

# Effective Cell Biology and Histology Teaching For Medical Undergraduates in Bangladesh: A Review

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## ABSTRACT

Cell Biology and Histology is one of the core subjects of Anatomy for medical undergraduates. As gross anatomy is the representation of the body from outside, but it defines deep into the body to display the microscopic features. It is a difficult issue that requires a rigorous dedication of time and effort by the students in order for them to achieve mastery of the subject and educational achievement. In many world's renowned universities have taken some new approaches in teaching Cell Biology and Histology to first year medical students in preparing them intended for subsequent medical training by enabling them to remember the useful and clinically relevant aspects of this subject. It is therefore expected to review published evidence for concise and comprehensive teaching methodology that may be affected on the Cell Biology and Histology teaching in our country. For this ground, 47 published articles and books were analyzed and thirteen 'idea's could be recognized to find out the insight views regarding the approaches received and was applied in dealing with these subjects. These include some approaches, such as functionally-, clinically-, and principle- oriented, Problem-based teaching, integrated approach to teaching Cell Biology and Histology with other subjects and some ways of teaching such as peer teaching, small group teaching, use of traditional microscopic slides along with illustration, virtual microscopic slides, computer assisted teaching materials etc. By incorporating the ideas of the present review, suggestions can be prepared for improving the methods of teaching in Cell Biology and Histology in Bangladesh.

**Keywords:** Cell Biology and Histology, Teaching, Bangladesh, Medical Undergraduate, 'idea's.

## INTRODUCTION

Cell Biology and Histology is the most valuable subject for Medical students, which is a vital section of Anatomy.<sup>[1,2,3]</sup> Morphological features that mean gross-, cellular- as well as histo-morphology of an organism is studied in Anatomy. For a comprehensive perception of development, function and dysfunction of an organ, one has to gain proper knowledge about Cell Biology and Histology consequently a tremendous improvement of Medical science is possible. That's why, there are several teaching methods are implemented for Cell Biology and Histology teaching in the different renowned Universities of today's world.<sup>[3,4,5]</sup> But in our country, the picture is to some extent different. One major problem that faces Bangladesh is the rapid growth of medical colleges throughout the country but lack of skilled teachers. Each year a great number of students receive subjects in Anatomy in first year, which is an important gateway lesson for desirable careers in the health sciences.

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Cell Biology and Histology is an exigent issue that obliges a rigorous dedication of time and effort by the students in order for them to achieve mastery of the subject and educational achievement. According to Nina 'unfortunately, students often perceive histology subject as being difficult, dull, and irrelevant to their careers'.<sup>[3]</sup> Many of the students of our country also have not developed good English language, have large course load and have little or no prior experience using microscopes and handling microscope slides. In this situation, the ratio of carrier anatomist and students is poor; it is not uncommon for laboratories to have 30-40 students with a single teacher. Nahid<sup>[1]</sup> asserts the problem by saying the following explanation: "Undergraduate students, especially the newly admitted students, usually feel it difficult to understand the concepts of Cell Biology and Histology in the beginning of their MBBS course. While Cell Biology and the basics of Histology are covered in lectures by the senior teachers, the details of Histology are usually dealt with in practical classes. In most cases, the junior teachers try to sort out this problem by helping the newly admitted students, because Histology tutorial and practical classes remains to a great extent the domains of the junior teachers, some of whom are not even career anatomists. This often aggravates the problem". It is too much difficult for junior teachers, especially whom are not even career anatomist to demonstrate clearly the subject matter. For this

ground, it is therefore expected to review published evidence for concise and comprehensive Cell Biology and Histology teaching methodology that may be affected on the Cell Biology and histology teaching in our country.

On qualitative analysis of the 47 published articles and books regarding the approaches received and ways applied in dealing with the teaching of Cell Biology and Histology, some 'ideas' could be recognized from the claims made by the authors/editors. The following are the details of the interpretation upon which those 'idea's were developed.

### **Cell Biology and Histology Teaching Methodology in the Different Countries of the World**

#### **Functionally- Oriented Teaching**

The significance of the structure-function relationship in the field of Histology can be realized by understanding the following statement from Wheeler, Burkitt and Daniels,<sup>[6]</sup> 'Histology have bored generations of students.....almost certainly because it has been regarded as the study of structure in isolation of function'. The significance of the structure- function relationship has been highlighted by several authors.<sup>[7-19]</sup> Other authors have also emphasized upon its importance. In this regard Acar, Plopper and Mail<sup>[17]</sup> believe that the structure/function relationship is fundamental to our understanding of biological systems at all levels. Black and Smith<sup>[20]</sup> also claim that Students learn about the core structure-function relationships, though hands-on study of microanatomy using conventional light microscopes and lecture material, which is continuously evolving to keep pace with our increasing understanding of the cell biology of these tissues.

Junqueira and Carneiro<sup>[21]</sup> elucidate the importance of functional aspects of Cell Biology and Histology by saying "students of biologic structure share a common goal- namely, to better understand how structure and function are integrated into the molecules, cells, tissues and organs of a living creature".

Leeson, Leeson and Paparo<sup>[13]</sup> emphasize that "the correlation between structure and function is essential and perhaps provides the reason that histology is such an intriguing and readily understandable subject". The authors also believe that if the students examine the structure of an organ or tissue, they can deduce much about its function—conversely, if they know its function, they can forecast more easily much of its microscopic structure. Thus, "Histology stands at the crossroads between gross anatomy and physiology and acts an integrative element between them".<sup>[22]</sup>

#### **Clinically Oriented Teaching**

One approach to helping students see the value of histology is to show them direct correlations between this subject and the study of disease.<sup>[3,9]</sup> It is also asserted that understanding how cells work in healthy and diseased states, cell biologist have been and will be able to develop new vaccines and more effective medicines, fight infertility and develop a better understanding of how all living things live.<sup>[23]</sup> It should be noted that "Clinical Anatomy" is a declared component of the course content of the MBBS (i.e., undergraduate) curriculum recently updated for different universities of Bangladesh. <sup>[24]</sup> From the Thompson's<sup>[25]</sup> assertion is clearly understandable the importance of clinical correlation of this subject that is "Many diseases occur at the tissue level. For example, cancer is often the result of problematic tissue overgrowth, and some infections cause tissue to necrotize. For future medical professionals, histology provides important insight into the development of disease. But even if you're just taking an introductory biology class, histology can help you understand why some treatments work more effectively than others and why certain lifestyle choices can harm your body over time."

#### **Principle-Oriented Approach**

The term 'Principle' means a general idea or plan to explain facts or events.<sup>[26]</sup> Yeasmin stated that 'Principle-oriented approach' can address deep understanding of an event, phenomena and structure-function relationship in the cells and tissues of the body and the histopathology related to them.<sup>[1]</sup>

#### **Problem-Based Teaching**

Mezirow<sup>[27]</sup> emphasizes the value of the process of learning. It uses approaches to learning that are problem-based and collaborative rather than didactic, and also emphasizes more equality between the teacher and learner. Sherman and Jue <sup>[8]</sup> said that the principal advantages of this method are involving students in critical thinking and problem solving. Many authors<sup>[7,27-29]</sup> support his statement for teaching histology by saying their suggestions.

#### **Integrated Approaches to Teaching Cell Biology and Histology with Other Subjects Such As Embryology, Gross Anatomy, Physiology, Pathology and Medicine**

Integrated approach provides the opportunities of understanding of overall conceptual knowledge of the subject. Integrated studies involve bringing together traditionally separate subjects so that students can grasp a more authentic understanding.<sup>[30]</sup> Knowledge of histology aids in understanding the pathology of the tissues. This is because histology gives you the

normal image of a tissue while pathology discusses what changes occur in this normal tissue when it becomes abnormal or diseased. So, there is always a link between histology and pathology.

It is discovered from the opinions of Nina<sup>[3]</sup> that learning to read microscopic slides of normal tissue specimens enables them to analyze certain pathological conditions. Alternatively, an examination of pathological specimens can be used to reinforce basic patterns and concepts of normal histology. The major learning outcome is to understand the histology of human organs within the context of cell biology in preparation for studying the pathology and advanced cell biology and molecular biology.<sup>[31]</sup> There are numerous examples of pathological correlations that could be used to illustrate fundamental outlines of normal histology.<sup>[3-5]</sup> Most of the authors<sup>[31-33]</sup> agreed the approaches of integrated teaching method that enhanced understanding of the subjects. Cellular Biology provides grounding in every concept related to the development and functioning of cells, therefore their study is essential to the understanding of dynamic life processes, ranging from the constitution of this basic unit of the body as a whole.

#### **International Collaboration for Teaching**

Geoff<sup>[34,35]</sup> believe teaching collaboration has had many benefits including the presentation of histology courses that meet all learning outcomes expected of histology courses provided within Australian and USA Medical, Dental, Health and Biomedical Science curricula.<sup>[43,44]</sup>

#### **Small Group Teaching**

In China, Chen<sup>[5]</sup> stated that the University currently taught lectures and laboratory classes.<sup>[5]</sup> The importance of practical activities is reflected from the following statements of Thiago, Mayara, Jose and Simone<sup>[36]</sup>: there is no denying the importance of practical activities for learner development and the acquisition of a new view of the subject presented in theory. According to Lunetta (cited by, Thiago, Mayara, Jose and Simone),<sup>[36]</sup> "Practical classes contribute to the development of scientific concepts, teach students how to approach the world objectively, and also develop solutions for complex problems". "Teaching practice has shown that textbooks are not always sufficient to explain conceptual relationships".<sup>[36]</sup> For this reason instructor based practical classes are so important for teaching Cell Biology and Histology.

#### **Team-Based Teaching**

To enhance students' appreciation of the role of science and specifically histology in clinical

reasoning, disease diagnosis, and treatment, a new teaching format was created to provide clinical context, promote the integration and application of science knowledge, and to foster peer teaching and learning.<sup>[32]</sup> Evaluation comments from Van and Bick<sup>[33]</sup> noted that sessions were beneficial due to their integrative structure, the increased peer-peer interactions, overall attitude improvements, leadership development and having a 'real-life' exercise, revealing this course innovation as something to be developed. They also get results from their study that inclusion TBL in our Histology and Cell Biology course was a positive, rewarding, and challenging experience for the majority of the students and increased student-student and student-faculty interactions without dependence on electronic resources.<sup>[33]</sup> Team based teaching is time consuming, and it causes the students become a critical thinker, it also plays a vital role in the development of a good physician.

#### **Use of Traditional Microscopic Slides**

Bloodgood and Ogilive<sup>[37]</sup> state that the light microscope has been the primary laboratory instructional tool for teaching Cell Biology and Histology.

The light microscope is one of the most widely used scientific instruments in teaching, diagnosis and research.<sup>[18]</sup> Scoville and Buskirk<sup>[38]</sup> conclude that for the purpose of teaching medical histology, no evidence exists that would urge us to prefer using one technology over the other as a teaching tool. Virtual microscopy is a representation of a glass slide, so the traditional method of histology teaching was not motivated by pressure to change the method of instruction, and provides evidence to accept virtual microscopy as an alternative or augmentative tool. In some situation, students prefer microscopic slides over virtual microscopy as, for example, the Bachelor of Science students preferred practical classes using the light microscope, while teacher certification students preferred classes where visual devices such as movies and/or animation were used.<sup>[36]</sup>

#### **Use of Illustrations**

The illustration must be measured as basic in Cell Biology and histology. One cannot build up the understanding of the structure of cells, tissues and organs and of their relationships with one another without looking at them. Their interconnected functions are also complicated to perceive without visual help. Amin<sup>[2]</sup> found in her research result that the overall mean proportion allotted to illustration in two books<sup>[21,39]</sup> is more than text. Many authors<sup>[7,8,28,29,40,41]</sup> strongly suggested that clear understanding

regarding Cell biology and Histology for students need to teach histological images at multiple sites.

### **Computer Assisted Teaching**

A trend in Medical schools/colleges across the world is the renovating of Cell Biology and Histology laboratories with computer-assisted learning.<sup>[5,20,28,29,41-43]</sup> Such systems may reduce teaching time but more comprehensive. Morales<sup>[18]</sup> also claims that one of the major obstacles in teaching histology to College and University students is the availability, preservation and maintenance of a large collection of tissue sections. To decrease these problems, digital images of cells, tissues and organs have revolutionized the traditional delivery of histology teaching-learning. According to Lehmann, Freedman, Massad and Dintzis<sup>[44]</sup> that the most interactive learning style was achieved when a pair of students shared a computer and a microscope. They also said that a computer-based histology atlas induces qualitative changes in the histology laboratory environment. Most students and faculty reacted positively.

### **Use of Virtual Microscopic Slides**

The rapidly enhanced sophistication and influence of microcomputers has led to the accessibility of many forms of computer-based instruction and development of virtual microscopy and virtual slides. Result from surveys administered to students and faculty indicates that virtual microscopy was very favorably received.<sup>[4]</sup> Data from examination and surveys indicate that virtual microscopy may significantly improve learning efficiency and performance. The time allocated for the basic sciences, especially in histology has been reduced in many universities.<sup>[20,37,42]</sup> For solving this problem many medical institutions use virtual microscopy as a teaching tool for histology.<sup>[20, 28, 29,41]</sup>

### **Combination of Multiple Teaching Modalities**

To enhance students' appreciation of Histology, a new teaching format that is a combination of multiple teaching modalities is created and followed by several universities of the world.<sup>[28,45,46]</sup> Chen does not believe there is a single teaching method suitable.<sup>[5]</sup> The visual nature of the two subjects is highlighted and the need for ensuring visual experience using varieties of tools in learning the subjects is emphasized.<sup>[7]</sup> McBride and Prays on<sup>[45]</sup> thought that as an alternative to lectures and labs, students engage in interactive seminars focused on discussion of clinical and research-based cases matched with normal histology and pathology slides. Sherman and Jue<sup>[8]</sup> also believe that there is no single method that works best for all students.

### **Recent situation of Cell Biology and Histology Teaching Methodology in Bangladesh**

From the last many years, there were some changes in the undergraduate medical curriculum of Bangladesh but not significantly in the field of histology. The time allocated for the basic sciences has been reduced in the new undergraduate medical curriculum of Bangladesh. In the new curriculum<sup>[24]</sup>, the time allocated for Anatomy, Physiology and Biochemistry is one year and five months. Previously these subjects were taught in two years. Although the time for Cell Biology and histology has been reduced, the complexity of the teaching-learning material has the same and the same level of skill in Cell Biology and Histology is required. The consequence has been to push the students into a more passive "information memorizing" role. In keeping with the new trend in curricular change, we try to focus to make Cell biology and Histology as functionally and clinically relevant as possible and to reduce the teaching-learning time without hampering any important issues of the subject. However, although few studies<sup>[2,7,23]</sup> have been done on Cell Biology and Histology teaching-learning in our country for providing evidence, these are insufficient to meet the demands of time in every aspect of Cell Biology and Histology. The main policy of our approach is to make the subjects more efficient and effective in teaching, learning and assessment system with a concise period of time. In this challenging situation, the need to devise a more novel and efficient methodology becomes obvious. Computer-based teaching methods, virtual microscopy, and other ideas that are practiced in world's renowned universities combinedly enriching Histology course offerings and providing a partial solution to decreased histology teaching time resulting from curriculum revisions.

Our medical institutions have already attempted to progress the subject of Cell Biology and Histology by accumulating few novel approaches for recognizing and interpreting Cell Biology and histology illustrations or slides and for conceptualizing the subject matter. The curriculum planner of Bangladesh can be included the other ideas that are evolved in this review or other approaches for teaching Cell Biology and Histology, which also reduces time allocations and increases acceptance for teaching Cell Biology and Histology. We tried to further increase the competence of students for improved understanding of Cell Biology and Histology. Our constant attempt with this methodology in the subject of Cell Biology and Histology is the present report.

## CONCLUSION

Commonly we see the problem of understanding of the subject matter in our students as well as time management in both of our teachers and students during the teaching and learning of Cell Biology and Histology. These can be solved by using different types of teaching modalities as well as teaching tools such as histological images along with microscopic slides, which influence the understanding of the subjects. In the picture, one can get insight of the description. The phrase 'Picture worth a thousand words' shows us the importance of visual images. From this point of view, it may be suggested that for teaching Cell Biology and Histology, more use of illustrations is obviously beneficial for students. If we desire to well built our knowledge and skill it should be comprehensive. Memorizing without thoughtful is a temporary knowledge in our brain and also for we suffer from stress. When we can understand something, we capture it in our brain for a long time, which results get answers in our own words during urgent situations. Knowledge is complete when it is taken from many ways. Modern technology brings us a lot of opportunities. The educational system of Bangladesh should include these opportunities and worldwide used several new technologies for better teaching learning of Cell Biology and Histology. For our educational growth of Cell Biology and Histology, visual understanding should be taken in consideration too. We can also assemble instructional processes for the multiplicity of learners, with identical content, by applying the various teaching methodologies for Cell Biology and Histology.

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