

20.109:Protein engineering/Possible topics for student presentations

The list of papers below is provided as a guideline for the types of papers that might be relevant for your presentation. You will notice that the papers fall roughly into three categories- biochemistry, protein engineering/assay development, and reports describing the biological role of endogenous beta-galactosidase.

You are not limited to the following list of primary research articles. The list is provided simply to give you an idea of the kinds of subjects that could make suitable presentations for the class. Search pubmed yourself (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed>) to find articles of interest to you. Once you have decided on a paper for your presentation, please email it to nkuldell AT mit DOT edu. As you prepare your talk be sure to follow the specific guidelines for oral presentations (**Guidelines for oral presentations**).

Biochemistry

1. Cupples CG, Miller JH, Huber RE. Determination of the roles of Glu-461 in beta-galactosidase (Escherichia coli) using site-specific mutagenesis. J Biol Chem. 1990 Apr 5;265(10):5512-8.
2. Gebler JC, Aebersold R, Withers SG. Glu-537, not Glu-461, is the nucleophile in the active site of (lac Z) beta-galactosidase from Escherichia coli. J Biol Chem. 1992 Jun 5;267(16):11126-30.
3. Hoogeveen AT, Reuser AJ, Kroos M, Galjaard H. GM1-gangliosidosis. Defective recognition site on beta-galactosidase precursor. J Biol Chem. 1986 May 5;261(13):5702-4.
4. Juers DH, Heightman TD, Vasella A, McCarter JD, Mackenzie L, Withers SG, Matthews BW. A structural view of the action of Escherichia coli (lacZ) beta-galactosidase. Biochemistry. 2001 Dec 11;40(49):14781-94.
5. Saito T, Kato K, Maeda S, Suzukia T, Shibab S, SIIjimab S and Kobayashi T. Overproduction of thermostable beta-galactosidase in Escherichia-coli, its purification and molecular structure. J Ferm. Bioeng. 74 (1): 12-16 1992.
6. Skalova T, Dohnalek J, Spiwok V, Lipovova P, Vondrackova E, Petrokova H, Duskova J, Strnad H, Kralova B, Hasek J. Cold-active beta-galactosidase from Arthrobacter sp. C2-2 forms compact 660 kDa hexamers: crystal structure at 1.9A resolution. J Mol Biol. 2005 Oct 21;353(2):282-94.

7. Rojas AL, Nagem RA, Neustroev KN, Arand M, Adamska M, Eneyskaya EV, Kulminskaya AA, Garratt RC, Golubev AM, Polikarpov I. Crystal structures of beta-galactosidase from *Penicillium* sp. and its complex with galactose. *J Mol Biol.* 2004 Nov 5;343(5):1281-92.
8. Fowler AV, Zabin I. Purification, structure, and properties of hybrid beta-galactosidase proteins. *J Biol Chem.* 1983 Dec 10;258(23):14354-8.
9. Carrio MM, Corchero JL, Villaverde A, Dynamics of in vivo protein aggregation: building inclusion bodies in recombinant bacteria. *FEMS Microbiol Lett.* 1998 DEC 1; 169 (1): 9-15
10. Distler JJ, Jourdan GW. The purification and properties of beta-galactosidase from bovine testes. *J Biol Chem.* 1973 Oct 10;248(19):6772-80.
11. Li SC, Mazzotta MY, Chien SF, Li YT. Isolation and characterization of jack bean beta-galactosidase. *J Biol Chem.* 1975 Sep 10;250(17):6786-91.
12. Prouty WF, Karnovsky MJ, Goldberg AL. Degradation of abnormal proteins in *Escherichia coli*. Formation of protein inclusions in cells exposed to amino acid analogs. *J Biol Chem.* 1975 Feb 10;250(3):1112-22.
13. AV Fowler and I Zabin. Purification, structure, and properties of hybrid beta-galactosidase proteins. *J. Biol. Chem.*, Dec 1983; 258: 14354 - 14358

Protein engineering and assay development

1. Villarejo M, Zamenhof PJ, Zabin I. Beta-galactosidase. In vivo - complementation. *J Biol Chem.* 1972 Apr 10;247(7):2212-6.
2. Rossi F, Charlton CA, Blau HM. Monitoring protein-protein interactions in intact eukaryotic cells by beta-galactosidase complementation. *Proc Natl Acad Sci U S A.* 1997 Aug 5;94(16):8405-10.
3. Juers DH, Jacobson RH, Wigley D, Zhang XJ, Huber RE, Tronrud DE, Matthews BW. High resolution refinement of beta-galactosidase in a new crystal form reveals multiple metal-binding sites and provides a structural basis for alpha-complementation. *Protein Sci.* 2000 Sep;9(9):1685-99.
4. Wehrman TS, Casipit CL, Gewertz NM, Blau HM. Enzymatic detection of protein translocation. *Nat Methods.* 2005 Jul;2(7):521-7.
5. Regev-Rudzki N, Karniely S, Ben-Haim NN, Pines O. Yeast aconitase in two locations and two metabolic pathways: seeing small amounts is believing. *Mol Biol Cell.* 2005 Sep;16(9):4163-71.

6. Parikh MR, Matsumura I. Site-saturation mutagenesis is more efficient than DNA shuffling for the directed evolution of beta-fucosidase from beta-galactosidase. *J Mol Biol.* 2005 Sep 23;352(3):621-8.
7. Feliu JX, Villaverde A. Engineering of solvent-exposed loops in Escherichia coli beta-galactosidase. *FEBS Lett.* 1998 Aug 28;434(1-2):23-7.
8. Levskaya A, Chevalier AA, Tabor JJ, Simpson ZB, Lavery LA, Levy M, Davidson EA, Scouras A, Ellington AD, Marcotte EM, Voigt CA. Synthetic biology: engineering Escherichia coli to see light. *Nature.* 2005 Nov 24;438(7067):441-2.
9. Bose M, Groff D, Xie J, Brustad E, Schultz PG. The incorporation of a photoisomerizable amino acid into proteins in E. coli. *J Am Chem Soc.* 2006 Jan 18;128(2):388-9.

Biological roles for endogenous beta-galactosidase

1. Mathis L, Nicolas JF. Progressive restriction of cell fates in relation to neuroepithelial cell mingling in the mouse cerebellum. *Dev Biol* 258, 20-31 (2003). (This protein was used as a biological marker of cell lineage, cell differentiation, and cell movement in the mouse cerebellum.)
2. Geertsma ER, Duurkens RH, Poolman B. The Activity of the Lactose Transporter from Streptococcus thermophilus Is Increased by Phosphorylated IIA and the Action of beta-Galactosidase. *Biochemistry.* 2005 Dec 6;44(48):15889-97.
3. Zhang S, Bagshaw R, Hilson W, Oho Y, Hinek A, Clarke JT, Callahan JW. Characterization of beta-galactosidase mutations Asp332-->Asn and Arg148-->Ser, and a polymorphism, Ser532-->Gly, in a case of GM1 gangliosidosis. *Biochem J.* 2000 Jun 15;348 Pt 3:621-32.
4. Norden AG, O'Brien JS. An electrophoretic variant of beta-galactosidase with altered catalytic properties in a patient with GM1 gangliosidosis. *Proc Natl Acad Sci U S A.* 1975 Jan;72(1):240-4.
5. Caciotti A, Donati MA, Boneh A, d'Azzo A, Federico A, Parini R, Antuzzi D, Bardelli T, Nosi D, Kimonis V, Zammarchi E, Morrone A. Role of beta-galactosidase and elastin binding protein in lysosomal and nonlysosomal complexes of patients with GM1-gangliosidosis. *Hum Mutat.* 2005 Mar;25(3):285-92.
6. AT Hoogeveen, H Graham-Kawashima, A d'Azzo, and H Galjaard. Processing of human beta-galactosidase in GM1-gangliosidosis and Morquio B syndrome. *J. Biol. Chem.*, Feb 1984; 259: 1974 - 1977.

7. Best-Belpomme M, Courgeon AM, Rambach A. beta-Galactosidase is induced by hormone in *Drosophila melanogaster* cell cultures. Proc Natl Acad Sci U S A. 1978 Dec;75(12):6102-6.