

## Multimedia software for demonstrating animal experiments in pharmacology

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### Abstract

For demonstration of animal experiments to undergraduate students of medical and paramedical faculties, a large number of animals are sacrificed every year. Such demonstrations can be humanely presented using computer simulations rather than experimental animals. Considering the necessity of such computer assisted learning tool to reduce/ replace the animal use and to refine the demonstrations as well the teaching process, a software '*X-cology: An Interactive CD-ROM for Pharmacology Undergraduates*' was developed.

This software (developed in Multimedia Director, Flash and visual basic for windows) displays complete video demonstrations of different procedures like isolation and mounting of animal tissues followed by on screen interactive interface to study the effects of various drugs on the isolated tissues. It simulates / demonstrates experiments causing undue pain to animals. The presentation is made user friendly and self explanatory.

This software can minimize the use of experimental animals in routine practical classes. It provides a tool to the teachers to clearly convey the required details on animal experiments.

**Keywords:** computer assisted learning, humane alternatives, multimedia software, animal experiments, teaching aid

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### Introduction

In recent years, internet and computer assisted learning are being widely accepted in the academia both by students and teachers. These modes of instruction are proving to be better accepted and advantageous over conventional methods of teaching and learning. As these methods suffice self-instructions, self-evaluation as well as virtualization of majority of the problems, they have revolutionized the process of education. Today, computer assisted learning has become a common modality in dissipation of knowledge. Recent progress in communication and information technology has further supported the acceptance of such methods.

This advancement has also led to development of virtualized models to be used in the teaching of the subjects like Pharmacology, Physiology and Biochemistry that involve use of animal experimentation to demonstrate the complex biological mechanisms. In the practical classes of these subjects a large number of experimental animals are sacrificed. Majority of these practicals are conducted to reinforce the well known theoretical aspects of the subjects and the learners are expected to master neither the surgical skills nor the experimental animal handling. There is a need to reconsider conductance of such animal experiments and to replace them with equally efficient and better

accepted modalities like computer simulations. Further, it is quite time consuming to demonstrate minute details of biological processes and drug effects to a batch of students. Till date it was considered that, in the practical part of a subject there is always a need of teacher-students interactions. However, bulging strength of practical batches is making it increasingly difficult to interact with each student.

Considering these facts, an interactive multimedia software was developed to demonstrate the Pharmacological experiments to medical and paramedical undergraduate students.

### Materials and methods

The syllabi of different Universities in India catering undergraduate course in Medical and Paramedical faculties were collected and reviewed for animal experiments prescribed for demonstrating physiological processes and drug actions. The expected depth of knowledge regarding each experiment was determined through the references quoted in the syllabi. The details on the experiments involving animal use were divided in to different topics to facilitate their presentation and easy navigation through the details. The content was classified into following topics:

**1) The experimental animals:** This section includes biological names of the common

experimental animals and their use in experimental Pharmacology and important information on the specific characteristic of each species that affects the choice of the experimental animals pertaining to particular biological activity.

- 2) **The equipments:** this topic includes the common instruments used for demonstration of animal experiments. The instrumental setups for routine as well as modern instruments have been presented in the interactive form as images provided with links to relevant information.
- 3) **Experimental techniques:** This section includes the information on manual skills and routine procedures involved in the experimental Pharmacology such as collection of blood samples, preparation of drug solutions and routes of drug administration.
- 4) **The experimental section** contains exhaustive details like video demonstrations on isolation and mounting of different tissues from experimental animals, an interactive interface to study effects of different drugs on isolated tissues, procedures to carry out bioassays and experiments on whole animals related to screening and evaluation of drugs. Each experiment has been started with basic information on the laboratory setup required for a particular experiment. Then the user can study minute details related to the dissection of

the animal and isolation of specific organ and its mounting. The user can further perform the isolated tissue experiment on screen and then study the details up to calculation of parameters like PD<sub>2</sub>, PA<sub>2</sub>, ED<sub>50</sub> etc. Experiments on bioassays enable the user to perform the bioassays of different type like interpolation assay, multiple point assay and matching assays

Each section has been further appended with links of important definitions, viva questions and historical information on scientists related to each section.

The interface has been designed make the navigation easy, user-friendly and accessible at minimum mouse-clicks.

The navigation through each topic has been planned so that user will not need additional verbal directions and can easily reach the expected topic details (as in Fig. 1).

In the experimental section, a facility has been provided to study and perform the experiments on screen. These interactive experiments have been designed in such a way that the learner has to proceed through a specific sequence of activities which are involved in actual experiment and is presented by the observations which are obtained in a standard setup. Further, details on calculations of drug concentrations and significance of each experiment have been emphasized through relevant details. As the user is actively involved in the performance of this on-screen experiment, this software also presents the problem



Fig. 1. An interface showing video demonstration and links for navigation

solving situations which are considered important in imparting practical skills (as in Fig. 2).

For presentation of these details, three Windows-98 based softwares *viz.* Macromedia Director (7.0), Macromedia Flash (5.0) and Visual Basic (6.0) were used. The video clips were incorporated to demonstrate the isolation followed by mounting of the tissues and behavioral responses of animals to different drugs.

The software was distributed to about 200 institutions throughout India to the medical and paramedical Institutions.

### Results

Development of this software entitled "X-cology-Experimental Pharmacology for Undergraduates has helped the teachers to demonstrate the animal experiments in the practical Pharmacology classes. This software has been very well accepted by the teachers as well as students. It has helped in reducing the number of animals that are sacrificed in the reinforcement of the theoretical knowledge.

The authors propose that, development of such a teaching aid can reduce the expenditures in terms of laboratory hours, the laboratory personnel, time of preparation for the experiment, cost of demonstration per experiment. The understanding of subject details can be evaluated through exam mode of such software hence the use of animals in routine syllabi of undergraduate students can be minimized

substantially. More such efforts to cover still wider aspect of the subject are essential to consolidate and practically implement the humane approach in teaching animal experiments.

### Discussion

After introduction of concept of three R's, use of animals in research has been considerably reduced. The inception of CPCSEA rules (Committee for the Purpose Control and Supervision on the Experiments on Animals) in India has also resulted into an upsurge of the demands for alternatives to reduce, refine and replace the experiments involving use of animals (CPCSEA, 2003). Different approaches are being implied to minimize the use of animals or to generate alternatives to experimental animals. In actual research however, the animal use has not been totally excluded, hence it is necessary to train the students of life sciences in animal experimentations. The students of medical and paramedical faculties are trained in animal experiments that involve use and sacrifice of the animals like mice, rat, rabbits, guinea pigs etc. The objectives of such practicals are to impart theoretical knowledge and demonstrate the already known facts about physiology and effects of difference chemicals on physiological processes. Hence these experiments can be efficiently conducted using computer simulations. While surgical skills can be taught using mannequins (Jowett, 2007).

The software 'X-cology: Experimental

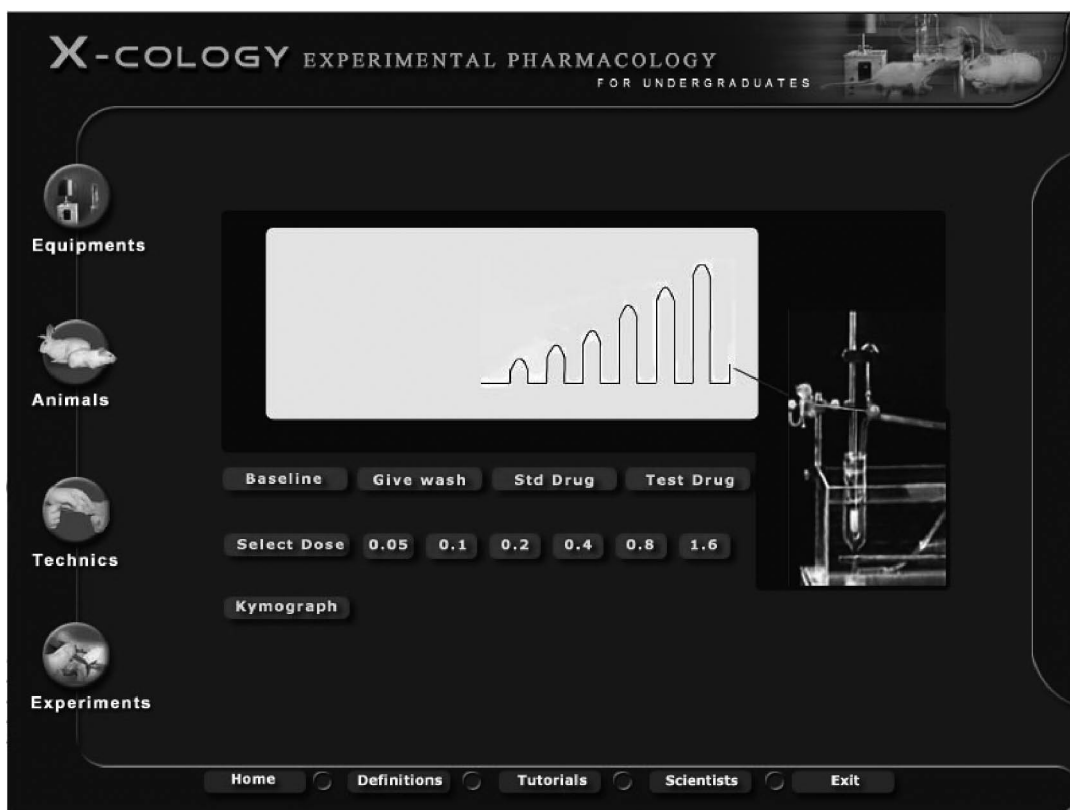


Fig. 2: Interactive interface for performing bioassays

Pharmacology for Undergraduates' developed by us is an effort to refine the process of demonstrating and performing experiments involving animals in a humane manner. The multimedia nature of this teaching aid enables the user to navigate through the details even without prior knowledge of computer use. This software is in use in certain Institutes in India and has proved to be as effective as conventional laboratory demonstrations. Also there is a possibility of multiple uses of the CAL for subsequently studying the subject details.

There are many controlled studies that have proved the computer assisted learning to be an advantage. Such teaching aids are also better accepted by students. They have proved to reduce the total investment in space, equipment, animals, and faculty time required in the traditional sequence of laboratory experiments (Rosser, 2000 and Wang 2001). The only disadvantage that is put forth on use of CAL is that there is no facility for evaluation of the knowledge and skill learned by the user (Rogers, 2000) However, the multimedia software can now eliminate even this problem if the programming of the software has been judiciously done. In X-cology, we have used an approach of providing the information to the user regarding the results that are obtained after performing a particular experiment in standard conditions hence the user can self evaluate his understanding of the experimental details. The next project to develop an Exam mode of this software has also been undertaken. The Exam mode is proposed to provide the facility to evaluate the students even during University examinations.

Thus, the software 'X-cology- Experimental Pharmacology for Undergraduates' is a teaching aid that can be effectively used to minimize the number of animals sacrificed and to reduce the undue pain inflicted on them during undergraduate medical and paramedical practicals. Further, such use of this software also fulfills the objectives of such experiments efficiently.

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## Name of the Institute where the work was carried out:

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