MSIF Workshop Panel 1

Diversifying and expanding facility user bases to optimize benefits for Canada / Diversifier et augmenter le nombre d’utilisateurs et utilisatrices des installations afin d’optimiser les retombées pour le Canada

Moderator: Volker Gerdts, Director & CEO, VIDO
Monique Albert, Chief Operating Officer, CBG
Jodi Cooley, Executive Director, SNOLAB
Alexandre Forest, Executive Director & COO, Amundsen Science

November 2, 2023
Introduction: Centre for Biodiversity Genomics

2005: Established as founding unit in the Biodiversity Institute of Ontario

2022: Transitioned to a separate University Research Centre

Vision: A world where we read the biosphere with DNA

Mission: Foster global biomonitoring system by providing 3 services: organization, DNA sequencing, and informatics
Introduction: The Motivation

Decline in 3000 vertebrate species since 1970
Decline in insect biomass since 1980
Introduction: Barcode Region for Animal Kingdom

Barcode Region

Barcode is a millionth of the genome

Genome Size

Barcode

600M bp

658 bp

COI

Barcode Region

Genome Size

Barcode
Introduction: *Species Discovery & Ecozone Validation*
Introduction: Species Interactions

- Hymenoptera
- Fungus
- Plant
- Diptera
- Nematode
- Wolbachia

Plant

- > 50%
- 10-50%
- < 10%
Introduction: Biodiversity Genomics Services

Biorepositories
- SPECIMENS: >10M
- IMAGE LIBRARY: >8M
- DNA EXTRACTS: >12M

Sequencing
- DNA BARCODING CAPACITY: 3M SPECIMENS PER YEAR
- METABARCODING CAPACITY: 20K BULK SAMPLES PER YEAR

Informatics
- 14M+ DNA BARCODES
- 1M+ SPECIES
Introduction: **Strong Usership in 2022-23**

**Biorespositories**
- 3M specimens + DNA extracts added
- 8K specimens + DNA extracts loaned

**Sequencing**
- 2.1M individual specimens sequenced
- 5K bulk samples sequenced
- 300 external users from 30 nations

**Informatics**
- 1.9M unique IP visits
- 7.2M ID requests fulfilled
- 94M records analysed
- 30 TB data accessed
User Diversity: Demographics

Users of sequencing services

Users of Informatics services

- Commercial
- Universities and research institutes
- Government

Other

- 3%
- 85%
- 12%

1.9M Unique Visitors
User Diversity: Categories

SECTOR

LOCATION

CITIZENS and COMMUNITIES

DEVELOPING NATION STATUS
User Diversity: Categories

RELATIONSHIP

TYPE OF REQUEST

IMPACT
### Expanding User Base: Influencing Factors

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<thead>
<tr>
<th>CONTRIBUTING FACTOR</th>
<th>EXPLANATION</th>
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<tbody>
<tr>
<td>1. PRODUCTS AND SERVICES</td>
<td>Range; suitable to needs of users</td>
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<td>Specimen quality; DNA integrity; data robustness</td>
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<td>5. AWARENESS and RELATIONSHIPS</td>
<td>Reach and reputation; collaborations</td>
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Expanding User Base: Influencing Factors

1. PRODUCTS AND SERVICES
   - Range; suitable to needs of users
   - Comprehensive offerings
     - User feedback
     - Product development

2. QUALITY
   - Specimen quality; DNA integrity; data robustness
   - Cold storage
     - Optimized methods
     - Validated data

3. EASE OF ACCESS
   - Friction: user experience; responsiveness
   - End-to-end solutions
     - User friendly interfaces
     - Capacity and Openness

4. PRICING
   - Affordability; cost-benefit to user
   - Aggressive cost management
     - Low margins
     - Leverage grant opportunities

5. AWARENESS and RELATIONSHIPS
   - Reach and reputation; collaborations
   - Marketing/communications/outreach
     - Fostering a user base
Expanding User Base: User and Expert Feedback

1. Address gaps to match user needs/demand

2. Develop technologies to advance capabilities

- Track trends in service requests
- Partnerships committee
  - “voice-of-customer”
  - usefulness/performance
- User surveys
  - Satisfaction
  - Future needs
- Science Committee
  - Advice on:
    - technology
    - methodology
Expanding User Base: Aid Access

BOLD SYSTEMS
Barcode of Life Data Systems Handbook

A web-based bioinformatics platform supporting the DNA barcoding of animal, plant, and fungal species.
Expanding User Base: Raise Capacity

BOLD 4 (2015): supports up to 10M records
BOLD 5 (2024): support up to 100M records

10 fold increase in capacity

3 fold increase in capacity over 3 years
(from 1M to 3M)

Specimen Processing and DNA Barcoding

Data Systems
Expanding User Base: Reduce Costs

Digital imaging costs per specimen

<table>
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<tr>
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<th>pre-Keyence</th>
<th>post-Keyence</th>
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<td># specimens/year</td>
<td>70K</td>
<td>3M</td>
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Comparison of Digital imaging costs per specimen:
- **pre-Keyence**: 70K specimens/year
- **post-Keyence**: 3M specimens/year

Extraction and sequencing costs

- **Sanger**
- **Sequel + GF**
- **Sequel + SPRI**
- **Sequel + SPRI + reusable plastics**
- **ONT**

- **TODAY**
- **COMING SOON**

**Comparable cost per unit**

- **70K specimens/year**
- **3M specimens/year**
Expanding User Base: Marketing and Outreach

Courses, workshops, training sessions
Public events (hosted): symposia, conferences, open houses, group tours
Media relations: interviews, press releases, broadcasts, podcasts
Stakeholder events: presentations, booths at trade shows, conferences
Expanding User Base: Expand iBOL Consortium
Expanding User Base: Lead Global Research Programs

$120M
2010 2015
BARCODE 500K
20 Nations

$180M
2019
BIOSCAN
40+ Nations

$800M
2045
PLANETARY BIODIVERSITY MISSION
50+ Nations
Expanding User Base: Support Distributed Facilities
Challenges: 

**Broaden the User Base**

Generate data for half of the world’s 867 ecoregions

Seek synergy with users

Adjust proportion of data users from high-impact sectors

Knowledge to manage biodiversity for:
- Policymakers
- Government
- Communities
- Conservation agencies
- Environmental assessment consultants
Diversifying and expanding the facility user base to optimize benefits for Canada
Alexandre Forest, Amundsen Science

MSIF Workshop 2023
Saskatoon, 2 November 2023
CCGS Amundsen

2,600+ research days at sea since 2003

300,000+ nautical miles travelled since 2003

3,000+ scientists from 25+ countries

2,100+ publications and datasets

140+ teams in 45+ programs since 2003

$55M+ of state-of-the-art scientific equipment
Primary on-board users
- 85% Canadians
- 60% universities
- 80% HQPs
- 35% students (PhD, MSc, post-docs)
- 50-50% men/women
- 50% below 30 years

Second-level users (data users)
- 65% Canadians
- 75% universities
- 65% HQPs
- 30% students (PhD, MSc, post-docs)

No data users without primary users

CCGS Amundsen user base ≈ 1100 / year
1 out of 6 users board the ship
On-board users: both a scientific and human experience

Often “life-transformative”...
What diversity mean: Diversity at the program level

Simpson’s Diversity Index increased since the creation of Amundsen Science, but reaches a plateau
Example: Imappivut 2023
First primary program led by an Inuit organization

- Nunatsiavut leading in collaboration with key academic and federal partners
  - MUN / Marine Institute, U of C, NRCan & DFO, AS
- Holistic view of research, onboard training
- First Inuit Chief Scientist
- Research & cultural exchange day in Nain
Diversity at the individual level
Our commitment to Equity, Diversity and Inclusion

Amundsen Science is committed to develop and adopt comprehensive EDI practices. Some actions taken recently to broaden the scope of our user’s community and help people feel safe on board:

- Form a committee to identify strategies to improve EDI practices;
- Adopt an Equity, Diversity and Inclusion Action Plan;
- Create a Code of Conduct for Expedition Participants.
- Identify safe contact persons onboard and onshore.
- Facilitating Inuit participation and supporting Indigenous-led research

Strengthening user engagement and diversifying our user community will contribute to the sustainability and growth of the facility.
Strategies for diversifying and expanding the user base

Reach out, reach out, reach out!

- In-person & virtual visits to universities, departments, and communities
- Organization of workshops and participation to relevant conferences
- Increase public awareness: newsletter, website, social media, outreach, etc.
Key communication and outreach activities

Social media

Newsletters

Annual Amundsen Science Planning Workshop

Website

https://amundsenscience.com/

Upcoming conferences

- ArcticNet Science Meeting, Iqaluit, December 2023
- Arctic Science Summit Week, Scotland, March 2024
- Canadian Polar Data Workshop V, Halifax, May 2024
Users become ambassadors since our most important success criterion is their satisfaction and the achievement of their scientific objectives.

1. Drive the science program of the *Amundsen*
2. Drive the development of the central equipment pool
3. Are consulted regularly through the Annual Planning Workshop and other venues
4. Their funding is leveraged by AS for the operation of the ship and new equipment
Challenges to diversifying and expanding the user base and mitigation approaches

Challenge 1
- Increasingly high ship-time costs that prevent access to users who may have no or limited access to ship-time funding

Challenge 2
- Costly and complex logistics associated with the mobilization and access to the ship that new users may find discouraging

Challenge 3
- Lack of awareness from users who may still believe that the Amundsen is always fully booked only used by a few large programs
Challenges to diversifying and expanding the user base and mitigation approaches

Mitigation approach 1
• Use of a larger share of the MSI funding to support innovative projects from atypical new users

Mitigation approach 2
• Increased support from Amundsen Science to aid in the mobilization and implementation of under-represented projects

Mitigation approach 3
• Continuously reaching out to the national and international community and to Inuit Nunangat organizations
Thank you!  
Join us!
SNOLAB Overview

Jodi Cooley
Executive Director | SNOLAB
Professor of Physics | Queen’s University
Adjunct Research Professor | SMU
Introducing SNOLAB

• SNOLAB hosts rare event searches and measurements. It’s located 2 km underground in the active Vale Creighton nickel mine near Sudbury, Ontario, Canada.

• SNOLAB is operated jointly by University of Alberta, Carleton University, Laurentian University, University of Montreal, and Queen’s University.

• SNOLAB operations are funded by the Province of Ontario, and the Canada Foundation for Innovation.
Why Underground?

- A growing community of users needs environments that are both shielded from radiation and clean to achieve sensitivity for rare event searches.
- Astrophysical systems emit high energy radiation which create muons in Earth’s atmosphere
- SNOLAB has the lowest muon fluxes available
- Clean room throughout the underground facility

Guo et al., arXiv:2007.15925v2
The science at SNOLAB is focused on increasing our understanding of the particles and forces that have shaped the universe.

- What is the nature of dark matter?
- What is the nature of the neutrino?

SNOLAB collaborates with scientific research required deep underground facilities.

- Neutrino observatories (solar, supernovae, geo, reactor, etc.)
- Effects of radiation on biological systems
- Environmental monitoring (nuclear non-proliferation, aquifers, etc.)

SNOLAB is interested in pursuing new collaborations and opportunities in emerging areas of underground science

- Effects of radiation on quantum technologies
SNOLAB by Numbers

1000+ users/collaborators
25% of those users/collaborators are Canadian researchers
24 Our international collaborators come from 24 countries
164 Our international collaborators come from 164 institutions

- Participating Countries
What Does Diversity Mean to SNOLAB?

• World class science and research excellence requires contributions from diverse perspectives.
• People are the heart of SNOLAB’s success:
  - Strive to achieve and maintain diversity in our staff, researchers, technicians, engineers, operations, corporate professionals and collaborators
• SNOLAB is committed to a diverse research portfolio.
  - Host experiments that represent diverse and multidisciplinary research topics.
  - Balance large-scale, mid-scale and small-scale programs.
  - Balance staging of experiments: conceptual design, technical design, installation, commissioning, operating and decommissioning.
Excellent science

Drive breakthrough discoveries at the frontiers of underground science.

Expected outcomes:
- Cementing of Canada’s leadership in deep underground science
- A stronger, more competitive Canada in scientific discovery
- More Canadian researchers positioned as global leaders

Cutting-edge infrastructure

Continuously improve our research infrastructure to remain state of the art.

Expected outcomes:
- Attraction of the most advanced international experiments to Canada
- Greater global impact and enhanced reputation of Canada’s underground science infrastructure

Skilled people

Foster and develop diverse talent in an inclusive environment.

Expected outcomes:
- Canadian leadership in advancing EDI in research facilities
- A new generation of HQPs prepared to discover and innovate in a global economy
- Greater access to STEM skills and opportunities in Northern Ontario
Strategies and Barriers to Expanding and Diversity SNOLAB User Base

• Pursue a diverse science portfolio anchored by our world leading dark matter and neutrino programs, and open to new science opportunities in emerging areas of underground science.
• Host experiments at a different stages of development
• Provide state-of-the-art infrastructure
• Encourage and foster a welcoming, collaborative environment for collaborations who use the facility.
SNOLAB – At a Glance

**Cube Hall**  
DEAP-3600, PICO500, NEWS-G  
Potential for large project after 2026

**Halo Stub**  
HALO  
Potential breakthrough for future expansion

**Ladder Labs**  
PICO40, SBC, CUTE, SuperCDMS

**Plants**  
UPW, LN2, Scintillator, Te Diol, TeA

**SNO Cavern**  
SNO+, SNO+ Te  
Potential for large project after 2035

**Low Background Lab**  
HPGe assay/screening, XRF, Radon Boards, FLAME  
XIA, CTBT Dual HPGe

**Cryopit**  
nEXO/LEGEND

**Electrical Shop**  
SENSEI, DAMIC, OSCURA

**Machine Shop**  
J-Drift

**Life Sciences Lab**  
Chemistry, REPAIR

**Cube Hall**  
DEAP-3600, PICO500, NEWS-G  
Potential for large project after 2026

5000 m² of class 2000 cleanroom underground.  
<2000 particles >0.5 μm in diameter per ft³
Infrastructure: Surface Spaces & Support

Become an intellectual hub that fosters collaboration and connection.

• Assign dedicated staff to assist domestic and international users in the navigation of logistical and cultural aspects of their long-term stay;
• Create a formal user support system that users can rely on;
• Provide dedicated physical space to encourage collaboration and connection;
• Promote equity, diversity, and inclusivity.

Create Welcoming Environment - SNOLAB Summer of Science

• SNOLAB will host a series of meetings and workshops in Summer 2024
• Invited senior scientists in-residence will give/lead topical and relevant lectures and discussions in weeks between.
• Challenge: Need to find funding to offset housing and travel costs for student participants.
Infrastructure: Underground Spaces

Improvements to the underground environment.

- “Drys” are in need of renovations with particular attention paid to equity for those who need more privacy.
- Plans to create wellness spaces underground.

Two-fold challenge:
- Balancing the various demands on a strained budget.
- Execution needs to be staged in order to keep laboratory requirements for cleanliness.
Infrastructure Challenge: Competition

- Underground laboratories around the world are making significant investments in their infrastructure.
- Boulby Underground Facility (UK) is planning an upgrade which includes doubling their staff and expanding their underground facility to include a large 25 m³ cavern to attract a next generation dark matter experiment.
- LGNS (Italy) will spend more than 4 times their yearly operating budget to update lab infrastructures.
- Homestake Underground Laboratory is also expanding their underground space.

Conclusions

LNGS is preparing for the next era of challenges in particle, astroparticle, and nuclear physics and astrophysics.

In 2023-2024, LNGS will spend more than 4 times the yearly running budget to update the lab infrastructures.

The new infrastructure will be focused both on refurbishing the current Lab structure and on adding new facilities to allow new technological and scientific developments.

New ideas and new discoveries will make this effort worthwhile: keep doing great science.
• SNOLAB life cycle process whereby SNOLAB supports experiments through their life cycle at the lab.
• All collaborations who seek space allocations are required to have both an EDI plan and a code of conduct which is reviewed as part of the life cycle process for an experiment.
Conclusions

• SNOLAB is a clean, underground laboratory hosting a variety of experiments.
• To retain its global leadership, SNOLAB recognizes it is essential to weave diversity into the culture of the lab.
• Diversity is woven through the three pillars of our 2023-2029 Strategic plan: Excellent Science, Cutting-edge infrastructure, and Skilled people.
• I am very excited about the opportunities that SNOLAB provides the scientific community. I believe SNOLAB well positioned to attract world-class experiments and support major discoveries in the next decade.