Baroreceptor Loop
&
Autoregulation

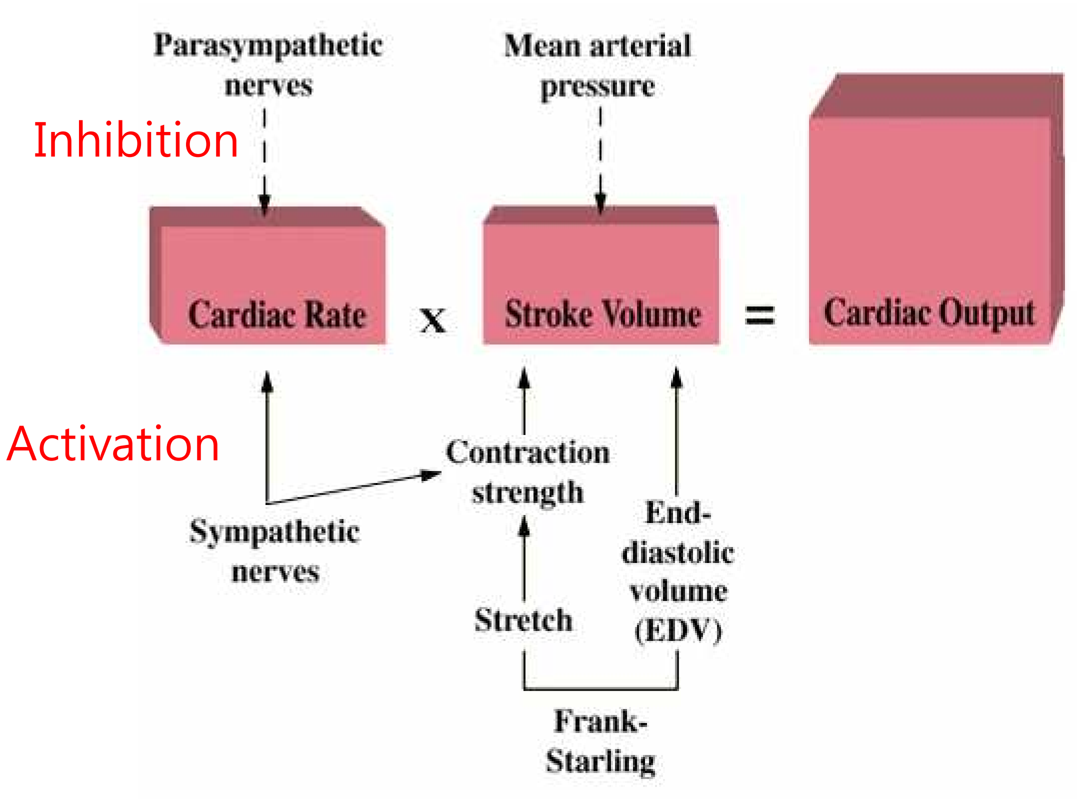
Baroreflex

- The **baroreflex** or **baroreceptor reflex** is one of the body's homeostatic mechanisms for maintaining blood pressure.
- It provides a negative feedback loop in which an elevated blood pressure reflexively causes heart rate to decrease therefore causing blood pressure to decrease.
- Likewise, decreased blood pressure activates the baroreflex, causing heart rate to increase thus causing an increase in blood pressure.

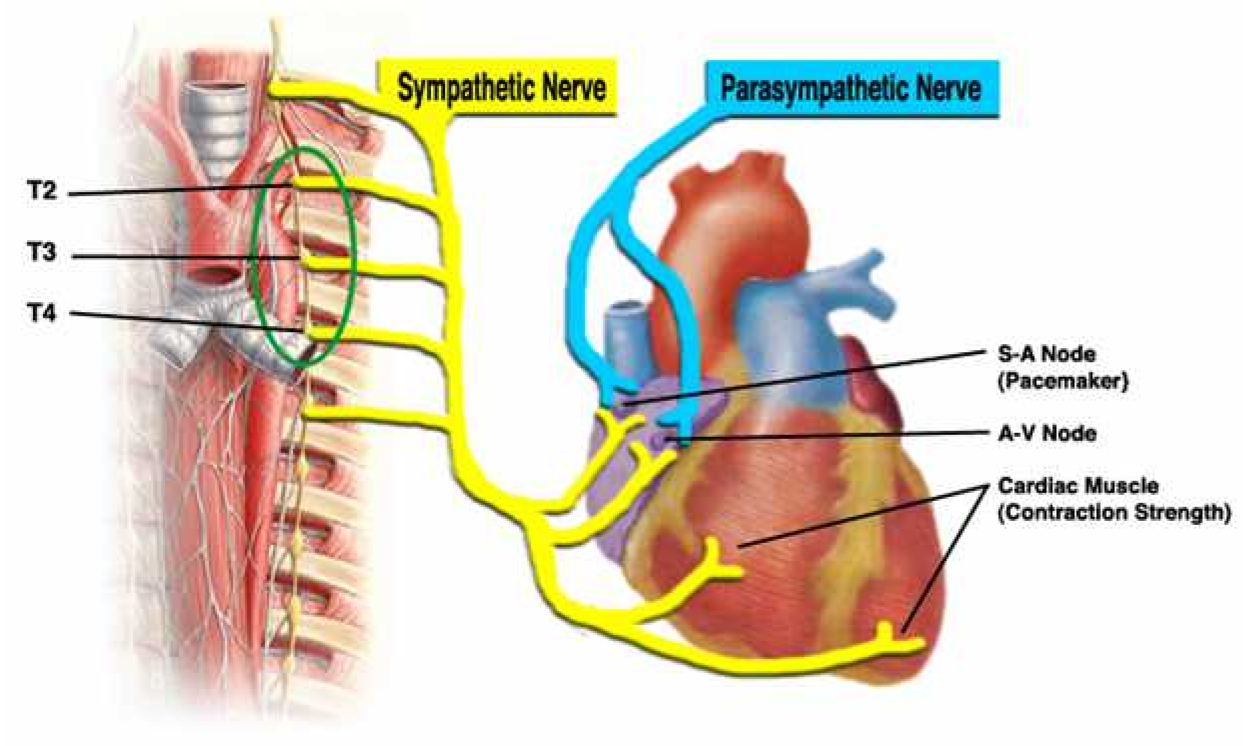
Baroreceptors

- The system relies on specialized neurons, known as baroreceptors, in the aortic arch, carotid sinuses, and elsewhere to monitor changes in blood pressure and relay them to the brainstem. Subsequent changes in blood pressure are mediated by the autonomic nervous system.

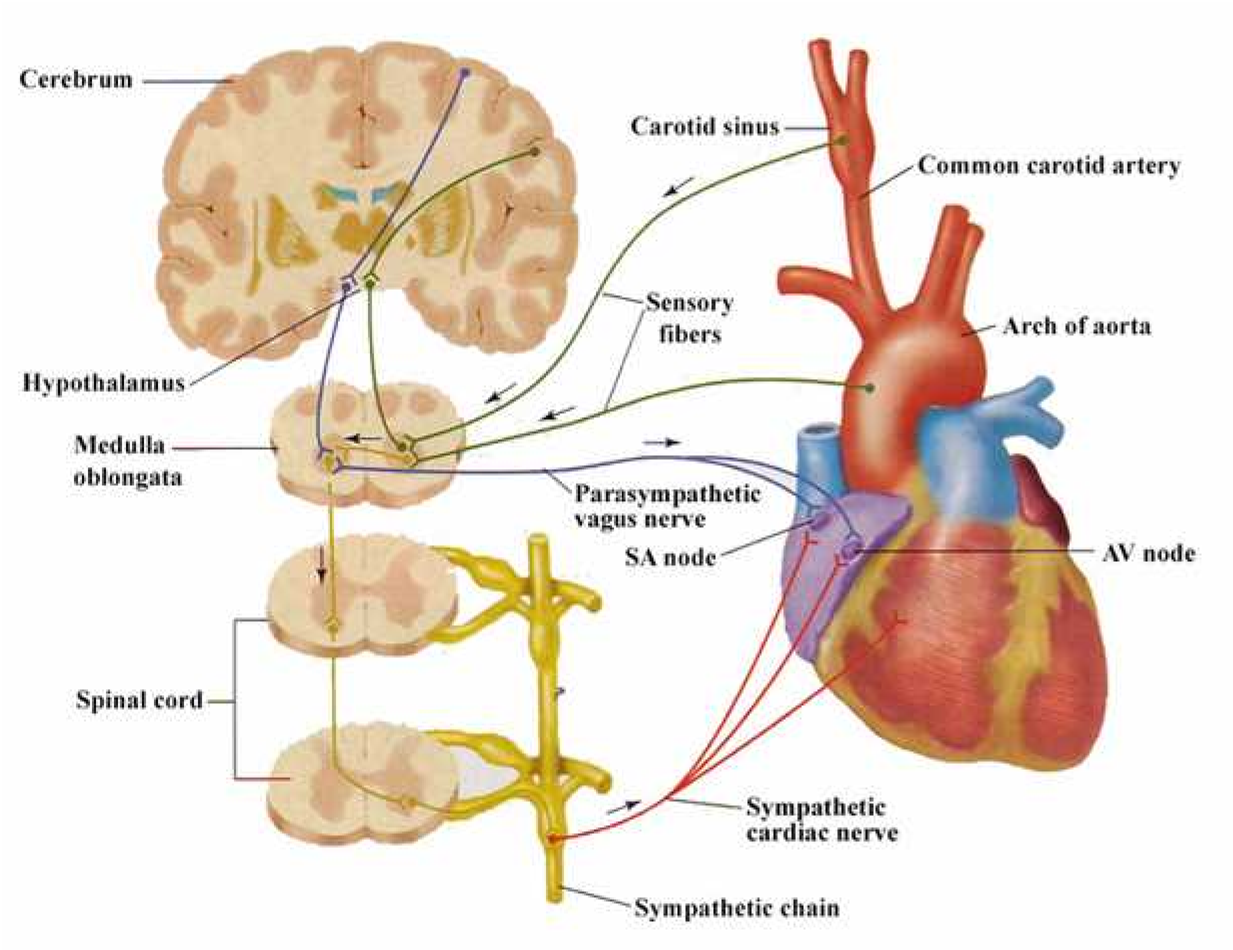
The Regulation of Cardiac Output



Schematic of Cardiac Innervation



Baroreceptor Reflex Structures



Autoregulation of Organ Blood Flow

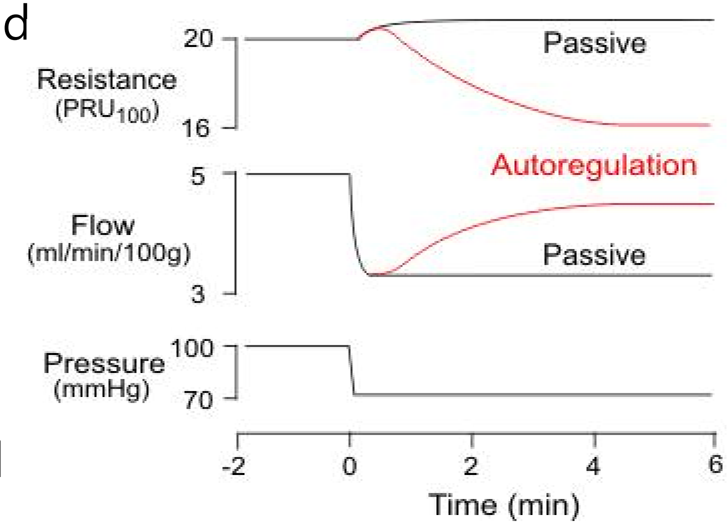
- Autoregulation is a manifestation of local blood flow regulation.
- It is defined as the *intrinsic ability of an organ to maintain a constant blood flow despite changes in perfusion pressure*.
- For example, if perfusion pressure is decreased to an organ (e.g., by partially occluding the arterial supply to the organ), blood flow initially falls, then returns toward normal levels over the next few minutes.
- This autoregulatory response occurs in the absence of neural and hormonal influences and therefore is intrinsic to the organ.
- When perfusion pressure (arterial minus venous pressure, P_A-P_V) initially decreases, blood flow (F) falls because of the following relationship between

$$F = \frac{(P_A - P_V)}{R}$$

Q →

- The figure to the right shows the effects of suddenly reducing perfusion pressure from 100 to 70 mmHg.

- In a passive vascular bed, that is, one that does not show autoregulation, this will result in a rapid and sustained fall in blood flow. In fact, the flow will fall more than the 30% fall in perfusion pressure because of passive constriction as the intravascular pressure falls, which is represented by a slight increase in resistance in the passive vascular bed.



- If a vascular bed is capable of undergoing autoregulatory behavior, then after the initial fall in perfusion pressure and flow, the flow will gradually increase (red line) over the next few minutes as the vasculature dilates (resistance decreases - red line). After a few minutes, the flow will achieve a new steady-state level.

- If a vascular bed has a high degree of autoregulation (e.g., brain and coronary circulations), then the new steady-state flow may be very close to normal despite the reduced perfusion pressure.

Coronary Autoregulation

- Since the heart is a very aerobic organ, needing oxygen for the efficient production of ATP, the coronary circulation is auto regulated so that the heart receives the right flow of blood & hence sufficient supply of oxygen.
- If a sufficient flow of oxygen is met and the resistance in the coronary circulation rises (perhaps due to vasoconstriction), then the coronary perfusion pressure (CPP) increases proportionally, to maintain the same flow.
- In this way, the same flow through the coronary circulation is maintained over a range of pressures.
- This part of coronary circulatory regulation is known as auto regulation and it occurs over a plateau, reflecting the constant blood flow at varying CPP & resistance.
- The slope of a CBF (coronary blood flow) vs. CPP graph gives 1/Resistance.