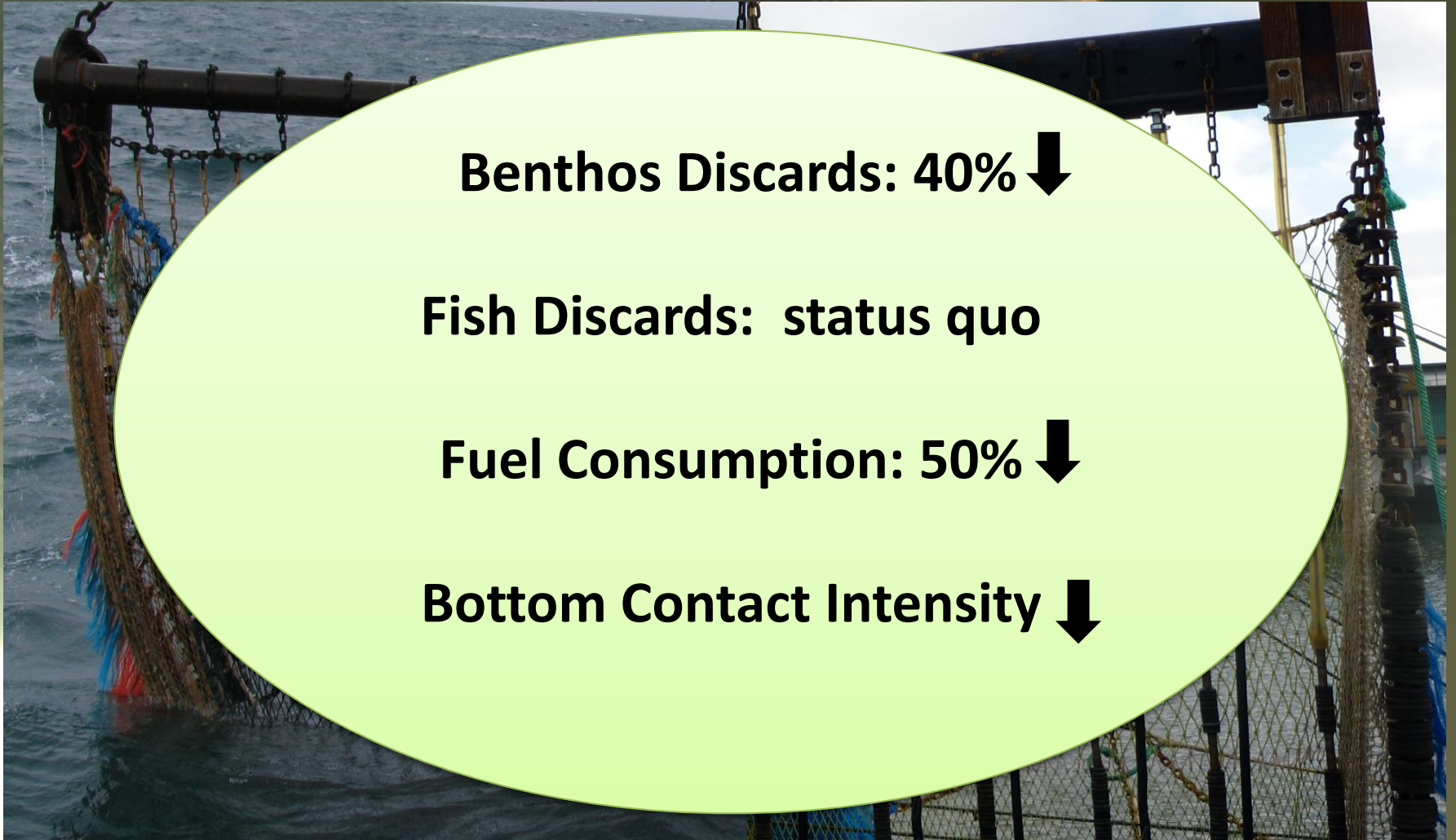
Pulse fishing on sole

Benthos Discards: 40% ↓

Fish Discards: status quo

Fuel Consumption: 50% ↓

Bottom Contact Intensity ↓



Overview

Introduction on Pulse Fishing

Effect of Sole pulse: what data are known/lacking ?

Effects of electrical pulses on benthic invertebrates

Experimental set up

Results

Conclusion

Open Questions

Effects of electrotrawls on benthic invertebrates

Effects of cramp pulse (I)

Smaal & Brummelhuis (2005):

19 species: 7 molluscs, 6 crustaceans,
4 echinoderms, 2 polychaetes

Species	Reaction	Reaction p.e.	Follow up
molluscs	closing shell	direct recovery	= control
crustaceans	cramp	direct recovery	= control
echinoderms	no response	no response	= control
polychaetes	no response	no response	= control

⇒ NO observed effect
BUT: number of individuals



Effects of cramp pulse (II)

Van Marlen et al. (2009):

Species	0.1-0.2m	0.2-0.3m	0.4m
Sandworm	-4.3%*	0%	- 4.3%*
Green crab	-1.9%	- 7.5%*	- 5%*
Razor clam	-7.3%*	+ 6%*	+ 6%*
Surf clam	0%	0%	0%
Prawn	-4.7%	- 0.8%	+12.4%
Starfish	+4.8%	- 5.6%	-13.6%

⇒ No/minor effects

⇒ “pulse trawls < < < conventional beam trawl”

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Our Research

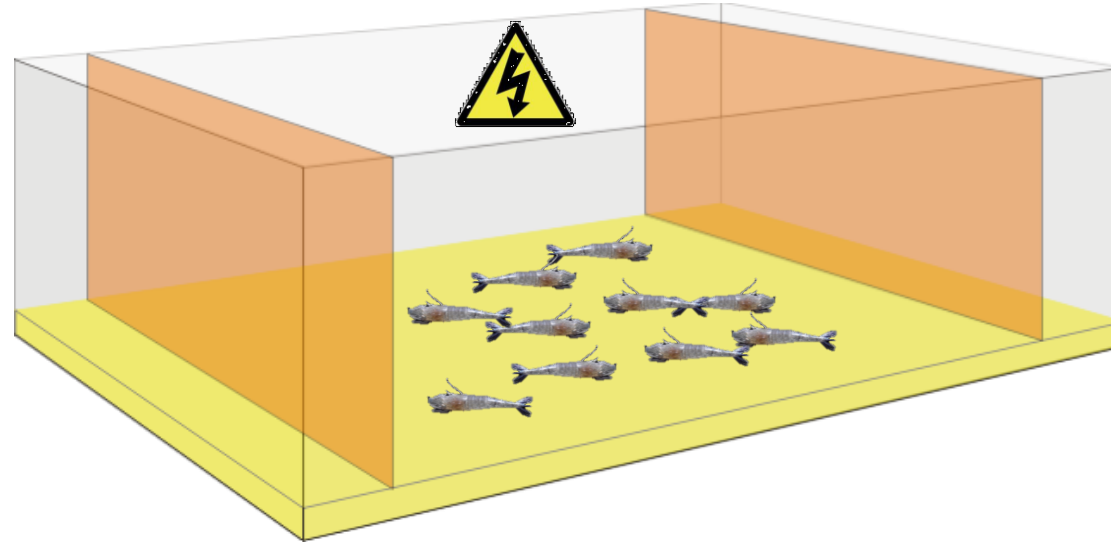
Is there a safe upper limit for the use of electrical pulses?

10 \neq pulses

14 d survival

Macroscopic lesions

Histology: muscles, gut, ganglia, parapodia, heart,
hepatopancreas



Pulse Parameters

Frequency: 5 to 200 Hz

Field strength: 50 to 200 V/m

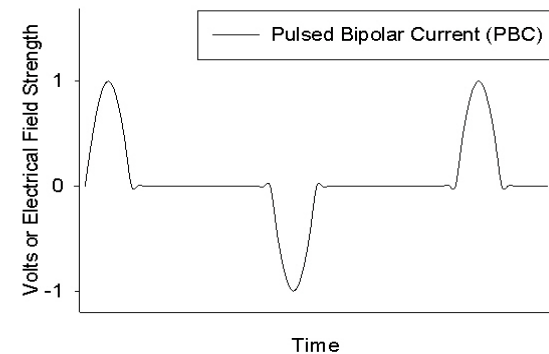
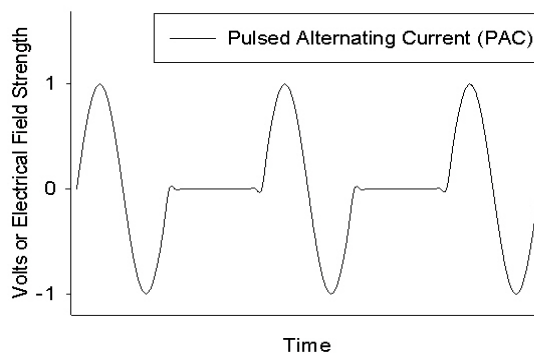
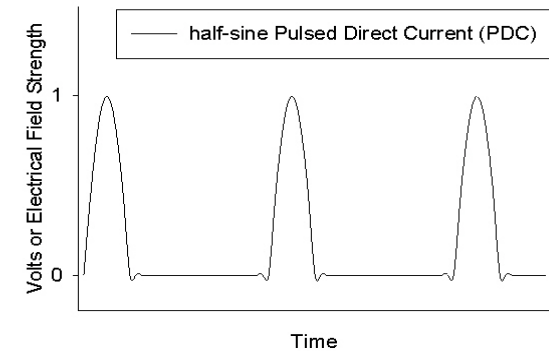
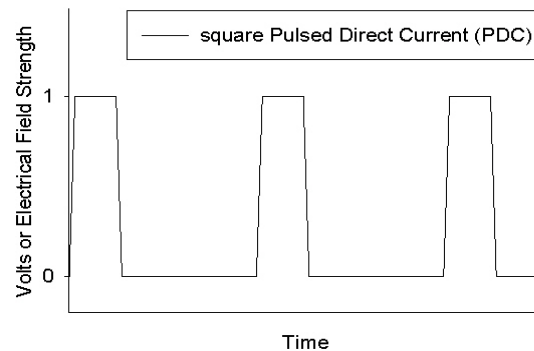
Pulse duration: 0.5 to 1 ms

Exposure: 1 to 5 s

Pulse shape

Pulse type

Exposures



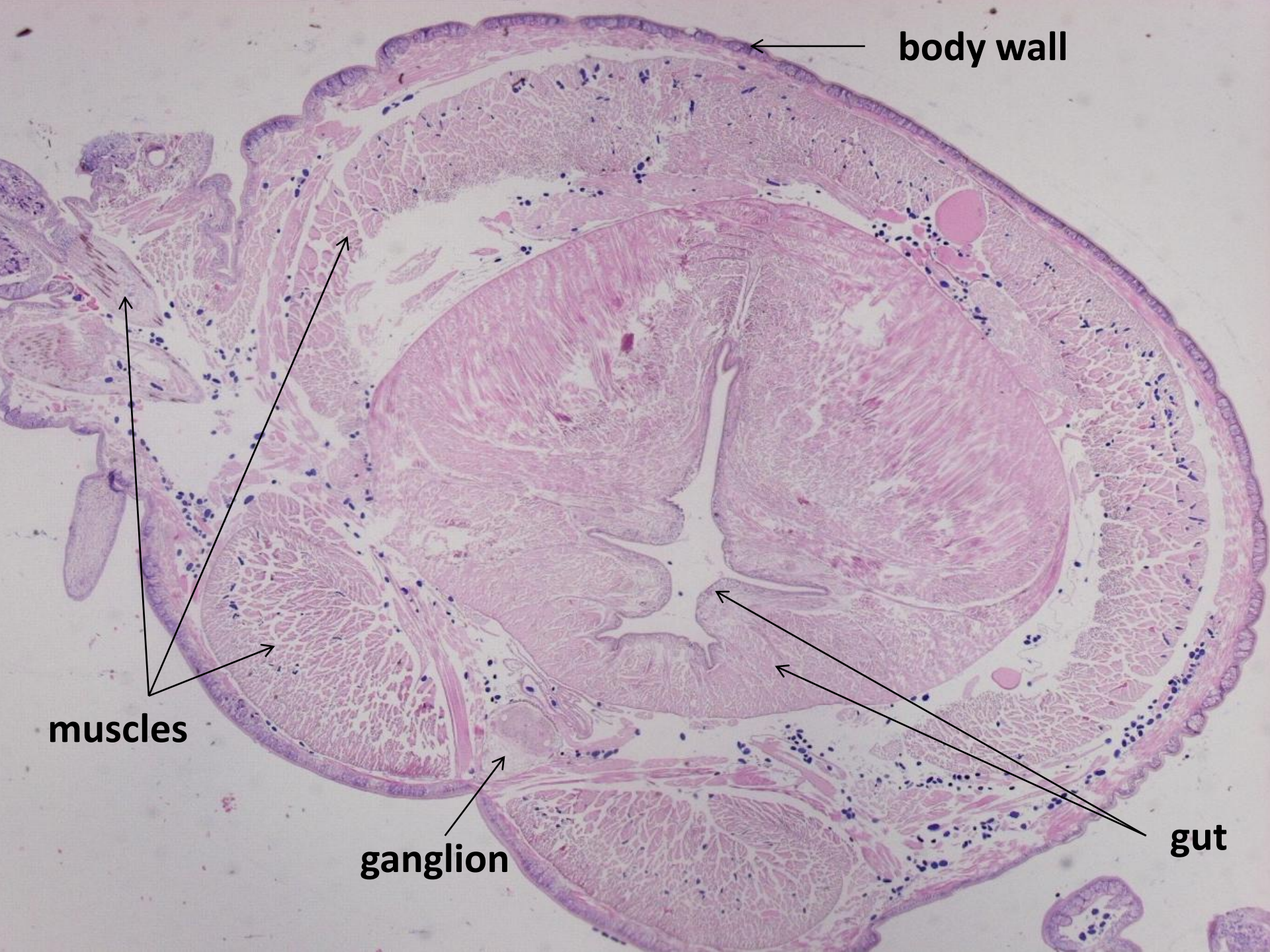
Sandworm (*Alitta Virens S.*)



Sandworm (*Alitta Virens S.*)

Behaviour: **squirming, no cramp**

<u>14d-survival:</u>	Parameter	Survival
	Control	96%
	Shrimp pulse	100%
	60 Hz	98%
	200 Hz	100%
	1 ms	100%
	300 V/m	100%
	Sole pulse 1	98%
	Exponential	100%
	Quarter sinus	97%
	Repetitive	98%

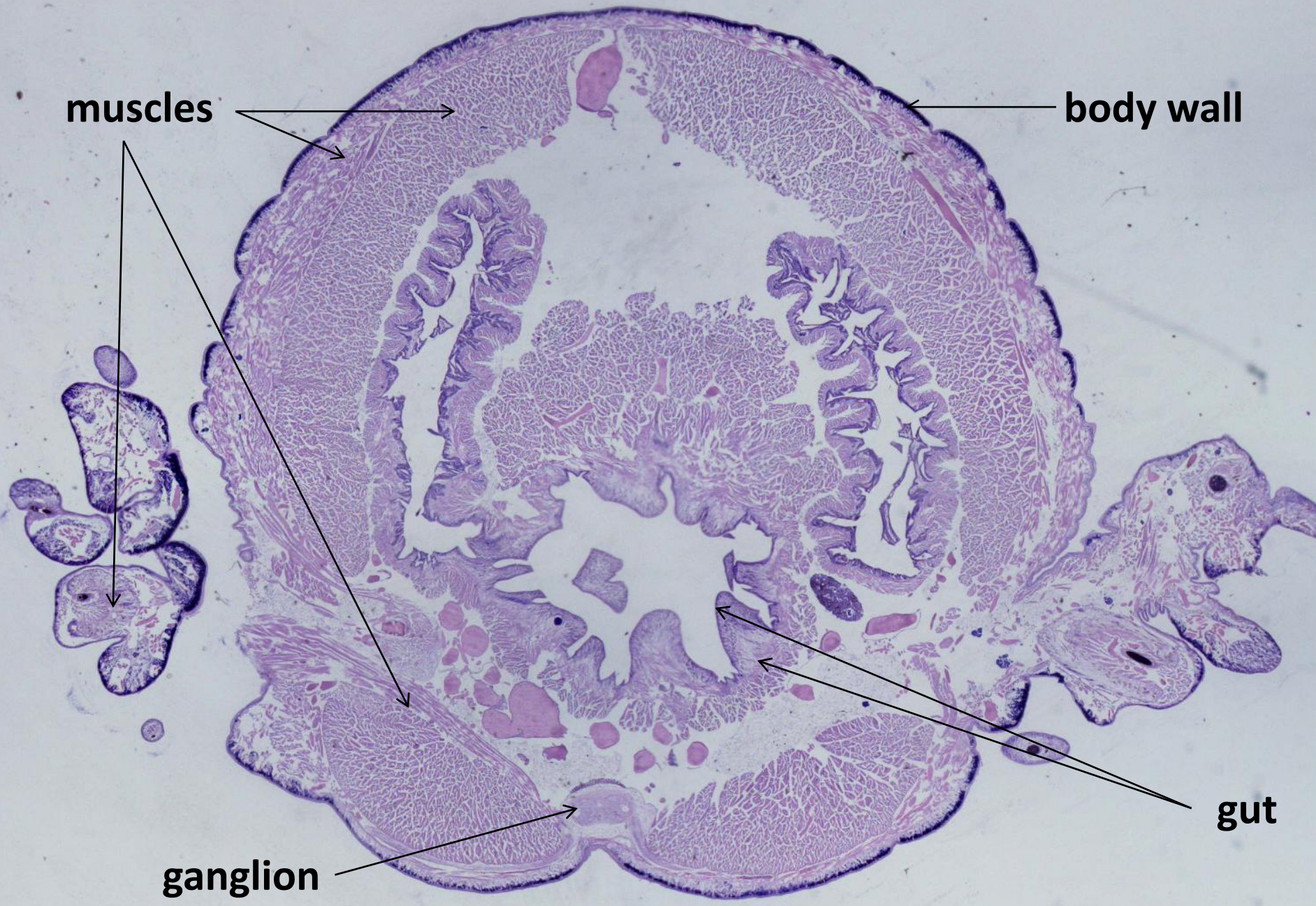


body wall

muscles

ganglion

gut



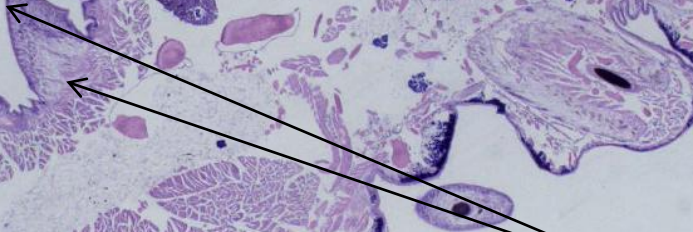
muscles



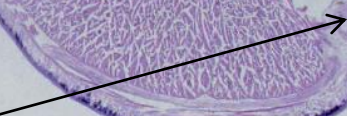
body wall

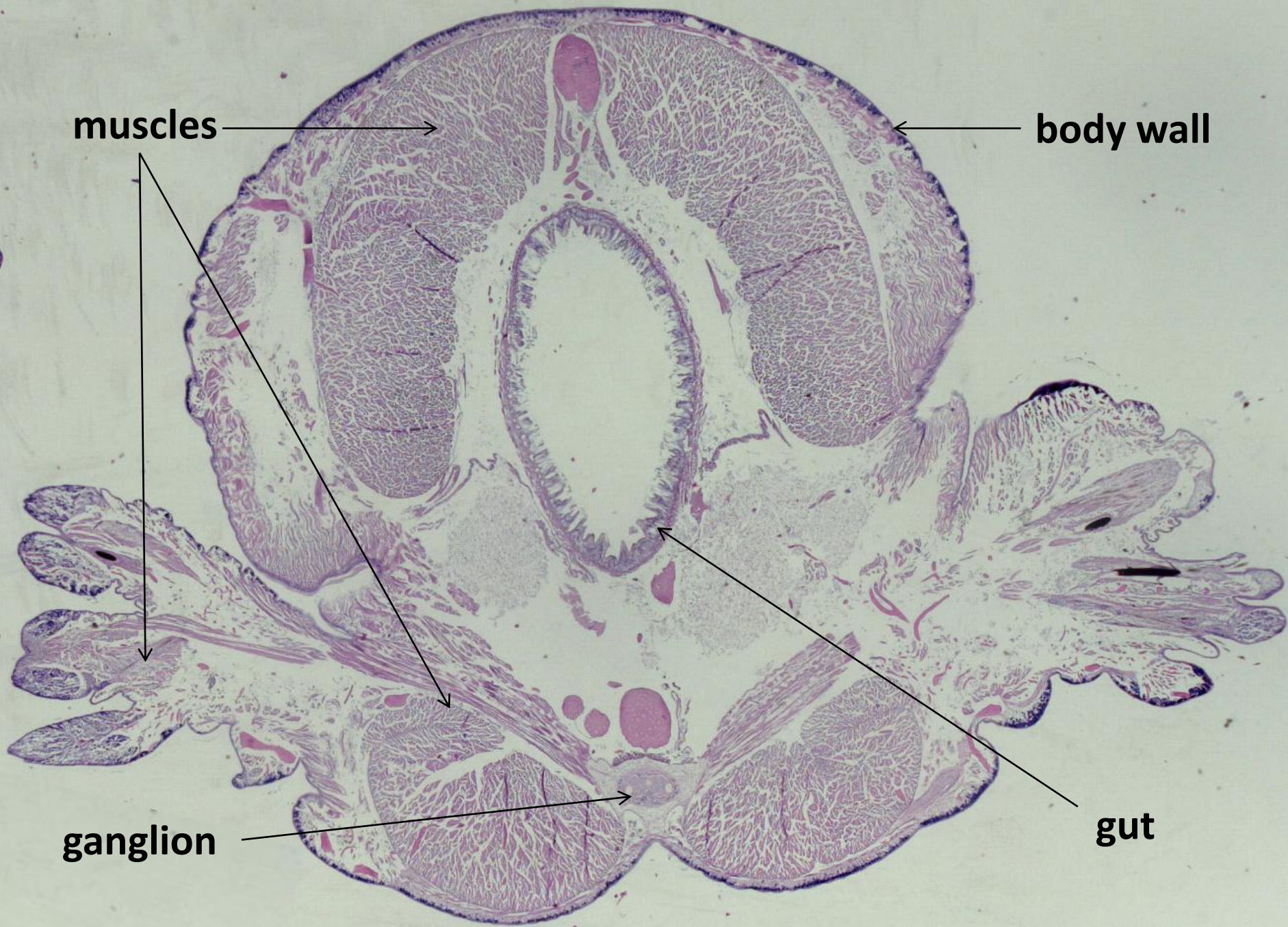


gut



ganglion



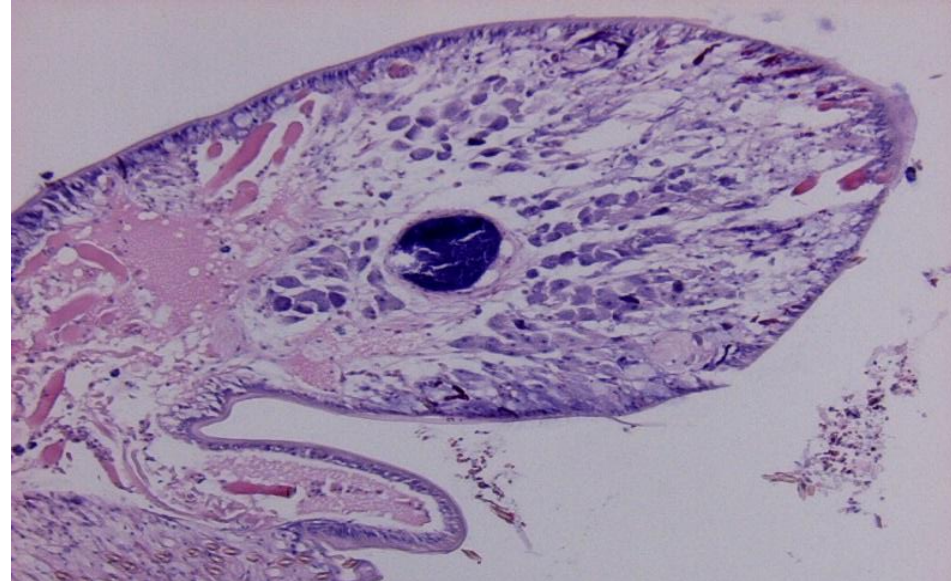
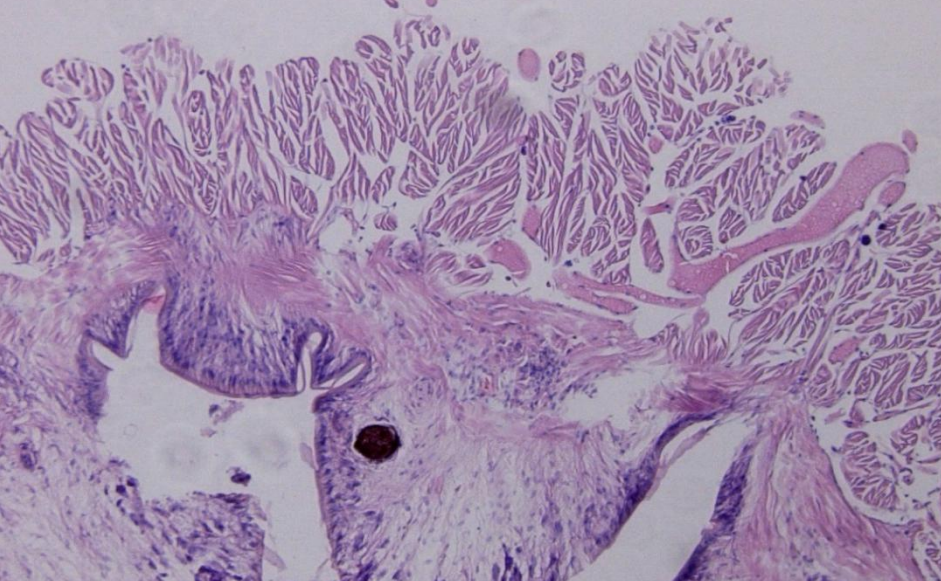


muscles

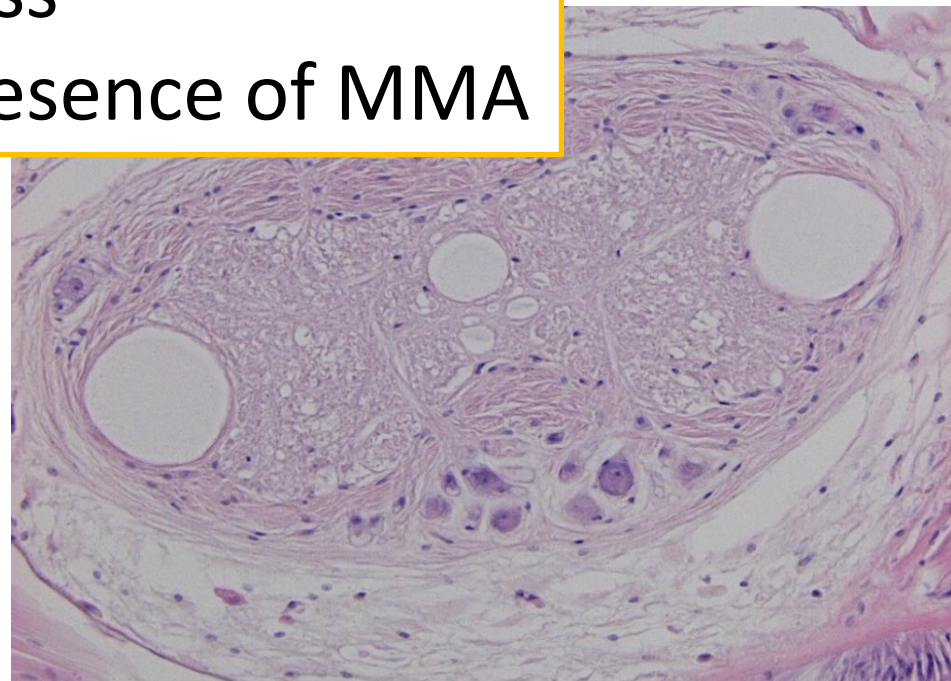
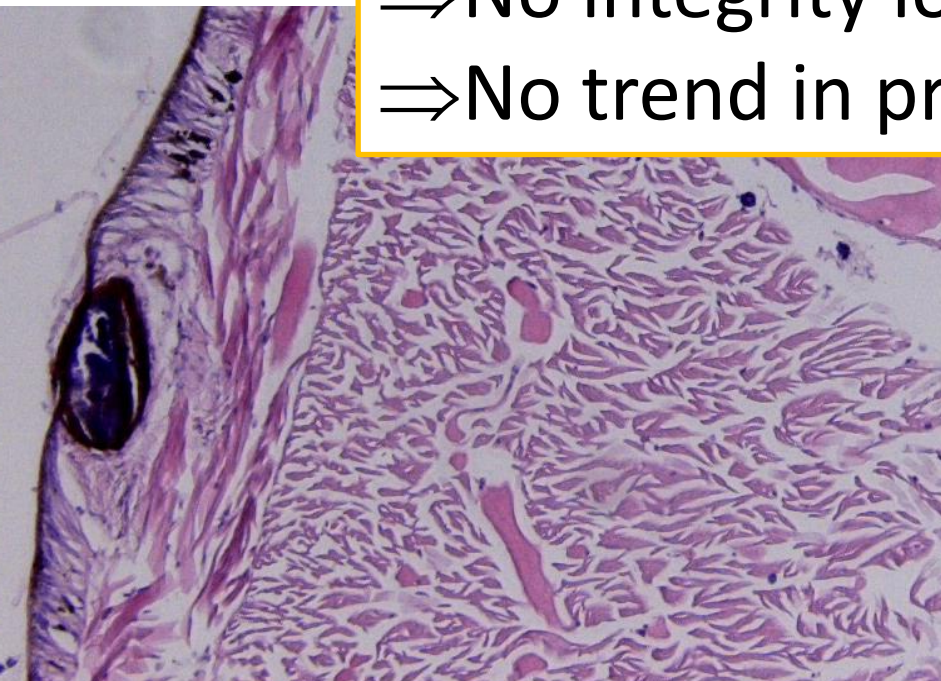
body wall

ganglion

gut



⇒ No cell degeneration
⇒ No integrity loss
⇒ No trend in presence of MMA



Brown Shrimp (*Crangon crangon* L.)



Brown Shrimp (*Crangon crangon* L.)

Behaviour

During exposure

Low Frequency: startle reaction

Frequency > 25 Hz: cramp

Post exposure

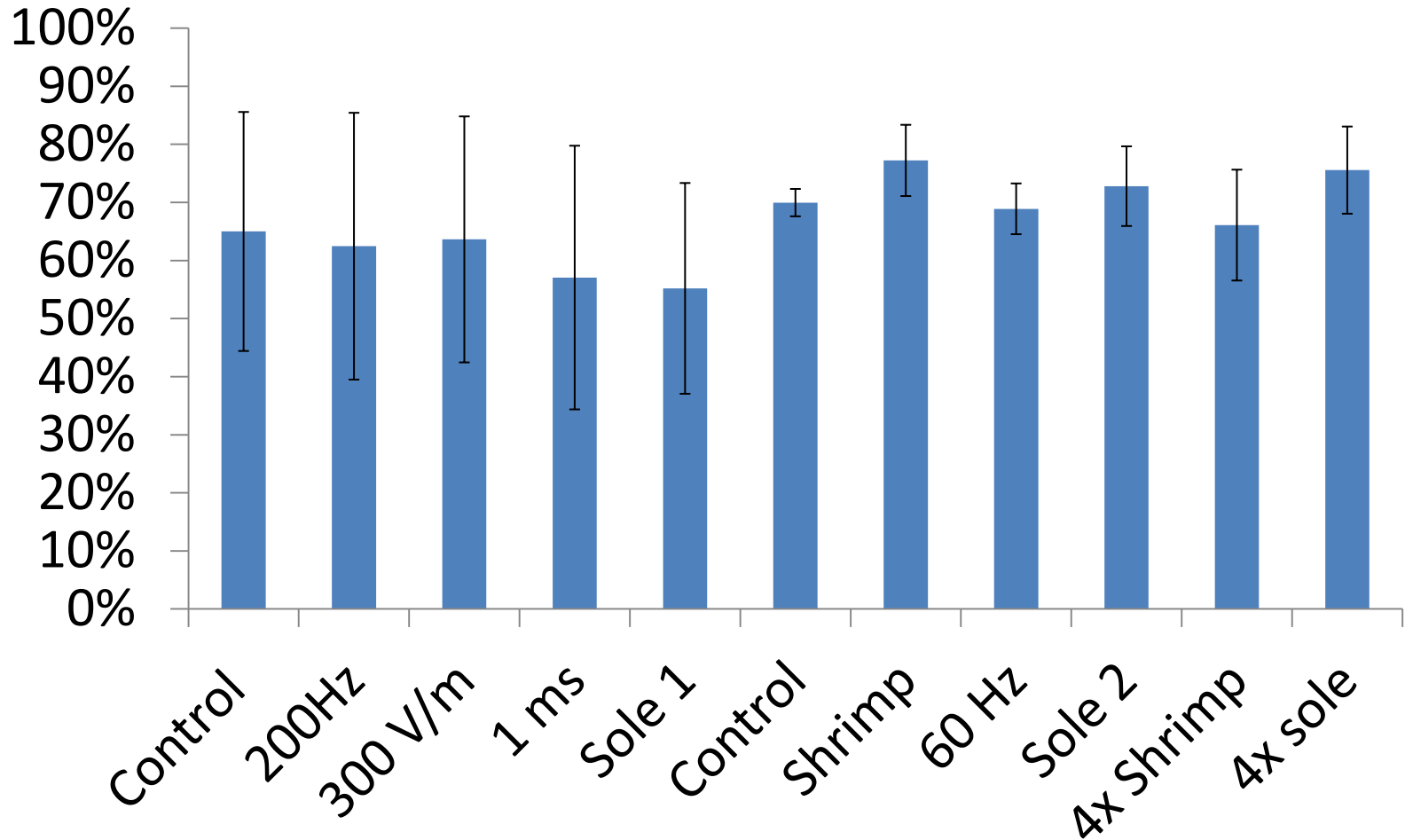
Short startle reaction & rebury

14 d follow-up

Apathetic & appetite decline



Survival



No significant effects on 14d survival

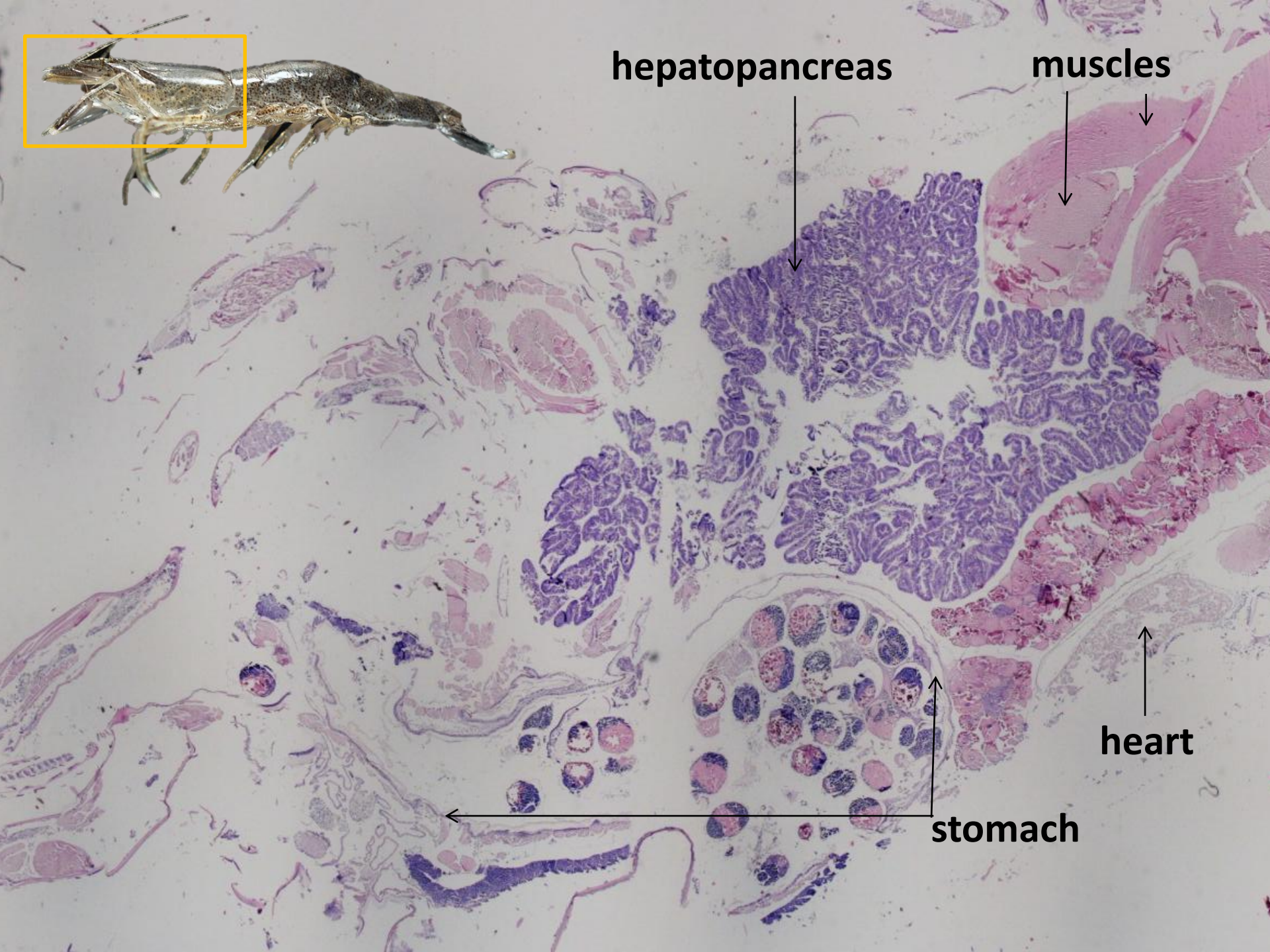


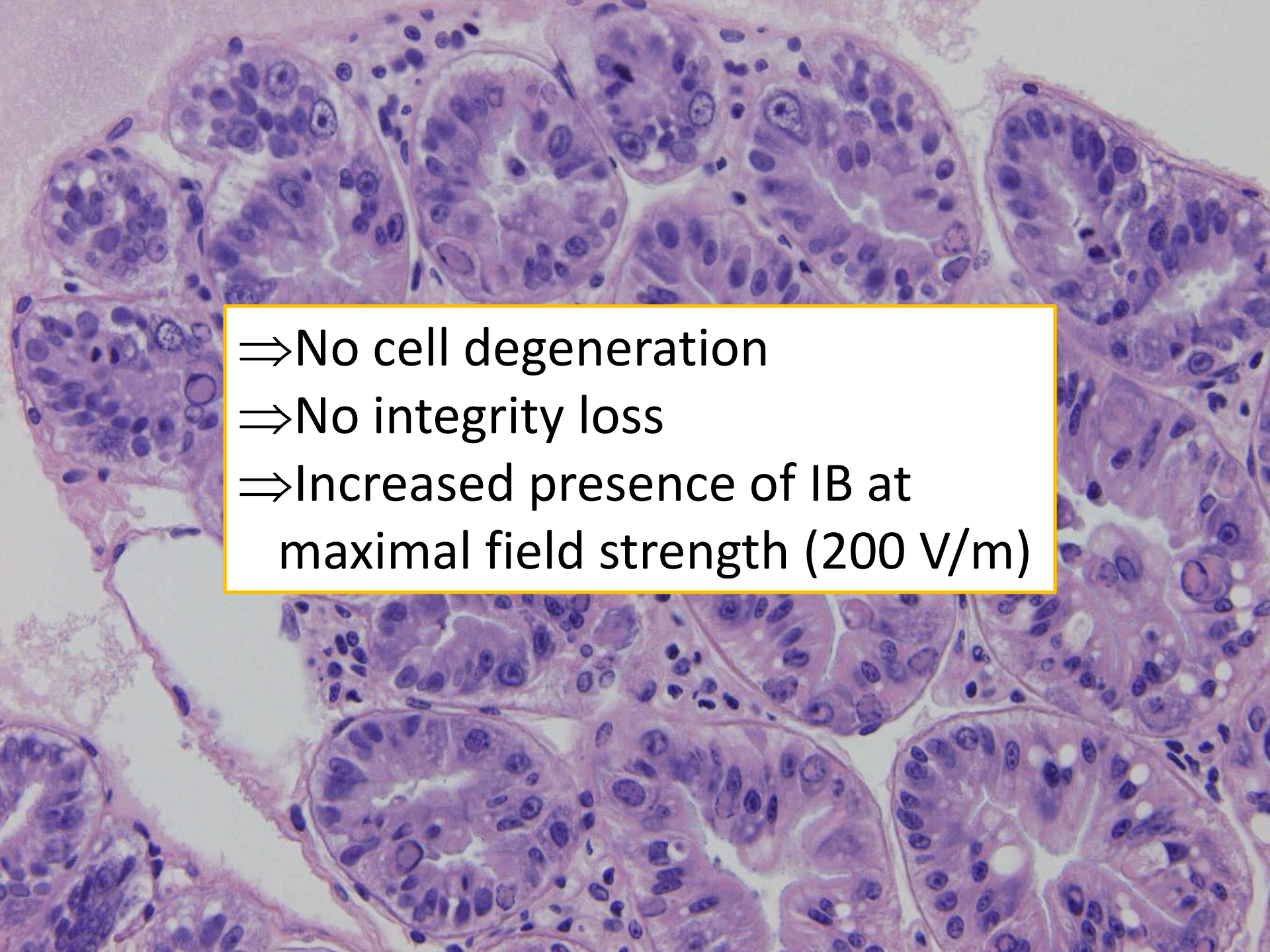
hepatopancreas

muscles

heart

stomach



A histological section of tissue, likely from the gastrointestinal tract, stained with hematoxylin and eosin (H&E). The image shows several glandular units or crypts. Each crypt is lined by a simple columnar epithelium. The cells are tall and rectangular, with their nuclei positioned near the base. The apical surface of these cells is covered by a brush border, which appears as a thin, fuzzy layer. The cytoplasm of the cells is stained pink, while the nuclei are stained dark purple. The overall structure is organized and regular, indicating a healthy or well-maintained tissue state.

⇒ No cell degeneration
⇒ No integrity loss
⇒ Increased presence of IB at maximal field strength (200 V/m)

	Sandworm	Brown Shrimp
Behaviour	Unaffected or Squirming	Startle < 20 Hz Cramp > 20 Hz
14d Survival	Unaffected	Unaffected
Gross injuries	No	No
Histology	No lesions	No lesions IB increase

Open questions

What is effect

of repetitive exposure during the day?

on immunological functions?

on reproduction?

on the long term?

...

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Total impact of electrotrawls on benthos

Reduced mechanical stimulation results in

Benthos discards
= 30-75% reduction

Trawlpath mortality
= probably lower

Electrical stimulation results in

No/limited short term effects

TAKE HOME MESSAGE

Total impact electrotrawls probably smaller compared to conventional beam trawls



Questions?

