

FUNCTIONING OF A NEUROGENIC HEART

Decapod ~~xxx~~ crustacean hearts consist of a ^{bag} of striated muscle whose contraction is brought about by bursts of nerve impulses from a ganglion on the inner dorsal surface of the heart. The ^{isolated} ganglion has received detailed study since the small number of nerve cells and their ^{good} separation permit ~~a complete~~ an approach to complete analysis of their interactions. An important unresolved question is to what extent isolation of the ganglion changes its pattern of activity.

The object of this study will be to attempt to record impulses from efferent axons of the ganglion with minimum disturbance to the heart and ganglion. ~~Since the xxxxxxxx can't do~~ It might be best to start by making an anatomical study of the position of the ganglion and its efferent nerves by removing a heart to a wax-bottom dish, ^{opening} ~~opening~~ the heart on the ventral mid-line and exposing the ganglion to dilute methylene blue. Next try a preparation in which the animal (lobster) is, in effect, cut away from around the heart leaving it untouched attached ~~to~~ by its suspensory ligaments to dorsal carapace and epimeral plates. It should be pinned in a shaped wax mold and perfused with cooled physiological saline via an ostia. Tension can be recorded by tying a strain gauge to the anterior arteries and the ganglion partially revealed by a small slit extended anterior from the emergence of the posterior arteries. A posterior lateral branch of the ganglion can then be drawn into a closely fitting suction electrode. Recordings obtained thus could then be compared with ones obtained by leaving the animal intact except for removal of the dorsal carapace

over

overlying the heart. The postero-lateral nerve would then be recorded through a slit made through the heart muscle near one of the posterior ostia.

References

Alexandrowicz, J., 1932. The innervation of the heart of the Crustacea.
I. Decapoda. Quart. J. Microscop. Sci. 75:181-249.

See references on attached sheets

Equipment

Strain gauge and polygraph

AC preamplifier

Oscilloscope

and monitor

Micromanipulator

Dissecting microscope

THE NEUROHUMORAL REGULATION OF THE CRUSTACEAN HEART

Set up crayfish hearts in a dish, ventral side up, so that they are held by their suspensory ligaments to the dorsal carapace and epimeral plates. Perfuse, and introduce drugs, by means of a canula inserted into one of the ostia. Initially, place very dilute methylene blue in the bath to aid in finding the regulator nerves. These may be taken up in suction electrodes for stimulation. Compare the effects of glutamic acid with accelerator nerve stimulation and of gamma-aminobutyric acid (GABA) with inhibitory nerve stimulation. Compare the effect of picrotoxin on inhibition produced by GABA and by nerve stimulation. Compare accelerator nerve stimulation to the effects of an extract of crab pericardial organs (PO's). If time permits you may wish to find and try crayfish PO material.

If you wish to try recording from the cardiac ganglion, try first a preparation of a lobster heart set up in the same way. Make a small cut in the heart on the ventral midline from the sternal artery forward, just enough to reveal the ganglion. Cut one of the branches of the ganglion and take it up in an exactly fitting suction electrode.

Finally, if equipment is available, you may try to use the hanging electrode. [to attached page]

- References
- Cooke, I. M., 1962. The Neurohumoral Regulation of the Crustacean Heart. Ph.D. Thesis, Harvard University.
- Maynard, D. M., 1961. Cardiac inhibition in decapod Crustacea. In Flörjey, E., ed., Nervous Inhibitions (N.Y., Pergamon), pp. 144-178.

[Add references from 2 attached pages]

Major equipment

strain gauge and polygraph
2 stimulators
AC preamp
oscilloscope
audiomonitor

Cardiac Ganglion

Maynard, D. M., 1960. Circulation and heart function. In Waterman, ed., The Physiology of Crustacea (N.Y., Academic), Vol I, chp 5, pp. 161-226.

Hartline, D., 1967. Integrative Physiology of the Lobster Cardiac Ganglion. Ph.D. Thesis Harvard.