



Studying Neural Control of Heart Beat in *Aplysia Californica*

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Introduction

Invertebrates provide us a very simple platform for studying neural control of autonomic functions such as respiration, circulation and reproduction. *Aplysia Californica* is one such invertebrate known to have distinct neurological control circuits within its abdominal ganglion, that mitigate the activity of its various vital organs including the heart.

Background

The neurological function of *Aplysia californica* has been extensively studied and characterized. The abdominal ganglion is a major component of the *Aplysia* nervous system. This particular population of neurons is known to play a pivotal role in controlling various biological activities, such as respiration, gill reflex, egg laying and cardiovascular activity. The immediate focus of this project is to study the neurological circuit in the abdominal ganglion that controls circulation.



Aplysia Californica

Objectives

- To design a real-time control system that will allow in-vivo recording and stimulation of the pericardial nerve and the heart.
- To characterize neurological activity of the pericardial nerve as it relates to cardiovascular activity.
- To develop a neural network model of the neuronal circuit that controls heartbeat.

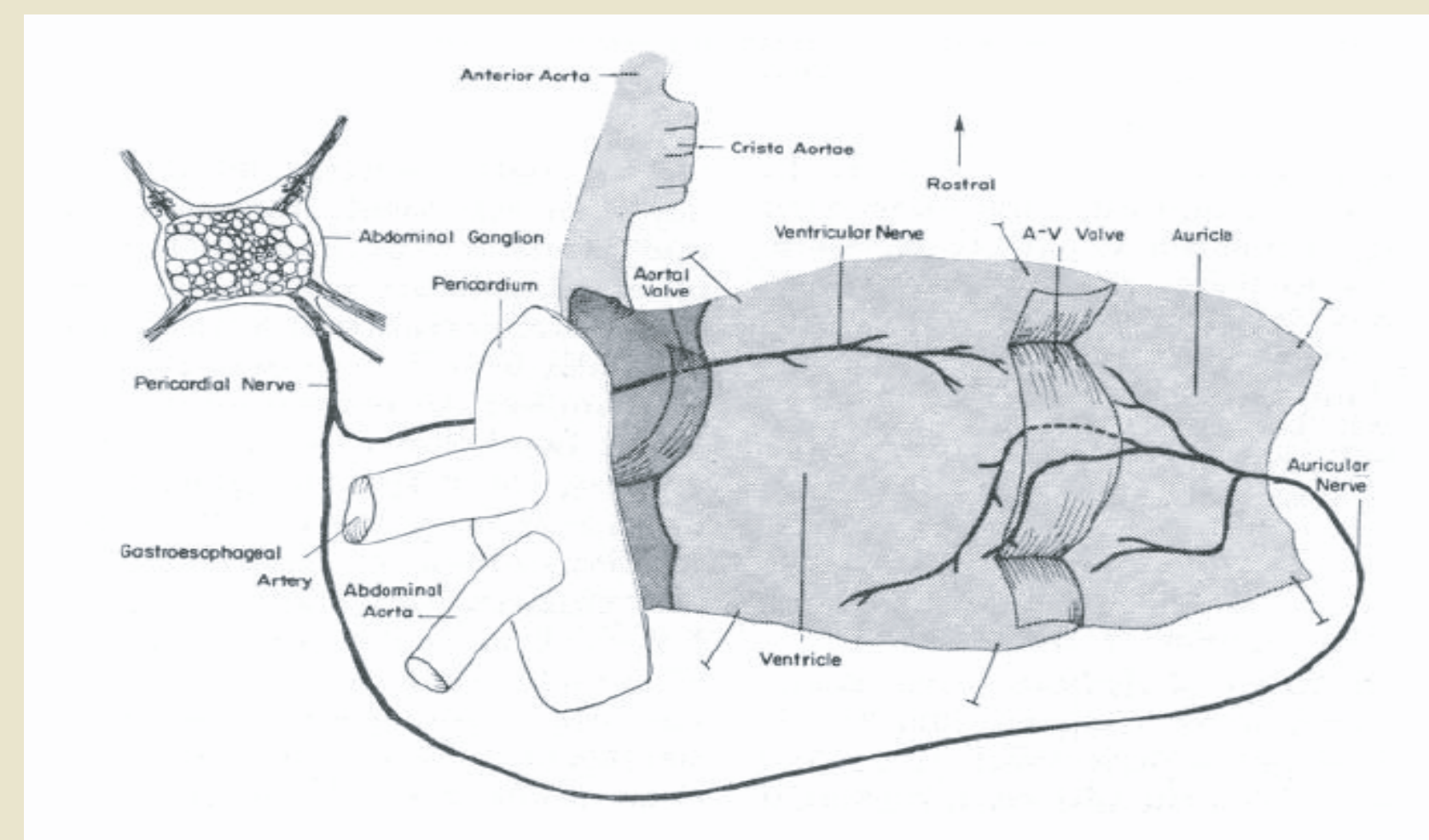


Diagram of innervation of the heart by the pericardial nerve of the abdominal ganglion (Mayeri et. al, 1974).

Methodology

- Animals will be dissected through the lateral body wall and an Ag/AgCl electrode will be attached to the pericardial nerve and the heart to allow for stimulating and recording.
- The body wall of the animals will be sutured and allowed to recover before recordings will take place
- Recording will take place for several hours.
- Data will be used to train an artificial neural network.
- Digital model will be created based on the neural network model.

Future Goals

Short Term:

- Obtain a sufficient amount of data to correlate extracellular neuronal signals on the pericardial nerve with heart beat.
- Develop a software model of neural control of heart beat in *aplysia*.

Long Term:

- Engineer an integrated circuit that will control heart beat and interface directly with the abdominal ganglion.

