Preface

Experimental Microbiology is a laboratory manual intended to introduce you to the field of microbiology. It is designed to allow you to begin to explore the world of microorganisms and to understand how microbiologists carry out the process of scientific discovery. Each exercise provides sufficient information so that you can understand the principles involved, that is, what does the exercise mean and why are you doing it. Each exercise also has a sufficient description of procedural detail so that you can perform the experiment independently and safely. Be sure to prepare in advance for the laboratory exercises you are going to perform; read your laboratory manual before coming to the laboratory. As Pasteur stated, "Chance favors the prepared mind."

In performing the experiments it is imperative to keep safety in mind. When used properly, microorganisms and the chemical reagents used to study them are not harmful. When used carelessly, however, you can hurt yourself or others. Be sure to read the instructions before performing the experiments, paying particular attention to the specific safety cautions for that exercise. Think about what you are doing and do not rush. Using common sense, such as avoiding placing your hand or hair in a Bunsen burner flame, so that you do not burn yourself, and avoiding mouth pipetting, so that you do not accidentally drink a bacterial culture or toxic chemical, will help ensure your safety and the safety of others in the laboratory.

The microbial cultures you will be working with are alive and although they have been selected because they are not supposed to be human pathogens, you should be aware that any microorganism can be an opportunistic pathogen. For example, in many experiments you will be working with the bacterium *Escherichia coli.* This is the most commonly and extensively studied microorganism. Each of us has billions of *E. coli* living in our intestines where they contribute to our health. Without bacteria living in the intestine, you would become ill. *E. coli,* however, is a major cause of urinary tract infections. If you were to accidentally inoculate your bladder with a culture of *E. coli,* you would become ill. So, be careful in handling the cultures and you will have an exciting and enjoyable learning experience as you perform the exercises in this laboratory manual.

Remember that a key component of any scientific investigation is to make observations. Because microorganisms are invisible to the naked eye, you will have to employ various microscopic methods in order to make observations of individual microbial cells. Only with a microscope will you be able to see the shapes and other structural details of microorganisms. You will also have to grow pure cultures of microorganisms in order to study them.

Organization

The laboratory manual is divided into three parts.

Part One Microbiological Methods

Part One is divided into eight sections covering different aspects of microbiology and the methods needed to study specific areas such as virology and immunology:

- Culturing and Handling of Microorganisms
- Observing Microorganisms and Their Structures
- Microbial Metabolism
- Enumeration of Microorganisms
- Microbial Genetics
- Virology
- Microbial Identification
- Immunology and Host Defenses Against Disease

This Part introduces the techniques needed to study microorganisms. It is in this section that you will learn the microscopic methods for observing microorganisms and the pure culture techniques for growing microorganisms so that you study their physiologies and genetics. You will begin by learning the fundamentals: safety in the microbiology laboratory and aseptic technique and how to handle microorganisms safely and transfer them between vessels without contaminating either yourself or the microorganisms. A series of exercises will enable you to practice aseptic technique, the preparation of microbiological media, the proper storage of media and cultures, and to understand the relevance of these important techniques to the successful completion of the exercises that follow. Probably the most important factor in your successful completion of the exercises in this laboratory manual is the mastery of these basic aseptic techniques.

Part Two Microbiological Investigations

Part Two is divided into seven sections covering different aspects of basic and applied microbiology and the investigative approaches used in studying these areas of microbiology:

- Cell Structure
- Microbial Growth
- Microbial Death
- Microbial Systematics
- Medical Microbiology