739.4 Homeostasis in undergraduate physiology textbooks

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Introduction:
We assessed (1) what terms are used in the text and the glossary [Figure 1] and how these terms are used, (2) the types of figures used to summarize or model homeostasis [Figure 2] and (3) the consistent use of terms and figures to discuss homeostasis in four sections of the text [Figure 2]: (a) where homeostasis is introduced, (b) temperature regulation, (c) blood pressure regulation and the homeostasis [Figure 2] and (3) the consistent use of terms and figures to discuss the elements in homeostatic systems. This can lead to problems transferring learning and confusion on assessment for some undergraduate students. In student interviews, we found 200-level physiology students that this process happens sequentially, with only one process (or box) operating at a time. Set point is often not represented in this type of figure.

Consistent Use of Homeostasis Figures in Textbooks:
Some textbooks were consistent in their use of the same iconic figure within the chapters of an individual text, however, others were not. Undergraduate physiology students often struggle with recognizing, understanding and applying homeostasis in different physiological systems. Consistent use of an iconic figure, along with consistent use of terminology to refer to the components of a homeostatic system, provides students with potential reinforcement of learning.

Figures & Student Misconceptions:
The iconic figures in textbooks can and should present a generalized model that can be applied to any specific homeostatic system. In doing so, instructors should be aware of some student misconceptions that may be reinforced by these simplified diagrams and important concepts that are not explicit in the figures should be addressed. This can be accomplished by eliciting student interpretation of these figures and by giving frequent feedback to build appropriate understanding.

Student Misconceptions:
• There is a single effector (one 'box' means one effector or type of effector).
• The sensors must be close to the control center (because they are usually represented in series and closer to each other in the figures).
• Effectors' responses directly change the regulated variable (e.g., if an effector changes heart rate, then heart rate must be the regulated variable, not blood pressure).
• Only one variable is controlled at a time (because they only see one at a time).
• Homeostatic processes only function during a perturbation or imbalance.
• Sensors only respond when the regulated variable is outside its normal range.

Conclusions:
Some terms are used consistently in the narrative of introductory physiology textbooks, especially ‘negative feedback’. In some texts, however, there is very inconsistent use of terms used to describe homeostasis. There are pairs of terms that are used interchangeably in different textbooks (but used consistently within a textbook), including sensor/effector. Effector/target, integrator/control center. The process of negative feedback is not always shown explicitly in the figures used in a textbook. Some important concepts, e.g. set point, are not represented in the figures that are used to depict homeostatic regulation in a textbook. Figures are not always used consistently in different places within a textbook. This is a missed opportunity to reinforce student learning of this fundamental concept.

References:

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