

## **PSL 439 sec 001 -- DR. ROOT-BERNSTEIN -- BIOMEDICAL DISCOVERY**

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OFFICE HOURS: Tuesdays, 10:20-noon and by appointment.

	<b><u>Abstracts Due</u></b>
Jan 11: Class introduction: Who Discovers, How?	none
Jan 18: Martin Luther King Day – NO CLASS	none
Jan 25: Modeling Discovery: Antibiotics	Root-Bernstein, “Innovation...”
Feb 1: “Something the Lord Made” Movie	Bond, “Intellectualism...”
Feb 8: “Glory Enough for All” pt. 1, Movie	Roy, “Pernicious...”
Feb 15: “Glory Enough for All” pt. 2, Movie	Lazebnik, “Can a Biologist...”
Feb 22: Beyond the Double Helix	<b><u>PAPER 1 DUE</u></b> “Glory....”
Feb 29: Library Exercise	Brody & Kern, “Stagnation...”
<b>Mar 7: SPRING BREAK – NO CLASS</b>	<b>none</b>
Mar 14: "Lorenzo's Oil," Movie	Library exercise
Mar 21: Student abstract presentations	“Lorenzo’s...”
Mar 28: The Roles of Autodidacts and Polymaths	<b>none</b>
Apr 4: Student reports	“Autodidacts...”
Apr 11 : Student reports	Reports
April 18: Student reports	Reports
Apr 25: Summary Discussion	Reports
May 2: <b><u>FINAL PAPERS DUE</u></b>	(No Final Examination)

## **REQUIRED BOOKS:**

Watson, James D. 1968. *The Double Helix*. New York: Norton.

Heiney, Paul. 2003. *Nuts and Bolts of Life: Willem Kolff and the Invention of the Kidney Machine*. New York: The History Press.

## **REQUIRED ESSAYS (HANDOUTS OR URLS):**

BBC News. 2004. Lorenzo's oil: The full story. <http://newsvote.bbc.co.uk>

Bond, R. J. 2002. Can intellectualism stifle intellectual discovery? *Nature Reviews/Drug Discovery* **1**, 825-829.

Brody, Jonathan and Kern, Scott E. 2004. Stagnation and herd mentality in the biomedical sciences. *Cancer Biology & Therapy*, **3(9)**: 903-910.

Concar, D. 2002. Lorenzo's oil really does save lives. *New Scientist* **176**, 7.

John, E. Roy. 2008. The sometimes pernicious role of theory in science. *International Journal of Psychophysiology* **62**: 377-383.

Lazebnik, Yuri. 2002. Can a biologist fix a radio: Or, what I learned while studying apoptosis. *Cancer Cell*, **2**: 179-182.

Root-Bernstein RS. 2007. Innovation (Fighting Against the Current). In: *Comprehensive Medicinal Chemistry. Vol 2: Organizational Aspect and Strategies for Drug Discovery*, W. Moos, ed. Amsterdam: Elsevier, pp. 253-264.

## **COURSE REQUIREMENTS -- PSL480 -- DR. ROOT-BERNSTEIN**

Attendance is required and you are expected to be on-time. You will lose 10 points for each unexcused absence; 5 points for being tardy or having to leave early.

Anyone caught cribbing or copying from other students' papers or abstracts will automatically flunk the assignment!

Grades will be calculated based on 325 possible points:

Abstracts on readings and movies: 10 x 10 points 100 points

Essay # 1	75 points
Student in-class report:	75 points
Report paper	75 points

Grades will be awarded on a percentile basis. There will be no curve, but I will drop the lowest abstract grade. There will be no extra credit.

96-100% = 4.0; 90-95% = 3.5; 84-89% = 3.0; 78-83 = 2.5; 72-77% = 2.0; 66-71 = 1.5; 60-65% = 1.0; <60% = 0.0

HELP: I will read and comment on drafts of abstracts up to two days before they are due and presentation- and paper-drafts up to a week before they are due. In addition, I will provide feedback on in-class presentations within a couple of days of the presentation so that you have time to incorporate corrections and additions into your written version. So with a bit of planning, you can therefore achieve whatever grade you desire in this class!

ABSTRACTS: Each separate reading and set of presentations (professor or student) will be abstracted and the abstract graded. (See Abstract handout for details). These abstracts are due the day indicated in the syllabus. Abstracts cannot be turned in late without instructor permission (which will only be given in case of demonstrated illness, emergency, etc).

ESSAY #1: The first essay will require you to read James D. Watson's *The Double Helix* and Heiney's biography of Willem Kolff and to write a 8-10 page paper comparing the discovery processes of Watson and Kolff in relation to the process of discovery elaborated during the first half of the course.

IN-CLASS PRESENTATION: Presentations will be 30 minute Powerpoint talks. Each student will choose a person from the list below. That person's major discovery will be summarized for the class, focusing, as in the essays, on the **Science** (what was discovered with enough detail that the class can understand what the problem was and how the discovery solved the problem and what problems the discovery itself created), **History** (who made the discovery, how were they trained, where did they work, and how did such factors influence what they discovered), and **Structure** of the discovery (relating your scientist's discovery process to the general process we are developing in class). As with the essays, clarity and conciseness will be rewarded, as will **making connections** to other discoveries discussed and described in the course through the readings and the movies.

**REPORT ESSAY:** This essay will be a 10-12 page paper based on your Powerpoint presentation. You are encouraged to turn in drafts of papers **PRIOR TO ONE WEEK BEFORE THEY ARE DUE** for comments and criticisms. And you are not only encouraged to correct any problems that arise during your Powerpoint presentations, but will be penalized if you do not! So listen to comments and suggestions from me and your classmates!

**MISSED WORK:**

**Missed work is expected to be made up when possible. If you must miss class to perform in an athletic or other event, or if you have a professional interview, please let the professor know in advance and arrangements will be made to excuse you from the work or to make it up in an appropriate matter.**

**Grief Absence Policy:** Last year, academic governance developed and approved a university-wide grief absence policy that provides clearer direction of student and faculty rights and responsibilities for students who have lost an immediate family member or suffer a similar serious bereavement. Please see the following website for university policy regarding missed work:

<http://splife.studentlife.msu.edu/regulations/student-group-regulations-administrative-rulings-all-university-policies-and-selected-ordinances/grief-absence-policy>

**ESSAY AND PRESENTATION GUIDELINES:** Essays will be graded in terms of seven components: 1) A description of the **SCIENCE** behind the discovery (this IS a Physiology class, after all!); 2) a summary of the **HISTORY OF THE DISCOVERY** with enough detail to permit; 3) a clear analysis of the **STRUCTURE** of the discovery (in relation to the issues and examples discussed in class); 4) **CLARITY AND CONCISENESS**; 5) the degree to which you **INTEGRATE** as much of the class readings and video material into your analysis of your particular scientist's discovery; 6) **SCHOLARSHIP**, which is to say, how well have you researched your topic, footnoted your sources and quotes, made use of more than just internet sources, etc; and 7) **WRITING** mechanics and style. You will be expected to find and read biographies, personal accounts of discoveries, original research papers, etc. as part of your presentations and the subsequent paper!

Scientists from whom you may choose for your second essay include, but are not limited to the following:

**SIR HAROLD GILLIES – PLASTIC SURGERY**  
**ALEXIS CARREL – SURGICAL PROCEDURES**  
**WERNER FORSSMANN – HEARTH CATHETERIZATION**  
**JOSEPH E. MURRAY – KIDNEY TRANSPLANTATION**  
**ALBERT SZENT-GYORGYI – MUSCLE FUNCTION AND VITAMIN C**  
**ROSALIND FRANKLIN – DNA STRUCTURE**  
**MAURICE WILKINS – DNA STRUCTURE**  
**OSWALD T. AVERY – DNA AS GENETIC MATERIAL**  
**ROSALYN YALOW – RADIO-IMMUNE ASSAY AND DIABETES**  
**JACQUES MONOD or FRANCOIS JACOB – FEEDBACK INHIBITION**  
**JULIUS AXELROD – NEUROTRANSMISSION**  
**ROGER SPERRY – SPLIT BRAIN FUNCTION**  
**JOHN ECCLES – BRAIN FUNCTION**  
**MACFARLANE BURNET – IMMUNOLOGY**  
**PETER MEDAWAR – TRANSPLANTATION IMMUNOLOGY**  
**NEILS JERNE – IMMUNOLOGY OF SELF-NONSELF**  
**PETER DOHERTY – IMMUNOLOGY (MHC GENES)**  
**BARUJ BENACERRAF – IMMUNOLOGY (HISTOCOMPATIBILITY)**  
**PAUL EHRLICH – IMMUNOLOGY AND FIRST SYNTHETIC DRUG**  
**GERHARDT DOMAGK – SULFA DRUGS**  
**HOWARD FLOREY – PENICILLIN**  
**ERNST CHAIN – PENICILLIN**  
**RACHEL BROWN AND ELIZABETH HAZEN – FIRST ANTIFUNGALS**  
**JAMES BLACK – BETA ANTAGONISTS AND ANTIHISTAMINES**  
**GERTRUDE ELION – ANTI-CANCER AND ANTI-HIV DRUGS**  
**GERTY AND CARL CORI -- METABOLISM**  
**ARCHIBALD HILL – MUSCLE PHYSIOLOGY**  
**CARL DJERASSI – BIRTH CONTROL**  
**PERCY JULIAN – STEROIDS**  
**BARBARA MCCLINTOCK – “JUMPING GENES”**  
**ALICE AND NANCY WEXLER – HUNTINGTON’S DISEASE**  
**RITA LEVI-MONTALCINI – GROWTH FACTORS**  
**MICHAEL J. BISHOP – CANCER**  
**ELIZABETH BLACKBURN – TELOMERES AND TELOMERASE**  
**BARRY MARSHALL – H. PYLORI AND ULCERS**  
**ROGER GUILLEMIN, ANDREW SCHALLY – PEPTIDE HORMONES**  
**OTTO LOEWI – NEUROTRANSMITTERS**  
**SIR HENRY DALE -- NEUROTRANSMITTERS**  
**JOHN HUGHES, HANS KOSTERLITZ -- NEUROTRANSMITTERS**  
**SOLOMON SNYDER – NEUROTRANSMISSION**  
**CANDACE PERT – NEUROTRANSMISSION**  
**ROBERT FURCHGOTT, LOUIS IGNARRO, or FERID MURAD -- NO**  
**MAX PERUTZ – HEMOGLOBIN STRUCTURE**  
**LUC MONTAGNIER – HIV**  
**ROBERT GALLO – HIV**

**KARY MULLIS – POLYMERASE CHAIN REACTION**  
**CRAIG VENTER – HUMAN GENOME**  
**FOREST BIRD – HEART-LUNG MACHINES**  
**JOHN WILD – ULTRASOUND**  
**RAYMOND DAMADIAN – INVENTION OF MRI**

**ANY NOBEL PRIZE WINNER – WITH APPROVAL OF INSTRUCTOR.**

**SOME GENERAL REFERENCES:**

Hargitai, I. 2002. *Candid Science II: Conversations with Famous Biomedical Scientists*. River Edge, NJ: Imperial College Press.

Judson, H. F. 1979. *The Eighth Day of Creation*. New York: Simon and Schuster.

Root-Bernstein, R. S. 1989. *Discovering*. Cambridge, MA: Harvard University Press.

Wolpert, L., Richards, A. 1997. *Passionate Minds: The Inner World of Scientists*. Oxford: Oxford University Press.

Yount, L. 1999. *A to Z of Women in Science and Math*. New York: Facts on File.

<http://nobelprize.org> (put your person's name in search box)

<http://www.nap.edu/> (put your person's name in search box)

<http://rsbm.royalsocietypublishing.org.proxy1.cl.msu.edu/content/by/year> (put your person's name in search box)

You may also try JSTOR on the Electronic Resources page of the MSU Library website

Google Scholar, etc.

**Some specific books about some of these scientists (as well as other acceptable scientists) follows:**

Baldwin, R. S. 1981. *The Fungus Fighters*. Ithaca: Cornell University Press.

Barnard, C. 1969. *One Life*. New York: Macmillan.

Benacerraf, B. 1998. *From Caracas to Stockholm. A Life in Medical Science*. Amherst NY: Prometheus Books.

Bickel, Lennard. *Rise Up to Life. A Biography of Sir Howard Florey*. London: Angus and Robertson, 1972.

- Bishop, J. Michael. *How to win the Nobel Prize : an unexpected life in science*. Cambridge, MA: Harvard University Press, 2003.
- Bliss, M. 1982. *The Discovery of Insulin*. Toronto: McClelland and Stewart.
- Brady, Catherine. *Elizabeth Blackburn and the Story of Telomeres*.
- Cannon, W. B. 1968. *The Way of an Investigator*. New York: Hafner Press.
- Carter, R. 1965. *Breakthrough: The Saga of Jonas Salk*. New York: Trident.
- Chargaff, E. 1978. *Heracleitean Fire*. New York: Rockefeller University Press.
- Clark, Ronald W. *The life of Ernst Chain : penicillin and beyond*. New York: St. Martin's Press, 1985.
- Comfort, N. C. 2001. *The Tangled Field: Barbara McClintock's Search for the Patterns of Genetic Control*. Cambridge, MA: Harvard University Press.
- Cournand, Andre F. *From roots... to late budding : the intellectual adventures of a medical scientist*. New York: Gardner Press, 1986.
- Crewdson, John. *Science fictions : a scientific mystery, a massive coverup, and the dark legacy of Robert Gallo*. Boston: Little, Brown, 2002.
- Crick, F. 1988. *What Mad Pursuit. A Personal View of Scientific Discovery*. New York: Basic Books.
- Damer, Eric & Astell Caroline. *No Ordinary Mike: Michael Smith, Nobel Laureate*. Vancouver BC: Ronsdale Press, 2005.
- Doherty, Peter. *The beginner's guide to winning the Nobel prize : a life in science*. New York: Columbia University Press, 2006.
- Dubos, R. 1965. *The Professor, the Institute, and DNA*. [Oswald Avery] 1976. New York: Rockefeller University Press.
- Edwards WS. 1974. *Alexis Carrel: Visionary Surgeon*. Springfield, Ill: Thomas.
- Ferry, Georgina. *Max Perutz and the Secret of Life*. New York: Cold Spring Harbor Press, 2008.
- Gallo, Robert. *Virus hunting : AIDS, cancer, and the human retrovirus : a story of scientific discovery*. New York: Basic Books, 1991.
- Goldberg, J. 1988. *Anatomy of a Scientific Discovery*. [Hughes and Kosterlitz]. Toronto: Bantam.

Hager, Thomas. *The Demon Under the Microscope. From Battlefield Hospitals to Nazi Labs, One Doctor's Heroic Search for the World's First Miracle Drug*. New York: Harmony, 2007. [Gerhardt Domagk and sulfa drugs]

Hall, Ruth. *Passionate Crusader: The Life of Marie Stopes*. New York: Harcourt Brace Jovanovich, 1977.

Kanigal, R. 1986. *Apprentice to Genius*. New York: Macmillan.

Keller, E. F. 1983. *A Feeling for the Organism: Barbara McClintock*. San Francisco: W. H. Freeman.

Kleinfeild, S. 1985. *A Machine Called Indomitable*. (MRI) New York: Times Books.

Lax E. 2004. *The Mold in Dr. Florey's Coat. The Story of Penicillin*. New York: Holt.

Levi-Montalcini, R. 1988. *In Praise of Imperfection*. New York: Basic Books.

Linton DS. 2005. *Emil von Behring: Infectious Disease, Immunology, Serum Therapy*. Philadelphia: American Philosophical Society.

MacFarlane, G. 1984. *Alexander Fleming*. Cambridge, MA: Harvard University Press.

Maddox, B. 2002. *Rosalind Franklin, the Dark Lady of DNA*. New York: Harper-Collins.

McCarty, M. 1985. *The Transforming Principle*. [Oswald Avery] New York: Norton.

Megroz RL. 1931. *Ronald Ross*. London: George Allen and Unwin.

Montagnier, Luc. *Virus : the co-discoverer of HIV tracks its rampage and charts the future*. New York: Norton, 2000.

Mullis K. 2000. *Dancing Naked in the Mind Field* (autobiography). New York: Vintage Books.

Nelson, R. 2004. "Blood on Demand" *Invention & Technology*, Spring, 24-31.

Nielsen H, Nielsen K. 2001. *Neighbouring Nobel. History of Thirteen Danish Nobel Prizes*. Denmark: Aarhus University Press.

Nye RE, Gibson ME. 1997. *Ronald Ross, Malariologist and Polymath. A Biography*. New York: St. Martin's Press.

Oshinsky, David M. *Polio: An American Story*. New York: Oxford University Press, 2005.

Pert, Candace. Molecules of Emotion: The Science Behind Mind-Body Medicine. New York: Scribner, 1997.

Quinn, J. 2004. "I was Dennis the Menace. I drove people crazy. [Forrest Bird]" *Invention & Technology*, Spring, 50-53.

Rabinow P. 1996. *Making PCR. A Story of Biotechnology*. [Kary Mullis] Chicago: University of Chicago Press.

Sayre, A. 1975. *Rosalind Franklin and DNA*. New York: Norton.

Shreeve, James. *The genome war : how Craig Venter tried to capture the code of life and save the world*. New York: Knopf, 2004.

Straus, E. 1999. *Rosalind Yalow, Nobel Laureate*. Cambridge, MA: Perseus Books.

Szent-Gyorgyi, A. 1963. "Lost in the Twentieth Century," *Annual Review of Biochemistry*, vol. 32, 1-14.

Valenstein, Elliot S. *The War of the Soups and the Sparks. The Discovery of Neurotransmitters and the Dispute Over How Nerves Communicate*. New York: Columbia University Press. 2005. [Otto Loewi and Henry Dale]

Wade N. 1981. *The Nobel Duel*. [Guillemin vs. Schally]. Garden City, NJ: Doubleday.

Wild, J. J. 1992. The origin of soft-tissue ultrasonic echoing and early instrumental application to clinical medicine. In: Weber, R. J., Perkins, D. N. *Inventive Minds: Creativity in Technology*. New York: Oxford University Press, pp. 113-141.

Wilkins, Maurice. *The Third Man of the Double Helix. The Autobiography of Maurice Wilkins*.

Wolpert, L., Richards, A. 1997. "Daydreaming Molecules: Sir James Black," *Passionate Minds: The Inner World of Scientists*. Oxford: Oxford University Press, 122-129.

Venter, J. Craig. *A Life Decoded: My Genome, My Life*.

Valenstein, Elliot S. *Great and desperate cures : the rise and decline of psychosurgery and other radical treatments for mental illness*. New York: Basic Books, 1986. [Antonio Moniz]

## WRITING ABSTRACTS – PSL439 – DR. ROOT-BERNSTEIN

The purpose of writing an abstract is to condense the material you have read into the most succinct form. To abstract is to pare away the unnecessary elements of an argument or its presentation to discover its essence. Since every narrative contains many levels of discourse and many themes, abstracting requires you to make informed decisions about what elements are most important. These decisions will depend on the questions you are asking and the problems you are trying to solve. You can't do a good job of abstracting until you have a clear question or problem in mind! Before you start reading, ask yourself what you want to know. Keep your question or problem in mind as you read! (For example, the Who, What, Where, When, Why, How that we will discuss in class.)

It is often easiest to write out whatever comes to mind in answering your question without regard to length and then to go back and pare away at it to make it suitably short.

If you have done your job well, your abstract should be able to achieve the brevity of a TV Guide description of a movie plot. It should state the basic problem and its resolution: "Man meets married woman, kills her husband, who turns out to be his twin brother who was adopted out at birth." A line this succinct should form the first sentence of your abstract. The abstract itself should then consist of a short paragraph or two (no more than a page, single spaced – double preferred!) that describes the most important elements of the plot line you describe in your first sentence. Try to balance generalizations with one or two specific examples.

Your abstract must include:

- 1) the main argument or arguments made by the author(s);
- 2) the key concept(s) upon which they base their argument(s);
- 3) the main points or data that support their argument(s).

You need to write one abstract for each set of readings that is assigned, and for each set of presentations that we have in class.

Abstracts are due in class the week the reading is listed in the syllabus, and the week after the class presentations. When more than one presentation is made, your abstract should compare and contrast the major points, rather than simply summarizing each presentation. Do some intellectual work – digest the material!

## MAKING ORAL PRESENTATIONS – PSL 439 – DR. ROOT-BERNSTEIN

The content of an oral presentation is like writing a paper:

- 1) Tell the audience what you are going to tell them (i.e., begin with an abstract of your talk outlining the flow of your key points or arguments)
- 2) Fill in the details, one key point or argument at a time. Think of the presentation in terms of paragraphs, with ONE topic per paragraph, which means ONE major slide per point.
- 3) When you are done, recap the “take home points” – these should go on one slide. This is what you want your audience to remember.

Tell a story. Every discovery and invention has a plot. Imagine it as a movie:

- 1) Begin with a problem, and explain when it was a problem, why it is a problem and to whom.
- 2) Introduce your characters – what do they bring that is unique to the problem, or how do they rethink the problem in new ways
- 3) What challenges must they overcome to solve their problem? Resources? Funding? Lack of data, techniques, materials, collaborators?
- 4) How do the key characters overcome each obstacle, one at a time?
- 5) What results from their struggles: a new technique? Data? Theory?
- 6) How does this invention or discovery solve their problem – or have they serendipitously discovered a different one altogether?
- 7) How is their discovery or invention received by others?
- 8) Who gets credit for the work?
- 9) What new problems and opportunities does the discovery or invention pose for subsequent investigators?

Don't read from a script

- 1) It is best to know your material well enough to work from notes – spontaneous speaking is much more effective than reading from a script.
- 2) If you must write out your talk to feel comfortable, go ahead – but then make notes of the talk and use the notes, not the full text.
- 3) NEVER read your talk unless you are so pressed for time, or your argument is so intricate, that you need to make every word and slide count.
- 4) Practice! Good speakers practice their talks in advance, preferably before a friendly audience. This way you can make your mistakes or find your oversights in advance and without embarrassment!

### Use visual aids effectively

- 1) Don't put your text on your slides
- 2) NEVER EVER read your slides (even if you need to read your talk)
- 3) At most, put brief phrases on your slides such as you would take for notes
- 4) Use pictures, graphs, tables, etc. that supplement your text rather than text itself
- 5) If you use graphs, tables, models or other illustrations, make sure you take time to explain them: just showing a slide without describing what is important about it is not sufficient!
- 6) If there is more information on a slide than you need, try to modify the slide, or carefully point out what is important and what can be ignored
- 7) In general, use only one slide per point
- 8) In general, put up only one slide per minute (average)
- 9) Rather than address controversial points in the talk, just make your point, but bring extra slides to which you can refer if someone from the audience questions you on such points.

### Talk to your audience

- 1) Talk to everyone in the room
- 2) Make your voice loud enough for the furthest person to hear you easily – project!
- 3) Speak slowly and clearly – take your time, don't hurry.
- 4) Make eye contact – pay attention to how your audience is receiving your pearls of wisdom!
- 5) Appear confident and speak confidently, no matter how you actually feel – public speaking is a form of acting! If you appear to be convincing, you will be convincing!
- 6) Better to put too little in a talk and generate questions than to put in too much and not finish.
- 7) Better to make your key points clearly and well than to overwhelm your audience with so much information they don't know what you told them.

### Timing your presentation

- 1) In general, one slide per minute.
- 2) In general, two to two-and-one-half minutes per page of written out text.
- 3) Cut your content to the bare minimum. Better to finish early and be able to expand on your talk than not to finish.
- 4) So put things you had to take out of the main body of your presentation at the end of your presentation (after its conclusion) that you can address in a question and answer period.

## Use of Social Media Derived from the Classroom

As members of a learning community, students are expected to respect the intellectual property of course instructors. All course materials presented to students are the copyrighted property of the course instructor and are subject to the following conditions of use:

1. Students may (may not) record lectures or any other classroom activities and use the recordings only for their own course-related purposes.
2. Students may (may not) share the recordings with other students enrolled in the class. Sharing is limited to using the recordings only for their own course-related purposes.
3. Students may (may not) not post the recordings or other course materials online or distribute them to anyone not enrolled in the class without the advance written permission of the course instructor and, if applicable, any students whose voice or image is included in the recordings.
- 4. Any student violating the conditions described above may face academic disciplinary sanctions.**