BIOGRAPHICAL SKETCH

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NAME: Devenport, Danelle

eRA COMMONS USER NAME (credential, e.g., agency login): DANELLE

POSITION TITLE: Associate Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Humboldt State University, Arcata, CA	B.S.	05/1997	Biology/Chemistry
University of British Columbia, Vancouver, CANADA	M.Sc.	12/1999	Genetics
University of Cambridge, Cambridge, UNITED KINGDOM	Ph.D.	04/2005	Cell and Developmental Biology
The Rockefeller University, New York, NY	Postdoctoral	08/2011	Cell and Developmental Biology

A. Personal Statement

How tissues are patterned into complex arrangements that perform specialized functions is a fundamental question in developmental and regenerative biology, and is the central problem my lab seeks to understand. My lab uses the mammalian epidermis to study organ patterning, morphogenesis, regeneration and cancer with an emphasis on how tissue-level polarity, or planar cell polarity, is established and maintained over vast distances across the epidermis. In addition, we investigate how the cell cycle regulates cellular architecture to preserve tissue integrity in a rapidly dividing organ. Our work led to the discovery of a conserved pathway controlling the global pattern of cell polarity across the skin, a novel mechanism by which tissue polarity is maintained during epidermal growth and regeneration, and a new mode of collective cell motility that drives polarized morphogenesis. Live and high-resolution imaging are the major techniques and tools driving our research forward and we have extensive experience in different modes of microscopy. I have a broad background and training in genetics, quantitative cell biology and developmental biology and have extensive research, teaching, and leadership experience.

I have a strong commitment to training and mentoring and I work to promote an inclusive, supportive and ethical research environment. I have trained 15 former and current graduate students (including 4 underrepresented minorities and 11 women), 4 postdocs, and 20 undergraduates since beginning my laboratory in 2011. Two of my postdoctoral trainees recently transitioned to independent tenure-track positions at R1 institutions, and all my former student trainees have gone on to pursue careers in science or medicine. All of my trainees complete ethics and safety training courses that are recorded and updated to promote the safety of all individuals in the lab and to ensure ethical and responsible research practices. I regularly participate in workshops and courses focused on best practices in mentoring so that I can support the career development of my trainees. I have successfully completed the EMBO Laboratory Leadership Course, the Kuggee Vallee Leadership Course for Women in Science, as well as the Faculty Success Program through the National Center for Development and Diversity.

1. Cetera, M., Leybova L, Joyce B and Devenport D. (2018) Counter-rotational cell flows establish morphological and cell fate asymmetries in mammalian hair follicles. *Nature Cell Biology*, 20(5):541-552 PMCID: PMC6065250

2. Box, K., Joyce BW and Devenport D. (2019) Epithelial geometry regulates spindle orientation and progenitor fate during formation of the mammalian epidermis. *Elife*, Jun 12;8 pii: e47102. doi: 10.7554/eLife.47102. PMCID: PMC6592681
3. Stahley SN, Basta LP, Sharan R, Devenport D. (2021) Celsr1 adhesive interactions mediate the asymmetric organization of planar polarity complexes. *Elife*. 2021 Feb 2;10: e62097. doi: 10.7554/eLife.62097. PMCID: PMC7857726.
4. Basta LP, Sil P, Jones RA, Little KA, Hayward-Lara, G and Devenport D. **(**2023**)** Celsr1 and Celsr2 exhibit distinct adhesive interactions and contributions to planar cell polarity. *Frontiers in Cell and Developmental Biology.* Jan 12 2023 Volume 10 – 2022; https://doi.org/10.3389/fcell.2022.1064907

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2021	NJ ACTS Academy of Mentors – TL1 and KL1 preceptor
2020	Board of Directors, Treasurer, Society for Developmental Biology
2020	Standing member - DEV2 study section – NIH
2019	Board of Reviewing Editors – eLife
2019	Editorial Advisory Board Member – Development – Company of Biologists
2019	Ad Hoc Reviewer - DEV2 study section - NIH
2018	Associate Professor. Department of Molecular Biology, Princeton University
2018	Program organizer, Society for Developmental Biology Annual Meeting
2017	Mini-symposium organizer, American Society for Cell Biology Meeting
2016-2019	Board of Directors, Junior Faculty Representative, Society for Developmental Biology
2015-2016	HHMI/National Academies Summer Institute on Undergraduate Education in Biology
2015	Co-organizer, Mid-Atlantic Society for Developmental Biology Conference
2012	Academic Advisor and Fellow, Whitman College, Princeton University
2011-2018	Assistant Professor. Department of Molecular Biology, Princeton University
2007-present	Member, Society for Developmental Biology
2005-2011	Postdoctoral Research Fellow. Laboratory of Mammalian Cell Biology and Development, The
1997-present	Member, American Society for Developmental Biology

Honors

2022	NIH-NIAMS STAR Award
2019	Schmidt Transformative Research Award – Princeton University
2016	James A. Elkins, Jr. '41 Preceptorship in Molecular Biology – Princeton University
2015	Research Scholar Award – American Cancer Society
2014	Molecular Biology Innovation Award- Princeton University
2014	Vallee Foundation Young Investigator Award
2013	Searle Scholars Award
2009	NIH Pathway to Independence Award-K99/R00 (NIAMS)
2005	Ruth L. Kirschstein NRSA Postdoctoral Research Fellowship (NIAMS)
2004	Wellcome Prize Fellowship – The Wellcome Trust
2000	Overseas Research Student (ORS) Award, University of Cambridge
2000	Wellcome Prize PhD Studentship – The Wellcome Trust

C. Contributions to Science

1. As a postdoctoral fellow and continuing as an independent investigator, I established the mammalian skin as a model system for investigating the molecular mechanisms controlling planar cell polarity (PCP). I chose this model system because skin is one of the most strikingly planar polarized tissues in nature, where polarity is organized at different biological scales: the cellular, multicellular, and organ-wide levels. In these publications, I lay the foundation for using mammalian skin to study planar cell polarity in a complex, regenerative, mammalian tissue. First, we describe the molecular and morphogenetic events underlying PCP development in skin and demonstrate that a conserved PCP pathway controls the global orientation of hair follicles. We discovered how embryonic tissue deformation acts as a long-range cue to direct the orientation of epidermal PCP, and discovered how tissue-scale polarity patterns locally emerge and reorganize over developmental time. Most recently,

we use super-resolution microscopy and adhesion assays to demonstrate how lateral, cis-interactions of the PCP cadherin Celsr1 organize the assembly of asymmetric PCP bridges.

a. **Devenport D**, Fuchs E. (2008) Planar Polarization in Embryonic Epidermis Orchestrates Global Asymmetric Morphogenesis of Hair Follicles. Nature Cell Biology 10 (11):1257-68. *PMCID: PMC2607065*
b. Aw WY, Heck B, Joyce B, **Devenport D**. (2016) Transient Tissue-Scale Deformation Coordinates Alignment of Planar Cell Polarity Junctions in the Mammalian Skin. Current Biology. 2016 Aug 22;26(16):2090-100 *PMCID: PMC5005808*
c. Cetera, M., Leybova L, Woo FW, Deans M, and **Devenport D**. (2017) Planar cell polarity-dependent and independent functions in the emergence of tissue-scale hair follicle patterns. Developmental Biology. 428(1):188-203. *PMCID: PMC5549468*
d. Stahley SN, Basta LP, Sharan R, **Devenport D**. (2021) Celsr1 adhesive interactions mediate the asymmetric organization of planar polarity complexes. Elife. 2021 Feb 2;10:e62097. doi: 10.7554/eLife.62097. *PMCID: PMC7857726*.
e. Basta LP, Sil P, Jones RA, Little KA, Hayward-Lara, G and **D. Devenport**. 2023**.** Celsr1 and Celsr2 exhibit distinct adhesive interactions and contributions to planar cell polarity. *Frontiers in Cell and Developmental Biology.* Jan 12 2023 Volume 10 – 2022; https://doi.org/10.3389/fcell.2022.1064907

2. Planar cell polarity is established and maintained during periods of rapid proliferation and turnover in the skin epidermis. We discovered a novel mechanism, mitotic internalization, which regulates PCP during epidermal growth and regeneration. This mechanism effectively erases PCP upon every cell division, which is restored at the completion of cytokinesis. Since this initial discovery, we have shown that entire intercellular PCP complexes are trans-endocytosed into dividing cells and that this process is regulated directly by the cell cycle machinery. Importantly, we show that defects in cell cycle regulation directly impact the maintenance if cell polarity, providing a possible link between loss of cellular architecture and cell cycle control in hyperproliferation and cancer.
    a. **Devenport D**, Oristian D, Heller E, and Fuchs E. (2011) Selective Mitotic Internalization of Planar Cell Polarity Proteins in Proliferative Epidermal Stem Cells. Nature Cell Biology 13(8): 893-904. *PMCID: PMC3149741*
    b. Shrestha R, Little K, Tamayo JV, Li W, Perlman DH and **Devenport D**. (2015) Mitotic Control of Planar Cell Polarity by Polo-like Kinase 1. Developmental Cell. 2015; 33(5):522-34. *PMCID: PMC4464975*
    c. Heck BW and **Devenport D**. (2017) Transendocytosis of planar cell polarity complexes during mitosis. Current Biology*.* 27(23):3725-3733*. PMCID: PMC5728440*
3. One of the biggest breakthroughs for my laboratory was the development of methods to perform long-term, high resolution, live imaging of skin development. For the first time, we imaged the formation, polarization, and growth of embryonic hair follicles over 24 hours of development at cellular resolution. These movies revealed the cellular basis for PCP-dependent polarization of multicellular hair placodes. We demonstrated that placode polarization occurs via extensive rearrangements in a counter-rotating pattern, which reorganizes the placode epithelium from a radial to planar polarized arrangement. These movements establish not only the morphological polarity of the hair follicle but also the planar polarized positioning of cell fates upon which the future follicle is built. Surprisingly, placode polarization mirrors the cell movements that accompany gastrulation in vertebrate embryos, suggesting a deep conservation of morphogenetic mechanisms across tissues and species. Our live imaging method also allowed us for the first time to correlate cell division plane with cell fate in the developing epidermis and thus, to define the mechanism by which cells choose between self-renewing and differentiating divisions during formation of a stratified epithelium. Combining these live imaging techniques with CRISPR/Cas9 mediated genome engineering, we have developed new mouse models that allow live imaging of planar cell polarity proteins *in vivo*.
    a. Cetera, M., Leybova L, Joyce BW and **Devenport D**. (2018) Counter-rotational cell flows establish morphological and cell fate asymmetries in mammalian hair follicles. Nature Cell Biology, 20(5):541-552. *PMCID: PMC6065250*
    b. Box, K., Joyce BW and **Devenport D**. (2019) Epithelial geometry regulates spindle orientation and progenitor fate during formation of the mammalian epidermis. Elife, Jun 12;8 pii: e47102. doi: 10.7554/eLife.47102. *PMCID: PMC6592681*

c. Basta LP, Hill-Oliva M, Paramore SV, Sharan R, Goh A, Biswas A, Cortez M, Little KA, Posfai E, and **D. Devenport**. (2021) New mouse models for high resolution and live imaging of planar cell polarity proteins in vivo. Development. Aug 31: dev.199695. doi: 10.1242/dev.199695. *PMCID: PMC8487645*

4. My early publications investigated the mechanisms by which integrin-mediated adhesion functioned in the assembly, migration, and morphogenesis of muscle, gut, gonad, and appendages. While integrin adhesion to the extracellular matrix had been studied in great detail in cell culture and *in vitro* systems, how adhesion contributed to the development of multicellular tissues was much less understood. My work defined new functions for integrin subunits and their associated proteins in migration of the endoderm, compaction and cell sorting in the gonad, and epithelial adhesion and polarity.
    a. Rogalski TM, Gilbert MM, **Devenport D**, Norman KR, Moerman DG. (2003) DIM-1, a Novel Immunoglobulin Superfamily Protein in Caenorhabditis elegans, Is Necessary for Maintaining Bodywall Muscle Integrity. Genetics 163:905-1. *PMCID: PMC1462474*
    b. **Devenport D** and Brown NH (2004) Morphogenesis in the absence of integrins: mutation of both Drosophila subunits prevents midgut migration. Development 131: 5405-5415. *PMID: 15469969*
    c. **Devenport D**, Bunch TA, Bloor JW, Brower DL and Brown NH (2007) Mutations in the alpha PS2 integrin subunit uncover new features of adhesion site assembly. Developmental Biology 308(2): 294-308. *PMCID: PMC3861690*
    d. Tanentzapf G, **Devenport D**, Godt D, Brown NH (2007) Integrin-dependent anchoring of a stem-cell niche. Nature Cell Biology 9 (12): 1413-1418. *PMCID: PMC3529653*
5. Recent collaborative works. My lab's expertise in skin biology, keratinocyte isolation and culture, and imaging of dynamic cellular processes has led to fruitful collaborations in recent years. Based on the fortuitous discovery that primary keratinocytes generate pulsed ERK signaling dynamics even under basal conditions, we collaborated with Jared Toettcher's lab in their high throughput screen for pharmacological inhibitors of ERK pulsatile dynamics. In collaboration with Daniel Cohen's group in Mechanical and Aerospace Engineering at Princeton, we discovered that primary keratinocytes are highly responsive to electrotactic cues to direct their migration, and found that the level of cell cohesiveness was a primary determinant of their electrotactic tunability.
    a. Goglia AG, Wilson MZ, Jena SG, Silbert J, Basta LP, **Devenport D**, Toettcher JE. (2020) A Live-Cell Screen for Altered Erk Dynamics Reveals Principles of Proliferative Control. Cell Systems. 10(3):240- 253.e6. doi: 10.1016/j.cels.2020.02.005. *PMCID: PMC7540725*.
    b. Shim G, **Devenport D**, Cohen DJ. (2021) Overriding native cell coordination enhances external programming of collective cell migration. Proc Natl Acad Sci U S A. 118(29):e2101352118. doi: 10.1073/pnas.2101352118. *PMCID: PMC8307614*.

A full list of published work can be found using the following URL:
https://www.ncbi.nlm.nih.gov/sites/myncbi/danelle.devenport.1/bibliography/42356004/public/?sort=date&direct