



Kentucky Academy of Science

The Voice of Science in Kentucky

# NEWSLETTER

www.kyscience.org

Susan Templeton, Editor

August 2014

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Faculty, staff and students at Enhanced Affiliate member organizations receive:

- free KAS membership
- online access to KAS Journal
- KAS Newsletter via e-mail

The KAS Newsletter is published in January, May and August. Current and archived issues are available at [www.kyscience.org](http://www.kyscience.org). You may contact the Editor of the KAS Newsletter via e-mail at [executivedirector@kyscience.org](mailto:executivedirector@kyscience.org).

Editor's Note: When viewing the Newsletter in Acrobat Reader the Table of Contents (TOC) contains live links to each article; at the bottom right of each page is a link back to the TOC!

## 2014 Centennial Meeting Tentative Program

### Friday, November 14

- Noon – 3:15pm Paper and poster sessions – TBA
- 3:30pm Symposium: *Scientific Communication and Publishing*, with UK's Erik Reece and Jim Krupa, and Dr. Jerzy Jaromczyk and Dr. Neil Moore, Editor and Assistant Editor, Journal of the Kentucky Academy of Science
- 6:00 pm Social hour
- 7:00 pm Keynote speakers
- 8:35 pm Sectional Officers Meeting

### Saturday, November 15

- 8 am – 4 pm Exhibitors
- 8:30 – 11:30 am Keynote speakers
- 12:30 -5 pm Paper and poster sessions, TBA
- 5:00 pm Reception
- 5:30 pm Annual Business Meeting
- 6:45-8:30 pm Awards Banquet & Centennial Celebration

### Sunday, November 16

- Field Trips**
  - Ancient Earthquakes of Kentucky
  - The Science of Brewing Beer
  - Algae as Biofuel
  - Lower Howard's Creek Nature and Heritage Reserve
  - Food Chain Aquaponics
  - Thoroughbreds in the Bluegrass

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**From the Editor: I have resigned after serving 13 years as the Kentucky Academy of Science Newsletter Editor. If you would be interested in serving the Academy in this rewarding position, please contact President KC Russell at [russellk@nku.edu](mailto:russellk@nku.edu).**

# Messages from the Executive Director

I am excited to celebrate our 100th year with all of you! This year's meeting is bigger and better, with activities spanning 3 days. I hope you'll join us to connect with your colleagues and celebrate this milestone.

Find links to registration, abstract submission, speakers, field trips, hotel & travel info, and other details about the meeting at <http://kyacademyofscience.net/programs/annual-meeting/>

Regular pre-registration (before October 20) for Friday and Saturday (November 14& 15) will be \$50 members / \$25 for students / \$75 non-members

Banquet tickets will be \$30 (\$10 for students participating in a research competition)

Abstracts are due September 22. Papers and posters will be presented on Friday and Saturday, November 14 & 15.

## Highlights of the 100th anniversary KAS meeting:

Keynote speakers: Dr. Carole Cramer, Arkansas Center for Plant-Powered Production; Advance Kentucky's Joanne Lang; KY Statewide EPSCoR's Dr. F. Richard Kurzynske; Dr. Lee Todd, and Governor Steve Beshear

Science Communication Symposium with UK's Eric Reece, and Jim Krupa, and Jerzy Jaromczyk, Editor, Journal of the Kentucky Academy of Science

Awards Banquet & Centennial Celebration

History exhibit of the Kentucky Academy of Science, 1914-2014

Field trips with your fellow scientists! No rock hammer required.

Ancient Earthquakes of Kentucky  
The science of brewing beer  
Algae as Biofuel  
Lower Howard's Creek Nature and Heritage Reserve  
Food Chain aquaponics  
Thoroughbreds in the Bluegrass

## Centennial Meeting Speakers

Science Communication Symposium, Friday afternoon  
November 14:

- Erik Reece, University of Kentucky
- University of Kentucky's Jim Krupa
- Dr. Jerzy Jaromczyk, Editor Journal of the Kentucky Academy of Science

Keynote Speakers Friday evening and Saturday morning:

- Governor Steve Beshear (invited)
- Joanne Lang, Advance Kentucky
- Dr. F. Richard Kurzynske Director, KY Statewide EPSCoR Program
- Dr. Carole Cramer, Arkansas Center for Plant-Powered Production
- Dr. Lee Todd, founder, DataBeam

## New this year!

KAS Author's table – If you have published a book recently and would like to sell and sign books at the meeting, consider sharing a table with other KAS Authors on Saturday, November 15. Cost is \$40.

Photo Contest- We want your photos from before, during, and after the Centennial meeting. Post them to our KAS Facebook page or email them to us.

## KAS Centennial Marker

Did you know? KAS commemorated its 75th anniversary in 1989 with a monument in front of the UK Chemistry & Physics building. We're updating it to 100 years this year, so keep your eye out for a new marker & new announcement! Post a selfie with the old monument (while it's still there) to our Kentucky Academy of Science Facebook page.

## KAS Archives – 100 years of promoting science in Kentucky

We are undertaking a once-in -100 years opportunity to check out our historical records! We have archives at UK and EKU and we've been going through them to glean some of the interesting tidbits from KAS History. Highlights we've found so far:

- In the 1920's KAS approved a resolution on the teaching of evolution and raised money for a national scholarship fund in support of it;
- The first Transactions of the KAS was published in 1924;
- Dr. Anna Schneib was KAS' first female president in 1931;
- KAS became active in early years as an advocate for conservation of Kentucky's natural areas (We still are, with 2 seats on the Kentucky Heritage Land Conservation Fund.); and
- KAS was a party to the 1986 Supreme Court case challenging the teaching of creationism in Louisiana public schools (the Court ruled that such teaching was unconstitutional).



Amanda Fuller and Cheryl Davis digging through the Academy archives at UK.

## Other News from KAS

Million Women Mentors is seeking more Science & Technology mentors in Kentucky

Step 1: Signup for their pledge at

<http://www.millionwomenmentors.org/>

Step 2: Sign up as a mentor, and find a student seeking a mentor, at Fab Fems, <http://www.fabfems.org/>

## Membership Survey

Thanks to all 109 of you who have taken our membership survey. Sarah Emery of the University of Louisville is our lucky winner! For completing our survey, Sarah will receive a free Centennial Meeting registration and a free banquet ticket.

What did you tell us? Among other things, you told us:

KAS should be working more aggressively

- in an advisory role to our government,
- in curriculum development, and
- across disciplines to create well-rounded scientists.

You told us you would be interested in seeing more public programs, and 60% of you would be interested in giving a program in your field of expertise!

Sixty five percent of you said you would be interested in volunteering for science education, and more than 70% of you expressed interest in the various committees that keep KAS going each year.

Forty-nine of you expressed some interest in collaborating in some way, sharing a field site or a lab space. We will be following up to connect you to each other!

Look for more opportunities to share your ideas with us at the Centennial meeting in November – we want to hear from you about the next 100 years of Science in Kentucky!

## Kentucky Science Center Partnership for Science Education

### Youth Science Summits

In June, The Kentucky Academy of Science put on 2 Youth Science Summits in Louisville and Lexington. KAS Members & friends helped out as mentors and workshop leaders for these middle and high-school students interested in careers in the Sciences. Thank you!

On October 4, we'll be helping the Science Center with the first-ever Northern Kentucky Youth Science Summit – see the article on page 6 for details. Consider helping out for an hour or two and share your expertise!

Kentucky Science Center is leading the charge for a STEM teacher-training collaboration among KAS, some of our members and affiliates, Schools of Education, and high-need Kentucky school districts. The team will be meeting Friday morning November 14 at the Lexington Convention Center, before the KAS meeting starts. If you are interested, contact [Rachel.beck@louisvilleky.gov](mailto:Rachel.beck@louisvilleky.gov).

## Share your news of science & scientists in Kentucky!

Send us your news, your job openings, and your event & grant announcements- we post them at [kyscience.org](http://kyscience.org) and on our Facebook page.

## KAS Presentation at your Institution or Workplace

If you'd like to invite me for a 30 minute presentation and Q&A about KAS for a group at your institution or company, I would be delighted to visit. Please get in touch at 859-227-2837 or email [executivedirector@kyscience.org](mailto:executivedirector@kyscience.org).

## New Journal issue

Our latest issue of the Journal of the Kentucky Academy of Science is now available – as a member, you can log in and access all of our journal issues at [www.kyscience.org](http://www.kyscience.org). The Journal is also indexed and searchable at [www.bioone.org](http://www.bioone.org). Consider publishing your latest research in the Journal – details are at our website. Estimated deadlines for fall and spring issues will be January and July, but contact Journal Editor Jerzy Jaromczyk ([jurek@cs.uky.edu](mailto:jurek@cs.uky.edu)) for details.

*Amanda Fuller, Executive Director  
Kentucky Academy of Science  
[executivedirector@kyscience.org](mailto:executivedirector@kyscience.org)*



KAS Member Sarah Emery did a workshop on Plant Sciences at the Louisville Youth Science Summit in June.

## Author Information Wanted!

If you are a KAS member and have recently published a science focused book please forward this information to the KAS newsletter editor ([executivedirector@kyscience.org](mailto:executivedirector@kyscience.org)) so that your accomplishment can be shared with other scientists in Kentucky. KAS promotes the dissemination of the scientific interests of the Commonwealth of Kentucky. We look forward to hearing from you!

# 2014 Guidelines for Meeting Presentations

## Oral Presentations

All presentations should be compatible with Power Point version 2007 for Windows and brought on a USB drive as the computers will not have a CD drive. You must be in your assigned room 15 minutes before your session is scheduled to start in order to load your presentation.

## Poster Presentations

Each presenter will be provided with an easel and a 3x4 ft. poster board identified with a number that matches the presenter's number in the program booklet. This year the poster presentations will be set up for viewing on Friday and judging on Saturday. The week prior to the meeting the program will be listed on the KAS website and will show the judging schedule for each section.

- Set up
  - Friday 10:00 a.m. until noon.
- Viewing
  - Friday Noon until the end of the day.
  - Presenters do not need to stay with their posters once they have been set-up, only during the official view times.
- Judging
  - Saturday 9:00 a.m. until 5:00 p.m.
- Removal
  - Saturday 5:00 p.m.

If you have any questions, please contact Melony Stambaugh, Program Coordinator, at [stambaughm1@nku.edu](mailto:stambaughm1@nku.edu).

## KAS Governing Board Meeting

The Governing Board of the Kentucky Academy of Science met August 16, 2014, at 1 PM (Eastern) at the Kentucky Science Center, in Louisville, Ky. The minutes of this and other 2014 KAS Board Meetings are available at <http://kyacademyofscience.net/about/meeting-minutes/>.

Although several board members attended via Skype, those attending in person were captured in the photo to the right. *Front row (left to right):* Pam Feldhoff, Cheryl Davis, Amanda Fuller, Melony Stambaugh; *Back row (left to right):* Eric Jerde, Doug Chatham, Neil Moore, KC Russell, Chris Adams, Jerzy Jaromeczyk, Rodney King.

*Not available for the photo:* David White, Rob Kingsolver, Judy Voelker, Susan Templeton, David Butz, Katie Ann Skogsberg, Mary Janssen, Ruth Beattie, and Claire Rinehart.

## SOME SUGGESTIONS FOR A GREAT POSTER

- Creative ability and scientific thought are equally important.
- Keep in mind the appropriateness of the format for your poster in relation to your field.
- You can make 8.5 x 11" handouts of the poster and have them available to those who do not have the opportunity to speak with you.
- Do not include an Abstract on a poster (or an oral presentation). Abstracts are available in the program.
- Studies show that you have only 11 seconds to grab and retain your audience's attention so make the punch line prominent and brief. Most of your audience is going to absorb only the punch line. Those who are directly involved in related research will seek you out anyway and chat with you at length so you can afford to leave out much of the details and tell those who are really interested the "nitty-gritty" later.
- Graphic materials should be easily visible from a minimum distance of 6 feet. For general text, 18 point is readable. For section headings (Introduction, Methods, etc.) use Helvetica or Arial, Boldface, 36 point. Keep in mind that sans serif fonts (having characters without curlicues or other embellishments) are easiest to read, particularly from a distance.
- Use left-justification; text with even left sides and jagged right sides is much easier to read.
- Edit Ruthlessly! There ALWAYS is way too much text in most posters. Posters primarily are visual presentations; the text materials serve to support the graphic materials. On average the total amount of space should include about 20% text, 40% graphics and 40% empty space.
- Spatial organization makes the difference between reaching 95% rather than just 5% of your audience. Time spent hunting for the next idea or piece of data is time taken away from thinking about the science. Arrange the contents in a series of 3, 4, or 5 columns.
- Columns facilitate the flow of traffic past the poster remembering that people read from the upper left downward.



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## KAS Centennial Meeting Call for Abstracts

The Centennial Meeting of the Kentucky Academy of Science will be held at the Lexington Convention Center November 14 – 16, 2014. Faculty, students, independent scholars, and practitioners are encouraged to submit abstracts for papers and posters in each of the KAS sections. The annual KAS meeting features a paper competition for undergraduate and graduate students, and a poster competition for undergraduate students. This is a great opportunity for scientists to network and collaborate.

The deadline for submitting abstracts is Monday, September 22, 2014. You must register for the meeting before you can submit an abstract.

Early registration rates (until October 20, 2014) are: Students \$25 (banquet tickets for students registered in the competition \$10); KAS members \$50 (banquet ticket \$30); Non-members \$75; Plenary lectures & symposium only \$20 (students \$10).

The links to register and Submit Abstract are at: <http://kyacademyofscience.net/programs/annual-meeting/>

Field Trip Registrations are SEPARATE-- links are at <http://kyacademyofscience.net/programs/annual-meeting/field-trips/>

Before submission, please review the “Guidelines for Meeting Presentations” and “Guidelines for Abstracts” located at the KAS 100th Annual Meeting webpage. Papers and posters will be presented on Friday and Saturday with judging of posters on Saturday.

Questions about abstracts? Please contact the Program Coordinator, Melony Stambaugh at [program@kyscience.org](mailto:program@kyscience.org)

Questions about registration, sponsorship, or anything else? Please contact Executive Director Amanda Fuller, [executivedirector@kyscience.org](mailto:executivedirector@kyscience.org)

## Call for KAS Governing Board Nominations

The Kentucky Academy of Science Nominations and Elections Committee is seeking assistance from the KAS membership in our effort to identify a ballot of quality candidates to assume leadership roles within the Academy for 2015. KAS members interested in nominating colleagues for these vacant positions (or individuals willing to volunteer to be placed on the ballot) should forward the name, e-mail address/phone number for each candidate, and indicate the leadership position of interest. The Nominations and Elections Committee will contact each candidate to request the necessary information to be included on the ballot. This is an extremely important responsibility for the members of KAS and the committee needs your assistance in identifying candidates for these vacancies. The membership is being contacted at this time for nominations for the following offices:

- Vice President
- Secretary
- Physical Sciences Representative
- Social Sciences Representative

Any member may nominate another member for Vice President or Secretary. However, for Physical Sciences and Social & Behavioral Sciences/Science Education representatives, the nominators must identify with the Division for which they are nominating. Please send nominations by September 15, 2014 to:

Cheryl D. Davis, Ph.D.  
University Distinguished Professor  
Department of Biology  
Western Kentucky University  
Bowling Green, KY 42101  
[cheryl.davis@wku.edu](mailto:cheryl.davis@wku.edu)

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## Call for KAS Research Grant Applications

The following sources of research funding are available through the Kentucky Academy of Science:

The *Marcia Athey and Botany Funds* are available to support student and/or faculty research projects.

The *Special Research Program* is directed particularly to faculty in Kentucky higher education institutions, public or private, involved primarily in undergraduate education; i.e., institutions which do not award the Ph.D. degree.

The *Undergraduate Research Program* makes available funds for research planned and conducted by undergraduate students of Kentucky colleges and universities under the supervision of a faculty member. Applicants may submit for either an *Undergraduate Research Supply Grant* (up to \$500) or a *Summer Undergraduate Research Grant* (up to \$3,000).

To submit a grant application please log on to your KAS Member Profile page and select the “Apply for Grants” tab.

The Terms and Conditions for all KAS Grants, the KAS Grant Application Cover Sheet, and the KAS Conflict of Interest form are downloadable in multiple formats.

The deadline for 2015 Grant Applications is November 15, 2014.

ALL GRANT APPLICATIONS MUST BE SUBMITTED ONLINE.

The Committee on Distribution of Research Grants will review all submissions and award announcements will be made in February 2015.

## KBRIN NIH R15 Grant Writing Workshop at KAS Meeting

Friday, November 14th, 2014

University of Kentucky WT Young Library

The Kentucky Biomedical Research Infrastructure Network (KBRIN) will again offer an intensive workshop on the development of National Institutes of Health (NIH) R15-Academic Research Enhancement Award (AREA) proposals. AREA grants are specifically designed to support research projects (three years- \$300,000) in the biomedical and behavioral sciences conducted by faculty and students in colleges/universities and health professional schools that have not received more than \$6 million in NIH research grants in four of the last seven fiscal years. Thus, faculty at nearly all colleges/universities in Kentucky are eligible.

The three main goals of the AREA program are: (1) to support meritorious research; (2) to strengthen the research environment of the institution; and (3) to expose students to research.

The workshop will be led by faculty at KBRIN institutions that have been successful in competing for AREA grants. The morning session is designed for faculty with little or no NIH grant writing experience, whereas the afternoon session is designed to enhance the competitiveness of faculty with some NIH grant writing experience. Depending upon level of experience with the NIH, registrations will be accepted for the either the full day workshop or the afternoon session only.

Past attendees at this workshop have been successful in obtaining NIH funding and this workshop is required to be eligible for KBRIN research grants (see <http://louisville.edu/research/kbrin/kbrin-cores/research-core>)

The morning workshop will begin at 9:00 am EST and the afternoon session will begin at 1:00 pm EST. Lunch will be provided at noon.

The workshop is free and open to interested faculty at all Kentucky public and private institutions.

As space is limited, please register online by Monday, October 27th at

<https://kbrin1.redcap.louisville.edu/redcap/surveys/?s=nPR4c2jZU8>

Registration deadline is Monday, October 27th.

For registration information contact, Ms. Whitney Rogers, KBRIN UBM at [whitney.rogers@louisville.edu](mailto:whitney.rogers@louisville.edu) or 502-852-3045.

For additional workshop information, contact Dr. Nigel Cooper, KBRIN PI ([nigel.cooper@louisville.edu](mailto:nigel.cooper@louisville.edu)) or Dr. Bruce Mattingly, KBRIN program coordinator ([b.mattingly@moreheadstate.edu](mailto:b.mattingly@moreheadstate.edu)).

This workshop is sponsored by the Kentucky Biomedical Research Infrastructure Network (KBRIN), which is supported by a grant from the National Institute of General Medical Sciences (8 P20 GM103436-14) from the National Institutes of Health.

## Northern Kentucky Youth Science Summit (YSS) needs STEM professionals

**When:** Saturday October 4, 9:00 to 4:30

**Where:** NKU campus

**What:** A day-long program of Science, Technology, Engineering, and Math (STEM)

**Who:** Middle & High School students, and STEM professionals, like you!

The Youth Science Summit aims to inspire youth about a potential career in a STEM field, while also providing a deeper understanding of regional career opportunities that meet their interests and strengths. Participants will be in tracks (25 youth each) for Middle School, High School, and a special focus for Middle School Girls in STEM.

**STEM Demonstrations / Lab Experiences** –We are looking for hands-on programs in 30, 60, or 90-minute blocks. A variety of classroom spaces are available, including multi-purpose conference rooms and computer labs. Slots available all day

**Reverse Science Fair**- For exhibits or informational displays, or short (5-10 minute) easily repeatable tabletop demonstrations. While it is ideal for presenters to share their information in person, these can be left unstaffed. Available Slots 1-3pm

**Speed Mentoring**- Groups of teens will rotate through tables with a professional (that's you!) to simply chat about higher education, career paths, STEM advice, etc. No preparation necessary -- & ideal if you can only volunteer for a couple hours. Available Slots 12:30-4:30

**Other Volunteers** – We need lots of help the day of the event with include chaperone duties, logistical support, etc.

Interested in any of these opportunities? Please contact us with questions and to sign up for the time and age level that works out best for you. Please note that we will be providing lunch to all of the STEM professionals and volunteers.

**Contact:** Andrew Spence, Visitor Experience Coordinator, (502) 560-7129, [Andrew.spence@louisvilleky.gov](mailto:Andrew.spence@louisvilleky.gov)



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## 2014 KAS Committees

The following individuals have been appointed to serve on the standing and ad hoc committees of the Kentucky Academy of Science. If you are interested in serving on a KAS committee, please contact President KC Russell ([russellk@nku.edu](mailto:russellk@nku.edu)).

### Committee on Membership

Mary Janssen, KCTCS -CHAIR  
John Starnes, KCTCS  
Cangliang Shen  
Amanda Fuller, KAS

### Committee on Legislation

Blaine Ferrell, WKU -CHAIR  
Cate Webb, WKU  
1 position vacant

### Committee on Distribution of Research Funds

George Antonious, KSU -CHAIR  
Gary Ritchison, ECU  
Ilsun White, Morehead State U  
Eric Jerde, Morehead State U  
Claire Fuller, Murray State U  
Nigel Cooper, U of L

### Committee on Publications

Jerzy Jaromczyk, UK -CHAIR  
KC Russell, NKU  
Neil Moore, UK  
Claire Rinehart, WKU  
Newsletter editor – vacant after August 2014  
1 position vacant

### Committee on Science Education

Nancy Martin, U of L  
Lingyu Huang, KSU  
Bill Staddon, ECU  
Akhtar Mahmood, Bellarmine U  
Michael Thompson, KCTCS  
John Carmen, NKU

### Program Committee

David White, Murray State U- CHAIR  
Melony Stambaugh, NKU  
Amanda Fuller, KAS  
Eric Jerde, Morehead State U  
KC Russell, NKU  
Program committee also includes all Section Leaders

### Committee on Awards

Eric Jerde, Morehead State U-CHAIR  
Amanda Fuller, KAS  
KatieAnn Skogsberg, Centre  
Chris Adams, Berea

### Committee on Nominations and Elections

Cheryl Davis, WKU  
Doug Chatham, Morehead State U  
1 position vacant

### Finance Committee

KC Russell, NKU-CHAIR  
David White, Murray State U  
Rodney King, WKU  
Eric Jerde, Morehead State U  
Amanda Fuller, KAS

### Planning Committee

Cheryl Davis, WKU-CHAIR  
Melony Stambaugh, NKU  
Amanda Fuller, KAS

### Public Relations Committee

Amanda Fuller, KAS -CHAIR  
KatieAnn Skogsberg, Centre  
John Starnes - KCTCS  
Ben Ashburn - Murray State U  
Newsletter editor – vacant after August 2014

### Steering Committee for KJAS

Ruth Beattie, UK-CHAIR  
Robin Cooper, UK

### AD HOC Superlative Award Nominating Committee

Phil Lienesch, WKU  
Albert Meier, WKU  
Dave Robinson, Bellarmine

### AD HOC Natural History Survey/Museum

representative from Board - vacant  
Ron Jones, ECU  
Albert Meier, WKU  
Demetrio Zourarakis- Ky Geol Survey

### AD HOC Centennial Committee

KC Russell, NKU Chair  
Cathleen Webb, WKU  
David Butz, Morehead State U  
Ken Crawford, WKU  
Amanda Fuller, KAS  
Melony Stambaugh, NKU  
Judy Voelker, NKU  
Cheryl Davis, WKU

### Ad HOC Digital Media Committee

KC Russell, NKU  
KatieAnn Skogsberg, Centre  
Chris Mullins, Campbellsville  
Newsletter editor – vacant after August 2014

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# *Science Across the Commonwealth*

## **Posters at the Capitol 2015**

Posters-at-the-Capitol is designed to celebrate the research, scholarly, and creative experiences of undergraduate students at Kentucky's public institutions of higher education. It provides students with the opportunity to present their projects to state legislators and to impress upon them the importance of faculty-mentored projects to the overall education of Kentucky students. Poster presentations are being sought from undergraduates in ALL DISCIPLINARY AREAS.

This event will be held on February 19, 2015. The abstract deadline is Wednesday, October 15, 2014. Register at:

<http://campus.murraystate.edu/services/URSA/>

Please call (270) 809-3192 or e-mail [jcofer@murraystate.edu](mailto:jcofer@murraystate.edu) with questions, or e-mail your local campus contact:

[jonathan.gore@eku.edu](mailto:jonathan.gore@eku.edu)  
[marye.janssen@kctcs.edu](mailto:marye.janssen@kctcs.edu)  
[george.antonious@kysu.edu](mailto:george.antonious@kysu.edu)  
[m.henson@moreheadstate.edu](mailto:m.henson@moreheadstate.edu)  
[jcofer@murraystate.edu](mailto:jcofer@murraystate.edu)  
[farrarj1@nku.edu](mailto:farrarj1@nku.edu)  
[evie.russell@uky.edu](mailto:evie.russell@uky.edu)  
[pamela.feldhoff@louisville.edu](mailto:pamela.feldhoff@louisville.edu)  
[blaine.ferrell@wku.edu](mailto:blaine.ferrell@wku.edu)

## **Ark Park Tax Incentive Petition**

The Kentucky Tourism Development Authority has given preliminary approval for as much as \$18.25 million in tax incentives for the first phase of the Noah's Ark Biblical Theme Park project in Grant County, Kentucky. A feasibility study will be conducted before final approval is given, which gives us a little time to make our voices heard.

The park is associated with Answers in Genesis, which runs the Creation Museum in Boone County. The basis of the Creation Museum is that the Earth is only 6,000 years old.

Kentuckians for Science Education has posted a petition opposing the tax incentives at the following link:

<http://www.ipetitions.com/petition/kentucky-state-government-to-ignore-constitution>

Please sign the petition at the link above. Also, pass this on to other people who may be interested in signing.

Thanks!

Dan Phelps

Kentucky Paleontological Society



Artist's rendering of the Ark Encounter, a Noah's Ark-themed park planned for a site west of Interstate 75 near Williamstown, Ky.



## Themes in Evolution VI: Amphibian Genetics and Conservation



The dusky gopher frog, *Lithobates sevosus* (left), is a critically endangered species, existing in only two geographically separated populations, one of which may already be extinct. Two related species, the gopher frog,

*Lithobates capito*, and the crawfish frog, *Lithobates areolatus*, are both near-threatened globally but are also in need of conservation mostly due to habitat loss.

These frogs share certain genetic and ecological characteristics, with “clumped” distributions of populations breeding in ponds across the landscape. Population size is positively correlated with genetic variability and connections between ponds that allow movement of individual frogs and therefore gene flow also enhance diversity. Two life-history characteristics make these frogs susceptible to adverse effects of habitat loss and fragmentation. Their annual reproductive success alternates infrequent seasons in which population size increases sharply, interspersed among more often-recurring years of population decline. In addition, individuals do not generally move long distances between ponds, so that habitat loss and consequent fragmentation have deleterious effects on species persistence. Stephen Richter, of Eastern Kentucky University, studies the relationships between habitat loss, which results in population declines, and genetic variability in these frogs.

Genetic variability is measured by allelic richness, or number of different versions of genes, and heterozygosity, or proportion of individuals with non-identical alleles. The effects of geographic isolation on genetic variability in the dusky gopher frog, *L. sevosus*, were assessed by Richter and his colleagues through comparisons with the gopher frog, *L. capito*, and the similar crawfish frog, *L. areolatus*. The dusky gopher frog was predicted to have lower genetic variability than the other two species, and to show genetic evidence of a recent population bottleneck, a sudden decline in the number of individuals. Populations of *L. sevosus* were sampled from a completely isolated site in coastal Mississippi, and compared with samples of *L. capito* from a contiguous protected habitat in Florida, and of *L. areolatus* from a contiguous pastureland with many breeding ponds in Oklahoma. DNA was extracted from individuals and measures of heterozygosity, allelic richness, and inbreeding were evaluated.

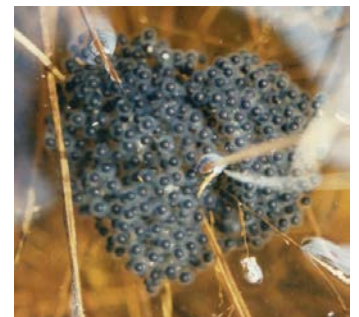
Genetic signatures of a population bottleneck event are heterozygosity and allelic diversity. Following a population-reduction event, allelic diversity is reduced at a faster rate than heterozygosity, resulting in heterozygotic excess. A population bottleneck results in greater heterozygosity than what would be expected at rates of random genetic drift through mutation in a population. A bottleneck event is also shown in the frequency distribution of alleles. In healthy populations, allelic frequency distributions show the presence of many low-frequency alleles. Following a bottleneck event, many of these low-frequency alleles are more likely to be lost, changing the shape of the frequency distribution.

Results of comparisons of *L. sevosus*, *L. capito*, and *L. areolatus* by Richter and his colleagues showed reduced genetic variation at individual loci in the isolated dusky gopher frog, *L. sevosus*, compared to the non-isolated *L. capito*, and reduced frequency of rare alleles at loci compared to both *L. capito* and *L. areolatus*. Analyses of heterozygotic excess compared to allelic richness and loss of low-frequency alleles indicated a recent bottleneck event had occurred in the dusky gopher frog, *L. sevosus*. Neither *L. capito* nor *L. areolatus* showed heterozygotic excess or shifts in frequency-distributions of alleles.

The reduced genetic variation in the dusky gopher frog was attributed by Richter to the small size of the remaining population of fewer than 200 adults in a single breeding pond. The findings have implications for conservation of *L. sevosus*, as well as other species. Richter made recommendations for continued demographic monitoring of known populations and searching for unknown populations, combined with restoring historic sites and maintaining buffer zones. Gene flow could be maintained through introducing tadpoles into existing populations.

Correlations between genetic heterozygosity and fitness are useful in small, isolated populations to measure whether inbreeding has resulted in genetic erosion, and to determine whether survival to reproductive adulthood, a direct measure of fitness, is related to genetic variability.

Richter and his colleague collected tissue samples and extracted DNA of the gopher frog, *L. sevosus*, from three life-stages in a pond in Mississippi during a single year. Individuals were genotyped for 8 microsatellite loci, which were determined through heterozygosity-heterozygosity correlations to be representative of genome-wide heterozygotic diversity. Differences in multi-locus heterozygosity and allelic richness were evaluated for individuals in each life-stage cohort and compared in the order of: adults that had migrated to the pond, egg clutches, and emerging metamorphic adults. Relationships between measures of genetic variability and differential survival of offspring, and between genetic variability and mortality of egg clusters, were analyzed. Findings showed a positive heterozygous genetic fitness association in the egg stage, and a surviving cohort with higher multi-locus heterozygosity in the metamorphic adults than in eggs, indicating survival to metamorphosis of the less inbred individuals. The probability of survival to metamorphosis was positively correlated with genetic variation.



Right: Cluster of dusky gopher frog eggs.

Fitness reductions due to inbreeding can be balanced by selection through purging of deleterious homozygous alleles and non-random survival of individuals with greater genetic variability.

In the short term, selective mortality in early life stages that results in genetic loss is not deleterious to populations. Inbreeding reduces heterozygosity, but does not affect allele frequencies, or allelic richness. However, inbreeding depression, in which the most inbred individuals do not survive to reproduce, results in loss of lethal alleles and heterozygotic excess, and affects allelic frequencies both across generations and within life-stages. Long-term persistence of a species requires allelic diversity, because this is the variation upon which natural selection acts. Richter and his colleague found shifts in gene frequencies, indicating inbreeding depression and loss of allelic richness in *L. sevosus*. The genetic loss of allele frequencies can be deleterious to these amphibians that experience habitat fragmentation and therefore loss of genetic influx. Declining genetic variation will decrease probability of long-term persistence of the species.

Population genetic analyses and diversity of gopher frogs, *L. capito*, and crawfish frogs, *L. areolatus*, were also carried out by Richter and his colleagues, with a view toward finding how evolutionary lineage divergence has established modern populations, and how conservation efforts of these frogs might be carried out. Populations of crawfish frogs, *L. areolatus*, in southern Indiana, were surveyed for genetic diversity and population structure. Crawfish frogs are threatened globally, and although their populations have declined in Indiana, Richter found their genetic diversity, measured by heterozygosity, was still greater than the isolated populations of the critically-endangered dusky gopher frog, *L. sevosus*.

Another gopher frog, *L. capito*, a species inhabiting the gulf and Atlantic coastal plains states, has been listed as near-threatened. Richter and his colleagues examined genetic diversity of populations of these gopher frogs for fine-tuned classification and conservation of these frogs. They isolated and amplified mitochondrial DNA from tissue samples collected throughout the range of *L. capito*. Independent sub-populations of *L. capito* could be identified by ordering population-level clusters of DNA sequences hierarchically. Population genetic structures were sorted into genealogies, and these were compared with the geographic distribution of the individuals sampled. Estimated times of lineage divergence could be obtained using molecular clock models, which assume that specific molecules (genes) mutate at different, constant rates, so genetic differences accumulating between different lineages indicate time of divergence from a common ancestor. The times of lineage divergence obtained by Richter and his colleagues were compared with known geological events to determine coincidence between phylogenetic and biogeographic factors.

The optimally partitioned analyses of the genetic data supported the view of a monophyletic *L. capito* having two groups, and one of these further subdivided. One group, or clade, occupies coastal plains of Mississippi, Alabama, Georgia, South and North Carolina, and panhandle Florida. The second group divides into two clades, in northern

peninsular Florida, and southern peninsular Florida. Divergence times between the coastal plains clade and the two peninsular lineages was estimated at 1.9 - 2.3 million years ago (mya), and divergence between northern and southern Florida clades was estimated at 1.1 - 1.3 mya.

These findings for the gopher frog, *L. capito*, have consequences for their conservation. They support recognition of coastal plains populations of gopher frogs as a genetically distinct “evolutionary significant unit” (ESU) from the two peninsular Florida ESUs. The federal Endangered Species Act permits listing of sub-populations as “distinct population segments” (DPSs). The Florida populations of gopher frogs are stable, but Richter advises that the coastal plains population of *L. capito* warrants immediate listing as a DPS, based on genetics and the corresponding geographical division of this species.

Both the gopher frog and the crawfish frog experience high mortality threats between egg stage and metamorphic adult. These threats come from genetic, but also from environmental factors. Loss of habitat results in patchy distribution and isolation of small populations from each other. Taken together, these studies contribute to an understanding of how genetic variation within species is partitioned into populations, and how ecological factors affect genetic structure. As such, they contribute to an overall understanding of gopher and crawfish frog conservation.

#### Further Reading

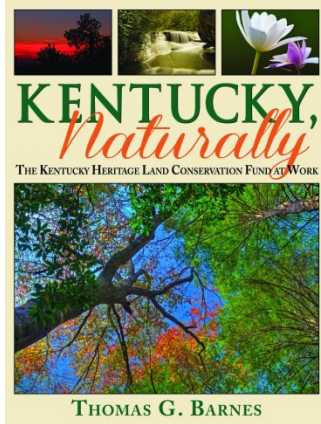
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# Kentucky Heritage Land Conservation Fund

## KHLCF Book Highlights Natural Areas

Dr. Richard K. Kessler (Chair) and Zeb Weese (KHLCF Biologist)



Dr. Thomas G. Barnes, full professor in the Department of Forestry at the University of Kentucky, has published a book about the natural areas purchased with the assistance of the Kentucky Heritage Land Conservation Fund (KHLCF) during the first 20 years of the program. *Kentucky, Naturally* displays hundreds of

beautiful photographs of the state's protected lands, including Kentucky State Parks, State Nature Preserves, Wildlife Management Areas, Wild River Corridors, State Forests, as well as smaller city and county parks. Over 100 sites statewide have individual chapters, from Three Ponds State Nature Preserve on the Mississippi River to the Martin's Fork State Natural Area in Harlan County. While primarily a photography book designed to interest recreational nature-lovers, it also provides detailed descriptions of each site's flora and fauna, including lists of rare species found at each site.

The KHLCF hopes that after perusing the book KAS ecologists, botanists, zoologists and other researchers may discover locations of interest as field research sites. The KHLCF supports the efforts of the new Kentucky Organization of Field Stations (KOFS) and several KHLCF properties featured in the book are formal participants in the KOFS, including the WKU Upper Green River Biological Preserves, EKU's Lilley Cornett Woods, the KSU Environmental Education and Research

Center, and Clay Hill Memorial Forest at Campbellsville University. In addition to these university-owned sites, many of the other properties featured in the book have been utilized in field studies by researchers or as field trip sites for college courses. For example, EKU's Dr. Ron Jones and his students have completed extensive floras at many KHLCF sites, including Kentenia State Forest, a 4,200 acre site in Harlan County. In the past the KHLCF has funded biological inventories of most properties it funds, however budget constraints may limit this in the future.

For more information on the Kentucky Heritage Land Conservation Fund or to find out more about natural areas suitable for research, please go to [heritagelands.ky.gov](http://heritagelands.ky.gov) or contact Zeb Weese at [zeb.weese@ky.gov](mailto:zeb.weese@ky.gov).



Forest canopy in fall color at Kentenia State Forest from overlook on Kentucky Highway 2010. Photo by Tom Barnes

Don't forget to buy a nature license plate when you register your car, light truck or SUV!

Money from the sale of these plates goes into the Heritage Land Conservation Fund for purchasing natural areas to be left as wild places held in trust for future generations.

