Blood Pressure, Heart Rate, Cardiac Output, ECG:

The contraction of the ventricles of the heart produce a 'force'; this force is the impact of the flowing blood on the inside surfaces of the blood vessels. In all major systemic arteries, the pressure that propels the blood along is pulsatile. This means that it fluctuates repeatedly from a high pressure to a low pressure, reflecting the events of the cardiac cycle. The highest pressure in a major artery is the **systolic pressure**. It is caused by the force of the flowing blood during systole of the left ventricle. In between the contractions the pressure does not drop to zero, but falls to a low value called the **diastolic pressure**. The systolic pressure is the highest pressure read; the diastolic pressure is the lowest pressure read.

The difference between the systolic pressure and the diastolic pressure is the **pulse pressure**.

[(systolic pressure) – (diastolic pressure)] = pulse pressure

ex: 120 mm Hg - 80 mm Hg = 40 mm Hg

Approximate the 'stroke volume' by multiplying the pulse pressure by 1.7

ex: 40 x 1.7 = 68 ml.

Cardiac Output (ml/min) = Heart Rate (beats/min) X Stroke Volume (ml/beat)

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I. Measure the 'resting pulse rate', or 'resting heart rate', by counting the number of pulses from the radial artery (found in your lab partner's wrist) for 1.0 minute (60 seconds). Also record your lab partner's 'resting blood pressure' with the provided blood pressure measuring device.

Resting Heart Rate = _____

Resting Blood Pressure = _____

II. Have your lab partner walk briskly down the hallway and back. Immediately record this new 'non-resting heart rate' and 'non-resting blood pressure'.

Non-Resting Heart Rate = _____

Non-Resting Blood Pressure = _____

III. Now calculate Cardiac Output for your resting patient/lab partner.

Cardiac Output (resting) = _____

IV. Next calculate Cardiac Output for your non-resting patient/lab partner.

Cardiac Output (non-resting) = _____

The heart is innervated by both sympathetic and parasympathetic nerve fibers. Remember that the heart will beat if not connected to the nervous system at an intrinsic rate of approximately 100 beats per minute (bpm). So if your heart rate at rest is below 100 bpm (as it should be), it is your parasympathetic nervous system that is sending signals to slow down your heart rate. During exercise, your heart rate increases due to a decrease in activity from the parasympathetic neurons. Less parasympathetic nervous innervation to slow down heart rate will result in an increase in heart rate due to the heart intrinsically trying to beat at 100 bpm. If you require a heart rate above 100 bpm, then the sympathetic nervous system will stimulate the SA-node.

V. Produce an ECG tracing from the classroom electrocardiograph machine.
   a)Examine the ECG wave forms. Do the individual waves look normal?

   b)Draw arcs directly on the ECG tracing paper to connect the R-waves; and then the P-waves.

     Is the frequency of R waves regular?

     Is the frequency of P waves regular?

     Is there a correlation between the R waves and the P waves?

   c)Calculate the Atrial Heart Rate (in beats/min).

     To do this, count the number of big boxes (or factions of a box) between 2 successive P waves, and divide into 300 (do NOT divide 'by' 300).

   d)Calculate the Ventricular Heart Rate (in beats/min).

     To do this, count the number of big boxes (or fractions of a box) between 2 successive QRS-complexes, and divide into 300.

   e)Measure the P-R Interval (in seconds) on the EKG.

     To do this, count the number of little boxes (or fractions of a box) between the beginning of the P wave and the Q inflection, and multiply times 0.04 seconds/little box.
     If the P-R Interval is > 0.2 seconds, there is some degree of A-V Nodal Block.

   f)Measure the duration of the QRS Complex (in seconds) on the ECG.

     Count the number of little boxes (or fractions of a box) between the Q and S inflection points, and multiply times 0.04 seconds/little box.
     If the QRS Complex is > 0.01 seconds, the ventricular depolarization is a Ventricular Ectopic Focus (extrasystole).
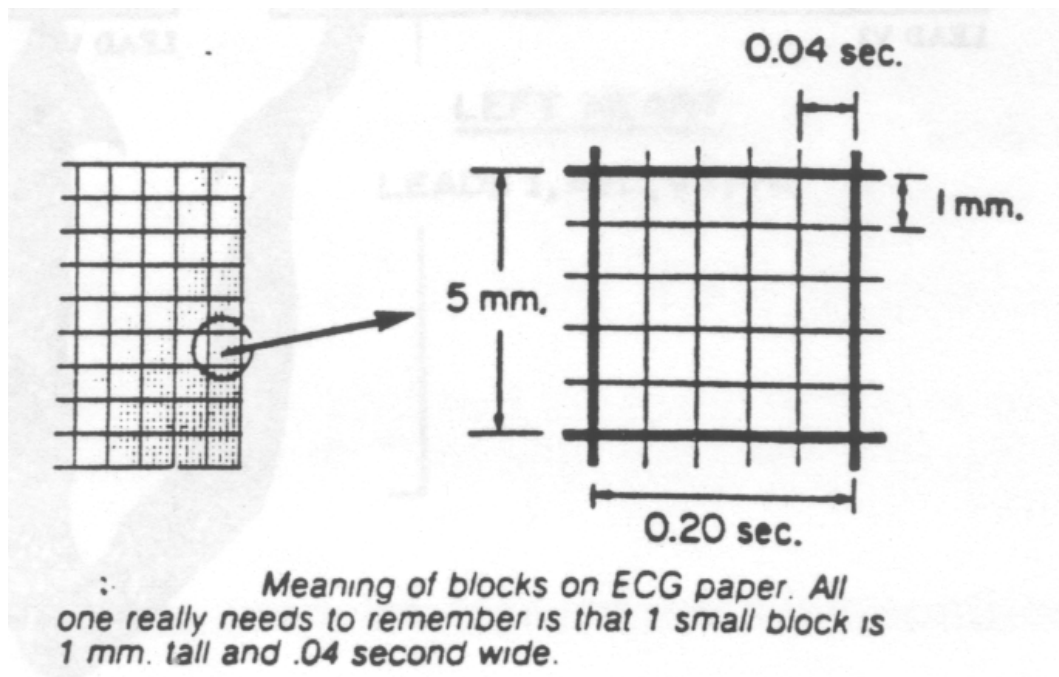
g)Measure the duration of the P wave (in seconds) on the ECG

Count the number of little boxes (or fractions of a box) between the beginning and end of
the P wave, and multiply time 0.04 seconds/little box.

h)Measure the Q-T Interval on the ECG

Count the number of little boxes (or fractions of a box) between the Q inflection and the
end of the T wave, and multiply times 0.04 seconds/little box.

Interval	Normal Length
P wave duration	less than or equal to .08 seconds
P-R Interval	.12 - .20 seconds
QRS Interval	less than .12 seconds
QT Interval	less than or equal to .40 seconds [but very dependent on rate, sex, age, etc.]
Cardiac Cycle Length	.6 - 1 second (for heart rates 60-100 BPM)
Heart Rate (at rest)	60-100 BPM (40-60 BPM for athletes)

0.04 sec.

5 mm.

I mm.

0.20 sec.

Meaning of blocks on ECG paper. All one really needs to remember is that 1 small block is 1 mm. tall and .04 second wide.

Since the paper speed is always set at 25 mm/sec (2.5 cm/sec), each little box (millimeter) from side to side is equal to 0.04 seconds.

Each big box (consisting of 5 small boxes) is equal to: 5 x 0.04 sec/little box = 0.20 sec/big box