Outlook

Thank you for submitting your ARC Final Report

From Langara | Applied Research Center <appliedresearch@langara.ca>
Date Tue 2025-04-22 2:23 PM
To Ji Yong Yang <jyyang@langara.ca>
Cc Applied Research <appliedresearch@langara.ca>

Thank you for submitting

ARC Final Report

Our team may reach out to you with follow-up requests for clarification regarding your submission.

Review your submission responses below:

Researcher First Name: Ji

Researcher Last Name: Yang

Department: Biology

Other Department:

Project Title: Investigating the diversity of BC wild yeast

using advanced multi-omics approaches

Start semester: 6/3/2024

End Semester: 3/31/2025

Introduction - Please introduce yourself and include pertinent background information as it relates to your project's research area. I'm Ji Yang, a botanist with a PhD in Botany and a strong background in plant sciences, supported by years of postdoctoral research. Over the past decade, I've been teaching a range of biology courses at Langara College, including one dedicated to fungi, which has led me to become the college's go-to expert in this area. My academic training and hands-on experience have given me a solid foundation in the biology of microbial organisms and their practical uses. Beyond the classroom, I've been deeply engaged in applied research, particularly in areas that connect botany with fermentation. I played a key role in launching a project with Kelly Sveinson to investigate the potential of feral hops in British Columbia's craft beer scene. Alongside David Anderson, I co-led efforts to secure one of the first major NSERC grants for this initiative. This work gave me valuable experience in bridging scientific research with industry needs. With a background that spans fungi, yeast, and hops, I bring a unique perspective to wild yeast research for brewing. My combined expertise in plant science and fermentation research puts me in a strong position to make meaningful contributions to this project.

Please discuss your educational background and your work experience as it relates to this project. If possible, include a quote that helps define your interest in the project. I earned my BSc in Biology and MSc in Botany from the University of British Columbia (UBC), followed by a PhD in Plant Biology from the University of California, Santa Barbara (UCSB). I later returned to UBC as a postdoctoral fellow, where I conducted research on cacao genetics. This academic path, grounded in both coursework and hands-on research, has provided me with a strong foundation in plant biology and molecular genetics. Over the course of my career, I've built extensive experience in both teaching and applied research. My work has consistently centered on plants and fungi—organisms that lie at the heart of this project. I've long been passionate about these fields, often saying, "I love to study everything that's related to fungi and plants." That passion continues to fuel my research today, particularly in the study of wild yeast for brewing. With my combined expertise in fungal biology and plant science, I'm well-prepared to contribute meaningfully to this area of investigation.

Please summarize your project in plain language that others not in your field could understand. This project explores the untapped potential of wild yeast—naturally

occurring fungi found in the environment—and their applications in brewing. Yeast is a key player in fermentation, the process behind the production of beer, wine, and other fermented beverages. By isolating and analyzing wild yeast strains from across British Columbia, we aim to uncover new varieties that could bring unique flavours and characteristics to craft brewing. Using molecular techniques, we will identify these yeasts at the genetic level and evaluate their performance in fermentation. The ultimate goal is to discover strains that can enhance the creativity, diversity, and quality of locally produced beers, supporting the continued growth and innovation of BC's craft beverage industry.

Identify the project goals and objectives. Explain how the results may be used to solve a problem or inform further research in the field. Project Goals and Objectives The goal of this project was to explore the diversity of wild yeast strains in British Columbia and assess their potential for brewing applications. Yeast samples were collected from a range of natural ecosystems across the province and identified using molecular techniques, including DNA sequencing, to classify them at both the species and strain levels. Selected strains were then evaluated for their fermentation capabilities, with an emphasis on their impact on flavor, aroma, and brewing efficiency. To further understand how different yeasts influence the final product, a metabolomics study was initiated to characterize the chemical profiles—or metabolomes—of the beers produced using these wild strains. This analysis aimed to identify key metabolites contributing to flavor, aroma, and other sensory properties. The project also sought to develop a comprehensive and accessible database of wild yeast strains to support ongoing research and innovation in BC's craft brewing sector. How the Results May Be Used The outcomes of the project offered multiple benefits. For BC craft brewers, the discovery of novel, locally sourced yeast strains opened up new possibilities for producing beers with distinctive regional character and complexity. The molecular and metabolomic data generated through the study provided brewers with deeper insights into how specific yeasts contribute to the sensory profile of beer, supporting more intentional and creative recipe development. The wild yeast database and beer metabolome profiles also served as valuable tools for researchers investigating yeast biodiversity, fermentation science, and sustainable brewing practices. Additionally, by identifying yeast strains with traits such as improved resilience or fermentation efficiency, the project contributed to the advancement of more environmentally sustainable brewing processes.

Briefly explain the steps taken (methods used) to conduct the research, and describe the key findings. For the next phase of this project, we plan to continue expanding our research in several key areas. We will extend our sampling efforts to include wild yeast from diverse ecosystems, such as alpine regions in the coastal mountains, where we hope to identify cold-tolerant strains, and BC hot springs, which we anticipate will yield

heat-tolerant yeasts. Additionally, we aim to sample urban settings in the Greater Vancouver area, particularly in former locations where breweries and bakeries once operated, to investigate how these environments may have shaped the yeast populations. This expanded sampling will further enrich our yeast collection and contribute to the growth of our wild yeast database. In addition to continuing brewing trials with the most promising wild yeast strains, we aim to explore their potential in other industrial applications, including biotechnology, bioremediation, and waste management. Ultimately, our goal is to find an industrial partner, potentially a craft brewery, to collaborate with us in fully assessing the value of these wild yeasts for the brewing industry.

Who was involved in this project (eg. faculty, students, community partners)? How did their involvement contribute to the project's success? Were there any challenges to overcome? This project was a collaborative effort involving myself, four dedicated student researchers, and two esteemed colleagues from the Biology Department: Dr. Stephanie Cheung and Dr. Anuli Uzozie. Each member of the team contributed uniquely and significantly to the success of the research. The student researchers—Parleen Mand, Carmen Fong, Cayetana Lopez, and Amber Cornick—played a central role in both field and laboratory components of the project. They were responsible for environmental sampling, yeast isolation and culturing, and assisting with molecular identification. Their enthusiasm, precision, and dedication were essential to the project's progress, particularly in collecting and analyzing data related to wild yeast diversity. Dr. Stephanie Cheung brought her expertise in molecular biology and yeast genetics, providing critical support and oversight during the DNA extraction and sequencing phases. Her guidance ensured that molecular identification was conducted with a high degree of accuracy and scientific rigor. Dr. Anuli Uzozie contributed her specialized knowledge in metabolomics. She is currently leading the effort to develop a comprehensive metabolite database for fermentation solutions as part of the ongoing analysis. In addition, she has played a pivotal role in establishing and optimizing the QTOF mass spectrometry system, laying the groundwork for future metabolomic profiling of wild yeast strains. The collaborative efforts of the entire team enabled the successful execution of this complex, interdisciplinary investigation into the biodiversity and brewing potential of wild yeasts in British Columbia. Challenges A key challenge during the course of this project was establishing an industrial partnership to support and extend the research. While we initially formed a promising collaboration with Renaissance Bioscience, a Vancouver-based yeast company, the partnership did not progress as anticipated. Renaissance ultimately chose to pursue a collaboration with a research group at the University of British Columbia, whose access to advanced equipment better aligned with their immediate research needs. Despite this setback, we have remained proactive in our efforts to build new

industrial relationships. We are currently exploring a potential partnership with Parallel 49 Brewing, which has shown interest in our work with wild yeast strains. In addition, we are preparing an application for an NSERC Applied Research and Development (ARD) grant to support future collaborative research. We continue to reach out to other potential partners in the brewing and fermentation industries who share an interest in local biodiversity and innovative brewing approaches.

Please share any personal stories that made this research experience memorable/valuable.

One of the most memorable experiences during this research was hiking to the peak of Grouse Mountain and exploring the old-growth forest of Lynn Valley, where I collected samples from unique ecosystems. Additionally, I embarked on a week-long sea kayaking expedition to the northern Gulf Islands, sampling substrates from remote marine environments, including eelgrass, seaweeds, jellyfish, and shellfish. I also gathered samples from the former dump site at Crowley Park, offering insights into environments shaped by both nature and human influence. These diverse locations provided a rich range of ecosystems to investigate wild yeast diversity, with the marine environments being particularly underexplored. This experience was both enriching and fulfilling, and I look forward to the possibility of publishing a paper on the wild yeast findings from these varied ecosystems.

What are the next steps for this project and for you as a researcher?

Methods This research followed a systematic approach to discover and evaluate wild yeast strains from across British Columbia. Environmental sampling was conducted in a range of habitats, including flowers, fruits, leaves, bark, mushrooms, lichens, slime molds, mosses, and soil. Yeast strains were isolated using selective media designed to support yeast growth while inhibiting other microorganisms. Pure cultures were then obtained for further study. DNA was extracted from the isolated strains, and molecular identification was performed by sequencing the Internal Transcribed Spacer (ITS) region, a commonly used genetic marker for fungal species identification. This allowed for accurate classification of the yeast at the species level. Selected strains were tested in small-scale fermentation trials to evaluate their brewing potential. These trials assessed fermentation efficiency, flavor, and aroma compared to conventional brewing yeasts. In parallel, a metabolomics study was initiated to characterize the chemical profiles of the beers produced with wild strains. While this work is still in progress, it is expected to provide deeper insights into how different yeast strains influence the sensory properties of beer. Key Findings The project identified several wild yeast strains, each exhibiting distinct fermentation characteristics and the potential to create novel flavor and aroma profiles in beer. Notably, some strains demonstrated greater fermentation efficiency than traditional brewing yeasts, suggesting promise for more sustainable brewing applications. Although the metabolomic analysis is ongoing, early results indicate

that these wild yeasts may contribute to diverse and unique beer metabolomes, offering further opportunities for innovation in the craft brewing industry.

Please upload any images that will help to showcase your project.

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