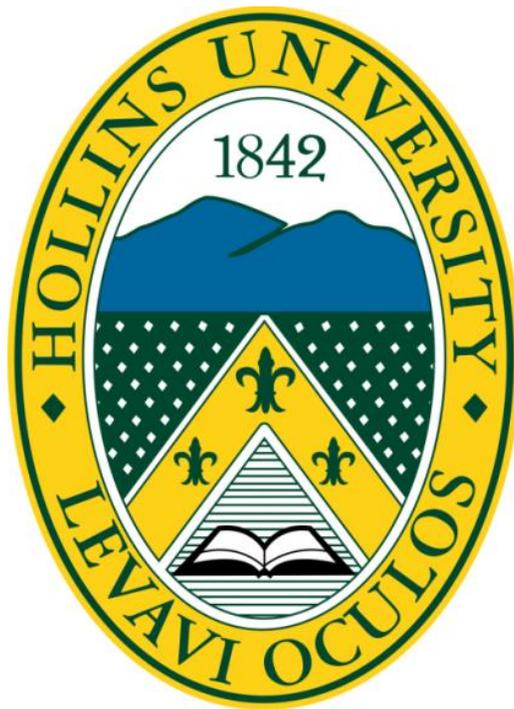


Hollins University



60th Annual Science Seminar

Thursday, April 27th
4:30-6:00 p.m. Ballator Gallery

We are pleased to have you join us as we celebrate the research conducted by science and mathematics students at Hollins University during the 2016-2017 academic year. In this program, you will find abstracts for the 22 research projects that are highlighted at this poster session. This, collectively, represents the work of 38 Hollins science students.

We encourage you to chat with our students during this poster session. They are eager to talk to you about their research and to answer any questions you may have. Posters will be up by 4:00 and students will be available from 4:30-6:00 p.m.

Light refreshments will be provided

Department of Biology & Department of Environmental Studies

Is Bigger Really Better?

The Tale of Isopod Parasitism on French Grunts (*Haemulon flavolineatum*)

Christina Havrila and Felicity Mampe

Under the direction of Drs. Renee Godard and Morgan Wilson

Cymothoid isopods are obligate crustacean ectoparasites that affect some species of marine fish. The effects of isopod parasitism on host fish may result in scale deterioration, alteration of host behavior, and possibly reduced fitness. In this study, we observed French Grunts (*Haemulon flavolineatum*) and looked for the presence of isopod(s), determined the degree of social affiliation by grunts, and estimated the size of each grunt encountered. We also compiled data from a research peer group to determine isopod parasitism rates for several additional host species. We found that the average encounter rate of grunts with isopods in 2017 was not different from the rate observed in 2016. However, our data suggest that large, parasitized grunts were more likely to appear in aggregates when compared to large, non-parasitized grunts. Finally, our results suggest that the degree of isopod parasitism across host species was similar in 2016 than 2017. These results suggest that isopod parasitism may affect French Grunt behavior, particularly for large individuals. However, the adaptive significance of this behavior is yet to be determined.

Invasion from the Deep?

Assessing *Halophila stipulacea* Populations

Shannen Kelly, Catherine Kirkpatrick, Kathryn Zamorski

Under the direction of Drs. Renee Godard and Morgan Wilson

Seagrass beds provide vital functions to marine ecosystems. Seagrasses serve as a source of nutrition for consumers, as structural support for the ocean floor, and a habitat to many marine species. Three native species are present in the Caribbean, but are currently being threatened by an invasive seagrass, *Halophila stipulacea*. In this study, a $\frac{1}{2}$ m² transect divided into 25 sections was used to determine seagrass species presence and composition along edges and within grass beds at 8 locations. Depth was recorded at each transect location. Overall, species presence differed, with *H. stipulacea* being the most common. There was a positive correlation between depth and *H. stipulacea* and a negative correlation between depth and the native species. No relationship between species composition and location (edge & middle) was noted. From 2016 to 2017, there was a statistically significant increase in *H. stipulacea* in at least three locations. Thus, it is likely that the invasive will continue to spread and impact native species.

Changes in Fish Biodiversity in St. John, USVI
Jessica Michael¹, Caleb Amstutz², Sunny Greene¹, and Dr. Renee Godard
¹Hollins University and ²Guilford College

Under the direction Drs. Renee Godard and Morgan Wilson

Marine biodiversity and health is influenced by structure and location. Our study compared fish biodiversity and abundance patterns in two habitat types (mangrove and reef) on St. John from 2016 to 2017. Twelve sites were surveyed by collecting 30 minute biodiversity samples. Species as well as relative abundance patterns were noted. Overall, species numbers decreased from 2016 to 2017 however, more species fell into the abundant/common category in 2017. On the other hand, the largest percentage of species in both reef and mangrove were classified as rare with fewer species classified as abundant. Biodiversity numbers showed no correlation to rugosity scores, reef-building coral, and coral of large size. These patterns are of interest and this data provides a valuable baseline for comparison of diversity in future years in a changing ecosystem.

Patterns of Parrotfish Abundance
Sunny Greene¹, Caleb Amstutz², Jessica Michael¹, and Dr. Renee Godard
¹Hollins University and ²Guilford College

Under the direction of Drs. Renee Godard and Morgan Wilson

Coral reefs have faced severe decline in structure and health, often as a result of human activities. Parrotfish are crucial species to coral health as they graze on competitive algae. We scored the abundance of parrotfish in initial and terminal phases in 2016 and 2017 at twelve survey sites on St. John USVI. The species as well as relative abundance of each were recorded during 30-minute surveys. Overall, parrotfish increased in abundance between 2016 and 2017. In 2017, Initial phases outnumbered terminals at most sites, and overall generalist species had higher abundance scores than specialist. These results are encouraging as parrotfish can be key players in coral health and thus potentially increase the chances that coral health and growth may improve in these waters.

Weedy Corals Dominate Reefs in St. John USVI
Natasha Bestrom, Madison Correiro, Holly Monger,
Nicole Troia, and Ya Gao

Under the direction of Drs. Renee Godard and Morgan Wilson

Coral reefs provide critical habitat for marine organisms as well as provide other environmental benefits (e.g. wave action barriers). Using 10m x 2m transects, the average number, size, and relative health of coral was assessed in 9 reef sites in St. John, USVI. Identified coral was classified into four categories (branching, hydrozoan, massive, and weedy) which relate to their natural history and contributions to reef systems. Weedy coral dominated most sites and was composed of primarily small and healthy individuals. Important reef building corals (e.g. massive coral) were much less abundant, but did not show additional decline from 2016 patterns. The current state of coral reefs (dominated by weedy small corals) suggests a reef system that has collapsed with a limited ability for regrowth. Continued annual data collection will allow for assessment of changing reef dynamics and potential for regrowth.

***Diadema antillarum* Population Dynamics**
Natalie Badawy and Brittany Richardson

Under the direction of Drs. Renee Godard and Morgan Wilson

The health of coral reef ecosystems is influenced by algal grazers such as parrotfish and sea urchins. *Diadema antillarum* have an intimate relationship with coral, they prevent macroalgae from overgrowing, which inhibit coral growth and fish diversity. According to Lessios et al. (1984), the condition of USVI coral reefs have been significantly impacted by a die-off of *Diadema* during the 1980s-1990s, creating a reef dominated by macroalgae. As *Diadema* populations rebounded, an increase in the abundance of juvenile corals was noted (Edmunds and Carpenter 2001). In our 2017 study, we surveyed *Diadema* populations at 13 locations and compared them with six sites sampled in 2016. In addition, the substrate at each transect was evaluated. We compared 2017 *Diadema* numbers with macroalgae, coral, and rugosity surveys. We found that *Diadema* populations increased from 2016 to 2017 at several of the sites sampled, suggesting that St. John's *Diadema* populations could be on the rise. We also found relationships between coral populations, macroalgae coverage, and rugosity at the sampled sites.

Rugosity of Coral Reef Habitats on St. John, USVI
Kendall Moyer, Morgan Wilson, and Renee Godard

Rugosity is a measure of the structural complexity of a coral reef. Coral reefs with higher rugosity have increased niche diversity, which allows for a positive correlation between the abundance of fish species, diversity, and total abundance. Our study measured rugosity at nine field locations surrounding St. John Island- Blue Cobblestone, Donkey Bite, Kiddle Bay, North Haulover, Octopus Garden, Pelican Rock, Salt Pond, Watermelon Key, and Yawzi Point. We found that majority of the coral reef in sampled areas had an average rugosity which indicated moderate structural complexity. Unique to this was Yawzi Point, which had an average rugosity score that indicated very complex structural relief. Our study found no correlation between depth and structural complexity.

Shell Quality and Crowding in Caribbean Hermit Crabs (*Coenobita clypeatus*)
Allison Caldwell

Under the direction of Drs. Renee Godard and Morgan Wilson

As *Coenobita clypeatus* grow over their lifetime, they require larger shells to better protect themselves from predators and weather. Without availability of new, larger shells, *C. clypeatus* growth and fitness are compromised. In this study, crowding and shell quality of *C. clypeatus* were assessed in crabs located near beaches as well as those at a field station further from the sea. While crowding was commonplace in crabs of all sizes and location did not have an impact on level of crowding, shell quality was good. The limited data on shell change suggests that crabs are limited by shell availability. Further research on the crowding and shell quality should include measuring chela width as well as length and an effort to increase sample size of crabs that are located near water (potential source for shells).

Resistance to Water Loss in Narrow-Range Tree Fern Species Across an Elevation Gradient in the Peruvian Andes-Amazon

Kathryn Zamorski

Under the direction of Dr. Adrian Tejedor, SFS Peru, Spring 2016

One of the biggest concerns with changes in climate is an increase in drought periods in sensitive tropical rainforest regions. Thus, it is important to determine how sensitive species will react to dehydration. Tree ferns grow across large elevation gradients and have rapid reproductive rates; therefore, they may show more rapid responses to dehydration than other species. Moreover, drought frequency may vary dramatically with elevation. This study examined the responses of ten narrow range tree fern species to dehydration, by examining water loss in pinnae over time using a dehydration chamber containing calcium chloride salts. Water content of tree fern species did vary but was not related to elevation. Furthermore, dehydration rates of species were not correlated to water content or elevation. It is possible that dehydration rate is instead more dependent on habitat type.

An examination of medicinal ethnobotany and biomedicine use in two villages on the Phnom Kulen plateau

Taylor Walker

Under the direction of Dr. Lisa Arensen, SFS Cambodia, Spring 2016

Cambodians address symptomatic illness in two ways: they use traditional medicine, including medicinal plants, and biomedicine. Despite various attempts to quantify medicinal ethnobotany in Cambodia, no national ethnopharmacopoeia exists, and there is a gap in the literature regarding the mechanisms through which traditional medicines are prepared and used. This report presents an examination of the ethnopharmacopoeia of two villages within Phnom Kulen National Park, a study site chosen for its unique ecology and status as one of Cambodia's last remaining regions with lowland evergreen and semi-evergreen forest. The report also investigates the mechanisms through which villagers make decisions regarding illness treatment with traditional medicine or biomedicine. Semi-structured interviews conducted during April 2016 in Sangkae Lak and Ta Penh revealed 161 botanical species in current traditional medicine use, and 111 of these species were new to the School for Field Studies medicinal plant taxonomy. Regarding the decision-making process involved in medicating illness, respondents articulated that biomedicine and traditional medicine were effective for different purposes. Traditional medicine was considered successful in addressing chronic illness or long-term treatment, but biomedicine was considered better for acute illness. This report also reveals that the decision-making processes involved in medicating illness in these villages are multi-faceted and affected by government intervention. Furthermore, the disparate ways in which general community members, traditional medicine practitioners and government agents understand drug interactions is hugely impactful in community decisions to use traditional medicine or biomedicine. This research contributes to the knowledge of medicinal ethnobotany and community health decisions on Phnom Kulen.

Early nesting Bluebirds (*Sialia sialis*) choose garlic scented nest boxes

Hayley Caulfield-James, Farren Dell, Jessica Kingrea, Jessica Michael, Tina Lehman, and Cindy Newell

Under the direction of Dr. Renee Godard

Previous studies of cavity nesting songbirds have indicated that some species seem to avoid nesting in boxes scented with a predator odor, while other species do not respond to these cues. In a previous study, Eastern Bluebirds (*Sialia sialis*) did not avoid nest boxes scented with odor cues from black rat snakes or deer mice. In this study, we set-up eighteen pairs of nest boxes on the Hollins University campus and scented one nest box of the pair with garlic extract (a strong neutral cue) and other with bobcat urine/scent gland (a strong predator odor) for 6 of every 7 days beginning Feb 27 and ending April 22, 2017. Observations of nest building of platform, cup formation, and egg laying were recorded. Eleven of the 18 sites were utilized by bluebirds, seven choosing garlic scented boxes and four selecting bobcat scented boxes. Birds choosing garlic scented boxes all began nesting earlier than those choosing bobcat scented boxes. This data suggests early nesting birds make different nesting decisions than later nesting birds which bears further investigation.

Mammals do not show high use of tunnel corridors under I-81 on the Hollins University campus

Lan Thi Ngoc Nguyen '18 and Jhovanna Salmeron '18

Under the direction of Dr. Renee Godard

Wildlife corridors like underpasses can increase habitat and provide connections between fragmented habitats for species with large home ranges or those that migrate. In this study, eight wildlife cameras were used to capture mammalian activity through two tunnel corridors under I-81 on the Hollins University campus from 2/13 – 4/21/17. Activity in and around these corridors was compared to vegetated campus habitats beside I-81. Camera traps indicated that species richness and abundance of mammals using the corridors was less than richness and abundance in adjacent vegetated space. In addition, it appeared that overall mammalian activity declined during the sampling period. It is possible that human activity and/or other factors may diminish the use of the underpasses by mammals. Future studies could survey a larger number of experimental sites to enhance data samples.

Environmental Factors Influence Anuran Calling Activity on the Hollins University Campus

Natasha Bestrom, Lainey Metz, Laren Minton, Brittany Richardson, Amanda Young

Under the direction of Dr. Renee Godard

The study of anuran species is very important as they are very sensitive to environmental changes and can be important indicators of the health of an ecosystem. Anuran species utilize vocalization when advertising for perspective mates during their annual mating seasons. The current study surveyed 5 locations on the Hollins University campus recording rainfall, temperature, and species rate of activity during March and April 2017. The wetland and the Oyster Pond locations had highest anuran activity. Spring Peepers (*Pseudacris crucifer*) showed highest activity in the wetland while Pickerel Frogs (*Lithobates palustris*) had the highest rate of activity at Oyster Pond. Spring Peepers rate of activity did not vary with different temperatures or rainfall, whereas the Pickerel Frogs rate of activity was significantly influenced by temperature ($r_s=0.668$, $n=24$, $p<0.001$), as temperature increased so did the rate activity. Continued surveys of anuran activity over longer periods of time may provide more insight into environmental factors that affect the species on the Hollins University campus.

Foraging Passerines Do Not Respond to Odor Cues of Predators

Christina Havrila

Under the direction of Dr. Renee Godard

While chemodetection of predators is well established in many vertebrate groups, studies of chemodetection in birds have resulted in ambiguous findings. Some studies suggest birds respond to predator odors while others suggest that they do not. This study was designed to determine if passerines foraging at backyard feeders would modify their behavior in response to odor cues from a potential predator (bobcat) or novel neutral scent cue (garlic extract). As a control, foraging passerines were videotaped for 30 minutes at feeders before they were scented with one of three cues (water, garlic, or bobcat). They were subsequently videotaped for 30 minutes at the scented feeder. The same procedure was followed for the next two days at each site with the two remaining scent cues. A balanced order design was employed at the 18 sites so that every possible order of scent cues was presented an equal number of times. Videotapes were transcribed for the following bird activity: time to begin feeding, time spent feeding, and vigilance behavior. There was no difference in the responses in the three odor trials in birds that typically sit and feed (e.g. house finches, gold finches, house sparrows), in birds that take seeds to open elsewhere (e.g. Carolina chickadees, Tufted titmice), or in house finches, the most common species, when their responses were considered alone. Thus, foraging passerines either do not detect the different odors used in this study, do not recognize the bobcat odor as potentially dangerous, or perhaps recognize the odor but given that there were no visual cues to support the presence of a predator there is no discernable differences in behaviors exhibited. Future studies are indeed warranted.

Department of Chemistry

Attempts to Improve the Bioavailability of Curcumin

Lauren Chin

Under the direction of Dr. Sandy Boatman

Turmeric is widely used in traditional Eastern medicine and as a nutritional supplement to prevent or treat a variety of conditions, including arthritis, high blood pressure, depression, and even cancer. In last 25 years scientists have published numerous reports in refereed basic scientific and medical journals of research testing the benefits of curcumin for many different therapeutic applications. Its main active ingredient is a mixture of three compounds collectively called curcumin. Curcumin is not soluble in water, and, therefore, has a low bioavailability because it is poorly absorbed and rapidly metabolized. The purpose of my research is to explore ways to increase the bioavailability of curcumin while maintaining its potency and low toxicity. My approach is to try to formulate a delivery system that is compatible with water and living organisms and is non-toxic. I have synthesized the major component of curcumin, curcumin 1, and have prepared polar polymeric nanoparticles that are water-soluble. I have "loaded" the nanoparticles with curcumin and am testing the resulting "nanocurcumin" particles for antibacterial properties. These tests should indicate whether this method of delivering curcumin is effective in an aqueous environment.

Moringa Oil: Extraction, Analysis, and Antimicrobial Activity

Ashani Davidson

Under the direction of Dr. Sandy Boatman

Moringa oleifera is a food plant native to sub-Himalayan areas of India, Southeast Asia, Africa and some Caribbean islands. Because of its medicinal properties, it has been used for centuries in traditional medicine. The oil found in *Moringa* seeds, Behen oil, is the seeds' main component and represents 36.7% of the seed weight. The aim of this research project is to test the antimicrobial properties of oil extracted from the mature *Moringa oleifera* seeds on bacterial strains commonly associated with acne. These include *Propionibacterium acnes*, *Staphylococcus aureus* and *Staphylococcus epidermis* which are often found abundantly in skin of individuals prone to acne vulgaris. The extracted oil will be used to determine the minimal inhibitory concentration for bacteria using the agar diffusion and/or micro-dilution technique. These experiments will aid in understanding how the oil found in the *Moringa* seeds can inhibit the growth of bacteria responsible for acne and other skin-related diseases and infections.

Study of Protein Folding Using Infrared Spectrometry

Felicity Mampe

Under the direction of Dr. Sandy Boatman

The purpose of this research is to investigate the infrared spectra of proteins in aqueous media and to attempt to use proteins' IR spectra to study effects of denaturants on protein structure. Guanidinium chloride (GuCl), sodium dodecyl sulfate (SDS), and heat affect hydrogen and other kinds of bonding in proteins resulting in changes in tertiary and secondary structures (unfolding). In this research, horse heart myoglobin (myb), bovine chymotrypsinogen (chy), and horse heart cytochrome c (cytc) were dissolved in deuterium oxide and subjected to these denaturing conditions; spectra were obtained for samples in cells with CsF windows. Proteins' amide I bond absorbances were compared; untreated proteins served as controls. Myb and cytc have amide I absorbances centered near 1650 cm^{-1} whereas chy has an amide I absorbance centered near 1640 cm^{-1} . With SDS, shifts of the amide I peak to lower frequency were observed with both cytc and chy; myb's amide I peak shifted to a higher frequency. All spectra of proteins treated with SDS show an increase in absorbance intensity. In heat treatments, intensities of protein amide I absorbances significantly decrease between 35.0°C and about 50.0°C , then increase with further elevation of temperature above 50° . The absorbances of proteins that were heated and then cooled are in the same range as those of proteins at higher temperatures; this suggests that these proteins retain the structures that they attain at the higher temperature as they are cooled. The spectra of protein samples treated with GuCl were dominated by the GuCl absorbances, so no spectral observations could be made. Overall, the results obtained were encouraging; in the near future, we plan to explore the use of ATR-FTIR using much lower protein concentrations.

Department of Mathematics

Investigating Tensors: Multilinear Algebra and the Physical Sciences

Rory Keeley

Under the direction of Dr. Emese Kennedy

Vectors and matrices are some of the foundational building blocks in linear algebra and analysis. These powerful arrays of data are used to describe relationships between magnitude and direction in one and two dimensional spaces. However, there are higher order and higher dimensional arrays called tensors which have the capacity to relate 3-tuple and in fact n-tuple pairing of information. Generally confined to mathematics of the physics, including motion and space-time, tensors are rarely covered in undergraduate curriculum despite their similarities to concepts in Linear Algebra. To expand upon ideas introduced in Linear Algebra, this investigation will explore the basic principles and multilinear algebra of tensors, focusing on 3rd order tensors. The basic principles include an introduction of index notation and investigation into the definition of a tensor, as well as how scalars, vectors, and matrices play a role in that definition. Following the example of vector algebra and matrix algebra from Linear Algebra, I will explore tensor algebra, including tensor products and Kronecker products. I will also consider the applications of tensors typically found in the sciences including mechanics, electromagnetism, and general relativity.

Department of Psychology

The Effect of Interactivity on Toddlers' Search Task Performance

Rose Franzen and Debra Henke

Under the direction of Dr. Tiffany Pempek

Children under 30 months of age learn less from video than from live presentations, a finding referred to as the video (or, transfer) deficit. The purpose of this experiment was to examine if interactivity provided by touching a tablet screen would eliminate the transfer deficit for children younger than 30 months of age. Participants included 49 children ages 24 to 36 months. Children played a brief hide-and-seek game in which they attempted to find "Sammy the Turtle" in one of four hiding spots. The information children received regarding Sammy's hiding spot differed in terms of interactivity (pointing or looking) and viewing method (live or video on a tablet). Results revealed a main effect of age group and viewing method. Older children performed better than younger children, and, as predicted, children exhibited a transfer deficit, with better performance while viewing live than on tablet. Counter to our hypothesis, there was not an effect of interactivity.

Exploratory, Boldness, and Defensive Behavior in Corn Snakes (*Pantherophis guttatus*)

Kateri Peterson and Noelle Ware

Under the direction of Dr. Bonnie Bowers

A behavioral syndrome occurs in a species when disparate behavioral traits are consistently correlated. This study assessed the relationships between exploratory, boldness, and defensive behaviors of captive-born juvenile corn snakes (4 males and 3 females) to assess whether these snakes exhibit any evidence of a behavioral syndrome. This is the first such experiment conducted with corn snakes. Because the sample size was so small, no significant relationships were found, but there was a moderate positive relationship ($r = .58$) between percent of the test arena explored and difference in activity before and after the presentation of a predatory stimulus. Snakes that decreased their activity the most after introduction of the predatory stimulus also explored the least area of the test arena. Positive but weaker correlations were found between the other measures of exploratory behavior and defensive behavior. The boldness measure was not used because of lack of response. Replication with a larger sample size and improved behavioral measures would be beneficial.

Spatial learning in a corn snake (*Pantherophis guttatus*)

Tessa Muehlendyck

Under the direction of Dr. Bonnie Bowers

The purpose of this experiment was to examine spatial learning in an adult male corn snake tested in a vertical arena. In each trial, the subject was placed on the middle level of the maze and allowed to explore each of the three levels until the subject reached the bottom level. After which the subject was presented with food as incentive to repeat this. Latency to reach the target level and number of errors (number of times that the body of the subject touched the top level) were recorded.

The Relationship between Implicit Racial Bias and Implicit Bias towards Ethnic Hairstyles

Noelle Ware

Under the direction of Dr. Bonnie Bowers

The standards of European culture still pervade in American society today, where afros, dreadlocks, and box braids are considered unprofessional. Children and adult are often forced to change their natural hair style in order to be considered professional lest they be perceived as a distraction to others. The purpose of this study was to utilize the Implicit Association Test (IAT) to assess whether participants who showed negative bias against Black faces would also show negative bias against afros. There were 104 participants (91% between 18 to 25 years old), eighty-nine of whom were self-identifying females, two were self-identifying males, and twelve identified as gender non-conforming or other. There were 68 White participants, five identified as Asian or Pacific Islander, 16 identified as Black, 12 identified as mixed-race or other, one identified as American Indian/Alaskan Native, and two participants did not answer the question regarding race. The IAT measures reaction time in pairing stimuli with emotionally-laden positive or negative words. Each participant was given three different versions of the IAT in a randomized order: a Racial Preference IAT, a Racial-Hairstyle Association IAT, and a Hairstyle Preference IAT. The IAT uses a scoring method with the same mathematical principle as Cohen's d . Each IAT yields a score for each individual (called a D Score), ranging from -2 to +2. Results indicated that participants who showed negative bias against afros tended to show negative bias against Black faces, and participants who associated Black faces with afros tended to show negative bias against afros. Understanding the racial components of societal norms can allow for greater vigilance when it comes to perceiving and intervening in prejudiced behavior, and can provide protection of the individuals who are often targeted due to their racial backgrounds. It is also beneficial for individuals to understand the sources behind their biases in order to acknowledge and correct subconscious behavior and become more tolerant.