

Michael Giles

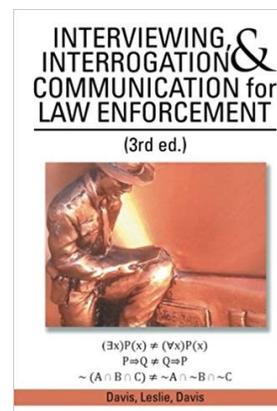
Assistant Professor of Visual Art, Michael Giles has been involved in two separate exhibitions during the summer of 2018. He had a solo exhibition of recent work titled, "The Space Between" at Room 912 Gallery in Richmond, IN. Room 912 is part of the art program at Indiana University East. The exhibition was held from July 3—August 24 and professor Giles gave a gallery talk at the gallery for the public and IUE art students on July 25th.



Professor Giles also had a painting included in *Number Magazine's* annual survey of southern art. Number is one of the preeminent arts periodicals in the region and covers contemporary art in the southeast. Giles was featured along with over 60 of the best artists working in the southeast. The exhibition was on display through September 18th at Crosstown Arts in Memphis, TN.

Wayne Davis

Assistant Professor of Criminology and Criminal Justice, Dr. Wayne Davis was recently notified that his book, *Interviewing, Interrogation, and Communication for Law Enforcement* was picked up by the FBI Academy Library.



Ledford Scholars present at ACA Summit

Last spring semester, four wildlife and conservation biology students, Elizabeth Maggard, Kiersten Dunaway, Kayla Howard, and Tanner Denton, received funding from ACA to conduct research in a variety of topics. These research projects were presented at the Annual Appalachian College Association Summit on September 29, 2018.

Elizabeth “Liz” Maggard was mentored by Assistant Professor of Biology, Conservation Biology, Dr. Barbara Shock to investigate the prevalence of two tickborne pathogens, *Borrelia spp.* and *Babesia spp.* *Borrelia* is a bacteria known to cause Lyme disease while *Babesia* are microscopic parasites that infect red blood cells and are spread by certain ticks. Liz was able to show that 37.5% of the ticks collected carried *Borrelia*, while 13% of the ticks collected carried *Babesia*. These results contribute to the growing knowledge of tick-transmitted disease in Appalachia.

Kiersten Dunaway was mentored by Dr. LaRoy Brandt. Kiersten’s research represents the first of many collaborations with the Kentucky Natural Lands Trust to study a number of conservation, ecological, and land management research questions. This initial project focused on the diversity and distribution of reptiles at a study site on the Pine Mountain ridge near Pineville, KY. Kiersten’s work estimates that as many as 11 different reptile species inhabit the region along Pine Mountain with most of the diversity at the upper elevations in areas consisting of dry, rocky habitats.

Working under Dr. Brandt’s mentorship, and in collaboration with Director of the Center of Imaging and Analysis and Professor of Physiology, Dr. Stan Kunigelis, Kayla Howard identified the concentrations of heavy metals in marsh and sea grasses within the Apalachicola estuary. Working out of the Florida State University Coastal and Marine Laboratory, Kayla collected fresh plant samples and used a scanning electron microscope (SEM) at LMU to perform energy dispersive spectroscopy (EDX) to measure heavy metals within the plant tissues. Kayla determined the presence of a number of heavy metals in relatively high concentrations including mercury (Hg) that was found to be as high as 11% in some plant tissues. This work establishes a baseline of heavy metals within the plant tissues and provides a novel method to more readily evaluate the impact of future oil spills.

Dr. Brandt also mentored Tanner Denton to investigate the micronutrient content of elk forage near Pineville, Kentucky.

Working with the Appalachian Wildlife Foundation, Tanner and Dr. Brandt collaborated with Dr. Kunigelis to utilize the SEM to perform EDX on grasses and forbs collected from an area where elk have been reintroduced near Pineville, KY. Although Tanner’s work indicated that elk were not choosing sites to forage based on the micronutritional quality of the plants, his efforts have demonstrated a new application of EDX technology to potentially inform wildlife managers as they make management decisions.



Kiersten Dunaway, Kayla Howard, Liz Maggard and Tanner Denton present at the ACA Summit.

LaRoy Brandt

Tapir Research in Costa Rica Published

Widely recognized as the largest terrestrial mammal in the Neotropics, the globally endangered, IUCN Red-listed, Baird's tapir *Tapirus bairdii* has been in a continual decline due to habitat loss, localized hunting, and their low reproductive rates. Because of its ecological role, the loss of this species is likely to have a cascading effect on a number of species that are important to the ecological functioning of the remaining fragments of tropical forests across Central America. During this past summer, Associate Professor of Biology, Conservation Biology, Dr. LaRoy Brandt co-authored a research article with Spring 18 Wildlife Biology graduating student, Maggie Singleton. The report includes a new record of *T. bairdii* in the Caribbean lowlands of northeast Costa Rica. Although *T. bairdii* may have historically existed in the region surrounding the area, they were believed to be extirpated with only anecdotal reports suggesting their continued existence. Dr. Brandt is continuing these efforts to help develop a tapir management plan for the La Suerte Biological Field Station.

Brandt LSE, Singleton M. (2018) Record of Baird's tapir *Tapirus bairdii* at the La Suerte Biological Field Station in the Caribbean lowlands of Costa Rica. PeerJ Preprints 6:e27128v1 <https://doi.org/10.7287/peerj.preprints.27128v1>

Reptile Surveys and Occupancy Modeling

Mentored by Dr. LaRoy Brandt, and as part of his Junior/Senior research requirement, wildlife biology student Damien Laws conducted reptile surveys on property owned by the Appalachian Wildlife Foundation near Pineville, KY. Damien's objective was to evaluate the potential success of reptiles inhabiting a reclaimed, mountaintop removal mining site. Damien conducted weekly snake surveys to compare sites that had been mined to those that had not. Furthermore, he made note of numerous habitat variables that are likely associated with reptile habitat preferences. The overall objective is to develop habitat models that will predict the presence or absence of individual reptile species. Such models could aid in the development of stronger species management plans. Damien presented preliminary results of his work at the annual meeting of the Tennessee Herpetological Society in Memphis on September 28, 2018. These results suggest that reptile diversity is greater on the reclaimed mining site. Although initially surprising, such a result seems reasonable because the environmental disturbance caused by the mining process may actually provide a suitable habitat for many reptiles. Further analysis will likely provide predictive models that could aid in a variety of land management decisions.



Wildlife Biology Student,
Damien Laws

News from the School of Mathematics and Sciences

Research Trip to Florida Estuary

Mentoring a number of Master of Science in Life Science graduate students, Dr. Kunigelis led a summer research trip to study copepods in the Apalachicola estuary along the panhandle of Florida. Dr. Kunigelis was joined by Dr. Marcelle Savoy, medical librarian, as well as Dr. LaRoy Brandt and a number of undergraduate students investigating the potential impact of oil spills on estuarian plant and tardigrades. Overall, the trip was a success as one undergraduate presented her research at the Appalachian College Association Annual Summit on September 29, 2018 and numerous graduate students presented their work at the Appalachian Regional Microscopy Society on October 4th and 5th, 2018.



Joshua Boone presents at Mathfest

Matrix Powers and Symmetric Polynomials
Joshua Boone
Department of Mathematics, Lincoln Memorial University

Objective	Symmetric Polynomials	Elementary	Example
<p>Find the trace of the powers of $A \in \mathbb{C}^{n \times n}$, $A^k = \sum_{i=1}^n \lambda_i^k$.</p> <p>Reference: see [1] for the reader who is familiar with the trace of a matrix.</p> <p>The trace of A^k is $\sum_{i=1}^n \lambda_i^k$.</p> <p>Theorem (Whittaker, 1922): Suppose A is a 2×2 matrix with eigenvalues λ and μ. For any positive integer k,</p> $\text{tr}(A^k) = \lambda^k + \mu^k$ <p>Theorem (Hilbert, 1910): For any integer $k \geq 2$, $\lambda^k + \mu^k$ is a symmetric polynomial in λ and μ.</p> <p>Theorem (Hilbert, 1910): Let A be a 3×3 matrix with eigenvalues λ, μ, ν. Then for any integer $k \geq 2$,</p> $\text{tr}(A^k) = \lambda^k + \mu^k + \nu^k$ <p>Theorem (Hilbert, 1910): Let A be a 3×3 matrix with eigenvalues λ, μ, ν. Then for any integer $k \geq 2$,</p> $\text{tr}(A^k) = \lambda^k + \mu^k + \nu^k$ <p>The Question: Are there special cases of a matrix A where $\text{tr}(A^k) = \lambda^k + \mu^k + \nu^k$ for all $k \geq 2$?</p>	<p>Complete Homomorphism: A complete homomorphism ϕ is a mapping $\phi: \mathbb{C}^n \rightarrow \mathbb{C}^n$ such that $\phi(A) = \phi(A)^k$ for all $k \geq 1$.</p> <p>Examples:</p> <ul style="list-style-type: none"> $\phi(A) = A$ $\phi(A) = A^2$ $\phi(A) = A^k$ for any $k \geq 1$ $\phi(A) = A^k + A^l$ for any $k, l \geq 1$ $\phi(A) = A^k + A^l + A^m$ for any $k, l, m \geq 1$ <p>Theorem (Hilbert, 1910): The elementary symmetric polynomials of the roots of a polynomial $P(x) = x^n + a_{n-1}x^{n-1} + \dots + a_1x + a_0$ are algebraically independent over \mathbb{C}.</p> <p>Example: The matrix $A = \begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$ has eigenvalues $\lambda = 1$ and $\mu = 2$. The elementary symmetric polynomials of the roots are $e_1 = \lambda + \mu = 3$ and $e_2 = \lambda\mu = 2$. The characteristic polynomial is $P(x) = x^2 - 3x + 2$.</p> <p>Proposition (Boone, 2018): Let A be a 2×2 matrix with eigenvalues λ and μ. Then $\text{tr}(A^k) = \lambda^k + \mu^k$ if and only if A is a scalar multiple of the identity matrix.</p> <p>Proposition (Boone, 2018): Let A be a 3×3 matrix with eigenvalues λ, μ, ν. Then $\text{tr}(A^k) = \lambda^k + \mu^k + \nu^k$ if and only if A is a scalar multiple of the identity matrix.</p>	<p>Example: The matrix $A = \begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$ has eigenvalues $\lambda = 1$ and $\mu = 2$. The elementary symmetric polynomials of the roots are $e_1 = \lambda + \mu = 3$ and $e_2 = \lambda\mu = 2$. The characteristic polynomial is $P(x) = x^2 - 3x + 2$.</p> <p>Proposition (Boone, 2018): Let A be a 2×2 matrix with eigenvalues λ and μ. Then $\text{tr}(A^k) = \lambda^k + \mu^k$ if and only if A is a scalar multiple of the identity matrix.</p> <p>Proposition (Boone, 2018): Let A be a 3×3 matrix with eigenvalues λ, μ, ν. Then $\text{tr}(A^k) = \lambda^k + \mu^k + \nu^k$ if and only if A is a scalar multiple of the identity matrix.</p>	<p>References:</p> <ul style="list-style-type: none"> [1] G. B. Whittaker, <i>Algebraic Theory of Functions and Quaternion Definite Integrals</i>, Cambridge University Press, 1922. [2] D. Hilbert, <i>Über die Theorie der algebraischen Zahlentheorie</i>, Mathematische Annalen 53 (1910), 53-197. <p>Contact Information:</p> <ul style="list-style-type: none"> ✉ jboone@lmu.edu 📞 423-869-6213 📍 Lincoln Memorial University, Lincoln, Tennessee

Assistant Professor of Mathematics, Dr. Joshua Boone recently presented a poster at the MAA Mathfest in Denver, Colorado.

News from Student Support Services

On September 29, 2018, students and staff from the Lincoln Memorial University Student Support Services program enjoyed a visit to Dollywood in Pigeon Forge, Tennessee. While there, students had an opportunity to participate in the Harvest Festival, which highlighted unique artisans from around the country who shared their beautiful handmade crafts as well as Dollywood's own skilled craftsmen. This year's booths featured inspirational jewelry, paintings, handmade historic games, textile art, woodworking, felt hats, dolls and textiles, pottery, glass jewelry, chainsaw carvings, fiddles, and hand-painted ornaments. The Student Support Services Program serves 165 qualifying students on the campus of Lincoln Memorial University and provides, advising, tutoring, counseling, mentoring, and career planning to help students succeed in a post-secondary education. For more information about the program, please contact Lila Combs, Director at 423-869-6213.



Assistant Professor of Public Health/One Health and Research, Dr. Vinayak Nahar recently had several articles published.

Dr. Nahar co-authored a study on binge drinking in college students. An article concerning the study was published in *The Journal of the American Osteopathic Association* in July 2018.

Dr. Nahar also co-authored a paper titled, *A Comparison of Tanning Habits Among Gym Tanners and Other Tanners*. The article was published in the September issue of *JAMA Dermatology*.

Two additional articles were co-authored by Dr. Nahar and published in the August 2018 issue of the *Journal of the American Osteopathic Association*. The first article was titled, *Predictors of Responsible Drinking or Abstinence Among College Students Who Binge Drink: A Multitheory Model Approach* and the second article was titled, *Using a Multitheory Model to Predict Initiation and Sustenance of Fruit and Vegetable Consumption Among College Students*.



Recent Submissions and Awards

Submissions:

Dawn Spangler submitted a proposal to PetSmart for the Appalachian Shelter Symposium.

Jason Johnson submitted a proposal to USDA National Institute of Food and Agriculture.

Paul Wood submitted a proposal to the Michael J. Fox Foundation.

Jason Johnson submitted two proposals to the Appalachian Regional Commission for the POWER Grant.

Patricia Stubenberg submitted a proposal to Olympus to support continuing medical education events.

Awards:

Dawn Spangler was awarded a grant from PetSmart to support the Appalachian Shelter Symposium.

Student Support Services received notice of their 2018-2019 funding. The overall grant is awarded for a period of 5 years but notices of funding amounts are received each year.

Jason Johnson was awarded a USDA National Institute of Food and Agriculture Grant.

The LMU Police Department was awarded the State of Tennessee High Visibility Grant for the sixth year in a row.



Contact information for grants:

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Reminder from the LMU Institutional Review Board (IRB)

Please remember that all research proposals and projects involving human subjects, must have IRB approval ***prior*** to the presentation of any information gathered during the course of the research.

Under federal policy, the IRB cannot grant retroactive IRB approval.

All applications for external funding must first begin by contacting the ORGSP.

If your grant award, application, presentation, or publication has not been mentioned in this edition, please forward your information to us using the contact information listed above. Thank you!

Institutional Animal and Care Use Committee (IACUC)

All research proposals and projects involving animals must have IACUC approval. Please have protocols submitted at least one week before the next scheduled meeting for committee review. Below is a schedule of upcoming IACUC meetings:

October 25, 2018
November 29, 2018
December 20, 2018