

NATURE'S

Grapevine

WASHINGTON CROSSING STATE PARK, NJ

Summer 2011

When Nature Glows in the Dark

by
Greg Baber

“Mom! Dad! The lightning bugs are back! Gimme a jar, quick!”

I was probably no more than six or seven. I remember how easy they were to catch. They'd glow for a few seconds, allowing me to get a bead on them. I'd spot them lazily moving through the warm air. I would “sneak up” on them, catch a few and stick them in an old Ball jar with holes in the lid. They would crawl around the glass, glowing at each other until I let them go. I remember looking for dark locations so I could see how brightly they glowed. I remember being disappointed.

“Lightning bugs” or fireflies are winged beetles, *Photinus sp.*, that produce light in their abdomens as a form of bioluminescence, the production and emission of light from a living organism. Their bodies produce luciferin, a light emitting pigment, and luciferase, an enzyme. The luciferin reacts with oxygen, assisted by the luciferase, resulting in the glow.

Scientists have proposed two theories about how fireflies control their light: the first is called the Oxygen Control

Theory. It supposes that the firefly controls the oxygen supply to its photic organ for use in the chemical reaction. The second, called the Neural Activation Theory, supposes that fireflies have neural control of structures called tracheal end cells which, upon stimulation, release a messenger molecule which initiates the chemical reaction that produces light. Irrespective of the means, light production in fireflies is very efficient; nearly all of the energy produces light, with very little heat. A truly “green” species!

Fireflies live in humid areas, usually around ponds or streams, and their larva can be found in rotting logs or other forest detritus. In the US, their habitat extends from the east coast only to about the middle of Kansas; the western half of the country is devoid of these interesting creatures. Some Asian fireflies have developed gills and live completely underwater, feeding on snails.

Luminescence

The term “luminescence” means light emission at low temperatures, as opposed to “incandescence” or light emitted at high temperatures. The popular toys called “glow sticks” use chemiluminescence (light produced from a chemical reaction) and you can hold them in your hand. A traditional incandescent light bulb is hot to the touch just a few seconds after being turned on.



Other forms of luminescence include fluorescence, (material that emits light while absorbing electromagnetic radiation at a different wavelength); phosphorescence, (light emitted from a body that has absorbed energy and is releasing it gradually); electroluminescence, (light emitted as a result of an electric current); and triboluminescence, (light generated when a material is ripped apart or crushed).

Let There Be Light!

So what is light? For the purpose of this article, light is electromagnetic radiation in the form of waves which have amplitude (height) and wavelength (distance between peaks). The wave theory of light has been around since the late 19th century. We'll ignore the more recent particle or quantum theory of light which describes light as packets of photons (we don't have the space in this newsletter for a physics lesson).

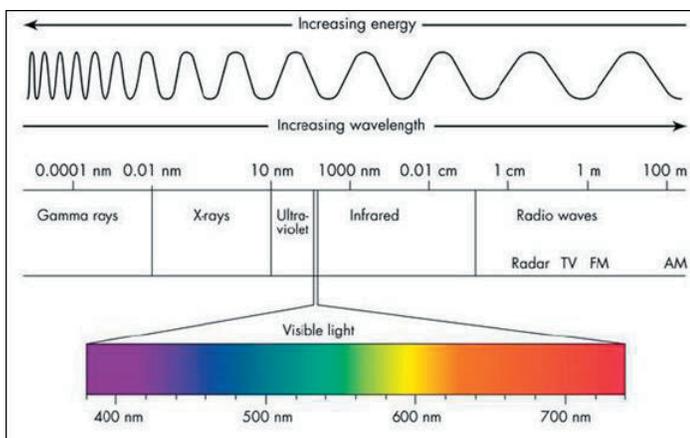


Figure 1 - The Electromagnetic Spectrum

Our human eye is sensitive to visible light, representing only a small portion of the known electromagnetic spectrum, which ranges from the relatively low-energy AM and FM radio waves (on the right in the chart) through to X-rays and Gamma Rays (See Figure #1). We perceive light and color when these waves of varying lengths reach our eyes. Waves or rays outside of the visible spectrum cannot be seen, but they definitely can be felt. Fall asleep on the beach and you'll feel the effects of the ultraviolet rays from the sun turning your skin bright red.

Fluorescent materials absorb ultraviolet radiation and emit visible light. I remember visiting the WCSP Nature Center years ago when my two children were younger. Geofluorescent minerals were on exhibit at the time, in a darkened display case. My kids were fond of flipping the switches on the interactive exhibit in order to view the specimens under ultraviolet light that caused the minerals to glow in bright reds, greens, yellows and other colors. Although those specimens are no longer generally on exhibit at the facility, they are brought out when students visit to participate in the Center's geology programs. Similar to fluorescence is phosphorescence, in which the materials absorb the energy and release it, but at a much longer time scale than in fluorescence. Some phosphorescent materials, once excited or energized, can glow for

hours or days. Despite all these different types of "-escences," most colors we see are the result of white light being absorbed or reflected to differing degrees by the objects themselves. Grass, for example, appears green because it absorbs all visible components of light except green, which it reflects.

Bioluminescence

Although fireflies are an obvious example, most bioluminescence ("BL") occurs in the world's oceans. It is estimated between 80% and 90% of deep ocean marine life are bioluminescent, the most abundant being bacteria, algae, jellyfish, fish and even some sharks. Scientists believe BL evolved independently many times, most frequently in the deep oceans where sunlight is rare or absent.

BL can be used as a form of communication, to attract prey or as a means of defense. Male fireflies flash in specific patterns and intensities to which the females respond for the purpose of mating. Deep ocean organisms glow to match the little ambient available sunlight, and thus, are able to hide in open water. The anglerfish uses a light emitting organ on the front of its head to attract prey, much like a fisherman uses a glowing lure.

Comb jellies, or ctenophores are jellyfish that use their cilia or tentacles for swimming. They produce bright flashes of light to startle their enemies. Other jellyfish produce a chain of light flashes, or release a cloud of light-emitting particles into the water (similar to a squid's ink) to mimic plankton and thus confuse their enemies.



Marine BL is mostly green or blue-green in color because those colors are most readily transmitted through seawater, and further, because the eyes of many sea creatures can only see



these colors. An interesting exception to this rule is the stoplight loosejaw, a form of ocean dragonfly that produces a red light, and whose eyes are receptive to red. Since most of its prey are blind to red light, the loosejaw is effectively hunting with an invisible light. The light produced by fireflies appears yellow or green.

Bioluminescence is rare in freshwater, for two reasons. First, freshwater habitats have historically not been as stable as the oceans, giving BL less time to evolve. Secondly, fresh water tends to be murkier than ocean water, and most ponds, lakes and streams have abundant sunlight and shallower depths than the oceans, thereby making any glow from a BL creature less likely to be seen, and thus, less effective.

Single-celled algae known as dinoflagellates are sensitive to turbulence in the water. Scientists have theories (but as yet, no proof) as to how these algae sense movement in their environment, but when they do, they glow a bluish-green. The turbulence can come from vigorous tidal activity, or from the motion of a motor boat or oar, or even from the paddle of baby turtles entering the sea. In Puerto Rico, Bioluminescent Bay near Vieques Island contains 720,000 dinoflagellates per gallon of water, and is said to shine bright enough to read a book by!

The most popular theory as to why these algae glow is the Burglar Alarm theory. According to Karen Steidinger, senior research scientist at the Florida Marine Research Institute in St. Petersburg,

“Think of yourself as a little predator like a copepod (tiny shrimp-like creature). It’s nighttime, and you’re swimming along trying to eat [dinoflagellates] from the water, and all of a sudden it lights up from being physically disturbed! The flash acts as an alarm that attracts attention of larger fish that might be around.. The fish are like the police that are attracted by the flash of the burglar alarm and then eat the illuminated copepod, thereby sparing the dino its life. That’s a pretty savvy strategy for a single-celled critter.”

Triboluminescence

Although natural minerals like fluorite can become luminous when scratched or crushed, by far, the easiest way to observe and demonstrate triboluminescence is to chew Wintergreen LifeSavers. These candies contain either natural wintergreen oil, or its manufactured equivalent, methyl salicylate (a distant cousin of aspirin), which is fluorescent. When the candies are broken, fractured or chewed, the positive and negative charges in the sugar molecules split, creating an electric field across the break. This field reacts with nitrogen in the air to release a burst of ultraviolet light. The UV light is absorbed by the methyl salicylate and is emitted as visible blue light. I’m going out to buy some Wintergreen LifeSavers and try this!

The Nature Center in WCSP offers night hikes in the summer. The July night hike most always features fireflies. Participants are instructed in how to use a flashlight to communicate with males of a particular species for the purpose of attracting them.

See the enclosed program schedule for more information on this event☺

Greg Baber is a long-time friend of the Nature Center who frequently writes for Nature's Grapevine. He resides in Yardley

Volunteer Notes

Lou Beck, Pennington, delivered a very interesting spring bird walk. The program featured quite a bit of avian activity and a healthy number of species. The walk was provided courtesy of **Washington Crossing Audubon**.

Gene Ramsey, Pennington, provided Memorial Day Weekend visitors to the Nature Center with an opportunity to view the sun with special solar observing equipment. Solar flares and prominences were visible along with more sunspots than we’ve seen in several years of these programs. The event was co-sponsored by the **Amateur Astronomers Association of Princeton**.

Pat Chichon, Lambertville, offered a wild edible plants hike in early May. Participants had an opportunity to sample a variety of tasty spring vegetation.

Jim Wade, Princeton, delivered a very interesting discussion of the spring practices of the local Lenape People prior to the period of European contact.

This newsletter is available free of charge electronically . It can be downloaded at the web address below. Requests to be included on the emailing list may be made by contacting the Nature Center.



Nature
CENTER

WASHINGTON CROSSING STATE PARK

355 Washington Crossing - Pennington Road
Titusville, New Jersey 08560-1617



Phone.....(609) 737-0609

Fax.....(609) 737-0627

Email.....wcpcsr@comcast.net

Hours.....Wed - Sat 9:00 a.m. - 4:00 p.m.
Sun 12:00 p.m. - 4:00 p.m.
Closed Mon and Tues

Website.....www.state.nj.us/dep/parksandforests/parks/washcros.html

Park Naturalist

& Newsletter Editor.....Wayne Henderek



Jim Silk, Hamilton, and **Jim Wade**, Princeton, provided a very informative presentation on the Paleo Indians who inhabited the area of the park during the last ice age.

Nettie Rekowski, Ewing, **Cheryl Burgos**, Morrisville, and **Ellen Coleman**, Ewing, all assisted at the Nature Center during public programs.

Al Fitipaldi, Titusville, helped out with trail maintenance.

Scout Troop # 230 from Bucks Co. worked on a trail clean up and marking project in April.

Around the Park

☼ Schools, scout groups and a home school group from Flemington, Princeton, Morrisville, Hamilton, Palmyra, Titusville, Pennington, Tinton Falls, Lawrenceville, Newtown and Plainfield/Edison visited the Nature Center this past spring. Programs offered included forestry, pond studies, trail hikes, forest and field ecology, rocks and minerals, ropes activities, stream stomps and geocaching. Teachers, scout leaders and other group leaders should give us a call to schedule for the autumn.

☼ A pair of pileated woodpeckers nested near the Nature Center this past spring and successfully fledged at least two young.

☼ WCSP has a new area supervisor. Neal Ferrari of Northampton has taken the reins of the park from regional superintendent Joe Winnicki, who had temporary managerial oversight since last autumn. Welcome aboard, Neal, and best wishes for a successful tenure here in WCSP.



Members of the Union Fire Co. in Titusville came out on Memorial Day Weekend with a bucket truck to assist park staff install a new rope on the flagpole at the Visitor Center/Museum.

Astronomy Seminar

The **Amateur Astronomers Association of Princeton (AAAP)** will be offering an astronomy seminar over the course of four Friday evenings at the WCSP Nature Center this fall. The seminar will be conducted by **Mr. David W. Letcher** and assisted by **Mr. Gene Ramsey** both of AAAP. The seminar will commence at 7:30 p.m. on Friday September 30, (Backyard Astronomy) and will follow on Fridays October 7, (Telescopes for Amateurs) October 14 (The Solar System) and October 21 (Stars, Star Clusters, and Galaxies). An additional Saturday will be scheduled during daylight hours at a later date for solar observing. Each Friday class will consist of a lecture/discussion augmented with contemporary photographs and videos that illustrate ideas and concepts of the science of astronomy. The classes at the Nature Center will be one hour in duration and will be followed with demonstrations at the adjacent AAAP Simpson Observatory as weather permits. Access to the Nature Center and the observatory will be via the Phillips Farm/ soccer fields/group camping entrance on Bear Tavern Rd., since the park's main entrance will be closed when the seminar begins. The classes are free. Advanced registration will be required for each session by calling the Nature Center at (609) 737-0609. Class size will be limited and registration will be available on a first come, first served basis. Registration will open on Aug. 31, 2011. AAAP will issue a certificate of completion for anyone who attends all four classes. The seminar will be designed for participants at the pre-teen – adult level. For further information, see the enclosed summer program schedule as well as the fall program schedule in the subsequent autumn edition of *Nature's Grapevine* or, call the Nature Center at the phone number listed on the preceding page.

Bike Hikes on the D&R Towpath

The Nature Center will be offering a new program this summer. Guided bike hikes on the Delaware and Raritan Canal towpath for pre-teens – adults, will take place on Saturday July 2, at 9:00 a.m. and Saturday September 24, at 9:00 a.m. The rides will head north toward Lambertville and will return via the same route in the opposite direction for a total of about 14 miles. Advanced registration will be necessary for these events and participants will need to supply their own bikes. For visitors who wish to participate but who are not able to provide their own bikes, rental bikes are available in the state park from Greenway Bike Rentals at (908) 581-5780 or www.greenwaybikerentals.com. Participants who will be renting bicycles for this event are advised to contact the bike livery and reserve equipment in advance to avoid shortages on the mornings of the events. Meet at the Nelson House in WCSP. Be advised that participants should call the WCSP Nature Center to register for either of these events at (609) 737-0609 and separate reservations with the bicycle livery will be necessary for those participants who will not be bringing their own bikes to the event. These events are free and will take place as weather permits.

Summer Programs
at the
Nature Center

The following is a list of activities being offered through the Nature Center at Washington Crossing State Park in Titusville, NJ. These events are available to families and individuals only. Programs for scouts, schools, camps and other groups are scheduled via phone call by special arrangement. Some programs are offered without registration requirements; some will require advanced registration. A fee of \$5.00 per car will be charged to all motor vehicles entering the park for daytime programs on weekends and holidays through Monday 9/5(Labor Day). Programs will initially meet at the Nature Center unless otherwise indicated. Attendance is limited and is available on a first-come, first-served basis. All children must be accompanied by an adult. In the event of inclement weather, some programs might be canceled. It is always advisable to call ahead before coming out. **Phone: (609) 737-0609.**

BIKE HIKE (pre-teens - adult) Saturday July 2, 9:00 a.m. Take a guided bicycle ride up the Delaware & Raritan Canal Towpath toward the Lambertville wing dam (approx. 13 mile round trip). Meet at the Nelson House parking lot. Bring your own bike and helmet. If you wish to rent a bike, WCSP has a bicycle livery concession. Contact Greenway Bike Rentals at (908) 581-5780 www.greenway-bikerentals.com to reserve a rental bike. Advanced registration for the hike required. Call the Nature Center at (609) 737-0609.

NIGHT HIKE (6 yrs. - adult) Saturday July 9, 8:30 p.m. Explore the park for nature at night and have some good old fashioned fun on this naturalist-guided hike and campfire. Advanced registration required. Bring a flashlight. Enter the park from the entrance on Bear Tavern Rd (Phillips Farm/ Group Camping Entrance) and follow the event signs. to the Nature Center. Advanced registration required. Free

FAMILY NATURE WALK (all ages) Saturday July 16, 1:00 - 2:00 p.m. Join us for an informal naturalist-guided trail walk. Park vehicle entrance fee; \$5.00 per car

POND STUDY (6 - 12 yr. old) Sunday July 17, 1:30 - 3:00 p.m. Kids will use pond nets to collect and examine the various organisms that inhabit our pond. Meet at the pond by the park service entrance off of Church Road in Titusville. Advanced registration required Free.

INSECTS AND THEIR KIND (4 - 10 yr old) Sunday July 24, 1:30 - 3:00 p.m. The diverse world of insects and other invertebrates will be explored through a variety of activities including a video, collecting, demonstration and direct observation. Advanced registration required. Park vehicle entrance fee; \$5.00 per car.

FAMILY NATURE WALK (all ages) Saturday July 30, 1:00 - 2:00 p.m. Join us for an informal naturalist-guided trail walk. Park vehicle entrance fee; \$5.00 per car

NIGHT HIKE (6 yrs. - adult) Saturday August 6, 8:30 p.m. Explore the park for nature at night and have some good old fashioned fun on this naturalist-guided hike and campfire. Advanced Registration required after 7/16. Bring a flashlight. Enter the park from the entrance on Bear Tavern Rd (Phillips Farm/ Group Camping Entrance) and follow the event signs to the Nature Center. Advanced registration required. Free.

POND STUDY (6 - 10 yr. old) Sunday August 21, 1:30 - 3:00 p.m. Kids will use pond nets to collect and examine the various organisms that inhabit our pond. Meet at the pond by the park service entrance off of Church Road in Titusville. Advanced registration required after 7/20. Free.

MONARCH MADNESS (all ages) Saturday August 27, 1:00 - 2:30 p.m. The monarch butterfly is a summertime classic here in Washington Crossing State Park. Come out for an introduction to the life cycle of this fascinating insect. We'll show you how to locate monarch eggs and larva and how to build a simple hatchery for raising the creatures. Advanced registration required after 7/26. Park vehicle entrance fee; \$5.00 per car. Bring a large plastic pretzel jar if you have one.

SOLAR OBSERVATION (all ages) Sunday September 4, 1:30 - 4:00 p.m. View naturalistic activity on the sun safely through a telescope equipped with a special filter. Observe sunspots, solar flares, prominences, and other solar phenomena as they are available. Learn how these storms can affect the earth as well as other interesting facts about our planet's closest star. Gene Ramsey of the Amateur Astronomers Association of Princeton will conduct this activity. Clear skies required. Park vehicle entrance fee; \$5.00 per car.

(Nature Center events continued)

SOLAR OBSERVATION (all ages) Monday September 5, 1:00 – 4:00 p.m. View naturalistic activity on the sun safely through a telescope equipped with a special filter. Observe sunspots, solar flares, prominences, and other solar phenomena as they are available. Learn how these storms can affect the earth as well as other interesting facts about our planet's closest star. Gene Ramsey of the Amateur Astronomers Association of Princeton will conduct this activity. Clear skies required. Park vehicle entrance fee; \$5.00 per car.

TREES OF THE PARK (adult) Sunday September 11, 1:30 – 3:30 p.m. Washington Crossing State Park is home to scores of species of native trees and shrubs as well as many non-natives that have become naturalized. Join the park naturalist on a walk and learn how to identify many of the most common species. Free.

NATURE MICROCOSMS (all ages) Sunday September 18, 1:30 – 3:00 p.m. Leaves, seeds, fall wildflowers and other artifacts of nature will all be utilized to create an interesting wall hanging in a surf clam shell. Come out to the Nature Center and let your imagination run wild. Advanced registration required. after 8/16. Free.

BIKE HIKE (pre-teens - adult) Saturday September 24, 9:00 a.m. Take a guided bicycle ride up the Delaware & Raritan Canal Towpath toward the Lambertville wing dam (approx. 13 mile round trip). Meet at the Nelson House parking lot. Bring your own bike and helmet. If you wish to rent a bike, WCSP has a bicycle livery concession. Contact Greenway Bike Rentals at (908) 581-5780 www.greenwaybikerentals.com to reserve a rental bike. Advanced registration for the hike required after 8/23. Call the Nature Center at (609) 737-0609.

BACKYARD ASTRONOMY (preteens – adults) Friday September 30, 7:30 – 8:30 p.m. This class will acquaint participants with the celestial sphere and its coordinates, sky maps, constellations/asterisms, and the popular objects viewable from our night sky such as planets and moons, stars, star clusters, galaxies and nebulae, comets, and our milky way galaxy. Presented by Mr. David Letcher and Mr. Gene Ramsey of the Amateur Astronomers Assoc. of Princeton. The class will be followed by a session of night sky observation at the adjacent AAAP observatory, weather permitting. Enter the park from the entrance on Bear Tavern Rd (Phillips Farm/ Group Camping Entrance) and follow the event signs to the Nature Center. Advanced registration required after 8/30. Free

Summer Programs
at the
Visitor Center Museum
(609) 737-9303

HISTORICAL WALKING TOUR (8yrs. - adult) Saturday July 2, 1:00 p.m. Join a Continental soldier on a “Historical Walking Tour” to learn the history of the famous Crossing and the march to Trenton. We meet in the lower park area (Delaware River) and then follow the Army's footsteps along the Continental Lane to the Visitor Center Museum for a musket firing demonstration and discussion of the Battle of Trenton. Call 609-737-9303 for more information. Free

READING OF THE DECLARATION OF INDEPENDENCE & VIDEO – INDEPENDENCE. Monday July 4, 2:00 p.m. A reading of the Declaration of Independence will be followed by a 28-minute video interpreting the unfolding drama of the struggle for Independence by our Founding fathers including Benjamin Franklin, George Washington and Thomas Jefferson. Park vehicle entrance fee applies.

MUSKET FIRING WITH FIFE AND DRUM DEMONSTRATION. Saturday July 9, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing with fife and drum demonstration. Park vehicle entrance fee applies.

MUSKET FIRING DEMONSTRATION. Saturday July 16, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing demonstration. Park vehicle entrance fee applies.

MUSKET FIRING WITH FIFE AND DRUM DEMONSTRATION. Saturday July 23, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing with fife and drum demonstration. Park vehicle entrance fee applies.

(Visitor Center events continued)

HISTORICAL WALKING TOUR. (8 yrs - adult) Saturday July 30, 1:00 p.m. Join a Continental soldier on a "Historical Walking Tour" to learn the history of the famous Crossing and the march to Trenton. We meet at 1pm at the lower park area (Delaware River) and then follow the Army's footsteps along the Continental Lane to the Visitor Center Museum for a musket firing demonstration and discussion of the Battle of Trenton. Call 609-737-9303 for more information. Free.

OUTWATER'S MILITIA ENCAMPMENT AND COLONIAL TRADES/CRAFT FAIR. Saturday August 6 & Sunday August 7, 10:00 a.m. – 4:00 p.m. Come and enjoy Outwater's Militia as they drill and demonstrate the Colonial crafts that were their livelihood. Park vehicle entrance fee applies.

MUSKET FIRING WITH FIFE AND DRUM DEMONSTRATION. Saturday August 13, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing with fife and drum demonstration. Park vehicle entrance fee applies.

MUSKET FIRING WITH FIFE AND DRUM DEMONSTRATION. Saturday August 20, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing with fife and drum demonstration. Park vehicle entrance fee applies.

MUSKET FIRING DEMONSTRATION. Saturday August 27, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing demonstration. Park vehicle entrance fee applies.

MUSKET FIRING DEMONSTRATION. Saturday September 3, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing demonstration. Park vehicle entrance fee applies.

MUSKET FIRING DEMONSTRATION. Saturday September 10, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing demonstration. Free

MUSKET FIRING DEMONSTRATION. Saturday September 17, 2:00 p.m. Join a Park Historian for an interpretive talk about some of the weapons used during the American Revolution and their use during the Battle of Trenton. Included will be a musket firing demonstration. Free.

Summer Programs
at the
Johnson Ferry House
(609) 737-2515

COLONIAL ICE CREAMS Monday July 4, 1:00 p.m. - 4:00 p.m.. **Susan Plaisted** of **Hearth to Heart Cookery** will demonstrate the making of ice cream in the late 18th century using recipes of that time. Free samples will be available. Park vehicle entrance fee applies.

1830's FOODWAYS Sunday, August 28 from 1:00 p.m. - 4:00 p.m. **Mercy Ingraham** will be demonstrating recipes from the 1830's era on the open hearth. Family event. **Meet at the Nelson House.** Free

18TH CENTURY KITCHEN GARDEN April-November 2011. Come and see what's blooming and growing in the kitchen garden at the Johnson Ferry House. The garden is open during all park hours, even when the house is closed. Just close the gates behind you to keep the critters out. Thank you!

