

## **Marian Johnson-Thompson**

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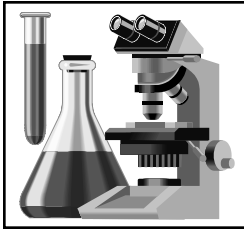
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**Marian Johnson-Thompson**  
**Molecular Virologist**  
**1946-**



*Unit developed by  
Marsha Lakes Matyas  
The American Physiological Society*

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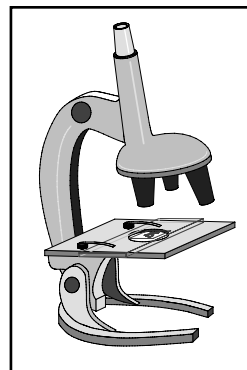


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## Growing up in Florida

Marian Johnson was born in Boston in 1946. She grew up in Rivera Beach, a small town in southern Florida. She was the oldest of six children. Marian's father was a physician born in the West Indies. He wanted Marian to follow in his footsteps and become a physician as well. Since her father was a "country" doctor who was always on call, day and night, Marian never saw being a physician as glamorous or exciting, but as a career involving long, hard work. Nevertheless, she was determined to do as her father asked.

During the time that Marian was growing up, schools were still segregated by race, and those schools that served African-American children had limited educational resources. At Marian's school, textbooks were usually leftovers from other schools and were full of markings from previous students. The science equipment was very limited; there was not a single microscope at her school. Marian remembers her biology teachers describing cells and other microscopic samples and saying, "If you had a microscope, you could see this." Fortunately, Marian's father supplemented the education she received at school by bringing her books to read and activities to do at home.

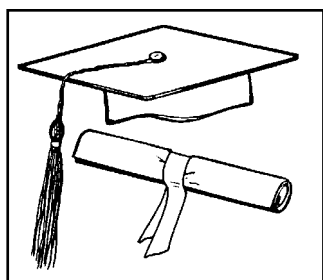


When Marian was 15, her father died. She realized that, although she did not have to be a physician in order to please him, she had grown to love her science studies. She decided to major in chemistry when she finished high school.

## Training to be a scientist

After graduating from high school in 1965, Marian went to Howard University in Washington, DC, as a chemistry major. She was surprised to find that, after being viewed as one of the top students at her high school, her pre-college preparation was not especially good and she had a lot of catching up to do in her courses. Her teachers encouraged her to work harder. Marian was discouraged and thought she was simply a mediocre student. She decided she would get a bachelor's degree in microbiology and then get married.

Campus life was turbulent in the late 1960s. Students protested the Vietnam war and called for civil rights for people of all races. Groups of protesters took over campus buildings. Marian became engaged to a fellow student, but he was drafted and went to Vietnam. While she was waiting for him to return, she decided to get a master's degree in microbiology. As she did microbiology research, she became more interested in academics and less interested in being a housewife. When her fiance returned, they decided not to marry.



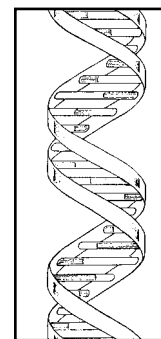
After finishing her master's degree, Marian accepted a job at the newly opened University of the District of Columbia (UDC). After working a year at UDC, she realized that she needed a doctorate degree (Ph.D.) to hold the type of position in her department that she was seeking. She asked for and received a leave of absence from UDC to earn a Ph.D. She went to graduate school at Georgetown University in Washington, DC. The courses were very challenging and, again, she found herself playing "catch up" on courses. Her hard work paid off when she earned her Ph.D. in 1978, in just two-and-a-half years.

During her graduate work, she met Charles "Skip" Thompson, Jr., through a blind date set up by a mutual friend. The two were married soon after she completed her degree. Dr.

Johnson-Thompson returned to UDC and became a full professor there. She also worked at the National Cancer Institute (NCI), a federal laboratory, and became an adjunct professor at Georgetown University.

### **Doing research on viruses and cancer**

Dr. Johnson-Thompson is a *molecular virologist*, that is, she looks at the molecules that make up viruses to see how the viruses are constructed and how they work. She uses viruses as a research tool to study both how cancer progresses and its treatment. She is especially concerned with how anti-cancer drugs work at the molecular level, and how lasers cause changes in the synthesis of DNA and RNA. She uses viruses as a model or tool because they replicate their DNA in the same manner as human cells. Researchers can expose viruses or viral DNA to lasers or anti-leukemic agents and then check the effects of these agents on DNA, RNA, and protein synthesis. They can determine whether the production of the viruses is slowed or stopped and whether the shape of the DNA molecule is changed. The results of these experiments indicate whether these agents may be useful in combating viral infections. In fact, this is one of the methods that researchers are using to determine an effective treatment for the HIV virus that causes AIDS.



At both NCI and UDC, Dr. Johnson-Thompson explored molecular models for multidrug resistance in cancer. Like other cells, cancer cells replicate their DNA before dividing into two new cells. Cancer drugs are often designed to get inside the cell and to cause problems when the cell tries to replicate its DNA. These drugs aren't selective; they damage or kill all rapidly dividing cells. Since cancer cells divide rapidly, they are susceptible to these drugs, but so are other normal cells that usually divide rapidly, such as the cells involved in hair growth, the lining of the intestine, and white blood cells in the immune system.

When a breast cancer patient first receives an anti-cancer drug, the tumor cells respond well and die. After a while, however, the cancer cells become resistant to that drug and to other drugs like it. Researchers found that the drugs were getting into the cancer cells but that the cancer cells were pumping them back out across the cell membrane before the drug could reach the DNA. The cell identifies the drug as a poison that will damage it or kill it. Dr. Johnson-Thompson looked for ways to prevent the cancer cell from pumping out the anti-cancer drug, either by changing the drug itself so that it's more difficult to pump out, or by disabling the "pump," the protein that pushes the drug out of the cell membrane.

### **A new career development**

In 1992, Dr. Johnson-Thompson was offered a different type of position for a scientist — as a program director at a federal funding agency, the National Institute for Environmental Health Sciences (NIEHS). She knew this position would be a good opportunity to have a broad impact on science education and research, and she is now the Director of Institutional Development for NIEHS, one of the National Institutes of Health and part of the U.S. Department of Health and Human Services. NIEHS has a staff of researchers on site who work on environmental health research, and it also funds researchers at colleges, universities, and other research facilities through grants. Dr. Johnson-Thompson's department, the Office of Institutional Development, works specifically in three areas:

- Funding grants to improve K-12 science education and to improve the overall science litera-

- cy of students across the country and of all racial/ethnic groups;
- Funding grants to address research needs on health and training issues for minorities, women, and persons from disadvantaged socioeconomic groups. In the past, the specific health needs of these groups have not received adequate attention; and
  - Assuring that the work force of NIEHS reflects the diversity of the U.S. population at all levels of jobs, including research and administration.

Looking at her career so far, Dr. Johnson-Thompson feels that her greatest contributions have been in the development of a new university, the University of the District of Columbia, and by being in a position to train minority students who then went on to get M.D. and Ph.D. degrees. Her former students are now addressing minority health issues, women's health issues, and educational issues related to underrepresented groups. She is very sensitive to the needs of young students; one of Dr. Johnson-Thompson's favorite activities at her new position is speaking to the groups of middle and high school students who take tours of the NIEHS facilities.

### **Balancing career and home lives**



Dr. Johnson-Thompson balances her rewarding career as a researcher and administrator with a rich home life. She and her husband Charles, a mortgage banker, have two sons, Chett, who is 13, and Émile, who is 10. She especially enjoys vacationing with her family. For example, one time they took a cruise to the Bahamas. She loves tennis and reading, especially nonfiction. Her favorite pastime is gourmet cooking; she makes everything from scratch. She finds that her laboratory skills help her in cooking complex recipes because she can follow procedures exactly, make precise measurements, and time "reactions" carefully.

### **Dr. Johnson-Thompson's advice for students**

Dr. Johnson-Thompson feels that she received important support from professors, friends, and family at each stage of her training and career. She believes that students can take an active role in building their own support networks and pursuing their goals. She advises students to:



- Identify a mentor who can support your work. Ask questions of teachers, pharmacists, physicians, and scientists who visit your class or whom you visit. These professionals are interested in responding to you and helping you;
- Take as many math and science courses as possible;
- Develop a spiritual life. This can take many forms and is essential because one needs guidelines on which to operate and a mechanism that will allow for reflection, validation, and support. Also, take care of your body and practice good health habits — exercise and eat healthy foods. If body and mind aren't in good shape, it's difficult to reach your goals;
- Participate in some volunteer activity where you are helping others. It's important to give back to the community; and
- Work on your communications skills and do a lot of reading. No matter what your profession, you must be able to communicate well.

To minority students, she recommends persistence. "Unfortunately, in our country many

minority students feel that their pre-college studies are inadequate. They have visions of earning a Ph.D. and find that they aren't prepared. Don't quit! It takes extra work to catch up but this is only a fraction of time compared with your whole life and your career." To young women, she encourages making active decisions. "We teach our girls that they can have everything, but that may be hard to do all at once. Set your goals, identify a positive support environment (including positive people to associate with), work hard, and be sure to include time for fun. If you don't set goals and make decisions about your life, they'll be made for you by default."

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**CAUTION...Warning Signs of Cancer!**

Change in your bowel or bladder habits;  
**A** sore that does not heal;  
**U**nusual bleeding or discharge;  
**T**hickening or lump in the breast or any other part of the body;  
**I**ndigestion or difficulty swallowing;  
**O**bvious change in a wart or mole;  
**N**agging cough or hoarseness.

## SUGGESTIONS FOR TEACHERS

### ACTIVITY #1: What Research Would You Like To Do?

### ACTIVITY #2: Setting Research Priorities

#### Purpose

To learn how research topics are selected for funding.

#### Objectives

- 1) To research a scientific topic, develop a mini-proposal for future research, and justify the need for the research.
- 2) To compare and contrast research proposals and set priorities for which research should receive funding.

#### Materials

None.

#### Before You Begin

##### Activity #1

- 1) Inform the school librarian about the upcoming project students will be doing.
- 2) You may wish to give students a list of possible research topics rather than have them start from scratch. If possible, select topics related to the current material you are covering in class.
- 3) Give each student or team a copy of the "Proposal Review Form" on page 255 so they know how their proposal will be rated.
- 4) Divide students into teams of two to three persons. Each team will develop a proposal. If possible, allocate library time to allow students to explore available resources.

##### Activity #2

- 1) *Activity #2* can be done in two ways. If students complete *Activity #1*, use their proposals for *Activity #2*. If students do not do *Activity #1*, use the two Sample Research Proposals provided, "Tamoxifen: Creating a Cure and Reducing Side Effects" on pages 249-250, and "Pursuing an Effective Treatment for AIDS" on pages 251-252.
- 2) After proposals are developed, set up review panels of four to six persons. Each panel should have four to six proposals to

read. Teams should NOT read and review their own proposals. Try to overlap panels (e.g., Panel A reads proposals #1, 2, 3, and 4; Panel B reads proposals #2, 3, 4, and 5; etc.). In this way, each proposal is compared with more of the competing proposals.

- 3) If you use student-generated proposals, take off the cover sheets before distributing them. This allows the review to be "blind" so that most of the students on the panel are unaware of who wrote the proposal.

#### Safety Considerations

None.

#### Questions to Ask

- Why do you need to provide background information about the research problem you would like to explore?
- Why is it important to justify the need for the research? Is "wanting to know" a good enough reason?
- How do you think a researcher selects a topic for his/her research? Do researchers get to choose a topic that is most interesting for them or one that is most likely to receive funding? Or a combination of these reasons? Interview a scientist to find out!
- What kind of educational and research backgrounds would you like the people on the review panel to have?

#### Where to Go From Here

- After *Activity #1* (and if time allows), teams can give oral presentations of their proposed research, using at least one visual aid (graph, photo, table, etc.). These research presentations should be no longer than 10 minutes. This is the amount of time allotted at most scientific meetings for a researcher to present his/her data in an oral presentation.
- Ask students to find articles on federal funding for research in newspapers or national magazines. Ask students to distin-

guish between “basic” research and “targeted” research. Discuss the merits of each. This could be a topic for a class debate. For more sources of articles, see “References and Resources” below.

- After a discussion of how federal monies are allocated for research, encourage students to write a letter, either individually or as a group, to their U.S. Senator or Representative indicating their opinion on whether there should be more or less money allocated to basic research, to targeted research, and to money overall spent on research. Contacting their Congressmen is a skill all voters should learn to keep their representatives better informed of the opinions of the voters. You may find that many students are unaware that their elected representatives are interested in their ideas and opinions!

#### **Ideas for Assessment**

- The oral presentation or written proposal can serve as an assessment tool.
- Also, gather rating sheets completed for each proposal in *Activity #2*.

#### **References and Resources**

##### ✓ *About current research topics:*

*Science* (especially the “News”, “Perspectives”, and “Research Reports” sections), *Science News*, *BioScience*, *Scientific American*, and *The Scientist* (a weekly newsletter for science).

Research briefs can also be found in *The Science Teacher* and *Science Scope*, from the National Science Teachers Association.

##### ✓ *Recent hot research topics funded by the NIEHS (Dr. Johnson-Thompson’s agency):*

The isolation of the breast cancer gene by Drs. Roger Weisman and Andy Futreal.

The discovery of the cellular chemical messengers called *G proteins* by Dr. Martin Rodbell.

Studies on the role of the environment and women’s health (e.g., environmental estrogens).

##### ✓ *About environmental health and related issues:*

Contact the NIEHS Enviro-Health Clearinghouse toll-free hotline (1-800-NIEHS-94).

See the NIEHS website on the Internet at

<http://www/niehs.nih.gov>.

##### ✓ *For related activities on viruses and DNA:* *A Sourcebook of Biotechnology Activities.*

(1990). Rasmussen, A. M., & Matheson, R. H., III. National Association of Biology Teachers, 11250 Roger Bacon Drive, #19, Reston, VA 22090. (800) 406-0775.

Gillen, A. L., & Mayor, H. D. (1995). Why do we keep catching the common cold? *The American Biology Teacher*, 57(6), p. 336-342.

##### ✓ *Other resources:*

Davis, D. L., & Bradlow, H. L. (October 1995). Can environmental estrogens cause breast cancer? *Scientific American*, p. 166-170.

Glausiusz, J. (January 1995). A gene for breast cancer. *Discover*, p. 99.

The Howard Hughes Medical Institute, 4000 Jones Bridge Road, Chevy Chase, MD 20815-6789, (301) 215-8855, offers several free booklets on human development, genetics, and blood, including *Blazing a Genetic Trail*, *From Egg to Adult*, and *Blood: Bearer of Life and Death*.

Laurence, L. (August 1995). Young women and breast cancer. *Glamour*, p. 58.

Stipp, D. (May 13, 1996). The gender gap in cancer research. *Fortune*, 133, p. 74-76.

##### ✓ *Photo credit:*

Photos on pages 241 and 245 courtesy of Marian Johnson-Thompson, National Institute for Environmental Health Sciences, Research Triangle Park, NC.

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**Sample Research Proposal #1:  
*Tamoxifen: Creating a Cure and Reducing Side Effects***

**What We Know**

**The Structure and Function of the Drug Tamoxifen**

Estrogen is one of the naturally occurring human female hormones that plays an important role in the development of female secondary sex characteristics, including breast development. Because estrogen stimulates the growth of breast tissue, it can also promote the growth of breast tumors, that is, breast cancer.

Tamoxifen is a drug that acts as an “anti-estrogen,” that is, it interferes with the activity of the female hormone estrogen. As a treatment for breast cancer, tamoxifen can “...slow or stop the growth of cancer cells that are already present in the body” (NCI, 1994a). After a breast tumor has been removed surgically, tamoxifen also can prevent the tumor from growing back again and prevent the development of estrogen-sensitive tumors in the opposite breast. Tamoxifen has been used successfully for nearly 20 years in treating patients with advanced breast cancer.

Tamoxifen has some additional side benefits. Like estrogen, it can lower cholesterol, which may reduce the risk of coronary artery disease. It also prevents bone loss and may be able to reduce the effects of osteoporosis and hip fractures among older women (Marshall, 1994; Seachrist, 1994). This is because tamoxifen acts like estrogen when it encounters tissues in the body other than breast tissue.

Can tamoxifen prevent breast cancer from occurring in the first place? Currently a large study is underway to determine whether tamoxifen can prevent the development of breast cancer among healthy women who are at high risk of developing breast cancer tumors. The initial results of this study are promising (Marshall, 1994).

**Side Effects of Tamoxifen**

Estrogen also can stimulate the growth of endometrial cancer. Since tamoxifen mimics estrogen, there was concern that it might stimulate the growth of tumors in the endometrium (the lining of the uterus). In fact, there is some evidence of this. Women taking tamoxifen to treat their breast cancer are two to three times more likely to develop uterine cancer (endometrial cancer) than are women in the overall population (NCI, 1994a). In the study of healthy women at risk of breast cancer mentioned earlier, those women taking tamoxifen are developing endometrial cancer at “three times the rate seen in the general population” (Marshall, 1994, p. 1526); this is higher than originally expected by the study planners. However, endometrial cancer is rarely fatal and usually can be treated when caught in its early stages. Breast cancer, on the other hand, is very likely to be life-threatening (see below). Unfortunately, how tamoxifen causes these side effects is not well understood.

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### What We Hope to Find Out

In this research study, we will look at the way that tamoxifen interacts with the cells lining the uterus (that is, the endometrium) at the molecular level in order to address several important questions.

- How does the structure of tamoxifen contribute to the development of endometrial cancer? Does it cause cells to change from normal cells to cancer cells? Or does it promote the growth of cancer cells that already exist in the endometrium?
- Is a specific type of endometrial cancer caused by tamoxifen? If so, what triggers it?
- What part of the tamoxifen molecule interacts with the cell to lead to the change from a normal cell to a cancer cell or to promote the growth of existing cancer cells?
- Can we modify the molecular structure or shape of the drug so that it can still inhibit the growth and/or development of breast tumors while reducing its effect on the endometrium?

### Why Is This Important to Know?

Each year, more than 180,000 women in the United States alone will be diagnosed as having breast cancer, and more than 46,000 will die of the disease (NCI, 1994b). Breast cancer affects women of all ages, all races, and all income levels. Currently, one of every eight women in the U.S. will develop breast cancer in her lifetime (NCI, 1993). The development of a drug, such as tamoxifen, that can treat existing breast tumors and prevent the development of tumors among women at risk of developing them could potentially save tens of thousands of lives each year. If this drug can be modified to treat and prevent breast cancer without causing negative side effects on the endometrium, then a major step will have been taken in the biomedical research community's war on cancer.

### References

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- National Cancer Institute (NCI). (August 1993). Lifetime probability of breast cancer in American women. *Cancer Facts* (on-line info sheets). Bethesda, MD: National Institutes of Health.
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**Sample Research Proposal #2:  
*Pursuing an Effective Treatment for AIDS***

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**What We Know**

Acquired Immune Deficiency Syndrome (AIDS) results from an infection of the immune system. It is usually acquired after birth by people who previously had perfectly normal immune responses (BSCS, 1986). AIDS is caused by the human immunodeficiency virus (HIV), which infects cells of the immune system and destroys them. HIV is transmitted from human to human by a variety of means, including sexual relations with an infected person, injecting drugs with contaminated needles, receiving a transfusion or transplant from an infected person, and/or, in the case of infants, transmission of the disease from mother to baby in the womb. Once in the body, the virus multiplies in certain cells of the immune system. Eventually, the immune system's ability to destroy parasites, viruses, and even cancer cells is reduced, and the infected individual becomes susceptible to all of these diseases.

Two types of immune cells are especially involved in AIDS: helper T-cells and macrophages. Macrophages are responsible for engulfing and digesting foreign materials, including bacteria, cancer cells, and other invading organisms. Helper T-cells work with B-cells (which produce antibodies), macrophages, and other immune system cells to kill foreign cells. The HIV virus causes the destruction of helper T-cells; therefore, the immune system becomes less effective and the person becomes susceptible to many kinds of infections and tumors (BSCS, 1986). Recently, researchers have found that there are several types or variants of the HIV virus and, while all of these will attach to and multiply inside T-cells, some variants also will attach to and multiply in macrophages. These are called macrophage-tropic HIV. Others invade only T-cells and form syncytia or groups of infected cells. These are called SI strains of HIV.

Recent research suggests that the infection of macrophages may be necessary for the HIV virus to cause the symptoms of AIDS. In other words, the infection of helper T-cells alone will not cause the full disease to develop (Mosier & Seberg, 1994). It has been found that infection with macrophage-tropic HIV causes rapid and complete loss of helper T-cell function, whereas infection with only SI strains leads to slower loss of immune cell function (Mosier et al., 1991 and 1993). Why is macrophage-tropic HIV so effective at leading to the loss of functioning T-cells? Mosier and Seberg (1994) suggest two possibilities: 1) that the macrophage-tropic virus may be able to more easily spread to other cells (including T-cells) and/or 2) that macrophages actively attract T-cells and therefore more easily transmit the virus to them. In either case, if we can gain a better understanding of 1) whether macrophage-tropic HIV variants are necessary for the full AIDS disease to develop, and 2) the exact mechanism for macrophage-tropic HIV's impact on T-cell loss, then we may be able to interfere with this process via the development of a drug or vaccine.

**What We Hope to Find Out**

In this research study, we will examine the role of macrophage-tropic HIV variants in order to answer the following questions.

- Must the patient be infected by macrophage-tropic HIV variants, SI variants, or both for the

*(continued)*

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full AIDS symptoms to develop?

- By what mechanism(s) do macrophage-tropic HIV variants cause the rapid spread of HIV from cell to cell?
- Does this mechanism suggest possibilities for the development of vaccines to prevent infection by macrophage-tropic HIV or for the development of drug(s) to interrupt its function and spread within the body? If so, preliminary studies on the identifying receptor sites for a drug(s) or antigens for a vaccine will be completed.

### Why Is This Important to Know?

Estimates indicate that, in 1994, 2.5 million people were newly infected with HIV. The total number of people infected worldwide is 19.5 million, including 1.5 million children. The hardest hit areas are Sub-Saharan Africa, but the greatest proportionate increase recently has been in Southeast Asia. As of 1993, more than 360,000 people in the United States were reported infected with HIV; 65% of those persons were between ages 20 and 39 (U.S. Cumulative Data, 1993). The World Health Organization estimates that, by the end of the century, 30-40 million people may have been infected with HIV.

In addition to the terrible human suffering caused by the disease, the economic implications of AIDS for a developed nation, such as the U.S. are tremendous. The direct medical costs for a single AIDS patient are in the tens of thousands of dollars. In addition, the indirect economic costs for the loss of productivity for that individual are in the hundreds of thousands of dollars over the person's lifetime. That is, the contribution that the person would have made to the national economy by working a job and spending money as a consumer becomes a large factor when a deadly disease, such as AIDS, becomes widespread within a nation.

According to Peter Piot, Director of the World Health Organization Global Programme on AIDS, two strategies must be pursued to stop the spread of AIDS. First, people's behaviors must change. Programs to change behaviors so that people reduce their chances of becoming infected are important but are very costly (WHO, 1994). According to WHO estimates, a "comprehensive prevention package for countries of the developing world" would cost \$1.5-2.9 billion yearly....this is 10 times more than is currently being spent. Second, a safe, effective, and affordable vaccine is needed. The research described here can serve as one step toward the development of such a vaccine or a drug to treat this deadly disease.

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## ACTIVITY #1: What Research Would You Like to Do?

### Your Mission

You are a young life scientist, just out of graduate school and in your first appointment as a faculty member at a major research university. You found out at this morning's faculty meeting that the federal government has set aside funds to help new scientists get a good start in their research. Specifically, they will provide money for three research projects from your state. Although most research proposals are long documents, detailing the research and how the money will be spent, this program wants only a short proposal.

**Develop a short (maximum 2-page typed or 4-page handwritten) "Student Research Proposal" that includes the following information about the life science, biology, or medical topic that you hope to research.**

### Procedure

Include the following information in your proposals:

**What we know.** This should include a brief description of the research topic so that the reader can understand what previous research has already shown us. This information can be provided by magazine or journal articles; use at least two different references in preparing your proposal. Your department chair (your teacher) will suggest some good sources.

**What we hope to find out.** What is the research you want to do? What do you hope to learn or create?

**Why is this important to know?** For example, will this research help people, animals, or plants to live longer or be healthier? Will it affect our quality of life? Can it prevent the extinction of a species? How many people will be affected by this work? If this is a disease or medical condition, is there an estimated cost to our society (such as medical treatment costs, lost wages from sick leave, etc.)?

**References.** What resources did you use to research your topic?

Remember to include a cover page noting the title of your proposal (but NOT the names of your research team members).

Hint: Your research proposal will be judged versus all of the other proposals being developed. You must write a convincing argument based on fact and with proper citations for the research and statistics you use in your argument. Before writing, look at the "Proposal Review Form" on page 255 and the point values assigned to each category. As you write, think about these categories and how you can write your proposal to earn a high score and thus increase its chance of getting funded.

## ACTIVITY #2: Setting Research Priorities

### Your Mission

**You have been selected as a member of a review panel** for a new program at the Department of Health and Human Services (DHHS). (DHHS is the federal agency that includes the National Institutes of Health and the National Institute of Environmental Health Sciences. The funding program described is a realistic one but does not actually exist). Among other things, this federal agency provides grants to researchers to do life science-related research. Specifically, DHHS has set aside funds to help new scientists get a good start in their research. The agency will provide money for one to three research projects from each state. Although most research proposals are long documents, detailing every step of the research and how the money will be spent, this program requires only a short proposal. A number of proposals have been submitted to the agency. As a member of the review panel for your state, **your responsibility is to read, review, and rate each of the proposals** that has been assigned to your panel.

### Procedure

1. Read each proposal.
2. Complete a Proposal Review Form for each proposal.
3. Discuss with your fellow panel members the ratings you gave to each proposal and why you rated it that way.
4. With the other members of your panel, select the best proposal among those you read.
5. Submit your rating sheets and the title of the proposal you selected to the program officer (your teacher) when your panel is finished. He/she will discuss with you the results of the other rating panels.

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**Proposal Review Form**

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**PROPOSAL TITLE:** \_\_\_\_\_

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**What We Know (Maximum = 20 points)**

Does the proposal present a clear picture of the research that has already been done?

Does the background information presented lead to the conclusion that additional research is needed?

**Write your comments here:**

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**max = 20**

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**What We Hope to Find Out (Maximum = 20 points)**

Does the proposal state clearly the research questions that will be answered?

Given the information provided in "What We Know?" is the proposed research a logical next step?

**Write your comments here:**

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**max = 20**

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**Why Is This Important to Know? (Maximum = 20 points)**

What are the practical applications of the research?

What will it help us to understand or do?

Ultimately, who will benefit from this knowledge?

**Write your comments here:**

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**max = 20**

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**Write any comments about the overall proposal here:**

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**Total Score  
max = 60**

