EDITORIAL

Importance of Physiology in Medicine – an introspection in the light of past 100 years

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As physiologists, we are (at least, I am) always proud that the Nobel Prize is awarded in the subject and it is named as 'Physiology or Medicine'. I wonder why Alfred Nobel has given the importance of both the 'Physiology' and 'Medicine' domains in his fundamental conditions (as mentioned in his original Will)[1,2] for the 'Medicine prize[2] and mentioned 'domain', not domains.[1,3] Thus, it appears that he believed both are equivalent when it comes to the 'benefit of mankind'. It is well-known that his association with Johan Erik (Jöns) Johansson, who researched in physiology for his doctoral thesis work, might have influenced him to constitute the third Nobel Prize in Physiology or Medicine.

Physiology is considered as the most basic subject in the field of medicine. 'Ease' and 'norm' of human body functions are explained by human physiology to provide a foundation on which abnormal and disease conditions can be understood better. In 1929, Maurice Holmes Rees, Professor of Physiology and Pharmacology and Dean of the University of Colorado School of Medicine has mentioned in his Chairman's address, read before the Section on Pathology and Physiology at the Eightieth Annual Session of the American Medical Association that "*Physiology is the keystone in the arch of medical and surgical knowledge. On its security depends the security of the superstructure of medicine as a science.*" [4] Essentially, as the great old-school clinicians believe, the level of human physiology learned decides the level of understanding in majority of the clinical subjects. These gained intellects are converted into clinical knowledge through rigorous training, handling patients under clinicians, and learning clinical concepts. This process is not only mastery of skills but also developing the clinical 'eye'. Thus, the clinical competencies are not only performing skills, the annexation of sensory and scholarly components are equally important. Rees also emphasized that practitioners should not ignore the 'science of medicine' physiology in their practice of 'arts of medicine' during the early age of modern medicine.[4] Nearly 80 years later, Michael Joseph Joyner (Frank R. and Shari Caywood Professor of Anesthesiology and Principal Investigator of the Human and Integrative Physiology and Clinical Pharmacology Laboratory at the Mayo Clinic) also echoed the same statement as' *physiology as an experimental discipline has been involved in both an intellectual and applied serve and volley with clinical medicine*' to remind why physiology matters in medicine.[5] Currently, the shift in conventional wisdom has gradually crept in all subjects and physiology is no exception. The inclusion of competency evaluation in medical education is a timely effort by the national and global accreditation quality controlling bodies to curb the creep-in mutilation. Combined with it, other efforts are also being made to reach the expected competency outcome in medical graduates; however, some of them are without accepting the existing deficiencies in logistic support at the implementation levels. In 1918, John Scott Haldane identified the deficiencies of teachings in preparatory biological sciences to the students of medicine.[6] Underscoring the importance *vis medicatrix naturæ* (the healing power of nature) in the practice of medicine, Haldane suggested improving the teaching of preparatory biological sciences, including physiology, to the true sense of Scottish name "Institute of Medicine" (literal meaning – Fundamental of Medicine), He indicated that "*With the human subject of experiment the teleological mode of approaching physiological problems is inevitable, and* pari passu *physiology is coming closer to medicine.*"[6]

Dalton Professor of Physiology, Dr. Frederic Schiller Lee mentioned the establishment of a postgraduate course of "Clinical Physiology" at the Columbia School of Medicine around 1911 to supplement the practitioners with the lacking knowledge of physiology.[7] He added "*while maintaining its firm and necessary basis on the principles of physics and chemistry, the subject -matter can often be made less esoteric, the bearings of a knowledge of the normal on an understanding of perturbed bodily processes can be emphasized, without the instructor's running the lamentable risk of giving a course in a narrow "medical" physiology.*" [7] A curricular inclusion of clinical physiology at the very late stage of undergraduate course was proposed so that "*An intimate acquaintance with physiology offers one of the most efficient preparations for successful medical practice.*" [7] From a condition where teaching physiology was gaining its importance in medicine, the subject of physiology is now slipping to a situation of declining coursework in the medical curriculum.[5] Are we, the physiologists, really bothered about this condition?

Teaching physiology to medical undergraduates in their first year is always a surpassing task. Haldane also had expressed his concern about this and suggested the improvement of teaching.[6] Highlighting the disliking of entry-level medical students for the apparently clinically irrelevant physiology teachings, Lee expressed the views of first-year medical students.[7] In relation to physiology in medical curriculum, deficiencies in training and trainee were delineated through nearly 100 years.[7,8] Even though the view-point is changed,

the problems remain the same. Fresh entrants of would-be doctors are allowed to take up this noble profession through a seemingly tough MCQ-based entrance test. To overcome the hurdle of the elimination test, the pursuers are trained well beyond the prescribed curricula and forced to memorize a lot of information related to physiology barely knowing relevant contexts of those. These new entrants lose the charm of learning new content in a medical curriculum because of apparent already-known words and facts. Minds already tired of forced training during long-term coaching look for something interesting and class-based deliberations of appear-to-be-known information bouquet fail to match their enthusiasm. Knowing that they have to crack another MCQ-based entrance test at the end of this curriculum, where physiology will be only a minuscule component of a vast collection of syllabi, they prefer to devote more time and energy to preparing next entrance tests. This is further supported by the unhealthy competition of ever-improving passing percentages in the course.

Exposing these students to patients at this early point would nurture their evanescing interest in medicine. Teachers in physiology face the dilemma of grooming these naïve student minds towards attractive clinical glory or bend them towards proper learning of medicine by giving them a good foundation of physiology. A good number of physiology teachers, specialists of a subject for which many of themselves are not convinced and happy to be depicted as physiologists with adjectives, like to prepare the students ready to learn more clinical subjects, even if the foundation of medicine is incomplete. Most likely, these teachers are favoring wrongs unknowingly. Subdued by the threat of the consequences of failing a student of high merit and exaggerated emotional sensitivity, a good number of teachers are not ready to take the responsibility of realizing the insufficiency of these students in learning fundamentals. Self-justifying statements like 'If not me, someone else will pass them,' 'I don't want to keep the garbage with me, let the other face them', 'What is the guarantee that next year they will come with learning,' 'I am only allowing them to learn the paraclinical subjects,' 'By passing them, I am not harming any patient,' 'They are the best of the lot,' 'They are tired of coaching, so they relaxed this year,' 'By the time they come out they should learn the medicine, not physiology,' 'We are not here to make physiologists,' 'If they could clear such a tough entrance test, they can learn physiology easily and they will,' 'Why should my score of passing be less than my peers,' 'Who will face the consequences of failing students', 'No question is asked if a student is passed, but you will be answerable if someone is failed,' 'Look my students are doing well in PG entrances' are often heard in formal or informal communications from physiology teachers. The issue is whether they understand that they are not doing justice to the subject. Multiple factors may be responsible for this behavior, including peer or near-peer pressures, frustration from unfulfilled desires, commercial races among the institutions, etc. However, the introduction of licentiate examination by autonomous authorities recognizes the awareness of the deficiencies in the assessment system and, therefore, is a welcome endeavor. Before blaming the students for not taking the subject seriously, an introspection might be helpful for both teachers and students. Identifying "reluctant and/or unskilled teachers" and motivating and training them may be a herculean task but it needs serious attention. Studies have suggested mechanisms of motivating of reluctant teachers[9,10] to take up endeavors towards better teaching of physiology has already been suggested.[10] Physiology teachers are classified into two groups on the basis of their exposure to up-to-date research in physiology and its allied subjects; therefore, interchanging ideas among the teachers are highly encouraged.[11] Availability of modern open source materials for teaching, their evaluation and implementation by teachers, and the assessment of quality of the same have been matters of concern.[12]

Being transitioned from a state of spoon feeding in schools and preparatory houses (force-feeding for repetitive reproductions of memorized facts), to a multitude of tasks associated with clinical competencies and thrown into the ocean of self-directed learning, the students need adjustment as well as training to adapt to the teaching-learning procedures of highly demanding medical curriculum. The issue remains whether they have sufficient time to adapt and adjust. Even though the 'deep' learning approach is described as most desirable, medical students choose it over the 'surface' approach only when they feel suitable.[10] Importance of self-discernment and supporting contribution of teaching faculties are highly appreciated in the choice of learning approach in medical school.[13,14] The highly-prescribed and well-practiced self-directed learning procedures may not result expected outcomes if not provided with sufficient time for the learners and due support by the teaching faculties all along this transition. Scaffolding is effective in teaching concepts and contexts, enabling students to develop critical thinking and clinical reasoning and apply knowledge of basic science in the clinical context.[14] Published articles in medical education commonly evaluate the students' perspectives in learning the subject (physiology) and mostly it is observed that they appreciate the new methods of teaching and express better learnings. However, the usefulness of these agreements in 'better learning' is hardly evaluated in the form of learning outcomes with clinical utilities. Making students a partner in teaching-learning and assessment processes may be an interesting exercise to establish their responsibility in the process; however, the question remains whether we can afford sufficient time to make them a contributory partner in the prescribed curriculum or they can be given the opportunity to manage their learning. The next issue is whether they will prefer to learn physiology to make their basics strong even if they are provided with opportunity and time. The problem is further compounded by various confounding factors that influence students and allow them to participate in non-academic activities beyond their purview. This raises the concern of developing efficient

health professionals with abilities of critical thinking and appropriate decision-making.

It needs to be thoroughly discussed what is more important for a first-year student of the medical curriculum, is it clinical knowledge, knowledge of basic physiology or is it a judicious blend of both? I believe that a judicious blend of basics with a dash of clinical physiology may equip students better in their early days of medical training. This can be done through proper planning of learning sessions, appropriate lesson plans and assessment strategies. Reducing the didactic passive presentation-based lectures and increasing sessions of early clinical exposure, case-based learning, team-based learning, scenario-based learning etc. may help the medical students be conscious that he will be constantly dealing with physiologic principles while treating patients in their later professional life. Every clinical teacher needs to impress upon his students the need of daily application of their knowledge of physiology to clinical problems. This approach, which can be possible when both educators and learners are well equipped with the basic concepts of physiology, will surely enhance the science of medicine based on physiological principles.[4]

I invite all physiologists – basic or clinical, to join hands together to bring back the glory of physiology in medicine, considering the extreme importance of the subject.

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