



## William Nelson

Rudy J. and Daphne Donohue Munzer Professor in the School of Medicine, Emeritus  
Biology

 NIH Biosketch available Online

### Bio

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#### ACADEMIC APPOINTMENTS

- Emeritus Faculty, Acad Council, Biology
- Member, Bio-X
- Member, Stanford Cancer Institute

### Research & Scholarship

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#### CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our research objectives are to understand the cellular mechanisms involved in the development and maintenance of epithelial cell polarity. Polarized epithelial cells play fundamental roles in the ontogeny and function of a variety of tissues and organs. Recent studies indicate that the development of epithelial cell polarity is a multistage process requiring instructive extracellular cues (eg. cell-cell and cell-substratum contact) and the reorganization of proteins in the cytoplasm and on the plasma membrane. Once established, polarity is maintained by targeting and retention of proteins to functionally distinct apical and basal-lateral plasma membrane domains.

We have developed three strategies to address molecular and biochemical aspects of the mechanisms involved in these processes:

- (i). Analysis of membrane and cytoplasmic protein sorting, targeting and distribution in established cell lines of polarized renal epithelia in tissue culture (eg. MDCK cells). Biochemical and molecular analysis of protein sorting into vesicles, transport and docking of vesicles with specialized membrane domains.
- (ii). Structural and functional analysis of cell adhesion in epithelial cells. Molecular genetic approaches to disrupt cadherin and associated protein (catenins) functions. Role of cell adhesion in establishing docking machinery for transport vesicles.
- (iii). In vitro studies of protein organization and interactions in purified and reconstituted cell systems.
- (iv). In vivo studies of embryonic development of polarized renal epithelia in the normal mouse and the cpk mouse mutant, a murine strain with autosomal recessive polycystic kidney disease in which cell polarity is partially reversed.

## Teaching

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### GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biology (School of Humanities and Sciences) (Phd Program)
- Cancer Biology (Phd Program)
- Molecular and Cellular Physiology (Phd Program)

## Publications

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### PUBLICATIONS

- **$\beta$ -catenin at the centrosome: Discrete pools of  $\beta$ -catenin communicate during mitosis and may co-ordinate centrosome functions and cell cycle progression.** *BioEssays*  
Mbom, B. C., Nelson, W. J., Barth, A.  
2013; 35 (9): 804-809
- **Danio rerio alpha E-catenin Is a Monomeric F-actin Binding Protein with Distinct Properties from Mus musculus alpha E-catenin** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Miller, P. W., Pokutta, S., Ghosh, A., Almo, S. C., Weis, W. I., Nelson, W. J., Kwiatkowski, A. V.  
2013; 288 (31): 22324-22332
- **Microactuator device for integrated measurement of epithelium mechanics** *BIOMEDICAL MICRODEVICES*  
Mukundan, V., Nelson, W. J., Pruitt, B. L.  
2013; 15 (1): 117-123
- **An epithelial tissue in Dictyostelium challenges the traditional origin of metazoan multicellularity** *BIOESSAYS*  
Dickinson, D. J., Nelson, W. J., Weis, W. I.  
2012; 34 (10): 833-840
- **alpha-Catenin and IQGAP Regulate Myosin Localization to Control Epithelial Tube Morphogenesis in Dictyostelium** *DEVELOPMENTAL CELL*  
Dickinson, D. J., Robinson, D. N., Nelson, W. J., Weis, W. I.  
2012; 23 (3): 533-546
- **E-cadherin is under constitutive actomyosin-generated tension that is increased at cell-cell contacts upon externally applied stretch** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Borghi, N., Sorokina, M., Shcherbakova, O. G., Weis, W. I., Pruitt, B. L., Nelson, W. J., Dunn, A. R.  
2012; 109 (31): 12568-12573
- **Competitive Regulation of E-Cadherin JuxtaMembrane Domain Degradation by p120-Catenin Binding and Hakai-Mediated Ubiquitination** *PLOS ONE*  
Hartssock, A., Nelson, W. J.  
2012; 7 (5)
- **Adherens junction function and regulation during zebrafish gastrulation** *CELL ADHESION & MIGRATION*  
Schepis, A., Nelson, W. J.  
2012; 6 (3): 173-178
- **alpha E-catenin regulates cell-cell adhesion and membrane blebbing during zebrafish epiboly** *DEVELOPMENT*  
Schepis, A., Sepich, D., Nelson, W. J.  
2012; 139 (3): 537-546
- **Protein Evolution in Cell and Tissue Development: Going Beyond Sequence and Transcriptional Analysis** *DEVELOPMENTAL CELL*  
Dickinson, D. J., Weis, W. I., Nelson, W. J.  
2011; 21 (1): 32-34
- **Ciliary Diffusion Barrier: The Gatekeeper for the Primary Cilium Compartment** *CYTOSKELETON*  
Hu, Q., Nelson, W. J.  
2011; 68 (6): 313-324

- **A Polarized Epithelium Organized by beta- and alpha-Catenin Predates Cadherin and Metazoan Origins** *SCIENCE*  
Dickinson, D. J., Nelson, W. J., Weis, W. I.  
2011; 331 (6022): 1336-1339
- **Rapid Suppression of Activated Rac1 by Cadherins and Nectins during De Novo Cell-Cell Adhesion** *PLOS ONE*  
Kitt, K. N., Nelson, W. J.  
2011; 6 (3)
- **CellBio-X: celebrating the interface between Cell Biology and other disciplines** *TRENDS IN CELL BIOLOGY*  
Nelson, W. J., Hosking, C. R., Alvania, R.  
2010; 20 (12): 689-690
- **VE-cadherin: at the front, center, and sides of endothelial cell organization and function** *CURRENT OPINION IN CELL BIOLOGY*  
Harris, E. S., Nelson, W. J.  
2010; 22 (5): 651-658
- **Formation of extra centrosomal structures is dependent on beta-catenin** *JOURNAL OF CELL SCIENCE*  
Bahmanyar, S., Guiney, E. L., Hatch, E. M., Nelson, W. J., Barth, A. I.  
2010; 123 (18): 3125-3135
- **In vitro and in vivo reconstitution of the cadherin-catenin-actin complex from *Caenorhabditis elegans*** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Kwiatkowski, A. V., Maiden, S. L., Pokutta, S., Choi, H., Benjamin, J. M., Lynch, A. M., Nelson, W. J., Weis, W. I., Hardin, J.  
2010; 107 (33): 14591-14596
- **Adenomatous Polyposis Coli Regulates Endothelial Cell Migration Independent of Roles in beta-Catenin Signaling and Cell-Cell Adhesion** *MOLECULAR BIOLOGY OF THE CELL*  
Harris, E. S., Nelson, W. J.  
2010; 21 (15): 2611-2623
- **Regulation of cell motile behavior by crosstalk between cadherin- and integrin-mediated adhesions** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Borghi, N., Lowndes, M., Maruthamuthu, V., Gardel, M. L., Nelson, W. J.  
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- **A Septin Diffusion Barrier at the Base of the Primary Cilium Maintains Ciliary Membrane Protein Distribution** *SCIENCE*  
Hu, Q., Milenkovic, L., Jin, H., Scott, M. P., Nachury, M. V., Spiliotis, E. T., Nelson, W. J.  
2010; 329 (5990): 436-439
- **alpha E-catenin regulates actin dynamics independently of cadherin-mediated cell-cell adhesion** *JOURNAL OF CELL BIOLOGY*  
Benjamin, J. M., Kwiatkowski, A. V., Yang, C., Korobova, F., Pokutta, S., Svitkina, T., Weis, W. I., Nelson, W. J.  
2010; 189 (2): 339-352
- **Remodeling Epithelial Cell Organization: Transitions Between Front-Rear and Apical-Basal Polarity** *COLD SPRING HARBOR PERSPECTIVES IN BIOLOGY*  
Nelson, W. J.  
2009; 1 (1)
- **Cell autonomous defects in cortical development revealed by two-color chimera analysis** *MOLECULAR AND CELLULAR NEUROSCIENCE*  
Kwiatkowski, A. V., Garner, C. C., Nelson, W. J., Gertler, F. B.  
2009; 41 (1): 44-50
- **Resolving cadherin interactions and binding cooperativity at the single-molecule level** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Zhang, Y., Sivasankar, S., Nelson, W. J., Chu, S.  
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- **Role of APC and Its Binding Partners in Regulating Microtubules in Mitosis** *APC PROTEINS*  
Bahmanyar, S., Nelson, W. J., Barth, A. I.  
2009; 656: 65-74

- **Epithelial cell surface polarity: the early steps** *FRONTIERS IN BIOSCIENCE-LANDMARK*  
Nejsum, L. N., Nelson, W. J.  
2009; 14: 1088-1098
- **Forchlorfenuron Alters Mammalian Septin Assembly, Organization, and Dynamics** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Hu, Q., Nelson, W. J., Spiliotis, E. T.  
2008; 283 (43): 29563-29571
- **Role of adenomatous polyposis coli (APC) and microtubules in directional cell migration and neuronal polarization** *SEMINARS IN CELL & DEVELOPMENTAL BIOLOGY*  
Barth, A. I., Caro-Gonzalez, H. Y., Nelson, W. J.  
2008; 19 (3): 245-251
- **Biochemical and structural analysis of alpha-catenin in cell-cell contacts** *BIOCHEMICAL SOCIETY TRANSACTIONS*  
Pokutta, S., Drees, F., Yamada, S., Nelson, W. J., Weis, W. I.  
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- **Regulation of cell-cell adhesion by the cadherin-catenin complex** *BIOCHEMICAL SOCIETY TRANSACTIONS*  
Nelson, W. J.  
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- **Adherens and tight junctions: Structure, function and connections to the actin cytoskeleton** *BIOCHIMICA ET BIOPHYSICA ACTA-BIOMEMBRANES*  
Hartssock, A., Nelson, W. J.  
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- **Immediate-early signaling induced by E-cadherin engagement and adhesion** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Perez, T. D., Tamada, M., Sheetz, M. P., Nelson, W. J.  
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- **Bench to bedside and back again: Molecular mechanisms of alpha-catenin function and roles in tumorigenesis** *SEMINARS IN CANCER BIOLOGY*  
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2008; 18 (1): 53-64
- **Epithelial polarity requires septin coupling of vesicle transport to polyglutamylated microtubules** *JOURNAL OF CELL BIOLOGY*  
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Bahmanyar, S., Kaplan, D. D., DeLuca, J. G., Giddings, T. H., O'Toole, E. T., Winey, M., Salmon, E. D., Casey, P. J., Nelson, W. J., Barth, A. I.  
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Hunt, S. J., Nelson, W. J.  
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- **A molecular mechanism directly linking E-cadherin adhesion to initiation of epithelial cell surface polarity** *JOURNAL OF CELL BIOLOGY*  
Nejsum, L. N., Nelson, W. J.  
2007; 178 (2): 323-335
  - **Characterization of mammalian Par 6 as a dual-location protein** *MOLECULAR AND CELLULAR BIOLOGY*  
Cline, E. G., Nelson, W. J.  
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  - **Separation of cell-cell adhesion complexes by differential centrifugation.** *Methods in molecular biology (Clifton, N.J.)*  
Vogelmann, R., Nelson, W. J.  
2007; 370: 11-22
  - **Cadherins in development: cell adhesion, sorting, and tissue morphogenesis** *GENES & DEVELOPMENT*  
Halbleib, J. M., Nelson, W. J.  
2006; 20 (23): 3199-3214
  - **Re-solving the cadherin-catenin-actin conundrum** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Weis, W. I., Nelson, W. J.  
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  - **Wingless signaling modulates cadherin-mediated cell adhesion in Drosophila imaginal disc cells** *JOURNAL OF CELL SCIENCE*  
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  - **E-cadherin tethered to micropatterned supported lipid bilayers as a model for cell adhesion** *LANGMUIR*  
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  - **alpha-catenin is a molecular switch that binds E-cadherin-beta-catenin and regulates actin-filament assembly** *CELL*  
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Yamada, S., Pokutta, S., Drees, F., Weis, W. I., Nelson, W. J.  
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  - **Cell-adhesion assays: fabrication of an E-cadherin substratum and isolation of lateral and Basal membrane patches.** *Methods in molecular biology (Clifton, N.J.)*  
Drees, F., Reilein, A., Nelson, W. J.  
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  - **Convergence of Wnt, beta-catenin, and cadherin pathways** *SCIENCE*  
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Louie, R. K., Bahmanyar, S., Siemers, K. A., Votin, V., Chang, P., Stearns, T., NELSON, W. J., Barth, A. I.  
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  - **Breaking into the epithelial apical-junctional complex - news from pathogen hackers** *CURRENT OPINION IN CELL BIOLOGY*  
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  - **Mechanism of recruiting Sec6/8 (exocyst) complex to the apical junctional complex during polarization of epithelial cells** *JOURNAL OF CELL SCIENCE*  
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  - **Cadherin adhesion: mechanisms and molecular interactions.** *Handbook of experimental pharmacology*  
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  - **Tube morphogenesis: closure, but many openings remain** *TRENDS IN CELL BIOLOGY*  
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  - **Mum, this bud's for you: where do you want it? Roles for Cdc42 in controlling bud site selection in Saccharomyces cerevisiae** *BIOESSAYS*  
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  - **Epithelial cell polarity from the outside looking in** *NEWS IN PHYSIOLOGICAL SCIENCES*  
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  - **Spatial control of exocytosis** *CURRENT OPINION IN CELL BIOLOGY*  
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- **The cadherin cytoplasmic domain is unstructured in the absence of beta-catenin - A possible-mechanism for regulating cadherin turnover** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
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- **Serum-activated assembly and membrane translocation of an endogenous Rac1 : effector complex** *CURRENT BIOLOGY*  
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- **Colocalization and redistribution of dishevelled and actin during Wnt-induced mesenchymal morphogenesis** *JOURNAL OF CELL BIOLOGY*  
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