Henry N. Higgs

Professor, Department of Biochemistry
Geisel School of Medicine at Dartmouth
Hanover NH 03755-3844
603-650-1520
henry.higgs@dartmouth.edu

Research Experience

2012-present **Professor.** *Geisel School of Medicine at Dartmouth.* Role of actin polymerization factors in organelle dynamics and filopodia assembly.

2001-2012 **Assistant/Associate Professor.** *Dartmouth Medical School.* Formin proteins, actin dynamics, and lymphocyte cytoskeleton. Promoted to Associate Professor in 2007.

1997-2001 **Post-doctoral Fellow.** *Salk Institute (Thomas Pollard).* Mechanism of actin nucleation by Arp2/3 complex and Wiskott-Aldrich Syndrome protein (WASp).

1996-1997 **Post-doctoral Fellow.** *University of Washington, Department of Biochemistry and HHMI (John Glomset).* Cloning and expression of a phosphatidic acid-preferring phospholipase A_1 from bovine testis.

1990-1996 **PhD Candidate.** *University of Washington, Department of Biochemistry and HHMI (John Glomset).* Identification, purification, and enzymological characterization of a phosphatidic acid-preferring phospholipase A_1 from sperm and brain cytosol.

1988-1990 **Research Technician.** *Universite Louis Pasteur, Strasbourg France (Pierre Chambon).* Purification and characterization of mammalian basal transcription factors.

1987-1988 **Research Technician.** *University of North Carolina-Chapel Hill, Laboratories for Reproductive Biology (Frank French).* Cloning, DNA sequencing, bacterial expression, and genomic mapping of human androgen receptor.

Education

1997-2001 Post-Doctoral Fellow
Salk Institute for Biological Studies, La Jolla CA

1996-1997 Post-Doctoral Fellow
Howard Hughes Medical Institute, University of Washington, Seattle WA

1990-1996 Ph.D. candidate
Department of Biochemistry, University of Washington, Seattle WA

1986-1987 BA Biology (Magna Cum Laude).
1984-1985 Lafayette College, Easton PA

1985-1986 Undergraduate Study. Cambridge University, UK (Corpus Christi College)

1983-1984 Undergraduate Study. Pennsylvania State University, State College PA

Awards and Affiliations

- Pew Biomedical Research Scholar, 2003 – 2007.
- Editorial Board of *Current Biology*, 2004 to present.
- NIH National Research Service Award, 1998 to 2001.
- American Society of Cell Biology, member, 1996 to present.
- Standing member of the NCSD study section (NIH), 2010 to 2015.

Research Publications

Ji, W. K., Hatch, A. L., Merrill, R. A., Strack, S. & **Higgs, H. N.** (2015) *Actin filaments target the oligomeric maturation of the dynamin GTPase Drp1 to mitochondrial fission sites.* eLife. PMID: 26609810.

Young, L. E., Heimsath, E. G. & **Higgs, H. N.** (2015) *Cell type-dependent mechanisms for formin-mediated assembly of filopodia.* Mol. Biol. Cell. PMID: 26446836.

Gurel, P. S., Guo, B., Shu, R., Mirke, D. F. & **Higgs, H. N.** (2015) *Assembly and turnover of short actin filaments by the formin INF2 and profilin.* J. Biol. Chem. 11:290(37): 22494-22506.

Manor, U., Bartholomew, S., Golani, G., Christenson, E., Kozlov, M., **Higgs, H.**, Spudich, J. & Lippincott-Schwartz, J. (2015) *A mitochondria-anchored isoform of the actin-nucleating spire protein regulates mitochondrial division.* Elife. PMID: 26305500.

Gauvin, T. J., Young, L. E. & **Higgs, H. N.** (2015) *The formin FMNL3 assembles plasma membrane protrusions that participate in cell-cell adhesion.* Mol. Biol. Cell. 26(3): 467-77.

Guo B., Gurel P. S., Shu R., **Higgs H. N.**, Pellegrini M. & Mierke D. F. (2014) *Monitoring ATP hydrolysis and ATPase inhibitor screening using (1)H NMR.* Chem. Commun. 50(81): 12037-9.

Sharma, S., Grintsevich, E. E., Woo, J., Gurel, P. S., **Higgs, H. N.**, Reisler, E., & Gimzewski, J. K. (2014) *Nanostructured self-assembly of Inverted Formin 2 (INF2) and F-actin-INF2 complex revealed by atomic force microscopy.* Langmuir. 30(25): 7533-9.

Korobova, F., Gauvin, T. J. & **Higgs, H. N.** (2014) *A role for myosin II in mammalian mitochondrial fission.* Curr. Biol. 24(4): 409-14.

Gurel, P. S., Ge, P., Grintsevich, E. E., Shu, R., Blanchoin, L., Zhou, Z. H., Reisler, E. & **Higgs, H. N.** (2014) *INF2-mediated severing through actin filament encirclement and disruption.* Curr. Biol. 24(2): 156-64.

Ramabhadran V., Hatch A. L., & **Higgs H. N.** (2013) *Actin monomers activate inverted formin 2 by competing with its autoinhibitory interaction*. J. Biol. Chem. 288(37): 26847-55.

Sun H., Schlondorff J., **Higgs H. N.**, & Pollak M. R. (2013) *Inverted formin 2 regulates actin dynamics by antagonizing Rho/diaphanous-related formin signaling*. J. Am. Soc. Nephrol. 24(6): 917-29.

Korobova, F., Ramabhadran, V. & **Higgs, H. N.** (2013) *An actin-dependent step in mitochondrial fission mediated by the ER-associated formin INF2*. Science 339(6118): 464-467.

Thompson, M. E., Heimsath, E. G., Gauvin, T. J., **Higgs, H. N.*** & Kull, F. J.* (2013) *FMNL3 FH2-actin structure gives insight into formin-mediated actin nucleation and elongation*. Nature Struct. Mol. Biol. 20(1): 111-118. *Co-corresponding.

Ramabhadran, V., Gurel, P. G. & **Higgs, H. N**. (2012) *Mutations to the formin homology 2 domain of INF2 have unexpected effects on actin polymerization and severing*. J. Biol. Chem. 287(41): 34234-45.

Hager, M. H., Morley, S., Bielenberg, D. R., Gao, S., Morello, M., Holcomb, I. N., Liu, W., Mouneimne, G., Demichelis, F., Kim, J., Solomon, K. R., Adam, R. M., Isaacs, W. B., **Higgs, H. N**., Vessella, R., Di Visio, D. & Freeman, M. R. (2012) *DIAPH3 governs the cellular transition to the amoeboid tumour phenotype*. EMBO Mol. Med. 4(8): 743-760.

Hetheridge, C., Scott, A. N., Swain, R. K., Copeland, J. W., **Higgs, H. N.**, Bicknell, R. & Mellor, H. (2012) *The formin FMNL3 is a cytoskeletal regulator of angiogenesis*. J. Cell Sci. 125(6): 1420-1426.

Heimsath, E. G. & **Higgs, H. N.** (2012). *The C-terminus of the formin FMNL3 accelerates actin polymerization and contains a WH2-like sequence that binds both monomers and filament barbed ends*. J. Biol. Chem. 287(5): 3087-3098.

Gaillard, J., Ramabhadran, V., Neumann, E., Gurel, P., Blanchoin, L., Vantard, M., & **Higgs, H. N.** (2011). *Differential Interactions of the formins INF2, mDia1, and mDia2 with microtubules*. Molec. Biol. Cell. 22(23): 4575-4587.

Ramabhadran, V., Korobova, F., Rahme, G., & **Higgs, H. N.** (2011). *Splice variant-specific cellular function of the formin INF2 in the maintenance of Golgi architecture*. Molec. Biol. Cell. 22(24): 4822-4833.

Sun, H., Schlondorff, J. S., Brown, E. J., **Higgs, H. N**. & Pollak, M. R. (2011) *Rho activation of mDia formins is modulated by an interaction with inverted formin 2 (INF2)*. Proc. Natl. Acad. Sci. USA. 15; 108(7): 2933-2938.

Harris, E. S., Gauvin, T. J., Heimsath, E. G. & **Higgs, H. N.** (2010) *Assembly of filopodia by the formin FRL2 (FMNL3)*. Cytoskeleton. 67 (12): 755-772.

Brown, E. J., Schlondorff, J. S., Becker, D. J., Tsukaguchi, H., Uscinski, A. L., **Higgs, H. N.**, Henderson, J. M., & Pollak, M. R. (2010) *Mutations in the formin gene INF2 cause focal segmental glomerulosclerosis*. Nat Genet. 42(1): 72-76.

Gauvin, T. J., Fukui, J., Peterson, J. R., & **Higgs, H. N.** (2009) Isoform-selective chemical inhibition of mDia-mediated actin assembly. Biochemistry 48(40): 9327-9329

Chhabra, E. C., Ramabhadran, V., & **Higgs, H. N.** (2009) *INF2 is an endoplasmic reticulum, associated formin protein.* J. Cell Sci. 122(9): 1430-1440.

Esue, O., Harris, E. S., **Higgs, H. N.** & Wirtz, D. (2008) *The filamentous actin cross-linking/bundling activity of mammalian formins.* J. Mol. Biol. PMID: 18835565.

Nicholson-Dykstra, S. M. & **Higgs, H. N.** (2008) *Arp2 depletion inhibits sheet-like protrusions but not linear protrusions of fibroblasts and lymphocytes.* Cell Motil. Cytoskeleton. 65(11): 904-922.

Wawro, B., Greenfield, N. J., Wear, M. A., Cooper, J. A., **Higgs, H. N.**, & Hitchcock-Degregori, S. E. (2007) *Tropomyosin regulates elongation by formin at the fast-growing end of the actin filament.* Biochemistry 46(27): 8146-8155.

Eisenmann, K. M., Harris, E. S., Kitchen, S. M., Holman, H. A., **Higgs, H. N.** & Alberts, A. S. (2007) *Dia-interacting protein modulates formin-mediated actin assembly at the cell cortex.* Curr Biol 17(7): 579-591.

Chhabra, E. S. & **Higgs, H. N**. (2006) *INF2 is a WH2 motif-containing formin that severs actin filaments and accelerates both polymerization and depolymerization.* J. Biol. Chem. 281(36):26754-26767.

Harris, E. S., Rouiller, I., Hanein, D., & **Higgs, H. N.** (2006) *Mechanistic differences in actin bundling activity of two mammalian formins, FRL1 and mDia2.* J. Biol. Chem. 281 (20): 14383-14392.

Kovar, D. R., Harris, E. S., Mahaffy, R., **Higgs, H. N.**, & Pollard, T. D. *Control of the assembly of ATP- and ADP-actin by formins and profilin.* (2006) Cell. 124: 423-435.

Barzik, M., Kotova, T. I., **Higgs, H. N.**, Hazelwood, L., Hanein, D., Gertler, F. B., & Schafer, D. A. *Ena/VASP proteins enhance actin polymerization in the presence of barbed end capping Proteins.* (2005) J. Biol. Chem. 280 (31): 28,653-28662.

Li, F. & **Higgs, H. N.** *Dissecting requirements for auto-inhibition of actin nucleation by the formin, mDia1*. (2005) J. Biol. Chem. 280 (8): 6986-6992.

Higgs, H. N. & Peterson, K. J. *Phylogenetic analysis of the Formin Homology 2 domain.* (2005) Mol. Biol. Cell. 16(1): 1-13.

Majstoravich, S., Zhang, J., Nicholson-Dykstra, S., Linder, S., Friedrich, W., Siminovitch, K. A., & **Higgs, H. N.** *Lymphocyte microvilli are dynamic, actin-dependent structures that do not require Wiskott-Aldrich syndrome protein (WASp) for their morphology.* (2004) Blood. 104(5): 1396-1403.

Harris, E. S., Li, F., & **Higgs, H. N.** *The mouse formin, FRLalpha, slows actin filament barbed end elongation, competes with capping protein, accelerates polymerization from monomers, and severs filaments.* (2004) J. Biol. Chem. 279(19): 20076-20087.

Li, F., & **Higgs, H. N.** *The mouse Formin mDia1 is a potent actin nucleation factor regulated by autoinhibition.* (2003) Curr. Biol. 13(15): 1335-1340.

Robinson, R.C., Turbedsky, K., Kaiser, D. A., Marchand, J. B., **Higgs, H. N.**, Choe, S., & Pollard, T. D. Crystal structure of Arp2/3 complex. (2001) Science. 294(5547): 1679-1684.

Hufner, K., **Higgs, H. N.**, Pollard, T. D., Jacobi, C., Aepfelbacher, M., & Linder, S. *The VC region of Wiskott-Aldrich syndrome protein induces Arp2/3 complex-dependent actin nucleation.* (2001) J. Biol. Chem. 276: 35761-35767.

Marchand, J. B, Kaiser, D. A., Pollard, T. D., & **Higgs, H. N.** *Interaction of WASp/Scar proteins with actin and vertebrate Arp2/3 complex.* (2001) Nature Cell Biol. 3: 76-82.

Higgs, H. N., & Pollard, T. D. *Activation by Cdc42 and PIP$_2$ of Wiskott-Aldrich Syndrome protein (WASp) stimulates actin nucleation by Arp2/3 complex.* (2000) J. Cell Biol. 150: 1311-1320.

Lin, Q., **Higgs, H. N.**, & Glomset, J. A. *Membrane lipids have multiple effects on interfacial catalysis by a phosphatidic acid-preferring phospholipase A$_1$ from bovine testis.* (2000) Biochemistry. 39: 9335-9344.

Linder, S., **Higgs, H. N.**, Huefner, K., Schwarz, K., Pannicke, U., & Aepfelbacher, M. *The polarization defect of Wiskott-Aldrich Syndrome macrophages is linked to dislocalization of the Arp2/3 complex.* (2000) J. Immunology. 165: 221-225.

Blanchoin, L., Amann, K. J., **Higgs, H. N.**, Marchand, J. B., Kaiser, D. A., & Pollard, T. D. *Direct observation of dendritic actin filament networks nucleated by Arp2/3 complex and WASP/Scar proteins.* (2000) Nature. 404: 1007-1011.

Higgs, H. N., Blanchoin, L., & Pollard, T. D. *Influence of the C terminus of Wiskott-Aldrich Syndrome protein (WASp) and the Arp2/3 complex on actin polymerization.* (1999) Biochemistry 38: 15212-15222.

Huang, M., Yang, C., Schafer, D. A., Cooper, J. A., **Higgs, H. N.**, & Zigmond, S. H. *Cdc42-induced actin filaments are protected from capping protein.* (1999) Curr. Biol. 9: 979-982.

May, R. C., Hall, M. E., **Higgs, H. N.**, Pollard, T. D., Chakraborty, T., Wehland, J., Machesky, L. M., & Sechi, A. S. *The Arp2/3 complex is essential for the actin-based motility of Listeria monocytogenes.* (1999) Curr. Biol. 9: 759-762.

Machesky, L. M., Mullins, R. D., **Higgs, H. N.**, Kaiser, D. A., Blanchoin, L., May, R. C., Hall, M. E., & Pollard, T. D. *Scar, a WASp-related protein, activates nucleation of actin filaments by the Arp2/3 complex.* (1999) Proc. Natl. Acad. Sci. USA. 96: 3739-3744.

Vinson, V. K., De La Cruz, E. M., Kaiser, D. A., **Higgs, H. N.**, & Pollard, T. D. *Evaluation of the affinity of Acanthamoeba profilins for actin by fluorescence anisotropy.* (1998) Biochemistry. 37(31): 10871-10880.

Higgs, H. N., Han, M., Johnson, G. E., & Glomset, J. A. *Cloning of a phosphatidic acid-preferring phospholipase A$_1$ from bovine testis.* (1998) J. Biol. Chem. 273(10), 5468-5477.

Higgs, H. N., & Glomset, J. A. *Purification and properties of a phosphatidic acid-preferring phospholipase A$_1$ from bovine testis. Examination of the molecular basis of its activation.* (1996) J. Biol. Chem. 271 (18), 10874-10883.

Higgs, H. N., & Glomset, J. A. *Identification and characterization of a phosphatidic acid-preferring phospholipase A$_1$ from bovine brain and testis.* (1994) Proc. Nat. Acad. Sci. 91, 9574-9578.

Lubahn, D. B., Brown, T. R., Simental, J. A., **Higgs, H. N.**, Migeon, C. J., Wilson, E. M., & French, F. S. *Sequence of the intron/exon junctions of the coding region of the human androgen receptor gene and identification of a point mutation in a family with complete androgen insensitivity.* (1989) Proc. Nat. Acad. Sci. 86, 9534-9538.

Lubahn, D. B., Joseph, D. R., Sar, M., Tan, J., **Higgs, H. N.**, Larson, R. E., French, F. S., & Wilson, E. M. *The human Androgen receptor: complementary deoxyribonucleic acid cloning, sequence analysis and gene expression in prostate.* (1988) Molec. Endocrinol. 2(12) 1265-1275.

Reviews

Hatch, A. L., Gurel, P. S. & **Higgs, H. N.** (2014) *Novel roles for actin in mitochondrial fission.* J. Cell Sci. 127(21): 4549-4560.

Gurel, P. G., Hatch, A. L. & **Higgs, H. N.** (2014) *Connecting the cytoskeleton to the endoplasmic reticulum and Golgi.* Curr. Biol. 24(14): R660-672.

Higgs, H. N. (2010) *Discussing the morphology of actin filaments in lamellipodia.* Trends Cell Biol. Oct 21. PMID: 20971009.

Chhabra, E. S. & **Higgs, H. N.** (2009) *The many faces of actin: matching assembly factors with cellular structures.* Nature Cell Biol. 9(10) 1110-1121.

Harris, E. S. & **Higgs, H. N**. *Biochemical analysis of mammalian formin effects on actin dynamics.* (2006) Methods Enzymol. 406: 190-214.

Higgs, H. N. *Formin proteins: a domain-based approach.* (2005) Trends Biochem. Sci. 30(6): 342-353.

Nicholson-Dykstra, S., **Higgs, H. N**., & Harris, E. S. *Actin dynamics: growth from dendritic branches.* (2005) Current Biology. 15(9) R346-357.

Higgs, H. N. *There goes the neighborhood: Eps8 joins the barbed-end crowd.* (2004) Nature Cell Biol. 6(12): 1147-1149.

Harris, E. S. & **Higgs, H. N.** *Actin cytoskeleton: formins lead the way.* (2004) Current Biology. 14(13) R520-R522.

Merz, A. J., & **Higgs, H. N.** *Listeria motility: biophysics pushes things forward.* (2003) Current Biology. 13(8): R302-R304.

Higgs, H. N. *Actin nucleation: cortactin caught in the act.* (2002) Current Biology. 12(17) R593-R595.

Higgs, H. N. *Actin nucleation: nucleation-promoting factors are not all equal.* (2001) Current Biology. 11(24) R1009-1012.

Higgs, H. N. & Pollard, T. D. *Regulation of actin nucleation by Arp2/3 complex: Activation by a diverse array of proteins.* (2001) Ann. Rev. Biochem. 70: 649-676.

Higgs, H. N., & Pollard, T. D. *Regulation of actin polymerization by Arp2/3 complex and WASp/Scar proteins.* (1999) J. Biol. Chem. 274: 32531-32534.

Invited Seminars

09/15 Department of Pharmacology. University of Iowa, Iowa City.

04/15 Department of Biochemistry. University of Washington. Seattle WA.

04/15 Molecular, Cellular and Developmental Biology. Yale University, CT.

03/15 Department of Cell Biology and Physiology, UNC-Chapel Hill, NC.

02/15 Cell Biology and Physiology Center, NIHLB, NIH, Bethesda MD.

11/14 Ludwig Institute for Cancer Research/Dept. of Biology. UCSD, San Diego CA.

10/14 EMBO Conference on Endoplasmic Reticulum. Barcelona, Spain.

10/14 Biogen. Cambridge, MA.

5/14 Pennsylvania Muscle Institute, University of Pennsylvania, Philadelphia PA

2/14 Keystone Symposium, Mitochondrial Dynamics. Santa Fe NM

1/14 Department of Biology, Brandeis University. Waltham MA

7/13 Physiology Course. Woods Hole MA

4/13 Department of Physiology, McGill University. Montreal Canada

10/12 Ludwig Maximilian University, Munich Germany

09/12 Institut Curie, Paris

09/12 DFG Summer Course on Actin Dynamics, Regensburg Germany

1/12 Molecular Biology Institute, UCLA. Los Angeles CA

10/11 Max Plank Institute-CBG, Dresden Germany

09/11 DFG Summer Course on Actin Dynamics, Regensburg Germany

04/11 Institute of Molecular Biology, University of Oregon, Eugene OR

10/10 University of Maine, Molecular and Biomedical Sciences, Orono ME.

9/10 International Meeting of the German Society for Cell Biology, Jena Germany

9/10 Keynote Address, DFG Summer Course on Actin Dynamics, Regensburg Germany

2/10 Department of Cell and Developmental Biology, SUNY Upstate, Syracuse NY

5/09 Department of Physiology and Biophysics, University of Vermont, Burlington VT

4/09 Department of Biology, University of Massachusetts, Amherst MA

9/08 Pennsylvania Muscle Institute, University of Pennsylvania, Philadelphia PA

9/08 Cytoskeletal and Cellular Motility Group, Yale University, New Haven CT

5/08	Department of Biology, University of Massachusetts, Amherst MA
5/07	Department of Biochemistry and Molecular Biology, Mayo Clinic, Rochester MN.
7/06	FASEB Conference, *Regulation & Function of Small GTPases*. Saxtons River VT.
4/06	Department of Biology, University of Massachusetts, Amherst MA
4/06	Pennsylvania Muscle Institute, University of Pennsylvania, Philadelphia PA
3/06	Department of Cell Biology, Emory University, Atlanta GA
12/05	Cell Migration Special Sub-group. American Society for Cell Biology, San Francisco.
12/05	Minisymposium Co-chair: Formins and Arp2/3 complex. American Society for Cell Biology, San Francisco.
11/05	Department of Physiology, McGill University. Montreal Canada.
4/05	Ludwig Institute, University College London.
12/04	Cell Adhesion Special Sub-group. American Society for Cell Biology, Washington DC.
11/04	Department of Physiology. University of Texas, Southwestern, Dallas TX.
9/04	Van Andel Research Institute, Grand Rapids MI.
9/04	Department of Cell Biology. Washington University St. Louis, MO.
12/03	Formin Protein Special Sub-group. American Soc. for Cell Biology, San Francisco CA.
10/03	Burnham Institute. La Jolla CA.
11/01	Department of Physiology and Biophysics. University of Vermont, Burlington VT.

Grant Review Committees:

-2015	NIH Special Emphasis Panel, Cell Biology IRG. October.
-2013	Deutsche Forschungsgemeinschaft (DFG) Priority Program on Actin Dynamics.
-2010 to 2015	NIH. Nuclear and Cytoplasmic Structure/Function and Dynamics Study Section (NCSD). Standing member.
-2010	Deutsche Forschungsgemeinschaft (DFG) Priority Program on Actin Dynamics.
-2010	NIH. Molecular, Celluar and Developmental Neurosciences IRG. Ad hoc.
-2010	NIH. Nuclear and Cytoplasmic Structure/Function and Dynamics Study Section (NCSD). Ad hoc.
-2008	American Heart Association. Region 1 Basic Cell Peer Review Committee.
-2008	American Heart Association. National Basic 4 Peer Review Committee.
-2008	American Heart Association. Region 1 Basic Cell Peer Review Committee.
-2005	Canadian NSERC Discovery Grant review.
-2005	Wellcome Trust.
-2005	Wellcome Trust.

Research Support

ACTIVE

R01 GM069818 (Higgs) 1/1/2014 – 12/31/2017 6 calendar
NIGMS
Comparative molecular physiology of mammalian formins

R01 GM109965 (Higgs) 1/1/2015 – 12/31/2018 1 calendar
NIGMS
Filopodia assembly by FMNL3: biochemical mechanism and cellular function

R01 GM106000 (Higgs: contact PI; Blanpied; Svitkina) 7/1/2013 – 2/28/2017 1.2 calendar
NIGMS
Cytoskeletal effects on mitochondrial dynamics through the ER-bound formin INF2

R01 DK088826 (Pollak) 1/1/2015 – 12/31/2018 1 calendar
NIDDK

Biological mechanism of INF2-mediated FSGS
Sub-award to study biochemistry of INF2 disease mutants

Teaching

DARTMOUTH MEDICAL EDUCATION:

DATES	NAME OF COURSE/ACTIVITY	ROLE	FREQUENCY	HOURS
2004 – pres.	Biochem 112 (Metabolism)	Instructor	Winter term	10*

Six hrs lecture/active session, two hrs Literature Discussion. 84 students.

DARTMOUTH GRADUATE EDUCATION:

DATES	NAME OF COURSE/ACTIVITY	ROLE	FREQUENCY	HOURS
2003 – pres.	Biochem 103 (Cell Biology)	Instructor	Winter term	6

Core Course for graduate students. Classes on metabolism, actin cytoskeleton, membranes. 20-30 students.

2006 – pres.	Biochem 259C (Actin)	Director	1.5 hr/week	45

Journal Club for graduate students. On-going 3 terms/year. Average of 8 students/term