

**BIOGRAPHICAL SKETCH**

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NAME: Olwin, Bradley B

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

POSITION TITLE: Professor, Associate Department Chair

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
University of California, San Diego; La Jolla, CA	BA	1979	Chemistry/Russian Lit
University of Washington; Seattle, WA (Dan Storm, Advisor)	Ph.D.	1984	Pharmacology
University of California San Francisco (Zach Hall Advisor)	Postdoctoral	1984-85	Neuroscience
University of Washington, Seattle, WA (Steve Hauschka, Advisor)	Postdoctoral	1985-88	Cell Biology

**A. Personal Statement**

Our research is focused on the role of skeletal muscle stem cells in maintenance of skeletal muscle homeostasis. We focus on mechanisms that regulate skeletal muscle stem cell function in the niche and intracellular signals involved in cell fate determination. We investigate the changes in stem cells and their niche that occur in skeletal muscle disease and during aging. Our long-term goals are to further understand the regulatory mechanisms that control skeletal muscle stem cell numbers and their function in order to evolve strategies for therapy development to treat skeletal muscle diseases and sarcopenia.

1. Tanaka, K.K., Hall, J.K., Troy, A.A., Cornelison, D.D., Majka, S.M., and **Olwin, B.B.** (2009). Syndecan-4-Expressing Muscle Progenitor Cells in the SP Engraft as Satellite Cells during Muscle Regeneration. *Cell Stem Cell* **4**, 217-225. (featured article for the March Issue).
2. Troy, A., Cadwallader, A.B., Federov, Y. F., Tyner, K., Tanaka, K. K. and **Olwin, B.B.** (2012) Coordination of Satellite Cell Activation and Asymmetric Division by Par Complex-Dependent Activation of p38 $\alpha$ / $\beta$  MAPK Cell Stem Cell. **11**:541-53. doi: 10.1016/j.stem.2012.05.025.(featured article).
3. Bernet, J.D., Doles J.D., Hall, J.K., Kelly-Tanaka, K., Carter, T.A. and **Olwin, B.B.** P38 MAPK Signaling Underlies a Cell-Autonomous Loss of Stem Cell Self-Renewal in Aged Skeletal Muscle (2014) *Nature Medicine* **20**: 265-71. doi:10.1038/nm.3465.
4. Vogler, T.O., Wheeler, J.R., Nguyen, E.D., Hughes, M.P., Britson, K.A., Lester, E., Rao, B., Betta, N.D., Whitney, O.N., Ewachiw, T.E., Gomes, E., Shorter, J., Lloyd, T.E., Eisenberg, D.S., Taylor, J.P., Johnson, A.M., **Olwin, B.B.\***, Parker, R.\*, 2018. TDP-43 and RNA form amyloid-like myo-granules in regenerating muscle. *Nature*. **563**, 508–513. (\*co-corresponding authors).

## **B. Positions and Honors**

### Positions

- 1980-1983 NIH Predoctoral Fellow: Daniel R. Storm, Advisor, Department of Pharmacology, University of Washington, Seattle, WA.
- 1984-1985 Muscular Dystrophy Association Postdoctoral Fellow: Advisor, Zach W. Hall, Division of Neurosciences, Univ. of California, San Francisco, CA.
- 1985-1986 Muscular Dystrophy Association Postdoctoral Fellow: Advisor, Stephen D. Hauschka, Department of Biochemistry, Univ. of Washington, Seattle, WA.
- 1986-1987 American Cancer Society Postdoctoral Fellow: Advisor, Stephen D. Hauschka, Univ. of Washington, Seattle, WA.
- 1988-1993 Assistant Professor, Department of Biochemistry, University of Wisconsin.
- 1993 Associate Professor, Department of Biochemistry, University of Wisconsin.
- 1993 Walther Associate Professor, Department of Biochemistry, Purdue University.
- 1996 Walther Associate Professor, Molecular, Cellular and Developmental Biology, University of Colorado.
- 2000 Professor, Molecular, Cellular and Developmental Biology, University of Colorado.
- 2016 Associate Chair, Molecular, Cellular and Developmental Biology, University of Colorado.

### Honors

- 1984 Achievement Reward for College Scientists, awarded for outstanding graduate research.
- 1988 Shaw Scholar Award.
- 1990 PEW Scholar in the Biomedical Sciences.
- 1991 Pound Research Award, College of Agriculture and Life Sciences, University of Wisconsin-Madison.
- 1991 ISI Most Highly Cited Paper of the Year.
- 1993 Showalter Research Trust Award, Purdue University.
- 1995 Lions Club Cancer Research Award, Lafayette, IN.
- 2003 Co-Chair for 3<sup>rd</sup> International Symposium on Skeletal Muscle Satellite and Stem Cells.
- 2006 Co-Chair and Founder for Gordon Conference on Fibroblast Growth Factors in Development and Disease Gordon Conference.
- 2006 Keynote Speaker at North Texas University Regional Stem Cell Symposium.
- 2008 Keynote Speaker for Satellite Cell Minisymposia on Aging, Experimental Biology, San Diego.
- 2010- Member Skeletal Muscle Editorial Board
- 2010 Member Scientific World Journal Editorial Board
- 2010 Interview finalist for NIH Pioneer Award
- 2012 Ellison Medical Foundation Senior Scholar Award in Aging Research.
- 2015 Glenn Foundation Award for Biomedical Research
- 2016 Aging Cell Editorial Board

### Service

- 1994-1996 NIH Molecular Cytology Study Section (member)
- 1999-2001 NIH CDF-5 Study Section (member)
- 2008-2010 NIH DEV1 Study Section (member)
- 2014-2018 NIH SMEP Study Section Standing Member.
- 2004-2019 Muscular Dystrophy Association Scientific Advisory Board.

## **C. Contributions to Science**

1. My early work directed at identifying the receptor for fibroblast growth factors (FGFs) led to the discovery that heparan sulfate glycosaminoglycan chains were required for the binding of FGFs to the FGF receptor and that heparan sulfate GAG chains were required to transduce FGF signals. These experiments led to the development of an entire field identifying heparan sulfate GAGs as essential information carriers and regulators of signaling for hundreds of growth factors, particularly those that act as morphogens during development. This field rapidly expanded when heparan sulfate biosynthetic enzymes were identified in invertebrate genetic screens mutants in FGF signaling, sonic hedgehog signaling, wnt signaling and TGF $\beta$  signaling. Heparan sulfate proteoglycans function to regulate the bioavailability and signaling of the majority of paracrine signaling growth factors.

- a. **Olwin, B.B.** & Hauschka, S.D. (1986) Identification of the fibroblast growth factor receptor of Swiss 3T3 cells and mouse skeletal muscle myoblasts. *Biochemistry* 25:3487-3492.
  - b. Rapraeger, A.C., Krufka, A. & **Olwin, B.B.** (1991) Requirement of heparan sulfate for bFGF-mediated fibroblast growth and myoblast differentiation. *Science* 252:1705-1708.
  - c. **Olwin, B.B.** & Rapraeger, A.C. (1992) Repression of myogenic differentiation by aFGF, bFGF and K-FGF is dependent on cellular heparan sulfate. *J. Cell Biol.* 118:631-640.
  - d. Cornelison D.D.W., Wilcox-Adelman, S.A., Goetinck, P.F., Rauvala, H., Rapraeger, A.C. & Olwin, B.B. (2004) Syndecan- 3 and Syndecan-4 have unique and essential roles in skeletal muscle growth and regeneration. *Genes and Development* **18**: 2231-2236.
2. Concurrent with the discovery of the heparan sulfate requirement for FGF signaling, I began exploring the role for FGFs in skeletal muscle development, regulation of skeletal muscle stem cells and in the loss of skeletal muscle function during aging. This work continues in my laboratory today and has made a number of contributions, including the demonstration that FGF is required to repress myogenic differentiation, that FGF is involved in the self-renewal of skeletal muscle stem cells and that loss of FGF receptor 1 signaling is in part responsible for the reduction in muscle stem cell function that accompanies normal aging and the loss of skeletal muscle function during aging. We pioneered the use of retroviruses for manipulating protein function *in vivo* and continued with the development of novel transplant procedures to assess stem cell function *in vivo*.
- a. Riley, B., Savage, M., **Olwin, B.B.** & Fallon, J.F. (1993) Retroviral expression of FGF-2 (bFGF) affects patterning in chick limb bud. *Development* **118**:95-104.
  - b. Flanagan-Steet, H.F.; Hannon, K.H., McAvoy, M., Hullinger, R., & **Olwin B.B.** (2000) Loss of FGF Receptor-1 Signaling Reduces Skeletal Muscle Mass and Disrupts Myofiber Organization in the Developing Limb. *Dev. Biol.* **218**: 21-37.
  - c. Hall, J. K. H., Banks, G., Chamberlain, J.S. and Olwin B. B. Prevention of Muscle Aging by Myofiber-Associated Satellite Cell Transplantation. *Science Trans Med* 2:57ra83 (DOI: 10.1126/scitranslmed.3001081; Featured Article and Cover).
  - d. Bernet, J.D., Doles J.D., Hall, J.K., Kelly-Tanaka, K., Carter, T.A. and **Olwin, B.B.** P38 MAPK Signaling Underlies a Cell-Autonomous Loss of Stem Cell Self-Renewal in Aged Skeletal Muscle (2014) *Nature Medicine* 20, 265-71. doi:10.1038/nm.3465.
3. Accompanying my efforts directed at understanding the role(s) for FGFs in skeletal muscle development, regeneration and aging, I began examining the downstream signaling pathways responsible for mediating these effects. I eventually found that the p38 MAPK family plays essential roles in self-renewal and maintenance of adult skeletal muscle stem cells. The p38 $\alpha/\beta$  MAPK is required for adult muscle stem cell activation and asymmetric activation of p38 $\alpha/\beta$  MAPK during cell division promotes distinct daughter cell fates, resulting in one self-renewed stem cell and one committed transit amplifying cell that expresses MyoD called a myoblast. The asymmetric activation of p38 $\alpha/\beta$  MAPK is disrupted in aged mice and contributes to the loss of adult stem cells and loss of muscle function during aging, identifying the p38 MAPK family as a critical regulator of adult muscle stem cell function. In my most recent publication, we identified a novel post-transcriptional regulatory mechanism as a target of p38 $\alpha/\beta$  MAPK in skeletal muscle stem cells. In the adult, quiescent stem cell the p38 MAPK pathway is inactive and an RNA binding protein, Tristetraprolin binds MyoD mRNA and promotes MyoD mRNA decay. Upon muscle injury, p38 $\alpha/\beta$  MAPK is activated, Tristetraprolin is phosphorylated and inactivated, promoting accumulation of MyoD mRNA, which transactivates its own transcription resulting in a feed forward loop committing the cell to a myoblast fate. I believe this will apply to many adult stem cells as it permits a rapid and precise response to tissue injury.
- a. Troy, A., Cadwallader, A.B., Fedorov, Y. F., Tyner, K., Tanaka, K. K. and **Olwin, B.B.** (2012) Coordination of Satellite Cell Activation and Asymmetric Division by Par Complex-Dependent Activation of p38 $\alpha/\beta$  MAPK Cell Stem Cell. **11**:541-53. doi: 10.1016/j.stem.2012.05.025.
  - b. Bernet, J.D., Doles J.D., Hall, J.K., Kelly-Tanaka, K., Carter, T.A. and **Olwin, B.B.** P38 MAPK Signaling Underlies a Cell-Autonomous Loss of Stem Cell Self-Renewal in Aged Skeletal Muscle (2014) *Nature Medicine* 20, 265-71. doi:10.1038/nm.3465.
  - c. Hausburg, M. A., Doles, J.D. Clement, S.L., Cadwallader, A.B., Hall, M.N., Blackshear, P.J., Lykke-Andersen, J., and **Olwin, B.B.** Post-transcriptional regulation of satellite cell quiescence by TTP-mediated mRNA decay (*eLife* 2015;10.7554/eLife.03390).
  - d. Tanaka, K.K., Hall, J.K., Troy, A.A., Cornelison, D.D., Majka, S.M., and **Olwin, B.B.** (2009). Syndecan-4-Expressing Muscle Progenitor Cells in the SP Engraft as Satellite Cells during Muscle Regeneration. *Cell Stem Cell* 4, 217-225. (featured article for the March Issue).

4. My efforts at understanding muscle stem cell function lead to broader questions exploring how stem cells function to maintain skeletal muscle and how skeletal muscle stem cell function is affected during aging and diseases. These inquiries have led to two distinct research thrusts. The first is aimed at delineating the behavior of muscle stem cells directly *in vivo* using new single cell technologies and advances in mouse molecular genetics. The second is aimed at how skeletal muscle is rebuilt following an injury and the changes in muscle and the surrounding environment that go awry during aging and in progressive neuromuscular diseases.
  - a. Pawlikowski, B., Pulliam, C., Betta, N.D., Kardon, G. & **Olwin, B.B.** Pervasive satellite cell contribution to uninjured adult muscle fibers. *Skeletal Muscle* **5**, 1–13 (2015).
  - b. Vogler, T.O., Wheeler, J.R., Nguyen, E.D., Hughes, M.P., Britson, K.A., Lester, E., Rao, B., Betta, N.D., Whitney, O.N., Ewachiw, T.E., Gomes, E., Shorter, J., Lloyd, T.E., Eisenberg, D.S., Taylor, J.P., Johnson, A.M., **Olwin, B.B.\***, Parker, R.\*, 2018. TDP-43 and RNA form amyloid-like myo-granules in regenerating muscle. *Nature*. *563*, 508–513. (\*co-corresponding authors)

<http://www.ncbi.nlm.nih.gov/sites/myncbi/bradley.olwin.1/bibliography/41825435/public/?sort=date&direction=ascending>

#### **D. Additional Information: Research Support and/or Scholastic Performance**

##### **Current Support**

NIH R01 AR049446

7/1/16-6/30/21

*Mechanisms regulating muscle stem cell homeostasis.*

The goals of this project focus on elucidating cell-cell interactions maintaining skeletal muscle stem cells.

Role: PI

NIH R01 AR070360

9/1/17-8/31/22

*Replicative Potential of Muscle Stem Cells*

The goals of this grant are to assess the role of FGF signaling in skeletal muscle stem cell self-renewal and asymmetric division.

Role PI

ALSAM Foundation

Role co-PI (Mallela, CU Anschutz co-PI)

03/01/17-02/28/20

*Protein structure-function based engineering of mini-dystrophins and mini-utrophins to treat muscular dystrophy*

The goals are to assess the efficacy of engineered proteins to ameliorate muscular dystrophy.

ALSAM Foundation

Role PI (Reisdorph CU Anschutz collaborator)

01/01/20-12/31/22

*Identifying mechanisms responsible for FGF receptor-dependent rescue of aged muscle.*

The goals are to identify the mechanisms involved in rescue of aged muscle by single cell RNA-sequencing and targeted proteomics.

Muscular Dystrophy Association

07/01/20-6/30/23

*Regulation of TDP-43 Aggregates in Normal and Diseased Skeletal Muscle*

The goals are to determine differences in TDP-43-containing aggregates in normal and diseased muscle and examine what differences are responsible for disease phenotypes.

##### **Pending Support**

*Chemically Defined Hydrogels to Study the Influence of Microenvironment on Muscle Stem Cell Behavior with Aging.*

Our goals for this project focus on understanding how age-induced changes in mechanical properties influence skeletal muscle maintenance and regeneration.

Role: co-PI with Kristi Anseth, Professor, Department of Chemical and Biological Engineering, CU-Boulder

**Past Support**

NIH R01 AR049446

4/1/11-3/31/16.

*Role of Syndecans in Satellite Cell Function.*

The goals of this project are to investigate the role of Syndecans in satellite cell self-renewal and muscle regeneration.

Role: PI

NIH AR049446S1

4/1/14-3/31/16

*Role of Syndecans in Satellite Cell Function (Diversity Supplement).*

Role: PI

NIH R01 AG040074

7/01/11-6/30/2016

*Age-Dependent Regulation of Muscle Stem Cell Homeostasis.*

The goals of this project are to lineage trace skeletal muscle stem cells and their myonuclear progeny by developing a novel, viral-based cellular barcoding delivery system and analysis by next generation sequencing.

Role: PI

Ellison Medical Foundation Senior Scholar in Aging Research Award

12/1/12-11/30/16

*Reprogramming Muscle Stem Cells to Resist Aging.*

In this proposal, we plan to examine the transplant environment perform lineage tracing on transplanted muscle stem cells in aged mice.

Role: PI

Linda Crnic Foundation Grand Challenge Award

4/1/2015-12/31/2016

*Mechanisms of Muscle Dysfunction in Down Syndrome*

The goals of this project are to determine if defects in skeletal muscle stem cells are responsible for deficiencies in skeletal muscle maintenance and regeneration in a mouse model of trisomy 21.

Role: PI

Glenn Foundation for Medical Research

12/01/15-11/30/17

Unsolicited Award for Aging-Related Research

Role PI

Muscular Dystrophy Association

02/01/16-01/31/19

*Enhancing Regeneration to Improve Dystrophic Muscle*

Our goals are to determine the efficacy of inhibiting Syndecan-3 expression to improve stem cell-mediated regeneration of dystrophic skeletal muscle

Role PI