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Princeton University
Chemical Engineering & Molecular Biology
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EDUCATION & TRAINING

2007 Embryology, Woods Hole Marine Biological Laboratory
2003-2007 Postdoctoral fellowship, Life Sciences, Lawrence Berkeley National Laboratory
1998-2003 Ph.D. (with high distinction), Biomedical Engineering, Johns Hopkins University
1994-1998 S.B., Chemical Engineering, Massachusetts Institute of Technology
S.B., Biology, Massachusetts Institute of Technology

POSITIONS HELD

2008- Associated faculty, Department of Molecular Biology, Princeton University
2008- Member, Breast Cancer Research Program, The Cancer Institute of New Jersey
2007- Assistant professor, Department of Chemical Engineering, Princeton University
2003-2007 Postdoctoral fellow, Department of Cancer Biology, Lawrence Berkeley National Laboratory (with Mina J. Bissell)
1999-2003 Research assistant, Department of Biomedical Engineering, Johns Hopkins University School of Medicine (with Christopher S. Chen)
1995-1998 Undergraduate research assistant, Department of Chemical Engineering, Massachusetts Institute of Technology (with Douglas A. Lauffenburger)

HONORS

E. Lawrence Keyes, Jr./Emerson Electric Co. Faculty Advancement Award (2009); Packard Fellow (2008-2013); Burroughs Wellcome Fund Career Award at the Scientific Interface (2007-2011); LBNL Outstanding Performance Award (2007); DOD Breast Cancer Research Program Postdoctoral Fellowship (2004-2007); NIH National Research Service Award Postdoctoral Fellowship (2004; declined); Keystone Symposia Student Scholarship, Signaling via cell-cell interactions (2003); Whitaker Foundation Graduate Fellowship (1999-2003); National Science Foundation Graduate Fellowship (1999; declined); Phi Beta Kappa Graduate (1998); Biotechnology Process Engineering Center Research Grant (1998); Tau Beta Pi Engineering Honor Society (1997); James E. Cunningham Memorial Fellowship (1997); Amoco Foundation Scholarship (1997); Edward Abdun-Nur Memorial Scholarship (1995-1998); Colorado School of Mines Engineers' Days Award (1994)

PROFESSIONAL ACTIVITIES

Students advised: Eline Boghaert (2008-present); Qike Kyle Chen (2008-present); Nikolce Gjorevski (2008-present); Sriram Manivannan (2009-present)

Fellows mentored: Esther Gomez, Ph.D. (2008-present); KangAe Lee, Ph.D. (2009-present)

Courses taught:

Princeton: Chemical Reaction Engineering (CHE 441; lecturer, 2008, 2009);

Quantitative Physiology and Tissue Design (CHE 539/MOL 539; lecturer, 2009)

UC Berkeley: Aspects of Bioengineering (BioE 24; guest lecturer, 2005)

Johns Hopkins University: Molecules and Cells (580.221; lecturer, 2002); Biological Transport (580.461; graduate instructor, 2001); Cell and Tissue Engineering (580.440; graduate instructor, 2000)

MIT: Experimental Biology (7.02; laboratory instructor, 1997)

Professional societies: American Association for the Advancement of Science (AAAS); American Institute of Chemical Engineers (AIChE); American Society for Cell Biology (ASCB); Biomedical Engineering Society (BMES); Society for Developmental Biology (SDB)

Manuscript and proposal reviews: *Acta Biomaterialia*; *Biophysical Journal*; *Breast Cancer Research*; *Cancer Research*; *Cell*; *Cell Biochemistry & Biophysics*; *Encyclopedia of Life Sciences*; *In Vitro Cellular and Developmental Biology*; *Journal of Biological Chemistry*; *Journal of Cell Biology*; *Langmuir*; *Nature Cell Biology*; *Nature Reviews Cancer*; *Nature Reviews Molecular Cell Biology*; *Physical Biology*; *PLoS ONE*; *Proceedings of the American Thoracic Society*; *Proceedings of the National Academy of Sciences*; *Proceedings of the Royal Academy Interface*; National Institutes of Health (NIH: NIBIB Special Emphasis Panel; NCI Tumor Progression & Metastasis Study Section); Netherlands Organisation for Scientific Research

PUBLICATIONS (*, **, and * denote those with ≥ 25 , 50, and 100 citations, respectively)**

36. Mori H., Gjorevski N., Inman J.L., Bissell M.J., **Nelson C.M.** Self-organization of engineered epithelial tubules by differential cellular motility, *Proc. Natl. Acad. Sci. USA.*, in press (2009).
35. Gjorevski N., **Nelson C.M.** Bidirectional extracellular matrix signaling during tissue morphogenesis, *Cytokine Growth Factor Rev.*, in press (2009).
34. Gomez E.W., **Nelson C.M.** Lithographically-defined two- and three-dimensional tissue microarrays. *Biological Microarrays (Methods in Molecular Biology)*, in press (2009).
33. Chen C.S., **Nelson C.M.**, Khauv D., Bennett S., Radisky E.S., Hirai Y., Bissell M.J., Radisky D.C. Homology with vesicle fusion mediator syntaxin-1a predicts determinants of epimorphin/syntaxin-2 function in mammary epithelial morphogenesis. *J. Biol. Chem.*, 284: 6877-6884 (2009).
featured on cover of journal issue
32. **Nelson C.M.** Geometric control of tissue morphogenesis. *Biochim. Biophys. Acta.*, 1793: 903-910 (2009).

31. LaBarge M.A., **Nelson C.M.**, Villadsen R., Fridriksdottir A., Ruth J.R., Stampfer M.R., Petersen O.W., Bissell M.J. Human mammary progenitor cell fate decisions are products of interactions with combinatorial microenvironments. *Integr. Biol.*, 1: 70-79 (2009).
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30. Xu R., **Nelson C.M.**, Muschler J.L., Veiseh M., Vonderhaar B.K., Bissell M.J. Sustained activation of STAT5 is essential for chromatin remodeling and maintenance of mammary-specific function. *J. Cell Biol.*, 184: 57-66 (2009).
Selected commentary on this manuscript: *Faculty of 1000* evaluations:
<http://www.f1000biology.com/article/id/1145077/evaluation>
29. Alcaraz J., Xu R., Mori H., **Nelson C.M.**, Mroue R., Spencer V.A., Brownfield D., Radisky D.C., Bustamante C., Bissell M.J. Laminin and biomimetic extracellular elasticity enhance functional differentiation in mammary epithelia. *EMBO J.*, 27: 2817-2828 (2008).
Selected commentary on this manuscript: *Faculty of 1000* evaluations:
<http://www.f1000biology.com/article/id/1124575/evaluation>
28. Gray D.S., Liu W.F., Shen C.J., Bhadriraju K., **Nelson C.M.**, Chen C.S. Engineering amount of cell-cell contact demonstrates biphasic proliferative regulation through RhoA and the actin cytoskeleton. *Exp. Cell Res.*, 314: 2846-2854 (2008).
27. **Nelson C.M.**, Khauv D., Bissell M.J., Radisky D.C. Change in cell shape is required for matrix metalloproteinase-induced epithelial-mesenchymal transition of mammary epithelial cells. *J. Cell. Biochem.*, 105: 25-33 (2008).
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26. **Nelson C.M.**, Inman J.L., Bissell M.J. Three-dimensional lithographically-defined organotypic tissue arrays for quantitative analysis of morphogenesis and neoplastic progression. *Nat. Protoc.*, 3: 674-678 (2008).
25. Liu W.F., **Nelson C.M.**, Tan J.L., Chen C.S. Cadherins, RhoA, and Rac1 are differentially required for stretch-mediated proliferation in endothelial versus smooth muscle cells. *Circ. Res.*, 101: e44-52 (2007).
24. Hirai Y., **Nelson C.M.**, Yamazaki K., Takebe K., Madden B., Radisky D.C. The non-classical export of epimorphin and its adhesion to αv -integrin for regulation of epithelial morphogenesis. *J. Cell Sci.*, 120: 2032-2043 (2007).
23. LeBeyec J., Xu R., Moonlee S.-Y., **Nelson C.M.**, Rizki A., Alcaraz J., Bissell M.J. Cell shape regulates global histone acetylation in human mammary epithelial cells. *Exp. Cell Res.*, 313: 3066-3075 (2007).
22. Itoh M., **Nelson C.M.**, Myers C.A., Bissell M.J. Rap1 integrates tissue polarity, lumen formation, and tumorigenic potential in human breast epithelial cells. *Cancer Res.*, 67: 4759-4766 (2007).
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- 21**. **Nelson C.M.**, VanDuijn M.M., Inman J.L., Fletcher D.A., Bissell M.J. Tissue geometry determines sites of branching morphogenesis in organotypic cultures, *Science*, 314: 298-300 (2006).
Selected commentary on this manuscript: *Faculty of 1000* evaluations: <http://www.f1000biology.com/article/id/1047582/evaluation>; Hayes, S. Shaped to split. *Nat. Cell Biol.*, 8: 1325 (2006); McCarthy, N. Tissue morphology: Branching out. *Nat. Rev. Cancer*, 6: 829 (2006); Vogel, G. How developing organs do the splits. *ScienceNOW*, 1012: 2 (2006); Yarris, L. Tissue geometry plays a crucial role in breast cell invasion. *Research News Berkeley Lab*, Oct. 12, 2006.
20. **Nelson C.M.**, Tien J. Microstructured extracellular matrices in tissue engineering and development. *Curr. Opin. Biotech.*, 17: 518-523 (2006) [Review].
19. Liu W.F., **Nelson C.M.**, Pirone D.M., Chen C.S. E-cadherin engagement stimulates proliferation via Rac1. *J. Cell Biol.*, 173: 431-441 (2006).
- 18**. **Nelson C.M.**, Bissell M.J. Of extracellular matrix, scaffolds, and signaling: Tissue architecture regulates development, homeostasis, and cancer. *Annu. Rev. Cell Dev. Biol.*, 22: 287-309 (2006) [Review].
17. Kenny P.A., **Nelson C.M.**, Bissell M.J. The ecology of tumors. *The Scientist*, April 2006: 30-37 (2006) [Review].
- 16*. Liu H., Radisky D.C., **Nelson C.M.**, Zhang H., Fata J.E., Roth R.A., Bissell M.J. Mechanism of Akt1 inhibition of breast cancer cell invasion reveals a protumorigenic role for TSC2, *Proc. Natl. Acad. Sci. USA.*, 103: 4134-4139 (2006).
15. **Nelson C.M.**, Liu W.F., Chen C.S. Analysis of cell-cell adhesion by bowtie-shaped microwells. *Adhesion Protein Protocols (Methods in Molecular Biology, Vol. 96)*, 1-10 (2006) [Book chapter].
- 14***. **Nelson C.M.**, Jean R.P., Tan J.L., Liu W.F., Sniadecki N.J., Spector A.A., Chen C.S. Emergent patterns of growth controlled by multicellular form and mechanics, *Proc. Natl. Acad. Sci. USA.*, 102: 11594-11599 (2005).
Selected commentary on this manuscript: *Faculty of 1000* evaluations: <http://www.f1000biology.com/article/16049098/evaluation>; Ingber, DE. Mechanical control of tissue growth: function follows form, *Proc. Natl. Acad. Sci. USA*, 102:11571-11572 (2005); Chin, G. Editor's choice: Geometry of cell proliferation, *Science*, 309: 1461 (2005); Development: geometry of cell proliferation, *Sci. STKE*, tw304 (2005).
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- 13***. Radisky D.C., Levy D.D., Littlepage L.E., Liu H., **Nelson C.M.**, Fata J.E., Leake D., Godden E.L., Albertson D.G., Nieto M.A., Werb Z., Bissell M.J. Rac1b and reactive oxygen species mediate MMP3-induced EMT and genomic instability, *Nature*, 436 (7047): 123-127 (2005).
Selected commentary on this manuscript: *Faculty of 1000* evaluations: <http://www.f1000biology.com/article/16001073/evaluation>; Chin, G. Editor's choice Biomedicine: Outside influences, *Science*, 309: 536 (2005); Lebrasseur, N. Research

roundup: MMPs rearrange DNA, *J. Cell Biol.*, 170 (3): 336 (2005); Bussell, K. Cancer: A bad influence, *Nat. Rev. Mol. Cell Biol.*, 6: 596 (2005); Novak, K. Research highlights: Environmental issues, *Nat. Rev. Cancer*, 5: 585 (2005); Comoglio, PM and L. Trusolino. Cancer: the matrix is now in control, *Nat. Med.*, 11: 1156-9 (2005).

- 12***. **Nelson C.M.**, Bissell M.J. Modeling dynamic reciprocity: Engineering three-dimensional culture models of breast architecture, function, and neoplastic transformation. *Semin. Cancer Biol.*, 15 (5): 342-352 (2005) [Review].
11. Alcaraz J., **Nelson C.M.**, Bissell M.J. Biomechanical approaches for studying integration of tissue structure and function in mammary epithelia. *J. Mammary Gland Biol. Neoplasia*, 9 (4): 361-74 (2004) [Review].
- 10***. Tan J.L., Liu W., **Nelson C.M.**, Raghavan S., Chen C.S. Simple approach to micropattern cells on common culture substrates by tuning substrate wettability. *Tissue Eng.*, 10 (5-6): 865-72 (2004).
- 9*. **Nelson C.M.**, Pirone D.M., Tan J.L., Chen C.S. Vascular endothelial-cadherin regulates cytoskeletal tension, cell spreading, and focal adhesions by stimulating RhoA. *Mol. Biol. Cell*, 15 (6): 2943-53 (2004).
- 8***. McBeath R., Pirone D.M., **Nelson C.M.**, Bhadriraju K., Chen C.S. Cell shape, cytoskeletal tension, and RhoA regulate stem cell lineage commitment. *Dev. Cell*, 6 (4): 483-95 (2004). **Selected commentary on this manuscript: Faculty of 1000 evaluations:** <http://www.f1000biology.com/article/15068789/evaluation>; Ball, P. Shape dictates fate. *Nature*, **428**: 907 (2004); Settleman, J. Tension precedes commitment - even for a stem cell. *Mol. Cell*, **14** (2): 148-150 (2004); Lucentini, J. Stem cell sculpting. *The Scientist*, **18** (16): 22 (2004).
- 7*. **Nelson C.M.**, Chen C.S. VE-cadherin simultaneously stimulates and inhibits cell proliferation by altering cytoskeletal structure and tension. *J. Cell Sci.*, 116 (17): 3571-81 (2003).
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6. **Nelson C.M.**, Chen C.S. Engineering cell adhesion for biotechnology applications. *Chem. Eng. Tech.*, in press (2003) [Review].
- 5*. **Nelson C.M.**, Raghavan S., Tan J.L., Chen C.S. Degradation of micropatterned surfaces by cell-dependent and -independent processes. *Langmuir*, 19 (5): 1493-99 (2003).
4. Tan J.L., **Nelson C.M.**, Gray D.S., Chen C.S. Approaches to organize cells on surfaces. *IEEE Engineering in Medicine and Biology Magazine*, 101-103 (2002) [Review].
- 3***. **Nelson C.M.**, Chen C.S. Cell-cell signaling by direct contact increases cell proliferation via a PI3K-dependent signal. *FEBS Letters*, 514 (2-3): 238-42 (2002).
- 2**. Tien J., **Nelson C.M.**, Chen C.S. Fabrication of aligned microstructures with a single elastomeric stamp. *Proc. Nat. Acad. Sci. USA*, 99 (4): 1758-62 (2002).

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- 1**. Asthagiri A.R., **Nelson C.M.**, Horwitz A.F., Lauffenburger D.A. Quantitative relationship among integrin-ligand binding, adhesion, and signaling via focal adhesion kinase and extracellular-signal regulated kinase 2. *J. Biol. Chem.*, 274 (38): 27119-27 (1999).

INVITED TALKS

19. Morphogenesis of model tissues. Society for Developmental Biology Annual Meeting, San Francisco, CA, July 26, 2009.
18. Mechanisms of pattern formation in model tissues. Biomedical Engineering Seminar Series, New Jersey Institute of Technology, Newark, NJ, April 3, 2009.
17. Organ development: Insights from engineered tissues and numerical models. Program in Integrative Information, Computer, and Application Sciences (PICASso) Interdisciplinary Computational Seminar Series, Princeton University, Princeton, NJ, February 23, 2009.
16. Cellular dynamics in tissue patterning and development. Carolina Biophysics Symposium, Chapel Hill, NC, November 21, 2008.
15. Pattern formation in microfabricated tissues. Institute for Medicine & Engineering (IME) Seminar Series, University of Pennsylvania, Philadelphia, PA, October 14, 2008.
14. Pattern formation in engineered tissues. Biomedical Engineering Seminar Series, Carnegie Mellon University, Pittsburgh, PA, September 29, 2008.
13. Control of tissue architecture and dynamics. Signal Transduction by Engineered Extracellular Matrices Gordon Conference, Bates College, ME, July 8, 2008.
12. Mammary gland development. Santa Cruz Developmental Biology Meeting, Santa Cruz, CA, June 29, 2008.
11. Emergence of patterns during tissue morphogenesis. Society for Industrial and Applied Mathematics (SIAM) Conference on Mathematical Aspects of Materials Science, Philadelphia, PA, May 13, 2008.
10. Understanding the emergence of patterns during tissue morphogenesis. Biomedical Engineering Seminar Series, University of California, Irvine, CA, April 24, 2008.
9. Quantitative models of mammary gland development and disease. Cancer Center Grand Rounds seminar, The Cancer Institute of New Jersey, New Brunswick, NJ, January 16, 2008.
8. Patterning and dynamics during branching morphogenesis. Biomolecular Seminar Series, Boston University, Boston, MA, December 10, 2007.

7. Emergence of patterns during morphogenesis of microscale tissues. Biophysics seminar series, Princeton, NJ, November 26, 2007.
6. Engineering models of mammary gland development and disease. Mayo Clinic Cancer Center, Jacksonville, FL, November 2, 2007.
5. Department of Molecular Biology faculty research seminar, Princeton, NJ, October 30, 2007.
4. Competition, cooperation, and emergence during tissue morphogenesis. Engineering Cell Biology II Conference, MIT, Cambridge, MA, August 5-8, 2007.
3. Branching from engineered tubes. Engineering Vascular Cell Function Using Nanoscale Cues Symposium, Experimental Biology 2007, Washington DC, April 30, 2007.
2. Engineering culture models for quantitative analysis of tissue morphogenesis. New Directions in Quantitative Biology Symposium, Harvard University, April 21, 2007.
1. An engineered tissue model of mammary epithelial branching morphogenesis. UCSF Mouse Genetics 2nd Annual Symposium, UCSF, May 19, 2006.