Diversity of symbionts as a tool for assessing biodiversity and ecosystem health.
A Sentinels of Change Alliance postdoctoral fellowship

Biodiversity change in the Salish Sea is a major ecological concern. The need to understand these changes, and their causes, is a primary research objective so that knowledge can be mobilized to inform conservation and policy actions in the region. The Sentinels of Change Alliance brings together Hakai Institute scientists, university scientists and local communities to deepen our understanding of Salish Sea biodiversity change at an unprecedented scale and resolution. The goals are to implement standard observation systems for biodiversity across a range of taxa, to conduct experiments to test hypotheses about the causes of diversity change, and to integrate knowledge from observation and experimental systems into a sustainable ongoing biodiversity observation system for the Salish Sea.

The Sentinels of Change Alliance project will train postdoctoral researchers and technicians to implement a series of globally recognized biodiversity monitoring programs (e.g. Sentinels light traps, ARMS, MARINe Biodiversity monitoring and other systematic observation and experimental systems). Project personnel will use state of the art data science and statistical approaches in the context of emerging frameworks for detecting and attributing biodiversity change. Sentinel Postdoctoral researchers will be co-advised by UBC professors and Hakai scientists to develop projects that synthesize the information coming in from the monitoring program, as well as provide complementary theory development, mechanistic experiments and monitoring.

Focal project

Symbiosis is a ubiquitous feature of the natural world, but the biodiversity of symbionts is missing from most biodiversity inventories. Hosts, such as animals and macroalgae, are colonized by diverse communities of microbial symbionts that modulate development, train the immune system, defend against disease, and otherwise influence host biology. Biodiversity loss of hosts and changing environmental conditions will almost certainly alter the diversity and distribution of symbionts, with cascading influences on host and ecosystem health. However, we lack a predictive understanding of how these alterations will unfold and the consequences for host and ecosystem health. The Sentinels project offers an unprecedented opportunity to integrate symbiont diversity into biodiversity monitoring efforts, and in doing so promises new insight into the contributions of symbionts to the diversity and health of hosts and ecosystems.

The postdoc will be responsible for leading data synthesis, surveys, and/or experiments that advance one or more of the following goals.

1) **Determining the host and environmental distribution of symbionts: are most symbionts host specialists?** By some estimates, parasites and symbionts make up the vast majority of undiscovered lineages because so few animal, plant, and seaweed species have been sampled. The extent of novel diversity depends on the portion of symbionts that are host-specialists versus host generalists. This project will use macroalgae and the animals associated with ARMS as a model systems to assess the distribution of symbionts across hosts. The resulting data in combination with the extensive datasets within the Hakai network of symbiont and planktonic microbial diversity represent an opportunity to gain a fine-grained understanding of the distribution of microbial symbionts across host species, their neighbors, and their environment. Note that within this project, symbionts are defined as microbes that are associated with a host, regardless of their fitness consequences (crossing the spectrum from mutualist to pathogen).

2) **Experimentally testing the response of symbiont diversity to the climate stressors of high temperature and low salinity for focal hosts such as dungeness crabs, green crabs and bull kelp.** Abiotic stressors are predicted to disrupt host microbiomes and facilitate opportunistic pathogen colonization. This is expected to lead to higher alpha diversity of the microbiome on individual organisms, but lower gamma diversity because the microbiome will be homogenized across species.

3) **Can symbiont diversity be used to predict host diversity and ecosystem health?** There are opportunities to develop methods for integrating microbial biodiversity with macrobial diversity measurements from eDNA and standard morphology-based taxonomic assessments. Though microbes are seldom included in programs monitoring biodiversity of animals and plants, there is a wealth of molecular data available that could be leveraged to improve overall diversity estimates. This project will evaluate the ability of symbiont diversity and distribution information to refine estimates of macrobial diversity. Further, the diversity of symbionts has been hypothesized to be an indicator of ecosystem health, with intact ecosystem supporting greater diversity of symbionts and parasites. The postdoc will work with the team of Hakai scientists to design monitoring data collection protocols so that this hypothesis can be tested. This project will focus on ARMS and the surrounding kelp forests.

This project focuses on surface-associated symbionts and will complement projects documenting parasite diversity and evolutionary significance led by the Keeling and King labs.

Postdoctoral responsibilities and Requirements:

The postdoctoral fellow will be responsible for collating datasets from within the Hakai network for microbes, animals, and macroalgae.

Work with the Hakai Sentinels research scientists to design and implement sampling strategies that promote the integration of microbiome data into biodiversity monitoring.

Postdoc will design and implement experiments to test the impact of the climate stressors including high temperature and low salinity on host health and the symbiont community of focal kelp species.

Required experience with biodiversity data analysis and/or data science, statistical analysis and modeling in R and proficient in open data methods. Experience with data synthesis or experimental approaches in marine ecosystems welcome. Experience conducting field work and/or generating generating biomolecular data is an asset but not required.

Project advising team:
The successful candidate will be housed in Dr. Laura Parfrey's lab at UBC, and co-supervised by Dr. Colleen Kellogg and Dr. Matt Lemay of the Hakai Institute, and Dr. Patrick Martone at UBC.

Additional details: We encourage applicants to apply for this position; equity and diversity are essential to research excellence. We encourage applications from members of groups that have been marginalized on any grounds enumerated under the B.C. Human Rights Code, including sex, sexual orientation, gender identity or expression, racialization, disability, political belief, religion, marital or family status, age, and/or status as a First Nation, Metis, Inuit, or Indigenous person. Candidates of any nationality are encouraged to apply.

The position is based at the Vancouver campus of the University of British Columbia, which lies on the traditional, ancestral, and unceded territory of the Musqueam people. Hakai is an independent research organization based in British Columbia with many scientists studying the fish, invertebrates, microbes, and seaweeds of coastal ecosystems. The postdoctoral fellow is expected to be able to travel within the Salish Sea Region to participate in experimental work, and accommodation at field stations will be provided.

Review of applications will begin on November 1, 2023 and we hope to fill the position for a start date of March 15, 2024 (negotiable). The position is for two years, with a performance review after one year.

To apply, please send a cover letter, CV, the two reference letters, and sample research publications to Kyoko Horiguchi (kyoko.horiguchi@ubc.ca). Your cover letter should address your motivation to excel in this project, and the particular skills and experience you can bring to the work.