

EUKARYOTIC MOLECULAR GENETICS
BIOL 7964
Georgia Institute of Technology
Spring, 2008

Class times/Room: Wednesday 12-2 pm, Room 322

Professors:

Francesca Storici

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Office 331, CE building

Office hours: Wednesday 2 - 3 PM

Yury Chernoff

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Office 2304, IBB building

Office hours: Thursday 10-11 AM

Kirill Lobachev

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Office 2303, IBB building

Office hours: Monday 3 – 4 PM

(Prior appointment by E-mail is strongly recommended for a meeting during office hours and required for any meeting outside of the office hours)

Course philosophy:

The objective of this course is to introduce graduate students to fundamental questions and experimental approaches in genetics and molecular biology.

The course is structured with seminars where each student will make a presentation of the assigned research paper(s).

This course places a major emphasis on developing the student's ability to understand and critically evaluate scientific papers.

This course is aimed at students who already have some background in Genetics and/or Molecular Biology, and are taking or have previously taken course 7668. This course is not intended to provide a comprehensive coverage of the whole field of Eukaryotic Molecular Genetics for the beginner students. Rather, it provides in-depth understanding of certain focus areas. *Students not having previous background in Genetics and/or Molecular Biology are strongly discouraged from taking BIOL 7964 and recommended to take BIOL 4668 instead.*

Text books:

There are no required textbooks.

Recommended books:

- B. Lewin (2003) Genes VIII, Prentice Hall, ISBN: 0-13143-981-2

- B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter (2002) Molecular Biology of the Cell, 4th Edition, Garland, ISBN: 0-81533-218-1

- E.C. Friedberg, G.C. Walker, W. Siede, R.D. Wood, R.A. Schultz, T. Ellenberger (2005) DNA Repair and Mutagenesis, 2nd Edition, ASM Press, ISBN: 1-55581-319-4

- Y.O. Chernoff (ed.) (2007) Protein-Based Inheritance, Landes Bioscience, Austin (Open Access chapters are available at [http:// www.eurekah.com/ chapter/3104](http://www.eurekah.com/chapter/3104))

Research papers for seminars for each topic will be distributed in the class or posted on T-Square.

Grading:

The grade is based on participation in seminars (presentations and participation in discussion)

In particular, the grade will be based on:

1. Paper presentation - 60%
2. Participation in discussion - 40%

Attendance:

Students are strongly encouraged to attend class, stay current with the assigned readings and to participate in discussions during seminars. Lack of attendance may result in point subtractions.

Schedule course:

Date	Topic	Professor	Papers for presentation	Presenter	Students preparing 3 questions
01.07.08	Organizational meeting	Chernoff Lobachev Storici			
01.14.08	Presentation example	Kirill Lobachev			
01.21.08	Mechanisms of gene targeting	Francesca Storici	1. Doetschman et al., 1987 2. Storici et al., 2003 3. Porteus and Baltimore, 2003	1. Bruce, Kathryn 2. Antonova, Elena 3. Xie, Bochuan	1. Lazin, Jamie; Hsieh, Benjamin 2. Zhao, Xiaonan; Zhang, Yu 3. Saini, Natalie; Lie, Lively
01.28.08	RNAi	Francesca Storici	1. Napoli et al., 1990 2. Fire et al., 1998	1. Zhao, Xiaonan 2. Phanthok, Tenzing	1. Antonova, Elena ; Bruce, Kathryn 2. Doroudi, Maryam; Wiest, Charlotte
02.04.08	DNA and chromatin	Kirill Lobachev	1. Raghavan et al., 2005 2. Li et al., 2008	1. Lie, Lively 2. Saini, Natalie	1. Phanthok, Tenzing; Zhao, Xiaonan 2. Doroudi, Maryam; Zhang, Yu
02.11.08	RNA-mediated DNA modifications and RNA editing	Francesca Storici	1. Lolle et al., 2005 2. Benne et al., 1986	1. Lazin, Jamie 2. Wiest, Charlotte	1. Antonova, Elena ; Saini, Natalie 2. Xie, Bochuan; Phanthok, Tenzing
02.18.08		Yury Chernoff	1. Brickner et al., 2007 2. Zacharioudakis et al., 2007	1. Doroudi, Maryam; 2. Hsieh, Benjamin	1. Lazin, Jamie; Hsieh, Benjamin 2. Wiest, Charlotte; Bruce, Kathryn
02.25.08		Yury Chernoff	1. Lu et al., 2004 2. Palanimurugan et al., 2004	1. Zhang, Yu; 2. Bruce, Kathryn	1. Antonova, Elena ; Doroudi, Maryam 2. Saini, Natalie; Lie, Lively
03.04.08		Yury Chernoff	1. Castilla et al., 2005 2. Tanaka et al., 2004	1. Saini, Natalie; 2. Lie, Lively	
03.11.08		Yury Chernoff	1. Du et al., 2008 2. Fowler et al., 2006	1. Xie, Bochuan; 2. Zhao, Xiaonan	
03.25.08		Yury Chernoff	1. Gliks et al., 2004 2. Decker et al., 2007	1. Lazin, Jamie; 2. Doroudi, Maryam	
04.01.08		Kirill Lobachev		1. Hsieh, Benjamin; 2. Zhang, Yu	
04.08.08		Francesca Storici	1. Zhu et al., 2008 2. Mimitou and Symington, 2008	1. Wiest, Charlotte; 2. Antonova, Elena	
04.15.08		Kirill Lobachev		1. Saini, Natalie; 2. Phanthok, Tenzing	
04.22.08		Kirill Lobachev		1. Xie, Bochuan; 2. Wiest, Charlotte	

Benne R, Van den Burg J, Brakenhoff JP, Sloof P, Van Boom JH, Tromp MC. (1986). Major transcript of the frameshifted coxII gene from trypanosome mitochondria contains four nucleotides that are not encoded in the DNA. *Cell*. 12;46(6):819-826.

Doetschman T, Gregg RG, Maeda N, Hooper ML, Melton DW, Thompson S, Smithies O. (1987). Targetted correction of a mutant HPRT gene in mouse embryonic stem cells. *Nature*.;330:576-578.

Fire A., Xu SQ., Montgomery M.K., Kostas S.A., Driver S.E. and Mello C.C. 1998. Potent and specific genetic interference by double-stranded RNA in *Caenorhabditis elegans* *Nature* 391 19 FEBRUARY 806-811.

Li Q, Zhou H, Wurtele H, Davies B, Horazdovsky B, Verreault A, Zhang Z. *Cell*. 2008 Jul 25;134(2):244-55.

Lolle SJ, Victor JL, Young JM, and Pruitt RE. (2005). Genome-wide non-mendelian inheritance of extra-genomic information in *Arabidopsis* *Nature* 434(7032):505-509.

Mimitou EP, Symington LS. (2008). Sae2, Exo1 and Sgs1 collaborate in DNA double-strand break processing. *Nature*. 2008 Oct 9;455(7214):770-774.

Napoli C., Lemieux C., Jorgensen R. (1990). Introduction of a Chimeric Chalcone Synthase Gene into *Petunia* Results in Reversible Co-Suppression of Homologous Genes in trans. *Plant Cell*. Apr;2(4):279-289.

Porteus MH, and Baltimore D. (2003). Chimeric Nucleases Stimulate Gene Targeting in Human Cells *Science* VOL 300 2 MAY 763.

Raghavan SC, Chastain P, Lee JS, Hegde BG, Houston S, Langen R, Hsieh CL, Haworth IS, Lieber MR. *J Biol Chem*. 2005 Jun 17;280(24):22749-60.

Storici F, Durham CL, Gordenin DA, Resnick MA. (2003). Chromosomal site-specific double-strand breaks are efficiently targeted for repair by oligonucleotides in yeast. *Proc. Natl. Acad. Sci. USA* 100(25):14994-14999.

Zhu Z, Chung WH, Shim EY, Lee SE, Ira G. (2008). Sgs1 helicase and two nucleases Dna2 and Exo1 resect DNA double-strand break ends. *Cell*. Sep 19;134(6):981-994.

Chernoff papers.

Brickner DG, Cajigas I, Fondufe-Mittendorf Y, Ahmed S, Lee PC, Widom J, Brickner JH (2007) H2A.Z-mediated localization of genes at the nuclear periphery confers epigenetic memory of previous transcriptional state. *PLoS Biology* 5(4):e81.

Zacharioudakis I, Gligoris T, Tzamarias D. (2007) A yeast catabolic enzyme controls transcriptional memory. *Current Biology* 17: 2041-2046.

TRANSLATIONAL REGULATION

Lu PD, Harding HP, Ron D. (2004) Translation reinitiation at alternative open reading frames regulates gene expression in an integrated stress response. *J. Cell Biology* 167(1):27-33.

Palanimurugan R, Scheel H, Hofmann K, Dohmen RJ. (2004) Polyamines regulate their synthesis by inducing expression and blocking degradation of ODC antizyme. *The EMBO J*. 23(24): 4857-67.

PRIONS

Castilla J, Saá P, Hetz C, Soto C (2005) *In vitro* generation of infectious scrapie prions. *Cell* 121: 195–206.

Tanaka M, Chien P, Naber N, Cooke R, Weissman JS.(2004) Conformational variations in an infectious protein determine prion strain differences. *Nature* 428 (6980): 323-328.

ROLE OF PRIONS AND AMYLOIDS IN REGULATION

Du Z, Park KW, Yu H, Fan Q, Li L (2008) Newly identified prion linked to the chromatin-remodeling factor Swi1 in *Saccharomyces cerevisiae*. *Nature Genetics* 40: 460-465.

Fowler DM, Koulov AV, Alory-Jost C, Marks MS, Balch WE, Kelly JW (2006) Functional amyloid formation within mammalian tissue. *PLoS Biology* 4(1): e6.

INTRACELLULAR COMPLEXES

Gilks N, Kedersha N, Ayodele M, Shen L, Stoecklin G, Dember LM, Anderson P (2004) Stress granule assembly is mediated by prion-like aggregation of TIA-1. *Molecular Biology of the Cell* 15(12): 5383-53.

Decker CJ, Teixeira D, Parker R (2007) Edc3p and a glutamine/asparagine-rich domain of Lsm4p function in processing body assembly in *Saccharomyces cerevisiae*. *J. Cell Biology* 179(3): 437-449.