BIOL-UA 995 "Becoming a Scientist"

Syllabus:
Fall (yearly)
Wed: 3:30pm-4:45pm

Instructor: Gloria M. Coruzzi
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Coruzzi Office: 12 Waverly Place, Room 505
Office Hours: Fridays (3:00-5:00 PM)

Course Overview: Pursuing a scientific career is intellectually exciting and practically important to society. Succeeding in a scientific career is both an art *and* a science. Being successful requires intelligence and expertise in the laboratory, but equally important, it requires skills in scientific writing, oral communication, and ethics. In this course, "Becoming a Scientist", undergraduate Biology majors who are conducting independent laboratory-based research projects will perform project-based learning through reading scientific papers, and through writing and oral communication of scientific results, while also gaining exposure to issues in scientific ethics and career paths. Each student will develop these skills using their honors thesis research project as a springboard. The course is divided into 5 modules: 1. Inspiring science and scientists, 2. Choosing *your* scientific problem, 3. Defining your scientific strategy (grant writing), 4. Honing your scientific communication skills, 5. Scientific ethics and career paths. The course is a mix of lecture, reading, writing, presentation and workshops.

REQUIRED BOOKS:

"Speaking of Genetics": A collection of interviews, by Jane Gitschier, Cold Spring Harbor Press. (2010) ISBN 978-1-936113-03-3 **(Out of print, supplied as PDF)**

"The Art of Being a Scientist", by Roel Snieder and Ken Larner, Cambridge University Press (2009), ISBN 978-0-521-74352-5 (**Purchase at NYU BookStore**)

ASSIGNMENTS

Writing: There is a writing assignment for 3 of the 5 modules. (3-5 pages of writing)

Presentations: There is a powerpoint presentation for 4 of the 5 modules (4 PPT presentations)

Workshops: Students will work in groups to evaluate and modify the Specific Aims of their project.

Critiques: Students will submit written summaries and constructive critiques of classmates' scientific presentations for 3 of the 5 modules (3 critiques)

Reading Assignments: Each module has a set of reading assignments from the course packet and books.

Class participation: Peer feedback is an essential part of science and of this course. Students are expected to attend and contribute to all class sessions, which will be highly interactive. The class participation grade will be based on the frequency and quality of contributions to class discussions.

Grading

4 Presentations:	= 40%
4 Writing Assignments:	= 30%
3 Written critiques/responses:	= 20%
Class participation	= 10%

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Module 1. Inspiring Science and Scientists (Weeks 1-4)

In this module, students will select a scientist interview from the book "Speaking of Genetics" and select an associated paper. Each student will address the points below in a one-page report and make a class presentation. ONE SLIDE FOR EACH POINT.

1. **Slide 1: Background of scientist:** How did their life history lead them into science?
2. **Slide 2: Inspiration that led to discovery:** Describe the inspiration for the discovery
3. **Slide 3**: **Inspirational Paper:** Paper title and seminal discovery
4. **Slide 4**: Describe and show ***the most significant figure*** from the paper.
5. **Slide 5**: **Broader Impact**: Describe the broader implications or applications of the discovery.
6. **Slide 6**: Share with us "**Something I had to look up**."

Week 1. Instructor (Coruzzi).

Scientist Interview: H. Boyer (Field: Recombinant DNA). In "Speaking of Genetics": p. 31-41.
Seminal Paper: Cohen (1973) "Construction of biologically functional plasmids in vitro" ***PNAS*** 70; 3240-3244.

Weeks 2 - 4. Student Presentations Follow above format (10-15 min each student)

Scientist Interviewed and their discoveries: Victor Ambros (*RNA interference*); Adrian Bird (*DNA methylation*), David Botstein (*DNA polymorphisms*), Herb Boyer (*Restriction Enzymes*), Pat Brown (*DNA Chips*), Rebecca Cann (*mitochondrial DNA and human origins*), Sean Carroll (*Evolution of Body Patterning*); Tom Cech (*RNA splicing*); Evan Eichler (*Genome Instability*), Jenny Graves (*Evolution and sex chromosomes*); Sir Alec Jeffreys (*Genomic fingerprinting and introns*), Mary Lyon (*X-chromosome inactivation*), Svante Paabo (*Ancient DNA*), Neil Risch (*Human Genetics and Race*); Sir John Sulston (*Cell lineage map of an animal*), Jamie Thomson (*Stem Cells*), Spencer Wells (*Human ancestry*).

Note: ***Do not*** pick the following scientist who will be covered in Module 5: Alternate Science Careers
Nicolas Wade; Elaine Strass; Judge John E. Jones III; Shirley Tilghman; Soraya de Chadarevian).

Assignments: Student selected Interview from " Speaking Genetics" and associated publication (see list of publications in "Further Reading p. 243-246).

Presentation: PowerPoint presentation addressing 6 points ABOVE (One slide per point).

Writing: One page report on Inspiring Scientist and Paper addressing the 3 points below.

1. **Inspiration that led to discovery:** Describe what was the inspiration for the discovery
2. **Inspirational Paper**: Describe the seminal discovery and the most significant figure.
3. **Broader Impact**: Describe the implications or applications of the discovery.

Critique:

1. What was the major take-home message of the presentation?
2. Describe something you learned that you did not previously know.
3. Add a short response/constructive critique of a classmates' presentation.

Suggested Reading:

1. "**The Art of Being a Scientist**", by Snieder & Larner; Chapter 1: "What is Science", p. 11-26
2. Yewdell (2008) Nat. Rev. Mol Cell Biol. Vol. 9; Part I; "How to Succeed in Science: A concise guide for young biomedical scientists"
3. Yewdell (2008) Taking the plunge" (p. 413-416); Part II; making discoveries (p. 491-494).

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Module 2. Identifying *Your* Scientific Inspiration and Question. (Weeks 5-7)

In this module, students will read and present a paper that has inspired their senior thesis research. Each student will write a one-page report and make a 10-15 min presentation to the class on the 6 points below:

Slide 1: Inspiring Paper: Title and What is the big question the paper addresses?
Slide 2: Key Figure: Present & describe key figure from the paper.
Slide 3: **Thesis Research**: How did this key paper inspire your scientific question and approach?
Slide 4: Include one key figure that describes the major goal of your project.
Slide 5: **Broader Implications**: Describe the potential implications or applications of your thesis
Slide 6: **Something I had to look up.**

Week 5 - 7: Student Presentations (10-15 min presentations each)

Assignments: Student selected scientific research article that inspired their thesis research.

Presentation: Student Powerpoint presentation to class. **ONE slide** for each of 6 points above.

Writing: One page report on the 3 points below for "Defining your scientific Question"; 3 figs separate

1. **Inspiring Paper**: What is the big question the paper addresses? Present & describe key figure.
2. **Thesis Research**: How did this discovery inspire your scientific question and approach? Include key figure
3. **Broader Implications**: Describe the potential implications or applications of your thesis work.

Critique:

1. What was the major take-home message of the presentation?
2. Describe something you learned that you did not previously know.
3. Add a short response/constructive critique of a classmates' presentation.

Suggested Readings:

1. "**The Art of being a Scientist**", Cambridge Press**":** Chpt 3.4. "Choosing a Project" (p. 39-52); Chpt 5. "Questions Drive Research" (pp. 65-80); Chpt 7. "Turning Challenges into opportunities" (p. 93-109); Chpt 9. "Using the Scientific Literature" (pp. 132-140).
2. Alon (2009) "How to choose a good scientific problem." **Molecular Cell** vol. 35, p. 726 – 728.

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Module 3. Defining your Scientific Strategy: Grant Writing (Weeks 8 - 9)

In this module, students will – based on their research project – write the Specific Aims of their thesis research in NIH format. Their Specific Aims will include points below:

- Specific Aims (One page ONLY):
  - Big picture relevance of your research
  - The problem/gap you are addressing.
  - Overall hypothesis you will test
  - Experimental Approach/Rationale
  - List THREE SPECIFIC AIMS with titles and short description.
  - Feedback of results to original question
  - Broader significance

Week 8. Instructor (Coruzzi):

"Writing a Grant Application" (SEE PPT).

Week 9: Student Writing/Editing of Specific Aims

Assignments:

Writing: Specific Aims in NIH format (One page)

Suggested Readings:

1. "**Art of Being a Scientist**", Chapter 13. Writing Proposals (p. 196-205)
2. Sample of NIH Specific Aims and Grant
   a. NIH Grant strategy guideline
   b. Examples of Specific Aims/Grants: Eichenberger, Stripen, Stanford
   c. Nature "How to construct a summary abstract"

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Module 4: Communicating Your Science in Presentations. (Weeks 10-12)

In this module, students will present a powerpoint presentation on their thesis research. Their presentation (10 min) will include 6 points:

Slide 1: Title of Your thesis research
Slide 2: Background
Slide 3: List of your 3 specific aims
Slide 4: Cartoon Model of your project (e.g. HOME SLIDE)
Slide 5: Preliminary Results
Slide 6: Broader Implications
Slide 7: Something I had to look up.

WATCH THIS VIDEO: Giving a scientific presentation

Video: Susan McConnell, Prof. Stanford Biology
"How to give an effective Scientific Presentation"
Available at: http://www.youtube.com/watch?v=Hp7Id3Yb9XQ

Weeks 10-12: Student Presentations 3-4 students/week (10 min each)

Assignments:

Presentation: Powerpoint presentation (8 slides maximum).

Critique:

1. What was the major take-home message of the presentation?
2. Describe something you learned that you did not previously know.
3. Add a short response/constructive critique of a classmates' presentation.

Suggested Reading:

1. "**The Art of Being a Scientist**" - Chapter 10: Communication (p. 146-174).
2. Alon (2009) "How to give a good talk". **Molecular Cell**; vol 36, p. 165-167.
3. Bourne (2007) "Ten simple rules for making good oral presentations" **PLoS Computational Biology**, vol 3, e77 – 78.

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Module 5. Following Scientific Ethics and Career Paths (Weeks 13 & 14).
In this module, students will learn about Ethics and Scientific Career Paths.

Week 13. Ethics

Assignments:

Presentation: Students will present an ethical issue raised in one of the readings below, and relate how it resonates with them and/or their experience in the lab.

Readings:

1. Art of Being A Scientist**. Chapter 8.** "Ethics of Research", p. 110-129.
2. "Ten Simple Rules for building and maintaining a scientific reputation." By Philip Bourne & V. Barbour (2011). **PLoS Computational Biology,** vol 7, e1002108.
3. What is Ethics in Research (2011), by David Resnik, NIH
   Available at: http://www.niehs.nih.gov/research/resources/bioethics/whatis/
4. Fang et al (2012) "Misconduct for the majority of retracted scientific publications"
   PNAS vol. 109. No 42. P.17028-17033.

Week 14. Scientific Career Paths.
In this week, students will read and explore about different career paths in Science. Students will select an interview of a career path in "Speaking of Genetics" from amongst scientists who have entered into publishing, law, scientific writing, and administration.

Assignments:

Presentation: Students will pick a scientist and describe their alternate career path in a power point presentation from "Speaking of Genetics" by Gitschier. As part of the presentation the student will present a synopsis of how one of the interviews on alternate career paths in Speaking of Genetics may have influenced their vision for a future career in science.

Select an interview for:

Science Writing: New York Times (Nicolas Wade)
Scientific Societies: Genetics Society of America (Elaine Strass)
Science and Law: Judge John E. Jones III.
Science and Administration: The Making of a President (Shirley Tilghman)
History of Science: Birth of Molecular Biology (Soraya de Chadarevian)

Writing: Students will write a one-page essay on "My scientific career path", with a discussion of how their vision of a career path may have been influenced by their laboratory experience at NYU and by the course "Becoming a scientist".

Suggested Readings:

1. "**Art of Being a Scientist**" Chapter 14. The Scientific Career: p. 210-230.
2. Searle (2009) Ten Simple Rules for choosing between Industry and Academia**. PLoS Comp.** Bio.
3. Career Paths for Life Sciences (2010) by Julie Miller Vick and Jennifer Furlong. Chronicle of Higher education. Available at: http://chronicle.com/article/Career-Paths-for-Life/65355/