

Homeostasis Lab Case Study

Lesson 3: Homeostasis Lab



Excerpt from *Too Hot to Trot? The Role of Exercise in Homeostasis*

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Link: https://static.nsta.org/case_study_docs/case_studies/cow_thermoregulation.pdf

Regulated physiological variables like body temperature are constantly monitored by the brain and tiny adjustments are continuously made, even if the animal does not appear to be actively thermoregulating. As with any regulated physiological variable, the maintenance of body temperature involves three main processes that function in a continuous homeostatic loop: sensing, interpreting, and responding if necessary. In regards to body temperature maintenance, sensing begins with the activation of thermoreceptors and the triggering of an afferent action potential within sensory neurons in the periphery of the body, internal organs, spinal cord, and even within the brain itself. After receiving multiple sensory inputs, a region of the brain known as the hypothalamus interprets the information and elicits an increased “correcting” response in the form of an afferent action potential if body temperature deviates further from its acceptable range. The correcting response requires the activation of motor neurons, which synapse upon and activate structures called effectors. It is the effectors that actually perform the work needed to restore body temperature. The brain finely tunes the degree of response as it continuously monitors and adjusts regulated variables using physiological feedback. These mechanisms act as forms of communication, allowing the brain to get a sense for how well effectors have done their job. For example, if a regulated variable had been outside of its acceptable range but through the action of effectors was corrected, the brain would need to know about this so that further activation of effectors does not occur. Thus there is continuous monitoring and adjustment of the physiological responses based on need. In the case of body temperature maintenance, negative feedback responses initiated by an increase in body temperature result in increased cooling and thus a decrease in body temperature. Sensory information from thermoreceptors continuously arrives in the brain and helps it to know when to decrease activation of effectors responsible for cooling its core once an acceptable temperature has been achieved. However, until then, the effectors would continue to operate at an increased rate with the rate slowing as the regulated variable of body temperature gets closer and closer to its normal physiological range.