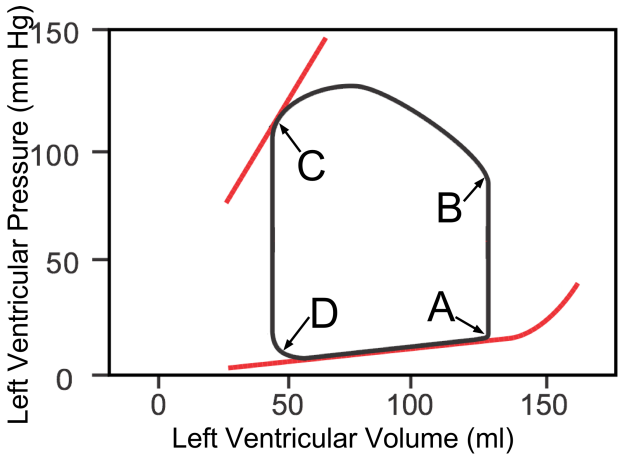
NROSCI/BIOSC 1070 and MSNBIO 2070
Exam # 1
September 28, 2018

Total POINTS: 100 20% of grade in class

1) A standard left ventricle pressure-volume curve is illustrated to the right. At each of the four points illustrated, a valve in the left heart either opens or closes. Indicate which valve has a mechanical change, whether it opens or closes, and which wave of the electrocardiogram (P, QRS, T) occurs closest in time (either before or after) the mechanical event in the valve. ***(12 points).***



Valve	Opens or Closes?		Closest ECG Wave		
	Opens	Closes	P	QRS	T
	Opens	Closes	P	QRS	T
	Opens	Closes	P	QRS	T
	Opens	Closes	P	QRS	T

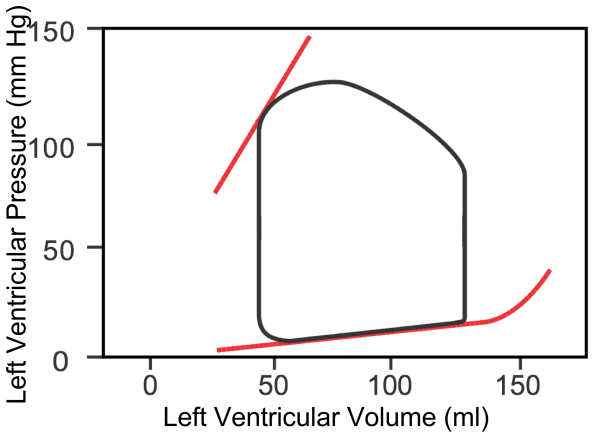
2) The individual whose data are shown above has a heart rate of 70 beats/min. What is their cardiac output? You must show your calculations. **(2 points).**

3) What is the ejection fraction of this individual? You must show your calculations. Also indicate if their ejection fraction is normal, high, or low. **(3 points).**

4) Peripherally-acting α_1 and α_2 receptor agonists (don't cross the blood brain barrier) have different effects on blood pressure. Briefly describe the effects of the two drugs (when administered intravenously) on blood pressure, and why they have different effects. ***(6 points).***

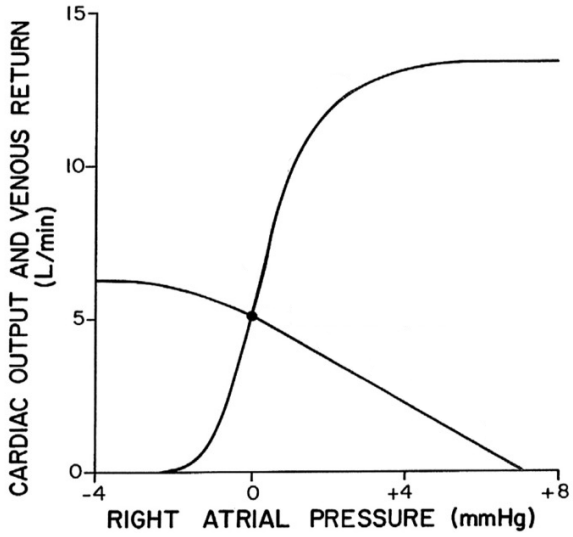
5) Indicate three additional physiological effects other than cardiovascular responses that would be produced by intravenous administration of a peripherally-acting α_1 receptor agonist. ***(6 points).***

6) A standard left ventricle pressure-volume curve is illustrated below. On the diagram, indicate the changes that occur in the curve for a patient prescribed a β_1 receptor antagonist (beta-blocker). Assume that the drug doesn't produce any compensatory (reflex) changes in the cardiovascular system. You may also provide a written description of the effects of the drug if it is helpful. ***(15 points).***



7) Both norepinephrine and epinephrine are commonly used drugs in the emergency room. However, the two drugs don't produce equivalent changes in total peripheral resistance (TPR). Indicate which drug induces the largest changes in TPR, whether TPR increases or decreases, and two reasons (mechanisms) why the two drugs have differing effects on TPR. ***(9 points).***

8) Using data obtained from the curves to the right, determine resistance to vascular return (RVR). You MUST show your calculations. **(6 points).**



9) The drug Cabergoline was developed to inhibit breast milk production in women who choose not to breastfeed. The drug has also been used to treat a number of neurological disorders, including Parkinson's disease. Describe the mechanism through which Cabergoline acts to suppress lactation. ***(8 points).***

10) Would you expect cardiac myocytes to more closely resemble type FF or type S skeletal muscle fibers? Provide a brief explanation for your answer. ***(6 points).***

11) The inside of a neuron has a charge that is about 70 mV more negative than the outside. List three factors contributing to the negative intracellular charge of neurons, and indicate which of these factors has the strongest effect. ***(10 points).***

12) Is a drug available that acts on a single type of receptor and suppresses both parasympathetic and sympathetic nervous system activity without paralyzing skeletal muscle? If so, describe the actions of the drug. If not, discuss why it would be impossible to generate a drug with these properties. ***(6 points).***

13) A patient presents for an exercise stress test. The baseline hemodynamic profile provides the following data:

Systemic systolic pressure	135 mmHg
Systemic diastolic pressure	75 mmHg
Pulmonary systolic pressure	30 mmHg
Pulmonary diastolic pressure	10 mmHg
Left atrial pressure	10 mmHg
Right atrial pressure	5 mmHg
Cardiac output	5 L/min
Coronary blood flow	250 cc/min

During exercise, the following hemodynamic data are obtained:

Systemic systolic pressure	180 mmHg
Systemic diastolic pressure	75 mmHg
Cardiac output	15 L/min
Coronary blood flow	1 L/min

Determine a) the change in coronary vascular resistance that occurs during exercise, and b) specify the percent change in resistance from the pre-exercise state. You must show your calculations. ***(5 points).***

14) Elderly individuals more commonly experience orthostatic hypotension, or a drop in blood pressure upon standing, than younger individuals. What is the main factor contributing to a predisposition for orthostatic hypotension in the elderly? ***(6 points).***