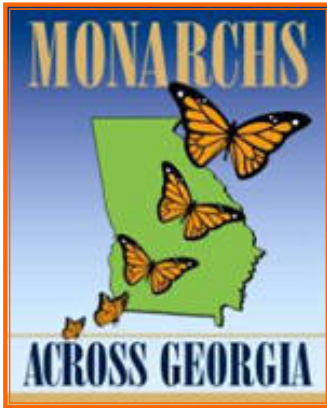


The Chrysalis



Emerging News from Monarchs Across Georgia

A Committee of the Environmental Education Alliance of Georgia



Monarchs Across Georgia announces 2009 Monarchs in Mexico Trips

Travel to Michoacan, Mexico, with us for the experience of a lifetime! Walk through the pristine forests atop the Transvolcanic mountains where millions of monarch butterflies drape the trees and flutter in the beams of sunlight that pierce the canopy. The silence is broken by a cascade of butterflies dropping off of a branch above your head, and the beating of their wings surrounds you like soft rain falling. This is truly a magical place!



We will visit several butterfly colonies during our weeklong stay and enjoy the rich cultural heritage of this delightful winter home of the monarch. From the charming colonial city of Morelia to the lava fields of Paricutin, you will taste the culinary delicacies, touch the artisans' handiwork, view the unearthed ruins of past civilizations and hear the stories of the people who live in this colorful land.

Upcoming Events

October 14, 2008

Registration deadline
for the
Journey North
Symbolic Migration
learner.org/jnorth

October 25, 2008

20th Annual Monarch
Butterfly Festival
St. Marks National
Wildlife Refuge
fws.gov/saintmarks/



Dates: January 31 - February 7, 2009
February 7 - February 14, 2009
February 14 - February 21, 2009

Cost: \$1500.00 double occupancy
\$1900.00 single occupancy
plus airfare to Morelia, Mexico

Visit the Mexico Trips & Events section of our website Monarchsacrossga.org for a complete itinerary, details and an application. Space is limited!

Five PLU credits are available to Georgia certified teachers. Attendance at all pre- and post-trip meetings plus journal and lesson plans are required for credit.

Monarch Watch Tagging Project

How do you tag a Monarch?

You must purchase a Tagging Kit from the Monarch Watch online store at <http://shop.monarchwatch.org/>. Each Kit includes a set of monarch butterfly tags, a datasheet, tagging instructions, and additional monarch/migration information. Kits are a seasonal item and are shipped beginning August 1st in plenty of time for the start of the Monarch migration in your area. Tags are only good for the year they are issued.

You can collect your Monarchs as eggs, larvae or pupae and raise them to adulthood. Or you can capture adults with a butterfly net that is at least 24 inches deep, allowing you to trap the butterfly in the deep end of the net without harming it. Nets can be purchased or made using simple inexpensive materials. Monarch Watch provides directions for making a net and tactics for successfully capturing Monarchs on their website.

Determining the sex of your Monarch is requested on the datasheet. Here are two easily seen differences between the male and female adult Monarchs.



Male Monarch

Notice the thin vein pigmentation and swollen pouches (black dots) on the hindwings.



Female Monarch

Notice the thick vein pigmentation and no hindwing pouches.

When should you tag?

Tagging Monarchs is not a year round activity. You can determine the peak of the fall migration in your area based on your latitude. The chart below notes the latitudes of several cities in Georgia.

Cities in Georgia	Latitude	Midpoint	Peak in Monarch Abundance
Toccoa, Rome, Gainesville	34N	5 October	27 September – 9 October
Atlanta, Augusta, Carrollton	33N	7 October	29 September – 11 October
Macon, Savannah, Columbus	32N	10 October	2-14 October
Albany, Tifton, Brunswick	31N	12 October	4-16 October
Valdosta, Bainbridge, Thomasville	30N	15 October	7 - 19 October

Why should you tag?

Many questions remain unanswered about the fall migration of the Monarch population east of the Rocky Mountains. How do the Monarchs move across the continent, i.e. do they move in specific directions or take certain pathways? How is the migration influenced by the weather? Are there differences in the migration from year to year? Data is needed to answer these questions and only through the cooperative efforts of volunteer taggers will sufficient recoveries be obtained and observations of the migration be made to answer these questions. Visit www.monarchwatch.org/tagmig for more information about the Monarch Watch tagging program.

Annual Monarchs Across Georgia Awards

Nomination Eligibility & Process

Monarchs Across Georgia is looking for some outstanding volunteers for the 2008 awards!

This award is intended for an individual or organization whose efforts in the arena of monarch education, conservation and/or habitat restoration have made an impact in the state of Georgia. In order to be eligible for the “2008 Outstanding Pollinator Habitat Award,” you must submit an application to certify your back yard, school yard, workplace, farm, community garden/park, church garden or rooftop/apartment garden and receive certification from Monarchs Across Georgia in the year 2008. All applicants in the calendar year are eligible; however, one factor that will be assessed for the award is the impact of the habitat, i.e. its use for community outreach and/ or education.



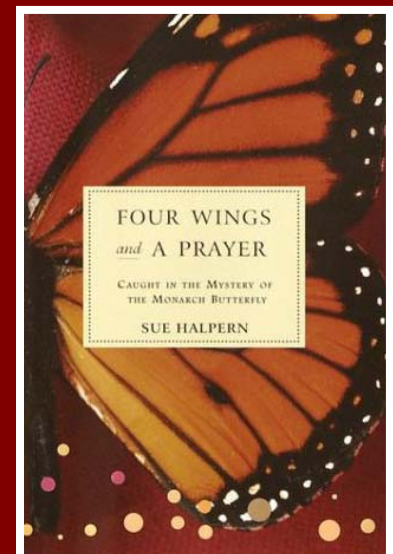
Application for the “2008 Monarchs Across Georgia Service Award” can be made on-line at www.monarchsacrossga.org. One winner will be chosen from the applications received by the deadline of June 30, 2009. The award will be presented at the annual Butterfly Symposium, September 26, 2009 at The State Botanical Garden of Georgia in Athens.

Recommended Reading

Four Wings and a Prayer
by Sue Halpern

Every autumn, monarchs in the Eastern United States and Canada migrate thousands of miles to a handful of Mexican overwintering sites, where they rest for the return trip home. No single butterfly ever makes the round trip, yet thousands converge on the same few sites year after year. Monarchs are the only butterflies to migrate such long distances; the question of how they find their way remains one of the great unsolved mysteries of animal biology. She visits a host of colorful scientists and dedicated volunteers who are helping to determine the butterfly's migration routes. Her lively, lyrical account of monarch life will delight armchair and active naturalists and anyone interested in scientists in action and skies loud with the beat of wings.

— *From Publisher's Weekly*



Scientists Discover the Molecular Basis of Monarch Butterfly Migration

Since its discovery, the annual migration of eastern North American monarch butterflies has captivated the human imagination and spirit. That millions of butterflies annually fly a few thousand miles to reach a cluster of pine groves in central Mexico comprising just 70 square miles is, for many, an awesome and mysterious occurrence. However, over the past two decades, scientists have begun to unveil the journey for what it is: a spectacular result of biology, driven by an intricate molecular mechanism in a tiny cluster of cells in the butterfly brain.

University of Massachusetts Medical School Professor and Chair of Neurobiology Steven M. Reppert, MD, has been a pioneering force in the effort to demystify the migration of the monarch. His previous research demonstrated that the butterflies use a time-compensated sun compass and daylight cues to help them navigate to the pine groves. His studies have shown that time compensation is provided by the butterfly's circadian clock, which allows the Monarch to continually correct its flight direction to maintain a fixed flight bearing even as the sun moves across the sky.

In "Cryptochromes Define a Novel Circadian Clock Mechanism in Monarch Butterflies That May Underlie Sun Compass Navigation," Reppert and colleagues reveal that the circadian clock of the monarch uses a novel molecular mechanism, heretofore not found in any other insect or mammal.

By studying the clock in two other organisms—the fruit fly and the mouse—scientists thought that they had very good models for an understanding of the insect clock and the mammalian clock, respectively. Through these studies, scientists had described a clock mechanism that is

essentially a loop where proteins are made and destroyed over a cycle that takes approximately 24 hours to complete. Further, investigators identified those factors that work together to drive this process.

Reppert and colleagues were particularly interested in one of these factors: CRY, a cryptochrome protein that was initially discovered in plants and was subsequently found in the fly and the mouse. In the fly, CRY functions as a blue light photoreceptor, allowing light access to clock-containing cells. This enables the resetting of the clock by the light-dark cycle. In the mouse, CRY does not function to absorb light; rather, it is one of the essential components that power the central clockwork enabling the feedback loop to continue. (In the mouse, light enters the clock through the animal's eyes.)

Given the function of CRY in flies and the role of light in migration, scientists presumed that the monarch's clock would resemble that of the fly. Reppert and his collaborators were stunned and elated to find that the clock of the butterfly was as spectacular as its migration. Genetic studies revealed that the monarch had not only the fly-like CRY, but also another cryptochrome that further tests identified as a new clock molecule in the butterfly. Surprisingly, this cryptochrome, dubbed CRY2, is more similar in structure to vertebrate CRY than to that of the fruit fly.

Notably, the scientists also found that the core components of the monarch clock resembled those of the mammalian clock. As in the mouse, CRY2 functions in the butterfly to maintain the feedback loop, while CRY1 still allows light to access the cells, as in the fly.



“This is a very interesting realignment of how one thinks about insect clock models. There was no reason to suspect that the butterfly clock would be different from that of *Drosophila*. That it is different has already told us something about how circadian clocks have evolved,” explained Reppert.

“What we have in the butterfly is an astounding clock mechanism, one that is more similar to our own circadian clock and less similar to the clock of the fly! The presence and function of two distinct CRYs suggest that the monarch’s is an ancestral clock; a clock that, over the course of evolution, has changed differently in other insects and mammals.”

Reppert and colleagues not only discovered the function of CRY2 in the monarch clock, but they also found that CRY2 may function to mark a critical neural pathway from the circadian clock to the sun compass. This clock-to-compass pathway provides an essential link between the clock and the sun compass, as both are necessary for successful orientation and navigation. As Reppert explains, “CRY2 appears to have a dual function— as a core clock component and as an output molecule, linking the clock to the compass.”

Concurrent with their studies of the monarch clock and relevant to the identification of CRY2, Reppert and colleagues have been working to create a butterfly genomics resource.

In “Chasing Migration Genes: A Brain Expressed Sequence Tag Resource for Summer and Migratory Monarch Butterflies (*Danaus plexippus*),” Reppert and his collaborators describe a brain expressed

sequence tag (EST) resource, used to identify genes involved in migratory behaviors by comparing the gene expression in the brains of migrating butterflies to those of non-migrating butterflies. They have already identified ~10,000 ESTs that likely represent over 50 percent of the genes that make up the monarch genome. The ESTs, which represent expression units of genes in the butterfly brain, are currently being analyzed and catalogued and Reppert hopes that the genetic information will be of wide use to scientists around the world.

“This information, along with genetic markers identified in the study, will help us distinguish genetic differences between populations or even between butterflies that are migratory and not migratory” Reppert said, adding, “This information sets the stage for the cloning of the butterfly genome.”

Ultimately, the Reppert laboratory will continue to work to understand how the monarch clock “talks” to the sun compass, with a focus on CRY2. The goal of the researchers’ studies is to understand the molecular mechanism and anatomical mechanisms for clock-compass interactions that enable migrants to maintain a set flight bearing as the sun moves across the sky during the day.

Dr. Reppert also states, “The monarch provides a fascinating animal model for the study of neurobiology. By understanding more about the way the circadian clock and the sun compass interact to allow the monarch to fulfill its biological destiny, we will gain valuable insights into how the brain functions to incorporate information about time and space, which has relevance far beyond the butterfly.”

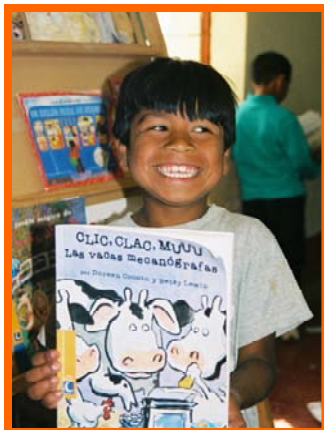
This article was originally published at www.biologynews.net. To read the original paper, *Cryptochromes Define a Novel Circadian Clock Mechanism in Monarch Butterflies That May Underlie Sun Compass Navigation* by Haisun Zhu, Ivo Sauman, Quan Yuan, Amy Casselman, Myai Emery-Le, Patrick Emery, and Steven M. Reppert, visit the Public Library of Science (www.plos.org).

Monarchs Across Mexico

2009 Book Project

For the last six years, Monarchs Across Georgia (MAG) has traveled to Michoacan in an effort to generate awareness and understanding between two cultures through the study of Monarch butterflies. We have always felt it was important to include a look at the Mexican educational system, which differs greatly from the American system. The Mexican education system is divided into four levels: preschool (K1-K3), compulsory basic education, called grades 1 through 9, upper secondary education, consisting of grades 10 through 12 and a university level education. Education in Mexico is mandatory only for nine years.

Two of the biggest problems that the educational system in Mexico faces are its low enrollment and high dropout rates. Encouragingly, enrollment in grades 1 through 9 grew from “9.7 million students in 1970, to 21.6 million students in 2000”. This rapid growth presented many problems as there are not enough teachers and/or supplies to teach this many students at one time. All of these challenges mean that only approximately 68% of Mexican children graduate from grade nine. To put this in context, note that this is very close to the high school graduation rate of 70.8% that was announced for Georgia in 2006. However, that rate was for a full K-12 education, with all of the advantages that our American tax dollars provide.



Over the past six years, MAG has developed a special relationship with Scholastic Mexico to bring elementary-level books written in Spanish to students who are taking care of Monarch butterflies in Mexico. We have collected donations from our many trip participants, and Scholastic Mexico has generously given us a discount, along with free shipping so we don't have to carry all of the books on the planes with us: a wonderful gift! We would like to ask for your support to meet our goal of \$2,500 this year. Your generous contribution will make it possible for MAG, a committee of the Environmental Education Alliance of Georgia (EEA), to bring much-needed educational materials to these deserving children.

Please consider making a tax-deductible donation to EEA designating it to the “Mexico Book Project.” Your check can be mailed to the address below. As a reference, books generally cost about \$5.00 in American currency. In appreciation for your donation, a bookplate with your name (or one designated by you) will be attached to the inside cover. We will also recognize donors by publishing their names on our website at www.monarchsacrossga.org. Receipts will be provided upon request. The deadline for these tax-deductible donations is January 10, 2009.

**Mail to: Mexico Book Project
Trecia Neal, MAG Co-Chair
2433 Kingscliff Drive NE
Atlanta, GA 30345
t.neal@fernbank.edu**

Literature Cited

Santibanez, Lucrecia, Vernez, Georges, Razquin, Paula. “Education in Mexico – Challenges and Opportunities.” Rand Corporation, 2005, Retrieved Aug 10, 2008, <www.rand.org/pubs/documented_briefings/2005/RAND_DB480.sum.pdf>

“High School Graduation Rates 2006-2007.” Bureau of Business Research and Economic Development. Feb 14, 2007. Accessed Aug. 10, 2008. <www.livingoak.org>



The Journey North

Symbolic Monarch Migration

Each Fall, millions of monarch butterflies make their way from Canada and the United States to remote mountaintops in the Transvolcanic Range of Central Mexico. The biology behind their amazing journey is one of the great ecological mysteries. How do the Monarchs know when to start their journey, how do they know which way to fly, and how do they know when they've arrived?

Citizens and students can join the effort to find answers to these and many other questions by participating in Journey North's monarch migration mapping initiative. Volunteers report monarch sightings in their areas to add to both the Spring and Fall migration maps. Students can also expand their knowledge by keeping a migration journal to reflect on their experiences and make predictions. This is a great way to get involved in a real-life field study! Journey North also has other lesson plans, resources and activities to help create an enriching monarch curriculum.



Science isn't the only subject that can be explored through Journey North. The Monarch is deeply rooted in Mexican culture and is believed to carry the souls of ancestors who arrive on *Día de los Muertos*, or The Day of the Dead (November 2nd). Canadian and American students can create a link with students in Mexico by participating in the Symbolic Migration. In Fall, students color a paper butterfly with Spanish phrases to send south to the children who live near the Monarch sanctuaries. In the Spring, coinciding with the real Spring migration, the same butterflies are returned with messages from the Mexican students.

To find out more about these exciting projects, visit www.learner.org/jnorth. The postmark deadline to send your Symbolic Monarchs is October 14, 2008.

SPOTLIGHT... Plants For Your Pollinator Garden



The genus *Solidago* is made up of approximately 100 perennial species that are native to North America. They are often incorrectly blamed for hay fever in humans, which is usually caused by ragweed pollen.

Habitat: Full sun. Will tolerate poor soils.

Bloom Time: late Summer—early Fall

Wildlife Uses: Goldenrod nectar attracts many species of butterflies and bees as well as aphid-eating insects. A few western butterfly species also use it as a host plant.

Goldenrod (*Solidago* spp.)