Bio 4337 Seminal papers in Molecular Biology

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Spring, 2009, MW, Room FO 3.222

11:30 AM-12:45 PM (001); 2:00-3:15 PM (002)

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 defense of Rosalind Franklin, and Afterword II, What Did Erwin Chargaff Contribute?

Most papers are covered in two sessions: the first session is devoted to background reading in Judson and the second to 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 Hershey 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 et Chapeville et al.)
Messenger RNA: (Brenner, Jacob and Meselson; Nirenberg and Matthaei)
The genetic code: (Crick, Barnett, Brenner and Watts-Tobin; (Nirenberg and Matthaei; Nirenberg and Leder)
Regulation: The Lac Operon (Jacob and Monod)
Allostery: (Monod, Changeux and Jacob)

Format, Student Participation and Grading

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

Seminal Papers: Journals, eJornals or reprint collections on reserve in the library.

Attendance and Class Participation: In a small class seminar format, attendance and class participation are essential. The readings should be completed before class. Come to class and be prepared!

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

> **Each student must submit a paper on a previously approved topic. The corrected 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 accepted. The second, and hopefully the last copy, must be returned within a week.**

The reading assignments and Exam schedule:

Date	Day	Exam	Reading Assignments Judson (pp.)/Seminal Paper
January 12	M		Introduction: Syllabus, Course Format
January 14	W		1. DNA is the hereditary material, pp. 11-24
January 21	W		*Avery, McCleod and McCarty paper*
January 26	M		2. Demise of the Tetranucleotide, pp. 73-75; 631-637
January 28	W		*Chargaff paper*
February 2	M		3. The alpha helix, pp. 51-65.
February 4	W		*Pauling and Corey paper*
February 9	M	EXAM I	Topics 1-3
February 11	W		4. Double Helix, I pp. 77 - 97
February 16	M		II pp. 97-123
February 18	W		…. III pp. 125-150 *Watson and Crick papers*
February 23	M		5. DNA Replication, pp. 161-166
February 25	W		*Meselson and Stahl paper*
March 2	M		6. tRNA, pp. 236-245,287-295; 312-313; 333-336
March 4	W		*Chapeville et al. paper*
March 9	M	EXAM II	Topics 4-6
March 11	W		7. The *lac* Operon, pp. 369-374, 390-403
March 23	M		*Jacob and Monod Review* I
March 25	W		*Jacob and Monod Review* II
March 30	M		8. UUU is phenylalanine, 453-464-
April 1	W		*Nirenberg and Matthaei paper*
April 6	M		9. Allostery, "The 2nd secret of life", 545-557
April 8	W		*Monod, Changeux and Jacob*
April 13	M		*Monod, Changeux and Jacob*
April 15	W		Study Day
April 20	M	EXAM III	Topics 7-9
April 22 - May 4			Student Presentations

Exams: **There will be 3 non-cumulative exams.**

Course grade: Determined approximately as follows:

1) Exams (3 x 25%)	**75 %**
2) Term paper:	
First submission:	**10 %**
Final submission	**5 %**
3) Oral Presentation	**5 %**
4) Attendance	**5%**

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

2009 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 Configuratons 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. 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 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)

Hoagland, Mahlon B. , Paul C. Zamecnik and Mary L. Stephenson 1957, Intermediates in protein synthesis, Biochimica et Biophysica Acta, 24, 215-216.

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 Jacques Monod 1960, Compte Rendus des Seances de l'Academie des Sciences, 250, 1727-1729. (Translated from the French) (A)

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

Crick, F.H., Leslie Barnett, Sidney Brenner and R. J. Watts-Tobin 1962, General Nature of the Genetic code for proteins. Nature 192, 1227-1232.

Nirenberg, Marshall, W., and J. Heinrich Mattaei 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, Jacques, Jean-Pierre Changeux and Francois Jacob 1963, Allosteric proteins and cellular control systems. Journal of Molecular Biology, 6, 306-329.

***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.**

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