

## **INTRODUCTION**

Hello! It's Gene again. Are you ready to have some fun? It is time to apply your knowledge about me using the workbook FUN WITH GENE. The workbook complements the textbooks CALL ME GENE and MY NAME IS GENE.

The book is divided into three sections:

1. **Cases to Solve**. You will be able to solve cases related to genetic diseases, agriculture, and forensic medicine. You will also learn about pedigrees and how scientists use the GeneBank database to identify and/or retrieve DNA sequences. This section is divided into two parts: THE BASICS and BEYOND THE BASICS. The former includes cases that are easy to solve. The latter contains more challenging cases to solve and a family pedigree. BEYOND THE BASICS is for the more daring among you.
2. **Hands-on Activities and Games**. In this section, you will learn how to extract DNA from a vegetable and make simple DNA and cell models. A game will show you how DNA decoding works. A crossword puzzle and a word search are also included.
3. **Exercises**. In this section, you will test your basic knowledge of DNA, RNA, mutations, and cell structure.

I hope that you will have fun. I will certainly have my own fun watching you work on me!



## What Makes A Good Scientist?

A good scientist conducts experiments under safe and environmentally appropriate conditions. He/she follows procedures set by his/her institution for conducting research in the laboratory. These include: wearing appropriate clothing, handling all materials cautiously, and disposing of any material according to procedures outlined by the institution. The laboratory should have signs and labels for any hazardous materials and be equipped with instruments that are in good condition. A good scientist conducts experiments with honesty and integrity.

Before a scientist begins with experiments, he/she should first investigate his/her proposal to check its feasibility. He/she should also critically evaluate and analyze the strengths and weaknesses of the proposal by a review of existing scientific literature.

Many grants that scientists apply for from the government require a detailed description of the project. The following are NIH (National Institute of Health) Guidelines for submitting a research proposal:

1. **Specific Aims:** The scientist has to state the specific purpose of his/her proposal and the hypotheses to be tested.
2. **Background and Significance:** The scientist has to write detailed background information on the proposal and state the importance of that

information in relation to his/her specific aims and long-term objectives. He/she should ask questions such as whether the proposal will contribute to society and in what ways.

3. **Research Design and Methods:** The scientist has to write a detailed description of all the procedures that will be implemented to accomplish his/her aims. These include all instruments and materials that will be used in the experiments.
4. **Preliminary data:** To evaluate the feasibility of a long-term project, many grants require the scientist to perform preliminary experiment(s) before embarking on the project. The scientist must record all his/her observations and findings in a clear and orderly fashion.
5. **Literature Citation:** The scientist has to list all references cited in the research proposal.

## SECTION 1

NOTE: In Basics case 1, and Beyond the Basics cases 1-4, the characters depicted are fictitious. Any similarity to existing characters is accidental and unintentional.

### THE BASICS

#### Can you solve the case?



#### CASE 1

Prerequisite: Punnett Square and basic Mendelian genetics (Chapter 3)

#### Sickle-Cell Anemia

Bill and Jane were married and a year later, they decided to start a family. They knew that Bill had a great-grandmother who had died from sickle cell anemia. In order to have the disease, a person has to inherit one copy of the gene from each parent. Jane was not sure if any of her ancestors had the disease. When baby Kyle was born, he seemed healthy. Several months later, the baby was not doing well and the doctor diagnosed sickle cell anemia. Bill and Jane were unhappy and confused. They knew that a long rough road was ahead of them. Since both were healthy, they knew that they must be heterozygous for the defective hemoglobin gene. DNA tests on blood samples taken from Bill and Jane confirmed their suspicions.

What do you think are the test results? Let us say that the gene for sickle cell anemia is *s*. Use the Punnett Square and then circle the correct answer from the following:

- Both Bill and Jane have one copy of the *s* gene.
- Jane, but not Bill, has two copies of the *s* gene.
- Bill, but not Jane, has one copy of the *s* gene.
- Both Bill and Jane have two copies of the *s* gene.

Punnett Square:


What is the chance of Bill and Jane's next child developing the disease?  
Circle the correct answer and explain in the space provided below.

- 100%
- 50%
- 25%
- 0%
- None of the above

**Explain:**

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