

## Revisiting undergraduate practical pharmacology

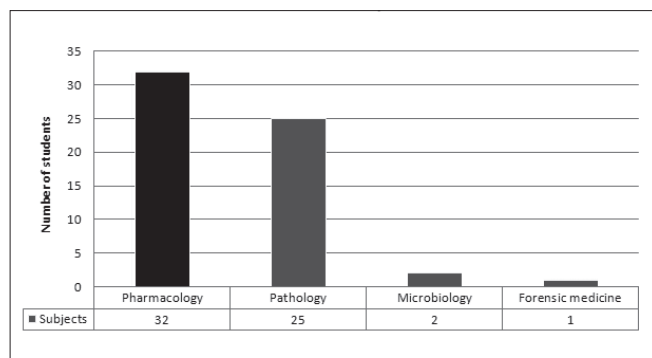
Sir,

Practical, being the most basic and effective tool for imparting knowledge, goes hand in hand with theory for better understanding and concept building. In view of the complexities in the basics and fundamentals of Medical sciences, a good practical demonstration of the underlying concept is a must to simplify the subject. Due to the rapid pace of research and generation of new knowledge, the traditional system of teaching is becoming increasingly inadequate to meet the requirement of the emerging doctors. The same is true for Pharmacology, especially for Practicals, which have become obsolete due to progressive innovation and development in the

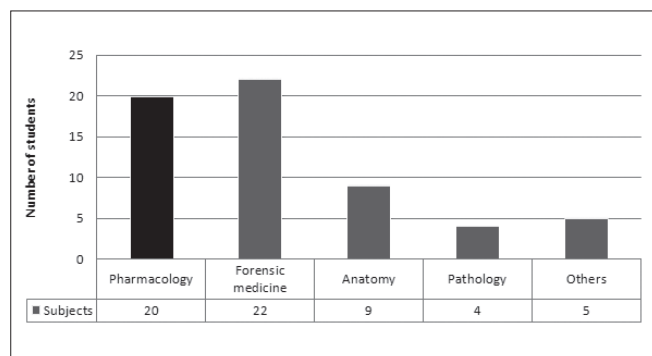
field, and are described by many academicians as being ‘out of sync with the current clinical scenarios’.

A survey of 60 medical graduates revealed that while a majority considered pharmacology as the most important second year subject, they also recognized the pharmacology laboratories as the most boring and least useful practical laboratories. Therefore, we intend to write this article to identify ‘what went wrong’ with practical pharmacology and ‘what needs to be done’ to make pharmacology more beneficial to students [Figure 1].

In general, the Indian medical schools offer two or three types



**Figure 1:** The most important subject of the second MBBS professional year as judged by MBBS graduates



**Figure 2:** The most boring and least useful practical classes as judged by MBBS graduates

of laboratories in their teaching curriculum, namely, pharmacy, experimental pharmacology, and sometimes a clinical pharmacology laboratory. Pharmacy laboratories are concerned with prescribing, compounding, and dispensing of some drugs. The fact remains that the work done and the knowledge gained by the students through practicals, in the Pharmacology laboratory, with the exception of prescription writing, has no relevancy in their future practices. Unfortunately, students being familiar with this fact, usually adopt a desultory approach toward the subject, with the sole aim of qualifying in the examination. [Figure 2]

As for experimental laboratories, the ban on most of the experimental animals has shrunk the scope of an experimental pharmacology laboratory to its shadow. Barring Rabbit eye experiments and perhaps an analgesiometer, the experimental laboratories are essentially dysfunctional. Therefore, a new syllabus has become the imminent need of the hour.

Our primary objective is to develop the skills and knowledge of an average student, on conclusion of the pharmacology curriculum, to enable him to theoretically treat a diagnosed patient of a given disease (without complication) with a rationale drug protocol. As Pharmacology is the foremost field of research in medical sciences, the students must be provided ample opportunities to learn the basic principles of preclinical and clinical research and

drug development. Therefore, our secondary objective must be to mould the young brains of medical students toward questioning and reasoning the present knowledge, identifying the loopholes, and trying to rectify them by using a generation of new knowledge. With the MCI's 2015 vision in sight, we have tried to incorporate the primary and secondary objectives and tried to evolve this prototype, the 'Practical Pharmacology Module,' which has three laboratories, an evening teaching programme and a year-long project, integrated with each other.

### Project 'Experimental pharmacology' laboratory

The Laboratory is to familiarize students with the research methodology, to enhance team skills in drug development and to learn at least two kinds of drug screening methods.

### Types of practicals

Each group of five students, consisting of a group leader, recorder, speaker, and two practical handlers, has to screen a drug, a plant extract or a chemical, during their three-month posting under the supervision of a guide. The students will be evaluated on their presentation of a full length article, which may be published in a journal or college magazine. In order to boost the seriousness and competitive environment among the students, the publications would be entitled for extra credits in the final examination.

### Infrastructure

A well-equipped experimental laboratory, with different kinds of drug screening techniques and facilities, drugs (plant extracts prepared via the Soxhlet apparatus or organic / inorganic compounds obtained from chemistry laboratories), laboratory animals, and clearance certificate from the Institutional Ethical Committee.

### Evaluation

Practical: The students' ability to demonstrate, via a practical performance, their respective Project works, Systematic data recording, and result analysis, including basic statistics.

Viva voice: Formulating a research protocol and a comparative study of their drug with other standard medications.

### Clinical pharmacology laboratory

The aim of the laboratory will be to generate clinical orientation pertaining to the treatment of disease and correlating the pharmacological concepts with diverse medical simulative treatments on a mannequin. In addition to it, a brief introduction to Drug delivery devices and hands on practice on different routes of drug administration will also be provided. There will be additional facilities for Theoretical introduction on clinical research, Therapeutic drug monitoring, and adverse drug reaction reporting.

### Types of practicals

- Practical demonstration of the mode of drug administration. (Intravenous, intramuscular, Intraosseous, and subcutaneous)

on a mannequin). Dose calculation and method of giving a calculated dose by parenteral routes.

- Practical demonstration (on dummies) on the use of different drug delivery devices like respiratory devices, such as, inhalers, nebulizers, and the like, and insulin delivery devices like insulin pens.
- Basics of clinical trials and drug development.
- Basics on Adverse Drug Reaction (ADR) reporting and filling up of an ADR reporting form for a model case.
- Therapeutic drug monitoring and clinical uses based on problem-based learning.

#### *Infrastructure*

Demonstration class with a practical table. Mannequin, different injections, different drug delivery devices for hands-on training of students. Projector and blackboard for integrated problem-based teaching.

#### *Evaluation*

Practical: Demonstration of the use of various drug devices and different routes of drug administration.

Viva voice: Dose calculation and phases of clinical trials and their main challenges.

#### **Computer-assisted human pharmacology laboratory**

A Computer-assisted learning (CAL) laboratory is an emerging concept in pharmacology practical teaching. The limitation of use of animals in practical classes has further enhanced its importance in the present scenario. The Medical Pharmacology Department of Aligarh Muslim University has the privilege of having such an advanced Computer-Assisted Laboratory. Even though the laboratory is still in its infant stage with regard to the teaching techniques and methods of evaluation of students, it has still been a corner stone in concept building, especially in the pharmacology of the autonomic nervous system. One problem that is faced by students is their inability to relate it to a clinical problem. The emerging view is that if we are going to simulate a particular system in pharmacology, then why not use human parameters instead of animals, which indeed would be easier to understand and can be correlated by the students. The disease scenarios (especially of the Emergency, Operation Theater, and the Intensive Care Unit) will give students a chance to perform in a simulated, stressful, and time-controlled environment. Hence, computer-assisted learning in simulated humans will be the second generation of CAL laboratories. However, the computer software and programs that can mimic human physiology and pharmacology, while simulating actual cases in medical ICUs and OTs, are yet to be written, for fulfilling our criterion of this laboratory.

#### *Types of practicals*

- Effects of drugs on the heart, gastrointestinal tract (GIT),

respiratory, and autonomic nervous systems, with the help of cardiac, respiratory, and other relevant clinical markers.

- Group exercise: Complete simulation of the relevant cases (in Emergency, ICUs, and OTs) followed by step-by-step treatment (group leader giving instruction to other students assisting him in a quest for saving a patient's life [simulated] with or without an integrated computerized mannequin).
- Simulated drug interaction studies with common medication when given together and the adverse effect profile study by a case scenario.

#### *Infrastructure*

A computer laboratory with a suitable number of computers, (two students per computer), computer software-like windows, teaching software, and so on.

#### *Evaluation*

Practical: To demonstrate step-by-step treatment of a simulated case scenario.

Viva voice: To explain the mechanism of action and underlying principle behind the particular drug treatment in the given problem scenario.

#### **Evening 'prescription teaching'**

Providing a more clinical outlook to pharmacology when teaching the students on regimens and protocols for treating different subacute and chronic invasive pneumococcal diseases (IPD) (inpatient department) diseases.

#### *Types of practicals*

Hands-on treatment of subacute and chronic IPD diseases like stroke, arrhythmias, COPD, nephrotic syndrome, and the like, followed by IPD bedside teaching in a group of students, with emphasis on therapeutics, in addition to recognition and treatment of common drug interaction and adverse drug reaction. A detailed overlook on prescription writing will also be taken into account.

#### *Infrastructure*

Bedside teaching with access to the Inpatient Department of the hospital.

#### *Evaluation*

Case-based viva voice on treatment protocols and prescription writing.

#### **Drug designing**

Drug discovery and designing are the important aspects of pharmacology and the students are encouraged to undertake the primary steps in this aspect.

#### *Types of practical*

- The students will be given a one-year assignment (no

laboratory required) to formulate a drug based on:-

- Chemical: In the chemical section of the Pharmacology Department or in the Department of Organic and Applied Chemistry.
- Plant extract and / or fractions of its components.
- A brief introduction to in-silico techniques.
- These drugs may be used in the experimental projects of the students in the following year, for screening purposes.

### **Infrastructure**

Chemistry laboratory for a student group of 10 to 20 each, plant extraction instruments, and a computer with internet facilities.

### **Evaluation**

End-of-session presentation on their drug, including its method of discovery and formulation, followed by viva.

The proposed module will help the students cover major treatment protocols and prescription writing for common emergency, sub-acute, and chronic IPD diseases, as instructed in the CAL laboratory and evening prescription teaching. Furthermore, the students will also be able to use various drug delivery devices according to different routes of drug administration in emergency and non-emergency settings, as taught in the clinical pharmacology laboratory. The new

generation of CAL laboratories will provide opportunities to students to make 'life-saving decisions' in simulated stressful conditions. Working in groups will enhance their leadership quality, mutual respect, and ability to divide work for effective patient care. The proposed training module will also enable the students to have a basic knowledge on clinical research, research methodology, and drug development.

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