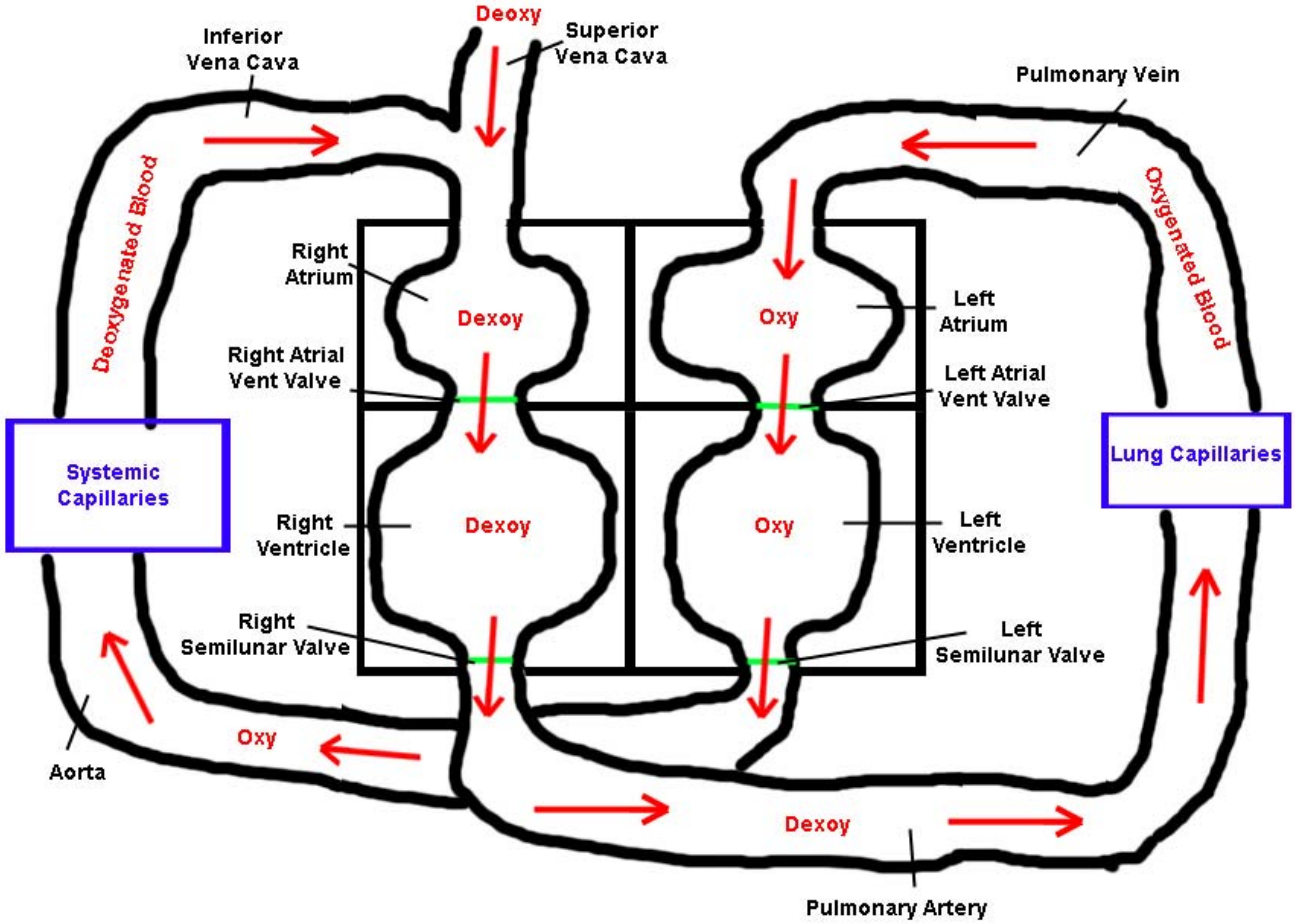
HL Biology Notes: Circulation and Immunity
[Circulatory System]

Blood — Remove Cells → Plasma — Remove Clotting Agents (Fibrinogen) → Serum

- Erythrocytes — red blood cells (Hemogobin)
- Leukocytes — white blood cells
- Platelets — cell plates

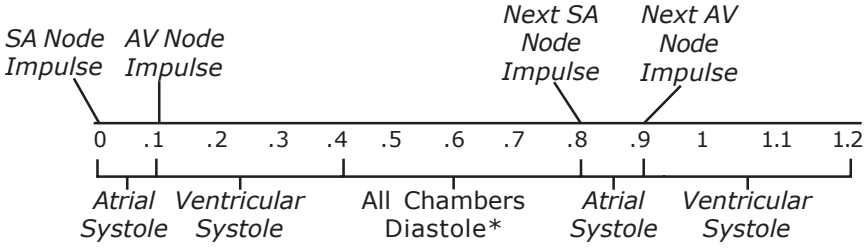
Schematic of the Heart



Circulation is measured by an EKG (Electro Cardiogram) that measures "electical activity" in millivolts. This electrical activity is actually neural activity spurred by two nodes:

Sinoatrial (SA) Node - Causes Atrium to contract, fires every .8 seconds
Atrioventricular (AV) Node - Causes Ventricle to contract (delayed .1 second from SA node "firing")

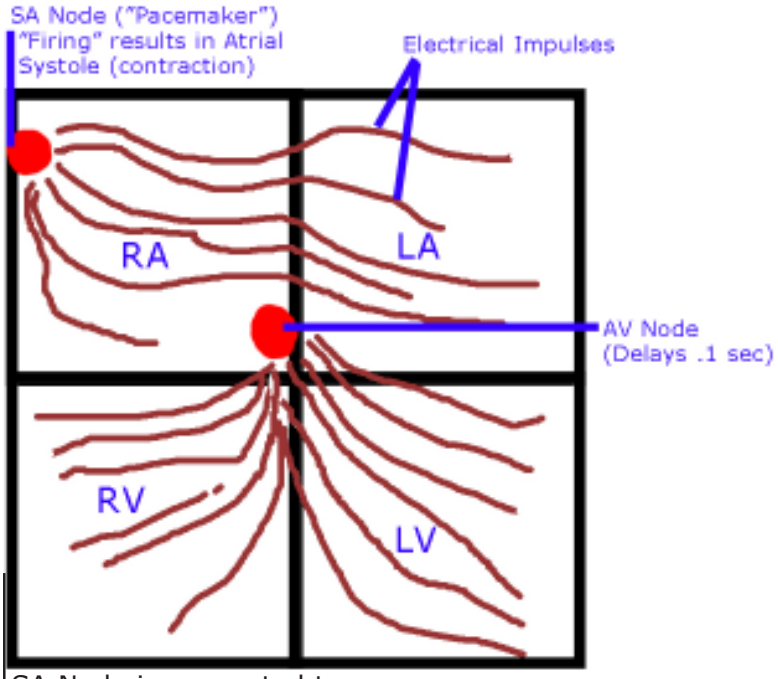
Heart Rate Control Timeline in Seconds
(at Myogenic, or resting, Heart Rate of 72 beats min^{-1})



**Diastole* is muscular rest, or time of no heart contraction

Average Resting Heart Rate
72 beats/min
or
72 beats min^{-1}

Schematic of the heart's Myogenic Source



SA Node is connected to the brain via 2 nerves (this is 1 of 12 pairs of cranial nerves).

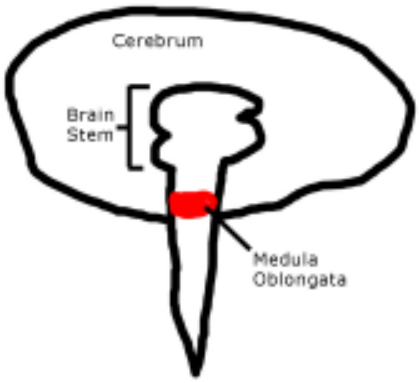
Vagus Nerve

Sends motor information to SA node and decreases heart rate

Cardiac Nerve

Sends sensory information to medula and increases heart rate

Autonomic Nervous System



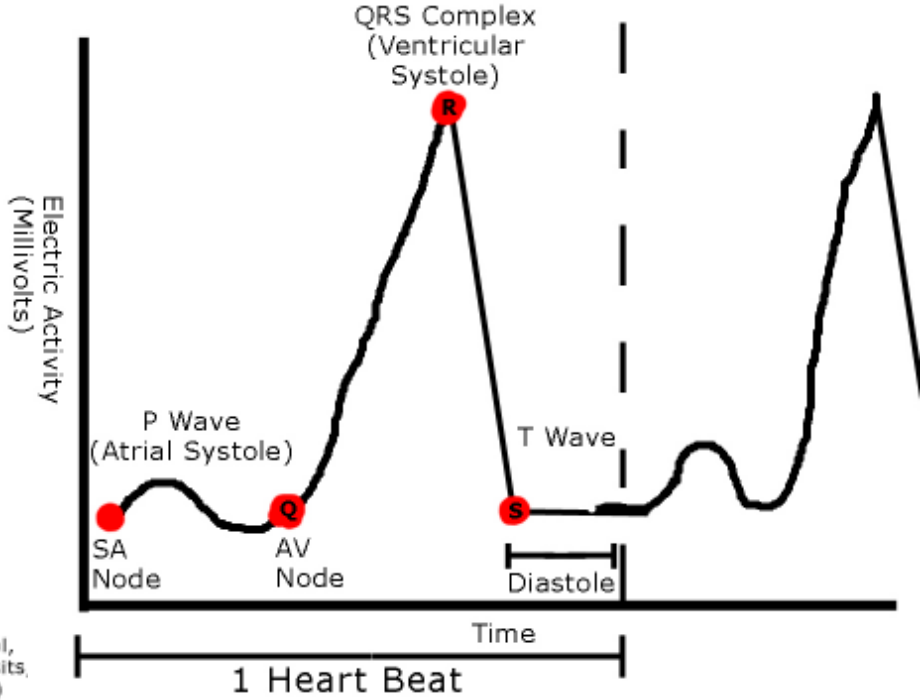
The **Medula Oblongata** monitors respiratory gasses (O_2, CO_2) in the blood stream.

Autonomic Nervous system is composed of 2 parts:
(Antagonistic Pair)

Sympathetic (Cardiac Nerve)

Parasympathetic (Vagus Nerve)

Electrical Impulses are measured on an electrocardiogram:



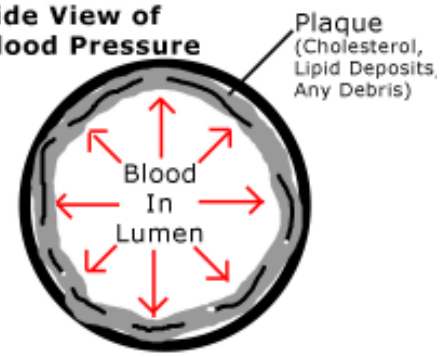
Blood Pressure

Sample:

120 — Systolic Pressure (Max Press)

76 — Diastolic Pressure (Min Press)

Side View of Blood Pressure



Functions of Autonomic Nervous System

Vasodialation

Makes lumen larger

Vasoconstriction

Makes lumen smaller

[Immunity]

Leukocytes (White Blood Cells)

Macrophages
Large wandering white blood cells that surround objects and digests them (phagocytation)

B Lymphocyte (B Cell)
Produces antibodies* (protein molecules)

B Cell
Immediate antibody production

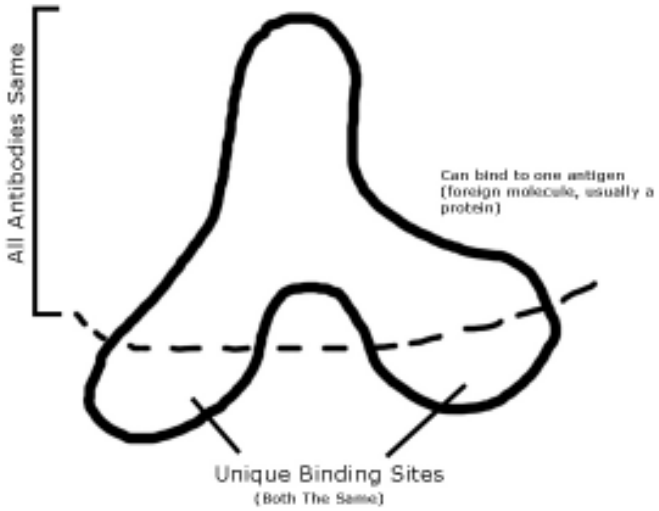
Memory B Cell
Lives a long time and produces antibodies on the 2nd or 3rd infection

T Lymphocyte (T Cell)
Produces antibodies* (protein molecules)

Helper T Cell
Communicates with other T cells and B cells to get proper antibody

Cytotoxic (Killer) T Cell
Kills already infected body cells

***Antibody**



Blood is 99% red blood cells, less than 1% white blood cells (many different types)

Clonal* Selection Theory

Macrophages determine Self vs. Not Self

Helper T Cell gets message, triggers 1 specific B Cell

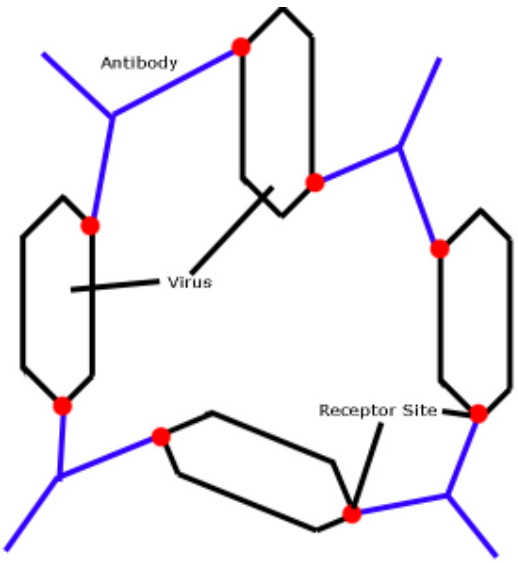
1 Specific B Cell that can work against "current" cold virus clones multiple times

100,000s of the same type of cell are existant

Antibody production begins

**Cloning = Mitosis*

Antibodies work by attaching themselves to antigens and bunching bacterium together:



Autoimmune Diseases - Diseases where body can't recognise self vs. not self

Antiserum - Injection of Antibodies

Monoclonal - One type of cloned antibody

Polyclonal - Different types of cloned antibodies

The Life Cycle of the Flu Virus