The Gloworm

None of God's Creatures absolutely consider'd are in their own Nature Contemptible; the meanest Fly, the poorest Insect has its Use and Vertue
- Mary Astell

Volume XXII No. 6 November-December 2015

An Extension Newsletter of the Dept. of Biochemistry, Molecular Biology, Entomology, & Plant Pathology

Season's Greetings from MSU Extension's Arthropod Adventures Team

MSU Beekeeping Camp Overview by Drs. John Guyton and Jeff Harris

Many of our readers are familiar with the MSU Bug and Plant Camp, but not as many know about the MSU Beekeeping Camp, first offered in 2014. Our original intention in starting a beekeeping camp was to provide 4-Hers and Bug and Plant campers with an opportunity to advance their knowledge of insect rearing and learn the fundamentals of running a business. That focus has not changed, however, we accept campers age 10 and up at our intergenerational camps, so parents, teachers, and other adults can attend. During this 5-day, comprehensive academic camp, we will cover all the topics a new beekeeper needs to know to start keeping bees and utilizing or selling honey and wax. Nights at beekeeping camp are not *as* long as those at bug and plant camp, enabling those in the local community to spend the night at home.

Extension Apiculturist and camp co-director Dr. Jeff Harris is an expert on hygienic behavior in honey bees, a natural defense against parasitic mites that are possibly the greatest obstacle facing bees. Jeff has bred honey bees that are capable of cleaning mites from their nests, which reduces the need for miticides. We will spend a significant amount of time preparing campers to monitor and manage mites.

Our goal is to make this as much of a hands-on experience as possible, so campers can expect to be in the hives daily. We start off with an introduction to the equipment, jargon, and personal protective

equipment, followed by how to use a smoker (an important piece of safety equipment). If it is not raining, campers will learn how to open hives on the first day. We, or experienced mentors nearby, will continue to assist campers once they are back home and setting up their first hives.

Camp topics include: getting started with bees; finding, marking and clipping the queen; how to recognize if the queen is a good egg layer; seasonal management; stings and colony defense; diseases, pests, and parasites; harvesting honey; honey and pollen in human nutrition (myths and truths); basic bee biology; queen rearing (quality, grafting, and requeening); specialty honey; protecting combs; bee communication (learn to do the waggle dance); swarm management; gustation of honey in bees and humans; processing honey and wax; honey judging; how to buy bees; income and the slippery slope into business; and a trip to a commercial apiary or bee yard.

The 2016 MSU Beekeeping Camp will run from June 5–9 on the Mississippi State University campus. The registration form (for both camps) is on p. 5 of the September-October 2015 edition of the Gloworm, which can be accessed at http://msucares.com/newsletters/pests/gloworm/2015/volume.xxii_no5_09_10.pdf.

4-H Art Exhibition and Photo Salon Winners Announced

Congratulations to the winners of the 2015 4-H Entomology Art Exhibition and Photo Salon! Prizes for the 2015 contest, provided by the Mississippi Entomological Association, went to:

Photography

First Place: Jonah Holland, Tishomingo County, age 15, "Agatha likes Pink"

Prose and Poetry

First Place: Jaquezz Shelton, Clay County, age 11, "Itchy, Itchy, Flea"

BUG CLUB ACTIVITY

Write a Play or Puppet Show about Insects or Other Arthropods by Dr. John Guyton

With school winding down for the holidays, now might be a good time to learn a little about insects while being creative. Some ideas to jumpstart your writing process include developing a play about: metamorphosis, cicada killer and cicada interactions (3 roles), jumping beans (1 or two roles), crickets and the lawnmower, an insect that hitchhikes across the country and arrives in a strange place (this would be about a non-indigenous species and could be really exciting), butterfly migration, or the different types of arthropods.

If you produce an entomology-related play or article, we will consider publishing it. To help get your creative juices flowing, I have written a short puppet show or play about different types, or orders, of insects (see below). Extension agents and others should feel free to use this to discuss the different orders in bug club meetings or classrooms.

"Mr. Frog Faces a Buffet of Choices and Gets an Unexpected Gift" by Dr. John Guyton

Selected orders: Mantodea, Isoptera, Diptera, Phasmida, Orthoptera, Odonata, Blattodea, Hymenoptera, Coleoptera, Ephemeroptera, Plecoptera, Tricoptera, Megaloptera

Roles (at least 12): Narrator, Frog, Mantid, Grasshopper, Dragonfly, Roach, Ants (3), Click Beetle, Toe-biter, and Blister Beetle. You could add the silent Termite, Fly, Walking Stick, Mayfly, Stonefly, Caddisfly, Dobsonfly or Hellgrammite depending on how you plan to use this production.

MR. FROG: I sure am hungry! I think I will find a big, juicy, crunchy bug for breakfast. Oh, I see a large mantid (*Mantodea*)! Will you join me for breakfast, Mr. Mantid?

MR. MANTID: Good morning, Mr. Frog! Will you let me just finish my prayers?

MR. FROG: Why certainly!

NARRATOR: As Mr. Frog bowed to give thanks for a huge tasty mantid, Mr. Mantid took flight!

MR. FROG: Drat! I should have realized those arms were built for preying, not praying!

[*Demonstrating the difference with his forelegs*]

NARRATOR: As Mr. Frog jumped, a piece of bark on the log from which he jumped broke off, revealing several small white termites (*Isoptera*). In an instant, his sticky tongue slapped the log as the termites ducked out of sight! Undeterred, Mr. Frog hopped across the park, looking for a tasty fly (*Diptera*).

MR. FROG: Good morning, Mr. Fly, although I cannot understand why you are attracted to that smelly old bologna sandwich!

NARRATOR: In the blink of an eye, Mr. Fly took flight. You could almost hear Mr. Frog's lips slamming shut while the fly circled back as if to poke fun at the slower frog. Mr. Frog continued his breakfast foray.

MR. FROG: Okay, Walking Stick (*Phasmida*). I know you're in there. Show yourself!

NARRATOR: With that, the wind rustled the leaves and stirred the twigs. Mr. Frog leaped in the air, chomping hungrily down on a branch instead of the lean but tasty walking stick he had hoped for.

MR. FROG: I guess my hunger made that twig look like a stick insect! Maybe I can catch a nice damselfly or dragonfly (*Odonata*) before they start flying this morning down at the pond.

NARRATOR: But before he reached the pond, he saw a large grasshopper (*Orthoptera*), and being quite hungry, he made a leap with tongue extended. But Ms. Grasshopper's incredible compound eyes saw him first, and she leaped faster!

MS. GRASSHOPPER: You can't catch me with beautiful eyes like these!

[*Calling over her shoulder*]

NARRATOR: All Mr. Frog got was dirt as he landed, so he immediately headed straight for the pond for a drink of water. On arriving at the water's edge, Mr. Frog saw a dragonfly sitting on top of a stem and looking the other way. He took aim and leaped. Splash!

MS. DRAGONFLY: Mr. Frog, you did not study your history. My ancestors teased the dinosaurs. I can hover like a helicopter and fly upside down while catching and eating mosquitoes. Aeronautical engineers are envious of my moves! I can also see you twitch.

MR. FROG: Well drat again, I should have known that 'snake doctors,' as we call you in the South, have eyes in the back of their heads! I guess anything that survived the dinosaurs can survive me! At least I got my mouth cleaned out!

NARRATOR: Crawling out of the water, Mr. Frog saw a roach (*Blattodea*) quickly crawling from the water's edge into the leaves under a bush. Once again he leaped, this time coming away with only a roach wing and some dried leaves.

MR. ROACH [*hissing*]: Missed me, missed me, now you have to kiss me. I didn't need that wing for much, anyway!

MR. FROG: I didn't really want to eat a roach, anyway! What was I thinking?

NARRATOR: At that moment a line of beautiful red ants (*Hymenoptera*) caught Mr. Frog's attention.

MR. FROG: Well, Ant Sisters, I missed breakfast, and a line of ants will make for a delicious lunch! I know my distant cousins the poison dart frogs from a land far away can kill fire ants. Maybe I can, too. Great balls of fire! Ouch, oh my, this was a mistake. Help!

ANT SISTERS [*in unison*]: Mr. Frog, just what part of *red* do you not understand? Red is nature's warning.

NARRATOR: Mr. Frog would have tucked his tail if he still had one as he crawled through leaves and hopped through branches trying to dislodge the fire ants on his way back to the pond, where he was sure the fire ants would turn loose! While underwater he lunged at mayfly (*Ephemeroptera*) and stonefly (*Plecoptera*) nymphs, deciding to leave the caddisfly (*Tricoptera*) nymphs alone in their stone cottages as well as the large, fierce-looking dobsonfly or hellgrammite larvae (*Megaloptera*). Coming up empty, Mr. Frog realized he was not as agile as he had been as a tadpole. It was getting late and he was still hungry.

MR. FROG: Okay, I know where I need to look for dinner. There are more beetles (*Coleoptera*) than any other insects. There just has to be one for me!

NARRATOR: Just at that moment, a firefly blinked within striking range.

MR. FROG [*croaking while leaping*]: With my depth perception, jumping ability, and long tongue, you are dinner!

NARRATOR: Landing with a clean tongue, Mr. Frog could only imagine the eye-shine from his tapetum lucidum, which reflects light at night, gave his position away. Mr. Frog wandered into the woods.

MR. FROG: Good evening, Mr. Beetle with the big black eyes. Why are you not running from me?

NARRATOR: With that, Mr. Frog leaped and Mr. Beetle clicked. The beetle disappeared straight up into the night!

MR. FROG: Where did you go?

MR. CLICK BEETLE: Straight up and straight down to give you a big surprise!

[Landing on and clinging to Mr. Frog's back]

MR. FROG: You'd better click your way on down the trail or I will punch out one of those big dark eyes and eat you for dinner!

NARRATOR: With one last good thump on Mr. Frog's back, the click beetle disappeared into the night. Driven by hunger, Mr. Frog returned to his search for a tasty insect midnight snack and headed back toward the pond to see what morsels were attracted to the water. He came to an abrupt stop face to face with a toe-biter. Though he was not worried about his toes, he had seen these bugs (*Hemiptera*) in action when a mere tadpole. That "X" on its back was a warning to not cross!

MR. FROG: Mr. Toe-Biter, I am very hungry and will be on my way.

[Mr. Toe-Biter extends his raptorial forelegs toward Mr. Frog, but not in time]

NARRATOR: Mr. Frog made one fine leap from the shallow water onto dry land. Now hungry, irritated, and insulted, Mr. Frog took a few small steps, trying to decide where to go and found himself face to face with another beetle—this time a blister beetle.

MR. FROG: What are the odds I would encounter *another* beetle?

NARRATOR: Quite good, actually! And, being a frog, he was not familiar with a blister beetle's nature. He was also unaware that Charles Darwin had described the blistering experience of placing such a beetle in his mouth!

MR. BLISTER BEETLE: Greetings, Mr. Frog. You look like you are on the hunt for a late-night snack, so I thought I should warn you that I am poisonous. My cantharidin will blister your skin and probably your insides as well.

NARRATOR: With that, Mr. Frog threw out his tongue and ate the brave but misguided blister beetle.

MR. FROG: The insects in my story were unusually successful, but in the end I gained the advantage of being poisonous because I retain the blister beetle's cantharidin. The insects do not always win!

WHAT'S NEW AT THE ZOO?

Stored Grain Beetles, the Smallest Zoo Critters (so Far) by Dr. John Guyton

I recently opened my flour canister and found a big surprise. The flour was infested with many tiny beetles. I have since identified them as confused flour beetles (*Trifolium confusum*) rather than the closely related species, the red flour beetle (*Trifolium castaneum*), that I had hoped for. Most people would wrap their flour well and toss it, possibly after freezing it for a while, but in the name of science, my beetles are now on display in a sealed plastic bag of flour in the Arthropod Zoo.

Confused flour beetles in flour canister. Notice the unsavory discolorations in the flour. Photo by J. Guyton.

There is an interesting query, "When you see a hole in a bag of flour, did the beetle go in or come out?" It turns out the infestation starts from undamaged eggs that survived milling in the processed flour. Once they hatch, beetles will eventually be seen in the flour. It may not be as much of a problem as most believe—just a little extra protein in the flour. However, because all stages of the beetles have been living in the flour, those dark spots are not protein! Confused flour beetle and red flour beetle are the most common pests of stored grains including flour, cake mixes, cereals, crackers, spices, beans,

seeds, and nuts. Because of them, some people keep these products in the refrigerator so the eggs never hatch.

The confused flour beetle is of African origin and is common in the southeastern U.S. The red flour beetle is of Indo-Australian origin and is more common farther north. Dark brown to reddish in color, they are similar in appearance. To differentiate them, observe their antenna very closely with a magnifying glass. The confused flour beetle has a four-segmented club antenna compared to the red flour beetle's three-segmented club. See other comparisons on Rebecca Baldwin and Thomas R. Fasulo's (University of Florida) Featured Creatures site: <http://entnemdept.ufl.edu /creatures/urban/beetles/red_flour_beetle.htm>.

Flour beetles develop from egg to adult in approximately 7 weeks, depending on temperature, and they can produce four or five generations per year. They can move to other products (e.g., dog food, spices, or dried flowers) rapidly. As they live and grow in flour or other products, they discolor them and the products take on a disagreeable smell.

Left-right: Confused flour beetle (*Tribolium confusum*) and red flour beetle (*Tribolium castaneum*). *T. confusum* antennae have 4 club segments, while *T. castaneum* has only three. Photos by J. Guyton and R. Baldwin, respectively.

Less common flour beetles include the black flour beetle, false black flour beetle, broadhorned flour beetle, slender-horned flour beetle, and small-eyed flour beetle. Drugstore and cigarette beetles are also common pests of stored products. The cigarette beetle is found in dried tobacco products.

BUG CLUB ACTIVITY Take advantage of an often overlooked collecting opportunity during the holidays. Check the flour at your house, your grandparents', or a friends' in the neighborhood for a colony of flour beetles. Keep some alive in flour in a tightly sealed container for a mini zoo exhibit or preserve some (see below) and start a specialty collection of agricultural pest beetles (a great next step for 4-H youth who have formerly competed with general insect collections). If you have relatives or friends in the northern U.S., have them check their flour, which may contain red flour beetles common to their region. Have them kill the beetles by placing them in the freezer for a week or so, dropping them in alcohol, or using an ethyl acetate kill jar before mailing them to you. Point mount the beetles or store them in alcohol vials for your collection.

Think like a Spider by Lois Connington

Some critters are just harder to keep alive than others. In the past few weeks I have found myself thinking, *If I were a spider, what would I do?* Putting myself into this mindset has helped me realize a few key things, enabling me to more effectively feed two of our new exhibits—and some of our old ones. My first revelation came to me as I watched our newest golden silk spider (*Nephila clavipes*) fail to thrive in her small critter keeper. We had kept other females and a pair of this species in an 18" tall x 18" wide x 3" deep handmade habitat with huge Plexiglas windows. The view from the outside was great, but the spider(s) stayed near the top on one spindly web, ignoring the crickets we threw in and the water dish way down at the bottom until each spider eventually died.

Before subjecting another orb weaver to the same fate, I read up on the habits of *N. clavipes*, which make meter-wide webs in the wild. Obviously no cage we have would accommodate a web that big, but putting her in one of the 16" tall x 16" wide x 18" deep display cabinets would at least let her live out her life in three dimensions. Just a few days after settling into her new habitat, she had spun her golden silk into an intricate system of webs between the screen top, the side walls, and the several sticks leaning at angles against the walls. Definitely not another 2-D habitat.

I also realized that her habit of sitting in the middle of her web waiting for prey to come along and get tangled in it meant that her food would need to be able to fly. No earthbound crickets for this girl. She has been on a steady diet of older painted lady butterflies, black soldier flies from the rearing center, and any other flying insects that crossed my path. I tend to toss the prey (sometimes pretty hard) into the web,

which is not as sticky as I had expected. These projectiles never fail to get her attention, though she is not always able to snag them long enough to paralyze them with her bite before trussing them up with her silk. If they get away, they still may fly back into the web eventually—and get stuck in it.

Our green lynx spider's egg mass hatched last month, providing another feeding challenge. Once the spiderlings stopped preying on each other, we were still left with lots of tiny spiders on our hands. Mom is fine feeding on a cricket here and there, but the rest of the time, she and her many offspring spend their days suspended upside down on the organdy that is attempting to keep the little ones in the critter keeper. Putting myself in the spiderlings' tarsi, I wondered, *What could I catch?* Well, how about some fruit flies, which also tend to gravitate to the top of the cage? If nothing else, chasing after the flies provides some exercise, though I did notice that none of the flies lived to see the next day and many were caught in webs.

Given my propensity to throw prey at the orb weaver and my relative success at thinking like a spider, I apparently lost my focus during feeding time last week. Imagine the Chinese mantid's surprise when I flung a cricket at her ceiling, where its tarsi stuck in the screening long enough for the mantid to grasp the prey in her long forelegs. Definitely a fortuitous fling for all involved (well, maybe not the cricket).

Author's note: The golden silk spider, collected near Hattiesburg, MS, died just after Thanksgiving. Although I thought we had the habitat and prey down this time, something was not suitable—or it is just that time of year.

2015 Entomological Society of America Annual Meeting Enjoyable and Memorable **by Dr. John Guyton**

The 2015 Entomological Association of America Annual Meeting in Minneapolis was particularly exciting because we were joined by Bug & Plant Camper and high school sophomore Corran Hall and his mother Teresa. Peggy had made several huge batches of insect-laden snacks, which we served in the hallways, exhibit hall, preconference teacher workshop, and Marianne Shockley's and my entomophagy symposium. Judging graduate students' 10-minute presentations was wonderful, allowing me to see more research presentations in this event than I usually do during the entire conference! I also officially began my term as chair of the ESA Education and Outreach Committee. In contrast to these highlights, the trip home from Minnesota is another story entirely…

Having Corran as my guest enabled me to discern what a high school student could gain from the conference. As a co-presenter, he provided excellent help during the teacher workshop. My worries that my obligations would diminish the experience were needless, as he certainly learned his way around fast. When I spent the morning judging graduate presentations, Corran went to Dr. Sonny Ramaswamy's Lunch and Learn, enjoying the opportunity to talk to the head of USDA NIFA. Later they continued their conversation when they were both at the BioQuip booth in the exhibit hall. Corran and Teresa joined us for MSU's dinner during the conference, sponsored by Dr. Angus Catchot. I also enjoyed having Corran join us for the Education and Outreach and Entomophagy symposiums. Judging from Corran's report (below) and conversations about what he learned from different sessions, I am completely convinced others his age would benefit from participation in an ESA conference. I must thank Becky Anthony, ESA Program and Meeting Manager, for assistance in waiving Corran's registration.

We brought a suitcase full of insect snacks including Cricket Fudge, Sugar Cricket Cookies, Chocolate Chirp Cookies, and Peggy's famous Cricket Peanut Brittle. In a quasi-scientific study, we discovered that all 12 ESA staffers (100%) in the computer control center ate cricket brittle every time it was presented to them. Of the 23 people wearing ESA conference badges outside the computer center, only 7 (30%) tried the cricket brittle. These results indicate that ESA staffers enjoy the world's cuisine!

While judging the *excellent* presentations by graduate students from many lands, I had the sudden realization that we are one. We all speak the same language—Science! The inspiration for their research suggested a lot of personal involvement, their analyses used proper protocols and procedures, and their reporting made it difficult for the judges to perform their tasks. The point spread was so close I was very glad for the two other judges on the panel.

I am honored to serve as chair of the ESA Education and Outreach Committee for the next year. It will be a pleasure working with incoming chair Dr. David Held from Auburn, who was on MSU's Bug & Plant Camp staff and was responsible for starting Mississippi's BugFest. Drs. Rebecca Baldwin, Andrine Shufran, and Marianne Shockley are former chairs and remain active in the group. We are busy getting ready for the International Congress of Entomology that will convene next September in Orlando, FL, marking only the third time since its inception in 1910 that it has met in the U.S.

A Bug & Plant Camper's Perception of the ESA Annual Meeting by Corran Hall

Recently I returned from the 2015 Entomological Society of America Annual Meeting [Synergy in Science: Partnering for Solutions] in Minnesota, which I attended with Dr. John Guyton. It was a great experience. I was able to learn about insects and their importance almost every minute of each of the five days. Even conversations with strangers often focused on insects and their importance and roles in our world.

I was able to learn and understand a whole new world of insects and how they can be used to control pests and as an alternate source of food. Given that the world is growing fast, supporting an estimated 9.4 billion people in the future (2050) will be hard. Insect rearing and the science of entomology will be very important in feeding the growing population.

I was excited to attend so many seminars about science because it really improved my understanding of how things work in nature, basic ways of problem solving, and what that means to the whole. If one of the components is missing or a new one is added, it can throw off a whole ecosystem.

Being able to talk to many people was also valuable. I was able to learn a lot about many different aspects of nature as well as teach others about insects. I love meeting fellow entomologists, having one-on-one conversations about bugs and what they do, and learning what research they are involved with.

I can say I thoroughly enjoyed attending the ESA annual meeting and have gained a wealth of knowledge from it.

2016 4-H Beekeeping Essay Contest Entries Due by February 4

Mississippi entries for the 2016 4-H Beekeeping Essay Contest are due by close of business on February 4, 2016. Email your essay and brief biographical sketch to Dr. Jeff Harris at JHarris@entomology.msstate.edu (Subject: 4-H Beekeeping Essay). The first place essay will be sent to the national contest. In 2014, the second place winner in the *national* contest was Mississippi's Garrett Smith from Oktibbeha County! For more information on the contest, visit http://preservationofhoneybees.org/essays. See essays by national winners at http://preservationofhoneybees.org/essays/2015-4h-essays. If you have questions or concerns as you prepare your essay, contact Lois Connington at lois.connington@msstate.edu or 662-325-0795.

AWARDS

State Winners •1st Place—$100 (this essay goes on to national competition) •2nd Place—$75 •3rd Place—$50 (prizes provided by the Mississippi Beekeepers Association)
National Winners •1st Place—$750 •2nd Place—$500 •3rd Place—$250 (prizes provided by the Foundation for the Preservation of Honey Bees). Each state winner, including the national winners, receives a book from the Foundation for the Preservation of Honey Bees.

The essay must be your work, in your own words. An important consideration in writing an essay is to avoid plagiarism (the act of repeating information from a source word for word; failing to cite a source, even though you paraphrased the information; or using someone else's idea without giving them credit). It may be helpful to write a summary of each source you review, without quoting it, then outline your essay by pulling ideas from your summaries.

2016 ESSAY TOPIC

"*Bees and Pollination. How Important Is It?*"

Beekeeping has had is five minutes of fame for the past five years. Now more than ever, people are asking "What will happen if the bees are gone?" Your paper should research and help answer this question.

Survey your community to see what is being done. Include your state in your survey to see if there are any programs they are using for pollination or any other program that could aid the honey bee.

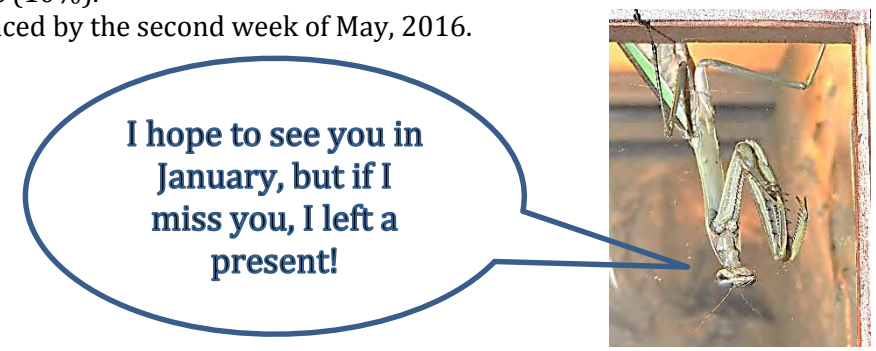
The scope of research is an essential judging criterion, accounting for 40% of your score. The number of sources consulted, the authority of sources, and the variety of the sources are all evaluated.

Personal interviews with beekeepers and others familiar with the subject are valued sources of information and should be documented. Sources that are not cited in the endnotes should be listed in a "Resources" or "Bibliography" list.

(Tips: Make your essay pop by adding a catchy title rather than using the topic as your title. Notice that "honey bee" is properly spelled as two words, even though many otherwise authoritative references spell it as one word.)

RULES

1. The contest is open to **active 4-H Club members only**. 4-H'ers who have previously placed first, second, or third at the national level are not eligible, but other state winners are eligible to re-enter.
2. Requirements (failure to meet any one requirement disqualifies the essay):
   - Write on the designated subject only.
   - All factual statements must be referenced with bibliographical-style endnotes.
   - A **brief biographical sketch** of the essayist, including date of birth, gender, complete mailing address, and telephone number, must accompany the essay.
   - Length—the essay proper: 750 to 1,000 words. The word count does <u>not</u> include the endnotes, bibliography or references, or the biographical sketch, which should be on a separate page.
   - ELECTRONIC SUBMISSIONS ONLY. Essays must be double-spaced, 12-pt. Times or similar type style, following standard manuscript format. Submit as a Microsoft Word–compatible document.
3. Essays will be judged on: scope of research (40%), accuracy (30%), creativity (10%), conciseness (10%), and logical development of the topic (10%).
4. The national winner will be announced by the second week of May, 2016.



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