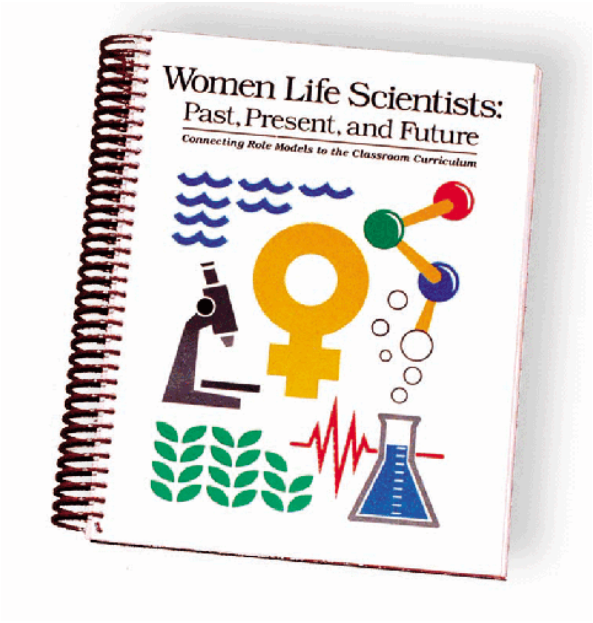

Alice Huang

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Copies of the activities from *Women Life Scientists: Past, Present, and Future* can be found at http://www.the-aps.org/education/k12curric/index.asp. To purchase bound copies, visit the APS store at http://www.the-aps.org/cgi-bin/ecom/productcatalog/Product_catalog.htm.

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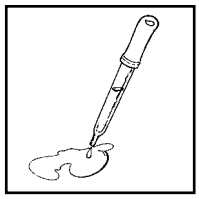
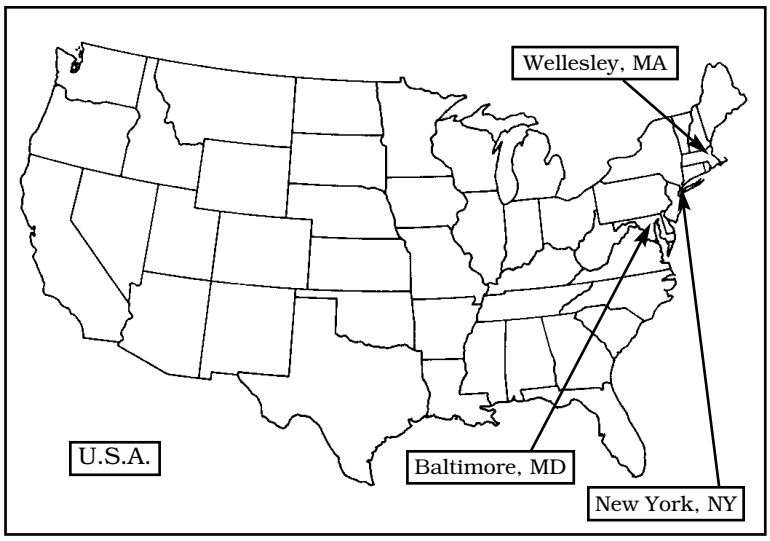


Alice Huang
Microbiologist/Molecular Geneticist
1939-

Unit developed by
Ann E. Haley-Oliphant
Miami University, Oxford, Ohio

Who is Alice Huang?

Alice Huang is a Professor of Biology and Dean for Science at New York University. She attended Wellesley College in Massachusetts for two years and then earned her bachelor's and master's degrees from Johns Hopkins University in Baltimore, MD. In 1966, Dr. Huang earned her Ph.D. in microbiology, also from Johns Hopkins University. She worked at Harvard University for 20 years prior to her current appointment at New York University.



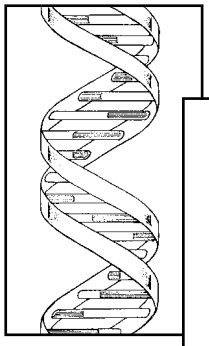
Why did Dr. Huang become a scientist?

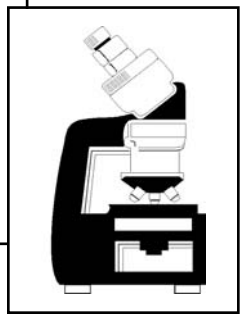
Dr. Huang was born in Nanchang, a city in central China, on March 22, 1939. She came to the United States as a child and became a U.S. citizen. She is married and has one child. Dr. Huang knew she wanted to be a doctor by the time she was 7 years old. She had the chance to enter medical school, but she soon realized that she could only help one patient at a time as a doctor. If, on the other hand, she became a researcher, then she might find answers that would help many patients. Also, she found that she really loved working in laboratories.

Who influenced Dr. Huang?

Dr. Huang's choice to become a scientist was influenced by her father, who told her that she could do anything that she wanted to do. When she entered graduate school in the early 1960s, she soon realized that there were limitations placed on women's aspirations. Dr. Huang had two teachers who inspired her during her early education. She states, "I had some wonderful women teachers who instilled in me a dedication to excellence, no matter what I did. They also instilled a real desire to be helpful to others. Two women, both Quakers, were very special to me. They were my fifth and sixth grade teacher, Elizabeth W. Jackson, and my high school history teacher, Elizabeth Fry."

What are Dr. Huang's greatest contributions to science?

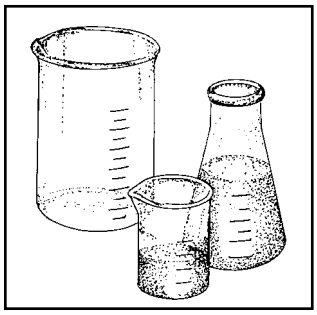




Dr. Huang discovered and characterized *defective interfering viruses*, that is, viruses that have the potential for helping to control plant, animal, and human viral diseases. These viruses produce natural *mutations* — changes in their DNA or RNA structure — that help control these viral diseases. She is intrigued by the rate at which viruses acquire mutations. She also explores the causes of those mutations. Studying mutations allows researchers to monitor evolutionary changes, which is very exciting because of its practical value. Dr. Huang has spent time studying the AIDS virus and she says, "Armed with knowledge of evolutionary processes, perhaps we can head off the next pandemic" (Huang, A. S. and Coffin, J. M., 1992).

In what other professional activities has Dr. Huang been involved?

Dr. Huang has served as president of the American Society for Microbiology, a professional society of approximately 44,000 microbiology researchers in the U.S. and around the world. She has been a member of the U.S. Army Medical Research and Development Command Advisory Committee under the Office of the Surgeon General. She received a patent in 1969 for "Defective Interfering Particles" at Massachusetts Institute of Technology. She also received a patent for a new laboratory method that allows researchers to test for *bacterial adherence*, or the ability of bacteria to stick to surfaces. At New York University, Dr. Huang is participating in a project in science education. She has obtained a grant that focuses on improving teachers' preparation for and ability to engage students in science exploration and discovery.



Do You Know These Terms?

EPIDEMIC

An epidemic is a disease that occurs at a level that is higher than normal, e.g., flu.

ENDEMIC

An endemic disease is one that is persistently present in a given area, e.g., cholera in India and malaria in Asia.

OUTBREAK

An outbreak is the sudden appearance of a disease, often in a small portion of the population, such as Legionnaire's, and food poisoning (*E. coli*, for example).

PANDEMIC

A pandemic is an outbreak of a disease that occurs over a wide geographic area and affects a very large percentage of the population, such as plague and HIV/AIDS.

SUGGESTIONS FOR TEACHERS

ACTIVITY #1: Mutations — Get the Point?

Purpose

For students to simulate *substitution*, *addition*, and *deletion* — the three types of point mutations that occur in DNA.

Objectives

1) To define the three types of point mutations.
2) To have a better grasp of protein synthesis.
3) To describe how mutations produce changes in the cell.

Materials

For each pair of students

- envelope containing one set of the "Base Cut-Outs" on page 236

Before You Begin

1) Make (or have students make) a complete set of "Base Cut-Outs."
2) Be sure students have an understanding of the significance of DNA in controlling life processes, how DNA codes for an amino acid, how proteins are made from amino acids, and the process of protein synthesis.

Safety Considerations

None.

Questions to Ask

- What is a mutation?
- How can DNA mutate? Describe a mechanism in which this occurs.
- Why is a change in DNA permanent for the cell?
- How does a point mutation cause severe changes in the organism? For example, sickle cell anemia is caused by a change in the base sequence that specifies one amino acid of the hemoglobin molecule.
- Why should we be so concerned about mutations?

Where to Go From Here

- Invite speakers such as genetic counselors, doctors, and nurses to discuss diseases caused by mutations.
- Have students research the effects of certain drugs and toxic chemicals on chromosomes.
- Have students research environmental agents, such as certain food preservatives that are known to cause mutations, and describe their mechanism of action.

Ideas for Assessment

- Evaluate student activity worksheets.
- Discuss the importance of mutations in organisms.

References and Resources

Huang, A. S., & Coffin, J. M. (1992). How does variation count? (News and views in virology). *Nature, 359*, p. 107-108.

McInerney, J. (1989). Genetics and the quality of life. *The American Biology Teacher, 51 (5)*, p. 264.

Thompson, R. (1989). Recombinant DNA made easy II. Gene, gene, who's got the gene? *The American Biology Teacher, 51 (4)*, p. 226.

Travis, J. (December 1995). Mutation location may predict cancer type. *Science News, 148*, p. 374.

Williams, G. C., & Neese, R. M. The dawn of Darwinian medicine. *The Quarterly Review of Biology, 66 (1)*, p. 1.

✓*Photo credit:*

Photo on page 231 courtesy of Alice Huang, New York University, New York, NY.

Base Cut-Outs

Instructions

1. Cut out each of the letters below.
2. Place a full set of letters in an envelope.
3. Make up one envelope for each pair of students.

A	A	C	D	E	E
G	H	H	M	O	S
T	T	T	W		

ACTIVITY #1: Mutations — Get the Point?

Background Information

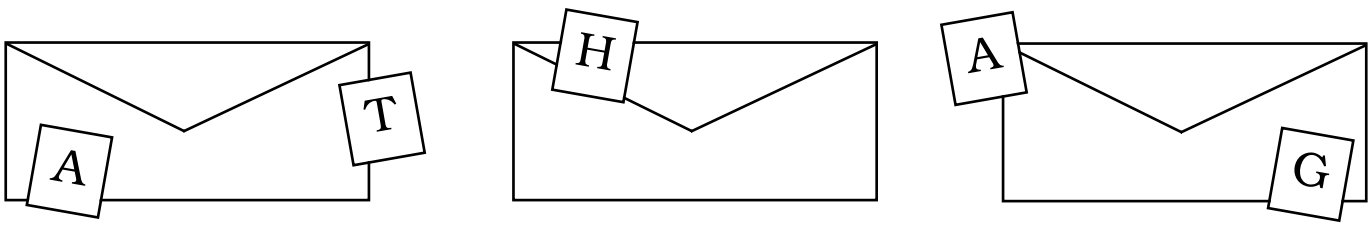
- A ***nucleotide base*** is a building block for nucleic acids (e.g., DNA and RNA).
- An ***amino acid*** is a building block for proteins.
- A ***protein*** is a compound that makes up the structural materials and enzymes in a cell.
- A ***point mutation*** is a change in the DNA of a gene. It involves only one or a few bases of DNA.
- A ***triplet code*** is a set of three nucleotide bases that code for a partiular amino acid.

Procedure

1. Using the *nucleotide bases* that are provided to you in the envelope, you will work with a partner to simulate *point mutations*.
2. To do this, you and your partner will arrange the *nucleotide bases* of DNA using *letters*, *words*, and *sentences* as models.
3. Use the following key as your guide:

Letter = Nucleotide Base
Word = Amino Acid
Sentence = Protein

HINT: Three *nucleotide bases* provide the "code" for the building of *amino acids*, and *amino acids* link to form *proteins*. In the same manner, *letters* provide the "code" for the building of *words*, and *words* link to form *sentences*.



Simulating Point Mutations

1. Using the letters in your envelope, arrange the bases in the following order:

T	H	E		C	A	T		S	A	W		T	H	E		D	O	G

(Remember: this sentence represents a *protein chain*)

QUESTIONS TO ANSWER

- Why are the bases in sets of three?
- What term is used to describe a set of three bases?

2. Now, rearrange your bases to simulate a *substitution point mutation:*

Replace the letter D **with the letter** H

QUESTIONS TO ANSWER

- How does the new sentence read?
- What happened to the sentence? Does it make sense? Does it have a new meaning?

3. To simulate an *addition point mutation*, rearrange your bases this way:

Add the letter [M] **after the letter** [C]

Move your bases into sets of three, but keep them in the same order

QUESTIONS TO ANSWER

- How does the new sentence read?
- What happened to the sentence? Does it make sense? Does it have a new meaning? How would this new sentence affect a conversation you were having? Would you be able to continue talking about the cat?
- What would happen to the protein if an addition point mutation occurred in the DNA?

4. To simulate a *deletion point mutation:*

Delete the letter [C] **from your sentence**

QUESTIONS TO ANSWER

- How does the new sentence read?
- What happened to the sentence? Does it make sense? Does it have a new meaning?
- What might occur if a deletion point mutation occurred in the DNA?
- Describe the relationships between mutations, amino acids, and proteins.