Who’s living in my community?
Community-engaged undergraduate research investigating local insect biodiversity

Mindi Summers & Kyla Flanagan
biodiversity.ucalgary.ca
taylorinstitute.ucalgary.ca/undergraduate-research-initiative
Goals for this session

1. Outline the UCalgary undergraduate research framework used to design a biodiversity focused Course-based Undergraduate Research Experience (CURE)
2. Share experiences in fostering community-partnerships
3. Discuss how to engage students as collaborators in local biodiversity research
Introductions

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College of Discovery,
Creativity and Innovation
Senior Instructor,
Department of Biological Sciences UCalgary
UCalgary Experiential Learning plan 2020 - 2025

“Experiential learning (EL) is learning-by-doing that bridges knowledge and experience through critical reflection....they empower learners to enhance individual and collaborative skills such as complex problem solving, professional practice skills, and teamwork. The EL process prepares students to take on roles as active citizens and thrive in an increasingly complex world.”
CUREs are courses that have been designed to include a significant research component. At UCalgary, our focus is to explore the possibilities for incorporating research into the curriculum for high enrolment first- and second-year courses.
Lecture learning outcomes: By the end of this course, you will be able to...
1) Describe the diversity and evolution of insects using phylogenetic trees, and discuss key evolutionary events in insect evolution.
2) Describe the structure function relationships that allow insects to feed, move, reproduce, and maintain life (respiration, excretion, ionic and osmotic regulation, and control/nervous systems).
3) Compare and contrast ecology - how different groups of insects feed, reproduce, develop, defend themselves, communicate, behave, and interact with their environment.
4) Discuss insect biology and ecology in the context of conservation, management, and other human-insect interactions.
5) Find and critically evaluate science communication on insects in different formats.
6) Share knowledge on a topic through writing, visualizations, video, or auditory podcast format.

Lab learning outcomes: By the end of this course, you will be able to...
1) Collect insects using active and passive methods.
2) Curate online and physical insect collections with metadata sufficient for scientific research.
3) Curate physical insect collections by pinning, and spreading and pointing if necessary.
4) Identify insects to order, and for seven major orders to more inclusive taxonomic ranks (e.g., super-family, family, and in rare cases genus or species).
5) Contribute biodiversity records to international scientific databases.
6) Critically reflect on and revise your approach to scientific research.
7) Give and receive appreciation and constructive coaching feedback.
May 26, 2020

UCalgary named a Bee Campus for bee-ing stewards of our landscape
Commitment to safeguarding pollinators and their habitats secures place on list

Plant-pollinator study (summer)
ZOOL 435: biodiversity survey

City of Calgary Urban Alliance
Contract & Taylor Institute for Teaching and Learning Pilot
DISCOVERY: Exploring biodiversity in City of Calgary

City of Calgary Urban Alliance Contract & Taylor Institute for Teaching and Learning
DISCOVERY: Zoology 435 Insect Survey Results


City of Calgary Urban Alliance Contract & Taylor Institute for Teaching and Learning
DISCOVERY: Zoology 435 Insect Survey Results
## DISCOVERY: Zoology 435 Insect Survey Results

<table>
<thead>
<tr>
<th>Category</th>
<th>City of Calgary</th>
<th>Total Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of digital observations on iNaturalist platform</td>
<td>2264</td>
<td>3396</td>
</tr>
<tr>
<td>Number of physical specimens collected</td>
<td>4795</td>
<td>6900</td>
</tr>
<tr>
<td>Number of physical specimens donated to UofC teaching collection</td>
<td>1397</td>
<td>3474</td>
</tr>
</tbody>
</table>
# DISCOVERY: Zoology 435 Insect Survey Results

<table>
<thead>
<tr>
<th>Number of identified</th>
<th>City of Calgary</th>
<th>Total Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orders</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>Families</td>
<td>113</td>
<td>127</td>
</tr>
<tr>
<td>Genera</td>
<td>183</td>
<td>265</td>
</tr>
<tr>
<td>Species</td>
<td>207</td>
<td>291</td>
</tr>
<tr>
<td>Introduced species</td>
<td>23</td>
<td>25</td>
</tr>
<tr>
<td>Threatened species:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vulnerable and endangered</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>on iNaturalist^</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COSEWIC Listed Species for Alberta</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

*City staff buzzing about endangered bee discovery as boulevard preps for another season*

2 gypsy cuckoo bumblebees spotted in the city's bee corridor, which is gearing up for its third year

CBC News - Posted: Apr 22, 2019 2:55 PM MT | Last Updated: April 22, 2019

![Image of gypsy cuckoo bumblebee](https://via.placeholder.com/150)

*The gypsy cuckoo bumblebee, seen right, has seen a decline in population over the past 30 years in Canada and was added to the endangered list in May 2014. (Ivar Leidus/Wikimedia Commons)*
Why should we care about insects?

A gallery of science communication projects created by students in Zoology 435 - Winter 2020, University of Calgary. Projects are organized by topic, and coloured by type of dissemination (infographics = yellow; podcast = purple; video = blue; social media = pink; and other formats = green. Please provide likes and positive comments for our student researchers and science communicators!

https://biodiversity.ucalgary.ca/resource/insect-science-communication-gallery/
STUDENT REFLECTION: Critical reflection exercises

“We do not learn from experiences, we learn from reflecting on experiences.” John Dewey

Weekly appreciation and constructive coaching feedback led by Graduate Teaching Assistants

Mid- and final project reflections

Your statement should describe:

• what you have learned so far (focus on skills and conceptual knowledge, rather than surface facts), including evidence of this learning (e.g., here is an insect I pinned at the start, here is one I have pinned now);
• what you have found most exciting or engaging in your research;
• what you have done that has helped your learning or motivation to complete your research;
• future goals: what you are interested in learning about next or areas of improvement.

You can also respond to the following questions:

• How did I learn the new knowledge and skills that I have now? What has helped or hindered my learning?
• Why does what I am learning matter? How does this learning connect to course themes, learning outcomes, and my own goals? How is this learning important to me?
• What will I now do differently as a result of this learning? What actions can I commit to?
• Why do my learning goals matter? How do they connect to this course or my future career?
REFLECTION: Top Benefits to Taking CURE Course

Percent of students reporting large to very large benefit in CURE survey (Lopatto, 2008):

- Understanding of the research process in your field (82%)
- Learning to work independently (83%)
- Understanding science (81%)
- Learning ethical conduct in your field (78%)
- Tolerance for obstacles faced in the research process (75%)
- Becoming part of a learning community (75%)
REFLECTION: Gains in Research Skills

Percent of students reporting “extensive” or “much” gains in CURE survey (Lopatto, 2008):

- Project in which students have some input into the research process and/or what is being studied (91%)
- Collect data (90%)
- Become responsible for a part of the project (88%)
- Work individually (87%)
- Analyze data (71%)
- Work in small groups (69%)

University of Calgary Teaching and Learning Grant
**REFLECTION: Project ownership**

Percent of students reporting “strong agree” or “agree” in Project Ownership Survey (Hanauer, 2014):  

<table>
<thead>
<tr>
<th>Statement</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>My research project was interesting.</td>
<td>94%</td>
</tr>
<tr>
<td>I faced challenges that I managed to overcome in completing my research project.</td>
<td>92%</td>
</tr>
<tr>
<td>My research project was exciting.</td>
<td>91%</td>
</tr>
<tr>
<td>The findings of my research project gave me a sense of personal achievement.</td>
<td>94%</td>
</tr>
<tr>
<td>I had a personal reason for choosing the research project I worked on.</td>
<td>53%</td>
</tr>
<tr>
<td>I was responsible for the outcomes of my research.</td>
<td>91%</td>
</tr>
<tr>
<td>The research question I worked on was important to me.</td>
<td>72%</td>
</tr>
<tr>
<td>In conducting my research project, I actively sought advice and assistance.</td>
<td>92%</td>
</tr>
<tr>
<td>My findings were important to the scientific community.</td>
<td>91%</td>
</tr>
<tr>
<td>My research will help to solve a problem in the world.</td>
<td>80%</td>
</tr>
</tbody>
</table>

University of Calgary Teaching and Learning Grant
Dec. 8, 2020

Bug-eyed for research: Undergrads catalogue Calgary’s insects
Zoology course empowers students to conduct research, contribute new insect biodiversity knowledge

April 22, 2021

Changemakers recognized in UCalgary’s 2021 Sustainability Awards
Annual awards, announced today to mark Earth Day, celebrate sustainability leadership at UCalgary

- Sustainability Experiential Learning Award
  - Zoology 435 team
  Designing a course-based research experience that encourages experiential learning about the essential role of insects in maintaining functioning ecosystems in Alberta
Acknowledgements - Funding

University of Calgary teaching & learning grants
- Advancing creativity in postsecondary STEM contexts (2019-present)
- Engaging students in authentic research in Biological Sciences through the use of collaborative course-based undergraduate research experiences (CUREs) (2018-present)

Taylor Institute for Teaching and Learning
- Course-based undergraduate research pilot program (2020)

City of Calgary Urban Alliance Contract
- Native bee biodiversity and their floral relations (2020 – 2021)

Andrew W. Mellon Foundation internal subgrant competition
Reflections

• Is there an existing CURE that you have been interested in trying in your course?
• What community partners may be appropriate for the classes you teach?
• How might this research framework be incorporated into your classes?
  • How can we engage students' curiosity?
  • What challenges exist in engaging students in the process of discovery and creating knowledge?
  • How might you help students articulate the skills learned through research with critical reflection?
  • What opportunities are there to disseminate student work?
• How can we support instructors developing CURES?
Ideas and Questions?