

## BIOGRAPHICAL SKETCH

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NAME <b>Jeffery R. Barrow</b>		POSITION TITLE Associate Professor, Physiology and Developmental Biology	
eRA COMMONS USER NAME JEFFBARROW			
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)			
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
New Mexico State University, Las Cruces, NM	Freshman year	1983-1984	Chemistry
Brigham Young University, Provo, UT	B.S.	1987-1990	Microbiology; minor: Chem.
University of Utah, Salt Lake City, UT	Ph.D.	1990-1999	Human Genetics
Harvard University, Cambridge, MA	Postdoctoral	1999-2003	Mouse molecular genetics

### B. Positions and Honors.

#### Positions and Employment

- 2009-Present Associate Professor, Dept. of Physiology and Developmental Biology, Brigham Young Univ.
- 2003-2009 Assistant Professor, Dept. of Physiology and Developmental Biology, Brigham Young Univ.
- 1999-2003 Postdoctoral Fellow with Dr. Andrew P. McMahon, Department of Molecular and Cellular Biology, Harvard University (*role of Wnt3/ $\beta$ -catenin signaling in primary axis formation and development of the limb of the mouse*).
- 1990-1999 Graduate research with Dr. Mario R. Capecchi, Department of Human Genetics, University of Utah (*role of vertebrate Hox genes in craniofacial and hindbrain development*).

#### Honors, Awards and Other Experience:

- 2026 Invited speaker, Plenary Session of the 2026 Society of Developmental Biology Meeting, Las Vegas, NV. Title: *Robust Genome Modification in the Chicken*
- 2026 Invited Speaker, Plant and Animal Genomes 33, San Diego, CA. Title: *Oasis<sup>lox</sup>: A Transgenic Landing Pad at a Chicken Safe Harbor Locus That Serves as a Robust Gateway to Transgenic Chickens*.
- 2025 Speaker XII Avian Model Systems Meeting. Stowers Institute, Kansas City, MO. Talk Title: *Oasis, DAZL and enhancer swaps: efficient genomic modification in the chicken*.
- 2022 Department of Cell Biology and Physiology Recognition Award
- 2022 Invited Speaker: Experimental Biology, Philadelphia, PA Talk Title: *Reptile to chicken enhancer swaps to understand the molecular basis underlying morphological diversity in the vertebrate lung*.
- 2020 BYU Skaggs Distinguished Mentoring Fellowship
- 2016 Invited Speaker: Southwest Society of Developmental Biology, SLC, UT. Talk title: *Sonic hedgehog regulates anteroposterior patterning of the limb by dictating AP length of the AER*.
- 2015-16 Visiting Scientist University of Georgia, Athens, GA (Oct 2015 to Feb 2016)
- 2015 Visiting Scientist Roslin Institute, University of Edinburgh (June 2015-Sept 2015)
- 2014 College of Life Sciences Outstanding Teaching Award
- 2014 Speaker for Southwest Society of Developmental Biology, Denver, CO. Talk title: *Dynamic recruitment: a model for understanding proximal to distal patterning in the limb*.
- 2013 Ad hoc grant reviewer for National Science Foundation Career Awards
- 2012-2013 Society of Developmental Biology Southwest Regional Meeting Organizing Committee

2012	College of Life Sciences Outstanding Teaching Award
2011-2014	Ferrin L. Orton Teaching and Learning Fellowship
2009	<i>Ad hoc</i> grant reviewer for the NIH CHHD-C Developmental Biology Subcommittee
2007	<i>Ad hoc</i> grant reviewer for the NIH CHHD-C Developmental Biology Subcommittee
2004-Present	Member, Society for Developmental Biology
2004	Speaker for Mouse Molecular Genetics, Cold Spring Harbor, NY. Talk title: <i>Wnt3</i> is required for proper alignment of the anteroposterior axis to the long axis of the mouse egg cylinder.
2003-Present	Member, American Society for Cell Biology
2002	Invited speaker for Keystone Symposium for “ <i>Wnt</i> and $\beta$ - <i>catenin</i> Signaling in Development and Disease.” Taos, NM. Talk title: <i>Wnt</i> / $\beta$ - <i>catenin</i> signaling is required for the establishment and maintenance of the AER.
2001	Speaker for Society for Developmental Biology. 60 <sup>th</sup> Annual Meeting. Seattle, WA. Talk entitled: <i>Wnt3</i> signaling in the limb ectoderm is required for the establishment of the AER.
1999-2002	Recipient of an NIH NRSA postdoctoral fellowship, Harvard University
1995-1998	Recipient of an NIH Developmental Biology Training Grant, University of Utah

### C. Contribution to Science

1. Patterning the segmented vertebrate hindbrain via Hox genes. I demonstrated that that the key defect in *Hoxa1* mutant mice was that rhombomere 4 of the hindbrain was homeotically transformed to take on a rhombomere 3 fate (anteriorization). This was one of the first demonstrations of homeosis in the mouse and that Hox gene loss of function results in anteriorizations in compartments similar to what had been previously observed in *Drosophila*. Thus, there is remarkable conservation between vertebrate and insect Hox genes not only similar in terms of their clustered organization and DNA sequence but also with respect to function. Ref: **Barrow, J.R.**, Stadler, H. S., and Capecchi, M.R. (2000) Roles of *Hoxa1* and *Hoxa2* in patterning the early hindbrain of the mouse. *Development* **127**:933-944. This work has been cited 153 times (1/19/17).
2. Ectodermal Wnts are required for the induction and the maintenance of the apical ectodermal ridge (AER). For over 70 years the AER has been at the forefront of developmental biology seminal work from John Saunders demonstrating its requirement for distal outgrowth and patterning of the vertebrate limb. Our work was the first genetic study demonstrating genetic mechanisms required to induce and maintain the AER. **Barrow, J.R.**, Thomas, K.T., Boussadia-Zahui, O., Moore, R., Kemler, R., Capecchi, M.R., McMahon, A.P. (2003) Ectodermal *Wnt*/ $\beta$ -*catenin* signaling is required for the establishment and maintenance of the AER. *Genes and Development* **17**: 394-409. This paper has been cited 260 times (1/19/17).
3. *Wnt3* signaling is required to reorient the anteroposterior (AP) axis from the short to the long axis of the elliptical egg cylinder. In 2006, two different groups demonstrated that the AP axis is initially induced such that it is parallel with the short axis of the egg cylinder but through morphogenetic processes reorients to align with the long axis. We demonstrated that this process is disrupted in *Wnt3* mutants such that the AP axis remains oriented along the short axis. We further demonstrate through chimeric analysis that *Wnt3* activity in the posterior epiblast is critical for function whereas its activity in the posterior visceral endoderm (PVE) is dispensable. Prior to this published work there was much debate as to whether *Wnt3* activity plays an important role in the PVE. **Barrow, J.R.\***, William D. Howell, Michael Rule, Shigemi Hayashi, Kirk R. Thomas, Mario R. Capecchi, and Andrew P. McMahon (2007) *Wnt3* signaling in the epiblast is required for proper orientation of the anteroposterior axis. *Developmental Biology* **312**:312-320. \*Denotes first and corresponding author. This work has been cited 50 times (01/19/17).
4. Porcupine is required for the secretion of all Wnt molecules. In a collaborative effort with Charles Murtaugh at the University of Utah, we demonstrated that the Porcn gene is required for the secretion of all Wnt molecules. We also demonstrated the utility of this mutant in the ability to remove the source of all Wnts

within a given tissue via conditional removal of *Porcupine*. Barrott J.J, Cash G.M., Smith A.P., **Barrow J.R.**, Murtaugh L.C. (2011) Deletion of mouse *Porcn* blocks Wnt ligand secretion and reveals an ectodermal etiology of human focal dermal hypoplasia/Goltz syndrome. *Proc. Natl. Acad. Sci. U.S.A.* **108**: 12752-12757. This paper has been cited 80 times (1/19/17).

5. Dynamic recruitment is a mechanism to regulate the shape of organs. One of the biggest questions in developmental biology is to determine how genes dictate the morphological form of organs. We have demonstrated that the apical ectodermal ridge (AER) (located at the distal tip of the limb bud) recruits limb mesenchyme cells toward itself. Because the AER regulates directed growth of the mesenchyme, it follows that its shape will in turn play a crucial role in shaping the mesenchyme that it recruits. We have shown that the dimensions of the AER change dramatically over time and correspond to the shapes of the skeletal elements that form along the proximal to distal (PD) axis. The notion that a signaling center of dynamic shape can in turn recruit cells and shape an organ along an axis of outgrowth is novel and provides important mechanistic insights underlying morphogenesis and evolutionary change. Refs: **Barrow, J.R.** (2011) Wnt/planar cell polarity signaling: An important mechanism to coordinate growth and patterning in the limb. *Organogenesis* **7**: 260-266.
1. **Barrow, J.R.** and Capecchi M.R. (1996) Targeted disruption of the *Hoxb-2* locus in mice interferes with expression of *Hoxb-1* and *Hoxb-4*. *Development* **122**:3817-3828.
2. **Barrow, J.R.** and Capecchi, M.R. (1999) Compensatory defects associated with mutations in *Hoxa1* restore normal palatogenesis to *Hoxa2* mutants. *Development* **126**:5011-5026.
3. **Barrow, J.R.**, Stadler, H. S., and Capecchi, M.R. (2000) Roles of *Hoxa1* and *Hoxa2* in patterning the early hindbrain of the mouse. *Development* **127**:933-944.
4. Manley N.R., **Barrow, J.R.**, Zhang, T., and Capecchi, M.R. (2001) *Hoxb2* and *Hoxb4* act together to specify ventral body wall formation. *Developmental Biology* **237**: 130-144).
5. **Barrow, J.R.**, Thomas, K.T., Boussadia-Zahui, O., Moore, R., Kemler, R., Capecchi, M.R., McMahon, A.P. (2003) Ectodermal *Wnt/β-catenin* signaling is required for the establishment and maintenance of the AER. *Genes and Development* **17**: 394-409.
6. Mao, J., **Barrow J.**, McMahon, J., Vaughan, J.E. McMahon, A.P. (2005) An ES cell system for rapid, spatial and temporal analysis of gene function *in vitro* and *in vivo*. *Nucleic Acids Research* **33** e155
7. **Barrow, J.R.** (2006) *Wnt/PCP* signaling: A veritable polar star in establishing patterns of polarity in embryonic tissues. *Seminars in Cell and Developmental Biology*, **17**: 185–193.
8. Thomson D.M., Porter B.B., Tall J.H., Kim H-J., **Barrow J.R.**, Winder W.W. (2007) Skeletal muscle and heart LKB1 deficiency causes decreased voluntary running and reduced muscle mitochondrial marker enzyme expression in mice. *Am J Physiol Endocrinol Metab.* **292**: E196–E202.
9. Thomson D.M., Brown J.D., Fillmore N., Condon B.M., Kim H-J, **Barrow J.R.**, Winder W.W. (2007) LKB1 and the regulation of malonyl-CoA and fatty acid oxidation in muscle. *Am J Physiol Endocrinol Metab.* **293**: E1572–E1579.
10. **Barrow, J.R.**<sup>#</sup>, William D. Howell, Michael Rule, Shigemi Hayashi, Kirk R. Thomas, Mario R. Capecchi, and Andrew P. McMahon (2007) *Wnt3* signaling in the epiblast is required for proper orientation of the anteroposterior axis. *Developmental Biology* **312**:312-320.
11. Thomson D.M., Herway S.T., Fillmore N., Kim H., Brown J.D., **Barrow J.R.**, Winder W.W. (2008) AMP-Activated Protein Kinase Phosphorylates Transcription Factors of the CREB Family. *J Appl Physiol.* **104**: 429–438.
12. **Barrow, J.R.** (2009) Gene targeting. *McGraw Hill 2009 Yearbook of Science & Technology*.
13. Mayo J.L., Holden D.N., **Barrow J.R.**, Bridgewater L.C. (2009) The transcription factor LC-Maf participates in *Col27a1* regulation during chondrocyte maturation. *Exp Cell Res* **315**:2293-300.

Principal Investigator/Program Director (Last, First, MI): Barrow, Jeffery R..

14. Barrott J.J, Cash G.M., Smith A.P., **Barrow J.R.**, Murtaugh L.C. (2011) Deletion of mouse Porcn blocks Wnt ligand secretion and reveals an ectodermal etiology of human focal dermal hypoplasia/Goltz syndrome. *Proc. Natl. Acad. Sci. U.S.A.* **108**: 12752-12757.
15. **Barrow, J.R.** (2011) Wnt/planar cell polarity signaling: An important mechanism to coordinate growth and patterning in the limb. *Organogenesis* **7**: 260-266.
16. Javadi, M., Pitt. W.G., Tracy, C. M. **Barrow, J.R.**, Willardson, B.M., Hartley, J.M., Tsosie, N.H. (2013) Ultrasonic Gene and Drug Delivery using eLiposomes. *J. Controlled Release* **167**: 92-100.
17. Lai, C.W., Kolesnikov, A., Jiang, L., Blake, D., Stewart, J. Chen, C-K., **Barrow, J.R.**, Baehr, W., Kefalov, V., Willardson, BM. (2013) Phosducin-like protein 1 is essential for G protein assembly and signaling in retinal rod photoreceptors. *J of Neurosci* **33**: 7941-7951.
18. Lin, C.Y., Javadi, M., Belnap, D.M., **Barrow, J.R.**, Pitt, W.G. (2013) Ultrasound sensitive eLiposomes containing doxorubicin for drug targeting therapy. *Nanomedicine* **S1549-9634**: 00336-5.
19. Bridgewater, L.C. Mayo, J.L. Evanson, B.G. Whitt, M.E., Dean S.A., Yates, J.D., Holden D.N., Schmidt A.D., Fox, C.L. Dhunghel, S., Steed, K.S., Adam, M.M., Nichols, C.A., Loganathan, S.K., **Barrow, J. R.**, Hancock, C. R. (2013) A Novel Bone Morphogenetic Protein 2 mutant mouse, nBmp2NLS(tm) displays intracellular Ca<sup>2+</sup> Handling in skeletal muscle. *Biomed Res Int* **125492**. doi: 10.1155/2013/125492. Epub 2013 Nov 28.
20. **Barrow, J.R.** (2019) Examining Gene Expression Patterns through Whole Mount In Situ Hybridization. *Developmental Toxicology Methods and Protocols* **1965**:281-295

## **D. Research Support**

### **Ongoing Research Support**

BYU Tech Transfer Grant \$20,000 April 2025

### **Completed Research Support**

BYU Tech Transfer Grant \$20,000 January 2024

BYU Turkey Vaccine Study \$15,000 January 2022

BYU Skaggs Distinguished Mentoring Fellowship \$20,000 April 2020

BYU Turkey Vaccine Study \$10,000 January 2019

BYU Turkey Vaccine Study \$5,000 January 2017

BYU Mentoring Environment Grant (2015) \$10,000. Determining the Role of Sonic Hedgehog Signaling in the Formation of Digits

BYU Mentoring Environment Grant (2014) \$20,000. Determining the Role of Sonic Hedgehog Signaling in the Formation of Digits

BYU Mentoring Environment Grant (2013) \$20,000. The role of Wnt signaling in normal muscle development and disease.

Ferrin L. Orton Teaching and Learning Fellowship 2011-2014; \$20,000. A university award given for outstanding teaching and mentoring.

NIH R15 AREA grant (1R15HD060087-01) *The role of Fgf and Wnt5a signaling in directed outgrowth of the limb mesenchyme* August 2009-August 2012). A grant to study the role of both Fgf and Wnt5a signaling in polarized growth of limb mesenchyme in the embryonic limb. \$75,000 per year.

NIH R03 grant (1R03HD051736-01A1) *The role of cell polarity in vertebrate limb outgrowth.* (July 2006-July 2008). A grant to study the role of cell polarity in limb outgrowth and patterning during embryogenesis. \$50,000 per annum.

Principal Investigator/Program Director (Last, First, MI): **Barrow, Jeffery R..**

**BYU Mentoring Environment Grant (2004-2008). \$20,000 per annum.**