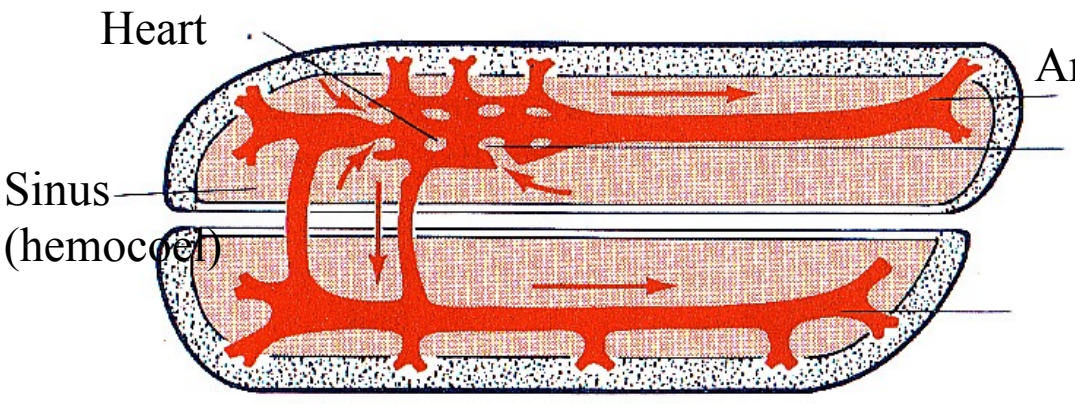
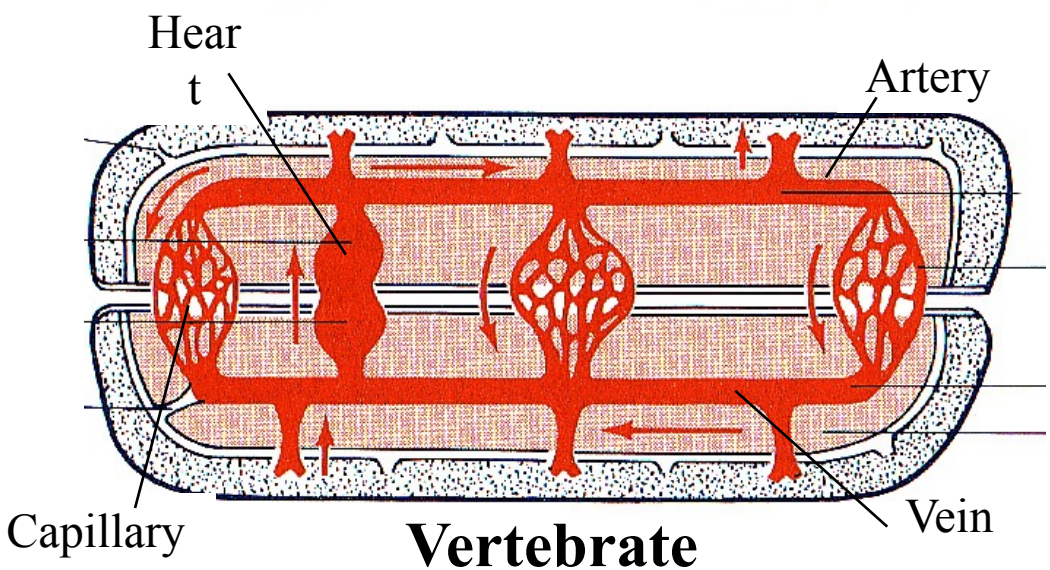
Types of Circulatory Systems



Arthropod

Open circulatory system

- **eg arthropods and mollusks**
- **body fluid leaves the heart by a series of tubes called arteries**
- **blood (*hemolymph*) from the arterial system enters sinuses called the *hemocoel***
- **where it bathes the cells directly**



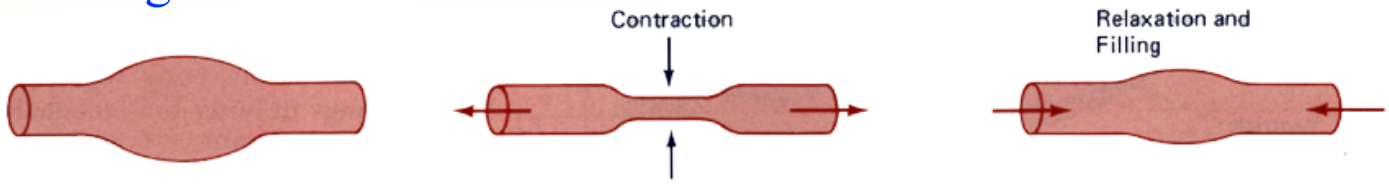
Vertebrate

Closed circulatory system

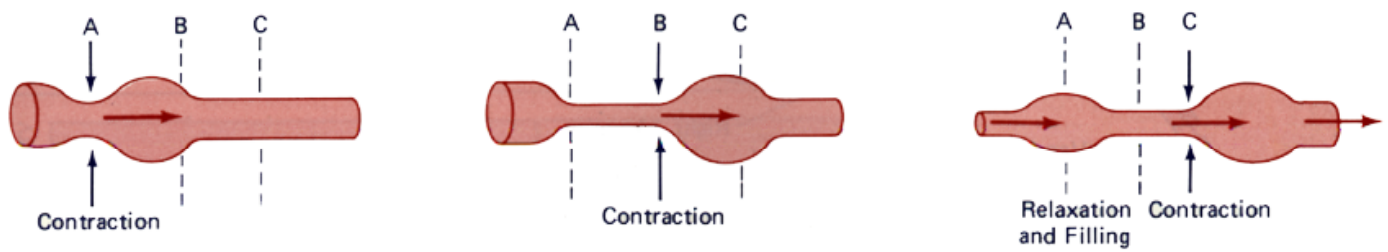
- **eg annelids and vertebrates**
- **heart to arteries to capillaries to venules to veins**
- **Blood stays in tubes for entire trip around body**

Types of Pumps

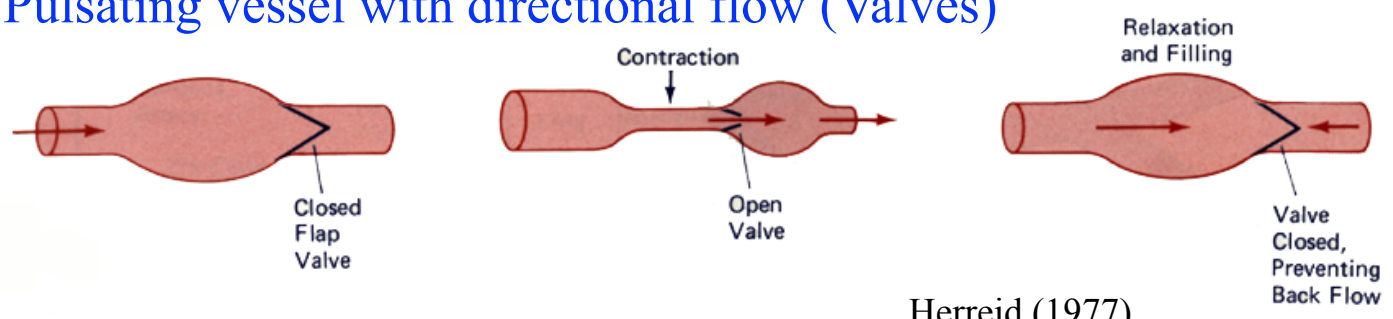
Pulsating vessel without directional flow



Pulsating vessel with directional flow (Peristaltic waves)



Pulsating vessel with directional flow (Valves)



Herreid (1977)

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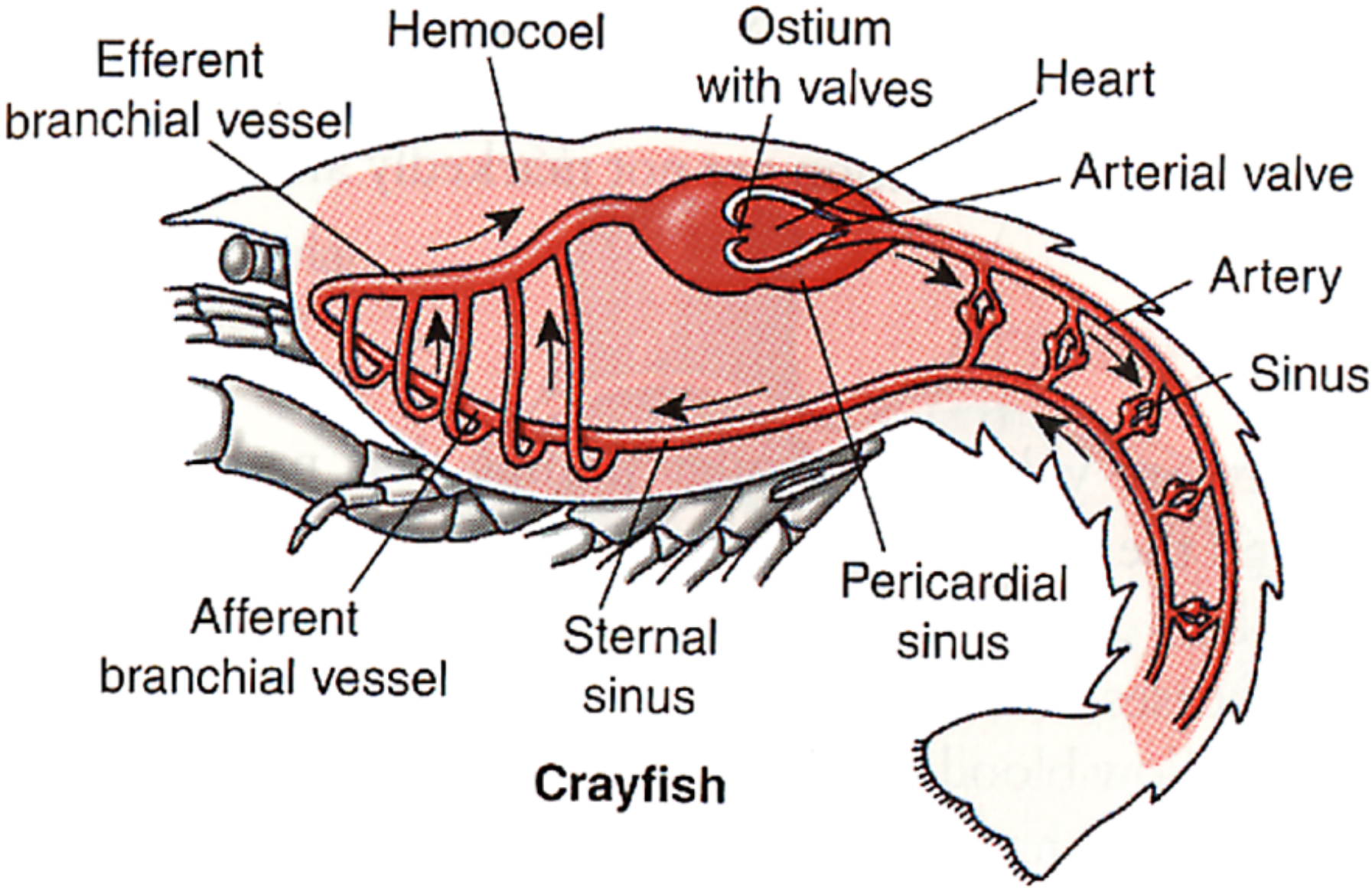
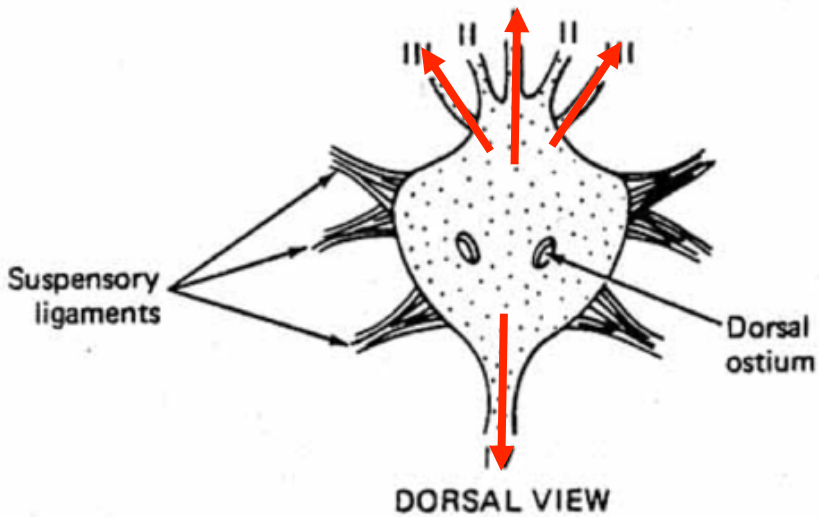
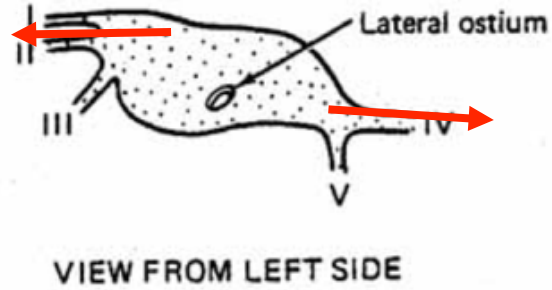
Tubular Heart - Open System

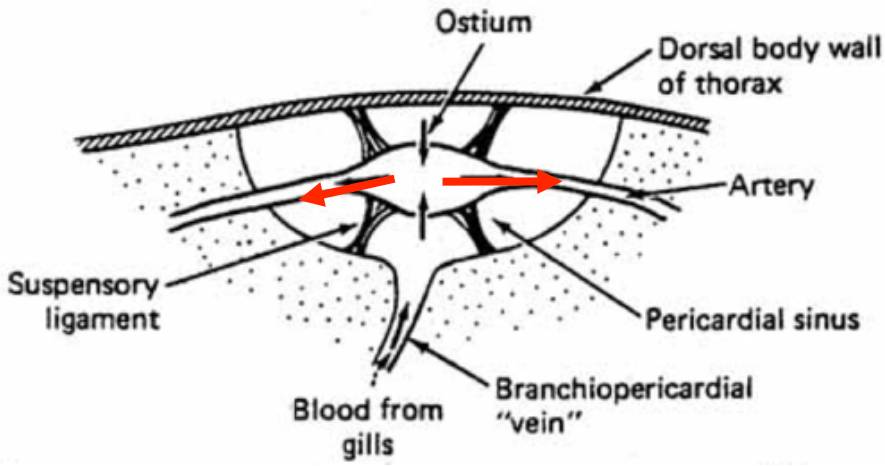


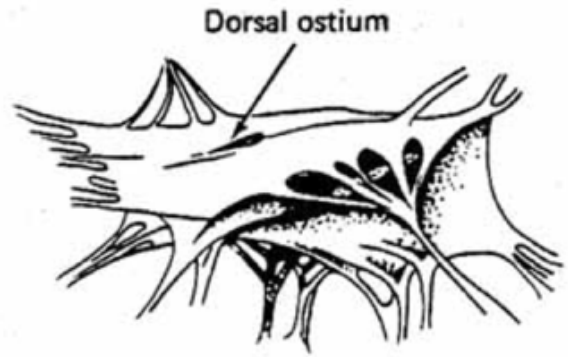
Simple Tubular Hearts





Systole - heart contraction





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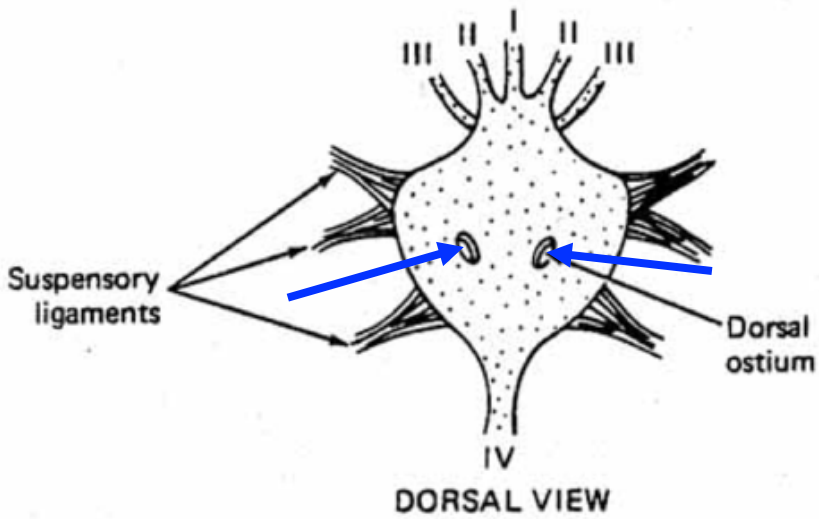
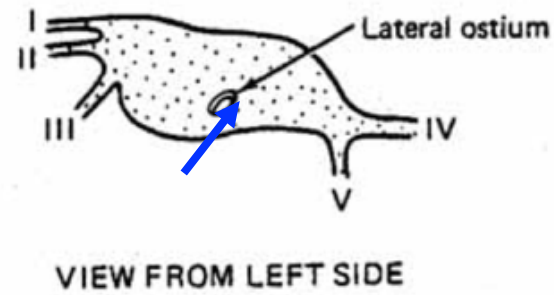
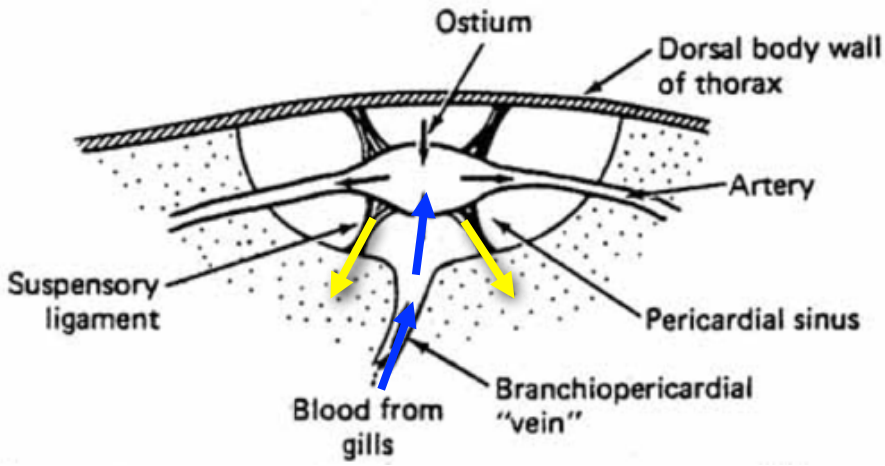
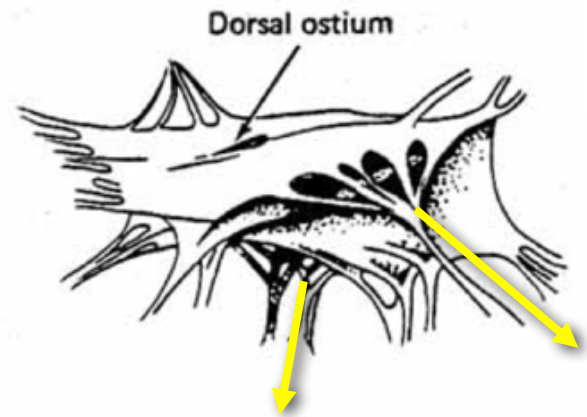
Simple Tubular Hearts





Diastole - heart relaxation





Electrical Activity of Hearts:Control

1. Neurogenic pacemaker

- heart beat initiated by neurons

2. Myogenic pacemaker

- heart beat initiated by modified muscle cell

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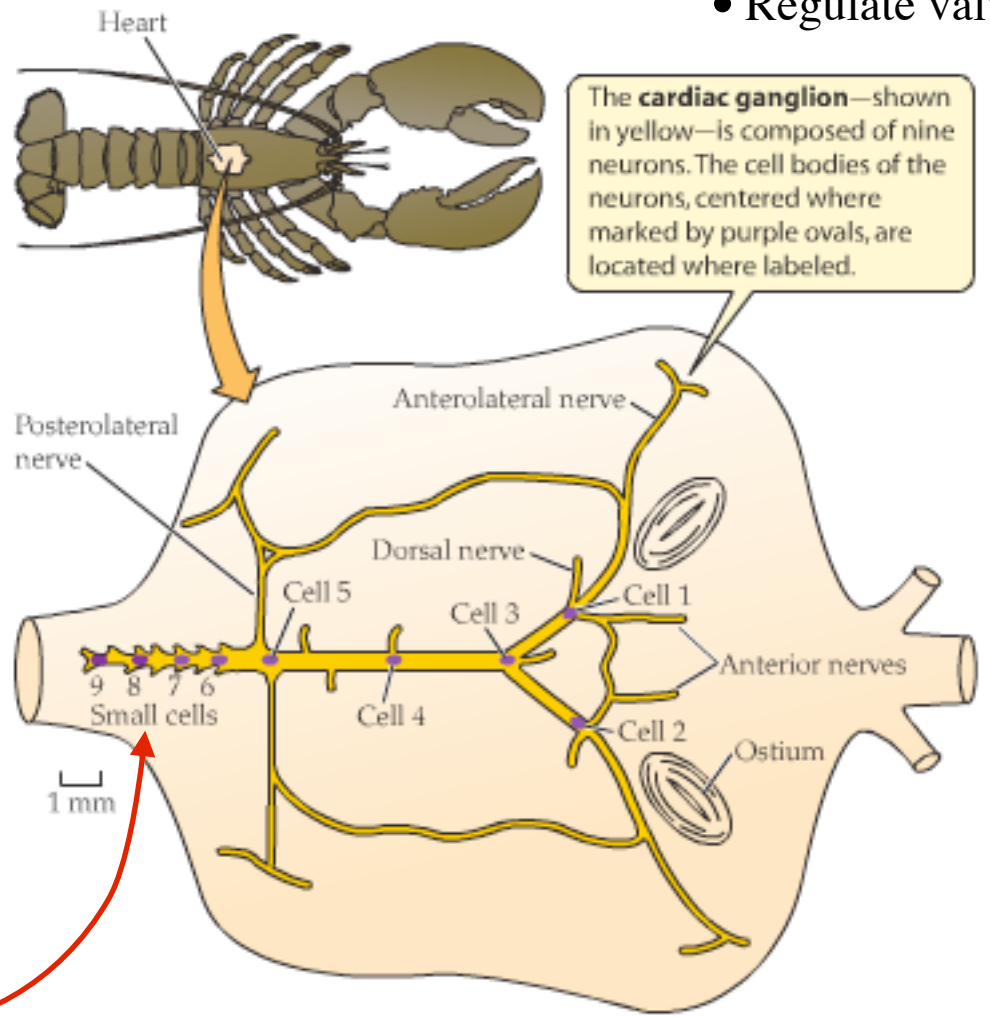
Lobster Cardiac Ganglion

- 9 neurons in CG
- Simple pattern generation system
- Attached inside dorsal wall of heart

- 5 anterior neurons have axons that innervate the heart muscle
- impulses from anterior neurons produce heart contraction in unison
- Regulate valves in arteries and ostia



- 4 dorsal neurons synapse with 5 anterior neurons
- one serves as the "pacemaker" or cellular oscillator (central pattern generator)
- spontaneously excites other dorsal neurons with train of impulses
- dorsal neuron impulses activate 5 anterior neurons

Starling's Law

Stroke volume <-> End diastolic volume

Force of contraction is proportional to length of the myofibrils (cardiac muscle cells)

Cardiac Output <-> Stretch

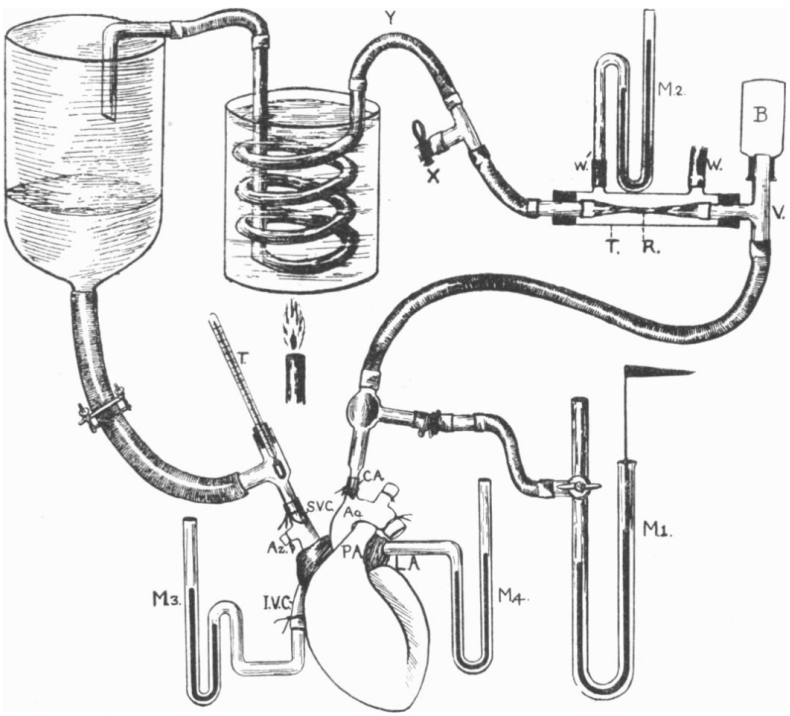
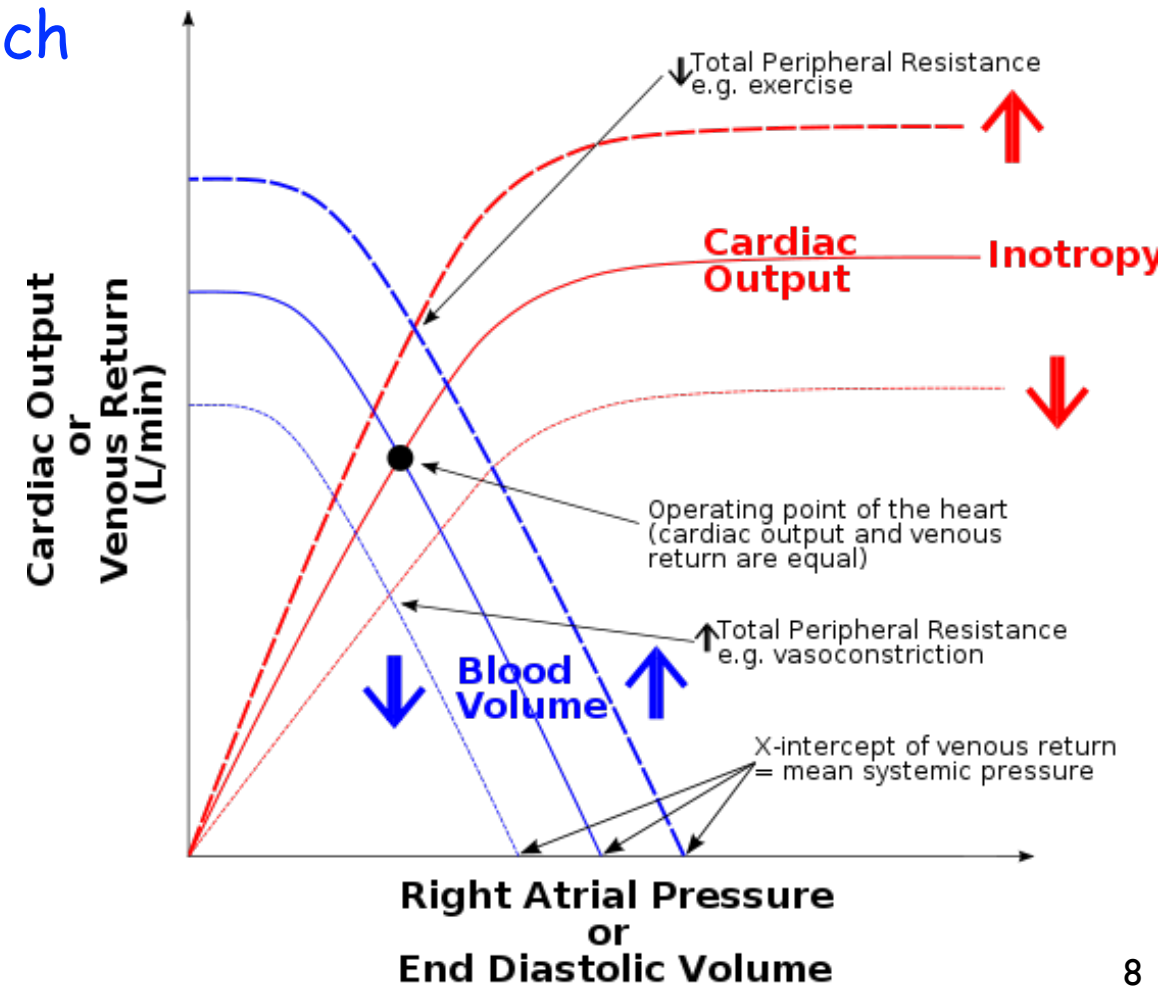


Fig. 1.



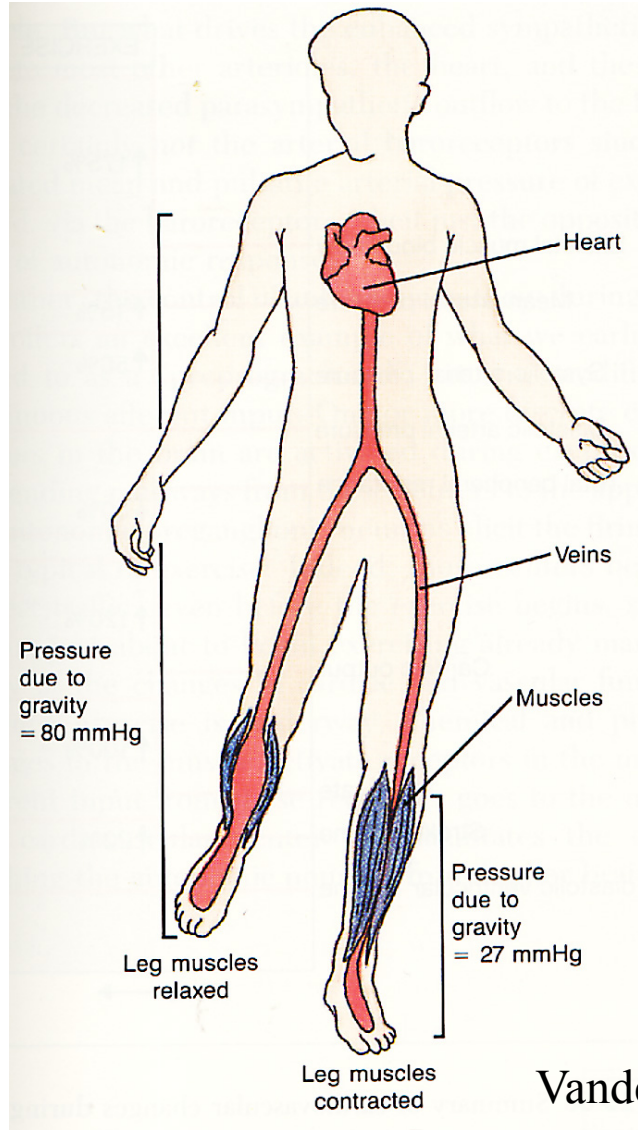
Muscle Pumps

High Pressure at Feet leads to venous pooling.

Blood in feet must be pumped against the weight of the column of blood above it.

Leg muscle acts as pumps.

Veins have valves to prevent back flow.



Vander et al.

Veins with ***One-Way*** Valves

Muscles contract and move blood toward heart.

Valves open in direction of heart.

One-way valves prevent back flow.