

Kris Noel Dahl, PhD

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ACADEMIC APPOINTMENTS

Carnegie Mellon University, Pittsburgh, PA, January 2006 - Present
Assistant Professor, Departments of Biomedical Engineering and Chemical Engineering
Associate Professor (elect) July 2012 -

Courtesy appointments and graduate groups:

01/07 - Materials Science and Engineering, Carnegie Mellon
05/08 - Member of the Lane Center for Computational Biology, Carnegie Mellon
01/09 - Center for Ethics and Policy, Carnegie Mellon (formerly CAAEPP)
02/09 - Program in Computational Biology, Carnegie Mellon and University of Pittsburgh
02/09 - Molecular Biophysics and Structural Biology Graduate Group, University of Pittsburgh
and Carnegie Mellon
03/10 - Department of Biology, Carnegie Mellon

EDUCATION

Johns Hopkins University School of Medicine, Baltimore, MD
Postdoctoral Fellowship, Department of Cell Biology, October 2004 – December 2005
“Biochemical and functional analysis of spectrin-repeat complexes at the nuclear envelope”
- Katherine L. Wilson, supervisor - NIH-NRSA fellowship supported
University of Pennsylvania, Philadelphia, PA
Ph.D. Department of Chemical and Biomolecular Engineering, December 2004
“From the red cell to the nucleus: mechanics and architecture of composite membrane systems”
- Dennis E. Discher, advisor - Whitaker fellowship supported
M.S. Department of Chemical Engineering, December 1999
“Non-viral gene transfer using fusogenic peptides derived from the influenza virus”
- Scott L. Diamond, advisor
Carnegie Mellon University, Pittsburgh, PA
B.S. Highest Honors, Chemical Engineering, May 1998

HONORS, DISTINCTIONS

Young investigator award: World Congress of Biomechanics 2010
CAREER award: NSF early career award 2010
Kun Li Award for excellence in education from Carnegie Mellon Chemical Engineering 2009
Ruth L. Kirschstein National Research Service Award: NIH Post-doctoral research fellowship
Whitaker Fellowship: Graduate research fellowship for biotechnology research

OTHER PROFESSIONAL AND ACADEMIC EXPERIENCE

08/04 – 09/04 *Visiting Scientist*, Universität Leipzig, Leipzig, Germany
- in collaboration with Jochen Guck and Josef Käs
01/00 - 08/00 *Researcher*, Health Care Division, Procter and Gamble, Cincinnati, OH

PEER REVIEWED PUBLICATIONS

18. Ribeiro AJS, Tottey S, Taylor RWE, Bise R, Kanade T, Badylak SF, **Dahl KN**
Mechanical characterization of adult stem cells from bone marrow and perivascular niches
Journal of Biomechanics in press
17. Wren NJ, Zhong Z, Schwartz R, **Dahl KN**
Modeling nuclear blebs in a nucleoskeleton of independent filament networks
Cellular and Molecular Bioengineering in press
16. Choi S, Wang W, Ribeiro AJS, Kalinowski A, Gregg A, Opreska P, Niedernhofer LJ, Rohde GK, **Dahl KN** (2011)
Multi-space computational image analysis of nuclear morphology associated with various nuclear-specific aging disorders
Nucleus 2(6)
15. Yaron PN, Holt BD, Short PA, Losche PM, Islam MF, **Dahl KN** (2011)
Single wall carbon nanotube uptake into cells by endocytosis not membrane penetration
Journal of Nanobiotechnology 9:45
14. Qin Z, Kalinowski A, **Dahl KN**, Buehler MJ (2011)
Structure and stability of the lamin A tail domain and HGPS mutant
Journal of Structural Biology 175(3): 425-33
13. Holt BD, **Dahl KN**, Islam MF (2011)
Quantification of uptake and localization of bovine serum albumin-stabilized single-wall carbon nanotubes in different human cell types
Small in press
12. Zhong Z, Booth-Gauthier EA, **Dahl KN** (2011)
 α II spectrin stabilizes stress fibers and actin-membrane interactions
Cellular and Molecular Bioengineering 4(1):106-115
11. Holt BD, Short PA, Rape AD, Wang YL, Islam MF, **Dahl KN** (2010)
Carbon nanotubes reorganize actin structures in cells and *ex vivo*
ACS Nano 4(8):4872-8
10. Zhong Z, Chang SA, Kalinowski A, Wilson KL, **Dahl KN** (2010)
Stabilization of the spectrin-like domains of nesprin-1alpha by the evolutionarily conserved "adaptive" domain
Cellular and Molecular Bioengineering 3(2):139-150
9. Philip JT and **Dahl KN**(2008)
Nuclear mechanotransduction: response of the lamina to extracellular stress with implications in aging
Journal of Biomechanics 41(15):3164-70
8. Pajeroski JD, **Dahl KN**, Zhong FL, Sammak PJ, Discher DE (2007)
Physical plasticity of the nucleus in stem cell differentiation
Proceedings of the National Academy of Science USA; 104:15619-24
7. **Dahl KN**, Scaffidi P, Islam MF, Yodh AG, Wilson KL, Misteli T (2006)
Distinct structural and mechanical properties of the nuclear lamina in Hutchinson-Gilford progeria syndrome
Proceedings of the National Academy of Science USA; 103(27):10271-6
6. Subramanian S, Tsai R, Sen S, **Dahl KN**, Discher DE (2006)
Membrane mobility and clustering of Integrin Associated Protein (IAP, CD47)-Major differences between mouse and man and implications for signaling
Blood Cells, Molecules and Diseases; 36(3):364-72
5. **Dahl KN**, Engler AJ, Pajeroski JD and Discher DE (2005)

Power-law rheology of isolated nuclei with deformation mapping of nuclear sub-structures
Biophysical Journal; 89: 2855-2864

4. **Dahl KN**, Kahn SM, Wilson KL and Discher DE (2004)
The nuclear envelope lamina network has elasticity and incompressibility suggestive of a molecular shock absorber.
Journal of Cell Science; 117:4779-4786 with Editor's Highlight and Research highlight in October 7, 2004 issue of *Nature*
3. **Dahl KN**, Parthasarathy R, Westhoff CM, Layton DM and Discher DE (2004)
Protein 4.2 is critical to the CD47-membrane skeleton attachment in the human red cell.
Blood 2004; 103:1131-1136
2. **Dahl KN**, Westhoff CM, and Discher DE (2003)
Fractional attachment of CD47 (IAP) to the erythrocyte cytoskeleton and visual co-localization with Rh protein complexes.
Blood; 101:1194-1199
1. Subramanian A, Ma H, **Dahl KN**, Zhu J and Diamond SL (2002)
Adenovirus or HA-2 fusogenic peptide-assisted lipofection increases cytoplasmic levels of plasmid in nondividing endothelium with little enhancement of transgene expression.
The Journal of Gene Medicine; 4: 75-83

CONFERENCE PRECEEDINGS

2. Ribeiro AS, **Dahl KN** (2010)
The nucleus as a central structure in defining the mechanical properties of stem cells.
IEEE Engineering Medicine and Biology Society; 1:831-4.
1. Rohde GK, Ribeiro AJS, **Dahl KN**, Murphy RF (2008)
Deformation-based nuclear morphometry: Capturing nuclear shape variation in HeLa cells
Cytometry A; 73(4):341-50

REVIEWS AND BOOK CHAPTERS

7. **Dahl KN**, Ribeiro AJS (2011 - accepted)
Biophysics of nuclear organization and dynamics
Chapter 7.10 in *Comprehensive Biophysics*
6. **Dahl KN**, Kalinowski A (2011)
Nucleoskeleton mechanics
Journal of Cell Science "at a glance" 124(5):675-8
5. Zhong Z, Wilson KL, **Dahl KN** (2010)
Beyond lamins other structural components of the nucleoskeleton.
Methods in Cell Biology 98:97-119
4. **Dahl KN**, Kalinowski A, Pekkan K (2010)
Mechanobiology and the microcirculation: cellular, nuclear and fluid mechanics.
Microcirculation. 17(3):179-91
3. **Dahl KN**, Booth-Gauthier EA, Ladoux B (2009)
In the middle of it all: Mutual mechanical regulation between the nucleus and the cytoskeleton
Journal of Biomechanics
2. **Dahl KN**, Ribeiro AJS, Lammerding J (2008)
Nuclear shape, mechanics, and mechanotransduction.
Circulation Research 102(11):1307-18. Review
1. Lammerding J, **Dahl KN**, Discher DE, Kamm RD (2007)
Nuclear mechanics and methods
Methods in Cell Biology 83: 269-94

PAPERS IN REVIEW OR IN FINAL PREPARATION

6. Cells uptake and recover from protein stabilized single wall carbon nanotubes with two distinct rates
Holt BD, **Dahl KN**, Islam MF
Accepted with minor revisions in *ACS Nano*
5. Altered cell mechanics from the inside: dispersed single wall carbon nanotubes integrate with and restructure actin
Holt BD, Shams H, Horst TA, Basu S, Rape AD, Wang Y-L, Rohde GK, Mofrad M, Islam MF, **Dahl KN**
Invited and in review in *Journal of Functional Biomaterials*
4. Mechanically induced changes in genome movement and rheology
Booth-Gauthier EA, Alcoser T, Venkatas P, Yang G, **Dahl KN**
3. Nuclear stiffening reduces cell metastatic potential of melanoma
Sukumar A, Khanna P, Ribeiro AJS, Dong C, **Dahl KN**
2. Hutchinson-Gilford Progeria Syndrome alters nuclear shape and reduces cell motility in 3D model substrates
Booth-Gauthier EA, Du V, Ghibaud M, Rape AD, **Dahl KN**, Ladoux B
1. Calcium-mediated regulation of membrane association of lamin A
Kalinowski A, Qin Z, Coffey K, Yaron P, Kodali R, Shenoy S, Buehler M, Lösche M, **Dahl KN**

CURRENT RESEARCH GRANTS

- | | | |
|---|-------------|---------------------|
| 2. IGERT: Educating and the Interface: Nanomaterial Environmental Impacts and Policy (senior) | | |
| NSF | \$1,237,608 | 07/15/10 - 06/30/12 |
| 1. CAREER: Genome regulation and nuclear rheology (PI) | | |
| NSF | \$400,000 | 2/1/10 - 1/31/15 |

PENDING RESEARCH GRANTS

- | | | |
|--|-------------|------------------|
| 2. NIH R21: Tuning Surface Coating to Design Bioactive Carbon Nanotubes with Targeted Subcellular Localization | | |
| NIH | \$405,965 | 9/1/12 – 8/31/14 |
| 1. NIH R01: Aberrant Lamin-Membrane Interaction and Nuclear Morphology in Progeria (PI) | | |
| NIH | \$1,793,516 | 9/1/12 – 8/31/17 |

PAST RESEARCH GRANTS

- | | | |
|--|-----------|---------------------|
| 4. Quantification of progerin recruitment to membranes: The role of farnesylation and local electrostatic interactions in HGPS (PI) | | |
| Progeria Research Foundation | \$100,000 | 01/01/09 – 12/31/11 |
| 3. NER: Actin Filament Crosslinking in vitro and in vivo using Purified and Isolated Carbon Nanotubes: A Potential Cancer Therapy (PI) | | |
| NSF | \$130,000 | 07/01/07 - 06/31/09 |
| 2. Acquisition of an Environmental Scanning Electron Microscope for Visualization, Characterization and Manipulation of Nanoscale Systems (senior personnel) | | |
| NSF | \$498,325 | 08/01/07 - 07/31/10 |
| 1. MRI: Acquisition of a Laser Scanning Multi-Photon Confocal Microscope to Investigate Structure and Dynamics of Soft Materials of Biological and Synthetic Origin (senior personnel) | | |
| NSF | \$610,000 | 08/01/06 - 07/31/09 |

TRAINEES

Graduate students

Elizabeth Booth-Gauthier - Doctoral Student, Chemical Engineering

Brian Holt - Doctoral Student, Biomedical Engineering

Co-advised by Mohammad Islam, ChemE-MSE

DOD-NDSEG fellowship

Patrick Boyer - Doctoral Student, Chemical Engineering

Steve Spagnol - Doctoral Student, Chemical Engineering

Aishwarya Sukumar - Masters Student, Biomedical Engineering

Yongqiang Xu - Masters Student, Biomedical Engineering

Undergraduate Students:

Turi Alcoser – Undergraduate, Biomedical Engineering and Materials Science and Engineering

Travis Horst - Undergraduate, Chemical Engineering

Matthew Biegler - Undergraduate, Biomedical Engineering and Materials Science and Engineering

Kelli Coffee – Undergraduate, Biomedical Engineering and Biomedical Engineering

James Weltz – Undergraduate, Biomedical Engineering and Biomedical Engineering

PAST TRAINEES

Postdoctoral Fellow

Peter Yaron, PhD – Chemical Engineering

Current position: Lexmark

Graduate Students:

Agnieszka Kalinowski – MD-PhD Student, Biomedical Engineering, graduated 12/11

Thesis: Lamin A Tail Domain Variants and their Membrane Association

NIH-NRSA predoctoral fellowship

Current position: completing medical degree at UPMC

Alexandre J.S. Ribeiro – PhD, Biomedical Engineering, graduated 12/10

Thesis: Mechanics of the Nucleus in Differentially Uncommitted Cells

Current position: postdoctoral fellowship Stanford University

Zhixia Zhong – PhD, Chemical Engineering, graduated 5/10

Thesis: Structural and Mechanical Roles of Spectrin Repeat Proteins in Nucleated Cells and Implications on Muscular Dystrophy

Current position: maternity leave

Julia T. Philip – Masters Student, Chemical Engineering, graduated 12/07

MS thesis: Nuclei Respond to Extracellular Shear Stress by Upregulating and Reorganizing Lamins

Chao-Kuei “Eric” Wang – Masters Student, Chemical Engineering, graduated 12/06

MS thesis: Actin polymerization *in vitro* and the Effects of Single Wall Carbon Nanotubes

Richard Taylor - Masters Student, Biomedical Engineering, graduated 05/11

MS thesis: Bone Marrow-Derived Stem Cells: Injection Response and Socio-Economic Hurdles to Clinical Utility

P. Alex Short - Masters Student, Biomedical Engineering, graduated 05/11

MS thesis: The Mechanics of Single Walled Carbon Nanotubes Effects on Cellular Mechanisms

Undergraduate Students:

Matthew Woodling, Alice Peiyang Wang, Sunhoo Kim, Andy SiWei Chang, Alexandra German, Nicholas Wren, Nikunja Kolluri, Sarah Brothers, Ryan Chehanske, Scott Chapman, Alexa Beaver, Joshua Taylor, SiWon Choi, Priyanka Venkatesh

INVITED SEMINARS

11. Stanford University, Department of Mechanical Engineering, January 2012
10. UC Berkeley Department of Bioengineering, May 2011
9. MIT Department of Civil Engineering, April 2011
8. University of Pittsburgh Department of Cell Biology, January 2011
7. West Virginia University Department of Chemical Engineering, January 2011
6. MIT Program in Polymer Science and Technology, April 2010
5. Pennsylvania State University Department of Bioengineering, January 2010
4. University of Pittsburgh Department of Bioengineering, October 2009
3. University of Paris-Diderot Department of Physics, December 2008
2. University of Pittsburgh Molecular Biophysics Structural Biology, October 2008
1. University of Maryland Baltimore County, Department of Mechanical Engineering, April 2006

INVITED ORAL PRESENTATIONS

11. ASCB Special Interest Subgroup, Denver, CO, December 2011
10. ASCB Special Interest Subgroup, Philadelphia, PA, December 2010
9. Wright Patterson Air Force Research Center, Dayton, OH, October 2010
8. World Congress of Biomechanics, Singapore, August 2010 - Young Investigator Gold award
7. ASME Summer Bioengineering Conference, Naples, FL, June 2010
6. Self-Assembly in Biology and Materials Science, Huatulco, MX, June 2010
5. Progeria Research Foundation annual meeting, Boston, MA, April 2010
4. Materials Research Society, San Francisco, CA, April 2010
3. Keynote Speaker for Cell Signaling at the Microcirculatory Society, Columbia, MO, October 2009
2. Physical and Chemical Aspects of Molecular Biology: An International Workshop on Current Problems in Complex Fluids, Puebla, Mexico January 2007
1. Educational Presentation American Association of Blood Banks, Seattle, WA, October 2005

CONTRIBUTED ORAL PRESENTATIONS

16. Kalinowski A, Qin Z, Buehler M, Dahl KN
Biophysical Society, Baltimore, MD, March 2011
15. Booth-Gauthier EA, Yang G, Dahl KN
American Society of Cell Biology, Philadelphia, PA, December 2010
14. Holt BD, Short PA, Dahl KN, Islam MF
Biomedical Engineering Society, Austin, TX, October 2010
13. Ribeiro AS, Dahl KN
Biomedical Engineering Society, Austin, TX, October 2010
IEEE Engineering Medicine and Biology Society, Buenos Aires, Argentina, September 2010
12. Zhong Z, Wilson KL and Dahl KN
American Society of Cell Biology, San Diego, December 2009
11. Dahl KN
Biomedical Engineering Society, Pittsburgh, PA, October, 2009

10. Zhong Z, Wilson KL, Dahl KN
American Institute for Chemical Engineers, Nashville, TN, November, 2009
9. Ribeiro AJS, Finol EA, Dahl KN
American Institute of Chemical Engineers, Philadelphia, PA, November 2008
8. Zhong ZZ, Chang SA, Wilson KL, Dahl KN
Biomedical Engineering Society, St. Louis, MO, October 2008
7. Dahl KN, Avila-Rencoret, Islam MF
Society of Biorheology, State College, PA, July 2008
6. Ribeiro AJS, Larenas CR, Guzman AG, Finol EA, Dahl KN
16th International Conference on Mechanics in Medicine and Biology, Pittsburgh, PA, July 2008
5. Dahl KN, Wilson KL, Discher DE
American Society of Cell Biology, Washington, DC, December 2004
4. Dahl KN, Engler AE, Discher DE
American Institute of Chemical Engineers, Austin, TX, November 2004
3. Dahl KN, Wilson KL and Discher DE
Biomedical Engineering Society, Philadelphia, PA, October 2004
2. Dahl KN, Wilson KL and Discher DE
Society of Histochemistry, Prague, Czeck Republic, September 2004
1. Dahl KN, Photos PJ, Parthasarathy R, Subramanian S and Discher DE
American Institute of Chemical Engineers, San Francisco, CA, November 2003

PROFESSIONAL MEMBERSHIPS

American Association Advancement Science, American Institute of Chemical Engineers, American Society for Cell Biology, Bio-Medical Engineering Society, Biophysical Society, Materials Research Society, IEEE EMBC

REVIEW ACTIVITIES – JOURNALS

ACS Nano, American Journal of Hematology, ASME, Biomechanics and Modeling in Mechanobiology, Biophysical Journal, Biotechnology Progress, Cell Biochemistry and Biophysics, Colloids and Surfaces A, Histochemistry and Cell Biology, Integrative Biology, Journal of Biomechanical Engineering, Journal of Biomechanics, Journal of Cell Biology, Journal of Microscopy, Journal of the Royal Society Interfaces, Nature Communications, PLoS ONE, Trends in Cell Biology

REVIEW ACTIVITIES – FOUNDATIONS

W. M. Keck Foundation, Wellcome Trust

OTHER CLASSES, LECTURES AND OUTREACH

42-798 Current Readings in Biomedical Engineering – Cell Mechanics

Fall 2010

2 units (1 credit)

student number: 10

Learning Objectives: This class is designed to discuss contemporary concepts of cellular mechanics including biology, biophysics, simulation, theory and techniques. Students will learn to critically evaluate published papers and discuss the paper's contents. This study is aimed to improve student's scientific literacy, communication skills and ability to hold meaningful discourse with colleagues. At the completion of the class, students will be more efficient in reading scientific articles, recognize ethical issues related to publication and have increased awareness of the breadth and depth cellular mechanics.

Lectures in Ethics

for Carnegie Mellon, University of Pittsburgh and UPMC undergraduate, graduate and medical students (Member of the Center for Ethics and Policy)

- Moral pluralism and professional ethics
- Comparative ethics: science, engineering and medicine
- Ethical concerns in nanotechnology
- Good research practices - ethical dilemmas and decision making in undergraduate research
- Ethics of cloning and human embryonic stem cell research

Open Learning Initiative (OLI)

Lead contributing author – Anatomy and Physiology

This OLI course is being developed for pre-medicine in high school and as a supplement to community college courses. The open and free nature of the course allows accessibility by individuals in rural areas and underprivileged regions of the country. OLI is unique in that it uses cognitive tutors, virtual laboratories and other web-based interactive modules to enhance learning.