

## CURRICULUM VITAE

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### **Education**

2004 - Present Ph.D. Candidate, Department of Biochemistry and Molecular Biology, University of New Hampshire, Durham, N.H.  
2004 M.S. Department of Biochemistry and Molecular Biology, University of New Hampshire, Durham, N.H.  
2001 B.S. Biology (major), Chemistry (minor), Plymouth State College, Plymouth, N.H.

### **Professional Experience**

2003 Adjunct Faculty Appointment, Department of Biochemistry and Molecular Biology, University of New Hampshire, Durham, N.H. Instructor for Biochemistry 659.  
2000-2002 Teaching Assistant, Department of Biochemistry and Molecular Biology, University of New Hampshire, Durham, N.H.  
General Biology Laboratory (BIO 411)  
General Biology Laboratory (BIO 412)  
Biochemistry Laboratory (BCHM 659)  
Ocean Technology (TECH 797)  
2000 Teaching Assistant, Department of Natural Science, General Biology, Plymouth State College, Plymouth, N.H.  
1999-2000 Teaching Assistant, Department of Natural Science, Anatomy and Physiology, Plymouth State College, Plymouth, N.H.  
1997-1998 Tutor, Plymouth Academic Support Services (PASS), Anatomy and Physiology, Vertebrate Zoology, Biology, Plymouth State College, Plymouth, N.H.

1991-1998 Franconia Inn, Franconia New Hampshire, Chef  
Developed all recipes and seasonal menu. Hired and trained all kitchen staff members. Established all vendors for meat, seafood, produce, dairy and groceries. Established work safety guidelines and enforced all health codes. Controlled and managed food and labor costs.

### **Professional and Community Service**

2002 Invited speaker, Plymouth State College, Plymouth, New Hampshire, Isolation and characterization of Gonadotropin Releasing Hormone from the Atlantic hagfish (*Myxine glutinosa*).

2002 Invited research assistant, University of Washington, Seattle, Washington. Friday Harbor Laboratories, San Juan Island, Effects of Immersion in Gonadotropin Releasing Hormone on Social Spawning in Several Vertebrate Taxa.

2001-2002 Graduate Student Organization representative for Department of Biochemistry and Molecular Biology, University of New Hampshire, Durham, N.H.

### **Professional Societies**

Society for Integrative and Comparative Biology (SICB)  
American Association for the Advancement of Science (AAAS)  
The Society for Neuroscience (SfN)

### **Professional Honors**

1999 Awarded Plymouth State College Anatomy and Physiology Undergraduate Fellowship for teaching assistant (\$1000).

### **Publications**

Sower SA, Freamat M, **Scott I. Kavanaugh** 2008 The origins of the vertebrate hypothalamic-pituitary-gonadal (HPG) & hypothalamic-pituitary-thyroid (HPT) endocrine systems. Gen Comp Endocrinol (In Press)

**Kavanaugh SI**, Nozaki M, Sower SA 2008 Origins of gonadotropin-releasing hormone (GnRH) in vertebrates: identification of a novel GnRH in a Basal vertebrate, the sea lamprey. Endocrinology 149:3860-3869

Ngernsoungnern P, Ngernsoungnern A, **Kavanaugh S**, Sobhon P, Sower SA, Sretarugsa P 2008 The presence and distribution of gonadotropin-releasing hormone-like factor in the central nervous system of the black tiger shrimp, *Penaeus monodon*. Gen Comp Endocrinol 155:613-622

Ngernsoungnern A, Ngernsoungnern P, **Kavanaugh S**, Sower SA, Sobhon P, Sretarugsa P 2008 The identification and distribution of gonadotropin-releasing hormone-like peptides in the central nervous system and ovary of the giant freshwater prawn, *Macrobrachium rosenbergii*. Invert Neurosci 8:49-57

Powell ML, **Kavanaugh S**, Sower SA 2006 Identification of a functional corpus luteum in the Atlantic hagfish, *Myxine glutinosa*. Gen Comp Endocrinol 148:95-101

Powell ML, **Kavanaugh SI**, Sower SA 2005 Current Knowledge of Hagfish Reproduction: Implications for Fisheries Management. Integr. Comp. Biol. 45: 158-165

**Kavanaugh SI**, Root AR, Sower SA 2005 Distribution of gonadotropin-releasing hormone (GnRH) by in situ hybridization in the tunicate *Ciona intestinalis*. Gen Comp Endocrinol 141:76-83

**Kavanaugh SI**, Powell ML, Sower SA 2005 Seasonal changes of gonadotropin-releasing hormone in the Atlantic hagfish *Myxine glutinosa*. Gen Comp Endocrinol 140:136-143

Root AR, Sanford JD, **Kavanaugh SI**, Sower SA 2004 In vitro and in vivo effects of GABA, muscimol, and bicuculline on lamprey GnRH concentration in the brain of the sea lamprey (*Petromyzon marinus*). Comp Biochem Physiol A Mol Integr Physiol 138:493-501

Powell ML, **Kavanaugh SI**, Sower SA 2004 Seasonal concentrations of reproductive steroids in the gonads of the Atlantic hagfish, *Myxine glutinosa*. J Exp Zool A Comp Exp Biol 301:352-360

Gorbman A, Whiteley A, **Kavanaugh S** 2003 Pheromonal stimulation of spawning release of gametes by gonadotropin releasing hormone in the chiton, *Mopalia* sp. Gen Comp Endocrinol 131:62-65

## **Chapter**

Sower, S.A., M.L. Powell and **S.I. Kavanaugh**. "Myziniiformes" IN: Grzimek's Animal Life Encyclopedia, 2nd Edition. Volumes 4-5, Fishes I-II, edited by Michael Hutchins, Dennis A. Thoney, Paul V. Loiselle, and Neil Schlager. Farmington Hills, MI: Gale Group, 2003. Vol. 1 77-82.

## Cover

General and Comparative Endocrinol. January 15;140(2):136-143, 2005. "Hagfish gonadal development. The developmental stages and description of the gonad in *Myxine glutinosa* (Atlantic hagfish).

## Published Abstracts

Sower, S.A., **Kavanaugh, S.I.**, M. Nozaki. 2008. Origins of GnRH in vertebrates: Identification of a novel GnRH in a basal vertebrate, the sea lamprey. 8<sup>th</sup> international congress of the Biology of Fishes.

Kosugi, T., Freamat, M., **Kavanaugh, S.I.**, S.A. Sower. 2008. Role of histidine residue 151 in the third transmembrane domain of an ancestral gonadotropin-releasing hormone receptor from the sea lamprey, *Petromyzon marinus*. 8<sup>th</sup> international congress of the Biology of Fishes.

Sower, S.A., Freamat, M., **S.I. Kavanaugh**. 2008 Insight from Lamprey Genomics: The origins of the GnRH-II family and hypothalamic-pituitary-gonadal (HPG) & hypothalamic-pituitary-thyroid (HPT) endocrine systems. Advances in Cyclostome Research Meeting.

**Kavanaugh S.I.**, S.A. Sower. 2007. Isolation of a cDNA encoding a third form of Gonadotropin-Releasing Hormone from the Sea Lamprey *Petromyzon marinus*. Integr. Comp. Biol.

Sower, S.A., **Kavanaugh, S.I.**, Santos, M., Rogers, Z., Schultz, B.M., Bushold, G., Wells, R., R. Gyurik. 2007. Transnasal Delivery of a GnRH Analog in Yucatan Miniature Swine. Integr. Comp. Biol.

**Kavanaugh, S.I.**, S.A. Sower. 2007. Isolation of a cDNA encoding a third form of Gonadotropin-Releasing Hormone (GnRH) from the Sea Lamprey. American fisheries society.

**Kavanaugh, S.I.**, S.A. Sower. 2006. Characterization of Gonadotropin-Releasing Hormone (GnRH) in the Atlantic hagfish *Myxine glutinosa*. Integr. Comp. Biol. 45:(6) 1152.

**Kavanaugh, S.I.**, Gorbman, A., Sower, S.A. 2004. The distribution of gonadotropin releasing hormone in the urochordate *Ciona intestinalis*. Integr. Comp. Biol.

Powell, M.L., **S.I. Kavanaugh**, and S.A. Sower. 2003. Reproductive hormone concentrations in the Atlantic hagfish *Myxine glutinosa*. Integr. Comp. Biol. 43:814.

**Kavanaugh, S.I.**, A. Gorbman, and S.A. Sower. 2003. The distribution of gonadotropin releasing hormone in the urochordate *Ciona intestinalis*. Integr. Comp. Biol. 43:883.

Powell, M.L., **S.I. Kavanaugh**, S.A. Sower. 2002. Seasonal gonadal development in the Atlantic hagfish, *M. glutinosa*. Integr. Comp. Biol. 42 (6), 1297.

**Kavanaugh, S.I.**, M.L. Powell, J.E. Davis, S.A. Sower. 2001. Sexuality and embryogenesis of the Atlantic Hagfish, *Myxine glutinosa*. Amer. Zool. 41 (6), 1490-1491.

### **Abstracts of Poster and Oral Presentations at National and International Meetings**

**S. Kavanaugh** and S. A. Sower. 2006. Characterization of gonadotropin-releasing hormone (GnRH) in the Atlantic hagfish *Myxine glutinosa*. Society for Integrative and Comparative Biology 2006 Annual Meeting, Orlando, Florida.

**S. Kavanaugh**, Masumi Nozaki, Stacia Sower. 2005. Characterization of gonadotropin-releasing hormone (GnRH) in the Atlantic hagfish *Myxine glutinosa*. 15th International Congress of Comparative Endocrinology Satellite Symposia, Reproductive Endocrine System in Agnathans and Protochordates. (Oral)

**S. Kavanaugh**, Adam Root, Stacia Sower. 2005. The distribution of gonadotropin releasing hormone in the tunicate *Ciona intestinalis*. 15th International Congress of Comparative Endocrinology, Boston, Massachusetts.

**S. Kavanaugh**, Masumi Nozaki, Stacia Sower. 2005. Characterization of gonadotropin-releasing hormone (GnRH) in the Atlantic hagfish *Myxine glutinosa*. 15th International Congress of Comparative Endocrinology, Boston, Massachusetts.

**S. Kavanaugh** and S.A. Sower. 2004. The distribution of gonadotropin releasing hormone in the tunicate *Ciona intestinalis*. Society for Neuroscience 2004 Annual Meeting, San Diego, California.

**S. Kavanaugh** and S.A. Sower. 2003. Isolation of the Gonadotropin-Releasing Hormone and its Distribution by in situ Hybridization in the Tunicate *Ciona intestinalis*. JSPS-NSF Workshop, University of New Hampshire, May 28, 2004. (Oral)

**Scott I. Kavanaugh**, Aubrey Gorbman, Stacia A. Sower. 2004. The Distribution of Gonadotropin Releasing Hormone in the Urochordate *Ciona intestinalis*. Society for Integrative and Comparative Biology 2004 Annual Meeting, New Orleans, Louisiana.

**Scott I. Kavanaugh**, Aubrey Gorbman, Stacia A. Sower. 2003. The Distribution of Gonadotropin Releasing Hormone in the Urochordate *Ciona intestinalis*. Thirtieth New England Endocrinology Conference, Dartmouth Medical School, Lebanon, New Hampshire.

**S. Kavanaugh** and S.A. Sower. 2003. Seasonal Changes in Gonadotropin Releasing Hormone in the Atlantic Hagfish *Myxine glutinosa*. JSPS-NSF Workshop, University of New Hampshire, May 31, 2003. (Oral)

Mickie L. Powell, **Scott I. Kavanaugh**, Stacia A. Sower. 2003. Seasonal Gonadal Development in the Atlantic Hagfish, *M. glutinosa*. Society for Integrative and Comparative Biology 2003 Annual Meeting, Toronto, Ontario.

**Scott I. Kavanaugh**, Mickie L. Powell, Joanne E. Davis, and Stacia A. Sower. 2002. Sexuality and Embryogenesis of the Atlantic Hagfish, *Myxine glutinosa*. Society for Integrative and Comparative Biology 2002 Annual Meeting, Anaheim, California.

Stacia A. Sower, Mickie L. Powell, Joanne E. Davis, and **Scott I. Kavanaugh**. 2001. Sexuality and Embryogenesis of the Atlantic Hagfish, *Myxine glutinosa*. Twenty- Eighth New England Endocrinology Conference, University of Connecticut.

### **Meetings Attended**

- 2009 Society for Integrative and Comparative Biology 2009 Annual Meeting, Boston, Massachusetts.
- 2006 Society for Integrative and Comparative Biology 2006 Annual Meeting, Orlando, Florida.
- 2005 15th International Congress of Comparative Endocrinology Satellite Symposia, Reproductive Endocrine System in Agnathans and Protochordates, Durham, New Hampshire.
- 2005 15th International Congress of Comparative Endocrinology, Boston, Massachusetts.
- 2004 Society for Neuroscience 2004 Annual Meeting, San Diego, California.
- 2004 JSPS – NSF Workshop: Phylogeny of Brain-Pituitary Hormones and Receptors in Hagfish, Lampreys, Polypteris, and Tunicate.
- 2004 Society for Integrative and Comparative Biology 2004 Annual Meeting, New Orleans, Louisiana.

- 2003 Thirtieth New England Endocrinology Conference, Dartmouth Medical School, Lebanon, New Hampshire.
- 2003 JSPS – NSF Workshop: Brain / Pituitary Hormones and Receptors of Agnathans, Ancient Osteichthyes and Crustaceans Annual Meeting, University of New Hampshire, Durham.
- 2003 Society for Integrative and Comparative Biology 2003 Annual Meeting Toronto, Ontario.
- 2002 Twenty-Ninth New England Endocrinology Conference, University of Massachusetts, Amherst.
- 2002 Society for Integrative and Comparative Biology 2002 Annual Meeting Anaheim, California.
- 2001 Twenty-Eighth New England Endocrinology Conference, University of Connecticut.

**Sources and Level of Support**

**Travel**

- 2006 Awarded University of New Hampshire Graduate School Grant to attend 2006 meeting of Society for Integrative and Comparative Biology (\$200).
- 2005 Awarded University of New Hampshire Center for Marine Biology Travel Grant to attend 15th International Congress of Comparative Endocrinology (\$170).
- 2004 Awarded University of New Hampshire Center for Marine Biology Travel Grant to attend 2004 meeting of Society for Neuroscience (\$275).
- 2004 Awarded University of New Hampshire Graduate School Grant to attend 2004 meeting of Society for Neuroscience (\$200).
- 2003 Awarded University of New Hampshire Graduate School Grant to attend 2004 meeting of Society for Integrative and Comparative Biology (\$200).
- 2003 Awarded University of New Hampshire Center for Marine Biology Travel Grant to attend 2004 meeting of Society for Integrative and Comparative Biology (\$225).
- 2002 Awarded University of New Hampshire Graduate School Grant to attend 2003 meeting of Society for Integrative and Comparative Biology (\$200).

- 2002 Awarded University of New Hampshire Center for Marine Biology Travel Grant to attend 2003 meeting of Society for Integrative and Comparative Biology (\$226).
- 2001 Awarded University of New Hampshire Graduate School Grant to attend 2002 meeting of Society for Integrative and Comparative Biology (\$200).
- 2001 Awarded University of New Hampshire Center for Marine Biology Travel Grant to attend 2002 meeting of Society for Integrative and Comparative Biology (\$170).

### **Accession Numbers**

AY186743    DQ457017    DQ915103    DQ915102

### **Experimental Techniques**

- Molecular biology: RNA/DNA isolation, First strand synthesis, Second strand synthesis, Polymerase Chain Reaction, Reverse Transcriptase PCR, Ligation, Transformation, Plasmid preparation, Worked with bacterial strains, DH5 $\alpha$ , JM107, JM109, XL1-Blue, Y1090, Expression library construction and screening.
- MALDI-TOF (Axima CFR and QIT)
- In situ hybridization (DIG labeled and Fluorescent dual label)
- Cell culture (COS7) IP accumulation assay and Secreted Enzyme Akaline Phosphatase
- Iodination
- Transmission electron microscopy
- Spectrophotometry
- Thin layer chromatography
- Gel permeation chromatography
- HPLC (isocratic and gradient)
- Size exclusion chromatography
- Affinity chromatography
- Ion exchange chromatography
- Histology: fixation, embedding, microtome use, staining
- Enzymatic assays
- Radioimmunoassay (steroid and protein)
- Field collection and laboratory maintenance of Agnathans
- Radiation safety training
- Environmental health and safety training
- Hazardous materials shipping training
- Drivers' safety training (required for operation of university vehicles)

## **Course Work**

### **Graduate**

Biochemical Regulatory Mechanisms

Biochemistry (2 semesters)

Biochemistry Seminar (8 semesters)

College Teaching

Endocrinology

Endocrine Disruptors

Molecular Genetics

Physical Biochemistry

Topics in Structural Determination Instrumentation / Mass Spectrophotometry

### **Undergraduate**

Anatomy and Physiology (2 semesters)

Biochemistry

Biology of Sex Roles

Biotechnology

Cell Structure and Function

Evolution

General Chemistry (2 semesters)

General Physics (2 semesters)

Genetics

Introductory Biology (2 semesters)

Invertebrate Zoology

Microbiology

Organic Chemistry (2 semesters)

Transmission Electron Microscopy

Vertebrate Zoology