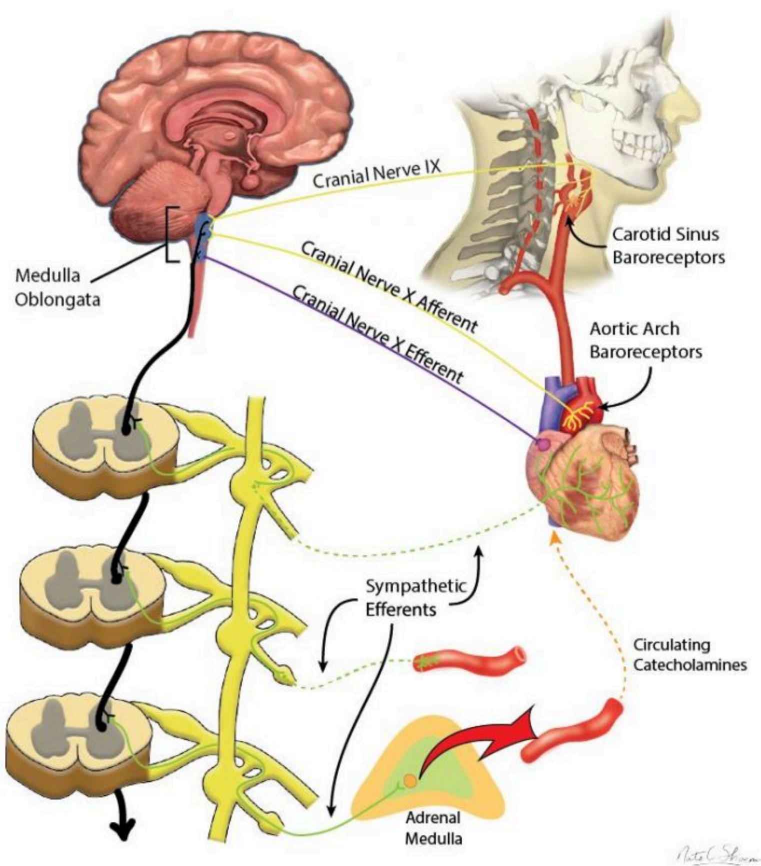
2.6.2

Short-Term Regulation

Short-term blood pressure regulation includes four responses: the baroreceptor reflex, the chemoreceptor reflex, the adrenal medullary mechanism, and the central nervous system ischemic response.

Baroreceptor Mechanism



Baroreceptor Reflex.
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The baroreceptor reflex is the most useful and common of the short-term blood pressure regulation responses. A **baroreceptor** (also known as a **pressoreceptor**) is a neuron that is sensitive to stretch and is located in the aorta and carotid sinus. Baroreceptors are sensitive to small changes in blood pressure and respond to these changes rapidly. Once a stimulus sets off an action potential in a baroreceptor, the signal is transmitted to an area of the medulla oblongata. The medulla oblongata contains areas that sense these action potentials and then determine which system (parasympathetic or sympathetic) should be activated to compensate for the response.

If blood pressure is too high then baroreceptors will increase their action potential frequency to the medulla and in response the medulla will activate the parasympathetic system, which will cause the heart rate to decrease. In addition, the sympathetic system inputs will be decreased allowing blood vessels to vasodilate as well as diminishing the amount of circulating epinephrine.

If blood pressure drops, there is less stretch of the aforementioned baroreceptors. Action potentials to the cardiovascular centers of the medulla decrease and the medulla responds by increasing sympathetic input to the heart for a faster heart rate. Signals will also be sent to increase sympathetic stimulus of blood vessels to cause more vasoconstriction which will increase peripheral resistance.

The baroreceptor reflex is an important minute-to-minute blood pressure regulator. For example, if you have ever jumped out of bed quickly and felt faint, you may have noticed that things "cleared" up within a few seconds. This was your baroreceptor reflex adjusting your blood pressure to your new upright posture and it happened relatively quickly.

Adrenal Medullary Mechanism

A second short-term blood pressure regulating mechanism is called the **adrenal medullary reflex.** During times of stress, exercise or anxiety, the sympathetic nervous system can respond independent of the baroreceptor reflex to stimulate the adrenal medulla and cause the cells there to release epinephrine into the bloodstream. The circulating epinephrine will activate adrenergic receptors that will increase the heart rate and the blood pressure.

Chemoreceptor Reflex

The **chemoreceptor reflex** occurs when low blood flow leads to an inadequate perfusion of body tissues. With low perfusion of the tissues, oxygen values rapidly decrease while carbon dioxide levels rise. The major driver of chemoreceptors is carbon dioxide, thus as CO_2 levels rise, the rate of action potentials in chemoreceptors, found in the carotid artery and aorta, signal to the medulla that tissues are starving for more blood flow. The result is stimulation of the sympathetic nervous system. The sympathetic nervous system will cause blood vessels to constrict and the heart rate to increase. This results in an increased heart rate, blood pressure, and greater blood flow to supply the body tissues. *Remember, body tissues have local vasodilators so that work is independent of the nervous system. Thus, the increased pressure will push more blood and that blood will be diverted to the areas that are vasodilating due to the local dilators. Amazing!

Central Nervous System Ischemic Response

The **central nervous system ischemic response** is an emergency response to very low blood flow. The CNS ischemic response receptors are located in the medulla oblongata and respond to very low blood pressure in the brain (below 50 mm Hg). In response, specific vasomotor center receptors stimulate severe constriction of peripheral blood vessels and very intense heart rate increase in order to increase blood pressure. Thus, for a short period of time, ischemia (lack of blood flow) is compensated for and the CNS is able to function. However, the CNS ischemic response is generally not sufficient to maintain adequate blood flow for very long. Metabolic activity in the brain struggles to continue and death is likely. The CNS ischemic response can be likened to a last-ditch effort to prevent the brain from shutting down during episodes of extremely low blood pressure.