BIOSCAN: Transforming Biodiversity Science

An Exceptional Opportunity for Early Career Researchers

20 POSTDOCTORAL FELLOWSHIPS
5 GRADUATE STUDENTSHIPS

The **International Barcode of Life Consortium** (**iBOL**) is coordinating a series of research programs that will register all multicellular species and activate a global biosurveillance system within 25 years. **BIOSCAN**, its current program, is an 8-year, $180 million effort involving organizations in 40 nations. Its scientific work focuses on three major themes - species discovery, interactions, and dynamics. This work will be advanced by exploiting the latest developments in DNA sequencing, AI, data science, and machine learning. This scientific work will support important applications designed to improve the sustainability of agriculture, forestry, and mining. Furthermore, BIOSCAN aims to ensure its science influences society through policy change. Further details are available at: https://ibol.org/programs/bioscan/

Because BIOSCAN's activities are rapidly expanding in Canada and internationally, this is the perfect time to join an enterprise that will transform our understanding of biodiversity and our capacity to manage it. We seek 25 early career researchers (ECRs) to join us in leading Canada's contribution to BIOSCAN.

- **20 postdoctoral fellows** (2- or 3-year appointments).
- **5 graduate students** (MSc/PhD level).

If selected, you will work with leading Canadian researchers in biodiversity science, genomics, and computer science to achieve BIOSCAN's mission. There will be strong opportunities for cross-disciplinary training, for national and international travel, and for carrying out impactful science. Positions are available at **eight** of Canada's most research-intensive universities:

Alberta
Area of research: marine biology
Position: 1 graduate student

Guelph
Areas of research: biodiversity genomics, species discovery, machine learning, anthropology
Positions: 8 postdoctoral fellows

McGill
Areas of research: biodiversity genomics, species dynamics, ecosystem sustainability
Positions: 3 postdoctoral fellows

Simon Fraser
Areas of research: computer science, artificial intelligence
Position: 1 postdoctoral fellow

Victoria
Areas of research: science policy, community action & knowledge bridging, marine biology
Positions: 4 postdoctoral fellows, 1 graduate student

Waterloo
Areas of research: data science, computer science
Positions: 1 postdoctoral fellow, 2 graduate students

Western Ontario
Areas of research: ecosystem function, soil biodiversity
Position: 1 graduate student

York
Areas of research: biodiversity genomics, species interactions, population genomics
Positions: 3 postdoctoral fellows

See following pages for a detailed description of each position.

To apply: Candidates should submit a 2-page letter of interest (outlining key skills and background), a full CV, and contact information for two references as one PDF to: BIOSCANCanada@ibol.org. Applicants should clearly indicate the position(s) that are of most interest.

BIOSCAN supports a culture of inclusion as an organizational imperative. As a result, we encourage applications from all qualified individuals, especially those from groups traditionally underrepresented in science.

Closing date: Review of applications will commence on March 21, 2022.

UNIVERSITY OF ALBERTA

Position #1

GS at Alberta; PI: Dr. Stephanie Green

Summary: Marine biodiversity supports goods and services to people across Canada and globally yet is changing rapidly due to global pressures on oceans. This project will focus on species discovery and biotic interactions within open-ocean (pelagic) ecosystems where diversity continues to be under-sampled due to logistical constraints. The successful candidate will engage in field sampling during marine research cruises to acquire animal specimens for DNA analysis and liaising with project scientists across the BIOSCAN network to reconstruct predator-prey interactions within the food web. Experience and interest in team-based remote and/or aquatic field research, predator-prey ecology, laboratory work including molecular techniques, quantitative statistical analysis, and coding in R or Python is an asset.

UNIVERSITY of GUELPH

Positions #2-7

PDF (x6) at Guelph; PI: Dr. Paul Hebert

Summary: These postdoctoral fellows will advance work on species discovery in both Canada and internationally. As more than 10 million specimens will be analyzed over the next six years, those selected for these positions will have access to unprecedented datasets in terms of both geographic breadth and taxonomic coverage. Work will involve the acquisition and analysis of long-read DNA sequences generated by in-house PacBio Sequel and Sequel II platforms supported by a strong team of analysts. Tens of thousands of species new to science will be registered, motivating the search for improved methods to discriminate species and to speed their description. Prior experience with arthropod taxonomy, especially with Acarina, Collembola, Hemiptera, Hymenoptera, or Lepidoptera is desirable. Candidates who couple such expertise with a background in DNA barcoding, metabarcoding, or molecular evolution will be ideal for these positions.

UNIVERSITY of GUELPH

Position #8

PDF at Guelph; PI: Dr. Mehrdad Hajibabaei

Summary: Our lab uses genomic methods to investigate biodiversity and its changes at various levels of organization and scales. This postdoctoral position will help advance the development of bioinformatic tools for the rapidly advancing field that uses metabarcoding and related approaches. This could involve the development of new tools or improvement of existing tools to be more scalable or user-friendly. Potential candidates should be comfortable working in a command-line Linux environment, and they should be familiar with a scripting language such as Python or Perl. Candidates should have experience in R and be comfortable performing basic statistical tests in R or Python as required. An interest in or experience implementing machine learning (ML) techniques using R or Python would be an asset but not required. Any previous experience with field work, molecular biology work, analyzing metabarcoding or other genomics data should be mentioned in your application. Our lab provides an excellent training environment for motivated candidates with a willingness to learn or further develop proficiency with scripting/coding/ML methods. Our team has expertise in ecology-evolutionary biology, bioinformatics, and computational biology. Your application should list your technical skills (platforms, languages, programs) and highlight relevant course work as well as how you have applied your technical expertise to address problems in the fields of ecology/evolutionary biology/genomics or related fields.

Position #9

PDF at Guelph/Vector Institute for Artificial Intelligence; PI: Dr. Graham Taylor

Summary: We seek a postdoctoral fellow to be based in the Machine Learning Group at the University of Guelph and affiliated with the Vector Institute for Artificial Intelligence, a network of more than 600 AI researchers. You are motivated to advance AI/ML research in the service of BIOSCAN's ambitious global mission. You will have the opportunity to work on projects that span computer vision and DNA sequence analysis. For vision, this involves pushing the limits of fine-grained recognition for taxonomic categorization using techniques such as self-supervised learning, generative models and sim2real. For DNA sequences, this involves graph representation learning to predict missing links and evolutionary paths from recovered structures. The data collected in BIOSCAN will also support learning joint visual-DNA representations. You have a strong publication record, preferably in international conferences such as NeurIPS, ICML, ICLR and CVPR. You are keen to raise awareness of biodiversity research in those communities. You have mastered Python-based frameworks such as PyTorch/TensorFlow/JAX. You also have experience managing experimental workflows on GPU-enabled clusters. You are open to and ideally experienced in cross-disciplinary collaboration.

Positions #10 - 11

PDF (x2) at McGill; PI: Dr. Melania Cristescu

Summary: Determining the number of species present at particular locations and quantifying how these assemblages vary in space and time is at the core of biodiversity science. The postdoctoral fellows will work with the BIOSCAN team to scale up molecular approaches based on eDNA and eRNA to study species dynamics by examining species composition at selected sites (terrestrial and aquatic) covering half the world's ecoregions (~2000 sites). Analyses will target arthropods and fungi which represent among the most diverse groups available. Candidates should have experience in working with eDNA, metabarcoding laboratory techniques, analysis of HTS data and a keen interest in ecological modeling.

Position #12

PDF at McGill; PI: Dr. Andrew Gonzalez

Summary: Understanding the extent and magnitude of human impacts on biodiversity is a core research objective of BIOSCAN and central to policy efforts aimed at meeting national and international biodiversity targets. Our aim is to assess how species assemblages vary in space and time using a novel detection and attribution framework for biodiversity change. The postdoctoral fellow will apply state-of-the-art statistical inference methods using essential biodiversity variables (a compact set of metrics describing the state of genomes, species, populations, or ecosystems) to provide a robust assessment of how biodiversity is changing across the 2000 sites in BIOSCANs dataset. This research will contribute to the information generated by BIOSCANs Global Biosurveillance System.

SFU
SIMON FRASER UNIVERSITY

amii

Position #13

PDF at Simon Fraser/Alberta Machine Intelligence Institute; PI: Dr. Angel X. Chang

Summary: We seek a postdoctoral fellow to help design machine learning algorithms for barcoding DNA sequences for BIOSCAN. This involves using current methods and developing novel algorithms for sequence alignment and clustering to match DNA sequences to known species and the discovery of new species, as well as taxonomic categorization. We are looking for candidates with experience working with self-supervised learning, contrastive learning, and current sequence modeling architectures. Candidates should also have a strong publication record, preferably in international conferences such as NeurIPS, ICML, ICLR, CVPR, ACL, and EMNLP. Strong candidates would be keen to raise awareness of biodiversity research in those communities and have mastery of Python-based frameworks such as PyTorch/TensorFlow/JAX. Strong candidates also have experience managing experimental workflows on GPU-enabled clusters and are open to and ideally experienced in cross-disciplinary collaboration. Familiarity with DNA sequencing and computational biology is a plus.

University of Victoria

Position #14

PDF at Victoria; PI: Dr. David Castle

Summary: This PDF will be focused on developing a Natural Capital Accounting (NCA) framework that integrates natural and social science and is inclusive of non-Indigenous and Indigenous perspectives about biodiversity (see PDF#15 below). The NCA will create an 'environmental profit and loss account' resembling an income statement, and a 'balance sheet' showing the gains and losses of natural assets viewed from both their quality and quantity. The NCA will be used to inform decisions, rapidly assess alternatives, monitoring the implementation and track distributional outcomes of decisions to evaluate their equity. Experience with ecosystem goods and services modelling and NCA approaches is required.

University of Victoria

Position #15

PDF at Victoria; PI: Dr. David Castle

Summary: This PDF will focus on the science-policy interface between the BIOSCAN project and all levels of government (Federal, Provincial, Territorial, Indigenous). Within the BIOSCAN project, an Integration Board will develop strategies for assembling natural and social science research findings to provide decision makers with integrated advice. The PDF will work with the Integration Board to generate and align BIOSCAN research to make it relevant to policy-making and decision-processes in government. Activities include mapping of stakeholders, knowledge of policy processes, and the alignment of research inputs to systems multi-level governance. Preferred candidates will have experience in science, technology and innovation policy.

University of Victoria

Positions #16 - 17

PDF and GS at Victoria; PI: Dr. Crystal Tremblay

Summary: BIOSCAN Canada will study biodiversity in six ecozones, in which there are diverse types of communities each with their own needs, perspectives, histories and cultural associations with biodiversity. Stakeholder analysis is required to account for different knowledge sources and perspectives. Engaging with Indigenous communities is particularly important as they have the deepest historical and cultural connections to the natural environment. We will follow the values and protocols for community-based and Indigenous-led research developed through the UNESCO Knowledge for Change (K4C) Consortium. For the PDF candidates are being sought with experience in participatory action research process (emphasizing knowledge co-creation, reciprocity, and horizontal decision-making) and community action and knowledge bridging. The PDF will collaborate with the PDF#14 described above. For the GS, a student with interest and experience in the mapping of community knowledge networks, geospatial techniques, and have worked with Coastal First Nations is being sought.

University of Victoria

Position #18

PDF at Victoria; PI: Dr. Julia Baum

Summary: Oceans harbour enormous biodiversity but are seriously undersampled. This postdoctoral position will explore the biodiversity of Pacific temperate coastal ecosystems and tropical coral reefs. Potential emphases include biodiversity scans, cryptic diversity and/or investigating how coral symbioses vary under climate change-amplified marine heatwaves as well local anthropogenic stressors. The postdoc will have access to archived samples, will coordinate collection of new samples in British Columbia, and COVID-permitting may also have opportunity to collect new samples in Costa Rica, Kiribati, Palau or other Pacific coral islands. The postdoc will also have opportunity to collaborate with scientists across the BIOSCAN network. Potential candidates should have a solid background in molecular ecology and be proficient at molecular laboratory work, bioinformatics pipelines, and statistical analyses, including experience coding in R and/or Python. Scientific diving experience would also be an asset.

UNIVERSITY OF WATERLOO

Position #19

PDF at Waterloo; PI: Dr. Tamer Ozsu

Summary: BIOSCAN deals with biodiversity data that comes in various forms and from numerous sources. This gives rise to typical big data management and analysis concerns. The PDF will be expected to have expertise in multi-modal data (structured and unstructured), data integration, data quality and large-scale data integration. The data management and analysis component will form a foundation for facilitating the work of domain scientists. The postdoctoral fellow will be expected to work in multidisciplinary teams with these scientists and the IT professionals within BIOSCAN.

Position #20

GS at Waterloo; PI: Dr. Paul Fieguth

Summary: The BIOSCAN team has an ambitious goal of mapping all species based on mitochondrial DNA sequencing. With remarkable progress on the biological side, significant remaining bottlenecks are in imaging and image classification. Recently purchased robotic imaging systems increase the throughput to 1.5 million high-resolution digital specimen images per year, so there is a great need for image classification. This PhD student will work with the BIOSCAN team to develop methods of machine learning classification to develop robust, pose-invariant image-based classifiers, applied to classify and count insects in images, each containing up to hundreds of insects in random pose, scale, lighting variations, occlusion, and possibly with some damage (e.g., bent or missing wings). The work is expected to build on existing vast CNN / DNN literature and network architectures for object extraction / localization and object recognition / classification.

Position #21

GS at Waterloo; PI: Dr. Lila Kari

Summary: The BIOSCAN program is harnessing new technologies to make DNA barcoding faster and less expensive. Therein lies a need to develop efficient DNA-based identification systems for the classification and clustering of DNA fragments at the species level, as one of the main goals of the project is to leverage the existing sequencing technologies to gather DNA barcodes of thousands of specimens simultaneously from a single sample. The Ph.D. candidate will work alongside the BIOSCAN team to develop machine learning algorithms to efficiently extract compositional information from mitochondrial DNA data. The successful applicant is expected to be familiar with the current literature in convolutional neural networks, representation and unsupervised learning, and natural language processing techniques.

Position #22

GS at Western Ontario; PI: Dr. Zoe Lindo.

Summary: Soil biodiversity is important for maintaining global ecosystem function and Canada's natural carbon capital. This scientific work will focus on species discovery and the study of soil biodiversity across a diverse Canadian landscape. The successful candidate will link biodiversity to ecosystem function through the development of unique taxonomic skills while contributing to the latest developments in DNA sequencing, and energetic food web modeling. Analyses will target soil microarthropods and address current and historic environmental factors, and spatial / temporal processes that structure these soil communities. The candidate should have experience in handling environmental DNA, metabarcoding laboratory techniques, and in remote field research.

Positions #23-24

PDF (x2) at York; PI: Dr. Elizabeth Clare

Summary: The interactions between species vary in time and space forming a web of ecological interactions which characterise ecosystems. Symbiome analysis involves the recovery of sequences from different taxonomic groups (bacteria, fungi, invertebrates, plants, vertebrates) from a single analysed specimen and can reveal the complex interactions between diverse taxa. These postdoctoral fellows will advance current symbiome protocols from proof-of-principle to optimization for four ecological systems of interest including insect pests of forest trees and pollinator syndromes. Candidates should have experience handling environmental DNA, metabarcoding and analysis of HTS data including animal, plant and fungal data. Ecological network analysis will be a benefit.

Position #25

PDF at York; PIs: Dr. Sandra Rehan & Dr. Laurence Packer

Summary: The bee holobiome incorporates species' population genomics, microbiomes and environmental DNA. This postdoctoral researcher will examine wild bee DNA to document species ranges, isolation by distance and environmental stressors. This postdoc will examine wild bee symbioses and potential pathogens in their environments using combined urban ecology and museomics approaches. The candidate should have experience with bioinformatics and analysis of genomic and/or transcriptomic data. Experience with bees, microbiome, and/or population genetics would be an asset.