

---

---

# TEST TUBE

*Communication for Tennessee Earth Science Teachers*

Volume 16 Issue 2

May, 2007

## **PRESIDENT'S CORNER**

By Rose Lummus

Hello to all TEST members. What a busy time of year! The end of the school year rapidly approaches. With Terra Nova and Gateway testing hopefully completed, we turn our thoughts and efforts to the completion of another school year.

We also look forward to making plans. The theme chosen for this year's topic at TSTA is Evolution: Teaching Change Over Time Using the Standards, a very timely topic indeed. As educators, we need the proper tools and up to date information to teach evolution. TEST advisors and members are making plans for these sessions.

### **Save... Save... Save...**

#### **Needed: Pull tabs from cans!**

All types of pull tabs of various shapes and sizes are needed for the evolution workshop. Start collecting now. Have your students collect them or collect some yourself. They are found on soft drink cans, tennis ball containers, cat food, tuna, etc. (you get the picture.) Dr. Gibson plans to use them for an activity in Thursday's session at TSTA in the fall. We will collect them at the scheduled workday in August.

### **Mark Your Calendar**

A workday to prepare TSTA teacher kits is scheduled for August 26th. Some will notice the date has been changed due to accommodate our advisors schedules. We will stay at the Horse Creek facility in Savannah, TN. If you are interested in attending the workday, contact Rose Lummus at [lummusr@yahoo.com](mailto:lummusr@yahoo.com). If you want to become more involved in the TEST organization, this is a great opportunity to get to know TEST and its members.

## **A MUST READ**

By Don Byerly

If you haven't already read this small paperback (222 pages), you really must. I recently finished it having found it in the textbook section of the UNLV bookstore. It is one of the best of Stephen Jay Gould's books that I have read. The title is, "Rocks of Ages - Science and Religion in the Fullness of Life".

This is what *Nature* has to say about the book: "This is an ambitious synthesis, but it neither intimidates nor does it seem too far-fetched. Gould appeals to common sense .... This small book is heftier than the volumes of inaccessible, jargon-wrapped material produced every year by some academic historians and philosophers. *Rocks of Ages* should be read not only in all our colleges, it should be read in our temples and mosques, in our churches and synagogues.

This is especially a pertinent read leading up to the TEST theme (evolution) for the upcoming TSTA meeting.

## **BEWARE**

By Don Byerly

It has been called to my attention that there are a number of URLs dealing with tourism, real estate, etc. that describe Sequatchie Valley as a "rift valley". This definitely erroneous. Please don't let your students be misinformed. Perhaps we need to take a TEST field trip through Sequatchie Valley some time. You can go to Google and search for "Sequatchie Rift Valley" and come up with about 10 or more sites that are in error. Dr. Mies at UTC made me aware of it recently in a talk he presented to ETGS.

## Evolution Corner: EvoDevo

By Michael A. Gibson  
(Summer, 2007)

“EvoDevo” sounds like a name for a 21<sup>st</sup> century retro, punk, or grunge band, does it not? Perhaps the moniker for a reincarnation of the 1980’s band “Devo” (I recall them being one of the bands that put the nail in the coffin of 1970’s Disco)? In the modern world of evolutionary science, however, EvoDevo means something very different and not grunge at all. EvoDevo is short for “evolutionary development” and refers to the new improved understanding of the genetic mechanisms responsible for organic evolution. Darwin’s Natural Selection is the ticket master filtering process, but genetic change is the author of innovation that Natural Selection is allowed to work on. The words “random mutation” have long been put together when discussing genetic change, but not so anymore. Modern genetics is not your old biology professor’s “Oldsmobile” genetics; “we’ve come a long way, baby” (O.K....getting tired of the advertising clichés...I’ll quit). The random part of genetics is not so random (we now see the pattern, and better yet, we manipulate it freely as part of genetic engineering and genetic selection). Nowadays we talk of “structural genes” and “regulatory genes”, and “Hox genes” and “homeoboxes”.

A complete, or even abstract primer, on EvoDevo is well beyond the two page limit I have in Evolution Corner, so please view my essay as an “infomercial” designed to pique your interest. The gist of EvoDevo is that both minor and major changes in organism’s genetic make-up (and hence their phenotype) can occur by making changes in timing of development (a process called heterochrony) and by making changes at critical junctions within the genetic code using specific genes that code as points of major body plan shift (hox genes). Such changes can result in major shifts in body plans or in innovative adaptations. The genes that carry the blueprints (all blueprints, whether expressed or not) are called “structural

genes”. Those genes that “turn-on” the structural genes are called “regulatory genes” and they act like gate-keepers or switchmen. Regulatory genes tell the structural genes when to express, how long to express, when to stop, what order to express in, etc. Regulatory genes are influenced by the environment, so changes are not as “random” as once believed...only complex. In EvoDevo, switching changes occur at different stages of evolutionary development. Some changes become “locked in” as being the predominant pathway during reproduction or ontogeny (growth). Natural Selection favoring survival reinforces these innovations. Others go “dormant” and are switched off...not necessarily lost. Later these “turned-off” switches can be turned on an “old” features be “reinvented”. Most of the changes are tinkering of already existing genetics, not lucky “random” discovery of new genetics (a process called exaptation). It is usually easier to renovate existing genes (read houses if you want), than to create new genes (build houses) from scratch if no new materials are available.

How can you learn about EvoDevo, and thus revolutionize your teaching, without going back to college and taking a modern genetics course? First, TEST’s evolution workshop this fall at the TSTA meeting will contain plenty of new information on the subject of EvoDevo, so watch for that opportunity! But, it doesn’t hurt for you to do a little general reading first. Fortunately for us all a terrific evolutionary biologist, Dr. Robert Carroll, who is also one of the prime movers and shakers in this field of study AND a terrific writer for the layperson, has written two fun books for the novice that are “must reads” for EvoDevo. I know what you are thinking...how can genetics reading be described as “fun”? My paleontology students and I will attest to Carroll’s writing ability (lively, humorous, informative, succinct, and best of all...layperson friendly). One of the books sat on the non-fiction best seller list for the better part of a year; I will focus on that book in this essay.

“*Endless Forms Most Beautiful: The New Science of Evo Devo*” (Norton Press, 2005, 350 p.) is the first place for you to go for your update on modern genetics and evolutionary change through EvoDevo. Carroll wrote this book for those of us who are “genetics challenged”. Carroll takes the approach that genetics would be taught very differently if we devised our teaching around what we know *now*, not what we discovered about genetics earlier as the science was developing. His approach is interdisciplinary in that he incorporates the fossil record extensively to provide a temporally holistic and realistic view of how major changes occurred through time to produce current biodiversity. He cites examples easily adaptable to high school classes in biology and geology. Carroll assumes no previous background in his writings, so do not think you will be handicapped by lack of genetics background. I am so impressed with this book that it will be required reading for my paleontology class this fall. Well illustrated for us visual learners, Carroll provides examples and breaks the processes of EvoDevo down into simple to understand logical steps.

Carroll answers many interesting questions in evolutionary biology. Ever met a person with six fingers? The sixth finger is always in the same place due to genetic switching “on” of genes for making digits. Where did the “head” come from anyway? Why are organisms bilaterally symmetrical? Learn about “frankenflies” (can’t you just see your student perk up when hearing that term). Why do most organisms develop in a modular form, compartmentalized functions? How did the genetics for this develop? If every cell contains the complete blue print for a human, how do some cells “know” to become part of head regions and others big toes? How did the butterfly get its spots...o.k. same question for the zebra? How many genes separate us from the chimp? Why do we look so different...or do we (ever see a newborn chimp)? Why do men have nipples? The answer to these and many other intriguing evolutionary questions can be found in this book?

Why is EvoDevo an important concept? We all know that evolutionary sciences are essentially historical in nature, chronically the development of life on Earth. We have devoted great energy to finding the patterns of change through time, but the *patterns* mean very little without an understanding of the *mechanisms* of change (recall that even Alfred Wegener’s continental drift was not accepted until the mechanism of sea floor spreading was well documented). EvoDevo *IS* the primary mechanism of genetic change; this we now understand. It is so well ingrained in the research community that it serves as the basis of genetic engineering and mapping genomes. But, as important as it is, it is a recent addition to our knowledge bank and one that has not filtered into our public education paradigm. This is a shame, because it is actually much EASIER to understand and to teach than our traditional approach, so why not update our teaching to the 21<sup>st</sup> century? Don’t take my word for it...put Carroll’s EvoDevo book on your summer reading list and revitalize your course next fall...AND still hit all of the Tennessee Science Standards! Next issue...Carroll’s follow-up book for the slightly more advanced evolutionary biology reader.

## GET READY FOR IYPE

By Don Byerly

TEST must take advantage of the upcoming triennium (2007-2009) event, the **International Year of the Planet Earth (IYPE)**. During this period all members must make every effort to place Earth Science before the eyes of our educational systems' administrators - local, state, and national, and the public at-large - parents of our students, politicians, and the business community.

We must stress the relevant importance of earth science knowledge in dealing with local, state, national, and global environmental problems. No one will deny that global-warming

is the hottest (no pun intended) topic in today's news media. Who are the professionals that have the best expertise to address this issue? Earth scientists, of course! There needs to be an awareness made to your students and the public that earth scientists are indeed the ones: oceanographers, hydrologists, meteorologists, astronomers, stratigraphers, paleontologists, volcanologists, climatologists, soil scientists, geochemists, etc. This is the time to educate your students about the careers for both women and men in earth sciences and how they will be needed in the future.

There will be no better time than during the IYPE to hype the Earth System and its long-term sustainability. The plight of our planet will be determined by understanding the interactions of Earth's subsystems: hydrosphere, geosphere, cryosphere, biosphere, and atmosphere. Earth scientists have expertise in all of these systems.

Begin now to develop outreach projects involving your students that will inform the stakeholders in your community: store-window displays, civic club presentations, fairs, poster sessions, plays, etc.

We should also make an effort to encourage TSTA to make the theme for the 2008 annual meeting related to IYPE.

## Pop Tops Needed for Workshop

TEST needs to collect a variety of pop-tops from cans of all types (soup cans, soft drink cans, Spam cans, oil cans, etc.) for activities in the Teaching Evolution workshop at the Fall TSTA meeting in Nashville. Hundreds of pop tops are needed to produce teacher and student kits. Please begin collections and encourage your students to save as many pop-tops as possible (even scrounging for the ancient style from the 1960's). The pop-tops will be used as part of several hands-on activities demonstrated in the workshop dealing with recognizing and naming fossils, evolutionary trees (cladograms), and interpreting ancestor

descendent relationships. We need the pop tops by August 1<sup>st</sup> to assemble kits for later use. You can send them to Dr. Michael A. Gibson, Dept. of Geology, Geography, Physics, University of Tennessee at Martin, Martin, TN 38238.

## Geology PD sessions at the Falls

By Alan Goldstein

[mailto:agoldstein@dnr.IN.gov]

### 2007 Educator Workshops: Falls of the Ohio State Park

The Falls of the Ohio State Park strives to be a leader in educator workshops on geology and archaeology. Pre-registration is required. For inquiries about our programs or customized workshops for individual schools contact: Alan Goldstein, Falls of the Ohio State Park, 201 W. Riverside Dr., Clarksville, IN 47129, 812-280-9970 ext. 403, agoldstein@dnr.in.gov

## Geology & Paleontology

### Field Paleontology Institute

June 19-21, 9:00 am-4:00 pm (limit 20) (Cost \$10)  
How do I get fossils for the classroom? Are there other ways to use fossils in activities for students? What are the best resources available? This three-day workshop combines collecting fossils in the field with activities using those fossils in the classroom. Participants take two excursions to collect Ordovician and Silurian/Devonian fossils (which you can keep) as well as explore the park's fossil bed (where you can observe, but not collect).

### Field Paleontology Institute - Discovery Day

June 18, 9:00 a.m. - 4:00 p.m. (limit 20) (Cost \$5)  
Participants will collect a variety of different types of Mississippian-age fossils in the morning. Afternoon time is used for identification. Shale can be used for in-class collecting activities. It is recommended (but not required) that participants take the three-day Field Paleontology Institute. For

in class fossil digs, bring a five-gallon bucket and a small shovel.

### Understanding Evolution & Adaptation

June 25 & 26, 9:00 a.m. - 4:00 p.m. (limit 25)  
(Cost \$40)

In partnership with the Louisville Zoo, this workshop is designed to help teachers and other interested educators better understand the unifying scientific concept of evolution. It will explore such questions as: What is science? What is the difference between a scientific theory and a belief? How do we tell geologic time? What is Natural Selection? Participants will learn a number of creative activities that can be put to use in the classroom. Content appropriate for grades 6 - 12.

### Indiana and Kentucky Geological Survey Fossil Festival Workshops

September 15, 9:30 a.m. - 12:15 p.m. (limit 30)  
(No charge.)

Learn how to use the extensive IGS or KGS web site in your classroom. Led by Indiana and Kentucky Geological Survey staff.

### Archaeology

#### Project Archaeology

June 7 & 8, 9:00 a.m. - 4:00 p.m. PM (limit 25)  
(No charge, optional book \$10)

Like Project WILD, this national curriculum was developed to help the classroom teacher by providing interactive lessons that are fun and meaningful. The workshop begins with a brief background in the archaeology of the Ohio River region, presented by an archaeologist. Participants are invited to try out tools and games that ancient people used, such as the drill and atl-atl. Classroom activities center on archaeological techniques that allow us to learn how ancient people lived. A Native American guest speaker shares insights on traditional culture and a personal view on archaeology. 12 hours of in-

service credit for JCPS educators. Participants can obtain a copy of "Intrigue of the Past" for \$10.



Mrs. Royle's sixth graders spend half their school day picking up and identifying fossils from the Devonian/Silurian Periods. They found an abundance of gastropods - some in perfect condition. Camden Gravel Pit in Camden, Tennessee is a great place for students to start a fossil, mineral, and rock collection. Chert, quartz, traces of iron and magnesium minerals in chert cross disciplines of Geology, Chemistry, Paleontology, and Biology. Additional cast and mold fossils included crinoids, bivalves, and several pieces of coral. We were on a treasure hunt of learning that was extended back in the classroom as we studied further our pieces of "gold."



## Newsletter Alert

Visit the website often as our newsletter will be posted instead of mailing due to the increasing cost of postage.  
<http://www.tnearthscience.org>

## ARTICLES AND ANNOUNCEMENTS WANTED

This newsletter is published three times annually, February, May, and October. The deadline for articles is January 15, April 15, and September 15 respectively. We want to hear about what you are doing so please email articles and photographs to Jane Skinner at [jaskinne@hotmail.com](mailto:jaskinne@hotmail.com)

## TEST Membership Application

Last Name \_\_\_\_\_

First Name \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Home phone \_\_\_\_\_

Work Phone \_\_\_\_\_

E-mail \_\_\_\_\_

School Name \_\_\_\_\_

School Address \_\_\_\_\_

\_\_\_\_\_

Subjects and grade(s) Taught \_\_\_\_\_

\_\_\_\_\_

Degrees Earned \_\_\_\_\_

Discipline of study \_\_\_\_\_

***Dues are \$10.00 per year. Make checks  
payable to TEST.***

Mail to: Christine Henry  
2805 Woodson Drive  
Knoxville, TN 37920