

Approach to Learning Physiology

Physiology is the foundation of clinical practice. Practicing physician need to have good conceptual knowledge of physiology.

When I was working as professor of physiology, with Seth G.S. Medical College, Mumbai, many of my final year MBBS students would come to me and report that they never found much of relevance of physiology then (I MBBS) and now they feel like going back to physiology concepts after clinical postings! And yes, that is even true for most of us.

It is mammoth task to recollect all concepts learnt when one encounters patient contact especially after many years. And the best way to tackle this problem is to teach basic sciences to the students in clinical context. Thus, by doing so they will find relevance and seeds of curiosity are planted in their mind which will grow as they ascend in their professional course. Also, it is equally important to assess them in similar way, which further enable their learning.

Thanks to Medical Council of India for the new competency-based curriculum wherein, to make preclinical learning relevant and contextual, they have made mandatory exposure of clinical content from preclinical phase. Implementation of competency-based curriculum, provides various opportunities in teaching learning context like early clinical exposure, integration horizontal as well as vertical, ethics and communication skills modules. Thus, this curriculum tries to help students in applying their concepts learned in preclinical phase to clinical context.

Before going further, let us see how exactly we learn? How cognition takes place? Is it a dynamic process and how it progresses?

Cognition involves mental action or process of acquiring knowledge and understanding through thought, experience, and the senses.

As per Bloom BS, taxonomy of educational objectives given in his 'Handbook- 1 for Cognitive Domain' it says it has following levels, let us see with the help of one example of gastric acid secretion.

First is **Knowledge** which is an awareness that you have some information/facts and if asked for, you can recall that. Example like What is basal gastric acid output?

Second is **Understanding/comprehension**, ability to understand the information you have. Going ahead with same example: What are different mechanisms involved in gastric acid secretion and how it is regulated?

Next level is **Application** simply means apply in appropriate situation what you have understood based on information you have. Example: How dysregulation of gastric secretion is presented as and what is basis for it?

Fourth level is **Analysis**, is thinking about given problem in all dimensions applying the concepts you have understood. Like interpreting the laboratory investigations related to gastric secretions may be like pH metry.

Next is **Synthesis** which is assembling all the concepts understood and synthesising your own theory to explain the given problem. This step-in cognition is attained only after first four steps have already been achieved. Example: Depending upon which of factor regulating gastric acid secretion is affected and what are the possibilities of its correction.

Last level of cognition process is **Evaluation**, it is process of judging what is good and bad about given problem-based on criteria attained so far with help of acumen. Example: Are these corrective measures suitable in given case/patient?

As per education experts there are no short cuts in achieving higher levels of cognition, one has to pass through all these processes stepwise.

So, cognition is evolving process! And to attain this higher level of cognition one should get trained and evaluated in similar way.

Here is our similar attempt to do so, by structuring clinical cases and scenario of various organ systems which are aligned as per new competency-based curriculum. This book gives students exposure to go step by step and to review concepts of physiology in clinical context. The questions are usually arranged from simple to difficult level. It starts with some basic physiological questions, answers to which you will get directly. Then it will ask you to organise your concepts and mechanisms learnt which will go onto synthesise the answers to next level questions. Cases here may be used by paraclinical phase and postgraduate students also.

As you are studying physiology, which range from studying single cell and its molecular dynamics across cell membrane, to the functioning of all the cells put together which forms the organs. And how all the organ functions with their various mechanisms, live in harmony with other organs in human body, which is nothing but cooperative system regulated and divided due to barriers.

Thus, it is clear that one should have the knowledge of entire composite functioning of human body as whole to understand what derangement can do to an individual.

A good clinician would rely primarily on physiology principles in deciding the best treatment protocols. Each

patient coming to physician goes through following ritual of, history taking, clinical examination, relevant lab/radiological investigations and thus physicians come to conclusion. As a student even in preclinical phase one must strive to synthesis the reasons for this clinical presentation and ask oneself these questions like (1) why such sign and symptoms arise in that patient; (2) what underlying physiological derangements must have led to this; (3) what must have been the cellular change; (4) what do the biochemical/lab findings suggest; (5) why they have taken place; (6) how major organ systems such as cardiovascular and respiratory system respond to achieve new level of homeostasis.

Let us see this by one clinical case scenario from chapter of cardiovascular system: A 40-year-old man brought to emergency room who met with vehicular accident, and have sustained multiple injuries. On examination his blood pressure was 86/56 mm Hg and pulse rate was 110/minute. He was pale and his extremities were cold. He was infused with a saline drip and lab investigations were done.

Herein this case scenario, we can judge that patient has multiple injuries, has lost quite amount of blood and this blood loss has led to drop in his blood pressure. We already have **knowledge** of physiology of blood pressure and **understanding** its regulation. Thus, we can now **apply** these concepts, to find physiological basis of drop in his blood pressure and rise in his pulse rate.

We know that cardiovascular system is closed loop system, thus this drop in blood pressure must have affected overall distribution of cardiac output so we can **analyse**, why his extremities being cold and he looked pale.

Further, we can **synthesise** the fact that, patient needs urgent volume replacement so as his blood pressure is raised even though short-term blood pressure regulation mechanisms are in place and doing their job at its best. And

lastly saline is infused to raise lost blood volume and how it does so. Thus, here we can conclude that patient is in hypovolemic shock! This is how, we can actually **evaluate** whole situation of this clinical context with composite knowledge of cardiovascular system functioning! Which also puts so many concepts learnt about blood pressure and its regulation in perspective.

Thus, by solving clinical case-based questions, students will develop a deeper understanding and facilitate retention of concepts of medical physiology. Also, in safe environment students will develop an enthusiasm for the lifelong learning process initiated by complex patient-based problem scenarios.

Reference

Bloom BS. Taxonomy of educational objectives. In: The Classification of Educational Goals. Handbook Domain Handbook 1-cognitive Domain. New York: David McKay Co Inc, 1956.