



Name: Samantha Weaver

Email: srweaver@wisc.edu

Major Professor: Dr. Laura Hernandez

Degree Objective: Ph.D. Endocrinology and Reproductive Physiology

Background: B.S. Spanish University of Wisconsin-Madison

Current Research Project:

Lactation is a period of heavy energy and calcium demands in all mammals, requiring significant adaptations by the mammary gland that are regulated in large part by the monoamine serotonin (5-hydroxytryptamine; 5-HT). Our lab has demonstrated that 5-HT regulates parathyroid hormone related protein (PTHrP) production by differential methylation of transcriptional start sites within the sonic hedgehog gene. This PTHrP produced from the mammary gland acts at the site of the bone to regulate demineralization and, therefore, calcium homeostasis. Animals such as the dairy cow that have been bred to produce large quantities of milk often cannot meet the calcium requirements of the mammary gland and therefore are predisposed to hypocalcemia, a condition that causes major losses at production and animal welfare levels. Conversely, women who are breastfeeding mobilize significant amounts of bone to meet calcium demands. When these women are concurrently taking the commonly-prescribed class of antidepressants known as selective serotonin reuptake inhibitors (SSRIs), which maintain elevated circulating 5-HT levels and cause bone mineral loss, they may be predisposed to bone-related diseases later in life. My project focuses on looking at the molecular and physiological mechanisms regulated by 5-HT that control calcium homeostasis during lactation. More specifically, I am investigating calcium mobilization from bone that is driven by 5-HT during lactation. Currently, my trials are aimed at understanding the effects of SSRI administration during pregnancy and lactation on bone-breaking strength and bone mineral density in a mouse model.

Honors:

Recipient of the 2016 National Science Foundation Graduate Research Fellowship. One out of 29 students selected to represent UW-Madison, and one of the 2,000 out of 17,000 applicants nationally. Featured on the CALS website: <http://dysci.wisc.edu/2016/06/02/uw-madison-dairy-science-graduate-student-awarded-prestigious-national-science-foundation-award/>

Abstract "Use of Selective Serotonin Reuptake Inhibitors promotes bone resorption during lactation" presented at ENDO 2016 selected for oral presentation and press coverage.

Work presented in "Use of Selective Serotonin Reuptake Inhibitors promotes bone resorption during lactation" selected for coverage in the Endocrine News magazine: "The Long and Short of It: The



Odyssey of Female Bone Health” in the September 2016 issue.
<http://endocrinenews.endocrine.org/the-long-and-short-of-it-the-odyssey-of-female-bone-health/>

Peer-reviewed article “Elevation of circulating serotonin improves calcium dynamics in the dairy cow transition period” (2016) featured by the *Journal of Endocrinology* in a press release titled “Happy Cows Make More Nutritious Milk”, which was widely reproduced in the media. Several selected reproductions are listed below:

- Quartz: “Scientists injected cows with “happy hormones” and got healthier milk.”
<http://qz.com/734830/scientists-injected-cows-with-happy-hormones-and-got-healthier-milk/>
- Wisconsin Public Radio: “Wisconsin Study Finds Serotonin Can Increase Calcium in Cow’s Milk.” <http://www.wpr.org/wisconsin-study-finds-serotonin-can-increase-calcium-cows-milk>
- Phys.org and Department of Dairy Science, UW-Madison: “Happy cows make more nutritious milk.”<http://phys.org/news/2016-07-happy-cows-nutritious.html>;
<http://dysci.wisc.edu/2016/07/15/happy-cows-make-more-nutritious-milk/>
- Food & Wine: “Happy Cows Really Do Make Better Milk.”
<http://www.foodandwine.com/blogs/happy-cows-make-more-nutritious-milk-study-says>

Featured in the 2016 Graduate Student Recruiting Brochure, *Faces of the Future: Graduate Studies in Dairy Science at the University of Wisconsin*

Second place in the Ph.D. Poster Competition at the Joint Annual Meeting of the American Dairy Science Association in Salt Lake City in July 2016

Recipient of the 2015 College of Agricultural and Life Sciences W.D. Hoard Memorial Graduate Scholarship

Recipient of the 2015 ERP Student Graduate Student Research Award

Poster Session Winner in the 2015 ERP Research Symposium

Publications:

Weaver, S.R., N.L. Jury, K.A. Gregerson, N.D. Horseman, L.L. Hernandez. Characterization of mammary-specific deletions for *Tph1* and *Lrp5* during murine lactation. PLoS One. Under Review.

Weaver, S.R., A.S. Prichard, A.P. Prichard, E.L. Endres, L.E. Hernandez-Castellano, M.S. Akins, R.M. Bruckmaier, L.L. Hernandez. 2016. Pre-partum infusions of serotonin alter the metabolic adaptation to lactation in the post-partum dairy cow. Am. J. Physiol. Regul. Integr. Comp. Physiol. Under Review.

Carvalho, P.D., C.C. Consentini, **S.R. Weaver**, R.V. Barleta, L.L. Hernandez, P.M. Fricke. 2016. Temporarily decreasing progesterone after timed artificial insemination decreased expression of



ISG15 in blood leukocytes, serum PSPB concentrations and fetal size in lactating Holstein cows. J. Dairy Sci. Accepted, in press.

Hernandez-Castellano, L.E., **S.R. Weaver**, L.L. Hernandez, R.M. Bruckmaier. 2016. Increased serum serotonin improves periparturient calcium homeostasis in dairy cows. J. Dairy Sci. Epub ahead of print. pii: S0022-0302(16)30877-3. doi: 10.3168/jds.2016-11638.

Weaver, S.R., J.C. Bohrer, A.S. Prichard, P.K. Perez, L.J. Streckenbach, J.M. Olson, M.E. Cook, L.L. Hernandez. 2016. Serotonin deficiency rescues lactation on day 1 in mice fed a high fat diet. PLoS One 11: e0162432.

Weaver, S.R., A.P. Prichard, E.L. Endres, S.A. Newhouse, T.L. Peters, P.M. Crump, M.S. Akins, T.D. Crenshaw, R.M. Bruckmaier, L.L. Hernandez. 2016. Elevation of circulating serotonin improves calcium dynamics in the dairy cow transition period. J. Endocrinology 230: 105-123. *Paper selected for special coverage by the Journal of Endocrinology (see Honors).*

Weaver, S.R., J. Laporta, S.A.E. Moore, L.L. Hernandez. 2015. Review: Serotonin and calcium homeostasis during the transition period. Domest. Anim. Endocrinol. 56 Suppl: S147-154.

Weaver, S.R. and L.L. Hernandez. 2015. Review: Autocrine-paracrine regulation of the mammary gland. J. Dairy Sci. 99: 842-853.

Weaver, S.R., C.M. Cronick, A.P. Prichard, J. Laporta, N.J. Benevenga, L.L. Hernandez. 2016. Use of the RatLoft decreases pup mortality in lactating mice. Lab Anim. 50:370-378.

Laporta, J., S.A.E. Moore, **S.R. Weaver**, C.M. Cronick, M.L. Olsen, A.P. Prichard, B.P. Schnell, T.D. Crenshaw, F. Peñagaricano, R.M. Bruckmaier, L.L. Hernandez. 2015. Increasing serotonin concentrations alters calcium and energy metabolism in dairy cows. J. Endocrinol. 226:43-55.

Laporta, J., K. Keil, **S.R. Weaver**, C. Cronick, A.P. Prichard, T.D. Crenshaw, G. Heyne, C.M. Vezina, R.J. Lipinski, and L.L. Hernandez. 2014. Serotonin regulates calcium homeostasis in lactation by epigenetic activation of Hedgehog signaling. Mol. Endocrinol. 28(11):1866-1874. PMID: 25192038

Laporta, J., T.L. Peters, **S.R. Weaver**, K.E. Merriman and L.L. Hernandez. 2013. Feeding 5-hydroxy-L-tryptophan during the transition from pregnancy to lactation increases calcium mobilization from bone in rats. Dom. Anim. Endocrinol. 44(4):176-184. PMID: 23733710

National Presentations:

Oral: L.L. Hernandez. A novel method to prevent hypocalcemia: Can we improve cow longevity and health in the herd? European Association for Animal Production Meeting of the European Federation of Animal Science, Belfast, Ireland. **S.R. Weaver** presented on behalf of Dr. Hernandez.

Poster: Prichard, A.P., **S.R. Weaver**, E.L. Endres, M.S. Akins, R.M. Bruckmaier, L.L. Hernandez. Infusion of a serotonin precursor pre-partum induces dynamic glucose and fat metabolism gene expression in the livers of multiparous transition period dairy cows. American Dairy Science Association Joint Annual Meeting, Salt Lake City, UT.



Poster: **Weaver, S.R.**, A.P. Prichard, E.L. Endres, M.S. Akins, R.M. Bruckmaier, L.L. Hernandez (2016). Elevation of circulating serotonin pre-partum decreases BHBA concentrations and improves energy status post-partum in multiparous dairy cows. American Dairy Science Association Joint Annual Meeting, Salt Lake City, UT.

Poster: **Weaver, S.R.**, L.L. Hernandez, S. Tao, J. Laporta (2016). Intravenous infusion of 5-hydroxy-L-tryptophan, a serotonin precursor, to transition dairy cows pre-calving affects GH-IGF axis gene expression in the mammary gland and liver post-calving. American Dairy Science Association Joint Annual Meeting, Salt Lake City, UT.

Oral: Carvalho, P.D., C.C. Consentini, **S.R. Weaver**, R.V. Barleta, L.L. Hernandez, P.M. Fricke (2016). Decreasing progesterone after timed artificial insemination decreases ISG15, PSPB, and embryo size in lactating Holstein cows. American Dairy Science Association Joint Annual Meeting, Salt Lake City, UT.

Poster: Bohrer, J., **S.R. Weaver**, A. Prichard, J. Olson, M.E. Cook, L.L. Hernandez (2016). Lack of peripheral serotonin protects against delayed stage II lactogenesis during high-fat diet feeding. Endocrine Society Meeting, Boston, MA.

Oral: **Weaver, S.R.**, L.L. Hernandez, C.M. Vezina (2016). Use of Selective Serotonin Reuptake Inhibitors promotes bone resorption during lactation. Endocrine Society Meeting, Boston, MA. *Abstract featured in a press conference and later in Endocrine News (see Honors).*

Poster: **Weaver S.R.**, A.P. Prichard, E.L. Endres, S.A. Newhouse, M.S. Akins, P.M. Crump, R.M. Bruckmaier, L.L. Hernandez (2015). Metabolite dynamics during infusion of 5-hydroxytryptophan to multiparous dairy cows. International Congress for Farm Animal Endocrinology, Billund, Denmark.

Oral: **Weaver, S.R.**, A.P. Prichard, E.L. Endres, S.A. Newhouse, R.M. Bruckmaier, M.S. Akins, L.L. Hernandez (2015). Infusion of 5-hydroxytryptophan increases serum calcium and mammary gland calcium pump activity during the transition period. American Dairy Science Association Joint Annual Meeting, Orlando, FL.

Oral: **Weaver, S.R.**, C.M. Cronick, A.P. Prichard, J. Laporta, N.J. Benevenga, and L.L. Hernandez (2014). "Use of the RatLoft in laboratory conditions decreases pup mortality in lactating mice". American Dairy Science Association Joint Annual Meeting, Kansas City, MO.

Oral: Laporta, J., S.A.E. Moore, **S.R. Weaver**, and L.L. Hernandez (2014). Full paper: Serotonin (5-HT) and calcium homeostasis during the transition period. Proceedings of the Southwest nutrition and management conference (SWNC), Phoenix, AZ.

Poster: Laporta, J., **S.R. Weaver**, C.M. Cronick, K.P. Keil, C.M. Vezina, and L.L. Hernandez (2014). Serotonin regulation of parathyroid hormone-related protein (PTHrP) and calcium homeostasis in the mammary gland involves the sonic hedgehog pathway. Gordon Research Conference: Molecular and Cellular Basis of Breast Development and Cancer Progression, Lucca, Italy.

Other Presentations:



Poster: **Weaver S.R.**, C.M. Vezina, and L.L. Hernandez (2016). Use of Selective Serotonin Reuptake Inhibitors promotes bone resorption during lactation. Endocrinology & Reproductive Physiology Symposium June 16, 2016.

Oral: **Weaver S.R.**, J. Bohrer, and L.L. Hernandez (2016). High fat diet-induced involution is mediated by serotonin in lactating mice. Developmental Endocrinology Seminar Feb 2, 2016.

Oral: **Weaver S.R.**, A.P. Prichard, E.L. Endres, S.A. Newhouse, T.L. Peters, P.M. Crump, M.S. Akins, T.D. Crenshaw, R.M. Bruckmaier, and L.L. Hernandez (2016). Elevation of circulating serotonin improves calcium dynamics in the dairy cow transition period. Endocrinology & Reproductive Physiology Seminar Jan 28, 2016.

Oral: **Weaver S.R.**, A.P. Prichard, E.L. Endres, S.A. Newhouse, M.S. Akins, T.D. Crenshaw, R.M. Bruckmaier, and L.L. Hernandez (2015). Serotonin and calcium dynamics during the transition period. Developmental Endocrinology Seminar Nov 3, 2015.

Poster: **Weaver S.R.**, A.P. Prichard, E.L. Endres, S.A. Newhouse, M.S. Akins, P.M. Crump, R.M. Bruckmaier, and L.L. Hernandez (2015). Metabolite dynamics during infusion of 5-hydroxytryptophan to multiparous dairy cows. Endocrinology & Reproductive Physiology Symposium, Abstract p. 29.

Oral: **Weaver S.R.** and L.L. Hernandez (2015). Serotonin and calcium homeostasis: Implications on bovine and human health during lactation. PLATO Frontiers in Life Sciences Sep 23, 2015.

Oral: **Weaver S.R.** and L.L. Hernandez (2015). Infusion of 5-hydroxytryptophan increases serum calcium and mammary gland calcium pump activity during the transition period. Developmental Endocrinology Seminar April 28, 2015.

Oral: **Weaver S.R.** and L.L. Hernandez (2014). Serotonin during the transition period in dairy cows. Developmental Endocrinology Seminar Nov 18, 2014.

Teaching and Mentorship:

Expanding Your Horizons, Summer 2015 and 2016. Conference for girls in grades 6 to 8 to learn about careers in science, technology, engineering, and math.

Badger Dairy Camp, Summer 2015 and 2016. Perform udder dissections and educational sessions with participants between the ages of 12 to 18 interested in graduate work in dairy science.

Wednesday Nite @ the Lab, Spring 2016. Series put on by the Wisconsin Alumni Association: Udder Anatomy and Physiology, Spring 2016. (http://www.biotech.wisc.edu/webcams?lecture=20160608_1900).

Family Science Night, Spring 2016. Local educational night for elementary-aged children and their families to explain how cows make milk.

Cows at the Concourse, Summer 2015. Supports the Madison area dairy industry and provides information to the public on dairy health.



Lactation Physiology Course, Fall 2015. Teaching assistant of the laboratory portion of the course and presented selected lectures.

Graduate mentor for Ryan Brown, Integrated Biological Sciences Summer Research Program, Summer 2016. Project entitled: Selective Serotonin Reuptake Inhibitors (SSRI) and folic acid interact in the mammary gland to regulate calcium homeostasis during lactation.

Graduate mentor for Shannon Palmer, Biology 152, Fall 2015. Project entitled: Mice on high fat diets with serotonin-deficient backgrounds have higher expression of fat synthesis genes in the mammary gland.

Graduate mentor for Megan Lauber, Biology 152, Fall 2015. Project entitled: Infusion of a serotonin precursor induces changes in hepatic gene expression during the transition period in Holstein dairy cows.

Graduate mentor for Zabdiel Alvarado, Integrated Biological Sciences Summer Research Program, Summer 2015. Project entitled: 5-hydroxytryptophan infusion in dairy cows will induce change in milk calcium levels, and mammary gland alveoli size and number.

Graduate mentor for Noah Maerz, Biology 152, Fall 2014. Project entitled: Administration of 5-HTP in the prevention of hypocalcemia in dairy cows.

ERP Service:

Member of the ERP Student Steering Committee, Fall 2016.