

Heal Thyself — Research Careers

Secrets of the Sequence Video Series on the Life Sciences • Grades 9 — 12
Teaching materials developed by VCU Life Sciences

V i r g i n i a C o m m o n w e a l t h U n i v e r s i t y

Classroom Tested Lesson

Video Description

“Secrets of the Sequence,” Show 148, Episode 3

“Heal Thyself – Research Careers” – approximately 9 minutes viewing time

At the age of three, Kyle Rattray developed a rare child-onset cancer of the kidney called Wilm’s tumor. The experience, which he survived, has directed his life to cancer research. Today, Kyle is a student at MIT, taking biology from Professor Eric Lander and working on a research project in Professor David Housman’s lab – research aimed at cancer.

Ward Television

Producer: Paul Gasek

Associate Producers: Trish Golden and Teri Prestholdt

Features: Kyle Rattray, Sophomore, MIT, Eric Lander, Biology, MIT, David Housman, Biology, MIT Featuring:

Lesson Authors; Reviewers: Catherine Dahl; Dick Rezba, Kieron Torres

Trial Testing Teachers: Martin Shields

National and State Standards of Learning

National Science Education Standards Connection

Content Standard A: Science as Inquiry

As a result of activities in grades 9-12, all students should develop:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Content Standard G: History and the Nature of Science

As a result of their activities in grades 9-12, all students should develop understanding of Science as a human endeavor

- Nature of scientific knowledge
- Historical perspectives

Selected State Science Standards Connections

Use <http://www.eduhound.com> (click on “Standards by State”) or a search engine to access additional state science standards.

Virginia

- BIO.1 The student will plan and conduct investigations in which
- c) variables are defined and investigations are designed to test hypotheses;
 - m) a scientific viewpoint is constructed and defended (the nature of science).
- BIO.2 The student will investigate and understand the history of biological concepts. Key concepts include
- e) the collaborative efforts of scientists, past and present.
- BIO.5 The student will investigate and understand life functions of archaebacteria, monerans (eubacteria), protists, fungi, plants, and animals including humans. Key concepts include
- e) human health issues, human anatomy, body systems, and life functions; and

Florida

The Nature of Science

Standard 1

The student uses the scientific processes and habits of mind to solve problems. (SC.H.1.4)

- 2. knows that from time to time, major shifts occur in the scientific view of how the world works, but that more often the changes that take place in the body of scientific knowledge are small modifications of prior knowledge.
- 7. understands the importance of a sense of responsibility, a commitment to peer review, truthful reporting of the methods and outcomes of investigations, and making the public aware of the findings.

Standard 2

The student understands that most natural events occur in comprehensible, consistent patterns. (SC.H.2.4)

- 1. knows that scientists assume that the universe is a vast system in which basic rules exist that may range from very simple to extremely complex, but that scientists operate on the belief that the rules can be discovered by careful, systemic study.

Standard 3

The student understands that science, technology, and society are interwoven and interdependent. (SC.H.3.4)

- 3. knows that scientists can bring information, insights, and analytical skills to matters of public concern and help people understand the possible causes and effects of events.

Overview

This video highlights the motivation behind Kyle Rattray's choice of a career path. He survived a rare child-onset cancer of the kidney called Wilm's tumor, and now as a student at MIT plans a career in cancer research. Kyle articulates those things that are most important when deciding which of the many paths a student of the life sciences can take. Some students may have a driving personal motivation to make an impact on a disease that they have suffered, and because it is "personal", keeps them focused through the generally long training periods in scientific research. However, for other students, he cites the "excitement" shown by his MIT Professor, Dr. Eric Lander. Kyle suggests that students pursue a life science field they can be passionate about because scientific discovery is not only "disciplined and rigorous" but can also be "repetitive and monotonous". Although many students think that most "big" scientific discoveries have already been made, many frontiers still exist as science is changing rapidly. Today's scientists, building on the work of earlier scientists, can still make an enormous impact.

NOTE TO TEACHERS: This video includes a few teen profanities, such as 'damn', 'kicked its ass' and 'crap'. A field test teacher suggested telling students about the language prior to viewing to reduce student reaction.

Testing: A sample related multiple choice item from State Standardized Exams

A biologist in a laboratory reports a new discovery based on experimental results. If the experimental results are valid, biologists in other laboratories should be able to:

1. Repeat the experiment with a different variable and obtain the same results.
2. Perform the same experiment and obtain different results.
3. Repeat the same experiment and obtain the same results. *
4. Perform the same experiment under different experimental conditions and obtain the same results.

Source: New York sample test question for the Living Environment Regents Examination, Part A

Video Preparation

Preview the video and make note of the locations at which you will later pause the video for discussion.

Before Viewing

1. Ask: "What kinds of occupations would be available if you wanted a career in biology or other life sciences?"
List them on the board.
2. Ask: "How much and what kind of training is required for each of these occupations?"
3. Ask: "What do you think are the most important characteristics that you will need in order to pursue most of these life science occupations?"
Personal motivation, excitement, discipline, intellectual curiosity, ability to solve problems, and patience

During Viewing

1. **START** the video.
2. **PAUSE** video (3.45 minutes into the video) as Professor Eric Lander starts to leave the lecture hall.

Ask: "Is the body of scientific knowledge almost complete?", "Are major discoveries in science over?"
No, science is changing rapidly and much remains to be learned. While most scientists today are building on what other people have already discovered, there will still be major discoveries in the coming years.

Ask: "What things have you studied this year that clearly show that science is not static and new discoveries are still being made?"

Ask: "What are some of the big frontiers – the areas of science that we've only begun to understand?"
The cell, the brain, the proteome, the microbial world, oceans, deep space.

3. **RESUME** the video and play to the end.

After Viewing

1. This video describes some of the processes involved in scientific investigation.
Ask: Can you list those processes mentioned in the movie from memory? If not, repeat the video from 6.05 minutes to the end.
Observe, recognize, classify, and repeat over and over again
2. Ask: "What are some other processes involved in doing scientific research?"
Questioning, hypothesizing, predicting, experimenting, manipulating variables, analyzing, concluding, explaining, etc.
3. Show students the VCU career Website for the life sciences at <http://www.lscareers.vcu.edu> and encourage them to explore its many features if they are thinking about a career in the life sciences.

Teacher Notes for the Student Activity: Careers in the Life Sciences

Materials

- Student Handout 1: Careers in the Life Sciences – Interviewing a Scientist
- Student Handout 2: List of Careers in the Life Sciences
- Student Handout 3: Sample Questions to Ask a Life Scientist (*Note:* to be distributed only if the students exhaust their ability to develop questions themselves. See Procedure #5)
- Student Handout 4: Determining Your Interest in a Life Sciences Career
- Teacher Resource: Career Descriptions are available at www.lscareers.org: click on 'Careers', then click on 'Careers A-Z')

In this activity, students in groups of 3-4 will research, plan, and role play an interview with a scientist. Students' knowledge of careers is largely influenced by the occupations of family members, friends, and neighbors. Exploring career options in the life sciences can broaden the horizons of many students who might otherwise not be exposed to these life options. Although the groups will explore a chosen career and plan their interviews at the same time, it is recommended that they role play their interviews weekly or bi-monthly as a *Career Moment in Time* during a designated 15 minute time period throughout the semester or school year.

Procedure

1. Assign students to groups of 3-4 and distribute Handout 1 and 2. Have them read Handout 1 along with you. Ensure that all groups know what is expected of them. Provide them time to individually select careers from Handout 2 and then to discuss their selections in their groups. During this time the group should select 5 careers from the individual lists.
2. Provide additional time for student to conduct some initial research on these 5 careers. Based on the groups' discussion of this initial career exploration, each group should pick a 1st and a 2nd choice of careers to research in depth and submit them to you for review. *Note:* The research could occur in class or as a homework assignment.
3. Survey the groups' choices and ensure that each group prepares to do a different career for their interview.
4. Have groups work to develop a list of questions for their interview. The questions should stem from student curiosity about a career.

5. After exhausting their own ideas for questions, have students to use the Internet to find additional interview questions and appropriate responses to all of the questions. Be aware that there are some Web sites that provide complete interviews with specific scientists. Tell students that they may use these Web-based interviews for ideas, but they may not replicate the interview. Require them to cite any Internet sites used. If students are still unable to develop a good list of questions, Handout 3 provides possible interview questions.
6. Identify 15-minute periods of time (*Career Moments in Time*) over the next several weeks or months. Have each group sign up for a 10-15 minute time slot to role play their "interview with a scientist" during the class. *Note:* The field test teacher suggested having one student act as the scientist while the others serve as the interviewing committee.
7. Evaluate each group interview for substantive content as well as general interest level and persuasiveness of career choice. You may wish to devise a scoring rubric for evaluating each group's career presentations.
8. Have students complete the survey on Student Handout 4.

Student Handout 1: Careers in the Life Sciences – Interviewing a Scientist

In this activity your group will

- a) research a life science career of your choosing,
- b) plan an interview to conduct, and
- c) role play the interview with a scientist.

Procedure

1. Individually read *Student Handout 2: List of Life Sciences Careers*. Select five (5) careers that interest you because you already know something about what they are or because you have little or no idea of what they do!
2. As a group, share the careers you selected with each other. Discuss everyone's choices and as a group select 5 that you want to learn more about. Use the library or the Internet, if available, to learn a little more about the careers your group has chosen.
3. Discuss what you found out about each career during your initial search. Based on your discussion, give your teacher 1st and 2nd choice careers that your group would like to research further.
4. After reviewing the choices suggested by all groups, your teacher will confirm for each group the one career they will research further.
5. As a group, 'brainstorm' what you would like to know about your groups' chosen career. Generate at least 10 interview questions based on your discussion. As you write questions, think about what will also be of interest to other students when your group role plays its interview for the class. If, after working hard at making a list, you need some more ideas for questions, your teacher might provide you with a list of possibilities.
6. Once you have identified the questions your group wants to ask, you will need to use the library and the Internet to develop answers to those questions. If you wish, you could begin with the following Internet site: <http://www.lscareers.vcu.edu>. Your teacher will also have suggestions for other available Websites, such as <http://www.accessexcellence.org/RC/AB/WYW/wkbooks/OBAS/careers.html> (or do a search for "Access Excellence Career Center") In addition you may want to use a search engine to find additional Internet sites. Begin by using such phrases as 'science careers' or 'careers in life science'.
7. Select one member of your group to role play the scientist to be interviewed. Your group can elect to have one interviewer or several interviewers who each ask some questions.
8. Arrange a time with your teacher to role play your scientist interview in front of the class.
9. Your group interview will be evaluated by your teacher for evidence of content knowledge as well as the general interest level and persuasiveness for that career choice.
10. Determine your personal interest and aptitude for being a scientist in the life sciences by completing the survey on *Student Handout 4: Determining Your Interest in a Life Sciences Career*. Discuss the results of the survey in your group.

Student Handout 2: List of Careers in the Life Sciences

Agronomist	Immunologist
Anatomist	Landscape ecologist
Aquatic Scientist	Limnologist
Arboriculturist	Mammalogist
Bacteriologist	Marine scientist
Biochemist	Mathematical biologist
Bioengineer/Biomedical engineer	Medical examiner
Bioethicist	Molecular biologist
Bioinformatician	Mycologist
Biologist (Systems/Structural)	Nanotechnologist
Biometrist	Nematologist
Biostatistician	Neuroscientist
Biotechnologist	Nurse
Botanist	Nutritionist
Cancer biologist	Oceanographer
Cellular biologist	Ornithologist
Conservation biologist	Parasitologist
Criminologist	Pathologist
Cytogeneticist	Pharmacist
Dentist	Pharmacologist
Development biologist	Photobiologist
Ecologist	Psychologist
Entomologist	Physician
Environmental scientist	Physical therapist
Epidemiologist	Physiologist
Ethologist	Plant pathologist
Evolutionary biologist	Proteomic scientist
Food scientist	Radiation therapist
Forensic scientist	Science educator
Forester	Scientific journalist
Geneticist	Soil scientist
Health scientist	Toxicologist
Herpetologist	Veterinarian
Horticulturalist	Virologist
Ichthyologist	Zoologist

Student Handout 3: Sample Questions to Ask a Life Scientist

Select at least 10 for your interview or create your own questions and add them below.

1. What inspired you to become a.....?
2. What is a brief description of your job?
3. Please describe a typical day at work
4. What work skills do you use on a daily basis?
5. What has been your biggest challenge?
6. What has been your scariest experience while working as an?
7. Did you do an internship before you decided you wanted to be an.....?
8. How does your field contribute to society?
9. What specific skills are needed to become a.....?
10. Do you work by yourself or in a team?
11. How does working closely with other scientists affect your workplace?
12. What is the job security of a ...?
13. What are some examples of equipment used by?
14. How long are you typically out in the field?
15. What are some of the disease outbreaks you've worked on?
16. Is it scary to work around people and animals that have fatal diseases?
17. What are some of the fun things about your job?
18. Do you have to become a doctor to be a...?
19. How would you describe what science is?
20. What is an example of a difficult and especially challenging research problem that you have experienced?
21. What do you think are important thinking behaviors for a scientist to have?
22. Science is pretty intense work. Do you ever think about doing something else?
23. Did you think this is what you'd be doing one day when you grew up?
24. What is the single most important reason you became a.....?
25. What advice do you have for a high school student interested in your career?
26. What science courses do you recommend for high school students?
27. What field of undergraduate study do you recommend for your career?
28. What is the future projection for jobs in your field?
29. What websites do you recommend for your field?
30. What sort of pay scale is typical in your field?
31. What are some colleges and universities that have good programs in your field?

Note: This handout to be distributed by the teacher as needed. See Teacher Notes: Procedure step 5.

Student Handout 4: Determining Your Interest in a Life Sciences Career

A life science career is often a combination of several professions. A life scientist can be described as an entrepreneur, a writer, an inventor, a designer, or a discoverer and each of these occupations have unique skills. You may already have interests or skills in these areas.

The survey questions below are based on some of the skills that are common in people who work in the life sciences. Rate yourself on each question and total your points. Use your total score to see how you rate on the Life Scientist Scorecard!

Interest Survey in Life Sciences Careers

		Extremely (3pts.)	Very (2pts.)	Sort Of (1pt.)	Not really (0pts.)
1.	Are you persistent?				
2.	Are you creative?				
3.	Are you curious?				
4.	Are you good at critical thinking?				
5.	Are you persuasive?				
6.	Do you have good leadership skills?				
7.	Do you interact well with different people?				
8.	Are you good at setting goals and attaining them?				
9.	Do you like learning about plants and animals.				
10.	Are you good at seeking answers for puzzling problems?				
11.	Are you good at listening and interpreting challenging information?				
12.	Do you want to understand how life works?				
13.	Do you think unlocking the secrets of the genome is the single most exciting event of the century?				

Your total: _____

Life Scientist Scorecard

Points:

30-39: Welcome, the life sciences will offer you the challenges your analytical mind desires. You'll find great rewards in a career spent applying scientific inquiry to the puzzles of life.

24-29: You have strong leanings toward the life sciences. There's a bright future for you. Keep developing your skills and interest in math and science.

18-23: Not bad! Learn more about biology and other life sciences to see whether there's a place in the life sciences that interests you. You may be surprised by what you find.

0-17: Okay, a career in the life sciences is not for everyone. But hopefully you will enjoy having pets, spending leisure time in nature, or having hobbies such as gardening.

Additional Resources

Because Web sites frequently change, some of these resources may no longer be available. Use a search engine and related key words to locate new Web sites.

<http://www.lscareers.vcu.edu/>

<http://www.accessexcellence.org/RC/AB/WYW/wkbooks/OBAS/careers.html>

<http://www.aibs.org/careers/>

<http://www.stfrancis.edu/ns/careers.htm>

<http://alpha.furman.edu/~snyder/careers/careerlist.html>

http://www.ornl.gov/sci/techresources/Human_Genome/education/careers.shtml

Genomic Revolution

http://www.ornl.gov/sci/techresources/Human_Genome/education/education.shtml

The Web site to the government-funded Human Genome Project with links about genomics, the history of the project, and more.

Secrets of the Sequence Videos and Lessons

This video and 49 others with their accompanying lessons are available *at no charge* from www.vcu.edu/lifesci/sosg