Kansas Association of Biology Teachers Newsletter

Volume 42 Number 1 - March 2001

KABT Web Site

http://kabt.org

NABT Web Site

www.nabt.org

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Species and Speciation: Introduction, Discussion, and Example

Christopher H. Haufler and Helen M. Alexander
Department of Ecology and Evolutionary Biology
University of Kansas

With some additions by Robert Hagen

All peoples and cultures on Earth recognize that the natural world is composed of different kinds of organisms that can be told apart by features that can be seen, described, and studied. Our ancestors discovered and passed along to us that some plants are palatable and others are poisonous, some animals are docile, others are dangerous, and it is vital to know the characteristics of each group.

Around 250 years ago, scientists and scholars began to

(continued on page 2)

Stuck-on Artemia

(prepared by C. Drewes 10-99)

Rationale:

Brine shrimp are inexpensive and fascinating organisms that allow students to study growth and development in relation to cryptobiosis. "Cryptobiosis" is a state of suspended animation induced by environmental adversity. An example is the cryptobiotic state of arrested embryonic development that occurs in invertebrates such as brine shrimp, fairy shrimp and tadpole shrimp. Prior to release by the female, the developing embryos of these organisms are encysted in a protective shell which enables survival of desiccation or other environmental extremes. In the encysted, cryptobiotic state embryos may remain viable for many years. Is it possible that methods could be developed for inducing cryptobiosis in human embryos? (Complete article found on page 11.)

replace the vague notion of "kinds" with a more precise and useful system for naming and distinguishing organisms. The basic group in the system of scientific names is the species. Each species belongs to a larger category, the genus, and each genus, in turn, belongs to a family, which belongs to an order, and so on. This nested arrangement of categories is a basic feature of biology.

The originators of scientific classification in the late 1700's believed that species were unchangeable and that they occupied fixed positions in a grand hierarchy of nature. The "great chain of being" began with rocks at the bottom, extended upward through plants to animals, and ended with people at the top. This idea implied that each species had been separately created in its place, distinct from all other species—Contrary to common belief, "creationism" began with this early scientific idea, not with ancient Jewish or Christian writers or sacred texts.

By 1850 the idea that species were separately created was being questioned by many biologists. One problem is that, although the majority of species can be distinguished from each other, there are many that are difficult to recognize. Some species appear to blend into one another, with many apparently intermediate individuals. Variation within species is common. Furthermore, the arrangement of organisms into nested categories doesn't really fit into a single "chain of being." The pattern resembles much more the branches of a tree or bush—or of a genealogy or family tree.

Charles Darwin's Origin of Species, published in 1859, provided overwhelming evidence that species can change over time and can give rise to new species. The natural processes that produce new species are called speciation. Darwin argued that the nested categories of organisms are a simple result of shared ancestry: Species within a genus are the products of relatively recent speciation from a common ancestor. Older speciation events produced the ancestors of genera (genera = plural of genus) within a family. Progressively more distant ancestors link the species within orders, classes, and so forth. (Fossils—when they can be found!—may preserve intermediate stages in divergence of the lineages descended from these unknown ancestors.)

Darwin's theory gives a logical explanation for "difficult" species: they are merely cases in which speciation is incomplete. The dynamic processes of evolution mean that we should not expect organisms to fit into neat and tidy categories. Ironically, the observation that many living organisms do fit into our classification schemes tells us that speciation must occur slowly, or rarely, on the timescale of human lives. This makes speciation difficult to study!

What is a species?

Despite the importance of species to biology, it is surprisingly difficult to define the term precisely. A large number of definitions have been proposed, but none is completely satisfactory for all types of organisms. For living organisms that reproduce sexually, most definitions of a species include the idea that members of the same species can breed successfully with one another (or at least, with members of the proper sex!), but not with members of other species. Failure to interbreed can be caused by any of a huge number of possible reasons. Usually, a simple "lack of opportunity" is excluded—unless it is caused by inherent differences between the potential partners. For example, although plants on one island might not interbreed with plants living on another island, they might still be considered members of the same species, if there was no other reason for their reproductive isolation. On the other hand, if the plants differed in their time of flowering, they might be considered different species because they would be unable to interbreed even when they occur together.

Reproductive isolation is significant because it defines the limits of a population that will evolve together. Within a few generations, favorable mutations and gene combinations can spread throughout a species as a result of interbreeding, but not into other species. By chance, even neutral traits (neither advantageous or harmful) can spread more slowly in this way. Over time, members of reproductively isolated species will differ in more and more genetically-based features.

In the initial stages of divergence, it may be very difficult to distinguish populations that have become permanently reproductively isolated from one another (in other words, after they have speciated). However, members of "older" species ought to be more easily recognized, because they should differ in many features.

When species are named, they are given complete descriptions of their features, from a thorough discussion of their physical characteristics, to a presentation of where they can be found, to a depiction of their habitat and ecology. In the science of biology, such species descriptions are hypotheses that are subject to the same rigorous experiments and tests as hypotheses in other fields. These hypotheses tell us that the features possessed by each species separate it from every other species on Earth. Some of these features are usually tied in some way to the reproductive system of the species; members of a species breed with each other to form viable (successful) offspring but either do not breed with members of other species or form sterile offspring when they do. Species as evolutionary hypotheses also have genealogical histories; they have ancestors from which they arose and from which they are now isolated. Experiments can be conducted to look carefully at the boundaries of species, to consider how they became isolated from each other, and to find out whether their descriptions (hypotheses) are accurate. Such experiments help us to discover whether the hypotheses should be supported or falsified.

How can we study speciation?

Experiments can also test hypotheses of how species originated and later separated from their proposed ancestors. These experiments have demonstrated that there

are many different mechanisms that can cause new species to evolve. The mechanism that is widely accepted as the most frequent cause of speciation begins with a simple geographical separation of individuals. The hypothesis states that large populations can have small populations at their edges and that it is likely for barriers to isolate such peripheral populations from the main population. If this isolation persists for a long enough period, the small population may develop significant differences from the main population and be recognized as a separate species. There are many situations that illustrate this kind of speciation mechanism. For example, there are two different squirrel species on either side of the Grand Canyon. Studies have demonstrated that they are closely related species, but there are easily recognized differences that may have developed because the two sets of populations are separated by an insurmountable barrier to reproduction, at least for squirrels! It is interesting to note that organisms such as birds that can easily move across the canyon have not diverged into separate species on opposite rims. The best hypothesis for how this kind of speciation mechanism works states that changes differentiating the two sets of squirrel populations have evolved gradually over many generations, and thousands or millions of years. Layer upon layer of evidence from physical characteristics, to breeding behaviors, to analyses of protein and DNA composition can support the hypothesis, yet it is difficult to do real-time experiments to test such a hypothesis directly.

There are, however, well known species whose origins can be replicated. Consider, for example, three different sunflower species from North America. Helianthus annuus, the common annual sunflower, was named by Linnaeus in 1753 and is a common roadside weed from Canada to Mexico. In 1821, Thomas Nuttall, a prominent botanist working in the Midwest, noticed that sunflower plants growing on better drained soils of the Midwest were similar to Helianthus annuus but were smaller plants. Looking more closely, he found that there were several distinctive features including longer, narrower leaves and a less hairy set of more narrow bracts (specialized leaf-like structures) underneath the flowering head. Later, working in dry, sandy regions of the Colorado plateau in 1931, the keen eye of Sidney Blake noticed yet another yellow sunflower that had narrow leaves like H. petiolaris, but had hairy bracts underneath its flowering heads, like H. annuus. He found these features different enough to describe and name a new species, Helianthus anomalus.

In 1969, Charles Heiser and his colleagues published a thorough review of the state of knowledge of the approximately 110 species in the genus Helianthus. Heiser affirmed that the three species introduced above were well characterized and clearly separated from each other based on where they grow and their physical features. These physical features were genetically determined, not environmentally induced, because even when grown together in a common greenhouse, individuals representing the different species maintained their own characteristics. In addition, based on these features and the observation that H. annuus and H. petiolaris often grow together and cross breed in nature to form semi-sterile hybrid offspring, Heiser hypothesized that new Helianthus species, such as H. anomalus, could have originated through hybridization between the other two species. Thus, with Heiser's hypothesis, we have a set of well recognized, closely related species and a mechanism by which interaction between two of the species could have initiated the third species.

Speciation via hybridization is a common feature of the evolutionary history of plants, as well as animal groups such as beetles, amphibians, and fish. Often, hybrids become stabilized as separate species and isolated from their progenitors (ancestors) by the process of polyploidy, a doubling of their chromosome number that erects a decisive genetic barrier between them and the species that participated in their origin through hybridization. In the case of the Helianthus example, however, all three species have the same number of chromosomes. So, the question arises, how did H. anomalus become isolated so effectively from its progenitors? The answer to this important question was provided by Loren Rieseberg and coworkers over the past decade. Rieseberg first used greenhouse-grown plants to re-create the hypothesized hybridization events. By crossing the proposed parental species, H. annuus and H. petiolaris, Rieseberg was able to produce hybrids that had the morphological features of H. anomalus. But he took the research further and described in detail the DNA from each parent and the derived hybrid. These genetic fingerprints showed (not unexpectedly) that DNA regions typical of each parental species were combined together in the hybrid species. What was not expected was the discovery that the way that the parental DNA was arranged in the hybrid was not random. Rieseberg produced the hybrid species three different times, and each time only one particular arrangement of DNA bases was found in the hybrid. Rather than being a haphazard process of melding the two progenitor species, only certain arrangements of the chromosomal elements led to a successful offspring. Genes from H. annuus were always found in the same position on the chromosomes of H anomalus, as were those from H. petiolaris. And, comparing the greenhouse-grown hybrid species to those obtained from field collections of H. anomalus revealed that both sets of plants had similar DNA arrangements. One explanation for this discovery is that only certain genetic arrangements work in nature and that these persist through time because they can be passed on to the offspring of the hybrid species. Crosses of the hybrid species to its parental species yields plants that do not survive because such backcrossed plants do not have the genetic combinations that can be tolerated by the chromosomal architecture of the organisms. Thus, H. anomalus has its own unique genetic features that it passes to its offspring

and that maintain the isolation of this lineage from closely related H. annuus and H. petiolaris from which it arose.

This example illustrates several important elements for understanding how evolution works and how scientists develop hypotheses about the history of life on Earth. First, careful observations and knowledge of organismal diversity are fundamental to developing new species hypotheses. Second, nearly all initial hypotheses about new species, such as those of Nuttall and Blake, are developed from carefully observing the physical characteristics of organisms and discovering their distinctive features. Third, by combining information from morphology, ecology, and geography, it can be possible to propose hypotheses, like Heiser did, about species relationships and origins. Fourth, some of the species discovered long ago by observation of natural populations can be re-created in modern laboratories under controlled conditions. Fifth, by studying the organization of genetic material in organisms, as Rieseberg did, it can be possible to develop insights into the processes by which evolutionary mechanisms yield biodiversity. Sixth, although often complex, the processes by which new species originate can be described, formulated as hypotheses, and tested.

It is important to emphasize that modern researchers stand on the shoulders of their predecessors and require the foundations of knowledge and understanding that have been provided by many generations of curious and thoughtful scientists. Without the insight provided by discoverers in centuries gone by, the steps taken today to explain evolutionary processes would not be possible. In some parts of the Earth, for example some of the tropical forests of South America and Asia, we are still at the discovery level of scientific explorations. New species are being described by specialists whose knowledge of biodiversity allows them to recognize new combinations of features that characterize and distinguish unique elements of the flora and fauna. And it will probably be many years before we are at the point of being able to develop testable hypotheses about the processes that lead to the origin of these species. However, the discovery of new species combined with modern methods and laboratory techniques will continue and accelerate as we reach clearer understandings of how organisms are constructed, function, and evolve.

Finally, it is noteworthy that studies of speciation are important in our everyday lives. Much of our ability to breed new crops and domesticated animals depends on our in-depth knowledge of their evolutionary history; for example, our modern wheat is the product of repeated hybridization and speciation events.

Thoughts on KSBE's Feb. 14th decision:

On February 14th the Kansas State Board of Education adopted Draft 6.1 of the Kansas Science Education Standards. The vote was 7-3. These new standards reinstate evolution and Darwin's theory of natural selection to their center of importance (in an educational sense) in modern scientific understanding.

KABT members and members of the writing committee, John Richard Schrock, Pat Wakeman, Steve Case, Ken Bingman, Brad Williamson and Carol Williamson were present for the historic event. The writing committee worked hard to provide the best science standards possible for Kansas students. We considered and deliberated over all public, professional and private input.

As you know, Darwin himself struggled with the issue of reconciling religious belief with scientific understanding. Included in a letter that his wife Emma wrote to him is the following:

"May not the habit in scientific pursuits of believing nothing till it is proved, influence your mind too much in other things which cannot be proved in the same way, and which if true are likely to be above our comprehension…."

Apparently Charles and Emma found it difficult to talk of this issue face to face. On the outside of this letter Darwin wrote: "When I am dead, know that many times, I have kissed and cried over this."

Today, Darwin still serves, as is a model of tolerance, respect, and propriety—especially for teachers. Let's keep in mind that the polls or the courts are only offer temporary resolution to issues such as this. Society, itself, still needs to maintain a dialogue and seek solutions that can accommodate a diversity of belief systems with an increased understanding of the limitations and nature of science. That dialogue begins with respectful teaching in the biology classroom.

Brad Williamson

Adopted from comments at Darwin's Birthday Celebration, Feb. 12, 2001, University of Kansas Museum of Natural History.

Publishing Dates For Newsletter

The newsletter is published during the months of September, November, February and April. Manuscripts must reach the editor by the 15th day of the previous month. The KABT Newsletter includes abbreviated minutes of the official meetings, announcements of future activities, brief news notes, and other brief items of interest to biology teachers. Send your contributions to John Wachholz, Editor, 2311 Applewood Lane, Salina, KS 67401 785-825-7742. You may send your information to wachholz@swbell.net.

Newsletter & Journal Articles

Articles are needed for the newsletter and journal. Send them via e-mail to jwachholz@midkan.net or on a disk. If you send it on a disk, any format is acceptable. Your help is appreciated.

Articles for the Kansas Biology Teacher should be sent to John Richard Schrock, editor KBT, Division of Biological Sciences, Box 50, Emporia State University, Emporia, KS 66801-5087. E-mail: <ksnaturl@esumail.emporia.edu>

Please remember to keep your dues up to date so you will continue to receive KABT publications.

Outstanding Biology Student Certificates

These are available for students who have completed a biology course under you and have shown outstanding achievement. Send your name and address to KABT Student Certificates, 2311 Applewood Lane, Salina, KS 67401-3707.

Please use these certificates as valuable awards for outstanding students.

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NABT news:

The end of 2000 was a milestone for NABT. The official NABT membership surpassed the 9000 member level for the first time in NABT history. This is a 35% increase in only two years. Interestingly, these new members are renewing at a higher rate than past members. Most of this increase can be attributed to an effective direct marketing campaign done by Marketing General. Our goal is to reach the 10,000 member level and maintain.

The 2001 convention is in Montreal, Canada. This will be a great place to have our convention but it is important that you begin now to work out travel details and support from you districts. Most districts are not prepared to deal with supporting travel out of the country so you'll need to forewarn them if you plan to attend.

Don't forget to send any Kansas OBTA nominations to Pat Lamb (listed in the KABT board of directors).

President's Message

From: Harry McDonald

Hope second semester is going well for all of you. If any of you need to contact me for any reason, my address, phone number and email address are listed with the other officers. Over the next several months, I am going to try and contact each of you, either by phone or by mail. I plan is to find out first-hand what you need and desire from KABT, what will make us a more dynamic organization. Additionally, whenever I ask for information in an article, I absolutely want to hear your ideas. Email is by far the fastest and easiest method of communication and I encourage you to use it. My email address is biologycctrack@hotmail.com.

I want to call your attention to several items that are included in the newsletter. First, you will find the agenda for the KABT winter board meeting. We included this so that you can see what the board is discussing and you can tell that KABT is actively representing you on important matters concerning biology education.

Second, you will find a copy of the letter that KABT has sent to the Kansas Department of Health and Environment. It resurrects the letter we sent two years ago. The guidelines put out by the state have proven a hassle to many districts as they struggle with developing appropriate policies governing the use of animals in the classroom. The referenced guidelines from the state are far too restrictive and have caused numerous districts to consider banning if not actually banning many animals in classrooms. Limits on hatching chicken eggs and handling of reptiles and amphibians are quite disturbing.

If you have experienced any difficulties in your district with this issue, please let me know.

Third, KABT is collaborating once again with KCFS and hosting a day long set of presentations at KATS Kamp. We did this last year with rave reviews. If you attend camp, look of our presentations.

Fourth, the information for the spring field trip is included in the newsletter. I encourage you to join us this year. Besides visiting some outstanding natural areas in Kansas every year, participation helps us network and build lasting friendships with other biology teachers.

On a personal note, I am still trying to absorb the recent information released concerning the Human Genome Project. My copy of the Human Genome issue of "Science," Feb. 16, 2001 is astounding. AAAS is allowing articles from this issue to be downloaded free. Go to www.sciencemag.org. The next day, I received my copy of The Human Genome Project education kit that contains an wonderful CD-ROM and videotape. If you haven't ordered your kit, go to www.nhgri.nih.gov/educationkit and order a copy.

KABT Winter Board Meeting
January 27, 2001
Emporia State University
AGENDA

9:00 - Greetings
9:30 - Meeting Called to Order
- Approve the Agenda
- Approve the minutes of the last meeting
- President's report/Webmaster's report
- Treasurer's /Newsletter report
- NABT report
- KBT report
- KACEE report
- Other officers/representative reports
- Old Business
  - State Science Standards
  - Initial Science Licensure Standards
  - Ongoing issue of religious intrusion into science education
  - Review the schedule of field trips for 2001 and 2002
- New Business
  - Development of a budget including the role of life memberships

- Member/non-member survey
- KABT/KCFS strand at KATS Kamp
- Conducting board business online
- Biology textbooks
- KABT presentation at NABT convention
- Discussion of state assessments
- KABT establishing a connection with each institution that prepares biology teachers
- Consider sending another letter to the Ks Dept of Heath and Environment about regs on animals in the classroom

- Adjournment

NEWS RELEASE

The Center for North American Herpetology (CNAH) is pleased to announce its new, completely updated and expanded internet web site at

http://www.naherpetology.org

The new web site is the result of many months of hard work by CNAH Web Site Director Travis W. Taggart, and I think you will be pleased with the finished product. All of the previous features, articles and sections of the old web site are retained (but in many cases re-configured), and much new has been added. Those of you who have book marked the old web site will be automatically forwarded to this new site. You may wish to update your bookmark for faster access.

This is the premier academic web site for North American herpetology, and will deliver the ultimate access to information about the amphibians, turtles, reptiles, and crocodilians of the United States and Canada.

We hope you find it useful, intellectually stimulating, and worthwhile.

Joseph T. Collins

The Wildlife Author Laureate of Kansas

Adjunct Curator of Herpetology, Sternberg Museum of Natural History

Herpetologist Emeritus, University of Kansas Natural History Museum

Links To Counter Black Box

Here a few links which will provide good info to counter Behe's "Black Box" arguments:

http://www.world-of-dawkins.com/box/behe.htm

http://www.talkorigins.org/faqs/behe.html

http://www.ncseweb.org/ (this is the home page of the National Center for Science Education - the best place to go for information regarding any aspect of the Creation/ Evolution "debate")

Interesting Websites

"Internet Learning Network" provides an opportunity for middle school students to see how their math and science skills measure up against other students worldwide. The site offers tutorials, practice opportunities, and reasons why math and science matter in the world today. (DOE)

http://www.getsmarter.org/index.cfm

"MegaMath" presents important mathematical ideas and allows students and teachers to experience math in ways that it is experienced by mathematicians and scientists. Through fun activities and real world applications (tied to the NCTM standards), the project allows students to see what mathematicians actually do. (DOE)

http://www.c3.lanl.gov/mega-math/

"Earth Resources Observation System (EROS) Data Center" is a data management, systems development, and research field center for the U.S. Geological Survey's National Mapping Division. The EDC stores, processes, and distributes a variety of data, including cartographic, satellite, and aircraft data. The EDC's archives also hold the world's largest collection of civilian remotely sensed data covering the Earth's land masses. (USGS)

http://edc.usgs.gov

"FrogWeb" is a multi-agency effort to inform the public about declines and deformities in numerous amphibian species. The site is designed for parents, teachers, and children, and it includes general information about amphibians and their habitats, research currently underway, programs in which the public can help collect amphibian data, and activities to help classes and families learn about amphibian biology and populations. (NBII)

http://www.frogweb.gov/

"Hands-on Experiments to Test for Acid Mine Drainage" invites students to learn about the effects of acid mine drainage on our groundwater and environment through experimentation and observation. The website explains how to make litmus paper, study aquatic organisms, examine the weatherization process, and more. (USGS)

http://pubs.usgs.gov/openfile/of00-369/

"SOHO: The Solar and Heliospheric Observatory" provides an uninterrupted view of the sun. It is designed to study some of the most perplexing riddles about the sun, such as its extensive outer atmosphere, the origin of the solar wind, and the stream of highly ionized gas that blows continuously outward throughout our solar system. The site offers lesson plans, never-before-seen pictures of the sun, a question and answer service with Dr. SOHO, and collection of space science information. (NASA)

http://sohowww.nascom.nasa.gov/

"Sustainable Seas Expeditions" focuses on exploration and discovery, scientific research, cutting edge underwater technologies, and public awareness of the marine environment. Visitors will find high-quality marine science teaching materials (linked to national standards), a multifaceted approach to teacher professional development, educational opportunities for students, and more. (NOAA)

http://sustainableseas.noaa.gov/

From Your Editor and Publisher

Please note my new e-mail address: <wachholz@swbell.net>. My sincere apologies for the lateness. Jury duty, NSTA convention, and other things caused the problem.

Balancing a Closed Ecosystem

Submitted by Ernie Brown—Trego Community High School

Introduction:

We live in a world which is made up of ecological systems or ecosystems An ecosystem consists of groups of organisms interrelating with the biotic and abiotic portions of their environment. Ecosystems consist of various components including a source of energy such as the sun, producers which convert the solar energy to chemical energy, herbivore type consumers which feed upon the producers, carnivore type consumers which feed mainly on the herbivores, and decomposers which recycle the chemical elements and release the remaining energy in to the ecosystem. The flow of energy through an ecosystem is unidirectional- through the producers, consumers, decomposers, and eventually back into the atmosphere.

In addition to the energy flow in an ecosystem, oxygen and carbon dioxide are cycled through the producers and consumers in the processes of photosynthesis and respiration. In an aquatic ecosystem, carbon dioxide is removed from the water by plants during the process of photosynthesis. Products of that biochemical reaction include carbohydrates utilized by the plant for growth and oxygen which is released as a waste product. This waste oxygen is necessary for the respiration of aquatic animals which remove it from the water through gills. During the respiration of these animals, this oxygen is combined with carbon atoms released as their food energy is utilized forming carbon dioxide. This carbon dioxide is then recycled by the aquatic plants in the process of photosynthesis.

In this lab, you are going to construct a closed aquatic ecosystem containing biotic and abiotic components of the ecosystem. Your objective is to balance the ecosystem between the producers and consumers so that when the system is sealed, it will continue to operate for a period of several weeks or months. You will select materials from the list below:

Materials List:

1. Wide mouth gallon jar
2. Sand/sift/stones collected from the creek bottom
3. One teaspoon charcoal
4. Rooted plant specimens
5. Floating plant specimens
6. Water collected from creek
7. Snail(s)
8. Small fish
9. Insect larvae
10. Water strider
11. Other

Procedure:

1. Obtain a wide mouth gallon jar. Clean the jar completely with hot, soapy water and rinse thoroughly. You **MUST** remove all soap traces from the jar or it will destroy your ecosystem.
2. Obtain a sample of sand/silt from the bottom of the creek as free from soil as possible. You might add a few small stones if you can find them. Wash the material through several changes of water (no soap).
3. Mix a teaspoon of charcoal into the sand washed above.
4. Placed the washed material in the bottom of the container to a depth of about two inches.
5. Fill the container with creek water to a level that when your hand is placed in the jar the water will not overflow. Allow time for the sediments to settle. If you use chlorinated water, age it by letting it stand for 24 hours.
6. Place the rooted plants in the jar. Press the rooted end of the plants into the sand in the bottom of the jar to anchor them in place. Add a few floating plants to the surface.
7. Place the snail(s) and fish in the jar. Allow the jar to sit overnight with the top open. This should allow the system to "settle out" so you can make final adjustments before sealing.
8. Inspect your ecosystem and make any necessary adjustments.
9. Place the lid on your jar and screw it down tightly to make an air tight seal on the ecosystem.
10. Label the jar with your names and the date it was sealed. Make daily observations in your journal. Note any changes which occur in the ecosystem. Can you tell through your observations if the system is succeeding or failing? If it is failing, what do you predict to be the problem? What treatment do you think is necessary?

(Adapted from TRACKS. Volume #2. No. 3. Spring 1991. Kansas Wildlife and Parks)

KABT Spring Field Trip — May 12th & 13th

Join us May 12 and 13 for the spring field trip. Last spring found us in Elkhart to tour the Cimmaron National Grasslands. This year we journey to the other side of the state to tour the Overland Park Arboretum and the Blue Valley Wilderness Science Center, in Johnson County.

The arboretum is a large tract being developed to emphasize public education. It has numerous gardens and paths to tour. We will meet at the Arboretum at 9:00 AM in the education building. After representatives from the arboretum explain what has been developed and what is in planning, we will spent the morning touring the site.

After lunch, we will drive about 5 miles over to the Blue Valley site. This is a 30 acre tract in the Blue River floodplain, donated to the district about 5 years ago. Development has reintroduced native prairie species, redeveloped a wetland area, developed woodland trails and is in the process of building a two-classroom building. Classes currently use one of the rooms in the nearby middle school. The wetland should be filled, the spring wildflowers in bloom and the bird migration going strong. There is a shelter if we need to dodge a May shower.

If anyone wishes to stay over, Brad Williamson will lead us on a birding trip to Weston Bend State Park about an hour north, just across the river from Leavenworth.

Camping Friday night is available at Hillsdale reservoir. You will need a day use permit ($5) unless you have an annual pass. Tenting (no utilities) is $6.50, camper sites with utilities are available for $13 – 15.00. Showers are available. Those going birding could move up to Weston Bend Saturday night or stay at Hillsdale and drive up in the morning.

Charlotte and Harry McDonald would like to have everyone over Saturday evening for a simple barbecue. We would ask you to let us know if you will attend so that we can plan the right amount of food. Email us at biologycctrack@hotmail.com.

Johnson County has most of the major motels. The following are 8 miles north of the arboretum at I-435 and Metcalf (that turns in to US 69 as you go south) and have reasonable prices:

Hampton Inn – 1-800-426-7866; $89 + tax
Holiday Inn Express – 1-913-648-7858; $85 + tax
Drury Inn – 1-800-325-8300; $59 + tax
Pear Tree Inn – 1-800-325-8300; $50 + tax
Fairfield Inn – 1-800-228-2800; $75 + tax

Information on these various sites is available at the following websites:

Arboretum:
http://www.opprf.org/arboretum.htm
http://www.opkansas.org/html/arboretum.html
http://www.opcvb.org/core/arboretum.htm
Hillsdale:
http://wwwkdwp.state.ks.us/parks/region3.html
http://www.nwk.usace.army.mil/hillsdale/hillsdale-home.htm
Weston Bend:
http://www.ci.weston.mo.us/pages/whattodo/state-park/wbsp.html
http://www.mostateparks/com/westonbend.htm
Blue Valley Wilderness Science Center:
http://www.bluevalleyk12.org/bvef/wsc2000.htm

Directions:
To Hillsdale Lake – Travel to Johnson County and take US 169 south. Catch it off I-35 at the south edge of Olathe. Travel south past Spring Hill. Four to five miles south of Spring Hill look for the turn-off to Hillsdale. We suggest camping at the Scott Creek loop which has a shelter for some late night socializing.

From the south, travel north on I-35 to Ottawa. Take K-68 east for about 20 miles to US 169. Go north about 2 or 3 miles to the Hillsdale turn-off.

To the arboretum:
From the south, travel north on US 69 to 179th St.. Travel west about ¾ miles, past Antioch St.. The turn-in is on the south side of the road.

From the north, take the I-435 loop around to the south and then east to the US 69 exit. Take US 69 south to the 179th St. exit and go west about ¾ miles, pat Antioch St.. The turn-in is on the south of the road.

IT IS ALWAYS HELPFUL TO KNOW WHO WILL ATTEND (though not absolutely necessary). PLEASE EMAIL HARRY MCDONALD AT biologycctrack@hotmail.com**.**

KABT/KCFS Biology Strand
KATS Kamp
April 27-29, 2001
Submitted by Harry McDonald
biologycctrack@hotmail.com

8:00 - 8:25 Harry McDonald, Blue Valley H.S. - Using Reduced-scale Hominid Skulls in the Study of Human Evolution

Take anthropomorphic measurements using miniature skulls to demonstrate how anthropologists gather information on hominid ancestry.

8:25 - 8:50 Mickie Pemberton, Blue Valley H.S. - A Hands-on Hardy-Weinberg Simulation for the Classroom

Use of 3X5 cards to generate allelic frequencies that allow individuals to "mate" within and without the parameters of the Hardy-Weinberg Law.

9:00 - 9:50 Paula Donham and Kylee Moon Sharpe, Olathe East H.S. - Exploring Evolutionary Relationships Using Electrophoresis of Fish Proteins

See how to prepare your own samples from fish/seafood from your local store. Analyze the proteins and compare to standard evolutionary trees. Another analysis option: Is that crab meat real or imitation?

10:00 - 10:50 Keith Miller, Geology, Kansas State University - The Cambrian Explosion: What is the Fossil Evidence?

THIS SUMMARY WAS SENT IN EARLIER BY KEITH HIMSELF.

11:00 - 11:50 Sandy Collins, Lawrence - Investigate Biodiversity Outdoors

Celebrate the year of Biodiversity with this outdoor lab investigation. Student teams survey and catalogue plants in plots of varying size to learn how are can affect biodiversity.

1:00 - 2:50 Donna Cooper, Hays H.S. and Ernie Brown, WaKeeney H. S. - Aquatic Macro invertebrates

Participants will have the opportunity to learn macro invertebrate collection techniques as well as to observe and identify macro invertebrates from the creek that runs through Rock Springs Ranch. THIS IS A TWO HOUR LAB.

3:00 - 3:50 Bob Hagen, Biology, Kansas State University - Cladograms: What They Are, How to Use Them, and How to Build One

Cladograms (branching diagrams) represent relationships among organisms. They are an important tool for researchers, too frequently ignored in biology classrooms. An exercise intended to demonstrate the principles behind these diagrams.

4:00 - 4:25 Paula Donham, Olathe East H.S. - Use of Mini-posters as Lab Write-ups

Learn how to use mini-posters as a form of lab write-up. A lab involving photosynthesis and/or respiration will demonstrate their use.

4:25 - 4:50 Kylee Moon Sharpe, Olathe East H.S. - Goldenrod Gall Size as a Result of Natural Selection

Participants will dissect goldenrod galls to determine what organism is inside, and examine the outside for evidence of predation. We will analyze data collected, and describe how survival of gall flies leads to evolution.

5:00 - 5:50 Harry McDonald, Blue Valley H.S., KABT President, KCFS Board Member - An Open Forum to Discuss the State of Science Education in Kansas

Discussion topics will include the newly adopted State Science Standards, state science assessments, local challenges to good science or other local problems you are experiencing, the ongoing status of KCFS and KABT, and just any old thing you want to discuss.

Harry McDonald
Blue Valley High School
6001 W. 159th St.
Stilwell, KS 66085

March 1, 2001

Gary Mitchell, Secretary
Kansas Department of Health and Environment
Landon State Office Building
900 SW Jackson
Topeka, Kansas 66612-1290

Dear Gary Mitchell:

The Kansas Association of Biology Teachers communicated with you in 1998 concerning the state guidelines for the safe handling and care of animals in the classroom. KABT shares KDHE's concern for the health and safety of our Kansas students. We appreciate your efforts to provide guidelines for the safe handling and care of animals in the classroom. Yours is certainly one of the more difficult jobs in state government. It's assuredly time that we as educators and you with the charge of public health as well as other stakeholders get together to develop an effective and appropriate policy that ensures the safety of our young people while at the same time maximizing their educational opportunities. However, KABT is concerned about the current guidelines and requests that KDHE reconsider these guidelines.

Our comments concern the published guidelines, "Animals in Kansas Schools-Guidelines for Visiting and Resident Pets." While we understand the intent of "guidelines," our concern is that these "guidelines" will be and actually have been implemented as restrictive and conservatively interpreted "regulations" in most of our state school districts thereby severely limiting student educational opportunities. We have concerns about several aspects of the guidelines. For example, the specific guidelines referring to reptiles and amphibians in the classroom seem, from our perspective, to be too restrictive. We realize there is a risk of Salmonella infection from such animals but our experience and knowledge of classroom conditions indicate that this risk is minimal with proper precautions. CDC's Recommendations for "Preventing Transmission of Salmonella From Reptiles to Humans" suggests that "pregnant women, children aged <5 years, and immuno-compromised persons... should avoid contact with reptiles." They go on to recommend that reptiles not be kept in child-care centers, but do not make that recommendation for schools. We are unaware of any student infected by classroom use of these animals in Kansas schools.

We have contacted the CDC's Dr. Cindy Friedman, Salmonella specialist, about the specific risks involving classroom reptiles. Her response was that their recommendation was for hygienic use of all these animals in the classroom. She wondered why our guidelines were so strict. If further research and information indicates a different level of risk, biology teachers would be in the lead for minimizing the risk to our students. In our view at this time a much more appropriate state guideline for reptiles would be a cautionary note to teachers to have students wash their hands before and after handling reptiles.

As the current KABT president, I was authorized, by the unanimous vote of our board of directors, to communicate our desire to work with you to revise these guidelines, and KABT welcomes any opportunity to engage in effective dialogue regarding this issue. Our board consists of 17 veteran teachers who average over 25 years of classroom experience handling animals, including reptiles and amphibians. That certainly lends credibility to our position, and the experience necessary to help craft a more appropriate set of guidelines.

Respectfully,

Harry McDonald
KABT President
Biologycctrack@hotmail.com

Stuck-on Artemia

(prepared by C. Drewes 10-99)

Rationale:

Brine shrimp are inexpensive and fascinating organisms that allow students to study growth and development in relation to cryptobiosis. "Cryptobiosis" is a state of suspended animation induced by environmental adversity. An example is the cryptobiotic state of arrested embryonic development that occurs in invertebrates such as brine shrimp, fairy shrimp and tadpole shrimp. Prior to release by the female, the developing embryos of these organisms are encysted in a protective shell which enables survival of desiccation or other environmental extremes. In the encysted, cryptobiotic state embryos may remain viable for many years. Is it possible that methods could be developed for inducing cryptobiosis in human embryos?

Brine shrimp cysts (in the gastrula stage of embryonic development) are abundant, inexpensive and reliable organisms for studying development in relation to cryptobiosis. However, there are some frustrations in working with brine shrimp cysts. They are light-weight and small (about 0.25 mm diameter), making them hard to handle and transfer in small quantities. Since they freely float or sink when placed in water, it is very difficult to keep track of the developmental progress of individual cysts, especially if there is any movement of water. Another common problem occurs if too many cysts are placed in a single container, leading to premature crowding and "crashing" of the growing population. The "Stuck-on Artemia" approach, described here, should eliminate or reduce these problems.

Advantages of the "Stuck-on Artemia" Technique

® a simple, new technique makes cysts easy to handle and transfer

® study and experimentation can be done with a manageable and quantifiable number of cysts

® cysts stay fixed in position within a single focal plane, thus aiding microscopic observation and data collection

Materials

1-2 liters of artificial sea water (about 20 ml per dish) [Recommend: 40 g of Instant Ocean salt g/liter of spring water (or de-chlorinated tap water). Or, use 7g NaCl/100 ml spring water). Chlorinated water is toxic to brine shrimp and must be avoided.]
10 cm-diameter, disposable, plastic petri dishes
Scotch double-stick tape
marking pen
small camel's hair brush -- watercolor-type (brush size: about 1 mm wide and 6 mm long)
brine shrimp dried cysts -- [see "Artemia franciscana" write-up for commercial sources]
scissors and small forceps
disposable plastic pipet
transparency sheets with multiple 10 mm X 10 mm grid patterns copied on surface
dissecting microscope with light source [Note: It is possible to use these same procedures and materials with a compound microscope and low-power or scanning objectives.]

Preparations and Procedures

(1) Make sure your hands and the paintbrush are clean and completely dry.
(2) Use scissors to cut out a 2 cm x 5 cm transparency strip with a 10 mm x 10 mm grid.
(3) Obtain a 2 cm long strip of double-stick tape, making sure to handle the tape by the edge with a forceps. Do not get fingerprints on the tape. Carefully place the strip of tape over the grid pattern, as shown in **Figure 1**. Using the non-brush end of the paintbrush, trace around the edge of the tape so that the tape is securely attached to the transparency strip.

(4) Now, using the brush-end of the paintbrush, touch just the tip of the brush into the container of dried brine shrimp cysts. Numerous cysts should attach to the brush. Then, carefully and gently "paint" these cysts onto the taped surface over the grid. Brush gently back and forth to make sure the cysts are secured to the tape. Repeat this procedure until a total of about 50-100 cysts are stuck to the tape within the grid area (see **Figure 2**). Try to get a fairly uniform distribution of cysts over the grid area. Do not worry if a few cysts are stuck outside the grid area.

(5) Now, grasp the edge of the strip in your fingers and use a finger on your other hand to gently flick the edge of transparency strip. This will dislodge any cysts which are not securely stuck to the tape. WHEN DOING THIS, BE CAREFUL NOT TO GRASP OR IMPACT THE CYSTS BECAUSE THEY ARE FRAGILE!

(6) Attach a small piece of double-stick tape to the bottom of the dish and then attach the edge of one edge of the transparency strip to the tape; make sure that you do not press directly on the cysts and that the cysts are facing upwards.

(7) Fill the dish about half-full of artificial sea water (about 20 ml), making sure the strip is fully immersed. Cover the container and place in continuous room light at room temperature.

(8) Each day for the next four days, inspect the cysts. Make sketches of your observations. Use the lettering and numbering on the grid to keep track of the appearance and developmental fate of at least 10 individual cysts.

(9) Each day for four days, count and record the overall number of cracked cysts, hatched embryos, and evacuated cysts from within the grid area. Free-swimming nauplius larvae may be counted, removed with a disposable plastic pipet, and used for other purposes. After four days, few if any brine shrimp should still be hatching. Have all cysts hatched? Estimate the percent that did not appear to hatch.

Experimental questions about brine shrimp development

Q1: Will brine shrimp cysts, which fail to hatch after an initial hydration, successfully hatch after a second hydration? Describe and perform experiments that would test this question. Hydrate and hatch a batch of cysts that are attached to tape, as described above. Then, after allowing hatching for 4-5 days, pour off all excess water, and let the tape along with attached cysts completely dry out for 1-2 days. Then, re-hydrate attached cysts in salt water. What are possible outcomes of this experiment? If some cysts do hatch after a second hydration, explain the possible biological/ecological significance of this result.

Q2: Will brine shrimp cysts hatch if they are confined and crowded into a small space? To address this question, use two separate transparency-grid strips, each with cysts attached to tape, prepared as described above. Use two additional pieces of tape to attach corners of the strips to the bottom of a dry petri dish, one strip with cysts facing up and the other strip with cysts facing down. Be very careful not to apply direct pressure to cysts -- they are fragile and may rupture. Add salt water. Compare the developmental progress of the two groups, especially noting when and how many cysts crack open, as well as when and how many nauplius larvae emerge and swim away. Explain your results in relation to key environmental factors that could retard or enhance hatching and stimulate embryonic development.

Q3: Can you care for and feed a small group of brine shrimp so they reach adult stage and sexual maturity? Suggested food source: "New Tech" liquid brine shrimp food (Carolina Biological, catalog #: AA-14-22650). This food is exceptionally good for sustaining growth. Add about one drop per day for a dish containing about 10-20 brine shrimp and a few hundred ml of artificial sea water (aeration not needed). An alternative food source that will sustain growth is Spirulina algae powder (Aquatic Ecosystems catalog #: SP1; www.aquaticeco.com). Powdered Spirulina is an excellent food source for a wide variety of freshwater and marine invertebrates including brine shrimp, aquatic oligochaetes, snails, fairy shrimp, tadpole shrimp, daphnia, copepods, and many others. Dispense the powder in <u>tiny quantities</u> by drilling a 1/16 inch hole in the screw cap of a plastic vial filled with the powder and dispense a small quantity in "salt shaker fashion" on the water surface. Stir the water lightly. Re-feed when all green color is gone. Do not overfeed]

Water Chemistry and the Environment

Workshop Leaders

Joseph Heppert, Professor of Chemistry, KCETP Program Director, jheppert@ukans.edu

Susan Mason, KCETP program assistant

Steven Case, KanCRN Project Director, Biology Teacher, scase@kancrn.org

Dates: June 18-June 29

Location: Malott Hall, KU Campus; Natural History Museum, KU Campus

Abstract

This project is a two-week workshop on water chemistry and the environment. The workshop will provide teachers with an extended knowledge of the chemistry of water and how it influences chemical and biological processes in the environment. The project emphasizes connections between chemical concepts with processes in the environment and biology. This will provide the maximum flexibility for participants as they incorporate the concepts covered into their own curricula. The workshop emphasizes the presentation of all science content using teaching techniques that reflect best practices. Consequently, many of the activities included in the workshop can be adapted for use in K-12 classrooms. Water chemistry concepts will related to stream quality through field studies involving both chemical analysis and biological surveys of surface water quality. A one-week practicum will allow teachers to implement a water chemistry curriculum planned during the workshop with early adolescent students in an informal learning environment.

Proposed Topics

The Chemistry and Biology of Water

- Physical properties and chemistry of water
- Water as a solvent
- Acids and bases
- pH
- Biological significance of water

Watershed Identification

Water Ecology and Resource Management

Surface Water Quality Assessments

- Stream survey
- Bioindicator survey
- Chemical monitoring of surface water quality

Applying water monitoring techniques with children in small groups

Rationale

Early career teachers and teachers who have recently changed their teaching assignment frequently find that their assignment requires that they cover chemical concepts. Students often find these concepts more engaging if they are linked to issues in biology and the environment. Students are also more invested in learning chemistry concepts if the concepts help them address specific research questions relevant to the student's lives. The chemistry of water is central to understanding modern biological concepts and interactions between humans and their environment.

Participants

The workshop is most appropriate for teachers of early adolescent students (grades 5-10). Teachers should have a background in life science and familiarity with concepts of chemistry and molecular science at the level presented in elementary and middle schools.

Teachers should be interested in using active learning and inquiry pedagogy.

The workshop is targeted to assist preservice teachers, early career teachers or teachers who have recently been assigned to teach courses including chemistry and the physical sciences.

Some experienced teachers who will make a commitment to mentor early career teachers will be included in the workshop.

All participants will agree to assist in developing and implementing an assessment of student

Procedures for Applications

Teachers can apply by submitting a brief letter of intent to the workshop director, Dr. Joseph A. Heppert, via mail or email. The letter should include a description of the teacher's current teaching assignment, background in the biological and chemical sciences and reason for interest in the program. Please attach a professional vitae and include the name of a district coordinator or teaching colleague who could be contacted to determine how the workshop would benefit the applicant. Applicants accepted for the program will be informed by late March. Teachers who cannot be accommodated in the workshop will be added to a waiting list for this and future workshops. These individuals will be informed as soon as an opening occurs.

Activities and Resources

Hands-on laboratory activities tied to water chemistry.

Sessions on planning authentic assessments in environmental and chemical sciences.

Sessions to foster questioning strategies for in class discussions.

Experience with computer facilities, data acquisition and analysis technology.

Field experiences in water chemistry and aquatic biology assay of surface water quality.

Application of water chemistry concepts and instructional strategies with early adolescent students in the context of a KU Natural History Museum water quality exploration.

$700 stipends through NSF for the two-week workshop.

Possibility of professional development credit (to be negotiated with your professional development coordinator)

Tentative Schedule

Week 1: 9 am – 3 pm; Hands-on laboratory activities, technology experiences, and field experiences in environmental water quality assessment.

Week 2: 11 am – 5 pm; Program evaluation and practicum in implementing water chemistry curriculum with students.

Qualifications of Workshop Leaders

All of the leaders have prior experience in developing and implementing teacher professional development programs in water chemistry and the environment. They participated in the development and implementation of a similar workshop last summer. The leaders have partnered in curriculum development for chemistry and environmental science at the college and precollege levels. Dr. Heppert has five years of experience in designing and implementing inquiry-based instruction at the secondary, community college and university levels. Steven Case directs the KanCRN network bringing inquiry curricula to teachers and students using Internet and Geographic Information Systems technologies.

Evaluation

Teachers attending the workshop will be required to participate in the evaluation of the workshop to satisfy requirements imposed by the funding agency. Participants must also agree to participate in anonymous pre- and postworkshop evaluations of their water chemistry concept knowledge. An instrument for evaluating the water concept knowledge of early adolescent students will be developed by the teachers during the workshop. We advocate that teachers employ these assessments with their classes during the following school year.

References

1) American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy*. New York, New York, Oxford University Press

2) National Research Council (1996). *National Science Education Standards.* Washington, DE: National Academy Press.

3) Helgeson, S. L. (1994). Research on problem solving: Middle school. In Gabel, D. L. (Ed.), *Handbook of Research on Science Teaching and Learning*, New York: Macmillan Publishing.

4) Atwater, M. M. (1994). Research on cultural diversity in the classroom. In Gabel, D. (Ed.), *Handbook of Research on Science Teaching and Learning*, Macmillan and Sons, New York, N.Y., 558-576.

5) Finn, P. J. (1999). *Literacy With an Attitude: Educating Working-Class children in Their Own Self-Interest.* Albany, NY: State University of New York Press.

6) Mayer, R. E.; Schustack, M. W.; Blanton, W. E. (1999). What Do Children Learn from Using Computers in an Informal, Collaborative Setting? Educational Technology, 39(2), 27-31.

LAB REPORT CHECKLIST

DIRECTIONS Use the checklist/scoring guide to evaluate the quality of your lab report. Remember that this scoring guide **will** be used to rode your re-

POINTS	CRITERIA TO BE ASSESSED
3 PTS.	**TITLE**
1 -	The title is a sentence that gives a clue to what the experiment is about.
1 -	The title should include the independent and d ndent variable.
1 -	The variables are underlined)
6 PTS.	**ABSTRACT**
1 -	Give a little background information in one to two sentences about the title or subject.
1 -	Problem statement (ion) is addressed and specified. Rewrite the problem statement below here.
1 -	Methods summarized in no more than three or four sentences.
1 -	The results are summarized in no more than two or three sentences.
1 -	Conclusion is stated in one sentence, which addresses the hypothesis and problem statement.
1 -	The abstract is one on
8 PTS.	**INTRODUCTION (Problem Statement)**
1 -	Problem statement (ion) is addressed and specified.
2 -	The independent variable is addressed.
2 -	The dependent variable is addressed.
2 -	The control is addressed and underlined.
1 -	The variables are rnrdarlinedl
6 PTS.	**HYPOTHESIS**
1 -	A prediction as to the outcome of the experiment is stated.
2 -	The hypothesis is predicted in the if-. then manner.
1 -	The independent variable is addressed.
1 -	The d nderrt variable is addressed.
1 -	The variables are underlined)
4 PTS.	**MATERIALS AND METHODS**
1 -	Materials are listed that were used in the experiment.
1 -	The procedure is clear indicated step step.
1 -	Procedure is either a flow chart or numbered e.
1 - -	Includes brief descri ion of how data were ana ed (calculations made/statistical tests used).
6 PTS.	**ANALYSIS OF RESULTS**
1 -	Data is included whether it is in the form of a table, h or chart.
1 -	All data (chart, table or h) show results very clear and can be understood without further explanation.
1 -	All data (chart, table or h) is labeled correct , indicating the x and -axis.
1 -	All statements made in re are z=ed with reference to data found.
1 -	The inde ndent variable is addressed.
1 -	The de ndent variable is addressed.
5 PTS.	**CONCLUSION**
2.5 -	You have stated whether or not the thesis is correct or not.
2.5 -	E lanation of results is clear and concise.
5 PTS.	**LITERATURE CITED**
2.5 -	Citations are provided for one reference found deali with the subject.
2.5 -	The citation is in the correct format.
5 PTS	**COMMENTS**
2 -	A comment is made whether or not you liked this lob on the e experiment.
1 -	Explanation of the above comment.
1 -	Discuss if you did this lab in what would you c
1 -	Discuss if did this lab in what would you not change.
____ /48	**POINT TOTAL**

by Susie Helwig and D. Lankford

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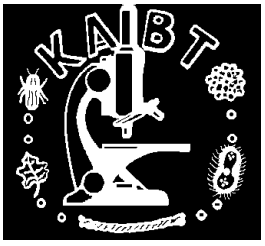
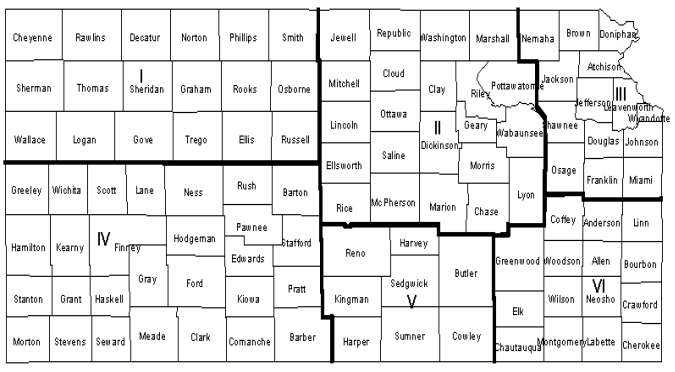


KABT Regions



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Cheyenne, Decatur, Ellis, Gove, Graham, Logan, Norton, Osborne, Phillips, Rawlins, Rooks, Russell, Sheridan, Sherman, Smith, Thomas, Trego, Wallace

Counties, In Region 2

Chase, Clay, Cloud, Dickinson, Ellsworth, Geary, Jewell, Lincoln, Lyon, Marion, Marshall, McPherson, Mitchell, Morris, Ottawa, Pottawatomie, Republic, Rice, Riley, Saline, Shawnee, Wabaunsee, Washington

Counties In Region 3

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Counties In Region 6

Allen, Anderson, Bourbon, Chautauqua, Cherokee, Crawford, Elk, Greenwood, Labette, Linn, Montgomery, Neosho, Wilson, Woodson

Your membership **expiration date** can be found on your mailing label. Starting immediately, all dues received before June 30th will be applied to the current year if you are past due. If your dues are current, they will apply for the extended year of your current due date. Dues received and postmarked between June 30th and September 30th will be applied to the next year of membership. The membership list was last updated on **April 8, 2001**.

KABT Membership Application - Renewal - Form

Name: _____

(Mr.-Mrs.-Ms.-Dr.-Miss) First Name Last Name

Mailing Address: _____

City: _____ State: _____ Zip: _____ - _____

School/Institution: _____

Position: _____

City: _____ State: __ Zip: _____ - _____

Phone: Work (____) _____ - _____ Home: (____) _____ - _____

FAX: (___) ___ - _____Internet Address: _____@_____

Enclosed Dues For KABT **$15** / Year—Life Membership Available For **$300**
National Association of Biology Teacher Dues: **$59.00** / Year
Dues Payment For Next Year Must Be Received Between Dates Of June 1st to September 30th
Dues Received On Dates Preceding June 1st Or After September 30th Will Be Applied To Current Year
Make Check Payable To KABT - Tax ID #: 48-0945206
Send Dues & Information To:
Kansas Association of Biology Teachers
2311 Applewood Lane
Salina, KS 67401 - 3707

Kansas Association of Biology Teachers

EVENT CALENDAR

Date	Event
April 19-21, 2001	South Western Assn. of Naturalists annual meeting, FHSU, Hays
April 27-29, 2001	KATS Kamp, Rock Springs 4-H Ranch
	http://www.kats.org/kamp/index.html
April 28, 2001	KGS field trip, Lawrence/Topeka area
May 4-6, 2001	KOS Spring Meeting-Crossed Timbers Area-Chataqua/Elk County
	http://www.ksbirds.org/kos/spring_meeting_2001.html
May 4-6, 2001	Kansas Herpetological Society Spring Field Trip East-Marais des Cygnes NWF
May 12-13, 2001	**KABT Spring Field Trip - Overland Park, KS**
June 1-3, 2001	Kansas Herpetological Society-Spring Field Trip, West-Hamilton County
September 8, 2001	**KABT Fall Meeting-KSU Manhattan-Molecular Biology**
Fall 2001	KOS Meeting-Great Plains Nature Center-Wichita
November 2-3, 2001	KACEE Environmental Ed. Conference, Great Bend
November 7-10, 2001	NABT annual convention, Montreal, Quebec, Canada
June 8, 2002	**Spring Field Trip-Smoky Valley Ranch, Logan Co.**
September 14, 2002	**Fall Meeting-Biology Teacher Exchange Retreat—Site Later**
October 30-November 2, 2002	NABT Annual Convention - Cincinnati, Ohio
	Brad Williamson will be President during this convention so help out by attending and presenting!
October 8-11, 2003	NABT Annual Convention - Portland, Oregon

Please send meeting dates and other items of interest to biology teachers to: John Wachholz, 2311 Applewood Lane, Salina, Kansas 67401-3707, 913- 825-7742 - E-mail: wachholz@swbell.net