

8

Exploring
Bioinformatic Careers

Introduction

Students synthesize the information they have learned throughout the unit about people in various careers who use bioinformatics. Students then have the opportunity to perform independent research about a career of interest before developing a resume to use when applying for a bioinformatics-related job. Students also learn about writing cover letters. Optional extensions include peer-editing of resumes and mock interviews for jobs related to a career of interest.

Learning Objectives

By the end of this lesson, students will know that:

- Although bioinformatics is a career in itself, there is a wide variety of careers that make and use the tools of bioinformatics.
- Different career paths require different amounts of education and training.
- Cover letters are used to introduce yourself and your resume to potential employers.

By the end of this lesson, students will be able to:

- Perform internet research to learn more about different careers, including job prospects, expected salaries, and required training.
- Create a resume that highlights skills gained throughout this unit.
- Critique and write cover letters introducing themselves and their resumes to potential employers.
- Ask and answer questions commonly asked in job interviews (optional extension).

Key Concepts

- Many different biology-related careers use bioinformatics skills and tools.
- Different career paths require different amounts of education and training.
- Career opportunities and employment projections vary by field.
- Online resources can be used to research many different careers.
- Information and skills students develop in the classroom can be used to construct a resume.
- Cover letters are used to introduce yourself and your skills to potential employers.
- Job interviews typically involve questions related to your skills and experience (optional extension).

Class Time

Up to 4 class periods (approximately 50 minutes each). 1-2 periods for career research and writing or updating their resume (including optional resume peer-editing), and 1 period for the cover letter activities. A final class period may be used for an optional mock interview. Additional homework time may be used to supplement class time (optional).

Materials

Materials	Quantity
Copies of Student Handout— <i>Careers in the Spotlight</i> (handed out in Lesson One)	1 per student
Copies of Student Handout— <i>The Process of Genetic Research</i> (handed out in Lesson One)	1 per student
Class set of Student Handout— <i>Career Interview 1: Ellen Sisk, Manager, DNA Sequencing Core Facility</i>	7 minimum (class set)
Class set of Student Handout— <i>Career Interview 2: Krishna Veeramah, Postdoctoral Scientist, DNA and History Program</i>	7 minimum (class set)
Class set of Student Handout— <i>Career Interview 3: Lalita Ramakrishnan, Microbiologist</i>	7 minimum (class set)
Class set of Student Handout— <i>Career Interview 4: Michael Crawford, Biological Anthropologist</i>	7 minimum (class set)
Class set of Student Handout— <i>Career Interview 5: James Ferrenberg, Molecular Diagnostics Researcher</i>	7 minimum (class set)
Class set of Student Handout— <i>Career Interview 6: Kris Freeman, Science and Technical Writer</i>	7 minimum (class set)
Class set of Student Handout— <i>Career Interview 7: Russell Saneto, Pediatric Neurologist</i>	7 minimum (class set)
Copies of Student Handout— <i>Spotlight on My Career</i>	1 per student
Copies of Student Handout— <i>Colleges and Universities in Washington and Oregon</i> [Note: If you are outside this area, you may wish to develop a similar resource for colleges in your area. Contact the Bio-ITEST program if you would like assistance.]	1 per student
Class set of Student Handout— <i>Bioinformatics Resume</i>	1 per student (class set)
Copies of Student Handout— <i>Resume Peer-Editing Form (Optional: See Part II)</i>	1 per student
Class set of Student Handout— <i>Writing a Cover Letter</i>	1 per student (class set)
Copies of Student Handout— <i>Cover Letter Examples</i>	1 per student
Teacher Answer Key— <i>Cover Letter Examples</i>	1
Copies of Student Handout— <i>Cover Letter Peer-Editing Form (Optional: See Part III)</i>	1 per student
Copies of Student Handout— <i>Mock Interview Grading Rubric (Optional: See Optional Extension/Assessment at end of the lesson)</i>	1 per student
Teacher Answer Key — <i>The Process of Genetic Research</i> (found in Lesson One)	1

Computer Equipment, Files, Software, and Media
Computer and projector to display PowerPoint slides. Alternative: Print PowerPoint slides onto transparencies and display with overhead projector.
Lesson Eight PowerPoint Slides— <i>Exploring Bioinformatics Careers</i> . Available for download at: http://www.nwabr.org/curriculum/advanced-bioinformatics-genetic-research .
Electronic versions of all <i>Career Interviews</i> and accompanying internet resources are available on the “Exploring Careers” page of NWABR’s Student Career Center at: http://www.nwabr.org/students/exploring-careers
A student version of lesson materials (minus <i>Teacher Answer Keys</i>) is available from NWABR’s Student Resource Center at: http://www.nwabr.org/students/student-resource-center/instructional-materials/advanced-bioinformatics-genetic-research .
Computer lab with internet access, and a word processing program such as Microsoft® Notepad or Word (minimum of seven computer stations – one per career group, or assign Student Handout— <i>Spotlight on My Career</i> as homework).

Teacher Preparation

- Load the classroom computer with the *Lesson Eight* PowerPoint slides.
- Make copies of the Student Handouts, one per student. The *Career Interviews*, *Bioinformatics Resume*, and *Writing a Cover Letter* Student Handouts are designed to be re-used as Class Sets.
- Electronic versions of all *Career Interviews* and accompanying internet resources are available on the “Exploring Careers” page of NWABR’s Student Career Center at: <http://www.nwabr.org/students/exploring-careers>.

Procedure – Day One

PART I: Researching a Career

1. Explain to students the **aims of this lesson**. Some teachers may find it useful to write the aims on the board.
 - a. **Lesson Aim:** Learn more about one of the careers highlighted in *Lessons One through Seven*.
 - b. **Lesson Aim:** Learn how to research careers using credible internet resources.
 - c. **Lesson Aim:** Develop a resume and cover letter.
 - d. **Lesson Aim:** Learn how to interview for a job (*Optional Extension*).

Teachers may also wish to discuss the *Learning Objectives* of the lesson, which are listed at the beginning of this lesson plan.

2. Have students use Student Handout—*Careers in the Spotlight* given out on the first day of the unit as a reference while the class reviews all seven of the *Careers in the Spotlight* PowerPoint slides that have been shown to students during the *Warm Up* portion of each lesson.
3. Show **Slide #1**, which highlights DNA sequencing core manager Ellen Sisk. Take a moment to review the information on the slide.

DNA Sequencing Core Lab Manager
 ELLEN SISK, MS



Place of Employment:
Seattle Biomedical Research Institute

Type of Work:
Manages the DNA Sequencing “Core.” The Core lab is a centralized facility that provides DNA sequencing for all the researchers at the Institute.

The Seattle BioMed Sequencing Core facility has been in operation for over 18 years and offers DNA sequencing and analysis to Seattle’s scientific community, as well as international scientists and organizations. Our service provides cost-effective solutions for small laboratories that lack access to sequencing technology.

Careers & Bioinformatics: **Slide #1**

4. Show **Slide #2**, and remind students that Sequencing Core Labs perform DNA sequencing reactions for a number of different labs. The core lab manager oversees the Sequencing Core Lab and offers her expertise to each of the labs.

Careers & Bioinformatics: **Slide #2**

CAREERS IN SPOTLIGHT:
DNA Sequencing Core Lab Manager

What do they do?
The manager oversees the core lab facility. These types of facilities make it possible to perform DNA sequencing reactions and analysis for many different researchers at a given institution, company, or university. The Core lab facility makes it possible for many researchers to share the same DNA sequencing facility and expertise of technicians and the Core Lab Manager.

What kind of training is involved?
Bachelor's degree in biology, molecular biology, biochemistry, or related discipline. Some have a Master's degree or a PhD.


What is a typical salary for a Core Manager?
Salaries vary with experience and range from \$50-\$100,000 per year (\$25-\$50/hour).

Source: Genome Technology Salary Survey 2010

5. Show **Slide #3**, which highlights postdoctoral scientist Dr. Krishna Veeramah. Take a moment to review the information on the slide.

Careers & Bioinformatics: **Slide #3**

Postdoctoral Scientist, DNA and History
KRISHNA VEERAMAH, PhD



Place of Employment:
University of California, Los Angeles (UCLA)

Type of Work:
Human population genetics, with emphasis on Sub-Saharan Africa

I always liked genetics, but it wasn't my first choice at school. I wanted to be a footballer (or soccer player), but... working with all these clever things like Y chromosomes possibly descended from the brother of Moses, I eventually started doing my own work and got wrapped into it.

6. Show **Slide #4**, and remind students that postdoctoral scientists have already received their PhD, and are seeking further training in a particular area. Dr. Veeramah is learning how to use genetics to study Sub-Saharan African populations.

CAREERS IN SPOTLIGHT:
Postdoctoral Scientist, DNA and History

What do they do?
Postdoctoral Scientists are people with a PhD who desire more training. The DNA and History program at UCLA is unique – a result of the dramatic increase in DNA data and biotechnology. The increase in DNA data influences research beyond biology, into the humanities and social sciences, like the history of human populations.

What kind of training is involved?
Dr. Veeramah has a PhD and is doing additional training and teaching at UCLA.


What is a typical salary for a Postdoctoral Scientist?
The minimum salary for a Postdoctoral Scientist funded by the National Institutes of Health (NIH): Starting salary: \$37,740 (\$18/hour). 5 years of experience: \$47,940 (\$24/hour).

Source: National Institute of Health

Careers & Bioinformatics: **Slide #4**

7. Show **Slide #5**, which highlights microbiologist Dr. Lalita Ramakrishnan. Take a moment to review the information on the slide.

Microbiologist
Lalita Ramakrishnan, MD, PhD



Place of Employment:
University of Washington

Type of Research:
Tuberculosis infection

Model Organism:
Zebrafish

Zebrafish are naturally susceptible to tuberculosis. Because their genes are fairly easy to manipulate, we can create some zebrafish that are susceptible to TB and some that are resistant to TB. Zebrafish are also good model organisms because they are transparent, so we can watch the infection process develop.

Careers & Bioinformatics: **Slide #5**

8. Show **Slide #6**, and remind students that microbiologists study microbes like bacteria, viruses, and protists. Dr. Ramakrishnan has an MD and a PhD and studies the bacterium that causes tuberculosis. She also studies the body's immune response to tuberculosis infection.

CAREERS IN SPOTLIGHT:
Microbiologist

What do they do?
Microbiologists study microbes: bacteria, viruses, fungi, and protists. Dr. Ramakrishnan is an expert in tuberculosis, a type of bacteria that infects almost a third of humanity worldwide. She also studies immunology, including the body's reaction to or defense from microbes.

What kind of training is involved?
Most Microbiologists who run their own lab have a Bachelor's degree and a PhD (which is usually 5–6 years of research training). However, each lab often employs scientists with diverse backgrounds, including people with Associate's, Bachelor's, and Master's degrees.

What is a typical salary for a Microbiologist?
Associate's degree: \$35,000/year (\$17.50/hour)
PhD, Full Professor: \$100,000/year or more (\$48.00/hour)

Source: Bureau of Labor and Statistics


Careers & Bioinformatics: **Slide #6**

9. Show **Slide #7**, which highlights biological anthropologist Dr. Michael Crawford. Take a few moments to review the information on the slide.

Careers & Bioinformatics: **Slide #7**

Biological Anthropologist

Michael Crawford, PhD



Place of Employment:
University of Kansas

Type of Work:
DNA analysis to study the history of human population and migrations

Science was something that I was always excited about. I have one foot in anthropology as an anthropological geneticist; therefore I'm not strictly limited to a laboratory, but can go into the field for my work reconstructing the history of human populations and their origins based on population genetics.

[**Note:** The paper describing this finding is referenced at the end of this lesson in the *Resources* section.]

10. Show **Slide #8**, and remind students that biological anthropologists study the evolution of the human species. Dr. Crawford also studies ancient human migration patterns and the genetics of ancient humans, like a 4,000-year-old Palaeo-Eskimo.

Careers & Bioinformatics: **Slide #8**

CAREERS IN SPOTLIGHT: Biological Anthropologist

What do they do?
Also called *Physical Anthropologists*, Biological Anthropologists study the development of the human species in the context of other primates and fossils.

They:

- compare and contrast traits among species
- study why and when certain traits evolved or disappeared

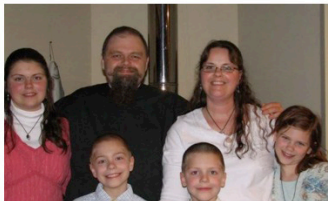
What kind of training is involved?
Bachelor's or Master's degree to work in the field. PhD to run your own lab.

What is a typical salary for a Biological Anthropologist?
Bachelor's Degree: \$35,000 to \$40,000 (\$17.50–\$19.00/hour)
PhD, Full Professor: up to \$150,000/year (\$72.00/hour)

Source: Bureau of Labor and Statistics

11. Show **Slide #9**, which highlights molecular diagnostics researcher James Ferrenberg. Take a few moments to review the information on the slide.

Molecular Diagnostics Researcher
James Ferrenberg



Place of Employment:
University of Washington
Molecular Diagnostics Lab
Virology Division

Type of Work:
Develop tests to diagnose
different types of viral infections

Discovery is really exciting and there is nothing cooler (in my job) than designing an assay and finding it works great and generates important data.

Careers & Bioinformatics: **Slide #9**

12. Show **Slide #10**, and remind students that molecular diagnostics researchers develop tests to identify organisms responsible for infections by studying the DNA or RNA of infectious organisms like viruses or bacteria. Mr. Ferrenberg develops tests to detect and identify viruses present in patient samples.

CAREERS IN SPOTLIGHT:
Molecular Diagnostics Researcher

What do they do?
Develop tests and methods to identify a disease or the predisposition to a disease by analyzing the DNA or RNA of an infectious organism (virus, bacteria, or parasite).

What kind of training is involved?
Associate's degree and/or Bachelor's degree


What is a typical salary for a Molecular Diagnostics Researcher?
Starting: \$35,000-\$45,000/year (\$17.50-\$22.00/hour)
Up to: \$55,000-\$65,000/year (\$26.00-\$31.00/hour)

Source: Genome Technology Salary Survey 2010

Careers & Bioinformatics: **Slide #10**

13. **Slide #11**, which highlights science and technical writer Kris Freeman. Take a few moments to review the information on the slide.

Science and Technical Writer
Kris Freeman



Place of Employment:
School of Forest Resources,
University of Washington

Type of Work:
Science and Technical Writing

I think we live in a time when people are overwhelmed by data, and the job of a good editor or writer is to help your reader deal with a particular set of complex data, to make it understandable. Not all scientists know how to convey their data, so your job is to help them convey this information.

Careers & Bioinformatics: **Slide #11**

14. Show **Slide #12**, and remind students that science and technical writers help scientists explain their results to other scientists and to the public. Ms. Freeman has worked with a number of different scientists. She currently works for the School of Forest Resources at the University of Washington.

Careers & Bioinformatics: **Slide #12**

CAREERS IN SPOTLIGHT:
Science and Technical Writing

What do they do?
Science and Technical Writers edit and format complex scientific reports, in collaboration with other scientists. Some Science and Technical Writers also communicate complex research findings to the public and to the media using language and terms everyone can understand.

What kind of training is involved?
Many have a Bachelor's degree in English, Journalism, or Technical Writing, and a minor in Biology or a related science.


What is a typical salary for a Science and Technical Writer?
Varies with experience, and ranges from \$30,000/year (\$14/hour) to \$90,000/year (\$43/hour).

Source: National Institutes of Health, Office of Science Education.

15. Show **Slide #13**, which highlights pediatric neurologist Dr. Russell Saneto. Take a few moments to review the information on the slide.

Careers & Bioinformatics: **Slide #13**

Pediatric Neurologist
Russell Saneto, DO, PhD



Place of Employment:
Seattle Children's Research Hospital

Type of Work:
Diagnosis and treatment of epilepsy, neurogenetic disorders, and neurometabolic disorders (in particular mitochondrial disease)

I count it a privilege to diagnosis and treat patients and their families. Although I am a pediatric physician, I have found that you not only treat the child, but the whole family. When a child gets sick, the whole family suffers.

16. Show **Slide #14**, and remind students that pediatric neurologists diagnose and treat children with disorders of the brain and spinal column. Dr. Saneto specializes in diseases involving the mitochondria, including Leigh's disease.

CAREERS IN SPOTLIGHT:
Pediatric Neurologist

What do they do?
Diagnose and treat children with disorders of the brain and spinal cord.

What kind of training is involved?
Usually an MD (Medical Doctor) or DO (Doctor of Osteopathic Medicine). The DO is trained specifically in understanding the muscular and skeletal system and how this may relate to disease or pain management.

What is a typical salary for a Pediatric Neurologist?
The average salary for a Pediatric Neurologist is \$220,000/year (\$106/hour).

Source: Physician Compensation Survey, by the American Medical Group Association (AMGA).

Careers & Bioinformatics: **Slide #14**

17. Ask students to look over Student Handout—*Careers in the Spotlight* and choose one career they find most interesting.
18. Pass out copies of Student Handout—*Spotlight on My Career* and Student Handout—*Colleges and Universities in Washington State*. Also pass out the *Career Interview* for the career they have chosen, or direct students to the “Exploring Careers” page of NWABR’s Student Career Center at: <http://www.nwabr.org/students/exploring-careers>.
19. Ask students to complete Student Handout—*Spotlight on My Career* on their own using the *Career Interview* and *Resources* section, as well as their computer’s search engine. Student Handout—*Colleges and Universities in Washington and Oregon* will help students identify colleges with programs for their career.

Students may work in groups with other students who chose the same career or work individually, depending on computer availability.
20. Allow 15-20 minutes for students to complete the information on Student Handout—*Spotlight on My Career* before asking students to share some of the interesting things they found in the interviews and during their internet research.

PART II: Bioinformatics Resume

21. Tell students they will create a resume for the career they are most interested in, highlighting skills they have gained through the course of this unit. If students completed a resume as part of the Bio-ITEST Introductory curriculum, *Using Bioinformatics: Genetic Testing*, they may update their existing resume with their new skills. Tell students that keeping your resume current as you learn new things is an ongoing, lifelong process.
22. Ask them to retrieve Student Handout—*The Process of Genetic Research* and pass out the class set of Student Handout—*Bioinformatics Resume*.

[Note: If you are outside Washington and Oregon, you may want to provide a similar resource that is specific to your region.]

[Note: If students completed the Bio-ITEST Introductory curriculum, *Using Bioinformatics: Genetic Testing*, they will be familiar with this research process and should be able to complete the assignment more quickly. If time is limited, students can complete the front page of Student Handout—*Spotlight on My Career* together, and complete the back page individually for homework.]

[Note: The suggested point value for Student Handout—*Spotlight on My Career* is **10-15 points**.]

[**Note:** The suggested point value for the Bioinformatics Resume is **20 points**.]

[**Note:** The suggested point value for Student Handout—Resume Peer-Editing is **5 points**.]

23. Students should use Student Handout—*Bioinformatics Resume* to create a resume for their career of interest, or use this handout to update their existing resume. Ask students to assume that they are applying for whatever position they desire (such as a laboratory technician in a research lab, assistant science writer, DNA sequencing core manager, etc.). To complete the *Knowledge/Understanding* and *Skills* sections, students should refer to their notes on Student Handout—*The Process of Genetic Research*.

If time is limited, students can complete their resume for homework.

24. **Optional Extensions:**

- Have students look for job postings online. They can use the results of their search as they write their resume specifically for the job(s) they found. In particular, students may look for jobs at the colleges or universities where they are applying or plan to attend. Some colleges and universities also provide help to students seeking jobs or internships.
- Pass out copies of Student Handout—*Resume Peer-Editing Form*, and ask students to exchange resumes with a classmate sitting near them (such as everyone passing their resume to the person sitting on their right). Tell students to review, comment on, and grade the resume of one of their classmates. Emphasize to students that this process is meant to be helpful, and that students will be graded on the quality of their editing and review.

25. **Closure, Day One:** Ask students to share their experiences writing and/or peer-editing a resume.

26. **Lesson Modification:** Teachers may wish to allow two days for the above activities, one day each for *Part I* (career research) and *Part II* (resumes).

Procedure – Day Two

PART III: Cover Letters

27. Explain to students that applying for a job often involves submitting a resume and a cover letter. Cover letters are an opportunity for you to introduce yourself and your skills to a potential employer.

28. Pass out the class set of Student Handout—*Writing a Cover Letter*, and review with students the information found in the box at the top of page one, “What is a Cover Letter?” Cover letters have many goals, including:

- To introduce yourself to the organization and explain which position you are applying for.
- To let the organization know how and why you are a good fit for them, and how your skills and interests fit the description of the job for which you are applying.
- To demonstrate that you are familiar with the work of this group, organization, or college.
- To demonstrate your writing abilities and try to set your resume apart from the others.

29. Allow students to read through the *Cover Letter Outline* on their own, or read through it with them, emphasizing each component:

- **Date and Greeting**
- **Paragraph One:** Why are you writing to them?
- **Paragraph Two:** Who are you and why are you a good fit for their organization?
- **Paragraph Three:** What next?
- **Closing:** Signature, and contact information

30. Now that students are familiar with the basic format of the cover letter, pass out copies of Student Handout—*Example Cover Letters*. Ask students to read through the first example of a quality cover letter (Example A) on their own, or read it with them as a class.

31. Have students edit and comment on the two cover letter examples provided, B and C.

32. After students have completed their comments, ask them to share what they found. Teacher Answer Key—*Cover Letter Examples* can be used to facilitate this discussion.

33. In class, or as homework, tell students to write their own cover letter to accompany the resume they prepared in *Part II* above. They should address their letter to the person featured in their career interview.

34. **Options for Differentiation and Extensions:**

- Have students write their cover letter in response to an online job posting (especially if they used this online job posting when creating their resume). Resources for finding online job postings are listed in the *Resources* section at the end of this lesson.
- Have each student peer-edit a classmate's cover letter, as they did with the examples provided in Student Handout—*Example Cover Letters*. For example, ask students to exchange cover letters with a classmate sitting near them (such as everyone passing their cover letter to the person sitting on their right). Tell students to review, edit and comment on their classmate's cover letter. Emphasize to students that this process is meant to be helpful to their classmates. A template, Student Handout—*Cover Letter Peer-Editing*, is provided.

[**Note:** The suggested point value for the student cover letter is **20 points**.]

[**Note:** The suggested point value for Student Handout—*Cover Letter Peer-Editing* is **10 points**.]

Closure

35. At the end of the lesson, review with students how each career either directly uses the tools of bioinformatics, or benefits from the knowledge gained from bioinformatics. Remind students that each of these individuals obtained their current job by applying for that position, including submitting a resume and cover letter. These are skills that students will use with any career.

Homework

Students may complete their career research (Student Handout—*Spotlight on My Career*) as homework in *Part I*. In *Part II*, students may complete their resume as homework. In *Part III*, students may complete their cover letter as homework.

Optional Extension/Assessment

[**Note:** The suggested point value for the mock interview, using Student Handout—*Mock Interview Rubric*, is **20 points**.]

A. Once student resumes are complete, have students “mock interview” one another with the questions provided below. Students can be in pairs or groups of three, based on their career choice. Have them take turns interviewing one another and scoring each other’s answers, using Student Handout—*Mock Interview Rubric*. You may suggest that student interviewers have one copy of Student Handout—*Mock Interview Rubric* for each student they interview. They can then circle the appropriate section in each row as feedback for the student interviewee.

Teachers may also wish to have students search online for job postings as part of the interview process. This could be the same job posting they used in developing their resume in *Part II* and cover letter in *Part III* above.

Write the following interview questions on the board:

- What job are you interested in?
 - Why are you interested in this job?
 - What skills have you learned that would help you succeed at this job?
 - What education and/or training did you have to prepare you for this job?
 - What is the one thing on your resume that you are most proud of?
 - Describe a challenge you have faced in school or in your bioinformatics project and how you overcame it.
- B. Alternatively, students could conduct informational interviews with one another to learn more about each other’s careers. Tell students that informational interviews are a helpful way to learn about a particular career, company, or industry. Sometimes these informational interviews lead to additional work-related contacts and/or job offers in the future. The following questions could be used:
- What is your job title?
 - What type of work do you do?
 - What skills have you learned that help you succeed at this job?
 - What education and/or training did you have to prepare you for this job?
 - What is your typical work day like?
 - What do you like most about your job?
 - What do you like least about your job, or find the most challenging?
 - What did you find most surprising about your career?

Resources

Dr. Crawford and his collaborators recently published a study in *Nature* detailing the sequencing and analysis of DNA isolated from a 4,000-year-old sample. Sequencing of the Y-chromosome confirmed that the remains were male, likely one of the first settlers of the New World Arctic (northern Alaska, Canada, and Greenland). Also among their findings: the man from whom the DNA was isolated had type A+ blood; likely had brown eyes, dark hair, and darker skin; had an increased risk of baldness; and had a dry earwax type more typical of Asians and Native Americans than the wet ear wax type of other ethnic groups. Students may recall discussions of genetic testing and ear wax type in *Lesson One* of the Bio-ITEST Introductory unit, *Using Bioinformatics: Genetic Testing*, when they explored the direct-to-consumer (DTC) genetic testing company 23 and Me. 23 and Me, as well as other DTC companies, also offer tests for increased risk of baldness. You can read more from the article (Rasmussen et al., 2010) in the free, full-text article available from *Nature* at: <http://www.nature.com/nature/journal/v463/n7282/full/nature08835.html>.

Information about Science Career Skill Building from BioCareers.com:
<http://biocareers.com/articles/skill-building>.

Information including job descriptions, required training, salary ranges, and job prospects for various careers can be found at the US Bureau of Labor Statistics. Search by job title at: <http://www.bls.gov/ooh/>.

The Genomic Careers center at the National Human Genome Research Institute has a variety of useful career resources:
<http://www.genome.gov/GenomicCareers/index.cfm>.

Bio-Link is the Next Generation National Advanced Technological Education (ATE) Center of Excellence for Biotechnology and Life Sciences (<http://www.bio-link.org/home/>). The ATE program was created to improve and expand educational programs that prepare skilled technicians to work in the high-tech fields that drive the US economy. The Bio-Link site contains many resources that may be helpful for students and teachers, including:

- Information about one- and two-year biotech degrees and certificate programs: <http://www.bio-link.org/home/degrees>.
- List of biotech employers by state: <http://www.bio-link.org/home/resources/where>.
- Information about various biotech-related careers, including Career Scenarios highlighting individuals in various fields: <http://www.biotech-careers.org>.

Useful sites for finding online job postings include:

- Careerbuilder.com: <http://www.careerbuilder.com/>.
- Monster.com: <http://www.monster.com/>.
- Indeed.com: <http://www.indeed.com/>.
- Jobpostingsonline.com, and select "Science Jobs":
<http://www.jobpostingsonline.com/jpo.cfm>.

Career Cruising is an online career guidance and planning system that helps students match their skills and interests with the right career. Many schools, libraries and other organizations have subscriptions to the site. For more information, visit: <http://www.careercruising.com/Default.aspx>.

See also the *Resources* section at the end of each *Career Interview*.

Credit

Crawford, Michael. Personal Interview. 19 March 2010.

Ferrenberg, James. Personal Interview. 14 July 2010.

Freeman, Kris. Personal Interview. 1 September 2010.

Ramakrishnan, Lalita. Personal Interview. 13 July 2010.

Saneto, Russell. Personal Interview. 22 July 2010.

Sisk, Ellen. Personal Interview. 26 July 2010.

Veeramah, Krishna. Personal Interview. 19 March 2010.

8 Career Interview 1: Ellen Sisk, MS Manager, DNA Sequencing Core Facility

DNA Sequencing Core Lab Manager
ELLEN SISK, MS



Place of Employment:
Seattle Biomedical Research Institute

Type of Work:
Manages the DNA Sequencing "Core." The Core lab is a centralized facility that provides DNA sequencing for all the researchers at the Institute.

The Seattle BioMed Sequencing Core facility has been in operation for over 18 years and offers DNA sequencing and analysis to Seattle's scientific community, as well as international scientists and organizations. Our service provides cost-effective solutions for small laboratories that lack access to sequencing technology.

CAREERS IN SPOTLIGHT:
DNA Sequencing Core Lab Manager

What do they do?
The manager oversees the core lab facility. These types of facilities make it possible to perform DNA sequencing reactions and analysis for many different researchers at a given institution, company, or university. The Core lab facility makes it possible for many researchers to share the same DNA sequencing facility and expertise of technicians and the Core Lab Manager.

What kind of training is involved?
Bachelor's degree in biology, molecular biology, biochemistry, or related discipline. Some have a Master's degree or a PhD.

What is a typical salary for a Core Manager?
Salaries vary with experience and range from \$50-\$100,000 per year (\$25-\$50/hour).

Source: Genome Technology Salary Survey 2010

1. Where did you grow up?

Richland, Washington. My father was an electrical engineer at Hanford right after WWII [World War II] and my mother's father was a security guard at the Hanford site, so I was an atomic baby.

2. What do you do (i.e., what career or field are you in, what is the title of your position)?

My field is Molecular Biology, and I am manager of the Seattle BioMed Sequencing Core Facility.

3. How did you choose your career? When did you first know this was the career you wanted?

I loved biology in high school and decided to study molecular biology in college. After graduating from the Evergreen State College, I worked as a brew chemist at the Olympia Brewery and soon realized that I would become restless with the routine of quality assurance, so I applied for a research job at the Battelle Pacific Northwest National Laboratory in Richland. At Battelle, I ran the first commercially-made automated DNA sequencer as part of the research project I was working on. I was also able to obtain my Master's degree at the Washington State University branch campus during that time and my thesis described how aqueous electrons created by exposure to radiation can migrate along DNA strands and cause damage.

4. Did your family support your decision to pursue your career?

My parents couldn't afford to financially help us with college (I have nine siblings) but they were proud that I was able to support myself through school with Pell grants and loans from my older sister. My other sisters and brothers were very supportive.

5. What is the highest level of education you have?

Master of Science in Biology.

6. What is the highest level of education reached by other members of your family?

Master's degree.

7. What is the salary range for a person in your position?

I'm guessing between \$55,000 and \$80,000/year (\$26-\$38/hour) depending on the size of the facility and years of experience.

8. What do you like most about your job?

The autonomy of making decisions about how the facility is run, and the satisfaction of knowing that I am providing a valuable service that supports research and clinical diagnoses.

9. What do you like least about your job?

The pressure of being in charge all the time can sometimes feel stressful, especially when the instrument is down and customers are eager for their data!

10. What's an abbreviated day-in-the-life of your job?

Customers request sequencing services through our website and when samples come in they are automatically entered into our database, which stores a record of each sample along with the requester's name, lab, date, etc. Samples are processed in plates of 96 and we run 1-4 plates per day. Sequencing results are reviewed and sent to the customer. In addition to sequencing DNA samples, we isolate plasmid DNA for customers and perform PCR reactions. We also maintain a RealTime PCR instrument for institute users. On a typical day, I may also troubleshoot issues customers are having with data quality, respond to questions about our services and create online accounts for new customers.

We are a **CLIA (Clinical Laboratory Improvement Amendment)** certified DNA sequencing facility which means the data we produce might be used to diagnose a disease or genetic disorder. Therefore, we are required by federal law to record the temperatures of our storage equipment, the lot numbers and expiration dates of our reagents, write up and follow protocols, and perform an equipment maintenance schedule. I am also responsible for submitting customer charges each month and keeping within our budget by monitoring costs and revenue. I supervise a technician who shares sequencing and other tasks with me.

11. How would you describe how you use bioinformatics in your work? If you don't use bioinformatics directly in your work, how has bioinformatics impacted your career field?

Bioinformatics is crucial in the DNA sequencing field for data interpretation, storage and tracking, for the identification of genes and other important DNA elements, and for downstream applications of the data, to name a few examples. This field is expanding rapidly with the enormous amount of data produced by the next generation of sequencing instruments. In my work I personally use DNA analysis software to translate the raw signal from the machine into sequence data and to align and compare sequences. I also use BLAST and GenBank to identify proteins or organisms. We have a large database where we store and track information about samples and customers.

12. Do you have any recommendations for students who are interested in entering your field?

If I were interested in genetics as a young person, I would consider genetic counseling. I think we are very close to the affordable "personal genome" and lay people will need help in deciphering the information and understanding its implications. A dual degree in molecular biology and information sciences also seems like a good idea for students interested in bioinformatics.

13. What are your favorite hobbies?


Traveling, mosaics, reading, hiking, biking, and movies.

Resources:

- Seattle Biomedical Research Institute (Seattle BioMed): <http://www.seattlebiomed.org/>.
- Seattle BioMed Sequencing Core Facility: <http://www.seattlebiomed.org/sequencing>.
- To learn about **job prospects** and **salary information** for **Natural Sciences Managers**, visit the US Bureau of Labor Statistics for Engineering: <http://www.bls.gov/ooh/management/natural-sciences-managers.htm>.

8 Career Interview 2: Krishna Veeramah, PhD Postdoctoral Scientist, DNA and History Program

Postdoctoral Scientist, DNA and History
KRISHNA VEERAMAH, PhD



Place of Employment:
University of California, Los Angeles (UCLA)

Type of Work:
Human population genetics, with emphasis on Sub-Saharan Africa

I always liked genetics, but it wasn't my first choice at school. I wanted to be a footballer (or soccer player), but... working with all these clever things like Y chromosomes possibly descended from the brother of Moses, I eventually started doing my own work and got wrapped into it.

CAREERS IN SPOTLIGHT:
Postdoctoral Scientist, DNA and History

What do they do?
Postdoctoral Scientists are people with a PhD who desire more training. The DNA and History program at UCLA is unique – a result of the dramatic increase in DNA data and biotechnology. The increase in DNA data influences research beyond biology, into the humanities and social sciences, like the history of human populations.

What kind of training is involved?
Dr. Veeramah has a PhD and is doing additional training and teaching at UCLA.

What is a typical salary for a Postdoctoral Scientist?
The minimum salary for a Postdoctoral Scientist funded by the National Institutes of Health (NIH): Starting salary: \$37,740 (\$18/hour). 5 years of experience: \$47,940 (\$24/hour).

Source: National Institute of Health

1. Where did you grow up?

I was born in England, in a small town just outside of London, where I went to school until I left for university at University College London.

2. What do you do (i.e., what career or field are you in, what is the title of your position)?

I am a postdoctoral fellow in the UCLA Department of History “DNA and History” program. My duties include teaching a course in “Using Genetics to Infer Human History,” and organizing the “DNA and History Faculty Seminar.”

My research interests include: human population genetics, anthropological genetics, evolutionary medicine and pharmacogenetics, with particular emphasis on sub-Saharan African populations.

3. How did you choose your career? When did you first know this was the career you wanted?

I always liked genetics, but it wasn't my first choice at school. I wanted to be a footballer (or soccer player), but during my third year of undergrad, I was studying human genetics and working on a project with Dr. Mark Thomas in the Center for the Evolution of Cultural Diversity, working with all these clever things like Y chromosomes that possibly descended from the brother of Moses. I eventually started doing my own work, and got wrapped into it. I liked it so much, I decided to stay and do my PhD. Then I came to UCLA to help transform the humanities to use genetic tools to help with their research.

4. Did your family support your decision to pursue your career?

Initially, being from Mauritius, next to Madagascar in Africa, and being of Indian descent, my family wanted me to do medicine – but eventually I convinced them that even though I won't make a lot of money, I can make some, and they are very supportive, especially with me being here in the States and them in England. As you get more successful, you get more papers published, and they realize it's a real career.

5. What is the highest level of education you have?

PhD.

6. What is the highest level of education reached by other members of your family?

My mom came to England as a mental health nurse. My dad came to England to do a Bachelor's degree in economics, and then a Master's degree – but because of the immigration law, he couldn't do economics in England. Then he met my mom, and then he got a job as a lecturer at the university, and then went on to get his PhD at the same time I got mine – a little friendly competition.

7. What is the salary range for a person in your position?

As a postdoc [postdoctoral scientist] I make about \$35,000 - \$50,000/year (\$17.50-\$24/hour), and then you get a big pay jump once you have a faculty position.

8. What do you like most about your job?

The interdisciplinary part is pretty incredible. I'm pooling lots of information and putting together a puzzle more so than with a lot of other problems in genetics. I'm working with linguists, anthropologists, archeologists, and historians. It's a very unique field. And you get to travel a lot, because I collect samples from all over. I went to Africa – it is very Indiana Jones-like. Every day you're finding out something completely new, and it is always very exciting.

9. What do you like least about your job?

It's not the job so much as the complete lack of structure in the sciences –you don't know how your career is going to progress, or how many good jobs are out there – you go from job to job until you get a faculty position.

In the last few years, there has been less elegance to the sciences, and more just pumping out data. There is less of a health emphasis in my field, so it's harder to get funding. I spend lots of time trying to raise money by writing grants.

10. What's an abbreviated day-in-the-life of your job?

I have very strange working patterns – I get up at midday, unless I have a meeting or need to talk to someone in England where the time zone is different, and then I go back to sleep for a few hours.

If it's a teaching semester, I have to teach class every week, and have office hours in mid-afternoon – talking to people, talking to my supervisor about what work to do – and from 6 pm onwards I sit down and do work until about midnight. If I'm not teaching, things are a little easier. I may not be a good example because I'm very unstructured! But I can be flexible in my work. It's very, very flexible.

11. How would you describe how you use bioinformatics in your work? If you don't use bioinformatics directly in your work, how has bioinformatics impacted your career field?

We've had a big shift in our field to using SNP [single nucleotide polymorphisms] and CHIP [microarray] data, with 500,000 to 1 million SNPs on a CHIP for each person costing only \$300-\$400 for each individual. With over a million data points per person, you don't really see the data; you have to keep them in databases to do all your analyses.

My boss just had a paper in *Nature* in 2008. They had all this data from 2000 European SNP CHIP data sets in which they did principal connection analysis to see how each person is related to each other, and then they graphed it and it looked like a map of Europe! There is lots of bioinformatics involved with this, messing around with data sets.

Now we are starting to look at new sequencing data to sequence individual genomes within a week, which costs about \$10,000, versus \$20 million and 8 years to sequence the first human genome. That is a lot of data – 10 GB of data per individual, so we need new bioinformatics tools to use and develop it. Everyone is developing and trying different things, and there are lots of forums to discuss how to deal with all that data and data compression.

12. Do you have any recommendations for students who are interested in entering your field?

I got really interested in genetics by listening to a professor called Steve Jones, who did TV programs on genetics, and wrote popular science books. I saw him speak, and he was a very good speaker; very funny, and his books are very interesting, but not very complex. He actually rewrote Darwin's *The Origin of Species* in a modern format. I would suggest students read his books, and read more popular science because they're accessible and they're specifically for non-scientists. Podcasts like *Nature Podcasts* are another great way to learn more about science.

Also, labs are always happy to have undergraduate students look around and see what they're doing. My labs were always looking for undergrads to do DNA extractions, or play around with data. Ask labs "Can I have a look around? Can I help with anything?"

13. What are your favorite hobbies?

I play a lot of video games now. I've always been doing population genetics and I always mess around with computers, and I guess video games are a natural extension of that. I also like running, walking, and hiking in the hills near Los Angeles.

Resources:


- Dr. Krishna Veeramah's Homepage: <http://kveeramah.bol.ucla.edu/>.
- To learn about **job prospects** and **salary information for Biochemists and Biophysicists**, including scientists who study chemical and physical principles of living things and of biological processes such as cell development, growth, and heredity, visit the US Bureau of Labor Statistics: <http://www.bls.gov/ooh/life-physical-and-social-science/biochemists-and-biophysicists.htm>.
- **Center for Genomics and Society** at UNC (University of North Carolina) Chapel Hill: <http://genomics.unc.edu/genomicsandsociety/>.

LESSON 8

CLASS SET

8 Career Interview 3: Lalita Ramakrishnan, MD, PhD Microbiologist

Microbiologist
Lalita Ramakrishnan, MD, PhD



Place of Employment:
University of Washington

Type of Research:
Tuberculosis infection

Model Organism:
Zebrafish

Zebrafish are naturally susceptible to tuberculosis. Because their genes are fairly easy to manipulate, we can create some zebrafish that are susceptible to TB and some that are resistant to TB. Zebrafish are also good model organisms because they are transparent, so we can watch the infection process develop.

CAREERS IN SPOTLIGHT:
Microbiologist

What do they do?
Microbiologists study microbes: bacteria, viruses, fungi, and protists. Dr. Ramakrishnan is an expert in tuberculosis, a type of bacteria that infects almost a third of humanity worldwide. She also studies immunology, including the body's reaction to or defense from microbes.

What kind of training is involved?
Most Microbiologists who run their own lab have a Bachelor's degree and a PhD (which is usually 5–6 years of research training). However, each lab often employs scientists with diverse backgrounds, including people with Associate's, Bachelor's, and Master's degrees.

What is a typical salary for a Microbiologist?
Associate's degree: \$35,000/year (\$17.50/hour)
PhD, Full Professor: \$100,000/year or more (\$48.00/hour)

Source: Bureau of Labor and Statistics

1. Where did you grow up?

I grew up in a small town in India called Baroda. The name of the town has now changed to its pre-British name, Vadodara, which means City of the Banyan Tree.

2. What do you do (i.e., what career or field are you in, what is the title of your position)?

I am a Professor of Microbiology and Medicine at the University of Washington. Mostly I do research in tuberculosis, train students and postdoctoral fellows (who are people with a PhD who are looking for further training). I also spend a small part of my time as an infectious disease doctor.

3. How did you choose your career? When did you first know this was the career you wanted?

I wouldn't say that I always knew that I wanted to do this. When I grew up in India, I was a pretty good student, but I wasn't particularly good at one thing versus another, so the default in my community was to go to medical school. This was based on your class rank order in school, not like here in America where you have to do lots of stuff specifically to get in to medical school. But I was unhappy in medical school. I was unhappy seeing all of the disease and poverty, and lots of rote learning, which is what medical school in India was like back then. I decided to get a PhD after medical school, so I got a scholarship for a PhD program here in America, in immunology. Then I did a medical residency related to immunology, and then went back to research.

4. Did your family support your decision to pursue your career?

I have a feeling – my parents were both scientists. I think my dad was pretty keen on having a doctor in the family, because this was a big deal. My brother went into physics. I actually thought about going into physics, too, but I wasn't as good at it as my brother. So I stayed at home and went to the local medical school, but when they saw how unhappy I was, they supported the change to research.

5. What is the highest level of education you have?

PhD and MD.

6. What is the highest level of education reached by other members of your family?

Both of my parents have PhDs. We are a family of PhDs! My mom is an experimental psychologist, and went to McGill. My brother, Venkatraman Ramakrishnan, recently won the Nobel Prize in Chemistry, along with Thomas Steitz and Ada Yonath, for having shown what the ribosome looks like on the atomic level, and how it functions.

7. What is the salary range for a person in your position?

It varies a lot, depending on where you do your research, whether you're in the College of Arts and Sciences, or associated with the medical school, but you usually start around \$80,000-\$90,000 per year (\$38-\$43/hour). There's no cap, and some researchers probably make in the high hundreds of thousands.

8. What do you like most about your job?

Well, I think two things: First, I love the sleuthing aspect of it and the puzzle solving. Second, I like interacting with young people. I interact with a lot of smart young people!

9. What do you like least about your job?

I dislike a lot of the bureaucratic work, scrambling for money for research, and also if things with personnel in the lab aren't going well, that is unpleasant, but that doesn't happen much.

10. What's an abbreviated day-in-the-life of your job?

It's been a long time since I worked in the lab myself. It's a pity, but that's how it goes! Much of the actual day-to-day lab work is done by laboratory technicians, graduate students, and postdoctoral fellows ("postdocs"). Depending on when it is, like now, I'm working on writing a paper [a research report for a scientific publication], which is based on five years of lab work. It's a complicated story, so I spend a lot of time on that. I talk to everyone in the lab, see what they're doing, see if they need help. Lots of meetings with students and postdocs, to see if they need help. I do lots of reading, writing, and talking to people, some administrative stuff. I sometimes give formal lectures to classes, maybe 16-20 hours per year.

11. How would you describe how you use bioinformatics in your work? If you don't use bioinformatics directly in your work, how has bioinformatics impacted your career field?

Our work has been impacted tremendously by bioinformatics. We study tuberculosis (or "TB"), so the fact that in 1998 the sequence of the organism, *Mycobacterium tuberculosis*, was published has been an unimaginable boon. I study TB in zebrafish as a model organism, and the zebrafish genome has also been sequenced, so when we make mutations in the zebrafish or TB, we know exactly where those mutations are, and we can see if they have an impact. The impact of this on our work is just huge.

12. Do you have any recommendations for students who are interested in entering your field?

As you proceed in life, it will become clear to you if something is not right for you. During undergrad in college and beyond, know yourself, and know that what you want and need will be constantly changing. Value serendipity! [Serendipity is when you make a fortunate discovery when you are looking for something unrelated, like Dr. Ramakrishnan going to medical school, only to discover that she really wanted to work in research.]

13. What are your favorite hobbies?

Very simple ones. I like to ride my bike, run, garden, read and cook.


Resources:

- Dr. Lalita Ramakrishnan's Homepage: <http://immunology.washington.edu/lalita-ramakrishnan-mbbs-phd>.
- To learn about **job prospects** and **salary information** for **Microbiologists**, visit the US Bureau of Labor Statistics: <http://www.bls.gov/ooh/life-physical-and-social-science/microbiologists.htm>.
- The American Society for Microbiology has career information for students through their **Microbiology Careers** portal: <http://www.microbiologycareers.org/>.

8

Career Interview 4: Michael Crawford, PhD Biological Anthropologist

Biological Anthropologist
Michael Crawford, PhD



Place of Employment:
University of Kansas

Type of Work:
DNA analysis to study the history of human population and migrations

Science was something that I was always excited about. I have one foot in anthropology as an anthropological geneticist; therefore I'm not strictly limited to a laboratory, but can go into the field for my work reconstructing the history of human populations and their origins based on population genetics.

CAREERS IN SPOTLIGHT:
Biological Anthropologist

What do they do?
Also called *Physical Anthropologists*, Biological Anthropologists study the development of the human species in the context of other primates and fossils.

They:

- compare and contrast traits among species
- study why and when certain traits evolved or disappeared

What kind of training is involved?
Bachelor's or Master's degree to work in the field. PhD to run your own lab.

What is a typical salary for a Biological Anthropologist?
Bachelor's Degree: \$35,000 to \$40,000 (\$17.50–\$19.00/hour)
PhD, Full Professor: up to \$150,000/year (\$72.00/hour)

Source: Bureau of Labor and Statistics

1. Where did you grow up?

From a genetic point of view, my mitochondrial DNA or H haplogroup is Russian; the non-recombining portion of my Y chromosome is Scottish; it was packaged in Shanghai, China of white Russian-Scottish parents. I went to a Catholic school in China which was run by French brothers, even though I was the only non-Catholic there. After WWII [World War II], when Chairman Mao came on the scene, we had to leave China and ended up in a displaced persons camp in the Philippines for nine months. We then went to Australia, through my freshman year in high school. As a teenager, we moved to Seattle, where I finished high school at O'Dea in Seattle, then went on to the University of Washington for my bachelor's degree, master's degree, and PhD. I was a postdoc [postdoctoral fellow] at a number of places, including in Australia.

2. What do you do (i.e., what career or field are you in, what is the title of your position)?

Director, Laboratory of Biological Anthropology, University of Kansas.

3. How did you choose your career? When did you first know this was the career you wanted?

Science was something that I was always excited about. My parents wanted me to become an MD, but I was more interested in research on humans than treatment. I started out in college as pre-med, and then channeled off into biological anthropology with some great courses from Dr. Stanley Gartler at UW Human Genetics and Arno Motulsky at UW Medical Center, who studied population genetics.

4. Did your family support your decision to pursue your career?

Initially, my parents were disappointed about my choice to go into academic research, but then my mother's physician told her research is science, and it is good, and then I had my mom's blessing.

5. What is the highest level of education you have?

BA University of Washington-Seattle 1960 Anthropology

MA University of Washington-Seattle 1965 Biological Anthropology

PhD University of Washington-Seattle 1967 Biological Anthropology & Genetics

6. What is the highest level of education reached by other members of your family?

My father was an electrical engineer in China, and my grandfather was a gold mining engineer, who ran the Czar's gold mining operations in Siberia. I was the only non-engineer in the group!

Mother was a fine artist, a painter, with exhibits in Seattle for a while.

7. What is the salary range for a person in your position?

Depends on your university – anywhere from \$80,000-\$150,000/year (\$28-\$72/hour) for a full professor, which I have been since 1976.

8. What do you like most about your job?

The tremendous diversity of things you can do and still be within your field. I'm most excited by research and training graduate students. My 32nd graduate student finished their PhD this year. I have one foot in anthropology as an anthropological geneticist; therefore, I'm not strictly limited to a laboratory, but can go into the field for my work reconstructing the history of human populations and their origins based on population genetics.

We just had a paper published in the Feb 12, 2010 issue of *Nature* in which we sequenced about 80% of the genome of a Paleo-eskimo from 4,000 years ago. He had some genes associated with male pattern baldness, and we could tell his eye color, hair color – even what type of ear wax he had. [For more information, see the reference to Dr. Crawford's paper in the *Resources* section at the end of this interview.]

9. What do you like least about your job?

The administrative stuff I find the least interesting, like committees, and teaching some of the undergraduate courses.

10. What's an abbreviated day-in-the-life of your job?

Depends when it is. In the summer, I may be sitting on the Aleutian Islands collecting DNA specimens from buckle swabs, collecting spit, and interviewing people. For the last 10 years, I've been working on the Aleutian Islands on Aleutian populations, reconstructing the settlement of the area based on mitochondrial DNA and Y chromosome analyses.

During the academic year, I usually go to the office in the morning, around 8:30, usually push a little paper. If I don't teach that day I stay home and write in the morning and push paper in the afternoon.

I'm rarely in the lab anymore, with so much time writing grant proposals, meeting with my 12 graduate students in the lab and 1-2 postdocs, figuring out ways to get them into the field and doing research. We just started a new three-year project on GAD – what they call Diabetes 1.5 – which is an autoimmune form of diabetes, but is not associated with obesity, and usually hits people in their 30s and 40s. It is identified by the presence of a particular antibody called GAD65 antibody.

11. How would you describe how you use bioinformatics in your work? If you don't use bioinformatics directly in your work, how has bioinformatics impacted your career field?

We do a lot of DNA sequencing with all the populations we study, including in our collaboration with the Danish Centre for Ancient Genetics & Centre for Comparative Genomics at the University of Copenhagen, where whole genomes have been sequenced (or about 80% of each have been sequenced). In order to measure evolutionary change, you have to characterize the genetic population or gene pool. You have to use genetic markers of some sort, including mitochondrial DNA, Y chromosomes, or variable tandem repeats. In addition to sequencing, we do a lot of microarray chips to get SNPs [single nucleotide polymorphisms], to try to identify or define a population genetically and test hypotheses about its origin.

In the case of the Aleutian Islands, where did the Aleuts come from? Siberia? Who are they? Did the settlement progress from the east to west or...? This interests a lot of the native groups like the Aleuts because they are questions that deal with *themselves*. We have great working relationships with the Aleut associations and tribal councils, and are always going back and providing feedback to the community about what we found. The last time we went, 400 people showed up for the lecture and asked great questions.

It is so important to be working in partnership with a population. We have also been working for 30 years on biological aging in Mennonite populations in Kansas to try to figure out why they live as long as they do.

12. Do you have any recommendations for students who are interested in entering your field?

Get a really good solid background in biology, population genetics, and statistics. So many students have a fear of numbers, a fear of statistics, but you need the background in statistics to test hypotheses.

13. What are your favorite hobbies?

When I was much younger, I played tennis, racquetball, and soccer at college at the University of Washington. Then into my mid-50s to early 60s, trying to keep up with the literature in my field has become a full-time occupation! The field has changed so much—from biochemistry, to DNA sequencing and amplification – fascinating changes. My job is my hobby, and they pay me to do it! But it's not a job, that's what makes it so much fun.

Resources:

Dr. Michael Crawford's Homepage: <http://www2.ku.edu/~lba/researchers/crawford.shtml>.

To learn about **job prospects** and **salary information for Anthropologists and Archaeologists**, visit the US Bureau of Labor Statistics: <http://www.bls.gov/ooh/life-physical-and-social-science/anthropologists-and-archeologists.htm>.

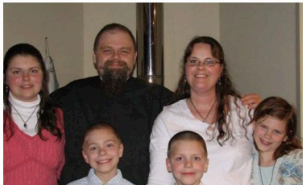
The UC San Diego site "A Career in Biological Anthropology": <http://weber.ucsd.edu/~jmoore/bioanthro/brochure1.html>.

Dr. Crawford and his collaborators recently published a study in *Nature* detailing the sequencing and analysis of DNA isolated from a 4,000-year-old sample from a Paleo-eskimo. You can read more from the article (Rasmussen et al., 2010) in the free, full-text article available from *Nature* at: <http://www.nature.com/nature/journal/v463/n7282/full/nature08835.html>.

LESSON 8

CLASS SET

8 Career Interview 5: James Ferrenberg Molecular Diagnostics Researcher

<p>Molecular Diagnostics Researcher James Ferrenberg</p>  <p>Place of Employment: University of Washington Molecular Diagnostics Lab Virology Division</p> <p>Type of Work: Develop tests to diagnose different types of viral infections</p> <p>Discovery is really exciting and there is nothing cooler (in my job) than designing an assay and finding it works great and generates important data.</p>	<p>CAREERS IN SPOTLIGHT: Molecular Diagnostics Researcher</p> <p>What do they do? Develop tests and methods to identify a disease or the predisposition to a disease by analyzing the DNA or RNA of an infectious organism (virus, bacteria, or parasite).</p> <p>What kind of training is involved? Associate's degree and/or Bachelor's degree</p> <p>What is a typical salary for a Molecular Diagnostics Researcher? Starting: \$35,000-\$45,000/year (\$17.50-\$22.00/hour) Up to: \$55,000-\$65,000/year (\$26.00-\$31.00/hour)</p> <p><small>Source: Genome Technology Salary Survey 2010</small></p>
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1. Where did you grow up?

Mostly Southern California, but I've learned to hate it there. I moved to the greater Seattle area in 1989 to attend college.

2. What do you do (i.e., what career or field are you in, what is the title of your position)?

My title is Research Consultant with the University of Washington, but I've been working in the same lab now for 15 years and have held many titles. Basically, I do research and development for the Molecular Diagnostics lab in the Virology Division.

3. How did you choose your career? When did you first know this was the career you wanted?

Tough question. I like science and I wanted to try and do something that would be of benefit to others in the grander scheme of things. I suppose I chose this path back in the mid-90's when I decided to enroll in the Biotech Program through the Seattle Community Colleges.

4. Did your family support your decision to pursue your career?

Yes. My wife and I worked very hard together.

5. What is the highest level of education you have?

I have a Bachelor's degree.

6. What is the highest level of education reached by other members of your family?

My dad has a PhD.

7. What is the salary range for a person in your position?

I'd say my position is pretty unique, but given my experience I'd say \$55,000-65,000/year (\$26-\$31/hour).

8. What do you like most about your job?

Compiling data/results and being able to see a picture of what the data means...or might mean. Discovery is really exciting and there is nothing cooler (in my job) than designing an assay and finding it works great and generates important data.

9. What do you like least about your job?

Sometimes it can be very repetitive.

10. What's an abbreviated day-in-the-life of your job?

At any given time I can be found reading papers, going to meetings, doing research online (PubMed, BLAST, etc.), planning experiments, running experiments, interpreting data, and reporting data both informally and more formally in presentations. I also do some ordering and other general instrument/lab maintenance.

11. How would you describe how you use bioinformatics in your work? If you don't use bioinformatics directly in your work, how has bioinformatics impacted your career field?

I would say one of the biggest areas in which we use bioinformatics is in the alignment of DNA sequences found online via Pubmed.gov resources. We frequently do this in order to find primers/probes for viruses which will match the widest array of strains.

12. Do you have any recommendations for students who are interested in entering your field?

Enjoy your time in labs at school. If you don't enjoy it, find a different career.

13. What are your favorite hobbies?


Home brewing, farming, and fishing.

Resources:

- University of Washington Department of Medicine, Molecular Diagnostics Testing: <http://depts.washington.edu/labweb/Divisions/Viro/MolPCR.htm>.
- To learn about **job prospects** and **salary information for careers as a Medical Scientist** (those who conduct research aimed at improving overall human health), visit the US Bureau of Labor Statistics: <http://www.bls.gov/ooh/life-physical-and-social-science/medical-scientists.htm>.
- Clinical Laboratory Sciences career overview from the Mayo Clinic: <http://www.mayo.edu/mshs/lab-career.html>.

8 Career Interview 6: Kris Freeman, MS Science and Technical Writer

Science and Technical Writer
Kris Freeman



Place of Employment:
School of Forest Resources,
University of Washington

Type of Work:
Science and Technical Writing

I think we live in a time when people are overwhelmed by data, and the job of a good editor or writer is to help your reader deal with a particular set of complex data, to make it understandable. Not all scientists know how to convey their data, so your job is to help them convey this information.

CAREERS IN SPOTLIGHT:
Science and Technical Writing

What do they do?
Science and Technical Writers edit and format complex scientific reports, in collaboration with other scientists. Some Science and Technical Writers also communicate complex research findings to the public and to the media using language and terms everyone can understand.

What kind of training is involved?
Many have a Bachelor's degree in English, Journalism, or Technical Writing, and a minor in Biology or a related science.

What is a typical salary for a Science and Technical Writer?
Varies with experience, and ranges from \$30,000/year (\$14/hour) to \$90,000/year (\$43/hour).

Source: National Institutes of Health, Office of Science Education.

1. Where did you grow up?

Mostly in Ballard, in Seattle. We moved here when I was 7, and aside from a year in Oregon, I've lived in the same zip code ever since! I'm a 4th generation Pacific Northwesterner.

2. What do you do (i.e., what career or field are you in, what is the title of your position)?

I have various jobs. I call myself a wordsmith. I have been a science writer most of the time. I've worked at the University of Washington for 17 years. Before that I was a writer and reporter for small magazines and newspapers. At the University of Washington, I've done a lot of science writing and website design, and currently I have a job as an editor.

3. How did you choose your career? When did you first know this was the career you wanted?

It pretty much chose me. It's the only thing I've ever made money at. I sold my first paper when I was 14, to a religious magazine. Then there was a long gap. I should have taken journalism in college – I don't know what I was thinking by not taking it! Then I got a job at a small regional weekly newspaper, the *Blue Mountain Eagle*, which was my first full-time writing job. So I basically knew nothing, because I hadn't taken journalism, but I learned as I went!

4. Did your family support your decision to pursue your career?

Yes.

5. What is the highest level of education you have?

I have an MS [master of science] degree in Technical Communications from the University of Washington.

6. What is the highest level of education reached by other members of your family?

My father had a PhD in geography; my mother had two Master's degrees – one in Home Economics and one in Counseling. They both wanted me to get a doctorate, but to get a doctorate you have to be very specialized, but I'm a generalist.

I didn't get my Master's degree until I was in my 40's. When you're a writer, what matters is your portfolio, what you can show that you have done, and often you have to work for cheap or free to get a portfolio. There are always non-profit groups who need help with newsletters and such, which can help you develop your portfolio.

If you work for the state, like I do, having some kind of degree is helpful, but because I write in the sciences, researchers like you having a MS degree instead of an MA [master of arts]. I did take statistics and I did publish research as part of my Master's degree, which was very helpful. I got my Master's at the University of Washington. The state has a wonderful program called tuition exemption, so you can get your tuition exempt [free] if your boss agrees, and you can get the classes.

During my undergraduate degree, I took a lot of classes, a lot of history and biology. And they have all been helpful. What I didn't do but should have was take a language. I'd say it is really important to be fluent in another language.

7. What is the salary range for a person in your position?

It's all over the map, but it's not terribly high. I'm a member of the Northwest Science Writers Association, and I see very talented people there not making a lot of money. I've made in the \$40,000/year (\$19/hour) range, sometimes more than that, sometimes less. I was a freelancer for a long time, and I lived in an attic apartment, gluing my shoes together. It all depends. You're going to make more money in the science and computer industries, if you have a specialty in bioinformatics, writing technical manuals, or writing about bioinformatics. The more technical the writing you can do, the more you can get paid. But I haven't regretted not making more money. I've done fine.

8. What do you like most about your job?

First, I love to write. I'm not doing that much writing at my current job, so I write on my own. Second, I love learning new things. At the University of Washington, I've written about marine science, toxicology, neurology, and genetics. Right now I'm editing reports about wildlife. You have to be a quick study. So you're always learning new things—it's painful initially as you start because you know nothing about that field, but then you have a learning curve.

9. What do you like least about your job?

It's a sedentary job. Currently I have a boss in an office situation that lets me walk around. I know people who hook their computer up to an exercise bike!

10. What's an abbreviated day-in-the-life of your job?

It changes so much. When I've done science writing, you need to figure out what the stories will be (like in a newsletter), then make appointments with the researchers to interview them, because they are very busy. I want to make the best use of their time, so I do research before I interview them, and I read their papers. I get the papers and try to understand them. Initially you won't understand the papers, but you learn the questions to ask. I read the abstracts and have a dictionary to look up the words I don't understand. The longer you work at something, the more you understand. What I'm good at is science translation, taking complex topics and making them understandable to people not in the field. Each field has its own vocabulary. People in the different disciplines often don't understand each other's technical words, so you're not alone! Wikipedia and Google are good for this kind of research, and of course you can always ask someone. For a 15 minute interview, I do 2-3 days of research. At a newspaper, you may not have the time for this much research.

It's also important to know some basic statistics, so when you're looking at papers, you can evaluate how significant the paper is, because studies with more people may have more significance than a study with fewer people. A researcher may not understand the importance of their paper. Most researchers don't

want you to overstate the significance of their work, so you need to understand the scope of the research question, and how far the result can be extrapolated or generalized. After you write the summary, the researcher has to approve it. I need to find out what information is best to know for my readers, and give researchers the space to say interesting things, and get good quotes.

11. How would you describe how you use bioinformatics in your work? If you don't use bioinformatics directly in your work, how has bioinformatics impacted your career field?

Bioinformatics has impacted genetics and neurology so much, that you need to understand bioinformatics to be able to write about the research in these fields. If you are looking at a particular gene, unless you have a carefully screened group of patients, 300-500 people may not be enough to find an association between the gene and a disease, but if you have a number of people with a specific disorder, you may be able to find an association. However, we now know that many diseases and traits are caused by a combination of multiple different genes.

12. Do you have any recommendations for students who are interested in entering your field?

Read a lot! And write whenever you can. Learning how to write is like learning a sport or a musical instrument – you have to practice.

13. What are your favorite hobbies?

Writing is also a hobby, and I read a lot, I garden, and I sing. I started taking singing lessons in my 40s, but I've always sung in a choir, and recently I've been doing solo singing.

I think we live in a time when people are overwhelmed by data, and the job of a good editor or writer is to help your reader deal with a particular set of complex data, to make it understandable. That could be making tables and charts work well, because they are important, but not all scientists know how to convey their data, so your job is to help them convey this information.

Resources:

- Kris Freeman's Homepage: <http://staff.washington.edu/kfreeman/>.
- To learn about **job prospects** and **salary information for Writers and Authors**, visit the US Bureau of Labor Statistics: <http://www.bls.gov/ooh/Media-and-Communication/Writers-and-authors.htm>.
- Northwest Science Writers Association: <http://www.nwscience.org/>.

LESSON 8

CLASS SET

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Career Interview 7: Russell Saneto, DO, PhD Pediatric Neurologist

Pediatric Neurologist
Russell Saneto, DO, PhD



Place of Employment:
Seattle Children's Research Hospital

Type of Work:
Diagnosis and treatment of epilepsy, neurogenetic disorders, and neurometabolic disorders (in particular mitochondrial disease)

I count it a privilege to diagnosis and treat patients and their families. Although I am a pediatric physician, I have found that you not only treat the child, but the whole family. When a child gets sick, the whole family suffers.

CAREERS IN SPOTLIGHT:
Pediatric Neurologist

What do they do?
Diagnose and treat children with disorders of the brain and spinal cord.

What kind of training is involved?
Usually an MD (Medical Doctor) or DO (Doctor of Osteopathic Medicine). The DO is trained specifically in understanding the muscular and skeletal system and how this may relate to disease or pain management.

What is a typical salary for a Pediatric Neurologist?
The average salary for a Pediatric Neurologist is \$220,000/year (\$106/hour).

Source: Physician Compensation Survey, by the American Medical Group Association (AMGA).

1. Where did you grow up?

I grew up in Burbank, California (it is in the San Fernando Valley near Los Angeles).

2. What do you do (i.e., what career or field are you in, what is the title of your position)?

I am a pediatric neurologist who specializes in the diagnosis and treatment of epilepsy, neurogenetics disorders, and neurometabolic disorders (in particular, mitochondrial disease).

3. How did you choose your career? When did you first know this was the career you wanted?

I initially was interested in doing research in human genetics and metabolic disorders and got a PhD degree in human biological genetics. My interests changed somewhat, and I did a postdoctoral fellowship in brain development and eventually became an independent researcher in how the cells of the brain develop and grow. After several years of research, I then decided to return to medical school, and subsequently did a residency and fellowship in my current area of interest: epilepsy and neurometabolic/genetic diseases that give rise to epilepsy. I also have a very strong interest in the diagnosis and treatment of mitochondrial disease.

4. Did your family support your decision to pursue your career?

Somewhat. They helped me pay for my college education. This was a big step as no one in my family went to college, let alone graduated from college. They always had the dinner table ready and clothing washer and dryer empty when I came home from college/graduate school/medical school during vacations. They always encouraged me to live my dream.

5. What is the highest level of education you have?

The highest academic degree is a PhD, which I possess. I also have a DO degree (doctor of osteopathy; similar to a MD degree which allows me to practice medicine).

6. What is the highest level of education reached by other members of your family?

High school diploma.

7. What is the salary range for a person in your position?

Salary depends on where you live in the country (higher salaries are found in the Northeast part of the country). There is a pretty standard salary for someone in academic medicine that increases with your title: Assistant Professor, Associate Professor, and Full Professor. Salary ranges are typically from \$100,000 to \$200,000/year (\$48-\$96/hour) for a neurologist practicing in the Northwest. The range is significantly higher if you are a surgeon. The scale varies between specialists and general practitioners.

8. What do you like most about your job?

I count it a privilege to diagnose and treat patients and their families. Although I am a pediatric physician, I have found that you not only treat the child, but the whole family. When a child gets sick, the whole family suffers.

9. What do you like least about your job?

The long hours. I wish that I could spend more time with my family.

10. What's an abbreviated day-in-the-life of your job?

Most of my days start about 8 am and I usually end up at home about 8 pm at night. Some of my days are spent seeing patients, some are spent reading special tests looking for abnormal brain waves (brain activity), and some days are spent in the hospital looking after children who have neurological problems. There are days that I do a little of each and some days, just one of the duties.

11. How would you describe how you use bioinformatics in your work? If you don't use

bioinformatics directly in your work, how has bioinformatics impacted your career field?

Our hospital has an electronic medical record: so all the patients' vital signs, notes, medications, and test results are within this medical record that can be looked at using computers. This allows easy and quick access about patient information.

I also am part of national studies that look at patients with specific diseases and their treatment. The entire patient's information (vital signs, disease, notes, special medications) are on the computer that I can access at any time. This allows multiple study caregivers across the nation the ability to look at the patient's data at any time from any place.

12. Do you have any recommendations for students who are interested in entering your field?

The hours are long and the salary is not extremely high, so do what you enjoy doing or else you will tire of it easily and end up doing something else.

13. What are your favorite hobbies?

Reading, riding bicycles, running, and walking our golden retriever.

Resources:

- Dr. Russell Santo's Homepage: <http://www.seattlechildrens.org/pediatrics/russell-p-saneto/>.
- To learn about **Job Prospects** and **salary information for Physicians and Surgeons**, visit the US Bureau of Labor Statistics: <http://www.bls.gov/ooh/Healthcare/Physicians-and-surgeons.htm>.
- "What is a Doctor of Osteopathic Medicine (DO)?" from the American Osteopathic Association: <https://www.osteopathic.org/osteopathic-health/about-dos/what-is-a-do/Pages/default.aspx>.

Name _____ Date _____ Period _____

Spotlight on My Career



My Career is: _____

Career Information

Often in bioinformatics, we refer to **Tool Makers** and **Tool Users**.

Tool Makers ask: What kinds of new bioinformatics tools are needed? How can I make the existing tools better?

Tool Users ask: What new questions can I answer using bioinformatics tools?

1. Would you classify your chosen career as an example of a **Tool Maker** or a **Tool User**? Explain your answer in at least one sentence.
2. All career paths require **education and training**. What are the common requirements for your chosen career?
3. What are the **employment projections** in your field for the next five to ten years (i.e., after **you** would graduate from college or professional training)?
4. List three **colleges or universities** that offer programs in your field of study.
 - A.
 - B.
 - C.

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HANDOUT

5. Many researchers and professionals join **organizations or associations** with others in their field, to set guidelines for career paths and to provide mentorship and guidance to people new to the field. These organizations are also reliable sources of information about that particular career. **List at least one professional organization or association with members in your chosen career.**

6. Based on the information you have read so far about your career, complete the following sentences:

a. I was surprised to learn that _____

_____.

b. I was confused by _____

_____.

c. I would like to learn more about _____

_____.

7. Given what you have learned about your career and the field of bioinformatics, **come up with at least one question that you could answer using the tools of bioinformatics in the career you chose.**

Name _____ Date _____ Period _____

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Colleges and Universities in Washington and Oregon

Public Baccalaureate Colleges and Universities

Public Research Universities: The state's two research universities offer baccalaureate through professional degree programs.

University of Washington — <http://www.washington.edu/>

Washington State University — <http://www.wsu.edu/>

Public Comprehensive Universities and Colleges: The state's comprehensive universities offer baccalaureate and master's programs.

Bellevue College — <http://bellevuecollege.edu/>

Central Washington University — <http://www.cwu.edu/>

Eastern Washington University — <http://www.ewu.edu/>

Western Washington University — <http://www.wvu.edu/>

The Evergreen State College — <http://www.evergreen.edu/>

Public Community and Technical Colleges

Some community and technical colleges offer biotechnology, biology pre-major, and/or biosciences technician programs.

Mt. Hood Community College — <http://www.mhcc.edu/>

Portland Community College — <http://www.pcc.edu/>

Shoreline Community College — <http://www.shoreline.edu/>

Spokane Falls Community College — <http://www.spokanefalls.edu/>

Additional Private and Public Colleges & Universities

Gonzaga University — <http://www.gonzaga.edu/>

Oregon Health & Science University — <http://www.ohsu.edu/son/>

Pacific Lutheran University — <http://www.plu.edu/>

Seattle Pacific University — <http://www.spu.edu/>

Seattle University — <http://www.seattleu.edu/>

University of Puget Sound — <http://www.ups.edu/>

Whitman College — <http://www.whitman.edu/>

Whitworth University — <http://www.whitworth.edu/>

For more information about bioinformatics, biology, and biotechnology-related programs and training, visit NWABR's Student Career Center, "Education and Career Planning Resources" page at: <http://www.nwabr.org/students/career-planning>

8

Bioinformatics Resume

Refer to Student Handout –*The Process of Genetic Research* to help complete your resume.

You are now ready to develop a resume based on your knowledge of bioinformatics and the skills you have learned about and used. Use the format below to create your resume. Create headings and put examples underneath in bullets. If you completed the Bio-ITEST Introductory unit, *Using Bioinformatics: Genetic Testing*, you can include your knowledge and skills from those lessons as well.

Name

Address

Contact Information

Job Objective/Career Interest: Describe the career you are most interested in that relates to bioinformatics.

Knowledge/Understanding: Review the “What Did You Do” section from Student Handout –*The Process of Genetic Research* for each lesson. List major ideas you have learned from the bioinformatics unit(s). For example:

- Understanding of a gene involved in barcoding organisms, and why that gene is used
- Understanding of the type of information gained from multiple sequence alignments

Skills: Review the skills you have learned and practiced from Student Handout –*The Process of Genetic Research*. Record skills, depending on the type, below.

- **Laboratory Skills:** List any “wet lab” skills you have acquired. For example:
 - DNA purification
 - Polymerase Chain Reaction (PCR)
- **Bioinformatics Skills:** List each general type of bioinformatics program and database that you have used, the specific program(s) or database(s) in parentheses, and the purpose for using that program or database. For example:
 - Molecular Structure Visualization Software (Cn3D): *Use Cn3D to view complex molecular structures, including binding sites for poisons.*
- **Professional Skills:** List any additional skills you have acquired that are beneficial for this career. For example:
 - Writing a research report
 - Creating scientific posters

Research Experience: Describe your experience designing an experiment to answer a testable question. Describe your research project(s).

- Designed a research experiment to barcode the purple ochre sea star, *Pisaster ochraceus*...

Name _____ Date _____ Period _____

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Resume Peer-Editing Form

When submitting a resume for a job, it is always a good idea to ask someone else to review it before you show it to your potential new boss. Here you will be grading your classmate's resume, and using this as an opportunity to offer valuable feedback. Follow the instructions below to review and assign points to your peer's resume. You can circle or add a check mark below each item that is correct in the resume, and enter the point total on the lines provided. This sheet and your classmate's resume will be returned to your classmate after your teacher reviews them both. **[Note: You will be graded on the quality of your review and comments (up to 10 points possible).]**

Name of the Person Whose Resume You Are Reviewing: _____

Instructions and Grading:

1. Did the resume contain all of the required sections found on Student Handout—*Bioinformatics Resume*?

- +0.5 points for **Name and Contact Information** at the top of page 1
- +0.5 points for **Job Objective/Career Interest**
- +0.5 points for a list of **Knowledge/Understanding**
- +0.5 points for a list of **Skills**
- +1.0 points if the **Skills** listed are subdivided into separate categories, such as Laboratory Skills, Bioinformatics Skills, Professional Skills, or as appropriate for the job (such as Artistic Skills, Animal Care Skills, Research Experience, etc.)

(3.0 points possible) Total for #1: _____

2. Circle key words, skills, or knowledge on the resume that are required for this particular job. You may need to draw on what you have learned about this career in other lessons. You may also refer to the career interview for that career.

(5 points possible, +0.5 points for each key word or skill included) Total for #2: _____

3. Note and correct any misspelled words or grammatical errors. **[Note: Your final draft of your resume should not have any of these errors.]**

- +2 points if there were **no** grammatical errors, misspelled words, or other typos
- +1 point if there were **1–4** grammatical errors, misspelled words, or other typos
- +0 points if there were **5 or more** grammatical errors, misspelled words, or other typos

(Up to 2.0 points possible) Total for #3: _____

4. List your comments about your classmate's resume below. Be helpful and note things that they did well, as well as things that you think they could improve.

Total Points for Resume: _____

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Writing a Cover Letter

What is a Cover Letter?

Cover letters accompany your resume when you are applying for a job, internship, or acceptance in a particular program or university. Your cover letter has many important goals:

- To introduce yourself to the organization and explain which position you are applying for;
- To let the organization know how and why you are a good fit for them, and how your skills and interests fit the description of the position for which you are applying;
- To demonstrate that you are familiar with the work of this group, organization, or college;
- To demonstrate your writing abilities and to set your resume apart from the others.

The cover letter should be specific to the position, and should not contain any typos or grammatical errors. Remember, this is the first impression your potential employer or admissions committee will have of you.

Before beginning to write your cover letter, be sure to read the position announcement carefully so that you may address your letter specifically to that posting.

If you are looking for a position such as a summer internship with a laboratory or organization that does not have a job posting, be sure to research the lab or organization so that you may demonstrate your familiarity with their work in your letter.

Cover Letter Outline

Date:

Greeting:

Dear (person to whom you are applying):

*You will find this information in the **job posting**, or you may address the letter to the Principal Investigator or Director of a laboratory or institution. You should address the letter to Mr./Ms. Last Name or, if the person has an MD, DO or PhD, they should be addressed as Dr. Last Name.*

Paragraph One: Why are you writing to them?

- Which position are you applying for?
- How did you find out about the position?
 - o Were you referred by someone?
 - "I received your name from Ms. Jane Smith."
 - o Did you see an ad in the paper or online?
 - "I saw your ad in *The Seattle Times*."

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- o Maybe there was no job posting, but you would really like to work there.
 - “I am familiar with the work your company does and am looking for a summer internship.”
- o In this example, you can say that you received the job information from your teacher.
 - “I received information about your summer internship from my teacher, Ms. Jones, at Anytown High School in Any Town, WA.”

Paragraph Two: Who are you and why are you a good fit for their organization?

- What are your skills?
 - o “I am a junior at Anywhere High School, and I am interested in molecular biology, biotechnology, and global health.”
 - o “Enclosed please see my resume, which explains my laboratory and professional skills. Included are details about the molecular biology experiments I performed in my science class.”
- Try to link **your** skills to **their** needs. Remember, they will be reviewing many resumes and cover letters, and you need to **explain why you are a good fit for them**, not the other way around. Demonstrate that you have done your research, and that you are familiar with the work done by their organization or company.
 - o “In your job posting, you requested a laboratory technician familiar with molecular biology, including the techniques I have listed above.”

Paragraph Three: What next?

- How will you follow up?
 - o “Thank you for considering my application for your position. I look forward to hearing from you.”

Closing:

- Be sure to sign your letter, and print or type your name below your signature (as some people may not be able to read your signature).
- Include your contact information, such as your home address, email address, and/or cell phone number.
 - o Sincerely,
Signature
Name
Address
Cell Phone Number
Email Address

Name _____ Date _____ Period _____

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Cover Letter Examples

Below are three examples of cover letters.

- The first is an example of a complete cover letter, written by someone applying for a Research Technician position.
- The second and third are letters written by students applying for summer internships with Dr. Michael Crawford, the biological anthropologist featured in *Career Interview 4*.

Instructions:

1. Read the first letter below, which meets all of the criteria for a cover letter as outlined in Student Handout—*Writing a Cover Letter*.

Cover Letter Example A

July 4, 2012

Dear Dr. Allen,

Please accept my resume for the Research Technician position posted on MonsterTrak. My background and skills in laboratory techniques will prove to be an effective match for the qualifications you require.

I have a BS in Chemistry, and a 3.8 GPA. I have taken several lab courses in Biochemistry, where I worked with chromatography, ELISA, and Southern and Western blotting techniques. While working for ABC Environmental Laboratory, I successfully applied my research skills and maintained the laboratory. I participated in planning experiments, evaluating test results, and monitoring equipment performance and maintenance schedules. In addition, I was responsible for maintaining biohazard and radiation safety standards, as well as ensuring proper handling of potentially hazardous chemical and biological agents. In addition to lab work, I recorded, calculated, and analyzed data and prepared reports. I worked closely with a team of researchers and learned the value of good lab practice. I work well as a team member, am very reliable and organized, and am willing to learn.

Thank you for your consideration. I look forward to hearing from you.

Sincerely,

Kevin Doe
222 Second Avenue
Anywhere, WA 98888
(206) 555-2323



2. Now that you have read the letter above, using Cover Letter Example A and the information in Student Handout—*Writing a Cover Letter*, review and comment on Cover Letter Examples B & C. Write your comments in your lab notebook or on a separate sheet of paper, as instructed by your teacher. For each letter:
 - Note at least three things that the author did well.
 - Note at least three areas where the author could improve his or her letter.

Cover Letter Example B

July 4, 2012

Dear Michel:

I saw your lab online and really like what you. Can I come and work for you? Enclosed is my resume. I am looking for a summer internship in a research laboratory, and I am particularly interested in evolution and human diversity, which you do.

I'm a senior at Middleson High School and I'm really good a science. I'm really good as sports, to, and sports have taught me how to practice. My teacher Mrs. Smthye says that I'm one of her best students because I always complete my work on time and I get good grades on my exams. I have done DNA purification, PCR, gel electrophoresis, and DNA sequence analysis.

Please let me know if you will accept my application.

Sincerely,

John Doe
111 First Ave
Anytown, WA 98888
(206) 555-1212

Cover Letter Example C

July 4, 2011

Dear Dr. Crawford,

Enclose you will find my resume, which details my skills and knowledge.

I have am currently a senior at Middleson High School, where I have a 3.8 GPA. I have taken several lab courses, including biology and chemistry, where I worked with DNA purification, polymerase chain reaction (PCR), agarose gel electrophoresis, and DNA sequence analysis. In addition to the lab work, I recorded, calculated, and analyzed data, and prepared research reports. I have been a member of my high school softball team for three years, where I have learned the value of team work and comitment. I work well as a team member, am very reliable and organized, and am willing to learn.

Thank you for your consideration. I look forward to hearing from you.

Sincerely,

Jane Doe
111 First Ave
Anytown, WA 98888
(206) 555-1212

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Cover Letter Examples Teacher Answer Key

Comments on Letter B:

John's letter does:

- Explain why he is writing to Dr. Crawford.
- Explain what about Dr. Crawford's work interests him, demonstrating that he has done his research about Dr. Crawford's lab.
- Introduce himself and his skills.
- Contain his contact information at the bottom of the letter.

John's letter does not:

- Have a proper greeting (it should be addressed to "Dr. Crawford").
- Have a professional tone.
- Describe how his extracurricular activities on the softball team will contribute to his work in the lab.
- Show good proofreading, as he misspelled Michael in the greeting, "at" and "too" in the second paragraph, and many of his sentences were incomplete.

Comments on Letter C:

Jane's letter does:

- Have a proper greeting.
- Introduce herself and her skills.
- Have a professional tone.
- Describe how her extracurricular activities on the softball team will contribute to her work in the lab.
- End the letter with her thanks, as well as information about how Dr. Crawford may follow up with her.

Jane's letter does not:

- Explain where Jane learned about Dr. Crawford's work.
- Explain why Jane is sending Dr. Crawford her resume.
- Explain how Jane's skills will be useful in Dr. Crawford's lab.
- Show good proofreading, as she misspelled "commitment" in the second paragraph.

Scoring Suggestions: +1 point for each comment for each letter, up to a total of 12 points.

LESSON 8

KEY

Name _____ Date _____ Period _____



Cover Letter Peer-Editing Form

As with your resume, when submitting a cover letter for a position, it is always a good idea to ask someone else to review it before you show it to your potential new boss or admissions committee. You will be grading your classmate's cover letter, and using this as an opportunity to offer valuable feedback. Follow the instructions below to review and assign points to your peer's cover letter. You can circle or add a check mark below each item that is correct in the cover letter, and enter the point total on the lines provided. This sheet and your classmate's cover letter will be returned to your classmate after your teacher reviews them both. **[Note:** You will be graded on the quality of your review and comments **(up to 10 points possible).**]

Name of the Person Whose Cover Letter You Are Reviewing: _____

Instructions and Grading:

- Did the cover letter contain all of the required sections found on Student Handout—*Writing a Cover Letter*?
 - +0.5 points for **Date and Formal Greeting** at the top of page 1
 - +0.5 points for **Paragraph One** explaining why they are applying for that position
 - Up to +3.0 point for **Paragraph Two** listing your classmate's skills (up to +1 point), knowledge (up to +1.0 point), and experience (up to +1.0 point)
 - +0.5 points for **Paragraph Three** noting what next, or how your classmate intends to follow up
 - +0.5 points for a **proper closing**, including contact information

(5.0 points possible) Total for #1: _____

- Note at least three things that your classmate did well

A.

B.

C.

(+1.0 points each): (3 points possible) Total for #2: _____

- Note and correct any misspelled words or grammatical errors. **[Note:** Your final draft of your cover letter should not have any of these errors.]
 - +2 points if there were **no** grammatical errors, misspelled words, or other typos
 - +1 point if there were **1–4** grammatical errors, misspelled words, or other typos
 - +0 points if there were **5 or more** grammatical errors, misspelled words, or other typos

(Up to 2.0 points possible) Total for #3: _____

LESSON 8

HANDOUT

As with your resume, when submitting a cover letter for a position, it is always a good idea to ask someone else to review it before you show it to your potential new boss or admissions committee. You will be grading your classmate's cover letter, and using this as an opportunity to offer valuable feedback. Follow the instructions below to review and assign points to your peer's cover letter. You can circle or add a check mark below each item that is correct in the cover letter, and enter the point total on the lines provided. This sheet and your classmate's cover letter will be returned to your classmate after your teacher reviews them both. **[Note:** You will be graded on the quality of your review and comments **(up to 10 points possible).**]

Name of the Person Whose Cover Letter You Are Reviewing: _____

Instructions and Grading:

1. Did the cover letter contain all of the required sections found on Student Handout—*Writing a Cover Letter*?
 - +0.5 points for **Date and Formal Greeting** at the top of page 1
 - +0.5 points for **Paragraph One** explaining why they are applying for that position
 - Up to +3.0 point for **Paragraph Two** listing your classmate's skills (up to +1 point), knowledge (up to +1.0 point), and experience (up to +1.0 point)
 - +0.5 points for **Paragraph Three** noting what next, or how your classmate intends to follow up
 - +0.5 points for a **proper closing**, including contact information

(5.0 points possible) Total for #1: _____

2. Note at least three things that your classmate did well

A.

B.

C.

(+1.0 points each): (3 points possible) Total for #2: _____

3. Note and correct any misspelled words or grammatical errors. **[Note:** Your final draft of your cover letter should not have any of these errors.]
 - +2 points if there were **no** grammatical errors, misspelled words, or other typos
 - +1 point if there were **1–4** grammatical errors, misspelled words, or other typos
 - +0 points if there were **5 or more** grammatical errors, misspelled words, or other typos

(Up to 2.0 points possible) Total for #3: _____

4. List below any other comments you wish to make about your classmate's cover letter, such as noting things that you think they could improve:

Total Points for Cover Letter: _____

Name _____ Date _____ Period _____

8 Mock Interview Grading Rubric

Skill	Excellent Interview You should get a job offer 5 points	Average Interview You could get a call back 3 points	Poor Interview You would not get this job 1 points
First Impressions	Greeting: Greets and shakes hands with interviewer Preparation: Arrives with enough copies of resume for interviewers Conversation: Enthusiastic and engaging	Greeting: Greets but forgets to shake hands with interviewer Preparation: Arrives with at least one copy of resume Conversation: Somewhat enthusiastic and engaging	Greeting: Does not greet or shake hands with interviewer Preparation: Does not arrive with copies of resume Conversation: Not energetic or engaging
Interview Content	Knowledge: Clear understanding of job requirements and use of bioinformatics Confidence: Displays poise and confidence Ability: Able to list 3-4 skills that relate to the job	Knowledge: Some understanding of job requirements and/or use of bioinformatics Confidence: Displays some confidence Ability: Able to list 1-2 skills that relate to the job	Knowledge: Does not seem to understand job requirements or use of bioinformatics Confidence: Not confident in answering questions Ability: Unable to list skills that relate to the job
Interview Skills & Techniques	Eye Contact: Excellent Language and Grammar: Appropriate. Does not use "um" or "and" excessively Voice: Speaks at the right speed	Eye Contact: Adequate Language and Grammar: Adequate. Use of "um" or "and" does not distract from interview Voice: Speaks a little too fast or a little too slowly	Eye Contact: Poor Language and Grammar: Poor. Overuses "um" or "and" Voice: Speaks too fast or too slowly
Closing	Expresses Interest: Successfully shows interest in the position Research: Asks questions that show understanding of the position Closure: Sincerely thanks the interviewer	Expresses Interest: Shows some interest in the position Research: Asks general, non-specific questions Closure: Thanks the interviewer	Expresses Interest: Does not show interest in the position Research: Does not ask questions Closure: Fails to thank the interviewer

LESSON 8

HANDOUT