How-To-Do-It

Blood Pressure Rummy

An Exercise in Integrative Thinking

John Walsh

One of the most difficult challenges to teachers of human anatomy and physiology is helping students to understand the ways the various body systems interact simultaneously to maintain homeostasis. Students may come to appreciate the individual responses of the body, but miss the large picture of how the systems interact to maintain stability and how the interactions themselves produce a new set of alterations with which the body must now deal. In response to this need, I invented a rather simple exercise that I call "Blood Pressure Rummy," because we use a deck of about 50 term cards to play the game. I introduce the exercise after we have covered all body systems except reproduction.

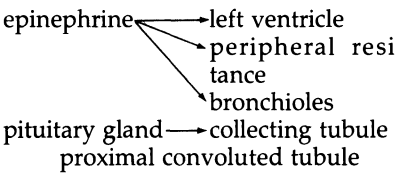
I begin the exercise by drawing seven term cards at random from the deck in front of the class, and after I post the terms on the blackboard, we rearrange them into a logical order. Each card has printed on it an anatomic or physiologic term from any of the body systems that we have covered so far in class. Each term is in some way related to blood pressure control. We then declare either an existing low blood pressure situation (hypotension) or a high blood pressure situation (hypertension). We rearrange the seven terms together into sets of terms that describe the body's responses to the declared blood pressure imbalance. If we chose hypotension as the existing condition, then we explain, using the seven ordered terms, how the body elevates blood pressure back to normal levels; if we chose hypertension, then we discuss how the body reduces this high pressure.

Students then move into groups of four or five and do the exercise within their groups. Each student is dealt seven cards. The student then arranges them into logical sequences and describes the role of each card in correcting the declared imbalance. The other students in each group act as helpers to get the player to see the interrelationships among the term cards. The helpers are instructed in ways of guiding rather than giving. That is, if a player is having difficulty with a term, a helper is more likely to guide the player to go as far as possible, starting from what the player already knows, no matter how little; helpers do not give answers. Having used all seven terms accurately, each player is then asked to outline other physiologic changes that are a result of this set of responses.

Perhaps a demonstration hand is in order. Here are seven term cards from the deck. I have elected to start with an existing hypotension. Therefore, if I were playing this round, I would explain verbally how the body raises blood pressure using these terms:

epinephrine	pituitary gland
collecting tabule	peripheral resistance
bronchioles	left ventricle
proximal convoluted tubule	

I would then arrange these into the following sequence, based on my knowledge of physiology:



Now I am required to explain the complete physiologic feedback loop in which each term is involved. For instance, the epinephrine loop would have to include the locations of the sensors that detect blood pressure changes (the baroreceptors of the aortic arch and carotid arteries), the primary control centers that receive this information from the sensors (medullary vasomotor centers), the mechanism by which the primary centers stimulate the secondary control center (the adrenal medullae) to release epinephrine, and the actions of epinephrine on the effectors (the left ventricle and bronchioles among others). It is rare that a hand of seven cards results in a single set of linear responses using up all seven cards. The above example is more typical because it involves simultaneous sets of events and a lone term.

Having used each term to describe accurately the body's responses to hypotension, I would now explain what new sets of internal changes come about because of my responses. For example, the dilation of the respiratory bronchioles by epinephrine would tend to raise blood pH by increasing CO_2 elimination. Also, increased reabsorption of electrolytes at the proximal convoluted tubule will alter blood plasma electrolyte levels and this new alteration must now be dealt with; how does this happen?

Besides fostering simultaneous thinking, this exercise has several advantages as a learning technique. Selecting term cards at random provides an endless variety of interactions and ensures that students understand processes, rather than memorize. Even with the same seven term cards, various students can, by arranging the cards differently, derive many sets of acceptable explanations, and this helps students to break out of the "only-one-right-answer" mold. The technique also promotes the ubiquity of change, wherein homeostatic mechanisms lead, not to stasis, but to a new set of conditions.

Some problems exist and student preparation can alleviate most of these. Students may strain to find an active role for all terms, without realizing that some organs are acted upon rather than being initiators of a response, i.e., the left ventricle in the demonstration hand. Getting students to help in the way that I have described above is difficult. Many stu-

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is excellent. He also demonstrates that, while Piaget has greatly influenced current thinking about intellectual development and cognition, there is, as would be expected, more recent research that has caused changes in our understanding of development. These sections have significance for biology educators. Piagetian positions have had a virtual stranglehold on our thinking about how students learn biology and what biology they can learn. It is not that Piaget was not significant, or that his work doesn't continue to be valuable —he was and it is —but just as knowledge in the biological sciences is evolving, so it is in the social sciences. Just as a turn-of-the-century view of genetics has been modified with the newer view shaping current research and practice, it is true that psychology has changed—it is the newer psychology that should be influencing practice.

Hunt also has chapters on problem solving and creativity that are a synthesis of up-to-date research, much involving science content. While the book is not meant to be a handbook for teachers, there is, nevertheless, much in it that could allow reflective teachers to alter their instruction.

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dents want to give answers and get on with the exercise, and it takes a patient (and practiced) teacher to show how to use leading questions to mobilize a player who is stuck on a term. The language of negative feedback loops must have been a regular aspect of class for students to grasp the exercise in a reasonable amount of time. Even with regular exposure to feedback loops, we take a week to get proficient in the exercise. A major barrier to success in using this technique is the resistance that students have to a nonlecture format. It takes a while for some to take any exercise seriously that involves interacting with other students.

Given these problems, students come to enjoy the challenge of new sets of terms to deal with, as their positive comments on evaluations show. Many would like to use variations at different times during the year. One suggestion that I've received is to introduce the exercise earlier in the year and have students add significant terms to the deck as we cover new systems. Thus, the technique could serve as a focal point for integrating new knowledge. Perhaps as significant is the active role that students play in helping each other to learn.