# Analysis of Computer Simulation Study for Pharmacodynamics

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**ABSTRACT:** The proposed system will be a computer software which is used for pharmacodynamics. The software will be developed by using and Microsoft Visual Studio and some kinds of simulation software. Pharmacodynamics is actually a mechanism of drug action. Pharmacodynamics is nothing but the experiments which are performed on living things like animals to show out the effects of certain medicines or chemicals or drugs. Pharmacodynamics is often summarized as the study of what can a drug affect a body of animals, whereas pharmacokinetics is the study of what the body does to a drug. The experiments has to perform on living things like on animal's body , nowadays the different pharma experiments like effects of given drugs on animal's bodies are banned. So we need an alternate to perform this kind of experiments which look like and real environment. The solution for this problem will be a software which do the experiments on animal bodies rather than to perform it on actual body of an animal. The software will do the experiments on simulated body of an animal. It is something like applying a drug on simulated body and see the changes on it and according to the result you can change the dose of drug.

**KEYWORDS:**Anticonvulsant, Actophotometer, Anticatatonic, Ciliary, Diazepam, Drug, Learning tools, Phenothiazine, MAYA, Morphine, Oxytocin, PCI, Pharmacodynamics, Pharmacology, Pharmacokinetic, Simulator, Simulation, System architecture

## I. INTRODUCTION

Animal simulation software are human education aids and teaching approaches that can replace harmful animal use and is used to hitthe existing teaching goals and to provide outcomes that cannot be met through animal experiments.The Pharmacy Council of India (PCI) gives the theory and practical curriculum and syllabus for all pharmacy subjects in undergraduate pharmacy courses in various universities of India. Pharmacology is branch of science that deals with the study of drugs and is taught for 2 years i.e. 24 months in B.Pharmacy during third and fourth year and is also taught for D-Pharm course in second and third year. Previously this experiments are takenpractically and they have to perform these animal experiments live to get hands on experience. Students are also involved and be a part in practical examination at the end of the semester and those who fail to clear examination are not get admission to the next semester. Presently, all the animal experiments in pharmacology subject for B.Pharm andD.Pharm are need to be replaced by animal simulation software.

In 2008, the practical syllabus given by The Pharmacy Council of India (PCI), India for D.Pharm in Pharmacology subject includes more than 10 experiment and in 1970s the D.Pharm and B.Pharm includes more than 20 experiments were taught to pharmacy students using animals like frog, mouse, rat, rabbit and guinea pig and larger animal such as dogs were used for M.Pharm students having specialization in Pharmacology.

## II. RELATED WORK

This paper give asolution to restrictions given by the government that they ban the animal procurement and testing on live animal body. Pastly, there was total 15 experiments for undergraduate pharmacy students on animals like frog, rats, rabbits, pig and etc. and the experiments were compulsory for the students to pass the examination. In 2014notification given by Pharmacy council of India (PCI) and University Grants Commission (UGC) the animal experiments have been replaced by alternatives with CAL techniques. Basically these alternative can fulfil the learning objectives of B.Pharm and D.Pharm students to a greater extent and must be implemented by applying it in institutes to overcome the ban given by the PCI. CAL i.e. Computer Assisted Learning tool is an approach where one can't harm any animal by using this software and also can do their experiments successfully [1].

**X-COLOGY PRO:**

X-cology Pro is a software used for demonstrating experiments on pharmacodynamics.Dr. C R Patil has presented the X-cology Pro at various global platforms and has generated interest in this software for simulations in Pharmacology [12].



Figure: X-Cology Pro[12]

DISADVANTAGES:

- The existing system doesn't have any audio interface or or audio included.
- They harm the live animal as they uses the video to demonstrate the experiment
- There is no proper method to calculate the observation table.
- No 3D graph.

HOW TO OVERCOME:

- The proposed system will have audio include for the better understanding.
- The proposed system will have 3D model instead of live animal, so no harm to animals.
- It will have proper way to calculate observation table.

- The Proposed system will have 3D graph generator which generate 3D graph for the given observation table.

**EXPHARM PRO:**

Author of this software is R. Raveendran Prof. of Pharmacology JIPMER, Pondicherry – 605 006. ExPharmPro is a computer assisted learning package having four or five programs which simulate animal experiments in Pharmacology. These programs can be used to demonstrate that how the drug can affect the body of the animal on different animals systems. The software is very user friendly, very interactive and full of animated sequences which make simulation realistic and more accurately one can observed [11].
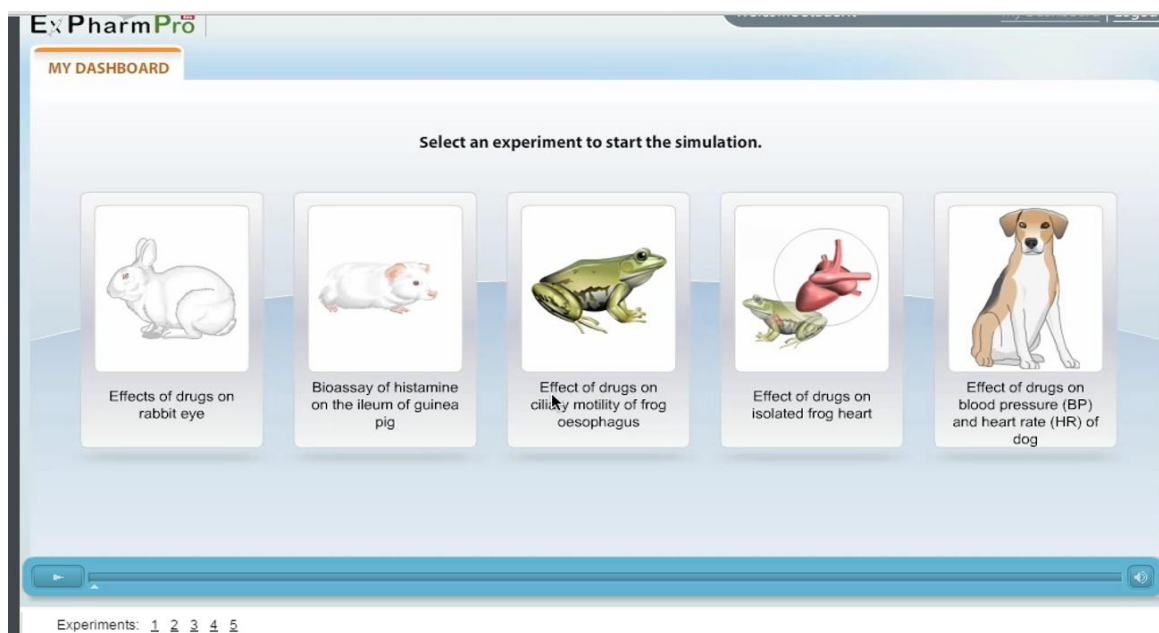


Figure: Expharm Pro[11]

DISADVANTAGES:

- The software contained 2D visualization of the animal.
- Selecting the quantity of drugs is not available.
- There is no proper method to calculate the observation table.
- No 3D graph.
- Stages of different Pharmacological responses not properly differentiated.

HOW TO OVERCOME:

- The proposed system will have audio include for the better understanding.
- The proposed system will have 3D model instead of live animal, so no harm to animals.
- It will have proper way to calculate observation table.
- The proposed system will have stages of different Pharmacological responses.

III. **PROPOSED ARCHITECTURE**

IV. *ARCHITECTURAL DESCRIPTION*

The proposed system architecture contains no. of different modules. The flow of the system architecture starts from selecting the experiment. Here we have to select the experiments given by the PCI to the B.Pharm and B.Pharm. After selecting the experiment we've to choose on which animal we've to perform the experiment, the animals will be like rats, rabbits, frog and etc. After selecting the animal, how much dosage of drugs we have to inject on a particular animal's body or part, dosage are something like the medicine given to animal by injection for the given experiments. After all this process the animal reacts and changes its behaviour. In the simulation process the animal start changing its behaviour according to the dosage of the drug. For example if we inject 30mm of drug into rabbits eye then the diameter of the rabbits eye changes. After the simulation process the observation table is generated related to the animal experiment. The observation table varies according the experiments. The last module of the system architecture is to generate the 3D graph.

Broadly, we've six modules in our system architecture which are selecting experiments, select animal, select drug, start simulation, generate observation table. The detail information about the modules are given below.
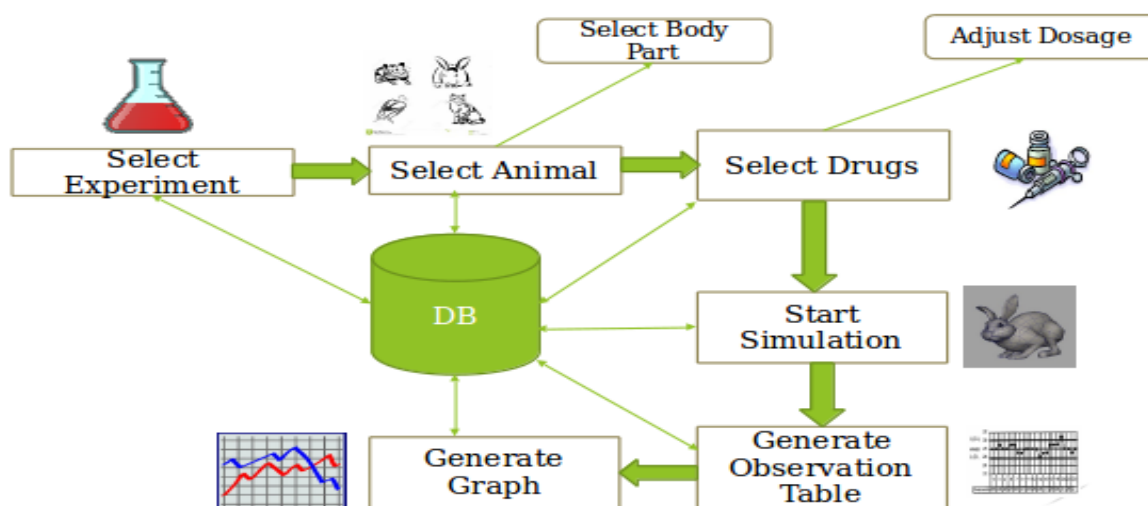


Figure: System Architecture

• **SELECT EXPERIMENT**

In this module, the student has to select the experiment. There would be different experiment lists in the select experiment module. The Pharmacy Council of India (PCI) gives the list of experiments to the B.Pharm and D.Pharm as per the given experiments the student or professor or any practical performer has to select the experiment. The below table shows the some of the experiments given by the Pharmacy Council of India (PCI).

| NAME OF THE ANIMAL | EXPERIMENT |
| --- | --- |
| Rat | 1. To Record The Concentration Response Curve of Oxytocin Using Rat Uterus Preparation. <br><br> 2. To Study Effect Of Diazepam On The Muscle Grip Strength Using Rota Rod Apparatus. |
| Mice | 1. To Study Analgesic Activity Of Morphine On Mice Using Hot Plate Method. <br><br> 2. To Study Anticonvulsant Activity of Phenytoin in MES induced convulsion in mice. <br><br> 3.To Study Effect of Drug on Locomotors Activity of Mice Using Act photometer |
| Rabbit | 1.To Study Effect of Drug on Rabbit Eye |
| Frog | 1. To Study Effect of Drug on Isolated Frog Heart. <br><br> 2. To Study Effect of Drug on Ciliary Motility |

Table: List of Experiments [1]

- **SELECT ANIMAL**

    In this module, the student has to select the animal. On which animal the students has to perform the experiment. Student also can choose the part of animal's body like frog's heart, eyes, etc. Theselect animal module have a sub partcalled 'Choose Body Part'. For example if the student has to perform experiment on rabbit eye so first the student has to select the animal(rabbit) and body part(eye). Same as student or professor or any practical performer want to select the heart of the rabbit then firstly he has to select the animal in this case the animal is rabbit then he has to select the body part for selected animal and here we want to select the heart so simply we select the heart.

- **SELECT DRUG**

    In this module, we have to select the drugs like medicine or some sort of chemicals which are going to use in selected experiments. In which,we've to select that how much quantity of drug we have to inject in the animal or animal's body part. The drug selection quantity is predefined in the module like there will be no option to provide self-define quantity of drugs the quantity of the drug will be provided in the program itself. The drug injection varies the animal body behaviour.

- **START SIMULATION**

This is the main module of this software. There will be a model of the animals like rat, frog, rabbit and etc. as per the student select the animal. After selecting the drug the animal which is selected is reacting or changes its behaviour. The actual behaviour of the animal is shown in this module.This modules show the original model i.e. before giving drugs and after giving drugs. There will be a different stages like the experiment on rat's heart can be for more than a week and we have to observe the changes at every day of the week so this software can be able to show the effects and behaviour at every stage.

- **GENERATE OBSERVATION TABLE**

After the simulation process an observation table is generated where the student gets easily understand the experiment. The values of the observation table is based on the simulation Section.

- **GENERATE GRAPH:**

After the generation of observation table there will be an option from where you can generate or obtain thegraph based on the generated observation table.

## V. CONCLUSION AND FUTURE WORK

This project fulfil the practical scope and objectives of pharmacology curriculum of B.Pharm and Pharm D students to give the freedom of performing experiments after banning the live animals to be test for undergraduate curriculum. The emerging trends of using this software as an alternative to animal experiments has a greater significance of reduction of time, human source and repeatability. It may help and motivate pharmacy students to study the mode of action of drugs and develop skills and to prepare them for perfect or rational or the point of accurate use of medicines. As per the rules or restriction given by CPCSEA, UGC and DMC the student suffered from many difficulties like lack of animals. But after development of computer tool to perform the same task students can easily perform the experiments without hurting the rights of animals and any live animals.

There will be a lots of correctness need to be look like the no. of experiments, no. of animals, the observation table can be more attractive there will be also an option for printing the graph and can also have the ability to generate all type of graph like line graph, bar graph, 3D bar graph and etc.

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**BIOGRAPHY**

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