BEECON 2019 PROGRAM

9:00 am to 9:30 am	**Registration and Reception**

PRESENTATIONS

9:30 am to 9:45 am	The heritability of detoxification in honey bees *Nadia Tsvetkov, York University*
9:45 am to 10:00 am	Examining the variation of neonicotinoid tolerance in the honey bee *Simran Bahia, York University*
10:00 am to 10:15 am	Bumble bee queen abundance and diversity in farms and natural areas *Kayla Mundy-Heisz, University of Guelph*
10:15 am to 10:30 am	Per-capita productivity in bumble bees: Michener's Paradox is an artifact of scale *Evan Kelemen, York University*
10:30 am to 10:45 am	Don't leave home without your phone! Citizen Science & Bumble Bee Watch *Victoria MacPhail, York University*

10:45 am to 11:00 am	**COFFEE BREAK** **Stephen Humphrey and Sarah Peebles: "Odes to Solitary Bees"**
11:00 am to 11:30 am	**Keynote Speaker:** Diversity of bees in Mexico and the current situation, given the loss of pollinators ***Dr. Ricardo Ayala, Universidad Nacional Autónoma de México***
11:30 am to 11:45 am	Toward a better understanding of the Mexican *Lasioglossum (Dialictus)*: First look at some new taxa *Joel Gardner, University of Manitoba*
11:45 am to 12:00 pm	What's on the menu? Exploring flower choice, decoy effects and urban agriculture with bees *Tanya Latty, University of Sydney*
12:00 pm to 12:15 pm	Social variation among Lasioglossum (Dialictus) species from the Niagara region *Lyllian Corbin, Brock University*
12:15 pm to 12:30 pm	*Epeolus*: one genus or two genera? Resolving the taxonomic position of the mostly Neotropical "*Trophocleptria* group" *Thomas Onuferko, Canadian Museum of Nature*

12:30pm to 1:30pm	**LUNCH BREAK**

1:30 pm to 1:45 pm	Do mass-provisioning bees fit the current Temperature-Size Rule? *Jessica de Haan, Brock University*
1:45 pm to 2:00 pm	Global- and local-scale impacts of the western honey bee (*Apis mellifera*) on plant-pollinator mutualisms in natural habitats *Keng-Lou James Hung, University of Toronto*
2:00 pm to 2:15 pm	Effects of land use on wild bee functional and phylogenetic diversity *Katherine Odanaka, York University*
2:15 pm to 2:30 pm	The Himalayan Honeybee, *Apis laboriosa*: distribution and notes on its ecology *Gard W. Otis, University of Guelph*
2:30 pm to 2:45 pm	Recombination rates in advanced eusocial insects are among the highest in the multicellular Animalia: sex in the social city *Clement Kent, York University*
2:45 pm to 3:00 pm	Demographic polymorphism of the solitary sweat bee *Lasioglossum zonulum* *Alex Proulx, Brock University*

3:00 pm to 3:30 pm	**COFFEE BREAK** **Stephen Humphrey and Sarah Peebles: "Odes to Solitary Bees"**
3:30 pm to 3:45 pm	Maternal manipulation and the formation of social hierarchies in the subsocial bee, *Ceratina calcarata* (Hymenoptera: Apidae) *Sandra Rehan, York University*
3:45 pm to 4:00 pm	Characterization of vitellogenin in bees *Madiha Hafeez, Brock University*
4:00 pm to 4:15 pm	Conducting laboratory toxicity tests with *Bombus impatiens* and Cyantraniliprole *Raidin Brailsford, York University FES*
4:15 pm to 4:30 pm	Social modularity: conserved genes and regulatory elements underlie caste-antecedent behavioural states in an incipiently social bee *Wyatt Shell, University of New Hampshire*
4:30 pm to 4:45 pm	Mysteries of the Sable Island Sweat Bee *Miriam Richards, Brock University*
4:45 pm to 5:00 pm	Investigating the chronic effects of environmental stressors on populations of wild bees *Emily Agar, University of Guelph*
5:00 pm to 5:15 pm	Closing remarks *Laurence Packer, York University*

5:15 pm to 5:30 pm	**SOCIAL HOUR & MINGLING**

The heritability of detoxification in honey bees
Nadia Tsvetkov, York University

The toxicity of neonicotinoids (NNIs) varies greatly between honey bee sub species. In order to investigate the potential genetic factors influencing the different tolerances to NNIs, we exposed honey bee workers to an NNI and recorded their 24-hour survival rate. We then genotyped the bees using microsatellites and found a statistically significant effect of patrilines on mortality. Afterwards, we sequenced three detoxification genes from 100 bees in order to determine the allelic variation between the patrilines with the most extreme survival rates. The effects of NNIs on honey bees is still a hotly debated topic, understanding the genetic mechanisms behind the natural variation of NNI detoxification could help reconcile seemingly contradicting results in the scientific literature.

Examining the variation of neonicotinoid tolerance in the honey bee
Simran Bahia, York University

Canadian honeybees have experienced high colony mortality in recent years with neonicotinoid usage on crops being a major contributing factor. Neonicotinoids are a class of agricultural pesticides that are chemically similar to nicotine. They are highly agonistic to insect nicotinic acetylcholine receptors (nAChRs), compared to the mammalian nAChRs. Honey bees tend to be more sensitive to N-nitro neonicotinoids (imadocloprid, clothianidin, thiamethoxam) compared to the N-cyano class (thiacloprid) due to the latter being more easily metabolized by the honeybee. Here we examine if honey bees that survive exposure to the N-nitro neonicotinoid clothianidin have different levels of expression of specific detoxification enzymes (e.g. CYP9Q1-3, a family of cytochrome p450 monooxygenases responsible for metabolizing neonicotinoids) relative to honey bees that die after exposure to clothanidin. Nine-day old bees were starved for 4 hours, before being fed 20ul of sugar solution which contained a field realistic dose (4.6 ppb), LD50 dose (29 ppb) or no (control) of clothianidin for 2 hours. Only bees which had consumed 90% of their solutions were used in the analysis. The bees were then given regular sugar solution and after 24 hours, they were either noted as dead or alive before being frozen at -80oC. RT-QPCR against CYP9Q1-3 was then completed on the brain, malphighian tubules and ventriculus of the bees.

Bumble bee queen abundance and diversity in farms and natural areas
Kayla Mundy-Heisz, University of Guelph

Bumble bees face a myriad of stressors that lead to declines, including pathogens and disease, climate change, pesticides, habitat loss (quality and quantity) and invasive species, all of which can lead to decline. In the spring, bumble bee queens must first establish a nest. Scouting of an appropriate nest site occurs shortly after emergence from the hibernation chamber and can last a few days to several weeks. During this time, queens travel to find floral resources to feed themselves and their growing brood. These flowers may be in backyards, urban parks, road verges, conservation areas, provincial parks and field edges. Natural areas would be an ideal place for the harbouring of bumble bee diversity as they are relatively unmanaged pieces of land and on the opposite end of the spectrum, farm sites are highly managed pieces of land and we would not expect high diversity in farm fields. We compared natural areas (conservation areas and provincial parks) to farms (field edges) to determine if there was any difference in the abundance and diversity of bumble bee queens in these two areas. We also looked at the foraging and nest searching behaviour that occurred in these two categories. Additionally, we look at the density and diversity of floral resources within natural areas and farms.

Optimal group size relies on the interplay of ecological factors and factors intrinsic to the group
Evan Kelemen, York University

Optimal group size relies on the interplay of ecological factors and factors intrinsic to the group. In a seminal paper, Michener (1964) showed in social Hymenoptera a per capita decrease in colony performance as group size increased suggesting that selection should favor smaller colonies than what we observe, a phenomenon known as Michener's Paradox. Michener found this paradox in most species examined except for bumble bees (*Bombus spp.*), however, this may be due to methodological differences as productivity in other species were measured from instantaneous censuses of colonies, while bumble bee productivity was measured from lifetime success. Therefore, does time scale affect our measure of group productivity? We tested if the effect of colony size on productivity changes when we measure productivity at discrete time points vs. over the lifespan of a colony in *B. impatiens*. We found that the lifetime productivity did not decrease per capita with colony size but productivity at discrete time points did decrease. These results suggest that is important to consider timescale when measuring group productivity as the benefits of group size may not be instantly apparent.

Don't leave home without your phone! Citizen Science & Bumble Bee Watch
Victoria MacPhail, York University

A common roadblock to species conservation efforts is a lack of awareness and data. Citizen science is a growing field that can help as volunteers can collect data over a broader spatial and temporal coverage than a research team could often cover alone, while increasing their own knowledge. The Bumble Bee Watch program has users take and submit photos of bumble bees that are then identified by regional experts. Results will be presented that show the power of combining both researcher and citizen science data to answer ecological questions and increase conservation actions for bumble bees. Over 36,000 records representing 40 different species, including >1,000 records of four at-risk species, have been submitted. This data is helping to fill knowledge gaps related to basic biology (e.g. phenologies) and distribution (e.g. range expansions). Data is used in species status assessments, property management decisions, and research into topics from habitat suitability to conservation breeding, further leveraging the impact of a single observation. Bumble Bee Watch has increased awareness of the diversity of bumble bees and improved identification skills in its participants. Many participate because they want to learn about the species in their area, contribute to science, and help save the bees.

Keynote Speaker:
Diversity of bees in Mexico and the current situation, given the loss of pollinators
Dr. Ricardo Ayala, Universidad Nacional Autónoma de México

Bees are considered within the more important pollinators of wild and cultivate plants; they provide an essential ecosystem service that results in the reproduction of many plants. The known bee fauna of México consists of six families, 141 genera, 1910 currently recognized species. The richness of the families is: Apidae with 668 species, Andrenidae 537, Megachilidae 363, Halictidae 244, Colletidae 102 and Melittidae 11. The five most diverse genera are *Perdita* with 234 species, *Megachile* 113, *Protandrena* 102, *Andrena* 95 and *Lasioglossum* 90. Due to gaps in faunistic studies, the bee fauna of Mexico is certainly richer and may exceed 2400 species, considering the inadequate sampling in this floristically diverse country. Despite their ecological and economic importance, bees are facing threats from the increasing loss of habitats, thereby, it is urgent to conduct more studies for the conservation of these pollinators. In recent years, the interest in meliponiculture has emerged in Mexico, with the management of *Scaptotrigona mexicana* in the states of Puebla, San Luis Potosí and Veracruz, something similar occurs with *Melipona beecheii* in Quintana Roo, Yucatán and Campeche the Maya area, where colonies of

this bee are grown for their honey and propolis appreciated for their medicinal qualities. Economically in Mexico bumblebees are important (after *Apis*), with increased management as a pollinator in the last 20 years for indoor agriculture. For this reason, interest has arisen in the study of *Bombus ephipiatus* and *B. wilmattae*, species with potential to be used in agricultural pollination. However, the bees in Mexico face additional problems since new agrochemicals were approved for use in 2015. With this, in the case of *Apis mellifera*, there have been losses of up to 70% of the hives, but in the case of native bees, the damages have not been quantified. Given this problem, it is necessary to promote the conservation of natural areas suitable for native bees and propose a friendly agriculture for the conservation of bees, but above all, it is necessary to propose new legislation that regulates the use of agrochemicals.

Toward a better understanding of the Mexican *Lasioglossum (Dialictus*): First look at some new taxa
Joel Gardner, University of Manitoba

The Mexican *Lasioglossum (Dialictus)* fauna is sorely understudied and in need of revision. Of the 213 currently recognized species of *Dialictus* in mainland North and Central America, only 31 are recorded from Mexico, most of which were described from the United States and since discovered south of the border. To help fill this knowledge gap, a revision of the *Dialictus* of western North America is underway, including Canada, the United States, and Nearctic Mexico. Selected provisional new species and new records are presented, and the designation of a new subgenus is suggested based on a preliminary new phylogeny.

Bees foraging in the environment are faced with a dazzling 'menu' of flowers to choose from
Tanya Latty, University of Sydney

Bees foraging in the environment are faced with a dazzling 'menu' of flowers to choose from. Most models of animal decision making assume that individuals assign absolute values to items and then choose the item that has the highest value. As aconsequence, the value of an item does not change if other items are added or subtracted from the menu. Experiments on human consumers, however, have shown that human consumers are easily swayed by 'decoy' products such as undesirable or unavailable menu items. Even though individuals do not choose decoy items, their simple presence can change the way other items in the choice set are valued, thus violating many models of choice behaviour. While the decoy effect was initially thought to be restricted to humans, it has now been demonstrated in a range of organisms including slime moulds, cats and honey bees. In this talk, I will discuss experiments on the existence of decoy effects in the Asian honey bee (*Apis cerana*) and the bumblebee (*Bombus impatiens*). Individual honey bees responded to dominated decoy effects (when a low-quality item is added to a choice set) and phantom decoy effects (when a preferred item is visible but inaccessible). In bumblebees, we investigated the effect of social information on the emergence of decoy effects by testing bee preferences alone and in a group. Our results suggest that decoy effects are taxonomically widespread and could consequently influence decision making in a wide variety of contexts such as flower choice, mate choice and nest site selection.

Assessing the sociality of various *Lasioglossum* species in the Niagara region
Lyllian Corbin, Brock University

Sociobiological studies on sweat bees have advanced our knowledge on the previously unknown social behaviours of various species. Furthermore, they have significantly contributed to phylogenetic studies, illustrating transitions that may underlie the evolution of eusociality. In the Niagara region, the social traits of approximately 25 sweat bee species remain unknown. My objective is to assess the sociality of these species and demonstrate whether they represent reversals to solitary behaviour or maintenances of eusociality within *Lasioglossum*. I will analyze pan trap data to infer their voltinism, as well as compare size, wear and ovarian development among females. I will then use these characteristics to distinguish whether a species' sociality may be solitary univoltine, solitary bivoltine, eusocial bivoltine, or polymorphic. In addition, previously assessed social traits of sweat bee species, from studies done outside of Ontario, have not been further investigated in this region. Thus, comparative analyses are needed to illustrate any behavioural or phenological variation among populations, possibly due to their geographic distribution.

***Epeolus*: one genus or two genera? Resolving the taxonomic position of the mostly Neotropical "*Trophocleptria* group"**
Thomas Onuferko, Canadian Museum of Nature

The bee genus *Epeolus* Latreille (Apidae: Nomadinae), which consists of cleptoparasites of *Colletes* Latreille (Colletidae: Colletinae), includes species previously assigned to genera that have since been synonymized under *Epeolus*. However, some systematists still consider the mostly Neotropical "*Trophocleptria* group", the monophyly of which is supported by morphological data, as a separate genus (*Trophocleptria* Holmberg) because its constituent species exhibit several unique features among the Epeolini. In this study, a phylogeny was constructed for *Epeolus* to determine whether the taxon is monophyletic and how species in the "*Trophocleptria* group" are related to other Epeolini. Additionally, the unranked taxon is reviewed for its constituents occurring Central America, where they are most diverse, Mexico, and the Caribbean. Now, the species group is considered to include 12 species, of which one is new to science. Total evidence analysis combining molecular and morphological data recovered the "*Trophocleptria* group" as monophyletic within *Epeolus*. To be considered as a separate genus, however, the rest of the *Epeolus* would have to be divided into multiple genera.

Do mass-provisioning bees fit the current Temperature-Size Rule?
Jessica de Haan, Brock University

An insect's body temperature and physiological processes are influenced by their environmental temperature. The relationship between temperature, developmental rate and body size in ectotherms is known as the Temperature-Size Rule (TSR). My research is focussed on investigating whether the TSR is applicable to mass-provisioning bees. The TSR states that insects develop more slowly at cooler temperatures, consume more food, and reach a larger adult body size than those that develop at warmer temperatures. In contrast to independently feeding insects, mass-provisioning bees are given a one-time nutritional investment by their mother that contains all the nutrients each offspring requires to develop from larva to adult. The size of these larval provisions determines the offspring's adult body size. By relocating newly founded *Ceratina calcarata* nests into sunny or shady plots, I have experimentally manipulated the temperatures at which the larvae will develop. Through maternal foraging observations, weighing of pollen provisions and adult offspring body size measurements, I hope to determine if bees raised in sun or shade (warm/cool) grow to be different sizes. If offspring body size differs between sun and shade, but the size of pollen provisions does not differ, then differences in offspring body size are due to developmental temperatures.

Global- and local-scale impacts of the western honey bee (*Apis mellifera*) on plant-pollinator mutualisms in natural habitats
Keng-Lou James Hung, University of Toronto

The western honey bee (*Apis mellifera*) is the most frequent floral visitor of crops worldwide, but quantitative knowledge of its role as a pollinator outside of managed habitats is largely lacking.

Here, we use a dataset of 80 published plant–pollinator interaction networks from six continents to assess the global-scale importance of the honey bee in natural habitats. We also use high-resolution pollination network datasets from a honey bee-dominated ecosystem to investigate the local-scale effects of non-native honey bees on plant-pollinator mutualisms. We found that the honey bee is the most frequent floral visitor in natural habitats worldwide, averaging 13% of floral visits across all networks (range 0–85%), with 5% of plant species recorded as being exclusively visited by the honey bee. For 33% of the networks and 49% of plant species, however, honey bee visitation was never observed, illustrating that many flowering plant taxa and assemblages remain dependent on non-honey bee visitors for pollination. We also found that, at the local scale, the number of honey bees visiting plant species increases much more rapidly with flower abundance than does that of non-honey bee insects. As a result, the percentage of all visitors represented by honey bees increases with flower abundance. Thus, honey bees could disproportionately impact the most abundantly blooming plant species and the large numbers of both specialized and generalized pollinator species that they sustain. Our results argue for a deeper understanding of how the honey bee, and potential future changes in its range and abundance, shape the ecology, evolution, and conservation of plants, pollinators, and their interactions in natural habitats.

Effects of land use on wild bee functional and phylogenetic diversity
Katherine Odanaka, York University

Globally, wild bee populations and the important ecological services they provide are experiencing drastic declines, especially in agricultural areas, which are especially impacted by changes in land use and management intensification. While wild bee abundance and richness in these areas has been previously documented, little is known regarding how bee communities respond to these landscape changes at the phylogenetic level nor based on their functional traits. We examined differences in the community make up of wild bees within six study sites in northern New England using a mix of traditional biodiversity measures, functional traits, and phylogenetic methods. We found that land use type and grazing pressure, and not management intensity, had the most affect on wild bee abundance and richness. In addition, we found that wild bee phylogenetic diversity remained largely unaffected by land use, management intensity, and grazing pressure, as four of the six sites retained high levels of individual phylogenetic evenness and phylogenetic similarity between them. Furthermore, analysis on selected functional traits indicated high trait conservation. Our phylogenetic analyses reveal that wild bee communities are able to retain high phylogenetic diversity even if abundance and richness appear to be low. Findings from our functional trait analyses indicate that the presence or absence of grazing is the main contributor to the variations observed in wild bee abundances at our sites. Furthermore, nesting alone was found to be a significant driver of bee assemblages in grazed habitats. These findings highlight the importance of using a mixed approach to evaluating biodiversity, especially if conservation is the goal, in order to obtain a more in depth understanding of how communities respond to environmental changes.

The Himalayan Honeybee, *Apis laboriosa*: distribution and notes on its ecology
Gard W. Otis, University of Guelph

In the past, *Apis laboriosa* has been known predominantly from Nepal and China. Records from other Asian countries were sparse when summarized by Otis in 1996. Since then numerous additional records show that it lives at higher elevations throughout the Himalayan ecozone. We will summarize its broader distribution in Asia and provide preliminary observations on its seasonal distribution in northeastern India.

Recombination rates in advanced eusocial insects are among the highest in the multicellular Animalia: sex in the social city
Clement Kent, York University

Why? What are the consequences of this? Our talk focuses on two kinds of effects: on genome composition. and on genetic diversity and colony performance. First, recombination shifts genome GC content: I show how much shift, and how this relates to a simple measure of eusociality. Second, recombination contributes to within-colony genetic diversity: again, I show a simple model of this and refer to some data for honeybee colonies.

Demographic polymorphism of the solitary sweat bee *Lasioglossum zonulum*
Alex Proulx, Brock University

Eusociality evolved from a solitary ancestor through a demographic shift from one to two broods per season and a social shift from solitary bivoltine to eusocial behaviour. Studying socially polymorphic bees that exhibit both solitary and eusocial behaviours allows for a better understanding of this evolutionary transition. However, demographically polymorphic bees have not been reported or studied, leaving a knowledge gap concerning the first steps in the transition to eusociality. The sweat bee *Lasioglossum zonulum* is a Holarctic species that is reported to be solitary univoltine but appears to be bivoltine in the Niagara region. We aimed to determine the social organization of *L. zonulum* and examine possible social or demographic polymorphisms by studying populations from both Calgary and Niagara. Specimens collected using pan traps and blue vane traps were used to create flight phenologies, confirming that *L. zonulum* is univoltine in the more Northern Calgary population and bivoltine in Niagara. Measurements of size, wear and ovarian development were used to determine that the Niagara population is solitary bivoltine and not eusocial. *L. zonulum* is therefore a demographically polymorphic species and is uniquely representative of the evolutionary transition from solitary to eusocial behaviour.

Maternal manipulation and the formation of social hierarchies in the subsocial bee, *Ceratina calcarata* (Hymenoptera: Apidae)
Sandra Rehan, York University

By manipulating resources or dispersal opportunities, mothers can force offspring to remain at the nest to help raise siblings creating a division of labour. In the subsocial bee, *C. calcarata* mothers manipulate the quantity and quality of pollen provided to the first female offspring producing a dwarf eldest daughter. The dwarf eldest daughter forages for her siblings and forgoes her own reproduction. To begin to understand how the mother's manipulation of pollen affects the physiology and behaviour of offspring, we measured the effects of pollen quantity and pollen type on offspring development, adult body size and behaviour. We found that by experimentally manipulating pollen quantities or pollen types we could recreate the dwarf eldest daughter phenotype. This behavioural phenotype begins to explain how maternal manipulation of resources could lead to the development of the social organization and reproductive hierarchies, a major step in the transition to highly social behaviours

Characterization of vitellogenin in bees
Madiha Hafeez, Brock University

Vitellogenin is a large lipid transfer protein and is involved in yolk production in oviparous organisms. Vg protein titers are associated with variation in insect reproductive traits. Among bees, only honey bee's vitellogenin is studied well. We have done manual annotation of vitellogenin gene and have extracted vitellogenin gene sequence from 26 newly assembled genome. Coding sequence and corresponding protein sequence has also been predicted. We

made multiple sequence alignments using different tools and have also adjusted them by eye. Using these refined alignments, we have made a gene tree with 40 bee species which coincides with the bee species tree. Our results show that there are seven exons and six introns in the vitellogenin gene of bees. We have found 2 independent events of intron loss in Ceratinini and Augchlorini. Further analysis yet has to be done on the rate of evolution of this gene and on the sequence patterns of intron 2.

Conducting laboratory toxicity tests with *Bombus impatiens* and Cyantraniliprole
Raidin Brailsford, York University FES

With the coming ban on neonicotinoids in Canada, there is a need for replacement pest management strategies. Given the ubiquitous use of neonicotinoid insecticides, any proposed alternative should be heavily investigated for negative effects on beneficial insects and at-risk species. Of particular concern are declining Canadian bumble bees such as *Bombus affinis, B. bohemicus, B. terricola, B. pensylvanicus, and B. occidentalis*. Two classes of proposed alternative insecticides are sulfoxamines and anthranilimides. Sulfoxamines, like neonicotinoids, are IRAC Group 4 insecticides, only varying in their structure-activity relationship, thus they may possess similar toxic properties. This has been confirmed by Siviter et al. (2018). However, anthranilimides are IRAC Group 28 insecticides, and act by means of an entirely different mechanism than neonicotinoids and sulfoxamines. In addition, anthranilimide toxicity to bees is largely understudied. Following protocols set by the OECD, we tested acute oral toxicity of an anthranilimide to adult worker *B. impatiens* at the minimum field application rate. Twenty-four hours post-exposure, complete mortality was observed in dosed bees. Our results call for further investigation and higher-tier studies of anthranilimides.

Social modularity: conserved genes and regulatory elements underlie caste-antecedent behavioural states in an incipiently social bee
Wyatt Shell, University of New Hampshire

Identifying the molecular mechanisms of insect social behavior is a focal pursuit in the field of sociobiology. Accordingly, comparative genomics studies exploring the behavioral plasticity of eusocial species have greatly expanded our understanding of the functioning of complex insect societies. One major theory to emerge from this work is the concept of behavioral toolkit genes: deeply conserved molecular elements which may play conserved roles in the expression and evolution of complex social phenotypes across taxa. Recently, sociogenomic work in less socially derived Hymenoptera has indicated that deeply conserved genes may also underpin the expression of relatively emergent social phenotypes; but few transcriptomic datasets yet exist which allow for further exploration of their role in the phenotypic plasticity of incipiently and facultatively social species. Here, we present brain transcriptomic data from the incipiently social small carpenter bee, *Ceratina calcarata*. These data capture gene expression variations over the course of female maturation; and allow for the identification and comparison of genes and regulatory pathways associated with two clear behavioral states, foraging and guarding, observed synchronously in mothers and one of their adult daughters during a brief period of interactive overlap in early autumn. As we disentangle the effects of age and behavior on gene expression, we find that both maturation and the conditions of an early and transient social environment may have global effects on gene expression in this species. We also uncover extensive transcriptional variation between guarding and foraging behaviors, and between mothers and daughters engaged in either behavior. Comparative analysis reveals that guarding and foraging behaviors in *C. calcarata* are underpinned by genes that are deeply conserved across social taxa. We thus emphasize the power of targeting behavioral phenotypes as a means of identifying highly informative but otherwise cryptic genes and gene regulatory elements in non-eusocial species; and offer empirical support for the role of deeply conserved genes in a bee of incipient sociality.

Mysteries of the Sable Island Sweat Bee
Miriam Richards, Brock University

Sable Island is a 42 km long sand dune 350 km east of Halifax. Sable Island apparently emerged from the Atlantic Ocean only about 10,000 years ago with the retreat of the Laurentide ice sheet. Four bee species are found on Sable, including two members of the horrid *viridatum* group, *Lasioglossum (Dialictus) novascotiae* and *L. (D.) sablense*, the Sable Island Sweat Bee. While *L. novascotiae* is found across Canada, *L. sablense* is endemic to Sable Island. Several mysteries surround the Sable Island Sweat Bee: Where does it nest? Is it solitary or social? Is it actually a distinct species, and did it evolve on Sable or elsewhere?

Investigating the chronic effects of environmental stressors on populations of wild bees
Emily Agar, University of Guelph

Despite the economic and ecological importance of wild bees for agricultural processes and wild plant communities around the world, the current state of these pollinator populations is poorly understood. Previous research suggests bee populations are declining as a result of the impacts of many environmental stressors, including the impacts of anthropogenic land-use changes and climate change. Although researchers have extensively studied the acute effects of these stressors, very little evidence exists concerning their chronic effects on pollinator populations. Our research addresses these questions by analyzing historical datasets of bee population dynamics in relation to changes in key environmental stressors. We have compiled an extensive database of over 20,000 wild bee records from Pennsylvania collected over the last 120 years. This provides a unique opportunity to understand the large-scale changes in bee populations in this US state over a considerable time period. Historical datasets, tracking changes in climate, the patterns of pesticide use, and land use change, can then be compared spatio-temporally to this 120-year dataset. Results from our analyses will provide a greater understanding of the chronic impacts of these stressors and inform future conservation strategies to improve the health of wild bees.

Odes to Solitary Bees: Ode to Minerva, masked cellophane bee *Hylaeus* (2019)
Stephen Humphrey, video & poetry. Sarah Peebles, concept & amplified trap nest structure

The Odes to Solitary Bees video-poem series (2010 - ongonig) features native solitary bees creating nests within amplified, observable trap nests paired with poetry inspired by the tanka form. A project of Resonating Bodies: Where art, pollination ecology, and community intersect. Ode to Minerva filmed at The Stop Community Food Centre courtyard garden, Artscape Wychwood Barns, Toronto 2013; poem commissioned for the sensory bee cabinet Sonic Solitaries, Cambridge Sculpture Garden (relocated to High Park Nature Centre, Toronto). Stephen Humphrey is a Toronto-based writer, poet, radio producer and photographer (stephenhumphrey.ca). Sarah Peebles is a Toronto-based installation artist, composer and musician (sarahpeebles.net). See more Odes at resonatingbodies.wordpress.com.

Ode to Minerva, masked cellophane bee (*Hylaeus*)
She does the secret dance of gauze
and cellulose. Her phantom face
conceals the dark arts her body
hides. She disgorges spun glass and
gold from her stomach's crucible.