SAGATAGAN SEASONS

Saint John's OUTDOOR UNIVERSITY

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Spring
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A Vision of Color

Tanner Rayman '16

A birch tree stands before me. The crisp, flaking bark is an opaque white and stands in stark contrast to the rest of the matted browns and greys of the forest. Where the knobs of long abandoned branches protrude we see glimpses of the rich brown core that we know resides under the startling exterior. Further up, the crown of the tree explodes into a firework pattern of pearled branches and green leaves that continually alter their shade and tone in the fluttering wind.

Light illuminates the birch tree's exterior and the complex gathering of tissues that make up the tree become distinguishable to the human eye. As light encounters the tree certain wavelengths of light are absorbed. A deeply green leaf absorbs all of the wavelengths except those representing the various shades of green.

The green wavelengths are able to escape the absorptive clutches of the leaf's pigmentation to be reflected towards the eye of the observer. In contrast, the ghostly white bark of the birch tree does not absorb very many of the wavelengths of visible light. White light strikes the bark and is nearly perfectly reflected back towards the observer.

The moon casts a meager light over the nearby landscape. I sit upon a large, obtrusive rock that seems to have been carved by the violent forces of erosion into a respectable throne for my nighttime observation post. Sitting on the edge of Lake Sagatagan, I can see the faint outlines of the Stella Maris Chapel across the lake—a noticeably human structure amidst the forest.

Night brings with it an absence of color, or rather, a dichotomy of color that limits vision to an essentially black and white chromatic scale. Lake Sagatagan is no longer a rippling expanse of stunning deep-water blues and shallow turquoises. Instead, it is a blackened glass surface that seems to gladly reflect any light away from it.

The human eye is especially adapted to interpret the varying sensations experienced during times of both high and low-light. In high-light, such as the careful observation of a birch tree in the daylight, our eye relies on cone cells to sense and compile the information in the environment and send it to the brain. Cone cells are also responsible for nearly all of our color vision. We have three different types of cone cells that are most sensitive to red, green, and blue light wavelengths. Our eyes sense a mix of these primary colors from the environment and the brain is able to interpret the coding so that we perceive color smoothly.

Our eye also contains rod cells, the cells that give us our night vision. They are hyper-sensitive

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The distinct color bands visible in a rainbow- red, orange, yellow, green, blue, indigo, and violet - are an artifact of the structure of the human eye and how we perceive color. Judy Kniss.

"Color vision has been integral to human existence in a survival sense, but it has also been vital as a source of beauty and inspiration."

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to light compared to cone cells, but they lack the ability to sense distinct variations in color. Thus, the moonlit night is not as vibrantly colorful as during the daytime. Yet it is hauntingly beautiful all the same.

A Great Horned owl (*Bubo virginianus virginianus*) hoots nearby. The characteristically low-pitched *ho-ho-hoo hoo hoo* seems to float across the water heavily. The owl is a great nocturnal predator that relies on a much more specialized vision system to understand its surroundings. Where my eyes sense only faint disturbances in the blackened surroundings, the great horned owl is able to clearly sense movement and follow it as easily as I would during the daytime.

The owl has adapted to be able to use light in surprising ways to stay alive. The owl's eye is monochromatic. It sees the world in just a single hue. This is because the owl's eye is made up almost entirely of rod cells. As a result, it has extreme sensitivity to light during low-light situations but is not able to perceive anywhere near the level of coloration as the human eye during high-light situations.

The owl has a limited perception of color but is able to focus on seeing and catching prey during nocturnal hours. In contrast, humans have developed a sophisticated trichromatic vision system because we face many more dangers as a result of our diurnal (active during daylight) nature. We need to be able to perceive the world around us in a much more complete manner to be able to identify sources of food (a lush, red berry stands out among the greens and browns of a bush), danger (sensing a camouflaged animal is difficult even with our highly evolved vision!), and also be able to easily determine various objects by color to assist with survival.

Color vision has been integral to human existence in a survival sense, but it has also been vital as a source of beauty and inspiration. The delicate white margins of a blossoming Stargazer lily, the glow from a vibrantly orange sunrise, and the uniformly powerful blues of the oceans are all possible because of our ability to perceive such a wide range of colors in the visible spectrum. Color at its most basic level is a simple scientific phenomenon, yet it continues to inspire us as it provides much of the beauty in the universe.

Tanner Rayman *is a sophomore nursing major at Saint John's University and is an office assistant for Outdoor U. While he sometimes covets the owl's keen night vision, he doesn't think it would be worth a trade for the fuller color pallete his eyesight provides.*

A sunset provides a vibrant backdrop of color for the big bluestem grass in the prairie. The landscape is already dissolving into shades of black and gray as light fades and our eyes' perception of color decreases. In contrast, the bright white bark of a paper birch tree (*Betula papryifera*) nearly perfectly reflects all wavelengths of light to give its ghostly appearance in the forest. Carol Johannes (left), Mike Ratdke (right).

Birds of a Feather

MJ Bach

There are two ways to create color: *pigment and structure.* Pigments are chemicals that absorb specific wavelengths of light and reflect others. The light reflected is the color we perceive (i.e. red pigments absorb all colors except red; red wavelength bounces off the object, hits our retina and we see "red"). Pigments may be combined like paints to produce new colors or color variations.

In bird feathers, the most common pigments are *melanins*. Birds create melanins through oxidation of amino acids, and these pigments show up as browns, blacks and grays in all types of feathers. The more melanin in the feathers, the darker the color.

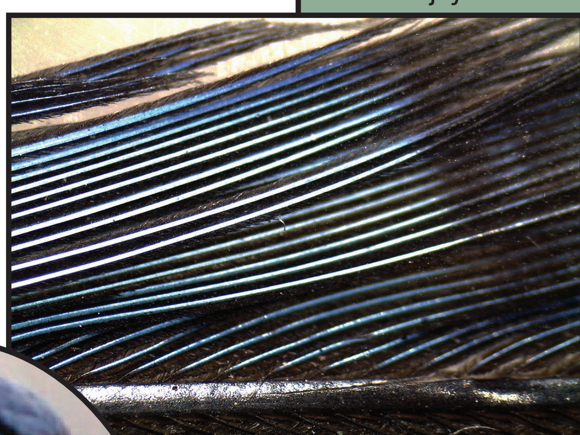
Carotenoids are pigments that produce reds, yellows and oranges. Birds cannot produce carotenoids on their own; these pigments are derived solely from their diet. When a Northern cardinal eats sumac fruits containing carotenoids, the pigment is digested and expressed in red as the bird grows new feathers.

Vibrant feather color is an indication of good health and good diet, and brighter colored males are more successful in attracting mates. Cardinal feathers themselves lack pigment, so if an individual stopped eating seeds or berries with carotenoid pigments, they would lose their color after molting. Similarly, American goldfinch feathers are yellow due to the carotenoids in the seeds they're eating.

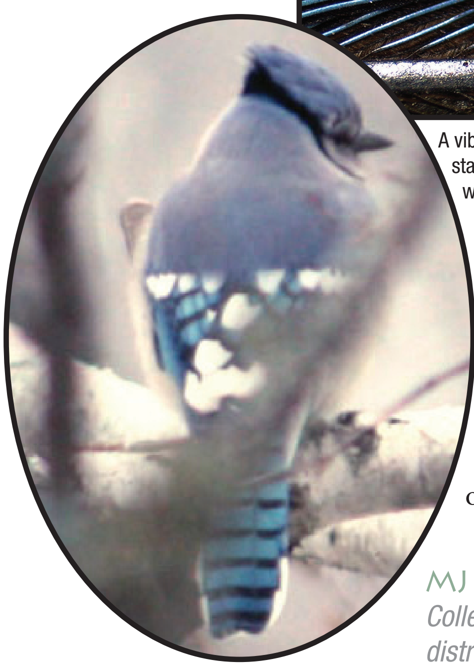
The pigments in a Cedar waxwing's (*Bombycilla cedrorum*) feathers include melanins and carotenoids that give the bird its distinct color pattern. Brandon Dale (above).

Test It

Crush up a Northern cardinal feather and the bright red-pigment will remain. Crush a Blue jay feather and it turns brown! The melanin pigments maintain a brown color, but by destroying the delicate structure of the feather it is no longer able to display the vibrant blue we associate with the Blue jay.



A photograph of a Blue jay feather taken at 16x magnification under a microscope shows the browns and grays of the feather color illuminated to a variety of blues when struck by the light. Other common examples of structural color in nature include iridescent beetle wings, silvery fish scales, and the iris of a blue-eyed human. MJ Bach (right).



A vibrantly blue bird, the Blue jay (*Cyanocitta cristata*) stands out among the grays and whites of a late winter forest. Jenna Pollard (left).

Structural colors use intricate shapes within the structure of an object to scatter and distort light, much like a prism. If the object's physical structure is changed, the light reflects differently, and the color we see changes.

Look closely at a Blue jay feather in the shade, you'll find it to be a dull brownish gray (from the melanin). The blue we see is a structural color, produced by the particular 3D-arrangements in the feather. Different shapes and sizes of these structural arrangements generate different shades of blue.

Richard O. Prum at the University of Yale is a leading researcher in the field of feathers and structural color. Prum and his colleagues discovered that the structures that generate color in blue feathers are actually *nanostructures*, existing on a scale between molecular and microscopic. These nanostructures form a sponge-like pattern within the feather that reflects, refracts, and scatters light uniformly. Red and yellow wavelengths interfere with one another and cancel each other out; blue wavelengths align, reinforce each other, and are expressed as the feather color when exposed to light.

Whether from pigment or structure, a flock of color will soon fill our spring!

MJ Bach is the 2013-14 environmental education fellow and a 2010 graduate of the College of Saint Benedict. She is glad the Blue jay stays in MN all winter, providing a colorful distraction to the long winter days.

The Color of Gold

Dr. Stephen Saupe

A popular misconception is that all maple syrup is the same color – gold. After all, it's commonly called "liquid gold." In reality, maple syrup comes in a nearly infinite variety of colors. If you don't believe me, look below.

The image below shows syrup samples that were made during the 2013 syrup season by Stu and Corinne Peterson at their Camp Aquila Maple Syrup operation in Dent, Minnesota. Each time the Peterson's remove a five gallon batch of syrup from their evaporator they save a small sample for testing. Of the 58 batches of syrup that the Peterson's made last year, perhaps half would qualify as 'gold' in color. The remainder vary from yellow to orange to brick-red.

Lined up in front of their sugarhouse window, these samples remind me of the swatches in a paint store. I suspect Benjamin Moore would use much more "colorful" names – like nacho-yellow, sunshine, and dragon's-blood – to describe the syrups.

How would you describe the color of maple syrup? Looking at samples of maple syrup produced in 2013 by Stu and Corrine Peterson at the Camp Aquila Maple Syrup operation in Dent, MN, it becomes difficult to narrow down as the color changes throughout the season. Image used with permission. Stu Peterson.

In contrast to the creative and nearly limitless number of names that are used by paint manufacturers, syrup producers have opted to categorize maple syrup into just four main colors or grades – *Golden, Amber, Dark,* and *Very Dark*. This classification system was developed by the International Maple Syrup Institute (IMSI) to standardize names and eliminate any differences in names for the same syrup. Once in place, a syrup that a Vermonter would call "Fancy" and a Minnesotan would dub "Light Amber," will be graded "Golden" by everyone. Though syrup-makers have been reluctant to give up the names they have traditionally used, it looks as though these new standards will officially be in place in 2015.

The color of a syrup is directly related to its flavor. Lighter colored syrups generally have a more delicate taste than darker ones. As a consequence, the new maple grades are also accompanied by a description of its taste – *Golden with a Delicate taste, Amber with a Rich taste, Dark with a Robust taste,* and *Very Dark with a Strong taste*.

Although scientists in Canada have created a "maple flavor wheel" to attempt to standardize taste, the grade of a maple syrup is largely determined by its color. The color of a syrup sample is compared to a series of glycerin-caramel solutions, shown on page 5. A syrup must be equal to, or lighter than, the standard to be labeled in that grade. For the most accurate results the samples should be examined against a clear blue sky or fluorescent lighting. Perfectionists replace the kits annually because the solutions fade with time. Alternately, you can purchase grading kits made with colored glass windows that are permanent and don't fade, but they are very expensive.

If we use the color comparator kit to grade the Peterson's samples, it appears that their syrups would fit all four grades. The samples in the middle of the top row would be graded as *Golden* while those on the bottom row are *Very Dark* with *Amber* and *Dark* syrups somewhere in between. Some producers, like the Peterson's, blend their

Some people prefer a delicately flavored, golden maple syrup, some prefer a syrup with a dark and robust flavor. To others still, a drop or two of slightly sweet sap straight from the tree, as pictured above, is just what's needed to whet the appetite for more. TONY PEROUTKY.

syrups when they bottle it to ensure a predictably-colored product for their customers.

If you have access to a spectrophotometer, an even more objective way of determining grade is by measuring the light transmittance of the samples. According to the new IMSI standards, *Golden* syrup must transmit more than 75% of the light, while the transmittance of *Amber*, *Dark* and *Very Dark* syrups would be 50 – 75%, 25 – 50%, and less than 25%, respectively.

Can you guess which syrup grade is the best? Trick question! Regardless of grade, they all taste great. It simply depends on whether you prefer a delicate flavor or a more robust, stronger maple flavor. In surveys, most consumers prefer stronger-flavored syrups. Thus, *Dark* or *Very Dark* syrups would be the choice for them. In contrast, I like the more delicate flavor of a *Golden* or *Amber* syrup.

A glycerin/caramel color comparator kit from Vermont shows the existing Fancy, Medium Amber, Dark Amber, and Vermont Grade B syrups, which are comparable to the new International Maple Syrup Institute standards for maple syrup color. CODY GROEN.

If you look closely at the Peterson's syrup samples you will see that they are labeled with the date and a small number in parentheses. These numbers refer to the batch that was produced on that particular date. Along with the grade name, the new IMSI regulations also require syrup to have a code so that it can be traced to a date and batch of production. Further, the syrup label must also include '100% pure maple syrup', 'grade A,' and the origin (i.e., state, province, country).

Finally, I suspect you noticed that the Peterson's syrup got progressively darker in color – or changed in grade from *Golden* to *Very Dark* – as the season progressed. The reason this occurs is that the sap contains an increasing assortment of flavor and color inducing chemicals, which when cooked result in a darker color and more robust taste. These chemicals are derived from two primary sources.

First, as the trees prepare to break dormancy they load additional chemicals into the sap to be used by the developing buds. An even more important source of color and flavor-inducing chemicals is derived from the byproducts of microbial contamination. Bacteria and molds consider maple sap as much a delicacy as we do and a perfect place to grow. Anything that comes in contact with the sugary sap – collecting buckets, storage tanks, pipelines and so on – are targets for microbial growth. As the maple season progresses and the weather warms, microbial populations skyrocket releasing their metabolic byproducts into the sap. One practical consequence is that it is typically more challenging to produce Golden syrups than darker-colored grades (Note: as the sap is cooked into syrup, these microbes are rendered harmless for us to consume).

This spring, if you need a little more color in your life, we invite you to visit the Saint John's maple syrup operation. Our community of volunteers will welcome you with our usual Benedictine hospitality while your senses revel in the colors and flavors of our heavenly maple syrup.

DR. STEPHEN SAUPE *is a CSB/SJU biology professor and is chair of the Outdoor U Education Advisory Council. We are grateful for his* Golden *(or at least* Amber*) grade of volunteering for maple syrup (and more) throughout the year.*

Persephone's Promenade

Kate Delfs

GODDESS OF THE UNDERWORLD,
Continually taken for her term near unlit fires,
Leaves the land both bare and buttoned up.

But she always returns.
Blind at first by her release into glowing dawn,
Unable to see ripples of relief
Spreading across expired grain
To expectant, stiff statues
Not ashamed to wait in the frost for their cue.

Each piece of ice suspended on frozen berries
Can exhale, relax, and collapse.
In syncope they sink beneath
Dissolving subnivean tunnels,
Drops liberated in syncopated tempo
To warm the earth and warn life to assemble.

Snowdrop soldiers are the first to leap for joy.
In pearled helmets and with self-made spears
They perforate the heavy blankets,
Embankments between the neglected and nurtured.

Arrowhead emerge to claim their territory
And to point out the way for others
Who will arrive much later in the parade.
Trillium stand tall to listen for
Echoes of the songbirds' thrill
At the promise of the softhearted sun,

Buds begin to find breadth
In crisp air that formerly seemed confining.
Anemone and hepatica join the succession,
The repossession of bitter lands
Once numb from indifference.

The white flowers whirl in the wind.
Each new colored whorl blooms.
Yellow-tinted violets sing a tune
To announce the blushing pasque flower.
Crimson columbine come forward
To spur the cusp of elation and ended sorrow.

A self-indulgent homecoming
For the goddess of fruit and seed,
Who perhaps only abandons the wild on impulse,
So all can witness the kaleidoscopic spectacle
Of energy and ardent production
Unfolding in her honor year after year.

Both the round and sharp-lobed hepatica (*Anemone sp.*) are among the first woodland wildflowers to bloom in spring. In Greek mythology, Persephone, the goddess of the underworld, returns to the world each spring with the flowers that pave her way. Each fall when she leaves for the underworld below, her mother mourns and winter comes while she awaits her daughter's return. Tony Peroutky.

Kate Delfs is a 2013 graduate of the College of Saint Benedict and is an environmental educator at Outdoor U. Like Persephone herself, Kate has returned during our busy teaching season to help us usher in spring.

Get Involved

Saint John's Outdoor University

Minnesota Natural History Lecture Series

3rd Monday Each Month
Feb. - Apr.
6:30 - 8:00 p.m.

Free - Students (any age) & Outdoor U members
$5 - Nonmembers, nonstudents

Mar. 17 *Swanning Around Saint John's, Marcus Webster*
Apr. 21 *The Biology of Resurrection, Steve Saupe*

Interested in learning more about Minnesota's natural world? Join us each month during the school year for a lecture and discussion on a variety of natural history topics. Lectures take place indoors. Check our website to see past topics or for updates to the 2013-14 lecture schedule.

Maple Syrup Festivals

Saturdays, March 29 & April 5

$5—Adult Outdoor U members, ages 17 & under FREE
$10—Adult nonmembers/scout adults
$5—Child nonmembers/scouts

1:00—4:00 p.m.
$1 off per person if you preregister by the Friday before the festival you attend (up to $10, does not apply to scouts)

Join us for what has become our most popular event of the year! Sap collecting, syrup cooking, horse-drawn rides, demonstrations, and hot maple syrup sundaes await the whole family during this fun-filled event! Bring your Boy and Girl Scouts and they can receive a "Saint John's Maple Syrup" patch! Preregistration for families is preferred but not required. Preregistration for scouts is required.

Fruit at the Finish Triathlon

Saturday, May 3

Prices TBA

Early Registration: Through April 19
Late Registration: April 20-27

Compete individually or in teams of three in the annual fruit-themed triathlon. Swim 0.75K, run 6K, and bike 23K in this event hosted by the Peer Resource Program, Outdoor Leadership Center, and Outdoor U. Participants receive a t-shirt with this year's fruit-based slogan. Check our website for more details. Register early and SAVE!

Annual Plant & Garden Tool Sale

Saturday, May 10
8:30 a.m.—12:00 p.m.
Or until sold out!

Welcome spring by stocking up at our annual plant and garden tool sale. Outdoor U members receive 50% off on all items. Memberships are available for purchase on the day of the sale.

Spring Birding Day

Saturday, May 17

$12—Outdoor U members
$16—Nonmembers
Includes meals.

5:30 a.m.—1:00 p.m., OR 8:00 a.m.—1:00 p.m.
Optional FREE tour of surrounding area at 1:30 p.m.
Preregistration preferred.

Spend a morning with Saint John's Outdoor U, hiking through the Abbey Arboretum with birders during peak migration. Early risers will be stunned by the abundance of birds active early in the day. Coffee and rolls will be served at 8:00 a.m., lunch and compilation of the bird lists at 12:00 p.m. An optional tour of birding sites in the surrounding Avon Hills will begin at 1:30 p.m.

Collegeville Kidstock Featuring Paul Spring

Saturday, June 28

Details coming soon!

Celebrate summer with Saint John's Outdoor U and Paul Spring! Enjoy a variety of outdoor activities, including canoeing, a bonfire with s'mores, educational tables, and live music. Bring a picnic, or purchase food at the event.

Paul Spring is a singer-songwriter from St. Cloud, MN. His first collection of kids and family music, *Home of Song*, was released in 2013 and was described on NPR as "an ode to books and stories, and to the families who nurture them."

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Sagatagan Seasons

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Saint John's Outdoor University

The Program

Saint John's Outdoor University provides environmental and outdoor education through classes, events and initiatives with the Abbey Arboretum, Saint John's University, and the College of Saint Benedict.

The Place

Saint John's Abbey Arboretum is more than 2,500 acres of lakes, prairie, oak savannah, and forest owned by Saint John's Abbey and surrounding Saint John's University.

In This Issue...

Maple Syrup Festivals

Saturdays, March 29 & April 5 | 1-4 p.m.

Tony Peroutky

Fun for the Whole Family!

Tree Tapping
Sap Collecting
Syrup Cooking
Maple Syrup Sundaes
Activities for Kids
Horse-drawn Rides
Scouts - Earn a Patch!

We
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Dare You!

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