INTRODUCTION

Research is probing the unknown through carefully planned experiments to find answers to a question or to explain a particular phenomenon. The scientist first formulates a hypothesis which is either confirmed or rejected by performing experiments. Thus, it is important that experiments are conducted properly, observations are made without bias, and data are recorded accurately. Conducting research requires that we are aware of and capable of understanding basic activities during the period of research. We now have a range of instruments, which extend our ability to observe and acquire data that are beyond our sensory perception.

The chapters on "The Basics of Research" introduces the scientific method and the concept of hypothesis testing, which are the foundation of the modern scientific enterprise. The interested student is encouraged to read the origins of the scientific method and perhaps the history of science. This would lead to the origins of the philosophy of science and how philosophy contributed to the development of the scientific method. Philosophy is regarded as the initial source of knowledge, before the advent of science.

There are no rules or regulations in the conduct of science; the scientific process regulates itself and progress is by a process of peer review. This means that peers – experts in one's field of research are the judges of one's scientific output when it is submitted for evaluation. These experts are supervisors of research, members of a thesis committee or editors of science journals. While by no means foolproof, this method has successfully guided the progress of science. It therefore, calls for a high degree of ethical conduct by scientists in the conduct and reporting of their results and the best place to begin is at the beginning of a research career. The chapters on Research Ethics should be taken seriously – whether it concerns research in general or research concerning humans or animals. The chapter on Experimental Designs gives an outline of how experiments should be designed so that meaningful results can be obtained. This is particularly important for research on human and animal subjects, where ethical consideration precludes certain experiments and replication is an issue.

Before beginning our research, we should be aware of what similar work has been done by other scientists, not only to avoid duplication but also to design and extend our experiments to answer unanswered questions. There has been an explosion of literature in the recent past which is growing exponentially day by day, particularly since the availability of the internet. One needs to know, not only where to look

for literature but also how to search and identify what is relevant. The chapters on Literature Resources provide a comprehensive answer to these questions and useful tips to look for freely available resources on the internet. Even senior researchers would find resources they were unaware of, and there is a wealth of information for everybody in these chapters.

The laboratory is a place with sophisticated and expensive instruments, chemicals and glassware. The objective of the section on 'The Laboratory' is to provide familiarity with the simple instruments, glassware, and the hazardous nature of chemicals in a laboratory. It is important to learn and observe the basic safety precautions when working in the laboratory. Also discussed are the basics of quantitative and volumetric calculations which form the fundamentals of many experiments in a laboratory.

The chapters under Physical Units and Measurements deals with measurements and describing them, which are fundamental to science. The basis of physical quantities is explained and also the conventions for writing such quantities and their units. Numbers are meaningless unless associated with the correct physical units and expressed correctly. The significance of the number of decimals that we record and the uncertainty associated with the measurements and the determination of this uncertainty are also explained. The researcher should always be skeptical of the reliability of instruments used in the experiments. Digital displays with many decimals are always impressive. The chapters on The Science of Measurements (Metrology) and Calibration of Equipment explain how to verify the accuracy of these readings using appropriate standards and calibration of instruments.

The success of the experiments and the validity of conclusions arrived at are ultimately dependent on the meticulous observations made and the recording of data. The chapters under Records and Writing explain how to maintain a laboratory notebook and what records and observations should be entered. It is necessary to make not only unbiased observations but also to know what to record. Well maintained records of experiments are indispensable when writing the results in the future. The constructing of tables for entering data and some guidelines for writing the thesis are also given. A brief guide is included on how to conduct yourself with your supervisor to make optimum use of their time and expertise.