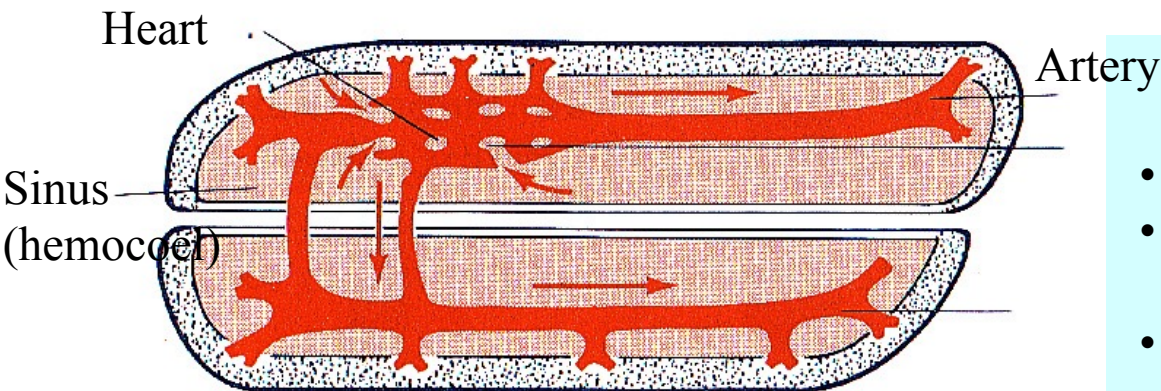


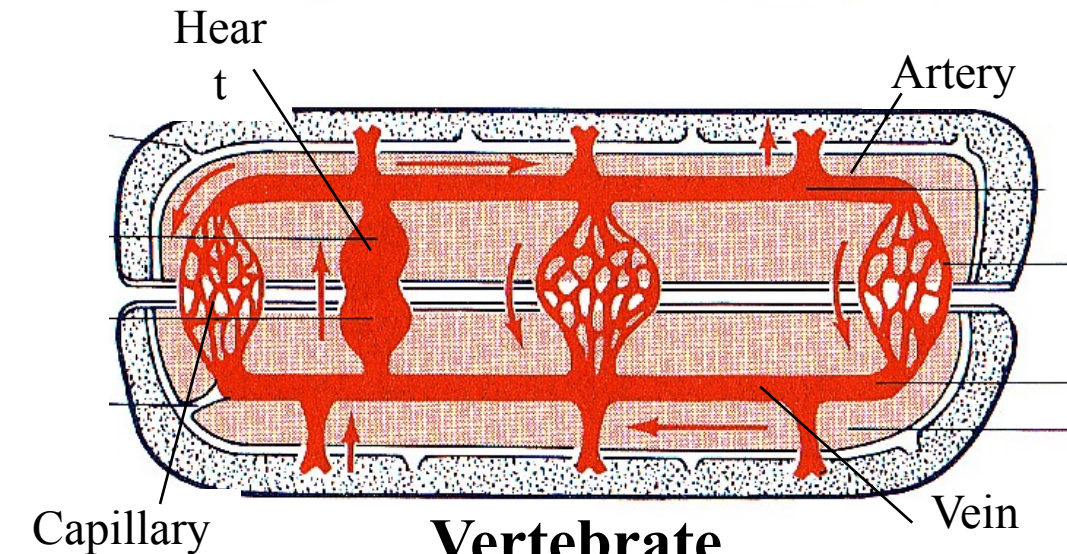
Types of Circulatory Systems



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

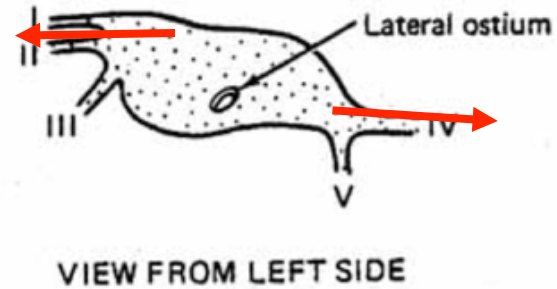
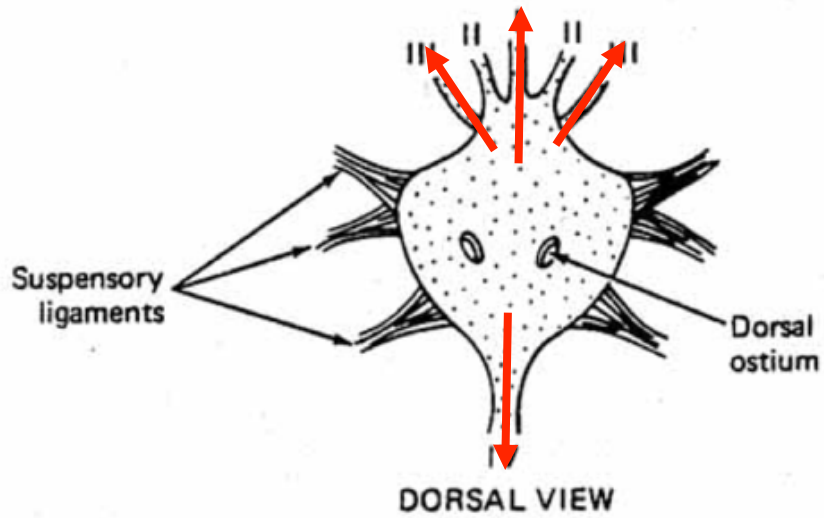


Vertebrate

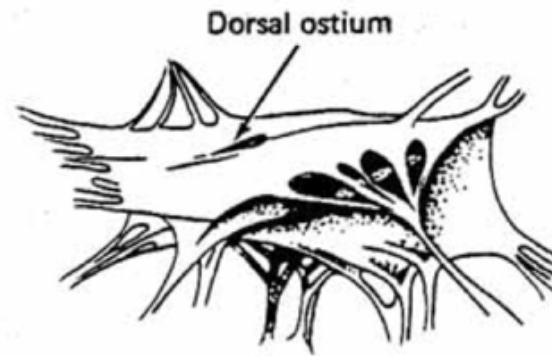
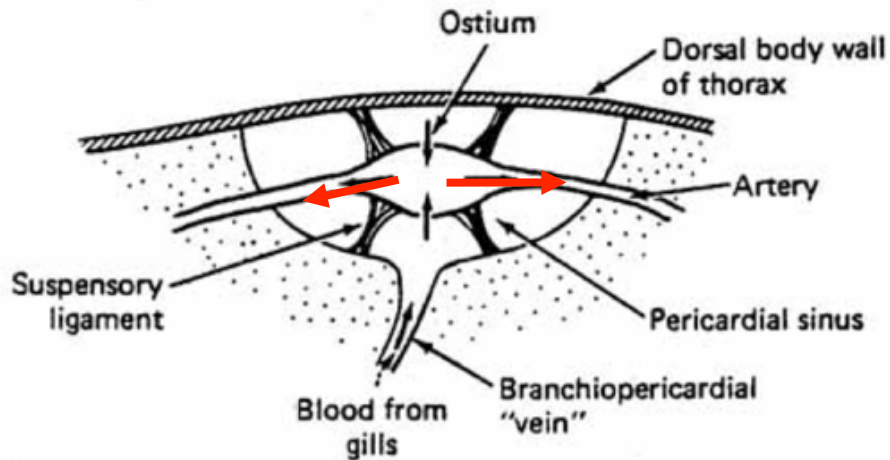
Closed circulatory system

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

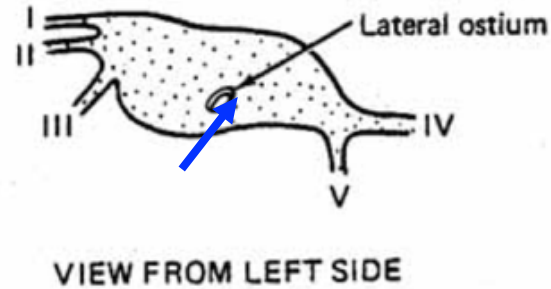
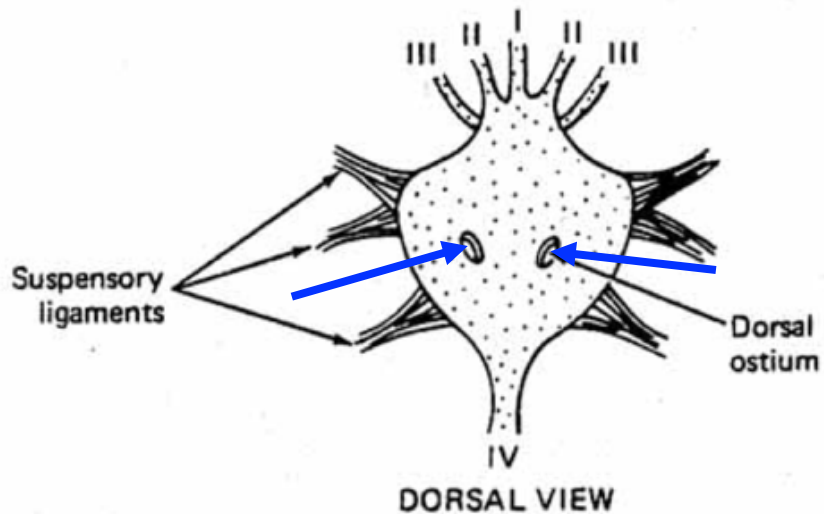
Simple Tubular Hearts



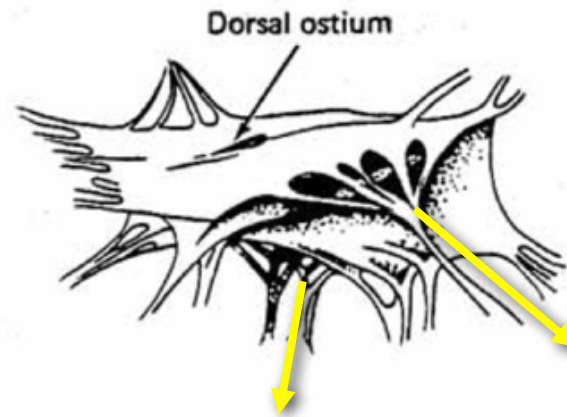
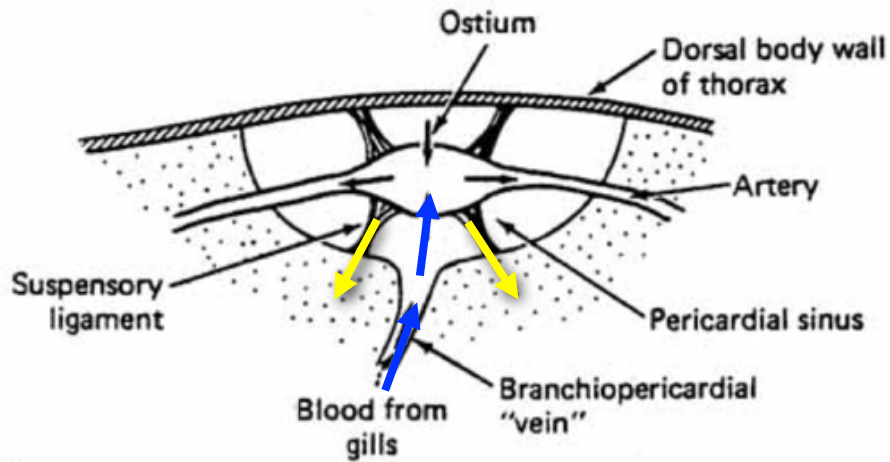
Systole - heart contraction



Simple Tubular Hearts



Diastole - heart relaxation



Electrical Activity of Hearts: Control

1. Neurogenic pacemaker

- heart beat initiated by neurons

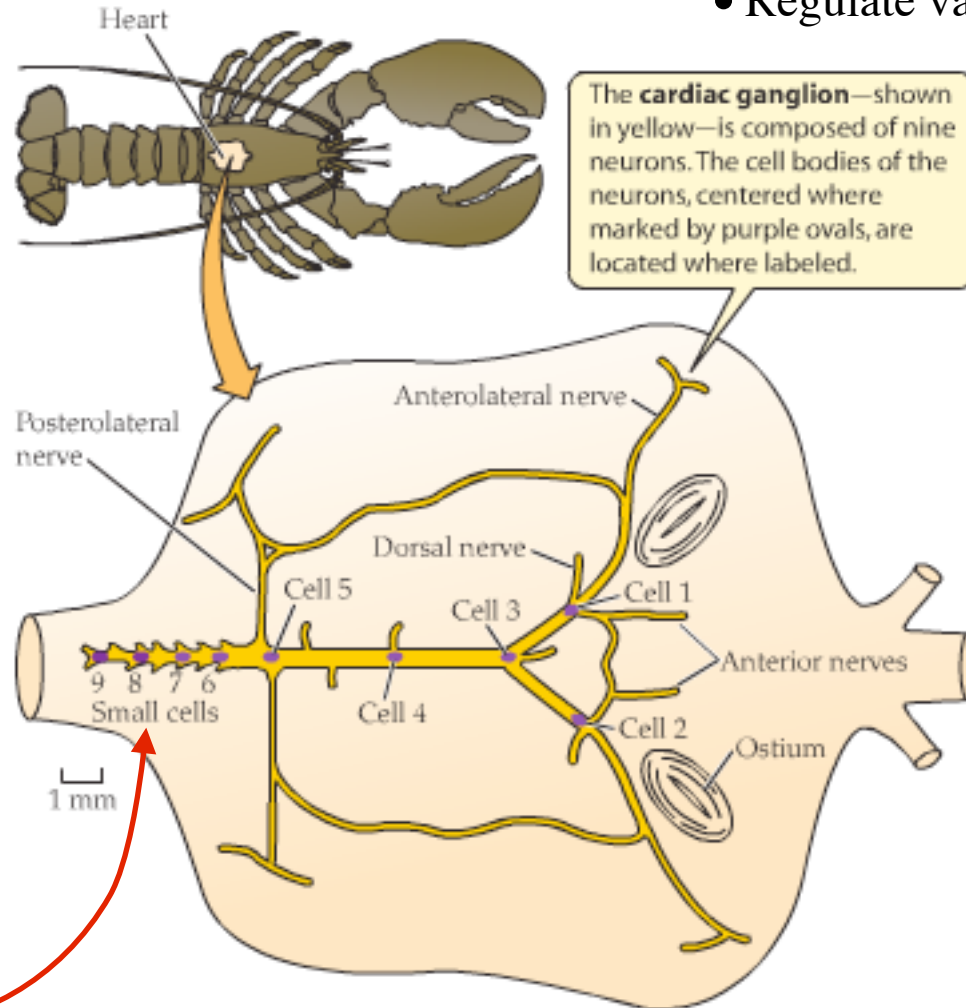
2. Myogenic pacemaker

- heart beat initiated by modified muscle cell

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