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*REVIEW ARTICLE*

# Computer Aided Learning in Continuing Pharmacy Education

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## INTRODUCTION

Since ages the teaching and learning of science has undergone different evolution of methodologies, versions, technologies and means. All the methods of teaching and learning had significant form of impact to the learner in some way. Wherever the learning requires greater attention, it has to involve more than three medias like lectures, boards and pictures for the best presentation. As the years past when the electronics emerged within human life, the technology such as audiovisual acquired a great scope. Even special departments were created to effectively use the technology.

Science, especially medical science, is the subject that has shown lot of interest and amazing development in the past decades. Research and Development (R&D) departments has contributed much for greatest inventions and made major advancements in upbringing the human life. All the science subjects require a practical oriented approach during their learning process. The learner's interest depends on the topic, teacher, the method of teaching and their style of presentation. In this speedy world, as the time becomes scare, the student requires less spare time to learn which should be abundant in the content as well.

After the evolution of computer and internet, the accessibility of the information has alleviated the stress of the learning. This opened the gateway for the creators of the presentation, a new and highly attractive method of teaching to reach their targeted audience. With the use of multimedia, it is evident that even an infantile level of learner gets ample information which was not possible before these technologies came into free existence. Though science subjects require a practical oriented approach to teach and learn, the high-tech era eases the time and effort by providing several simulations, which reduced the cost and time greatly. The demonstrations and the practical lessons for the students were also governed by the software's which almost gave a real lab environment to provide the experience they need for their syllabus. As there were efforts directed towards remote learning methods like WebCT®, "BlackBoard®" almost in all the fields, the medical field utilized a maximum benefit.

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This article highlights few easy computer assisted learning of human physiology, anatomy, and pharmacology at the level of graduate and postgraduates for the Pharmacy, Medical, Nursing and Dental Students. As the titles covered are mostly common for these disciplinary, the use of these material is posted for all the students in these fields. The significance of the subject covered depends on their level of requirement. To get the attention of the community pharmacist of this region who is serving long hours, this article is curtailed to basic information.

Several Universities and Institutions have focused on the development of CBL (Computer based learning) which the institutions from UK and USA have a major contribution since many years [1-6].

Few establishments like www.coacs.com /pccal have commercialized these projects with association with professionals from the academic background.

Few reviews on the models, their benefits and uses were highlighted

1. http://www.ijp-online.com/archives/2001/033/04/r0280-0282ra.pdf
2. http://www.cis.um.edu.mt/~phcy/symp/jermical.htm

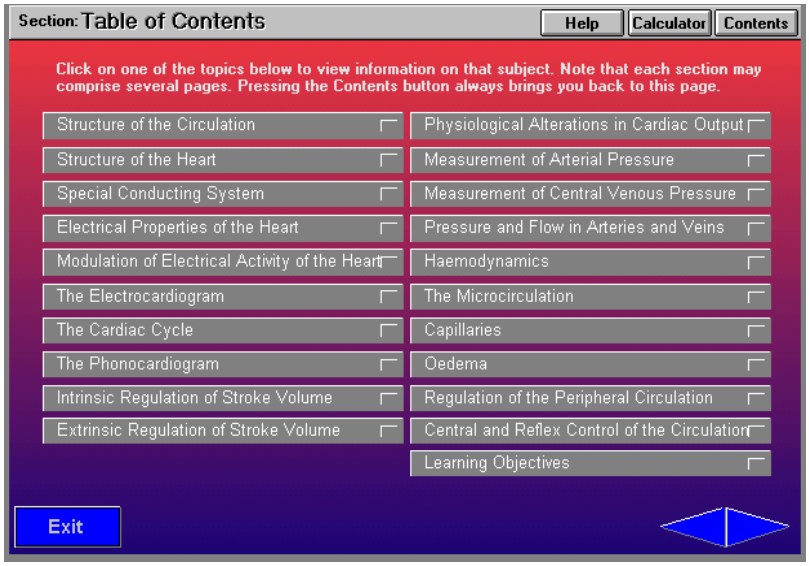


**Figure 1**

Here are few examples and their e-shots of the programs which are used for the students. Most of the software are standalone and executable files but many requires the association of another software which are available for free downloads or few to-pay from their respective websites.

As in the cardio vascular system learning, the following example describes complete anatomy, physiology of the heart and the blood circulation. It also describes the various drugs

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used in the treatment of cardiac dysfunctions. Fig 1 shows the table of contents of the programs which gives an idea about the depth of subject they covered in it.

To show an example of using the cardio vascular tutorial program, the basic physiology existing in the formation of the cardiac cycle is illustrated (Figure 2) The learner can anytime request help by selecting the Help menu. The built in calculator function can be used to calculated the time cycle of the occurrence of the electrical activity within the pacemaker and non pacemaker tissues. On clicking the pacemaker or non pacemaker button, the user can view the changes in the membrane potential in relation to the time scale in animated window

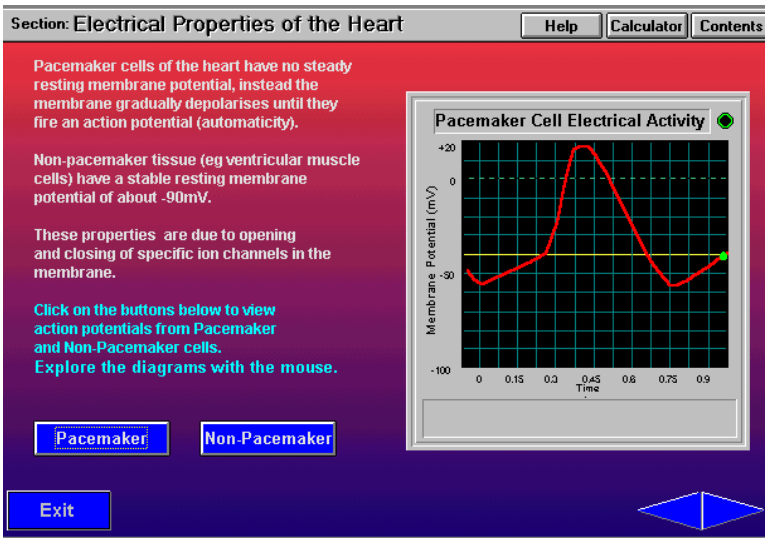


**Figure 2**

One other program in the cardio vascular module describes the normal and several abnormal patterns of ECG (Fig 3). The description of the pattern of the ECG is provided to make understand the ECG patterns at different pathological states of diseases. A game is also incorporated to play and test their ability to identify their knowledge in recognizing the several ECG patterns.

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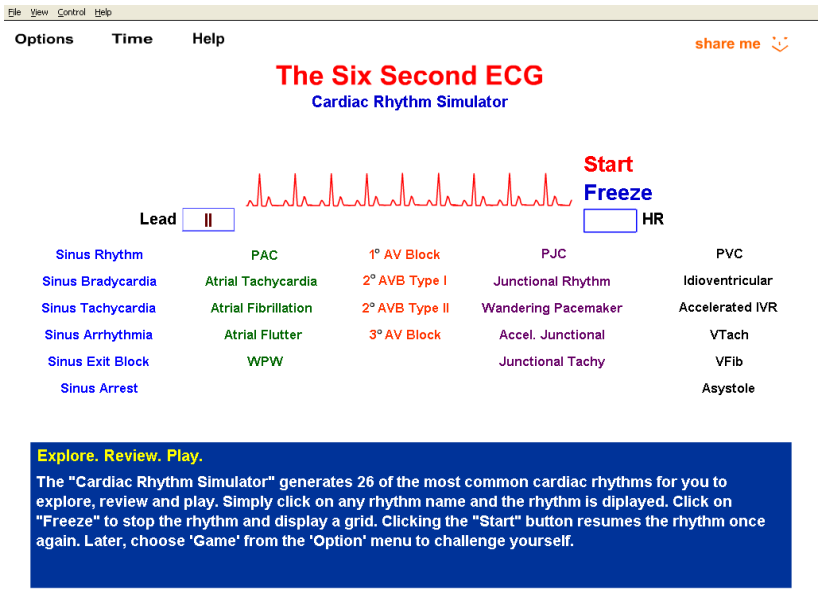


**Figure 3**

As another contribution to the cardio vascular physiology to help learn the students particularly medical and nursing, the heart sounds of different condition in the disease state like arrythmias, congestive failure etc., (fig 4) This helps the students for the placement of the stethoscope on appropriate position to differentiate between the placement and their heart sounds. The ECG, cardiac filling (animation) and myocontractility are well explained.

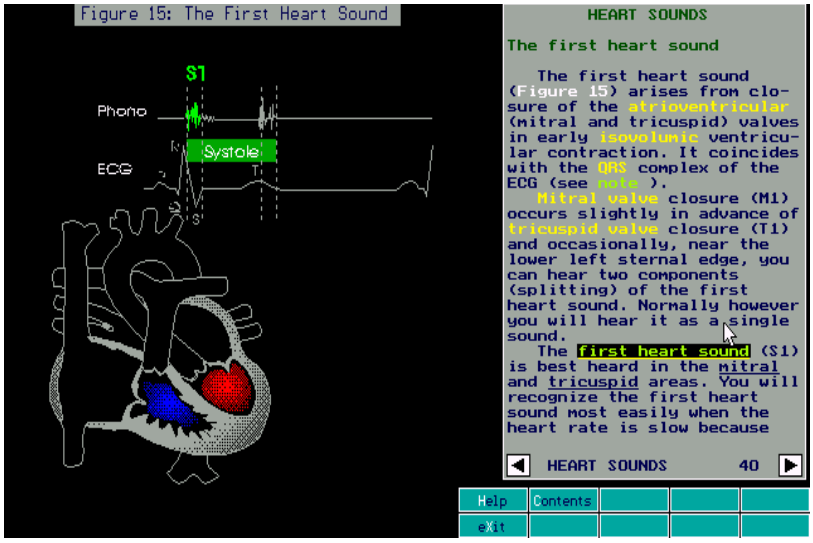


**Figure 4**

Figure 5 is an example of the objective type quiz which is interactive to the user which scores. On selecting true or false, the brief justification is provided for the answer that the user's awareness will be improved.

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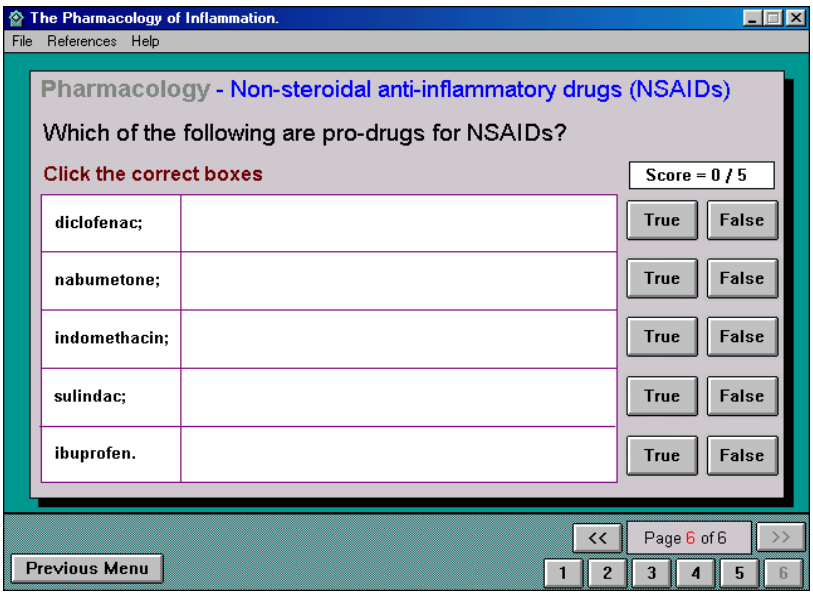
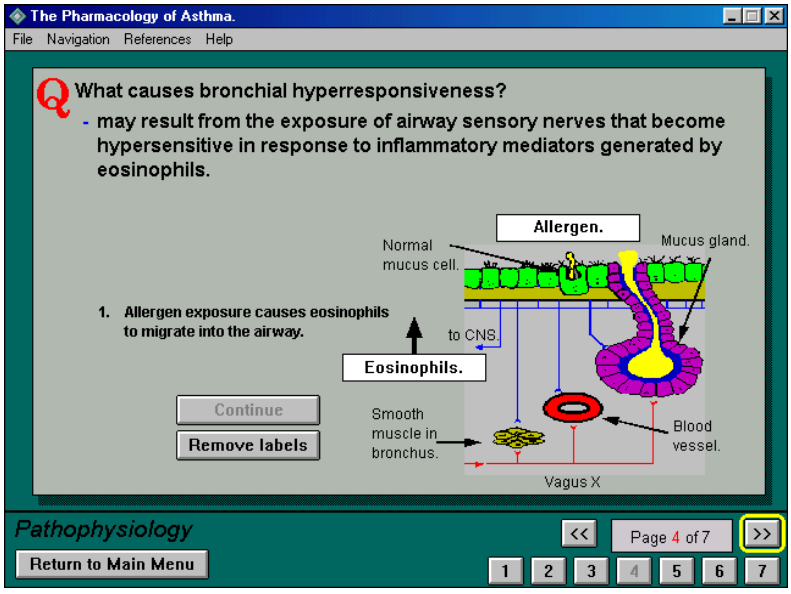



**Figure 5**

In figure 6, the pharmacology of Asthma is described illustratively about the pathophysiology and the treatment with several references for further reading. The users are made interactive to move the buttons and to place in appropriate positions to make the animation and to obtain the answers. The animations are designed for the correct placement and selection of answer which describes the multiple events occurring during asthma.




The following illustration (Fig 7) shows the basic neuronal physiology from the autonomic nerve distribution and their anatomy. Here as it is from different program, this is interactive to the users by selecting the buttons of different parts with drag and drop mode. This program describes the entire neuroanatomy and physiology starting central, autonomic

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and peripheral neurodistribution and their functions in the body. At the year 1 of the syllabus, this program seems to be great to teach and learn the neurology.

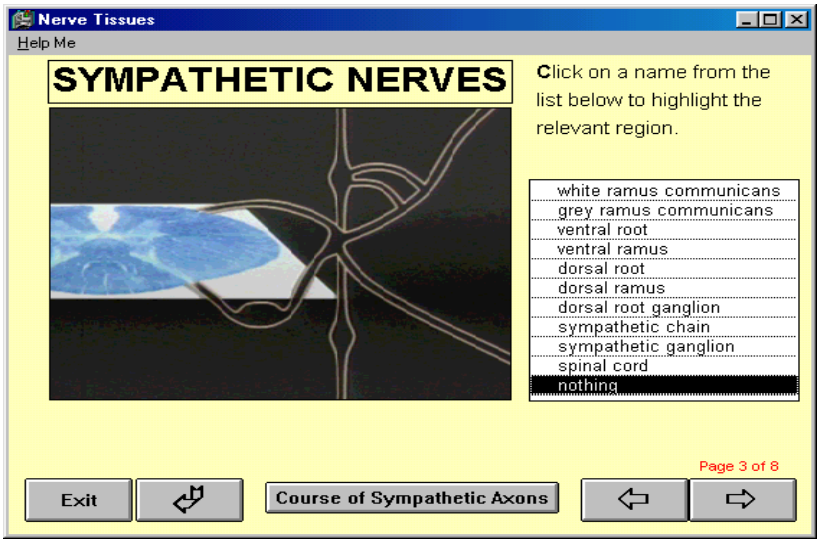


**Figure 7**

The Creators used multimedia technology movies to explain the basic and advanced functionalities of the biosystems. In this example (fig 8), the movie describes the different stages of muscle contraction with the myosin, actin, fibrils and ligaments with different myoproteins

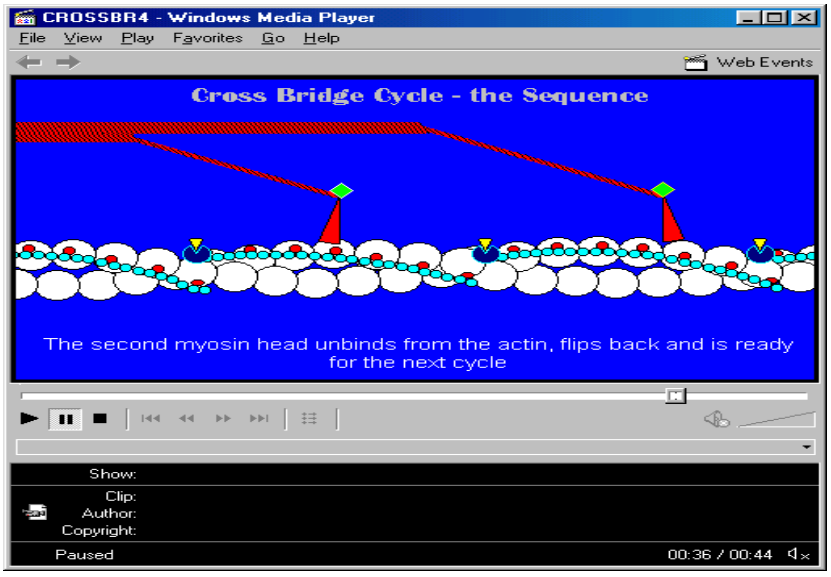


**Figure 8**

Figure 9 explains about the isolated tissue experiments which involves, in reality, the lab animals. As the restriction of usage of lab animals has emerged high, these programs which is a simulation of the real isolated tissues which can be used to study the effects of various drugs and chemicals of unknown property. The tissue and drug can be selected from the list to

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demonstrate the action. The experiments can be extended to study the agonist and antagonistic properties of the drugs and their interaction. This gives the learner the ample knowledge on the properties of the drug on specific tissue model. Here in this depiction, the arterial ring from the rat is used to study the dose related contraction and can be extended to study the antagonistic property of any given unknown drug.

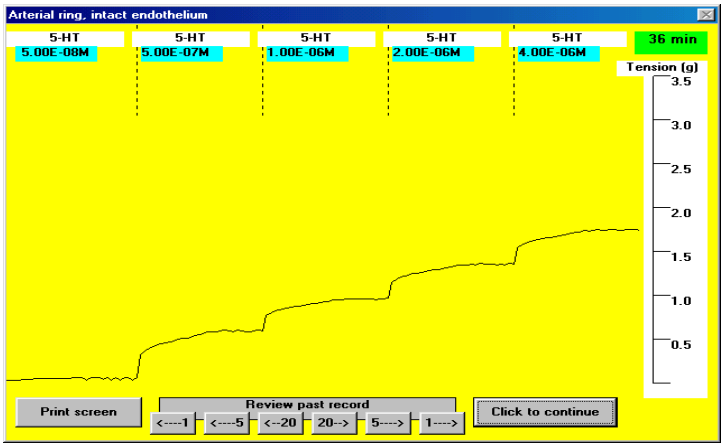


**Figure 9**

In the following figure (fig 10), the program is written efficiently to interact with animated features. Here in this example, to study the various receptors activity and its behavior in different conditions in stomach, the microsopical description of the gastric glands and its various components are included. The learner is subjected to interact at his own pace to move the receptor to appropriate position of the layers of the cell. On placing in appropriate position, and with the different combination of the receptors, the ion exchange between the gastric mucosa and the blood is clearly depicted. The descriptions of the events will also popup to show the reaction that occurs on such change. In the following example, the receptors such Histamine, Gastrin and Acetylcholine were used. The agonists of respective receptors and the pumps of different nature like $Na^+K^+$ATPase Pump, $Na^+H^+$ATPase Pump are also incorporated to show their significance in the pathway of the release of acid in the gastric lumen. The effect of various anti-ulcer drugs like Cimitidine, Ranitidine, Loratidine, Omeprazole, Esomeprazole Pantoprazole etc can also be demonstrated with help of this software.

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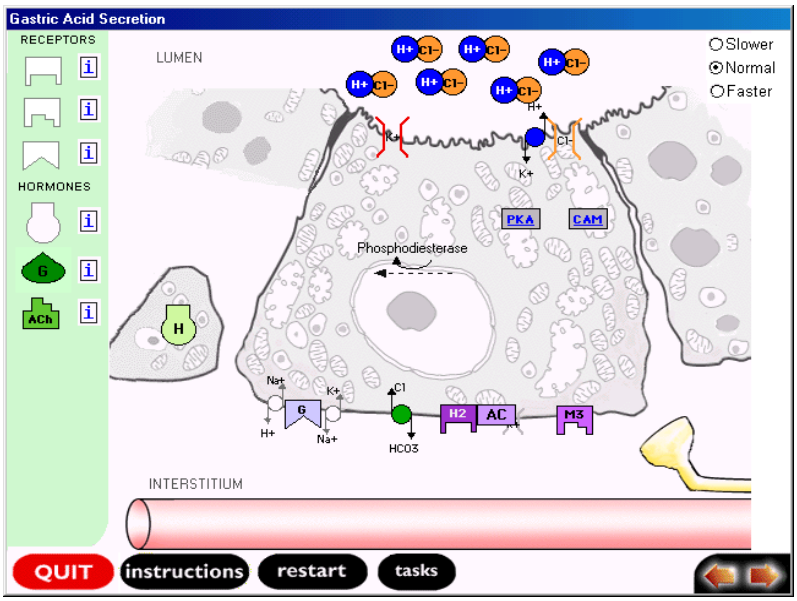


**Figure 10**

To describe all the existing software which will be almost impossible within this article. But to highlight the availability of the programs I shall try to list few.

Cardio vascular (Blood Pressure reflex, Cardiac dysfunction, CVS Tutorial, ECG, Heart Anatomy, RALE Heart Sounds, RALE Lung Sounds, Vascular rings), Kidney (Anatomy of Kidney, Acid Base Disturbance, Kidney Function, Tubules), Nerve (Axon tutorial, Nerve tissue anatomy), Simulation experiments (Anaesthetised CAT BP, End plate channel simulation, Gold Man Equation, Neuro muscular junction, Pithed rat, Squid Axon Nerve Biophysics), Asthma, Clinical Concepts of Medicines, CNS - anatomy, Cross Bridge muscle contraction mechanism, Drug metabolism, Drug Targets, Gastric Secretions and Regulation, G-Protein, Pharmacology of Inflammation, Movement Disorders, Schizophrenia).

The review of the students and the teachers were carried out by different authors. The CBL on Physiology, Pharmacology and Anatomy showed greater interest with high learning objectives, good understanding of the subject, preference of computer to that of animals, work at ease, interactive tutorials, answer to the question and doubts, can be carried over to the next hour in case of inability to attend in the stipulated hours, self learning made possible, cost and effort saving.

Other important issue to be noted is the learner could miss the significance of the topic he is going to learn in CBL, if he is not instructed appropriately to approach the CBL. The interest generated could lead into no practical experience and the problems occur during the experiments which the user may miss. As the contents of most of the program were comprehensive, allotment of time to study every detail could be inadequate.

In conclusion, Computer aided learning of experiments appear to be feasible and effective in major part of practical lessons. The Pharmacists and the students of pharmacy could benefit out of these technologies with the greater extent in learning the practical aspects of the pharmacology or physiology. Pharmacists in Middle East particularly lack the laboratory based education during their service which may be needed. These programs could bring back fruitfulness and benefits.

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