

# Bio 4337 Seminal papers in Molecular Biology

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Spring, 2007, MW 11:00 AM-12:45 PM

Seminal Papers is a history course. Selected theoretical and experimental papers in the history of Molecular Biology will be assigned to be read by all students. They will be discussed and analyzed in class. The topics will be covered roughly in the order in which they are discussed by Horace Judson in *The Eighth Day of Creation: Maker's of the Revolution in Biology*" (Expanded Edition, 1996, CSHL Press). Judson's book, a widely acclaimed history of molecular biology, is based on the interviews of 111 scientists. The first Edition was published in 1978, the twenty fifth anniversary of the Watson and Crick paper on the structure of DNA. In his 1988 book, *What Mad Pursuit*, Francis Crick stated that in comparison with other accounts, *The Eighth Day of Creation* "is more vivid, since it contains lengthy verbatim quotations from most of the participants. His story begins nearer in time to the discovery of the double helix and continues for another dozen years or so until the genetic code was unraveled ..... provid[ing] the most complete and the most balanced accounts so far of the beginnings of classical molecular biology" (p. 81). Readings in Judson will serve as a background narrative for the selected papers. The Expanded Edition has important additions: an Epilogue, "*On the transformation of Molecular Biology, 1970-1995*", Afterword I, *In defence of Rosalind Franklin*, and Afterword II, *What Did Erwin Chargaff Contribute?*

Seminal papers are usually covered in two sessions: the first session is devoted to background reading in Judson and the second session on the reading of the seminal paper. Outlines are provided for both readings in the Learning Module.

## Topics to be covered

### DNA

The genetic material (DNA): (Avery and Chase)

DNA Structure: (Chargaff; Watson and Crick; Franklin; Wilkins)

DNA Replication (Meselson and Stahl)

### Proteins

Protein Structure: (Pauling)

Protein Synthesis:

Adaptor hypothesis: tRNA (Crick; Zamecnik /Hoagland; Chapeville et al.)

The genetic code: (Nirenberg and Matthaei; Crick and Brenner)

Messenger RNA: (Brenner, Jacob and Meselson)

Regulation: The Lac Operon (Jacob and Monod)

Allostery: (Monod, Changeaux and Jacob)

## Format, Student Participation and Grading

**Text:** : *The Eighth Day of Creation, Makers of the Revolution in Biology, Expanded Edition*, Horace Judson, 1996, Cold Spring Harbor Laboratory Press.

**Seminal Papers:** Journals or reprint collections on reserve in the library

**The reading assignments, Quiz and Exam schedule:** The readings should be completed before class; quizzes will insure that you come to class prepared.

Date	Day	Quiz Exam	Reading Assignments Judson (pp.); Seminal Paper
Aug. 20	M		Syllabus, Course Format, Introduction
Aug. 22	W		1. DNA is the hereditary material, pp. 11-24
Aug. 27	M		<i>Avery, McCleod and McCarty paper</i>
Aug. 29	W		2. Demise of the Tetranucleotide, pp. 73-75; 631-637
Sept. 5	W	Quiz 1	<i>Chargaff paper</i>
Sept. 10	M		3. The alpha helix, pp. 51-65.
Sept. 12	W		<i>Pauling and Corey paper</i>
Sept. 17	M		4. Double Helix, I-II, pp. 77-123
Sept. 19	W		III, pp. 125-150 (618-629)
Sept. 14	M	Quiz 2	.... <i>Watson and Crick papers</i>
Sept. 26	W		5. DNA Replication, pp. 161-166
Oct. 1	M		<i>Meselson and Stahl paper</i>
Oct. 3	W	Exam 1	Topics 1-5
Oct. 8	M		6. tRNA, pp. 236-245,287-295; 312-313; 333-336
Oct. 10	W		.... <i>Chapeville et al. paper</i>
Oct. 15	M		7. The lac Operon, pp. 369-374, 390-403-
Oct. 17	W	Quiz 3	<i>Jacob and Monod Review</i>
Oct. 22	M		8. mRNA, 414-427, 440-442-
Oct. 24	W		.... <i>Brenner, Jacob and Meselson paper</i>
Oct. 29	M		9. UUU is phenylalanine, 453-464-
Oct. 31	W	Quiz 4	<i>Nirenberg and Mathaei paper</i>
Nov. 5	M		10. Allostery, "The 2 <sup>nd</sup> secret of life", 545-557
Nov. 7	W		.... <i>Monod, Changeux and Jacob</i>
Nov. 12-26	M		Student Presentations
<b>Finals Week</b>		<b>Exam 2</b>	<b>"Pizza Final": Topics 5-10</b>

**Term paper:** Students must submit a term paper which meets the University writing requirement (i.e. 15 pages of text).

**First Draft:** At mid-semester, students are to submit a draft of the paper on a previously approved topic.

**Subsequent Drafts:** The corrected First Draft will be returned within a week with indications of whether it is acceptable as a Final Paper, after corrections, or must be resubmitted as a subsequent draft. More than one draft may be necessary until an acceptable Final Paper is submitted.

**Final Paper:** Upon final approval of a Final Draft, a final Paper must be submitted ***no later than*** the last day of class.

**Exams and Quizzes:** There will be 4 quizzes and 2 exams.

**Course grade:** Determined ***approximately*** as follows:

1) Quizzes (4 x 5%)	20%	
2) Exams (2 x 25%)	50 %	
3) Term paper: Draft(s)	10%	
4) Term paper: Final		10%
5) Oral Presentation	10%	

I tend to send many e-mails with comments on the reading or reminders of upcoming deadlines. ***Please read your e-mails every day.***

## 2007 Seminal Papers

Avery, Oswald, T., Colin M. MacLeod and Maclyn McCarty 1944 Studies on the chemical nature of the substance inducing transformation of pneumococcal types. Induction of transformation by a desoxyribonucleic acid fraction isolated from *Pneumococcus* Type III. *Journal of Experimental Medicine*, 79, 137-158.(T)

Chargaff, Erwin 1950 Chemical specificity of nucleic acids and mechanism of their enzymatic degradation. *Experientia*, 6, 201-209. (T)

Pauling, Linus and Robert B. Corey 1950 "Two Hydrogen Bonded Spiral Configurators of the Polypeptide Chain. *Journal of the American Chemical Society* 72, 5349

Pauling, Linus, Robert Corey and H. R. Branson 1951 The structure of proteins: Two hydrogen-bonded helical configurations of the peptide chain. *Proceedings of the National Academy of Sciences, USA*, 37, 205-211.

Pauling, Linus and Robert Corey 1951, The pleated sheet, a new layer configuration of polypeptide chains. . *Proceedings of the National Academy of Sciences, USA*, 37, 251.

Watson, James, D. and Francis H. C. Crick 1953, Molecular structure of nucleic acids. *Nature* 171, 737-738. **Reprinted in Judson: pp. 170-171**

Watson, James, D. and Francis H. C. Crick 1953, Genetical implications of the structure of deoxyribonucleic acid. *Nature*, 171, 964-967 **Reprinted in Judson: pp. 171-173**

Meselson, Mathew and Franklin W. Stahl 1958, The replication of DNA in *Escherichia coli*, *Proceedings of the National Academy of Sciences, USA*, 44, 671-682. (T)

Chapeville, Francois, Fritz Lipmann, Gunter von Ehrenstein, Bernard Weisblum, William J. Ray, Jr., and Seymour Benzer 1962, *Proceedings of the National Academy of Sciences, USA*, 48, 1086-1092.

Brenner, Seymour, Francois Jacob and Mathew Meselson 1961, An unstable intermediate carrying information from genes to ribosomes for protein synthesis. *Nature* 190, 576-581. (T)

Jacob, Francois, David Perrin, Carmen Sanchez and Jacque Monod 1960, *Compte Rendus des Seances de l'Academie des Sciences*, 250, 1727-1729. (Translated from the French) (A)

Jacob, Francois and Jacque Monod 1961 Genetic regulatory mechanisms in the synthesis of proteins. *Journal of Molecular Biology* 3, 318-356. (T)

Nirenberg, Marshall, W., and J. Heinrich Matthaei 1961, The dependence of cell-free protein synthesis in *E. coli* upon naturally occurring or synthetic polyribonucleotides. *Proceedings of the National Academy of Sciences, USA*, 47, 1588-1602. (T)

Monod, Jacque, Jean-Pierre Changeux and Francois Jacob 1963, Allosteric proteins and cellular control systems. *Journal of Molecular Biology*, 3, 306-329.

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#### Note on copying papers

Because of copyright regulations, copies of the papers cannot be distributed to students and purchasing copies through the University Copy Center is prohibitively expensive. Therefore, students must make their own copies from books on reserve or journals in the library. Papers, marked with a T or A, above, are in collections of reprints on Reserve\*. All other papers must be copied directly from the Journals.

\*T: J. H. Taylor, 1965 *Selected Papers on Molecular Genetics*, Academic Press, NY

\*A: E. A. Adelberg , 1960 *Papers on Bacterial Genetics*, Little Brown and Co., Boston.