

Research Article

Focus Areas for Computer Animation Development in Biochemistry for Ist Year MBBS Students

Saritha Gadicherla¹ and Ravi Kishore P²

¹Assistant Professor, Department of Biochemistry, MVJ Medical College, Bangalore, India

²Associate Professor, Department of Biochemistry, MVJ Medical College, Bangalore, India

***Correspondence Info:**

Dr. Saritha Gadicherla
Assistant Professor,
Department of Biochemistry,
MVJ Medical College, Bangalore, India
E-mail: saritha_g7778@yahoo.co.in

Abstract

Background: Understanding complex molecular biochemical processes is crucial to Ist year MBBS students in solving clinical problems. Though animations have been developed to aid understanding of molecular processes, they are not medically relevant. There is a need to develop animations in specific areas that cater to the requirements of MBBS students. There are no studies that have recommended the focus areas for the development of medically relevant animations for biochemical processes for MBBS students.

Objectives: In this study our objective was to select the focus areas for animation development in Biochemistry for the students of Ist year MBBS.

Methods: The study was conducted in Department of Biochemistry MVJ Medical College & Research Hospital, Hoskote, Bangalore. Eight textbooks of Biochemistry commonly referred by Ist year MBBS students were used to delineate topics and sub topics that could become focus areas for animation development for the Ist year MBBS students.

Results: The topics and subtopics that need animations in Biochemistry for Ist year MBBS were shortlisted. These include 18 topics and 52 subtopics.

Conclusion: We recommend that medically relevant animations should be developed in specific focus areas of Biochemistry for the Ist year MBBS students to help in better understanding and application of Biochemistry in solving clinical problems.

Keywords: Animation, MBBS, Biochemistry

1. Introduction

The Medical Council of India Regulations on Graduate Medical Education, 1997 on teaching of Medical Biochemistry for Ist year MBBS state that the broad goal of teaching of undergraduate students in Biochemistry is twofold. It is to make students understand the scientific basis of life processes at the molecular level and to orient them towards the application of knowledge acquired in solving clinical problems.¹ The knowledge of molecular processes in Biochemistry can be used to create mental models to understand the phenomenon of health and also to understand the principles behind screening, diagnosis and treatment of disease. The knowledge is also useful for the prognosis and monitoring of the patients. However, most of the Biochemical molecular mechanisms are abstract which make them difficult to visualize leading to impairment in understanding and memorization of concepts. This may hamper the ability to apply molecular concepts to understand the health disease phenomenon.

Animations have been created to help students visualize complex molecular processes. They have been shown to improve understanding and memorization of molecular processes.² Animations coupled with lecture have specifically been shown to aid the memorization of sequence of molecular events as compared to lecture alone.³ Animations for many molecular mechanisms are available freely on the internet. However most of the animations are not customized to the needs of MBBS students. They are complex and do not cover all the medically relevant topics as prescribed by Medical Council of India. Hence there is a need to develop medically relevant animations for Ist MBBS students to aid in understanding and applying molecular concepts to solve clinical problems. To the best of our knowledge there are no studies that have shortlisted the focus areas for development of animations in Biochemistry for Ist MBBS students. The purpose of this study is to review the commonly referred textbooks (which have topics as prescribed by MCI) by the students and select the topics and subtopics that should become the focus areas to develop relevant animations.

2. Methods

The present study was carried out in the Department of Biochemistry, MVJ Medical College and Research Hospital, Hoskote, Bangalore. Textbooks of Biochemistry (list mentioned below) usually referred to by Ist year MBBS students were used to develop focus areas for animation development. The list of textbooks was based on informal interactions with the students. Both the authors have more than seven years experience in teaching Medical Biochemistry for Ist year MBBS students. Based on this experience, areas which need animations were shortlisted.

1. D M Vasudevan, Sree Kumari S, Kannan Vaidyanathan, editors. Textbook of Biochemistry for Medical Students. 7th ed. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd; 2013.
2. Richard Harvey, Denise Ferrier, editors. Biochemistry. 5th ed. New Delhi: Wolters Kluwer/Lippincott Williams &Wilkins Pvt Ltd; 2011.
3. Thomas M.Devlin, editor. Textbook of Biochemistry with Clinical correlations. 7th ed . New Jersey: John Wiley and Sons Inc; 2011.

4. Dinesh Puri, editor. Textbook of Medical Biochemistry. 3rd ed. New Delhi: Elsevier; 2011.
5. U. Sathyanarayana, U.Chakrapani, editors. Biochemistry. 3rd ed. Vijayawada: Uppala Author Publisher Interlinks; 2006.
6. Robert K Murray, David A. Bender, Kathleen M. Botham, Peter J.Kennelly, Victor W. Rodwell, P. Anthony Weil, editors. Harper's Illustrated Biochemistry. 28th ed. New York: Mc Graw Hill; 2009.
7. David L. Nelson, Michael M. Cox, editors. Lehninger Principles of Biochemistry. 4th ed. New York: W. H. Freeman and Company; 2008.
8. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, editors. Biochemistry. 7th ed. New York: W. H. Freeman and Company; 2012.

3. Results

Following is the list of topics and subtopics which should be the focus areas for animation development.

1. Cell membrane :Transport across membranes
2. Proteins : Structure of proteins
3. Enzymes
 - a) Enzyme inhibition
 - b) Mechanism of enzyme action
 - c) Regulation of enzyme activity
4. Vitamins
 - a) Wald's visual Cycle
 - b) Formation of active form of vitamin D
 - c) Actions of Vitamin D
5. Carbohydrate Metabolism
 - a) Digestion and absorption of Carbohydrates
 - b) Glycolysis
 - c) Citric acid cycle
 - d) Gluconeogenesis
 - e) Glycogen synthesis
 - f) Glycogenolysis
 - g) Cori's cycle
 - h) Hexose monophosphate shunt pathway
 - i) Regulation of blood glucose
6. Protein Metabolism – Urea cycle
7. Metabolism of Fatty acids
 - a) Digestion and absorption of lipids
 - b) Beta-oxidation of fatty acids
 - c) Denovo Synthesis of fatty acids
 - d) Metabolism of Ketone bodies
 - e) Formation of atherosclerotic plaque
 - f) Lipoprotein metabolism
8. Minerals
 - a) Calcium Homeostasis
 - b) Mechanism of Iron absorption from intestine
9. Bilirubin Metabolism
10. Hemoglobin
 - a) Mechanism of oxygen transport by Hemoglobin
 - b) Sickling of hemoglobin in Sickle cell anemia
11. Nucleic Acid Metabolism
 - a) Purine synthesis
 - b) Pyrimidine synthesis
12. Molecular biology
 - a) Structure of DNA and RNA
 - b) DNA repair
 - c) Replication of DNA
 - d) Transcription & post transcriptional processing
 - e) Translation
 - f) Regulation of gene expression
 - g) Recombinant DNA technology
13. Molecular Diagnostics
 - a) Blotting techniques
 - b) Microarray
 - c) Polymerase chain reaction
 - d) Restriction fragment length polymorphism
 - e) Production of monoclonal Antibodies
 - f) DNA Fingerprinting
14. Hormones
 1. Mechanism of action of hormones
 - a) Hormones binding to cell surface receptors. Ex. Insulin
 - b) Hormones binding to intracellular receptors. Ex. Glucocorticoids
 2. Metabolism of Thyroid hormones
15. Biochemistry of cancer
 - a) Mechanism of Oncogenesis
 - b) Mechanism of action of anticancer drugs
16. Techniques

- a) Principles of Electrophoresis
 - b) Chromatography
 - c) Enzyme linked immunosorbent assay
 - d) Mass Spectrometry
17. Biochemistry of AIDS :Human Immunodeficiency Virus (HIV) Replication
 18. Free Radical formation.

4. Discussion

The present study was conducted in the Department of Biochemistry at MVJ Medical College & Research Hospital, Hoskote, Bangalore. In this study we have made an attempt to shortlist the relevant areas of Biochemistry for development of animations. We are not aware of any studies that have delineated the focus areas of animation in Biochemistry for MBBS Ist year students.

O' Day in his study has shown that students performed better in tests when they used animation as compared to static graphics.² In another study by the same author he has found that students retain more information 21 days after viewing an animation without narration compared to an equivalent graphic with or without legend.⁴ McClean *et al* have shown that animations when coupled with lectures resulted in better knowledge retention as compared to the use of graphics with lectures.⁵ In Biochemistry it is crucial to remember not only location but also sequence of events. Animations have been shown to be effective for achieving this goal.³ Complex animations were found to increase the depth of understanding of abstract molecular events as compared to simple animations.⁶ Guy has shown that animations in neurophysiology have been shown to enhance the learning.⁷

Our study had the following limitations. We could have incorporated feedback of MBBS students about their choice of topics for animation development. In addition we could have included larger sample of teachers for short listing the focus areas. Further studies may be done in this regard. We recommend that the animations for medical students be medically relevant and should be customized for the need of Ist year MBBS students. We recommend that institutes and medical publishing companies that focus on developing animations should keep the above mentioned areas in mind.

5. Conclusion

In conclusion we recommend that medically relevant animations should be developed in focus areas (mentioned above) to help Ist MBBS students to understand and apply molecular concepts to solve clinical problems.

References

1. Medical Council of India [Internet]. New Delhi: Medical Council of India; 1997 [cited 2014 February 10]. Available from :http://www.mciindia.org/Rules-and-Regulation/GME_REGULATIONS.pdf
2. O' Day D H. Animated Cell Biology: A Quick and Easy Method for Making Effective, High Quality Teaching Animations. *CBE Life Sci Educ* 2006; 5:255-263.
3. Stith B J. Use of Animation in Teaching Cell Biology. *Cell Biol Educ* 2004; 3:181-188.
4. O' Day D H. The Value of Animations in Biology Teaching: A Study of Long Term Memory Retention. *CBE Life Sci Educ* 2007; 6:217-223.
5. Mc Clean P, Johnson C, Rogers R, Daniels L, Reber J, Slator B M *et al*. Molecular and Cellular Biology Animations: Development and Impact on Student Learning. *Cell Biol Educ* 2005; 4: 169-179.
6. Jenkinson J, Mc Gill G. Visualizing protein interactions and Dynamics: Evolving a visual Language for molecular Animation. *CBE Life Sci Educ* 2012; 11:103-110.
7. Guy R. Overcoming misconceptions in neurophysiology learning: an approach using color coded animations. *Adv Physiol Educ* 2012; 36:226-228.