Instructor' s Response - Module 9 Discussion Question

In the instructor-generated videos for this Module the instructor several times described the sympathetic and parasympathetic branches of the autonomic nervous system as operating in "push-pull" in their control of cardiac function. Explain what is meant by the term "push-pull" in the context of this module. Answer individually**; post your response by 9:00 PM on Day 4 of the module.**

The following material is an edited version of a response written by a student who took this course in a previous semester. I was particularly taken by his mention of engineering principles in his response.

The "push-pull" description of the sympathetic and parasympathetic branches of the autonomic nervous system (ANS) control of cardiac function simply designates the actions of the sympathetic and parasympathetic branches of the autonomic nervous system on cardiac function as a standard control system. Whether it's cardiac function, climate control in a building, or a robotic arm, just about every system has the same basic concept of a control system. That is, in order to obtain precise control of an action, whether that action be cardiac output, temperature of a room, or position of a robotic arm, there must be at least two competing inputs to the system that counter each other, or in the instructor's words, "push-pull". In the case of the ANS on cardiac function, the parasympathetic and sympathetic nerves in the heart can control heart rate independently, thus if one branch increases nerve activity to increase heart rate, the other branch can decrease its nerve activity to also increase heart rate, thus a "push-pull". Alternatively, if increasing activity in one branch increases heart rate then increasing activity in the other branch will decrease heart rate; this arrangement allows a precise control of heart rate. This "push-pull" minimizes overshoot and undershoot that would occur if only one system controlled heart rate, thus allowing for a precise control of the heart rate and thus cardiac output. There are many other examples of "push-pull", or control systems, in the heart in particular, and in the body in general.

Rev 0, 11/8/16 - with MRB edits
Rev 1, 3/31/17 - MRB text edits to Rev 0
Rev 2, 7/15/18 - update for 601; no content changes
Rev 3, 10/21/19 - change time due to 9:00 PM