

LAURA M. BRADEN, PhD

PAST: Senior Research Scientist & Program Lead Molecular Immunology and Biotechnology

AquaBounty Canada

Souris, PE

EDUCATION

University of Victoria – Ph.D. Biology (Sept 2009 – March 2015)

Vancouver Island University – Bachelor of Science (June 2009, with distinction), Psychology Major

Malaspina University-College – Bachelor of Science (June 2007, with distinction), Biology Major
(Honours thesis: Investigation into the uptake of *Loma salmonae* (Microsporea) spores by phagocytic cells using RTS11, a rainbow trout macrophage cell line).

Atlantic Veterinary College – Adjunct Graduate Professor, Department of Veterinary Medicine
(2019-2021)

FELLOWSHIPS

2009 Fellowship, University of Victoria (1yr, \$13,500)

2010 Alexander Graham Bell Canada Graduate Scholarship, NSERC CGS-M (1yr, \$17,500)

2011 Alexander Graham Bell Canada Graduate Scholarship, NSERC CGS-D (3yr, \$105,000)

2015 Post-Doctoral Fellowship, NSERC (2yr, \$90,000)

2017 Post-Doctoral Fellowship, Canadian Excellence Research Chair (1 yr, \$63,000)

AWARDS & SCHOLARSHIPS

Best MSc-Level Presentation – Western Fish Disease Workshop, Corvallis, OR

2011-2014 President's Scholarship, University of Victoria (\$4,000 annually)

2011 Innovation Award, University of Victoria (\$1500)

Best MSc-level presentation – AAC 2011, Quebec City, QC

Novartis Young Scientist Award – Sea Lice 2012, Bergen, Norway

Poster Award (3rd) – Genome Canada: The Power and Promise, Ottawa, Canada (\$500)

Early Career Development Award 2016 – Canadian Excellence Research Chair (\$2500)

GRANTS

ACRDP19-M-03: "Assessing the evolution of virulence in the salmon louse (*Lepeophtheirus salmonis*) in the Bay of Fundy"; \$480,640/2 yrs; Aquaculture Collaborative Research & Development Program; Co-PI, 2019-2021.

ACRDP20-M-02: "Functional characterization of salmon lice virulence factors using post-transcriptional silencing"; \$104,913/1 yr; Aquaculture Collaborative Research & Development Program; Co-PI, 2020-2021.

PEER-REVIEWED PUBLICATIONS

Braden L.M., Michaud D, Igboeli OO, Dundrop M, Hamre L, Dalvin S, Purcell SL, Kongshaug H, Eicher C, Nilsen F, Fast, M.D. (2020). Identification of critical enzymes in the salmon louse synthesis pathway as revealed by RNAi-mediated abrogation of infectivity. *Int J Parasitol, in press*.

Braden, L.M., Fast, M.D., Monaghan, S. (2020). Salmon immunological defense and interplay with the modulatory capabilities of its ectoparasite *Lepeophtheirus salmonis*. *Parasite Immunology, in press*.

Carvalho, L.A., Whyte, S.K., **Braden, L.M.**, Purcell, S.L., Manning, A.J., Muckle, A., Fast, M.D. 2020. Impact of co-infection with *Lepeophtheirus salmonis* and *Moritella viscosa* on inflammatory and immune responses of Atlantic salmon (*Salmo salar*). *Journal of Fish Diseases*, 43(2):1-15.

Brown, A.B.J., Whyte, S.K., **Braden, L.M.**, Groman, D., Purcell, S.L., Fast, M.D. (2020). Vaccination strategy is an important determinant in immunological outcome and survival in Arctic charr (*Salvelinus alpinus*) when challenged with atypical *Aeromonas salmonicida*. *Aquaculture*, 518, 734838.

Braden, L.M., Whyte, S.K, Brown, A.B.J., Van Iderstine, C., Letendre, C., Groman, D., Lewis, J., Purcell, S.L., Hori, T.S., Fast, M.D. (2019). Vaccine-induced protection against infection with *Aeromonas salmonicida* spp. *salmonicida* in Arctic charr *Salvelinus alpinus* involves pre-emptive priming of humoral immunity. *Frontiers in Immunology*, DOI: 10.3389/fimmu.2019.00120

Braden, L.M., Rasmussen, K.J., Purcell, S.L., Ellis, L., Mahony, A., Cho, S., Whyte, S.K., Jones, S.R.M., Fast, M.D. (2018). Acquired protective immunity in Atlantic salmon *Salmo salar*

- against the myxozoan *Kudoa thyrsites* involves induction of MHII⁺ CD83⁺ antigen-presenting cells. *Infection & Immunity*, 86:e00556-17.
- Poley, J.D., **Braden, L.M.**, Messmer, A.M., Igboeli, O.O., Whyte, S.K., Macdonald, A., Rodriguez, J., Gameiro, M., Rufenerd, L., Bouvierd, J., Wadowska, D.W., Koop, B.F., Hosking, B.C, Fast, M.D. (2018) High level efficacy of lufenuron against sea lice (*Lepeophtheirus salmonis*) linked to rapid impact on moulting processes. *IJP: Drugs and Drug Resistance*, 8, 174-178.
- Braden, L.M.**, Sutherland, B.J.G., Koop, B.F., Jones, S.R.M. (2017). Enhanced transcriptomic responses in the Pacific salmon louse *Lepeophtheirus salmonis oncorhynchi* to the non-native Atlantic salmon *Salmo salar*, implies increased parasite fitness. *BMC Genomics*, 18:110.
- Poley, J.D., **Braden, L.M.**, Messmer, A.M., Whyte, S.K., Koop, B.F., Fast, M.D. (2016). Cypermethrin exposure induces metabolic and stress-related gene expression in copepodid salmon lice (*Lepeophtheirus salmonis*). *Comp. Biochem. Phys. D.*, 20, 74-84.
- Braden, L.M.**, Koop, B.F., Barker, D.E., Jones, S.R.M. (2015). Differential modulation of resistance biomarkers in skin of juvenile and mature pink salmon, *Oncorhynchus gorbuscha* by the salmon louse, *Lepeophtheirus salmonis*. *Fish Shellfish Immunol.*, 47, 7-14.
- Braden, L.M.**, Koop, B.F., Jones, S.R.M. (2015). Signatures of resistance to *Lepeophtheirus salmonis* include a T_H2-type response at the louse-salmon interface. *Dev. Comp. Immunol.* 48, 178-191.
- Braden, L.M.**, Barker, D.E., Koop, B.F., Jones, S.R.M. (2012). Comparative defense-associated responses in salmon skin elicited by the ectoparasite *Lepeophtheirus salmonis*. *Comp. Biochem. & Physiol. D.* 7, 100-109.
- Braden, L.M.**, Prosseri-Porta, G., Kim, E., Jones, S.R.M. (2010). *Tetracapsuloides bryosalmonae* in spawning pink salmon, *Oncorhynchus gorbuscha* (Walbaum), in the Quinsam River, British Columbia, Canada. *Journal of Fish Diseases*, 33, 617-621.
- Barker, D.E., **Braden, L.M.**, Coombs, M., Boyce, B. (2009). Preliminary studies on the isolation of bacteria from sea lice, *Lepeophtheirus salmonis*, infecting farmed salmon in British Columbia, Canada. *Parasitology Research*, 105(4):1173-7.

INVITED & CONTRIBUTED PRESENTATIONS

Invited presentations

- 2019 – **L.M. Braden**, D. Michaud, W. Cai, J.D. Poley, M.D. Fast, “Characterization of the host-parasite interactome in the salmon-lice relationship”. Oral presentation, International Conference of Integrative Salmonid Biology, Edinburgh, Scotland.
- 2019 – **L.M. Braden**, D. Michaud, W. Cai, J.D. Poley, M.D. Fast, “Characterization of the host-parasite interactome in the salmon-lice relationship”. Oral presentation, International Society of Animal Genetics, Lleida, Spain.
- 2019 – **L.M. Braden**, W. Cai, D. Michaud, J.D. Poley, A. Overgaard, M.D. Fast, “Virulence in *Lepeophtheirus salmonis* – characterizing the salmon-lice interactome”. Oral presentation, Aquaculture Association of Canada, Victoria, BC.
- 2019 – **L.M. Braden** “Leveraging biotech to improve sustainability in aquaculture: A global perspective”. Oral presentation, Eastern Aquaculture Veterinary Association Meeting, Moncton, NB
- 2018 – **L.M. Braden**, C. Smith, M.D. Fast. “Should I Stay or Should I Go? Dismantling the molecular decision to smolt in an anadromous salmonid”. Oral presentation, PHARMAQademy Conference, Inverness, Scotland.
- 2018 – **L.M. Braden**, M.D. Fast. “Subverting molecular subterfuge – Coho find the Achilles heel of salmon lice”. Oral presentation, PHARMAQademy Conference, Inverness, Scotland.
- 2018 – **L.M. Braden** “Leveraging OMICs to reveal novel biomarkers and pharmaceutical targets for sea lice control: A holistic approach”. Oral presentation, Institute of Aquaculture, University of Stirling, Scotland.
- 2018 – **L.M. Braden**, J.D. Poley, D. Michaud, A. Øvergård, H. Kongshaug, S. Dalvin, F. Nilsen, M. D. Fast. “Decoding important regulators of sea lice physiology using gene silencing techniques”. Oral presentation, Atlantic Canada Fish Farmers Association Research Forum, St. Andrews, NB.
- 2016 – **L.M. Braden**, Hori, T., Poley, J.D., Byrne, P., Fast, M.D. “Characterizing the rapid rejection of salmon lice, *Lepeophtheirus salmonis*, by juvenile coho salmon, *Oncorhynchus kisutch*”. Oral presentation, Atlantic Canada Fish Farmers Association Research Forum, St. Andrews, NB.
- 2015 – **L.M. Braden**, B.J.G. Sutherland, S.R.M. Jones. “Susceptibility to infection by the salmon louse is related to both host and parasite responses”. Oral presentation, Host-Microbe Interaction Workshop, Plant & Animal Genome XXII, San Diego, CA.

- 2014 – **L.M. Braden.** “Investigating the molecular basis of the variable host response of salmonids to *Lepeophtheirus salmonis*.” Guest lecture, Ecological Parasitology, Vancouver Island University, Nanaimo, BC.
- 2013 – **L.M. Braden.** “Investigating the molecular basis of the variable host response of salmonids to *Lepeophtheirus salmonis*.” Novartis Parasitology Research & Development, Bioforum, St. Aubin, Switzerland.
- 2013 – **L.M. Braden.** “The sea lice saga: past, present and future of the pesky little parasite.” Vancouver Island University Science & Technology Seminar Series, Nanaimo, B.C.
- 2012 – **L.M. Braden.** “Investigating the molecular basis of the variable host response of salmonids to *Lepeophtheirus salmonis*”. Marine Scotland Lunch & Learn, Aberdeen, Scotland.
- 2011 – **L.M. Braden.** “Living off a fish – a co-evolutionary success story.” Guest lecture, Fish Health, Vancouver Island University, Nanaimo, BC.

Contributed presentations & posters

- 2018 – **L.M. Braden,** O.O. Igboeli, M. Dundrop, L. Hamre, F. Nilsen, S. Dalvin, M.D. Fast. “Critical links between GFAT, the chitin synthesis pathway, and infection in *Lepeophtheirus salmonis*.” Oral presentation at the 12th International Sea Lice Conference, Punta Arena, Chile.
- 2018 – **L.M. Braden,** “Virulence factors in the salmon louse.” Oral presentation at the 12th International Sea Lice Conference, Punta Arenas, Chile.
- 2018 – **L.M. Braden,** S.L. Purcell, K.J. Rasmussen, M. Zadworny, C.T. Smith, M.D. Fast. “Should I Stay, or Should I Go? Divergent immunity in an anadromous salmonid.” Oral presentation at the International Symposium on Aquatic Animal Health, Charlottetown, PE.
- 2018 – **L.M. Braden,** S.K. Whyte, A.B.J. Brown, C. VanInderstine, C. Letendre, D. Groman, J. Lewis, S.L. Purcell, T.S. Hori, M.D. Fast. “Vaccine-induced protection against infection with *Aeromonas salmonicida* spp. *salmonicida* in Arctic charr *Salvelinus alpinus* involves pre-emptive priming of humoral immunity.” Oral presentation at the International Symposium on Aquatic Animal Health, Charlottetown, PE.
- 2016 – **L.M. Braden,** Hori, T., Poley, J.D., Byrne, P., Fast, M.D. “Characterizing the rapid rejection of salmon lice, *Lepeophtheirus salmonis*, by juvenile coho salmon, *Oncorhynchus kisutch*.” Oral presentation at the 11th International Sea Lice Conference, Westport, Ireland.
- 2016 – **L.M. Braden,** Poley, J.D., Hori, T., Byrne, P., Fast, M.D. “Characterizing the rapid rejection of salmon lice, *Lepeophtheirus salmonis*, by juvenile coho salmon, *Oncorhynchus kisutch*.” Oral presentation at Aquaculture Europe, Edinburgh, Scotland.
- 2016 – **L.M. Braden***, S.D. Cho, M.D. Fast, S.R.M. Jones. “Defining the cellular response of Atlantic salmon *Salmo salar* to *Kudoa thyrsites*.” Oral presentation at the International Society of Fish and Shellfish Immunology conference, Portland, Maine.
- 2015 – **L.M. Braden***, M.D. Fast, S.R.M. Jones. “*Kudoa thyrsites* in salmon aquaculture.” Oral presentation at Atlantic Canada Fish Farmers Association Research Forum, St. Andrews, NB.
- 2015 – **L.M. Braden***, S.D. Cho, M.D. Fast, S.R.M. Jones. “Resolution of *Kudoa thyrsites* infection is associated with infiltration of MHI β ⁺ cells in Atlantic salmon.” Oral presentation at the 17th European Association of Fish Pathologists, Las Palmas, Gran Canaria, Spain.
- 2015 – **L.M. Braden***, B.J.G. Sutherland, B.F. Koop, S.R.M. Jones. “Host susceptibility to infection by the salmon louse, *Lepeophtheirus salmonis*, involves responses by salmon and parasite.” Oral presentation at the 17th European Association of Fish Pathologists, Las Palmas, Gran Canaria, Spain.
- 2015 – S.R.M. Jones, **L.M. Braden,** B.F. Koop. “Age-dependent immunity to the salmon lice, *Lepeophtheirus salmonis*, in pink salmon, *Oncorhynchus gorbuscha*.” Oral presentation at the 17th European Association of Fish Pathologists, Las Palmas, Gran Canaria, Spain.
- 2014 – **L.M. Braden***, B.J.G. Sutherland, B.F. Koop, S.R.M. Jones. “Host-specific virulence by the sea louse, *Lepeophtheirus salmonis*.” Poster presentation at Genome Canada: The Power and Promise, Ottawa, Canada.
- 2014 – **L.M. Braden***, B.J.G. Sutherland, B.F. Koop, S.R.M. Jones. “Evidence for host-specific feeding responses by the sea louse, *Lepeophtheirus salmonis*.” Oral Presentation at the 10th International Sea Lice Conference, Portland, Maine, USA.
- 2014 – **L.M. Braden***, B.F. Koop, S.R.M. Jones. “Cellular factors in the skin of salmon during sea lice attachment.” Poster presentation at the 2nd International Conference on Integrative Salmonid Biology, Vancouver, BC, Canada.
- 2014 – S.R.M. Jones*, B.J.G. Sutherland, **L.M. Braden,** B.F. Koop. “Salmon – Louse interactions: genomics and the evolution of the inflammation paradigm.” Oral Presentation at the 2nd International Conference on Integrative Salmonid Biology, Vancouver, BC, Canada.

- 2013 – S.R.M. Jones*, B.J.G. Sutherland, **L.M. Braden**, B.F. Koop. Parasitological, physiological and molecular metrics of resistance to *Lepeophtheirus salmonis* among salmon. Oral presentation at the 16th International Conference on Diseases of Finfish and Shellfish. Tampere, Finland.
- 2013 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Insight into the molecular basis for resistance of Pacific salmonids to the ectoparasite, *Lepeophtheirus salmonis*." Oral presentation at World Aquaculture 2013, Nashville, TN, USA.
- 2012 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Development of a skin injection model for studying local and systemic responses to *Lepeophtheirus salmonis* in salmon." Oral presentation at the 9th International Sea Lice Conference, Bergen, Norway.
- 2012 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Development of a skin injection model for studying local and systemic responses to *Lepeophtheirus salmonis* in salmon." Oral presentation at the 2012 Aquaculture Association of Canada Meeting, Charlottetown, PEI, Canada.
- 2011 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Site-specific transcriptomic responses in salmon skin elicited by the ectoparasite *Lepeophtheirus salmonis*." Oral presentation at the 2011 Aquaculture Association of Canada Meeting, Quebec City, QC.
- 2011 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Defense-associated responses in salmon skin elicited by the ectoparasite *Lepeophtheirus salmonis*." Oral presentation at the 8th International Symposium on Fish Parasites, Vina del Mar, Chile.
- 2011 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Site-specific transcriptomic responses in salmon skin elicited by the ectoparasite *Lepeophtheirus salmonis*." Oral presentation at the Western Fish Disease Workshop, Nanaimo, BC, Canada.
- 2010 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Immune gene expression in Atlantic (*Salmo salar*), pink (*Oncorhynchus gorbuscha*) and chum (*O. keta*) salmon due to *Lepeophtheirus salmonis* infection." Oral presentation at the Western Fish Disease Workshop, Corvallis, OR, USA.
- 2010 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Immune gene expression in Atlantic (*Salmo salar*), pink (*Oncorhynchus gorbuscha*) and chum (*O. keta*) salmon due to *Lepeophtheirus salmonis* infection." Oral presentation at the 2010 Aquaculture Association of Canada Meeting, St. John's, NFLD.
- 2010 – **L.M. Braden***, B.F. Koop, D.E. Barker, S.R.M. Jones. "Immune gene expression in Atlantic (*Salmo salar*), pink (*Oncorhynchus gorbuscha*) and chum (*O. keta*) salmon due to *Lepeophtheirus salmonis* infection." Oral presentation at the 8th International Sea Lice Conference, Victoria, BC, Canada.

PROFESSIONAL MEMBERSHIPS

World Aquaculture Society
Aquaculture Association of Canada
International Society of Fish and Shellfish Immunology
European Association of Fish Pathologists
American Society of Microbiology

ACTING REFEREE

Developmental & Comparative Immunology
Fish & Shellfish Immunology
Journal of Fish Diseases
Aquaculture
Parasites & Vectors
Journal of Aquatic Animal Health
Histology & Histopathology
Journal of Immunology

SUPERVISION AND MENTORSHIP

2009-2015 Laboratory Instructor – Cell Biology/Genetics (University of Victoria)
2010 Temporary instructor – Fish Health (Vancouver Island University)
2011 Megan Knight (Honours thesis, Vancouver Island University)
2009-2012 Daniel Lewis (Master's student, University of BC)
2009-2012 Colin Novak (Master's student, University of BC)
2015 Lauren Elis (DVM Candidate, Atlantic Veterinary College)
2015-2018 Aly Brown (Master's student, Atlantic Veterinary College)
2016-2018 Laura Carvahlo (Master's student, Atlantic Veterinary College)

2017-present Eric Ignatz (Master's student, Memorial University/AquaBounty Canada)
2019-present Kathleen Parrish (Master's student, Atlantic Veterinary College/UPEI)
