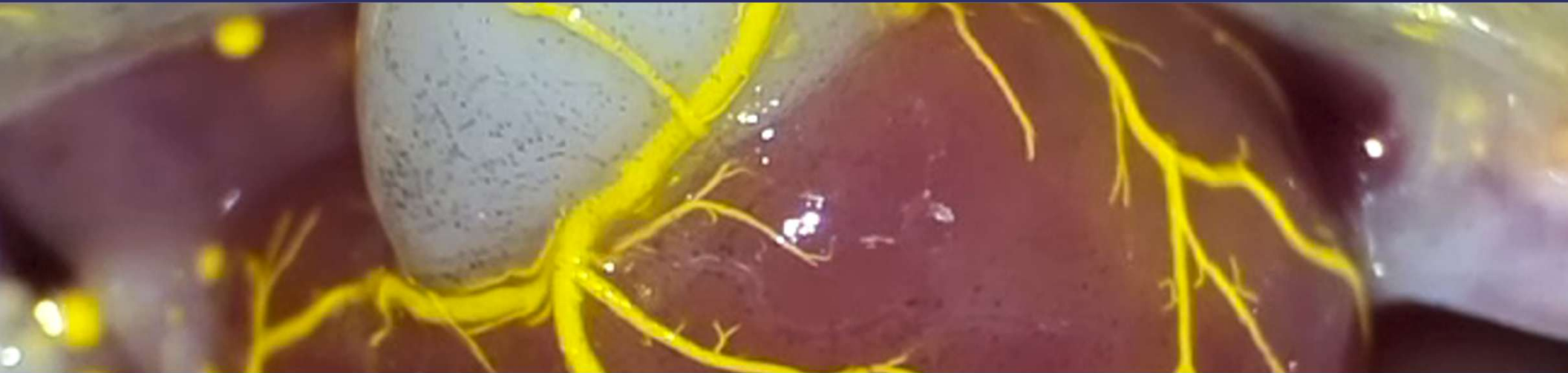


The use of electrocardiography for the diagnosis of cardiac disorders in farmed fish

Lucas Zena
Scientist

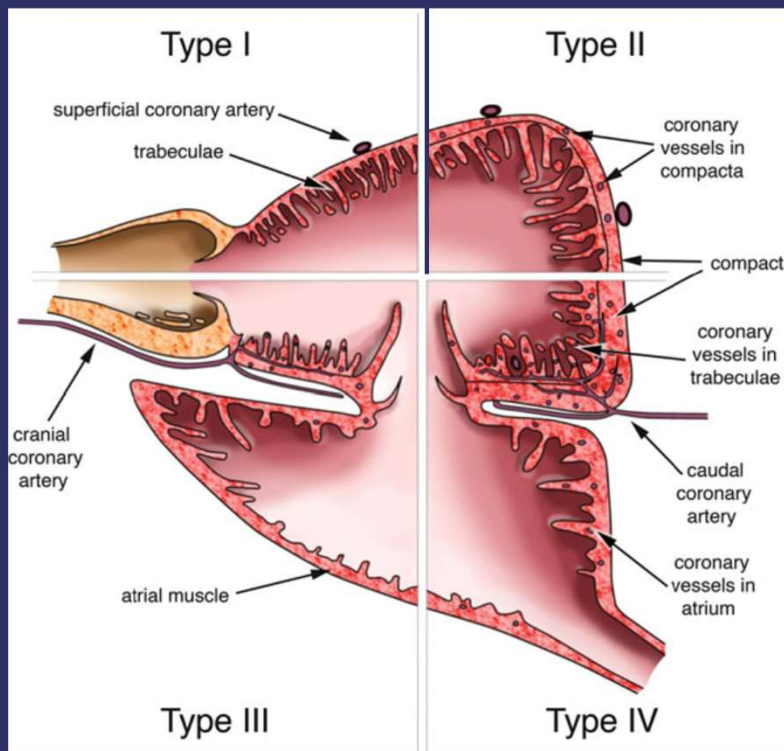


Heart Morphology

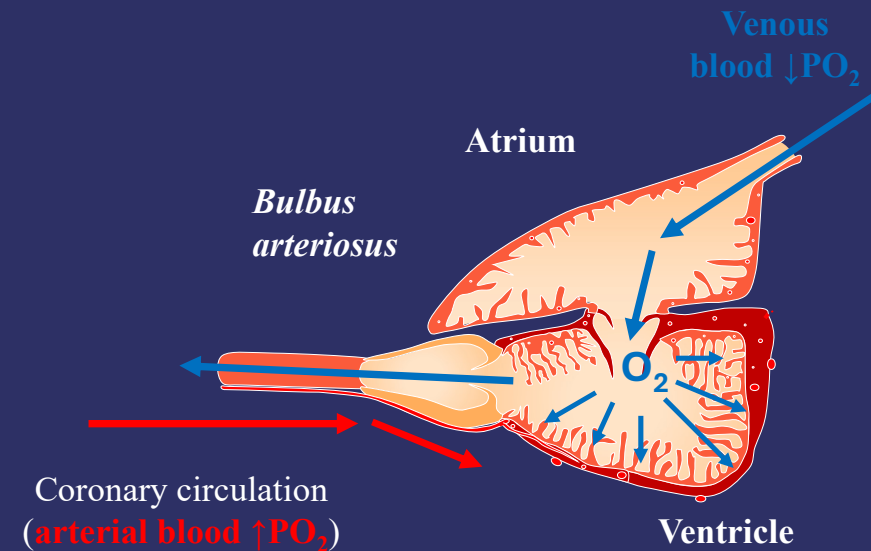
- Topology = slightly left-right asymmetry, but large variation along the caudo-cranial and dorso-ventral.
- Shape = tubular, sac-like, or pyramidal.
- **Proportion of spongy vs compact myocardium and the extent of coronary vasculature.**

Proportion of spongy vs compact myocardium and the extent of coronary vasculature

The greatest variation in form and function of the heart in any vertebrate class, is in bony fish (Farrell, 2023).

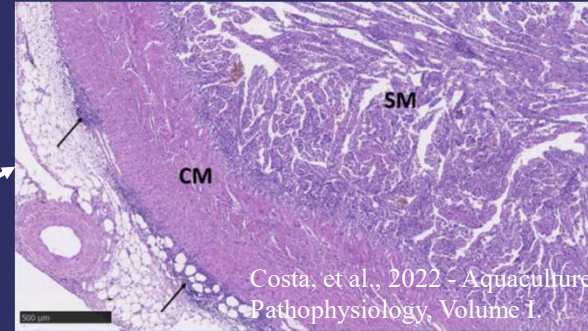


Tota, et al., 1989

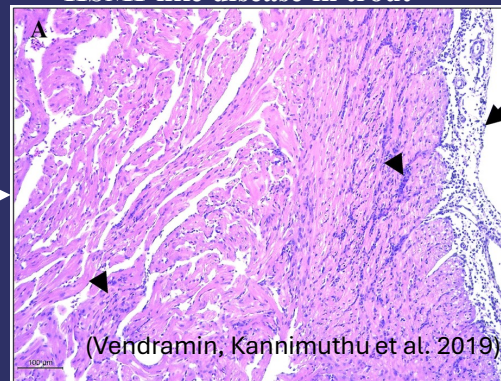


Modified from Davie and Farrell 1991; Adapted by Ekström

Diseases Affecting The Heart And Blood Vessels in Salmonids

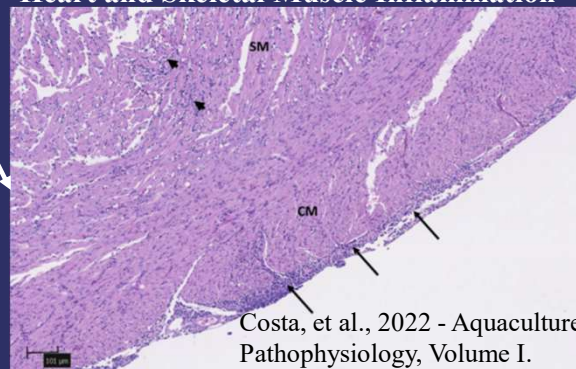


HSMI-like disease in trout



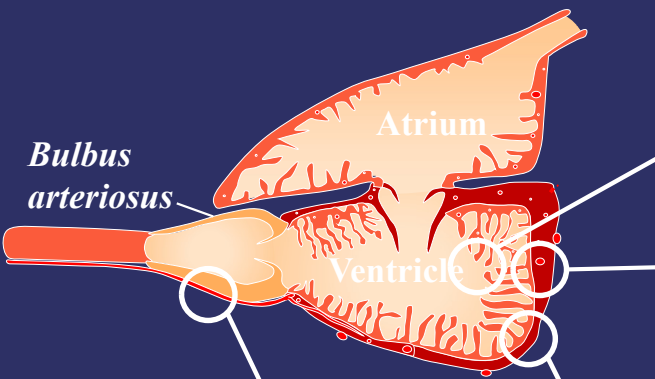
- Crowding, pumping, and other stressors;
 - Risk factor for cardiovascular diseases

Heart and Skeletal Muscle Inflammation

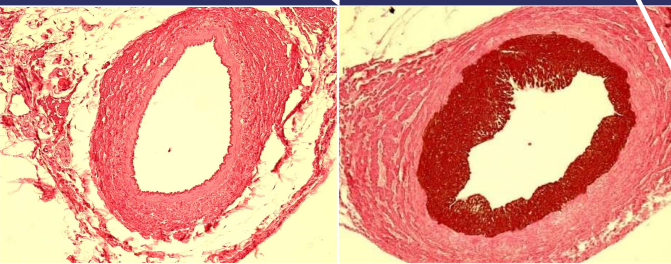


Diagnosis

- Combination of external observations and laboratory techniques;
 - Histopathology/qPCR
 - Good quality samples: moribund/fresh dead fish



Arteriosclerosis

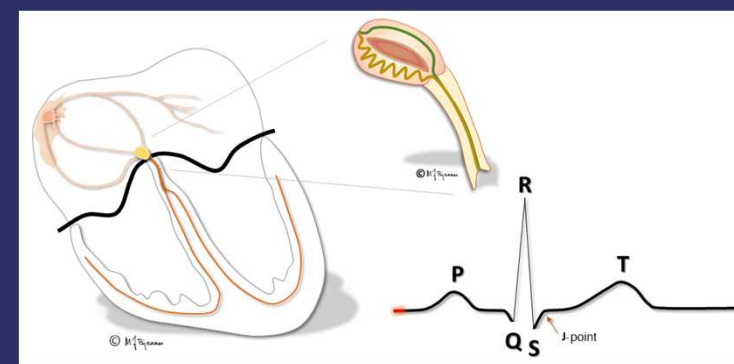


Brijs & Gräns et al. 2020

Electrocardiography

	Likelihood of myocardial infarction (MI)				
	LOW				HIGH
I. Clinical setting Symptoms and vital signs					
II. Electrocardiogram (ECG)					
III. Troponin level at 0h	—	—/+	+	+++	++++
IV. Troponin change (within 1, 2 or 3h)	—	—/+	+	+++	If any of the above, consider direct rule-in
Triage decision	Rule-out MI		Observe	Rule-in MI	
Differential diagnosis	Noncardiac		Unstable angina	Other cardiac	NSTEMI STEMI

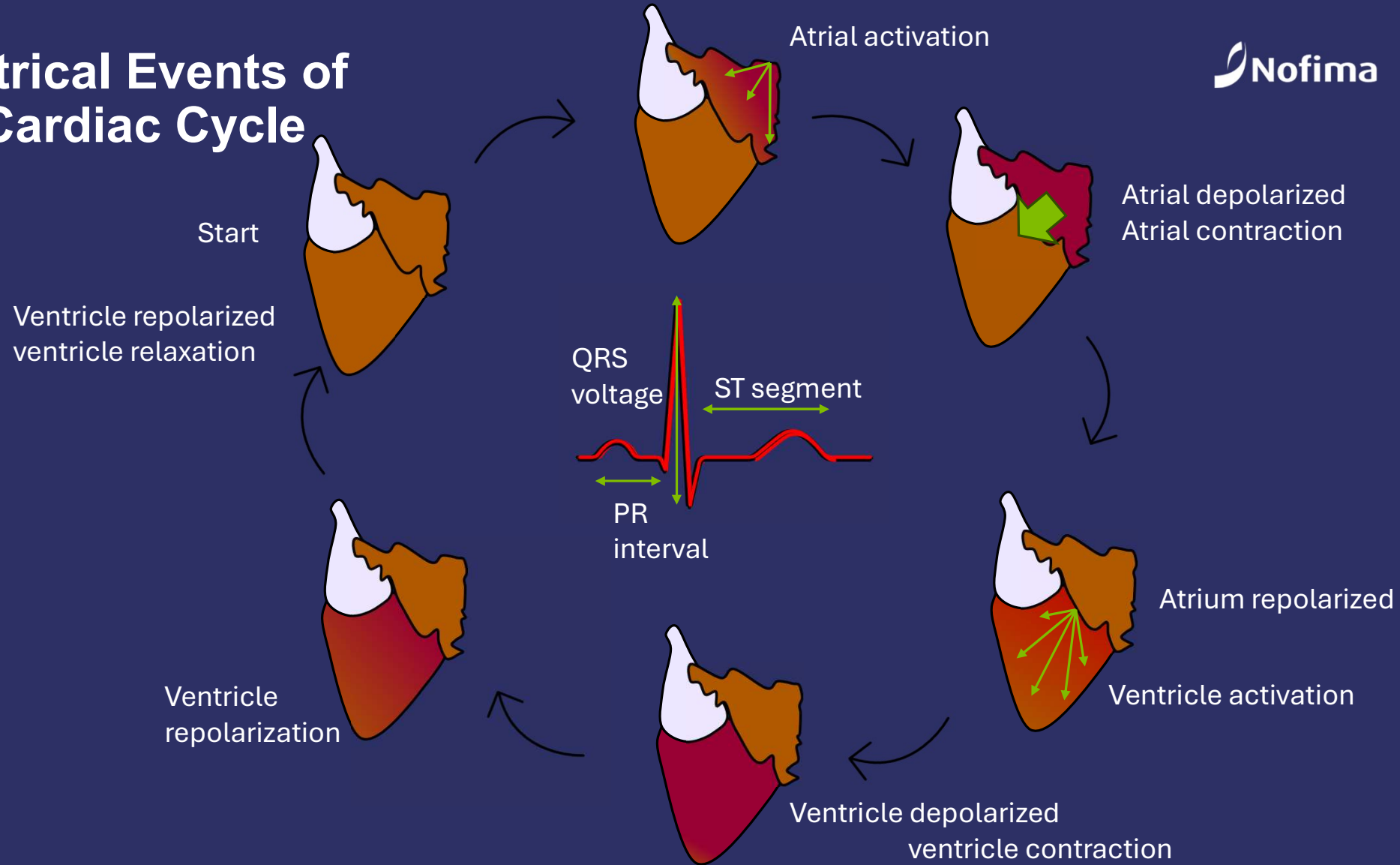
Twerenbold, R. et al. J Am Coll Cardiol. 2017;70(8):996-1012.



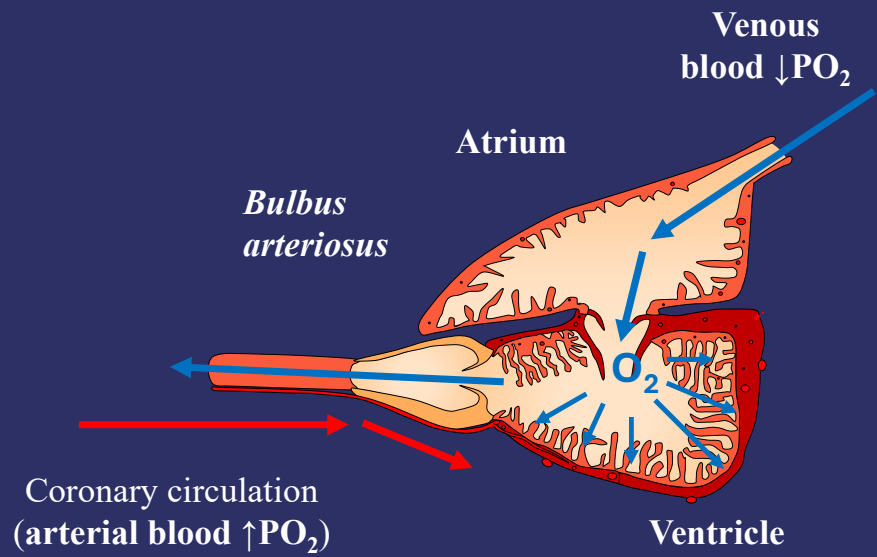
Human clinical practice

- Heart attack;
- Arrhythmias (Irregular Heartbeat);
- Heart Block and Conduction Issues;
- Inflammatory Diseases;
- Electrolyte imbalances;
- ...

Electrical Events of the Cardiac Cycle

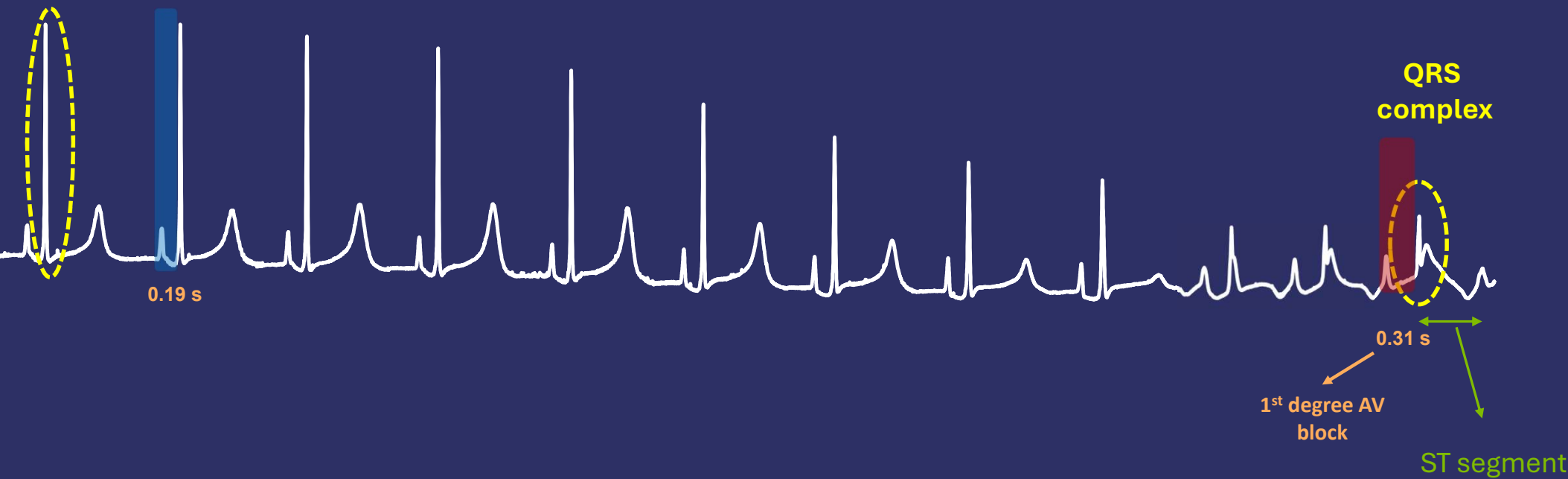


Cardiac O₂ dependence



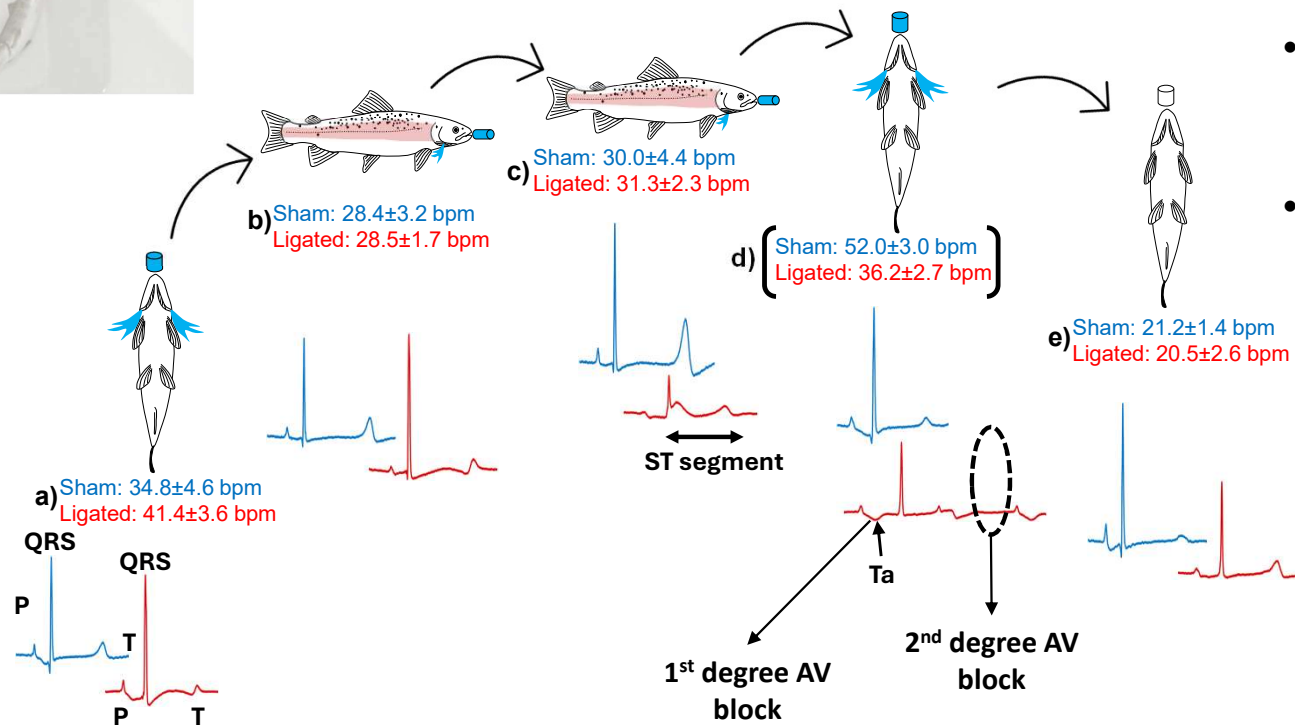
Electrical Events linked with Myocardial Ischemia

QRS complex



Electrical Events linked with Myocardial Ischemia

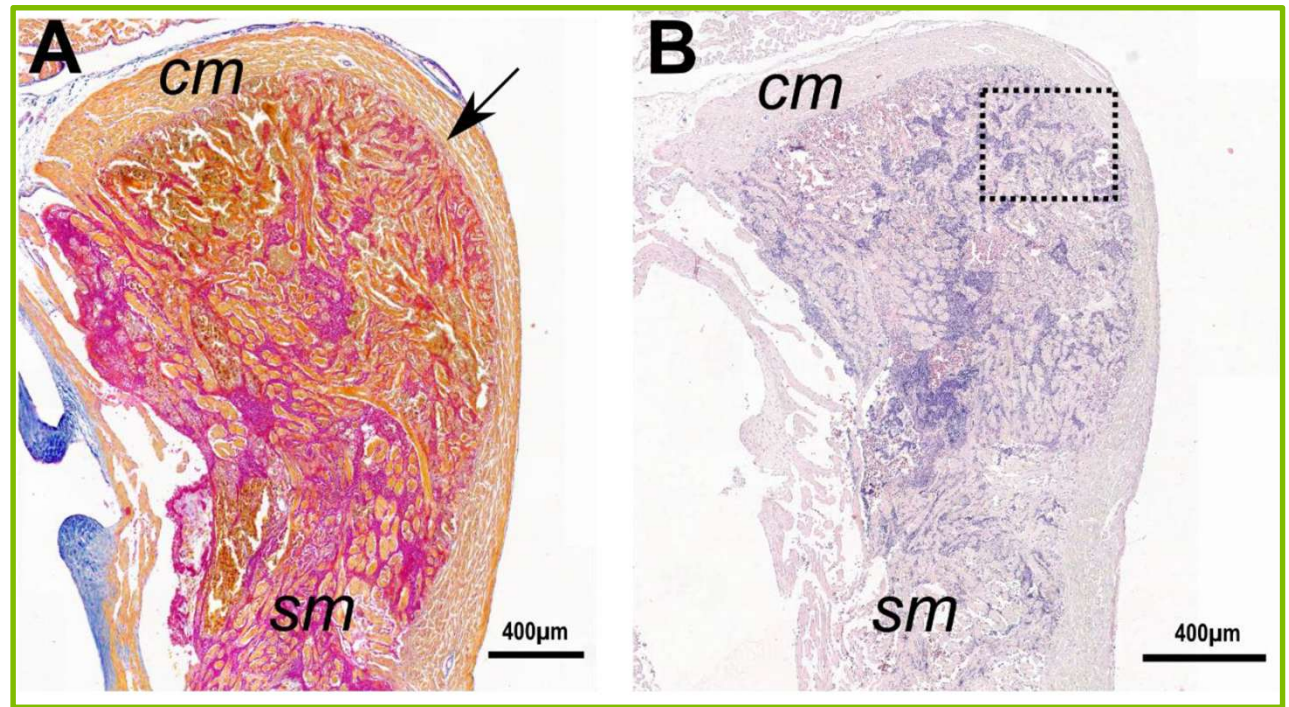
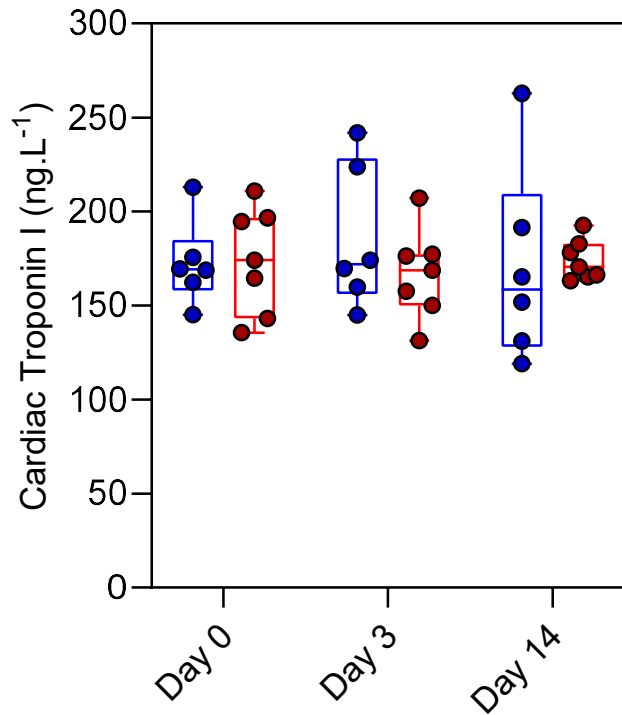
Brønstad, 2022



- ↓ HR → improved myocardial electrical signal;
- Improved O₂ delivery during diastole?

Plasma troponin levels and Histopathology

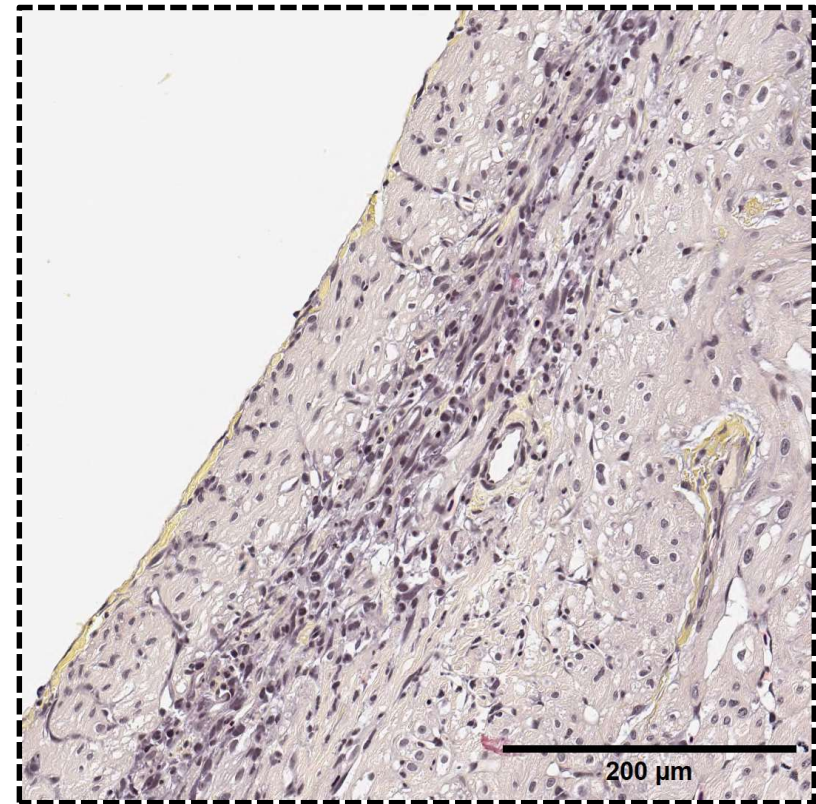
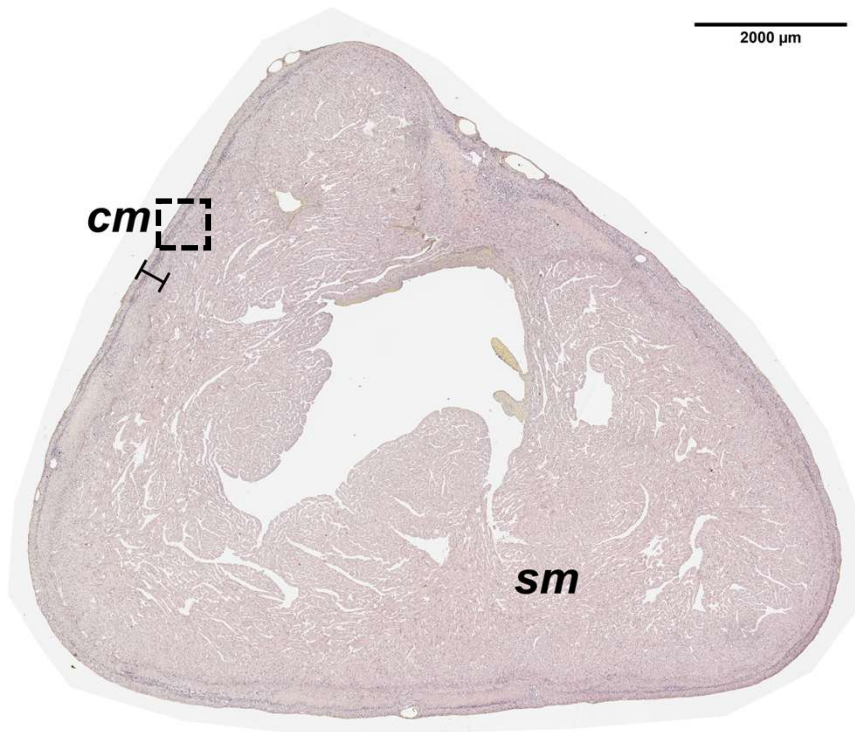
3 days after occlusion



Zena, et al., 2021 – Journal of Experimental Biology

Plasma troponin levels and Histopathology

14 days after occlusion



Acknowledgements



**HELGE AX:SON
JOHNSONS STIFTELSE**

FORMAS

ETT FORSKNINGSRÅD FÖR
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