

INSPIRING FUTURE SCIENTISTS



An Integrated
Science and Language Arts Unit
for Grades 3-5

2008

Lesson Plan

Grade: 4

Goal: to inspire future scientists

National Content Standards:

Content Standard F: Science in Personal and Social Perspectives

- *Types of resources*

Content Standard G: History and Nature of Science

- *Science as a human endeavor*

Lesson Plan:

ODE Academic Content Standards

K-12 English and Language Arts (4th grade Indicators)

Reading Process

- Compare and contrast information on a single topic or theme across different text and non-text resources.
- Summarize important information in texts to demonstrate comprehension.
- Select, create, and use graphic organizers to interpret textual information.

Reading Applications: Informational, Technical and Persuasive Text

- Summarize main ideas in informational text, using supporting details as appropriate.
- Draw conclusions from information in maps, charts, graphs and diagrams.
- Distinguish fact from opinion.

K-12 Science

Scientific Ways of Knowing

- To explain that men and women of diverse countries and cultures participate in careers in all fields of science (Grade 3-5 Benchmark)
- To record the results and data from an investigation and make a reasonable explanation. (Grade 4 Indicator)

Objectives:

Upon completion of this unit, the student will be able to:

- tell or write about how he/she learns
- tell or write about how scientists in the past and present learn
- compare how he/she learns with how scientists learn
- use graphic organizers to order thinking
- use book and internet resources to research the lives of scientists
- to record data on a chart

- to summarize data
- to distinguish fact from opinion
- to give examples of science-related careers
- analyze data to decide if a science career would be interesting to him/her

Materials: See Teacher Resources

- *Kid's Study Survey*, 1 copy for each student.
- *J.J. Audubon: The Boy Who Loved Birds* skit, 1 copy per student.
- Trade books about the lives of famous scientists
- *Scientist's Study Survey*, 2 copies per student.
- *Rubric for Famous Scientist Project, Fact/opinion flip-flap book and Bio-Poem*) 1 copy per student
- *Scientist Checklist*, 1 copy for teacher
- *Bio-Poem*, 1 copy per student.
- Computers with Internet access: 1 per group of 3. *Bio-Quest* web
- 4 pieces of large chart paper, markers, highlighters, tape. These charts may be prepared ahead of time by the teacher. These are class-sized copies of the Scientist's Study Survey.

Engage: Capture students' interest:

- Teacher will share how he/she liked to learn as a child. (Did you have a special tree you liked to read in, special music you listened to, a favorite chair?) Ask students how they learn best – reading, writing, doing, listening to music. . . ? Give students *Kid's Study Survey*, Save these surveys to give back to the students at the end of the unit. Tell students that they will be collecting data about how scientists from different time periods learned.
- Next the students will be reading a skit about how a famous naturalist and artist learned when he was a boy. Give each person (or every 2 persons) a copy of the skit, *J.J. Audubon: The Boy Who Loved Birds*, Assign parts. Ask students to read through the skit, paying special attention to how J.J. learned.
- Display a large, class-sized chart copied from *Scientist's Study Survey* Ask students to recall or look up information in the skit to answer each question. Write their answers on the class chart. Tell them that, as a class, they have just collected data about a famous scientist in the same way they will each find information from a book based on a scientist's life.

Explore: Hands-on experiences to help students construct concepts

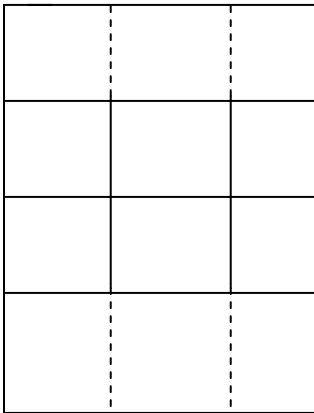
- Display scientist biography trade books. Have each student pick a book that looks interesting to them. They are to read the book, and fill out a *Scientist's Study Survey* about the scientist. They are collecting data about how scientists learned to use later in the unit.

Explain: Learners articulate their ideas in their own words and listen critically to one another.

- Groups present the data from their *Scientist's Study Survey* written on chart paper, "*Famous Scientist's Study Survey*." This chart should be saved for future reference.

Evaluate: Learners demonstrate understanding of concepts

- Have students make flip-flap books to demonstrate knowledge of scientists' lives and distinguish fact from opinion.
 - Quiz students on the difference between fact (can be proven, 100% true) and opinion (can't be proven, person's feeling) by giving them a few examples. (Fact or opinion: Mrs. Abby teaches 4th grade. Mrs. Abby is the best 4th grade teacher. Albert Einstein had gray hair when he was older. Albert Einstein had funny-looking hair.)
 - Make flip-flap fact/opinion booklets. Here are the directions.



1. Fold a piece of paper into 4 parts width-wise. (The solid lines represent folds.)
2. Fold the paper into thirds long-way.
3. Open the paper. Re-fold it so that it makes an "M" shape when viewed from the side.
4. Cut flaps where dotted lines are located. You have made a double-sided flap booklet with 1 piece of paper.
5. Write information about scientists on 6 flaps.
6. Write "fact" or "opinion" in the box under each corresponding flap so students can check their work.

- Have students get into pairs and trade flip-flap books so they can quiz each other.

- Use the *Project Rubric* to assess student project,

Explore: Hands-on experiences to help learners construct concepts

- Ask the students if they think that scientists today still learn in the same way as the famous scientists about whom they just read. Explain that they will work in groups of 3 to research 1 "modern" scientist by completing the Web Quest, *Bio-Quest*. Each group will use data from its research to complete a *Scientist's Study Survey*, and then write a bio-poem about its modern scientist's life.
- Teachers may assign students to a group, or allow them to pick their own groups. *Bio-Quest* will detail the roles the children will assume in their groups:

- The DIRECTOR will read the Web Quest directions and information about the scientists aloud to the group.
 - The RESEARCHER will sit at the computer to type, click on links, and complete the Web Quest.
 - The RECORDER will record the data about the scientist on the "How Scientists Learn" Data Table.
 - EVERYONE will help choose a scientist to research, give ideas for the recorder to use to fill out the Data Table, and report data to the class.
- Once students have had a chance to look at the modern scientists featured in *Bio-Quest*, the teacher will record the scientist each group chooses to research to make sure that more than 1 group is not investigating the same scientist. See *Scientist Checklist*.
 - Provide a *Scientist's Study Survey* for each group to complete during their Bio-Quest.
 - Provide a copy of the page, *Bio-poem* for each student. This page shows a sample poem and includes the format for writing a rough draft. Help students understand the format, edit, design, and copy pictures from the computer, as needed. Provide drawing paper for final copies.
 - Optional extension: when all bio-poems are completed, print out a copy of each person's page to make a class book, called Move Over, Einstein: Scientists of Today.

Evaluate: Learners demonstrate understanding of concepts

- Use *Project Rubric* to assess the modern scientist and bio-poem components of the lesson.
- For questions on the accuracy of student data, see copies of the *Scientist Profiles* which supply the basic information for the students' *Bio Quest* research.

Explain: Learners articulate their ideas in their own words and listen critically to one another.

- Groups present the data from their *Scientist's Study Survey*. The teacher records their findings on a large class chart, entitled, "How Modern Scientists Learned." (This is teacher-constructed, using *Scientist's Study Survey* as a sample.) Save this chart for future reference.

Elaborate: Help learners correct their misconceptions and generalize the concepts in a broader context. Apply, extend.

- The teacher will post the 2 class-sized charts that have been saved, *How Famous Scientists Learned* (based on trade book research) and *How Modern Scientists Learned* (based on data collected during *Bi- Quest*). Ask students if they notice anything that is alike on both charts. As students look at both class charts, highlight similar ideas with the colored markers. (For example, if the scientists from both charts learned by

“reading books,” the teacher would highlight these words with the same color. If “doing things,” is on both charts, a different highlighter color would be used.)

- When the charts have been compared, the teacher will use the information to make a large, class-sized Venn diagram comparing famous and modern scientists. Save this chart for future reference.

Evaluate: Evaluate learners’ understandings of concepts and skills.


- Return the *Kid’s Study Surveys* that students took on the first day of the unit. Ask students to highlight characteristics on the class Venn diagram that are the same as ones on their surveys.
- Ask students to sum up their findings in their journals using the sentence starter, “I am like other young scientists because. . . ”
- Optional Assessment: make a class book called, Science Careers. Each student makes a page featuring a science-related career, e.g., marine biologist, science illustrator, museum curator, entomologist, medical researcher, etc.



TEACHER RESOURCES

Table of Contents	Page
Kid's Study Survey	8
Skit: <i>J.J. Audubon: The Boy Who Loved Birds</i>	9
Bibliography of Famous Scientist Biographies	14
Scientist's Study Survey	17
Project Rubric	18
Scientist Checklist	19
Bio-poem	20
Venn Diagram Comparing Scientists Past and Present	21
Scientist Profiles	22

KID'S STUDY SURVEY

Questions	Data
1. What kinds of jobs do you do at home and school?	
2. What is your favorite thing to do?	
3. What do you want to learn more about?	
5. What kind of student are you in school? (What kind of grades do you get? Do you like to learn at school?)	
6. What tools do you use to study and record your data? 	<input type="checkbox"/> reading books <input type="checkbox"/> doing things <input type="checkbox"/> using computer <input type="checkbox"/> writing/journaling <input type="checkbox"/> watching television <input type="checkbox"/> taking classes <input type="checkbox"/> other _____
7. Do you collect anything? What?	
8. What job would you like to do when you grow up?	
9. Was there a time when you kept trying, even though you wanted to quit? If so, tell about it.	
10. Do you have any advice for young students?	

J.J. Audubon: The Boy Who Loved Birds

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A Play Based on The Boy Who Drew Birds by Jacqueline Davies

Characters: Narrator 1, Narrator 2, Papa, J.J., Mrs. Thomas, Aristotle, Scientist 1, Scientist 2, and Scientist 3

NARRATOR 1: One fall day, John James Audubon walked through woods in France with his papa.

PAPA: Look there, John. See the beautiful colors on the wings of that bird?

J.J.: I see, papa. But why are so many of them joining together? And why do they fly away in big groups?

PAPA: Ah, you notice much for one so young. It is a great mystery. They disappear each fall and come back in the spring.

Narrator 2: John James loved walking in the woods and talking about the birds they saw more than anything in the world. But at eighteen, his life changed forever.

Papa: John, I have news for you.

J.J. Yes, papa?

PAPA: You are old enough now to make your own way in the world. You are going on a trip across the ocean in a big ship, to America.

J.J.: What's in America?

PAPA: English-speaking people. Businesses to build. It is time you learn to become a business-man.

J.J. As you say, papa. But will there be woods to walk? Are there different types of birds there? When do we leave?

PAPA: Not we, YOU. You are going alone.

NARRATOR 1: That had been 6 months and 4,000 miles ago. Now J.J. lived in a farmhouse on the banks of a creek in Millgrove, Pennsylvania, with a housekeeper named Mrs. Thomas. He burst in through the door just as she began to worry about him.

MRS. THOMAS: John James, and where have you been? Land sakes, it's only April and still winter out!

J.J.: (*excited*) I was in the cave across the creek. You'll never guess what happened.

MRS. THOMAS: You watched birds all day long.

J.J.: Besides that.

MRS. THOMAS: You drew pictures of birds all day long.

J.J. Besides that.

MRS. THOMAS: (*shaking her head*) You do the same thing every day. What could be different today?

J.J.: The Pewee flycatchers are back. I've been checking the empty nest for the past five days, and they're back! I was right in front of the cave when the female bird shot out like an arrow. Then the male beat his wings right above my head and snapped his beak, *Clack, clack, clack*.

MRS. THOMAS: (*pointing a long wooden spoon at his muddy boots*) Clack, clack, clack, heh? Why don't you clack right over to the fire and put your muddy boots to dry. (*shaking her head*) *Clack, clack, clack*, he says.

J.J.: (*pretending to fly with arms out like wings*) You should have seen them dipping and soaring – snapping up mayflies in flight.

MRS. THOMAS: Well I'd rather see a boy your age out skating, or hunting, or riding horses with your friends. It's not natural for you to be by yourself so much.

J.J.: I'm not by myself. I'm with the birds. I wish my father could have heard the male calling, *Fee-bee! Fee-bee!*

MRS. THOMAS: Mercy me, don't even mention the man's name. He thinks you're dancing the minuet like a king, or fencing, or playing your fiddle with all your country friends. What would he say if he knew you spend every day in the woods with your birds?

J.J. (not listening) I've got to pin this drawing upstairs on my wall. Tomorrow I'll try to find a feather for my collection.

MRS. THOMAS: Heaven help me, not more junk for your collections! Why I can hardly sweep in that attic as it is, with every spare inch covered with birds' eggs, nests, stuffed birds, dried flowers, bones, berries, dead lizards, tree bark, and I don't know what else! (*muttering to herself*) What an odd boy!

NARRATOR 2: J.J. went to his bookcase in the attic and took down the natural history books which his father had given him.

J.J.: *(to himself)* Why can't scientists agree on the answers to my questions? I just want to know, where do little birds go all winter long? And do the birds come back to their same nests in the spring? Maybe if I read through these again, I can make sense of them.

NARRATOR 1: J.J. imagined each dignified author in the room with him speaking as searched through his books.

ARISTOTLE: I am the famous Greek philosopher, Aristotle. Though I lived 2,000 years ago, I am sure that every fall great flocks of cranes fly south and return in the spring.

J.J.: Yes, I know that, sir. But what about the small birds?

ARISTOTLE: Small birds? Small birds, you say? Well, those are a different story, of course. They do not migrate. They hibernate. Yes, they hibernate all winter long under the water or in hollow logs or places such as those.

NARRATOR 2: J.J. opened up another book.

J.J.: Let's see what you have to say. Where do small birds go in the winter?

SCIENTIST 1: Small birds? Why, everyone knows they gather in a great ball, beak to beak, and lay under water, frozen, all winter long. Many fishermen tell of catching tangles of birds in their nets.

J.J. *(giggling)* I have never, EVER found a tangled ball of birds under the water. What does the next scientist say?

SCIENTIST 2: Small birds transform from one kind into another each winter. A goldfinch might become a marsh hawk, a sparrow could become an eagle.

J.J. *(disbelieving)* Oh, really? I highly doubt it. Well, let's hear another idea.

SCIENTIST 3: I have solved the mystery! Small birds travel to the moon each fall and return in the spring. I have calculated the distance, and it is a very long trip, I can tell you. It takes them sixty days to fly to the moon and back!

J.J.: *(shaking his head)* I don't believe any of you. I will study the birds in my cave every day, and I'll find the answer to where they go all by myself.

NARRATOR 1: Now J.J. had never spent much time in the classroom. He failed every test he had ever taken indoors. So he decided to learn where he was most comfortable – outdoors. He took his books, pencils, paper, and flute to the cave with him. Soon the birds were used to him and ignored him altogether – like an

old log. All summer long, he watched the birds, learning about their habits and behaviors

J.J. The days are growing shorter and colder. Soon it will be autumn, and the birds will fly away for the winter. How can I find out if they come back to the same nest? I know! I just read that medieval kings tied bands on the legs of their prize falcons so they could be returned if lost. Why couldn't I band a wild bird to see where it goes?

NARRATOR 2: After finding that the baby birds pecked off regular string he tied around one leg, J.J. walked five miles to the nearest village to buy some strong thread woven from fine strands of silver. When the mother and father birds were away from the nest, J.J. tied a piece of the silver thread to one leg of each baby bird. A week later they were gone. He passed the winter working in his *musée*, or attic.

MRS. THOMAS: Happy nineteenth birthday, Master John. What are you doing? What's that you're throwing into the fire?

J.J.: My artwork from this year. Every year on my birthday, I burn all of my work. When my drawings are good enough to save, I'll stop burning them.

MRS. THOMAS: But, young master, you spend hours drawing and painting your sketches. They are beautiful!

J.J.: Not good enough. Maybe next year.

NARRATOR 1: The next spring, J.J. waited at the cave for his birds to return. One morning, he heard a bird call, *Fee-bee! Fee-bee!* The birds did not fly at him or snap their birds as they had the spring before. They just ignored him – like an old log.

J.J.: (smiling) Welcome home, my friends. Now where are your children?

NARRATOR 2: J.J. searched the nearby woods and orchard. Then he heard their calls. Two birds were building a nest inside the hay shed. One had a silver thread around its leg. He found two more nesting birds under a bridge. Again, one wore a silver thread around its leg.

J.J.: I have proved it! The birds return to their same nests. And the children build nests nearby. I must write and tell my father. And when I am older, I will tell the whole world!

NARRATOR 1: And that's just what he did. John James Audubon shared his experiments with the rest of the world in a book called, ***Ornithological Biography***. Today he is remembered as the first person in North America to tie

a marker around a bird's leg to track its movement – called **banding**. As for his simple experiment, it helped prove a behavior called **homing**. That is, birds return to the same nests each year, and their children live nearby.

NARRATOR 2: By the way, John James Audubon did stop burning his pictures because they weren't good enough. In fact, his pictures became so good that he is known as the greatest painter of birds of all time. Scientists love his paintings because of their careful detail, and ordinary people just enjoy the beauty of his birds.

Vocabulary

musée – French for museum

banding – tying a marker around a bird's leg to track its movement

homing – animals' return to their same homes each year, with their offspring nearby



Bibliography of Famous Scientist Biographies

Check to see if a local library has a service in which they order books from other libraries. If not, most local librarians are happy to find and set aside books for your teaching units.

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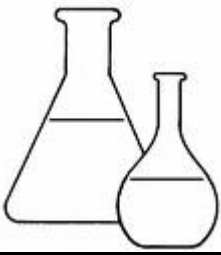
*Author's Favorites

**Note: Capstone Press has a series of biographies about famous inventors/people printed in the graphic novel format. The illustrations look like comic strips, and are very high interest to many children. See the following link for titles:

<http://www.capstonepress.com/asp/padvancedsearch.aspx?Mode=QUERY>



SCIENTIST'S STUDY SURVEY

Questions	Data
1. Why did he/she become famous?	
2. What was the scientist's favorite thing to do when he/she was young?	
3. What was his/her favorite thing to study?	
4. What kind of student was he/she in school? (Did he/she receive high grades? Did he/she like to learn at school?)	
5. What tools did he/she use to study and record data? <div style="text-align: center; margin: 10px 0;">  </div>	<input type="checkbox"/> reading books <input type="checkbox"/> doing things <input type="checkbox"/> using computer <input type="checkbox"/> writing/journaling <input type="checkbox"/> watching television <input type="checkbox"/> taking classes <input type="checkbox"/> other _____
6. Did the scientist collect anything when he/she was young?	
7. Was there a time when the scientist kept trying, even though he/she wanted to quit? If so, tell about it.	
8. Does the scientist give any advice to young people? If so, what is the advice?	
9. What surprised you about your scientist?	

Project Rubric

	Beginning 1	Developing 2	Accomplished 3	Exemplary 4	Score Comments
Quality of information	Many details are not accurate.	The project is accurate in some details.	The project is accurate in most details.	The project is accurate in all details.	
Completeness of project	The project is not complete with text or pictures.	The project is complete with text and no pictures.	The project is complete with text and pictures that are somewhat related to the topic.	The project is complete with text and related pictures.	
Understanding of the scientist's life	The project reflects little understanding of the scientist's life.	The project reflects some understanding of the scientist's life.	The project reflects good understanding of the scientist's life.	The project reflects a deep understanding of the scientist's life.	
Appearance of the project	The project is not neat and there are many spelling and grammar errors.	The project is somewhat neat with some spelling and grammar errors.	The project is neat with a few spelling and grammar errors.	The project is very neat and appealing with accurate spelling and grammar.	
Total					

Scientist Checklist

Scientist	Students Researching
Greg Asner: Rainforest Mapper	
Sandra Begay-Campbell: Navajo Woman Engineer	
Mary Claire-King: Researches Mutant Genes	
Darlene Ketten: Marine Investigator	
Joe Keiper: Fly Guy	
Rick Lee: Cold Critter Expert	
Steve Madewell: Musical Park Protector	
Yoky Matsuoka: Bioengineer Who Makes New Limbs	
Laurie Santos: Monkey Scientist	
Kathy Sullivan: First Woman Moon-Walker	

Bio-poem

Fill in information about a scientist you've researched to create your own poem. Recopy the poem on different paper and illustrate.

Line 1: Scientist's first name _____

Line 2: Scientist who studies _____

Line 3: 3 adjectives that describe the scientist _____,
_____, _____

Line 4: Who works at _____

Line 5: Who learned by _____

Line 6: Who found that _____

Line 7: Who would like to see _____

Line 8: Last Name _____

Sample Bio-poem

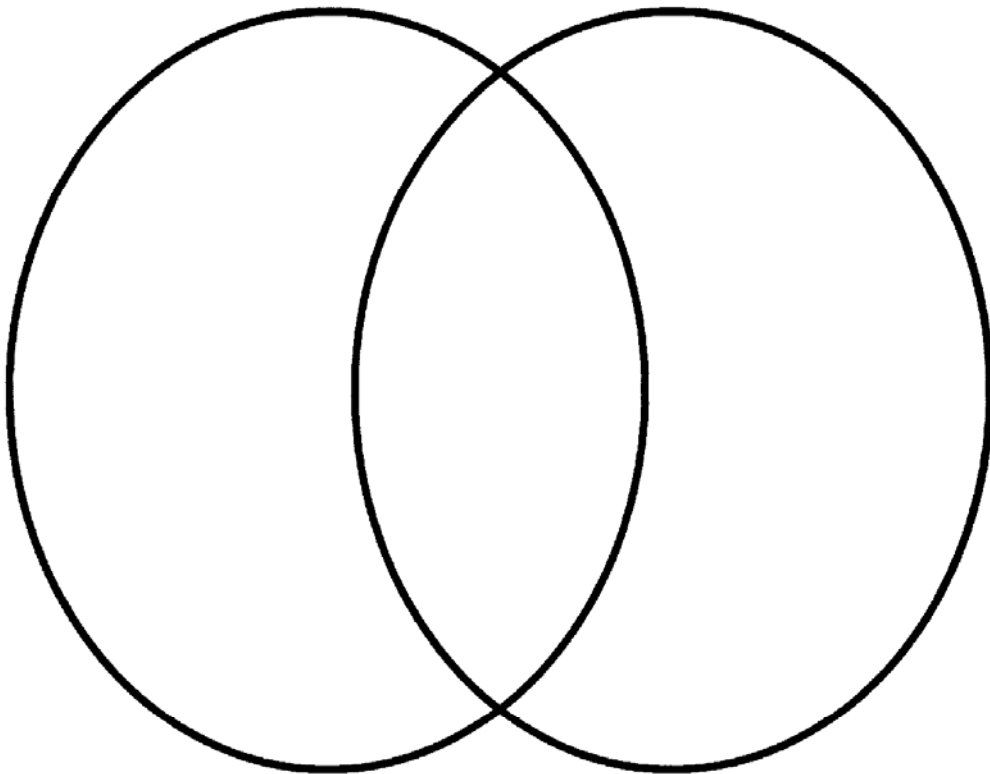


LAURIE
Scientist who studies monkeys
Observant, creative, curious
Who works at an island off Puerto Rico and
Yale University,
Who learned by watching monkeys,
Who found that monkeys make the same mistakes we do,
Who would like to see kids do what they love, get involved,
and read
SANTOS



Comparison of Scientists Past and Present Venn Diagram

Venn Diagram



SCIENTIST



PROFILES

These profiles can be found in the Bio Quest computer component that goes along with this unit. They are based upon internet surveys completed by real scientists in December, 2007. The Scientist Profiles are the basic articles from which students will find data for their data tables and bio-poems.

BIO QUEST: SCIENTIST PROFILE



RAINFOREST MAPPER

GREG ASNER

CARNEGIE INSTITUTION IN PENNSYLVANIA, STANFORD UNIVERSITY IN CALIFORNIA

Greg maps Hawaii's rainforests with a Twin Otter Plane. His technology can find the chemistry of a forest.

Job Description:

His maps can show

- the amount of water in an area which can be used to predict and track drought
- nitrogen levels which can be used to identify which invasive species are spreading fastest
- levels of carbon which could be used to regulate tree-planting projects designed to counter global warming.

His technology gets maps to Hawaiian land managers that help them make smarter decisions about controlling invasive species.

In 2005, Greg studied logging in the Amazon rainforest and proved that “selective logging” in which the best trees are harvested from the forest, can be just as hard on the forest as clear-cutting. He thought up a method to use old satellite images to see the forest down to single trees that had been cut down. His studies found that up to 25 trees can be killed when trying to harvest just one.

Biography:

Young Greg was all about nature, space, and sports when he was a kid. In school, he loved science, mainly biology. He liked to collect many things, including model airplanes, rocks, and beer cans.

Greg was an A- or B+ student. “I couldn’t often reach the A or A+ level,” he says. Sometimes he felt that he just wanted to quit -- like in grade school when he was in competitive swimming, or in AP calculus in high school. “I survived,” he says. Though he was pushed hard in high school, that’s when he realized he wanted to be a scientist. He was really interested in biology and physics by his senior year. He chose to go to college at the University of Colorado, where he got a degree in engineering.

Greg’s Advice for young scientists:

“Learn the basics now, like math, physics and chemistry, but also ask how the basic knowledge applies in real world applications. Students should feel comfortable in asking for some practical applications of the science early on in their education. Doing so will inspire them to continue on to harder scientific

topics. For example, I think looking at chemical reactions in a beaker is good once, but how about chemical reactions in a car or rocket engine, or in an ecosystem? That's where chemistry gets exciting. That's where all of the sciences come together. Students should ask for these connections up front, not years after learning what otherwise might appear to be abstract or boring."

For more information about Greg's work, check out

http://cao.stanford.edu/highlights/hawaii_forest_invaders.html

http://cao.stanford.edu/highlights/airborne_carbon_studies.html

http://cao.stanford.edu/cao_gallery.html

BIO QUEST: SCIENTIST PROFILE

RESEARCHES MUTANT GENES

MARY CLAIRE-KING

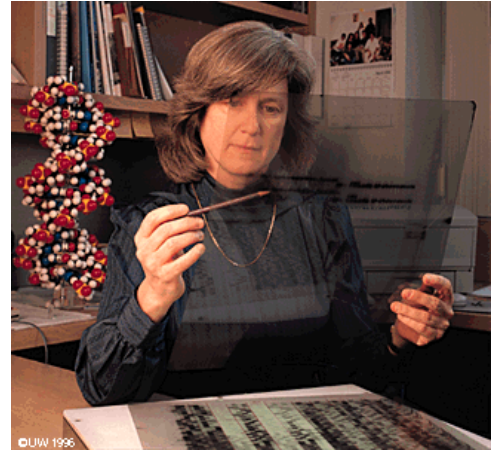
PROFESSOR OF MEDICAL GENETICS AND THE
UNIVERSITY OF WASHINGTON IN SEATTLE

She studies mutant genes that can cause people to get sick.

Job Description:

Mary studies human genes. She looks for mutant genes that can cause people to get sick, like HIV, lupus, inherited deafness, and breast cancer. She is best known for 3 things. . .

- Identifying breast cancer genes
- Demonstrating that chimpanzees are 99 percent genetically identical
- Using her knowledge of genes to identify victims of human rights abuses



Biography:

When Mary was young, she liked to play the flute, bike with her friend, Debbie, and walk on the beach. She lived in Florida near the ocean, and collected things like shells, small vases, stamps, coins, and local reed flutes. Her favorite things to study were math and music.

Her special way of learning was to sit with her dad, who was an invalid and home all of the time. They would invent math puzzles based on the baseball games they watched together on TV. Mary was a serious student who learned by reading books, writing and journaling, watching television, and taking classes. There were no personal computers when she was young.

Many, many times, she wanted to quit, but she kept on trying.

Her advice to young scientists is:

“Find a nice puzzle that’s fun and keep at it.”

Fore more information about Mary’s work, check out:

<http://www.uchsc.edu/sm/mstp/aspen98/king.html>

BIO QUEST: SCIENTIST PROFILE**NAVAJO WOMAN ENGINEER****SANDRA BEGAY-CAMPBELL**

University of New Mexico, U.S. Department of Energy



She has spent the last 10 years bringing solar-powered electricity to remote tribal members of the Navajo reservation.

Job Description:

Sandra listens to tribes about their energy needs and gives them information about renewable energy or green energy. She works to find solutions for her people. One of her first jobs was to analyze buildings after a huge earthquake in California. She knew from her early training that nature was stronger than human technology. "My cultural heritage has taught me that engineers ultimately cannot control Mother Nature and we have to accept the consequences from natural phenomena," she says.

When she was in sixth grade, she was interested in architecture, math, and solving problems. Since she was not a good artist, she decided to become an engineer. Sandra was a serious student who kept trying even when she felt like giving up.

Some tools for learning were her parents. Her father was a tribal leader who showed her that she needed to use her skills to help other American Indians. Her mother guided her as a working woman.

Today her goal is to develop a large wind farm on the Navajo Nation. In the future, she wants to change the image of today's engineers. She jokingly refers to herself as an "INJUN-eer." She enjoys science fiction TV, (especially "X-Files"), her family, and friends.

Kathy's advice to young scientists is:

"If possible, I would encourage young women to discover what an engineering career is like by visiting with a woman engineer."

For more information about Kathy's work, check out:

http://www.myhero.com/myhero/hero.asp?hero=Begay_Campbell_california_06
<http://pbskids.org/dragonflytv/scientists/scientist55.html>

BIO QUEST: SCIENTIST PROFILE

FLY GUY

JOE KEIPER

CURATOR OF INVERTEBRATE ZOOLOGY CLEVELAND MUSEUM
OF NATURAL HISTORY PROFESSOR AT KENT STATE
UNIVERSITY

He studies insects, takes care of bug collections at the Natural History Museum, and helps hospitals solve mysteries.



Job Description:

Joe is an entomologist. His purpose as a scientist is to provide new information to the fields of insect studies, ecology, behavior, evolution, and forensics. Hospital staffs sometimes call on him to help with a case they can't solve. Once, doctors treating a young girl for a serious eye infection asked him to clear up a medical mystery. Audubon Magazine reported the story.

"The doctors had removed a live maggot from under the girl's eyelid, where it was feeding on tissue," Joe recalls. "They wanted to know how in the world the maggot got where it was. I identified it as a warble fly, which ordinarily bores into live rodents and similar animals. That gave us a clue, and under questioning, the girl remembered visiting a petting zoo, where she had handled rabbits." Bingo!

Biography:

Joe liked to read when he was young. His entire family encouraged him to love science by buying him books and science equipment. He loved to pretend he was stranded on a desert island and had to fend for himself for food and shelter. He had a rock collection, his grandfather's mineral, fossil, and projectile point collection, and football and baseball trading cards. Joe loved to study bugs. There were so many with neat behaviors and shapes and colors. He also loved birds. When he saw a bird, he would note what kind it was, where, when, what time, what it was doing, etc.

He was an average student in school. He daydreamed a lot. He didn't focus on homework and studying until college. The topics he was interested in, like natural history, were not covered in class. Looking back, he wished he would have done better in math, history, and English, as those subjects would have helped him in his work today. In college, he found that he had to work TWICE as hard as the good students just to keep up. He did it, but it would have been much easier if he'd paid proper attention as a young student.

As for how he learned, he says, "you learn by doing -- period." Even though you can learn by reading, true learning comes by trying, failing, gathering information, trying again, and succeeding," Joe says. The tools he used to learn with were:

reading books, using computer, writing and journaling, watching television, taking classes, and being in the Boy Scouts which taught him natural history lessons.

Joe decided to become a scientist in college when he realized that people no better than he were succeeding. He decided to apply himself to his studies. There were many times when he kept on trying, even though he wanted to quit. He knows that he's better off taking the hard way in life.

Joe's advice to young scientists:

"Be prepared to have fun with life. Whatever you do in life, you have to enjoy it. If you do things associated with developing a scientific background (like visiting a natural history museum, reading a science book, or flipping a rock to see what lives under it) and you ENJOY IT, then you might have what it takes to be a good scientist. If you go into science for any other reason, it will be difficult to be a good scientist. The BEST scientists I know and wish to emulate ENJOY their work. Never forget to smile sometimes while you do your work in school. If the people around you are not smiling, don't worry if you smile yourself. A good, positive attitude is amazingly contagious!"

To find out more about Joe's work, check out:

http://www.cmnh.org/site/ResearchandCollections_InTheField.aspx

http://bugsandbear.blogspot.com/2007_07_01_archive.html

BIO QUEST: SCIENTIST PROFILE**MARINE INVESTIGATOR****DARLENE KETTEN**

SENIOR SCIENTIST AT WOODS HOLE OCEANOGRAPHIC INSTITUTE IN MASSACHUSETTS, HARVARD RESEARCHER

She studies whales and dolphins that have beached themselves on the Massachusetts coast.

*Job Description*

Darlene examines the bodies of marine animals that have beached themselves to find out how and why they died. Darlene works in forensics, diagnosis, and the science of hearing, especially for marine mammals. Some tools that she uses are X-rays, and ultrasound.

Biography

When Darlene was young, she liked to read and see new places. She liked to study languages and math. In school, she was at the top of her class. Since there were no computers in her high school, she learned by reading and taking classes. Now computers are really important to her work, and she uses them all the time.

Darlene didn't collect anything special, and didn't decide to become a scientist until she was in college. She has often wanted to quit, but learned that the perfect experiment is not very likely. She expects the unexpected and then some.

Darlene's advice to young scientists is:

"Do science and the type of science that excites you, not the science that is popular or has a high priority with everyone else. Science fields are fashionable just like most things in life, and the research areas go in and out of fashion and funding. It is horrible to work on something as demanding as science just because someone will pay you to do the research. The real joy of science is to discover something new in an area about which you are passionate. Enjoy yourself since science has its own magic."

To find out more about Darlene's work, check out:

http://www.myhero.com/myhero/hero.asp?hero=Darlene_Ketten_06

BIO QUEST: SCIENTIST PROFILE**COLD CRITTER EXPERT****DR. RICK LEE**

DIRECTOR OF DEPARTMENT OF ZOOLOGY AT MIAMI UNIVERSITY, OHIO

He's finding out how insects, frogs and turtles survive extreme cold including some that can survive freezing.

*Job Description*

Rick Lee is a biologist who is interested in CRYOBIOLOGY (the study of how plants and animals live in the cold). In the winter, he travels to Antarctica, where he researches how bugs survive cold and severe weather. His findings may help develop ways to freeze transplant organs such as hearts and livers to help them last longer for people who need organ transplants. In the summer, he takes students out West to Wyoming and Montana to experience science first-hand.

Biography

When Rick Lee was a boy, he loved to play outside. His favorite things to study were biology and nature. He collected insects, leaves, and shells.

In school, he was a good student who learned mostly by reading books. He knew he wanted to be a scientist after college. Instead of teaching high school biology and coaching as he'd planned, he ended up teaching college students and doing research in the Department of Zoology at Miami University.

Dr. Rick's advice for young scientists:

"Develop strong skills in speaking, writing and reading. Be prepared to work hard to achieve your goals."

For more information about Dr. Rick's work, check out:

<http://www.units.muohio.edu/cryolab/projects/InsectCryobiology.htm>

BIO QUEST: SCIENTIST PROFILE**MUSICAL PARK PROTECTOR****STEVE MADEWELL**

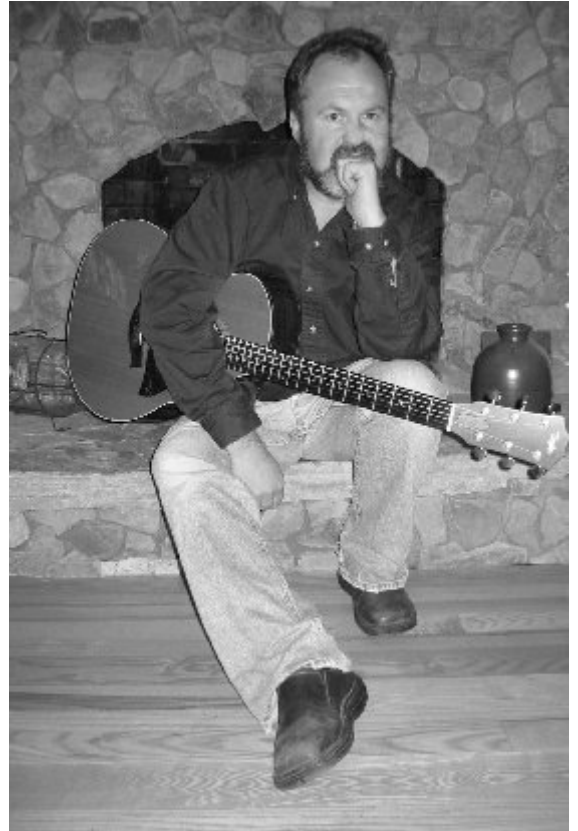
DEPUTY DIRECTOR OF LAKE METROPARKS,
CONCORD, OHIO

He watches over wetlands, forests and meadow lands, and protects endangered plants and animals.

Biography:

Steve used to love to explore the woodlots and pastures around his house. He was outside from morning 'til dark. Even after dark, he would sit on the porch with a candle and watch carpenter ants and other insects. He also learned certain bird calls and enjoyed "talking" with the birds. Fishing was a big pastime, as well as building dams in the creeks near his house, and catching salamanders and fireflies. Steve collected arrowheads and fossils when he was young.

He loved to study anything out of doors, and read the natural history encyclopedias.



Steve learned by reading the encyclopedia. That's how he taught himself to play chess. At school, Steve didn't always do his homework. He didn't always study, but enjoyed class discussions, especially about science. He wasn't good at spelling or math. In fifth grade, he almost got suspended from school because he researched how to make gun powder, and made a small batch. In college, he learned how to write and realized that he was very good at figuring things out in his own way. Reading books, taking classes, and doing things were his best tools for learning. He always loved conservation, and knew that humans disrupted earth's natural systems. This made him very discourage at times.

Steve's advice to young scientists:

There is a great need for people to understand the world around us and how we're a part of that world. We still need to improve our understanding of how we can live and prosper in the world without destroying it by waste and consumption.

For more information about Steve's life, check out:

<http://www.madewellmusic.com/photos.html>

BIO QUEST: SCIENTIST PROFILE

BIOENGINEER WHO MAKES NEW LIMBS



YOKY MATSUOKA

BIOENGINEER AT THE UNIVERSITY OF WASHINGTON IN SEATTLE
She builds artificial hands, arms, feet, and legs. Her goal is to make limbs that snap on and can be controlled directly by the brain.

Job Description:

Yoky made a model of a human hand with three fingers. She will use monkeys to test it. First the monkey will be sitting in front of a bottle with food in it. Its arms will be strapped to its side, and wires will connect its brain to a computer, then to Yoky's model hand. The monkey will send brain signals to the computer which will move the model fingers. Yoky hopes that the monkey will be able to control the model hand with its brain, open the bottle, and get a snack. Her final goal is to make model limbs for people who have lost theirs. These models will pop on and be ready-to-go!

Biography:

When she was young, Yoky loved to play sports, solve puzzles, collect rocks, and do math and science homework. In school, she was quiet and never asked questions. She didn't like subjects that had to do with feelings, like psychology. Instead, she loved physics and math. Yoky learned by remembering the context (where, what, and how she learned) in her brain. Though she didn't use a lot of special tools to learn, she did keep a journal. It was mostly about boys, though!

Yoky was a great tennis player, and dreamed of being a professional. When she was on the court, she also did a lot of thinking about how her brain was controlling her hand. She thought about how her brain helped her swing the racket at just the right time and angle. Many times, she felt like quitting, but she kept playing until she was in college. In college, she knew that she would never be the number one tennis player in the world, and that she wanted to become a scientist. Yoky learned that she couldn't do everything, so she had to figure out what was most important to her.

Yoky's advice for young scientists:

"Work hard but also play hard. Play sports. Play music, etc. These exposures will allow you to find out what you really like and can pursue without getting sick of it for a long time."

For more information about Yoky's work, check out:

http://www.ri.cmu.edu/projects/project_443.html

<http://www.popsci.com/popsci/science/8986e1bddf565110vgnvcm1000004eebc/cdrcrd/9.html>

BIO QUEST: SCIENTIST PROFILE**MONKEY SCIENTIST****LAURIE SANTOS**

ASSISTANT PROFESSOR IN THE DEPT. OF PSYCHOLOGY AT YALE UNIVERSITY, CONNECTICUT.

She compares monkey and human thinking.

*Job Description:*

Laurie designs experiments to measure the thinking abilities of primates such as rhesus macaques in Cayo Santiago near Puerto Rico and capuchin monkeys in her laboratory in Connecticut. One experiment showed that a rhesus monkey will take a grape from an unwatched plate 90 out of 100 times. This is seen as evidence that monkeys think like us.

Biography:

When Laurie was young, she played with dolls, on the computer, and writing stories and poems. Her favorite subject was history. She like hearing about how people behaved in the past and why they did the things they did. Studying monkey behavior is actually very similar to studying history. Looking at the thinking and behavior of monkeys living today is a window into how our forefathers thought and behaved millions of years ago. Laurie grew up near the shore, so she kept a very big collection of beach glass. She liked how the sand and surf smoothed it out. The collection is still at her mom's house today.

She was a pretty good student in school, but had really bad penmanship. The most important learning tool for her is curiosity. Being a scientist is all about being curious and wondering about the ay the world works. She kept a journal which was like her own private blog with her thoughts and what happened during the day. Laurie planned to be a lawyer until she took a class in evolution and was fascinated. She really wanted to understand what made humans different from other animals. She started taking some psychology classes and got hooked. She's never looked back since. There have been times when she wanted to quit, but "science is all about working through difficult times," she says.

Laurie's advice for young scientists:

"My first pieces of advice would be to do what you love. If you like animals, get involved at your local zoo, even if it's just volunteering, or try starting your own pet-walking service. Whatever you like. Try to get involved now. My second piece of advice would be to read, read, read. Your library has lots of books on cool topics that you might be interested in. So you should dive in and learn more about what interests you."

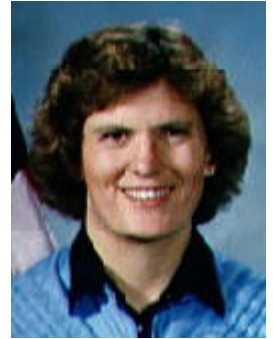
For more information about Laurie's work, check out:

<http://www.yale.edu/monkeylab/Main/Research.html>

BIO QUEST: SCIENTIST PROFILE**FIRST WOMAN MOON-WALKER****KATHY SULLIVAN**

FORMER NASA ASTRONAUT. PRESIDENT AND CEO OF COSI, COLUMBUS, OHIO.

She was the first American woman to walk on the moon, and now studies marine animals and writes about how the ocean is changing. She is the president of a Science Center in Ohio.

*Job Description:*

Kathy study seabirds, sea turtles, and ocean fish. She writes about how the ocean is changing and what it means for wildlife and people.

When she was young, she had a lot of pets and liked to be outside fishing. Her favorite thing to study was biology. Her special way of learning was to read books, and explore the woods and along the shore. She collected things and made aquariums and terrariums.

She was a good student who usually got good grades. But she was not a genius. The tools she used to learn were: reading books, watching television, and taking class. Since there were no computers yet when she was young, Kathy learned by being outside and experiencing the world first-hand.

In 11th grade, she decided to become a scientist, even though she almost became a musician. Many times she felt like quitting, but she kept trying. Even now, writing books is discouraging. She tries to remember that quitting is much more discouraging than hard work.

Kathy's advice to young scientists is:

“Science is the greatest thing ever invented for the mind. Curiosity is very energizing. You can spend your whole life being amazed and excited by what you’re learning. It can be hard through college but after that, grad school and beyond is very stimulating, and a lot of fun.”

For more information about Kathy's work, check out:

<http://quest.arc.nasa.gov/people/bios/women/sullivan.html>