Sempervirens

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Bringing it home: Reviving the Fredericksburg area chapter

Article by Stacey Churchill, photos by Nancy Vehrs

Preface: *VNPS member Stacey Churchill reached out to the Society in July asking for information about reviving the former Fredericksburg Area Chapter. Losing two chapters (Shenandoah and Fredericksburg) on my watch was something that weighed heavily on me, and Stacey's drive and enthusiasm leads me to believe that a revival can happen just as it did for the Shenandoah Chapter under the leadership of Anna Maria Johnson. Stacey has already arranged local garden tours to engage the public, and she has formed a steering committee that meets regularly on Zoom. We can't wait to welcome this chapter back into the VNPS family.*
—Nancy Vehrs, VNPS President

As a VNPS member and a *Sempervirens* reader, you already know: native plants matter.

I first encountered native plants when my parents xeriscaped their Denver, Colorado, yard over 30 years ago; the plants that were native to the local arid environment were the obvious choice. Decades later, when working on a low-impact development project in our own yard in Stafford, the use of native plants was suggested, and I jumped on board. It was hard not to!

Ernie Ackermann welcomes guests to the garden that he and his wife have developed in Fredericksburg.

Here in Virginia, we're lucky to live in one of the most botanically rich regions of the country. But the work of protecting, celebrating, and restoring that natural heritage doesn't just happen at the state level — it happens in our own backyards, neighborhoods, and local communities. That's why our team is working to revive the Fredericksburg-Area Chapter of VNPS.

The Fredericksburg region sits at a unique ecological crossroads, home to a diverse mix of Piedmont and Coastal Plain species, and it is a longstanding hub for environmental education, restoration, and advocacy. Reviving the local VNPS chapter means bringing together passionate gardeners, conservationists, educators, and everyday nature lovers who believe that the future of our ecosystems depends on the plant choices we make close to home. I am honored to be one of these community members; lucky to have found VNPS when searching online for resources to guide my own journey.

Why does reviving our local chapter matter? Because change starts locally. Around the state, there are chapters that are practicing what we hope to emulate. We also hope to bring our own

Mike Worsham led a tour of his and wife Pat's native plant garden on an intensely planted city lot.

priorities into the mix, such as:

- Accepting each native plant enthusiast for where they are on this journey;
- Encouraging and sharing what we learn with each other; and
- Partnering with other organizations in the greater Fredericksburg area with similar values.

Our chapter revival isn't starting from scratch — we're building on the foundation of past leaders and longtime members who have been tending this soil for years. Our community is active and engaged; we are already busy with monthly garden tours and planning our first plant-sharing event.

We would love to have all those in the greater Fredericksburg area join us as we revive the chapter. We plan to have our

(See Fredericksburg revival, page 3)

Nation's natural beauty spurs a desire to protect

From the President
Nancy Vehrs

Fall is here! Yellow now dots our wild landscapes with the abundant blooms of sunflowers, Wingstem, and goldenrods.

Did you have any special travel this summer? I took only a week for a trip out West where I managed to visit my 46th state: Nevada. I never had any interest in visiting Las Vegas, so Nevada never made it to the top of my list. Just like last year, my longtime (since seventh grade) friend Kim Largen was participating in a dinosaur dig in southeastern Utah, and she invited me to join her for a sightseeing trip afterward in late May/June. She planned the itinerary, and we met in Salt Lake City where she picked me up in her rental car.

The city is surrounded by stunning snowcapped mountains. Besides the downtown attractions, we visited the Red Butte Garden and Arboretum, a part of the University of Utah. It had a spectacular setting in the foothills, and the sun shone brightly on the afternoon we visited. I was surprised to see quite a few East Coast natives, such as lovely specimens of Trumpet Honeysuckle (*Lonicera sempervirens*) and American Wisteria 'Aunt Dee' (*W. frutescens*), a cold hardy cultivar. One native tree that had gorgeous pink-purple blooms was the New Mexican Locust (*Robinia neomexicana*).

I, of course, was interested in flowers in natural areas so we headed outside the city. During our first few days we stayed in a condo outside Park City that was surprisingly spacious and inexpensive and had a view of Jordonelle Reservoir. From there we visited several state parks and took short hikes. We took the Alpine Scenic Drive by Sundance and discovered Mountain Bluebells and the blue Wasatch Beardtongue (*Penstemon cyananthus*) in Uinta National Forest.

Our destination in Nevada was Great Basin National Park (GBMP), a remarkably lovely park located in the middle of nowhere. The park has camping but no other accommodations. We stayed in a remote private ranch resort that boasted of its dark skies. It was a lovely setting down in a canyon with a creek, but getting there involved dirt roads with twisty turns. GBNP is a real gem. We toured Lehman Cave by the visitor center and walked a nature trail there. The scenic drive is exceptional and has several trailheads. We walked on a trail among conifers that had a carpet of Mountain Bluebells (*Mertensia ciliata*) and Creeping Mahonia (*Berberis repens*) as Ruby-crowned Kinglets serenaded us. Brightly colored Indian Paintbrush bloomed along the road as we climbed to higher than 10,000 feet in elevation. Short hikes from the parking area led to picturesque alpine lakes. I highly recommend a visit to this park in eastern Nevada.

Indian Paintbrush (*Castilleja* spp.)

Mountain Bluebells (*Mertensia ciliata*)

Besides a requisite drive on the Bonneville Salt Flats, we ended our trip with a daylong exploration of Antelope Island State Park in the Great Salt Lake back in Utah. The lake is a closed basin with no outlet, and the water level fluctuates dramatically with rainfall and evaporation. Besides a herd of bison, pronghorn (antelopes), and lizards, the birds were diverse in the park. I especially enjoyed the song of Western Meadowlarks and a Rock Wren. The island was very dry and hot with little shade. Native plant species included Gray's Biscuitroot (*Lomatium grayi*) and Fourwing Saltbush (*Atriplex canescens*).

We live in a nation with a wealth of natural beauty that I hope will remain protected. While the West has spectacular scenery, I still prefer my beautiful, green Virginia.

P.S. Many thanks to Richard Stromberg and Garrie Rouse for identifying a number of species in my Facebook posts from the trip. ❖

A native plant "deep dive" thanks to scholarship

When I first learned of the Cullowhee Native Plant Conference earlier this year, I knew I needed to attend. I quickly applied for the scholarship, and I was delighted when I was awarded the Mary Painter Memorial Scholarship. I began imagining what my time there would be like, but the conference far exceeded any and all expectations.

Many have made the annual trip to Cullowhee for years, if not decades, and it's easy to see why. With more than 500 attendees from a wide range of fields (horticulturists, ecologists, conservationists, landscape designers, architects, growers), the wealth of knowledge and passion was palpable. But what took me pleasantly off-guard was how supportive everyone was; instead of tit-for-tat networking, people were encouraging and excited for each other. Many people fondly (and accurately) compared the conference to summer camp for native plant enthusiasts.

My first day was spent hiking Panthertown with almost 40 others, led by landscape architect and artist Preston Montague. During the field trip, we explored different principles of landscape design–prospect/refuge, transitions, scale, tension/release–while hiking the idyllic Panthertown Valley. The seven-mile hike had many opportunities to botanize, enjoy scenic views, and converse with other conference-goers. This was a great way to disassociate from the "real world" and establish the tone for the rest of the conference.

Bugs Utsey and Ashley Moulton (Moulton Hot Native Plants, Richmond) pose outside of the conference center.

With almost 80 presenters, it was like drinking water from a fire hose. I was delighted to see Doug Tallamy speak in person, having read all three of his books; I was inspired to hear landscape architects Thomas Woltz and Brad Odom discuss their design processes and works; and I was in awe while listening to Kelly Holdbrooks and Matt Sprouse discuss building a greenhouse for the Southern Highlands Reserve to enhance red spruce propagation efforts.

But one of the most evocative presentations was J. Drew Lanham's "Coloring the Conservation Conversation." As an author, poet, and wildlife biologist, Lanham began his talk by having the audience treat their minds as "fallow fields," able to accept and grow the seeds of new ideas. He spoke on the verbiage we use in the native plant world–"invasive," "native," and "non-native," and how this strong language may be perceived as problematic, especially to people of color and immigrants. I'm still wrestling with Lanham's musings and how they inform and challenge my own perspectives.

I am beyond grateful to the Virginia Native Plant Society for providing me with the opportunity to attend the Cullowhee Native Plant Conference. I left inspired, with new knowledge and new friends, all of which will influence and enhance my own workings with native plants. Having just returned home, I am already looking forward to attending 2026's conference!

--Bugs Utsey is a landscape designer and owner of Root 11 Native Plant Nursery in Lexington, VA. He became passionate about native plants after joining his local Master Gardeners. He enjoys identifying and photographing native plants while hiking with his husband and three Australian cattle dogs.


Landscape architect Preston Montague leads a hike through the scenic Panthertown. The focus was on exploring landscape design precedents.

Fredericksburg revival

(Continued from page 1)

petition to revive the chapter to the VNPS Board by September and hope to have the chapter fully up and running later this fall. So whether you're new to native plants or a seasoned expert, we need your voice. Your shovel. Your passion. Your questions. Your backyard experiments, your successes, your failures, your photos, and your stubborn love for a scraggly patch of goldenrod. Together, we can build something rooted, resilient, and local.

Interested in getting involved as we get the chapter up and running? We'd love to hear from you. Reach out at crnativeplanters@gmail.com, on Facebook at Central Rappahannock Native Planters and on Instagram at native_planters. ❖

Virginia's Pollinator Smart Program gaining steam

From Your Natural Heritage Program

By Nicki Gustafson
Project Review Assistant

Over the past few years, you may have noticed an increase in solar development across Virginia. You may have even had a solar facility built in your community. Since the passage of the Virginia Clean Economy Act in 2020, which requires Dominion Energy to produce 100% of its electricity from renewable sources by 2045 and Appalachian Power to reach the same goal by 2050, Virginia has seen a significant increase in the number of solar facilities. The rise of solar is not unique to Virginia as solar energy production is increasing across the country.

While solar energy is renewable and carbon free, the facilities do have environmental impacts through the conversion of large acreages of land from natural vegetation to frequently mowed fescue. In anticipation of the increase in land conversion associated with solar energy development, the Department of Environmental Quality (DEQ) and the Department of Conservation and Recreation (DCR) collaborated to develop the Virginia Pollinator Smart Program in 2019 (https://www.dcr.virginia.gov/natural-heritage/pollinator-smart).

The Pollinator Smart Program is a voluntary certification program aimed at encouraging ecologically sound native pollinator habitat on solar installations. The use of native plants in lieu of fescue provides ecological and environmental benefits while also lowering operating costs for the facility. Pollinator Smart sites are certified based on design plans initially and then are recertified every two years following vegetation monitoring efforts. The design certification ensures that the planned vegetation will provide high quality habitat for native pollinators while the monitoring certification ensures that these plans are implemented, and the habitats are maintained.

Cople Elementary School solar facility after two years. (René Hypes (2021) DCR Division of Natural Heritage)

At the time of our last *Sempervirens* article about the Pollinator Smart Program in 2021, we had one certified solar site, Cople Elementary, a facility in Westmoreland County installed to produce renewable energy for the school. Since then, the Cople site recertified following a two-year monitoring report, and four additional sites have been certified Pollinator Smart (Foxhound-Halifax County, Sandale-Lancaster County, James Madison University (JMU)-City of Harrisonburg, and North Ridge-Powhatan County). The largest Pollinator Smart certified site, Foxhound Solar, was certified in December of 2022 and is roughly 600 acres that will produce 76 MW of energy. The smallest site, an installation at JMU that will serve as a demonstration site for students and stakeholders, is just 1.64 acres. The large range of project sizes illustrates that pollinator habitat can be implemented on solar facilities of any size. In fact, there are measurable benefits to pollinators when there is just a half-acre or more of installed pollinator habitat.

JMU sign ceremony, depicting JMU staff along with members of the Pollinator-Smart Team and agency representatives. Department of Environment Quality, Department of Conservation of Recreation, Department of Wildlife Resources, The College of William & Mary, and the Flora of Virginia. (Emi Endo DCR- Public Communications Office)

As the program has grown, we have been developing ways to increase awareness and encourage more solar sites to participate. As part of those efforts, the Pollinator Smart team has developed Pollinator Smart signage recognizing the solar facilities that have successfully become certified. We were able to present

this signage for the certified site at JMU in July of 2024.

The JMU sign presentation took place during a drought in the mountain region of the state and the solar site was still flowering with some species setting fruit. It was a great illustration of how choosing native plants can improve the ecological function of a site.

While the JMU demonstration site was a great way to expand our reach, we also wanted to educate local governments about the program. In September of 2023, the Pollinator-Smart team held an information meeting about the program for Virginia locality staff and elected officials.

After an initial survey revealed that most localities knew nothing or very little about the program, we held a virtual meeting to discuss the benefits of native plants, an overview of the Pollinator Smart Program and how some localities were already addressing vegetation in conditional use permits and zoning ordinances. The meeting was attended by 49 people from 34 different localities and 7 regional planning district commissions. The attendees expressed interest in encouraging native vegetation and pollinator habitat on solar sites due to the benefits such as screening, vegetation more likely to survive because it's adapted to the site conditions, better erosion and sediment control because of deep rooted plants, better wildlife habitat, and aesthetics. The participants expressed concern that developers were "greenwashing" and were unsure what standards would ensure high quality habitat was installed. Our hope was that the Pollinator Smart Program could provide a framework for counties that wanted to address native plants and pollinators in the regulations but did not feel they had the expertise to develop standards for high quality native meadow habitat.

The locality meeting not only helped us educate and engage with local governments, but also helped local officials gain a comprehensive understanding of the existing regulations around native vegetation and pollinator habitat. As a result, we produced the "Virginia Localities Solar Ordinances and Native Vegetation Report." (https://www.dcr.virginia.gov/natural-heritage/document/va-solarordin-natveg.pdf). We are currently updating the December 2023 report. The report gathers information about native and pollinator friendly vegetation requirements for all 133 of Virginia's cities and counties and addresses trends across local governments. There are 56 localities in Virginia that have requirements for native vegetation in their ordinances, 18 of these have added these requirements since the 2023 report was published. However, many regulations do not define what a native plant is or what standards pollinator habitats should meet.

Some localities have solved this by turning to the best management practices and evaluation tools developed by the Pollinator Smart Program. Currently, eight localities reference the program, four more than the 2023 report. Several localities also point to the Pollinator Smart Program's definition of native plants, the Virginia Native Plant Finder (https://www.dcr.virginia.gov/natural-heritage/native-plants-finder).

The Virginia Native Plant Finder is based on the Flora of Virginia's Digital Atlas and is a database consisting only of Virginia native plants appropriate for planting. The finder has multiple ways to search for plants including, by name, site characteristics, and locality or region. This tool allows for a more flexible and dynamic approach based on site conditions rather than a static seed list. The finder also provides the user with vender information and additional information about the plant, making it a great tool for both these large-scale developments and users like homeowners. The Native Plant Finder was updated to improve search functionality in 2023 with financial support from the Department of Wildlife Resources.

The Pollinator Smart team has been working hard to continue to educate the public about the Pollinator Smart Program and the benefits of native plants in general. In the future we are hoping to develop a scorecard that can be applied to types of development beyond solar as we continue to ride the current pollinator wave.❖

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October 2025

Ruby Daniels

Walking in Zenda with Ruby Daniels

Unearthing hidden history with native plants

On a warm Saturday morning in June, native plant enthusiasts and history buffs gathered at Long's Chapel in what was known as Zenda, north of Harrisonburg, Virginia, for an unforgettable experience: *Doctor's Orders: Black Heritage/Native Plant Walk*. Organized by the Shenandoah Valley Conservancy in partnership with the Shenandoah Valley Black Heritage Project and guided by "Affrilachian" herbalist and forest farmer Ruby Daniels, the event opened a window into the rich, often-overlooked world of African American ethnobotany and resilience.

Zenda, a historic African American community, served as the perfect backdrop for a walk blending native plant knowledge with stories of survival, resistance, and deep-rooted wisdom passed down through generations.

Daniels, founder of *Creasy Jane's Herbal Remedies*, brought far more than just expertise in medicinal plants — she brought lived experience, ancestral memory, and an unwavering reverence for the land. As attendees wandered through fields and forest edges, Daniels pointed out familiar plants with unfamiliar histories. Plantain, White Oak, Black Walnut — all became portals into the lives of enslaved Africans and their descendants who used plants not only to heal bodies but to quietly assert autonomy in a world of oppression.

"I feel like the African American superpower is working with the scraps we're given," Daniels told the group. "So, I like to work with what's in my area because I am a big conservation person."

Her words resonated deeply with those present, many of whom were native plant enthusiasts unfamiliar with this cultural layer of plant use. Ruby spoke of how enslaved people were punished — even killed — for foraging roots or herbs, forcing them to hide their practices in plain sight by turning to bark or inconspicuous weeds.

She described how medicinal plants have a way of showing up when and where they're needed. "In Baltimore city, I just kept seeing large amounts of Passion Flower. . . A good plant for withdrawing from opiates," Daniels continued. "I have Elecampane growing in my yard. Well, my husband was diagnosed with COPD. So, huh? Those plants come up because they know that someone in that vicinity needs that medicine."

Daniels's connection to land and lineage came alive in stories of her family homesteading in West Virginia, of reading slave narratives and finding confirmation of her own lived experience — not through textbooks, but in the soil, the bark, the leaves.

Attendee and Virginia Native Plant Society member Lauren Philp remarked that the walk made an impact that was more than educational. "Gardening supports my emotional health, and I am leaving this walk feeling a deeper connection to the earth and more curious about how native plants can support my physical health as well," Philp said.

Through humor, wisdom, and herbal samples, Daniels painted a picture of a people who turned adversity into ingenuity — growing their own remedies, carrying roots in their pockets for protection, and using "five-finger grass" (Cinquefoil) to bring money through their hands.

Historical Highway Marker for Long's Chapel and Zenda (Photos courtesty Shenandnaoh Valley Conservancy)

The event also served as a gentle but powerful call to action. Daniels urged participants to respect the land and the plants that sustain us. "If you're going in the woods and taking the plants away, then there's nothing for your children to see, your great-grandchildren to see. I always say: grow your own stash."

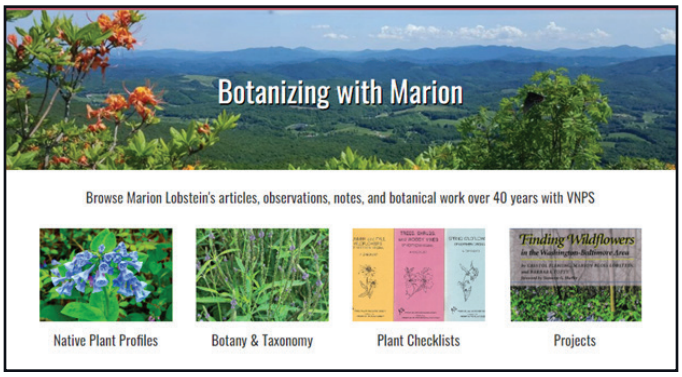
By the walk's end, it was clear this wasn't just a field trip. It was a living history lesson — a weaving together of botany and Black heritage, science, and spirit. And for those fortunate enough to walk alongside Ruby Daniels that day, the plants of Zenda now speak in new ways.

Reporting by Lauren Philp; written by Aaron Kershaw, Vice Chair of the VNPS DEIJ Committee

For more information: about native plants and events like this, visit vnps.org; about the Shenandoah Valley Black Heritage Society Project, visit https://valleyblackheritage.org; for details about the Shenandoah Valley Conservancy, go to https://shenandoah.org.

Enjoy a lifetime of work with 'Botanizing with Marion'

Marion Blois Lobstein is a charter member of the Prince William Wildflower Society as well as the Virginia Wildflower Society now the Virginia Native Plant Society. Nancy Arrington, cofounder of the PWWS and first volunteer newsletter editor, proposed and published the new chapter's initial newsletter *Wild News* in June 1982. Nancy, a former student in Marion's spring 1982 NVCC-Manassas plant identification class, asked Marion if she would like to write an article on a native plant for the issue. Marion enthusiastically agreed to do so and wrote an article on Butterfly Weed (*Asclepias tuberosa*) focusing on botanical aspects and historical uses of the plant. Nancy wrote a complementary article on gardening with this species. (https://vnps.org/princewilliamwildflowersociety/wp-content/uploads/sites/12/dlm_uploads/2022/10/Wild-News-June-1982.pdf). Forty-three years later, Marion is still writing articles on native plants, taxonomic changes, and botanical topics for *Wild News*.



Screen shot of "Botanizing with Marion" on the VNPS website.

Marion's *Wild News* articles as well as her checklists and projects are available on "Botanizing with Marion," the VNPS website feature at https://vnps.org/botanizing-with-marion/. The name of this resource was initially suggested by Deanna High, *Wild News* editor from 2005 through the beginning of 2017. When the *Flora of Virginia* (FOV) was published in 2012, Marion began writing articles on the taxonomic changes in the FOV to accompany the native plant articles. Deanna proposed the idea of this feature to include additional information to accompany the native plant profiles and taxonomic changes. Unfortunately, some issues with the VNPS website resulted in the loss of much of this additional information and the feature was discontinued.

In 2021 the current *Wild News* editor Brigitte Hartke suggested reviving this feature to provide more detailed botanical information on the native plant profiles and taxonomic changes. Mark Murphy, the VNPS webmaster at that time, agreed this was a promising idea. That summer Marion worked with Mark and Linda Wilcox, a former student and friend, to begin developing and formatting this website. In the fall of that year the initial version of "Botanizing with Marion" was added to the PWWS and VNPS websites. David Gorsline, current VNPS webmaster, is now working with Marion to add additional information to this site.

Those wishing to browse the "Botanizing with Marion" site will see four menu choices: Native Plant Profile, Botany and Taxonomy, Plant Checklists, and Projects.

- The "Native Plant Profiles" features Marion's articles on native plants (and one non-native plant, chicory) from *Wild News* issues dating back to June 1982 with Marion's article on Butterfly Weed. Over 110 articles are included with information on the botanical details, distribution, and human uses of these species. These articles can be searched by date or by title. The links will open the *Wild News* issue in which that article was published. The articles are typically toward the middle or end of the issue.
- The "Botany and Taxonomy" menu category contains links to *Wild News* issues dating back to 1985 with Marion's article on "Myrmecochory: Seed Dispersal by Ants." There are more than 50 articles on botany and taxonomic changes based on the *Flora of Virginia* manual and now the Flora of Virginia App. These articles can be searched by date or by title. The links will open the *Wild News* issue in which that article was published. The articles are also typically toward the middle or end of the issue.
- The "Checklists" menu includes background on developing the three checklists for "Spring Wildflowers of Northern Virginia," "Trees, Shrubs, and Woody Vines of Northern Virginia," and "Summer and Fall Wildflowers of Northern

(See Botanizing with Marion, page 12)

Podophyllotoxin: Molecules That Deter Herbivores Can Also Cure Cancer

Article and images by W. John Hayden, Botany Chair

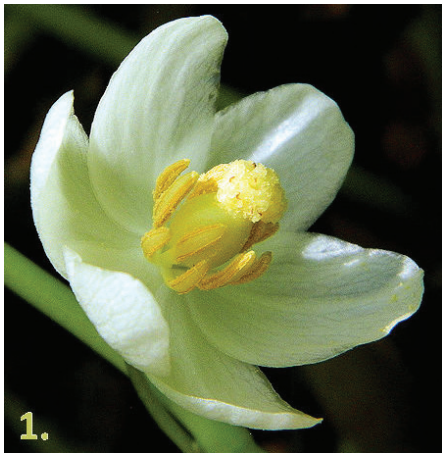


Figure 1. *Podophyllum peltatum*, Mayapple, the 2025 VNPS Wildflower of the Year. (W. John Hayden photo)

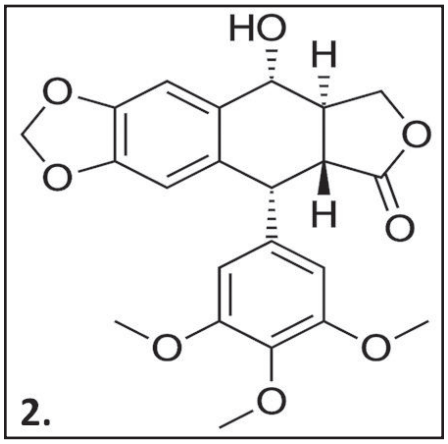


Figure 2. Podophyllotoxin, the molecule that renders Mayapple toxic to potential herbivores

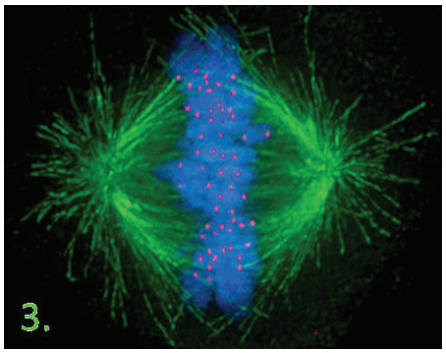


Figure 3. Mitosis of a human cell; chromosomes are in blue, microtubules in green, and the pink dots indicate points of attachment of chromosomes to microtubules of the mitotic spindle; podophyllotoxin interferes with the activity of the mitotic spindle. (Wikipedia photomicrograph)

In terrestrial communities, it is a basic fact of nature that photosynthetic, green, plants create the biomass that nourishes other organisms. Plants have this role because they are primary producers—they make their own biomass from just a few simple ingredients: air, water, and mineral nutrients. Herbivores consume plant biomass, carnivores consume herbivores, and decomposers, e.g. bacteria and fungi, decompose biomass of all kinds, breaking down the relatively complex molecules of life into the simple components of air, water, and soil. While it is true that making biomass and becoming food for other life forms is an important ecological role, this cannot be the whole story of plant biology. Just like all other organisms, plants share the biological imperative to reproduce—and being eaten, either whole or in part, works to the detriment of reproducing healthy, viable, descendant plants. For a plant, being eaten is a bad thing.

But how can plants avoid being eaten? Plants are rooted in soil, they have no nerves, no muscles, no organs of locomotion—plants are, figuratively, "sitting ducks" in a world full of hungry herbivores. Nevertheless, plants are not totally vulnerable. Plants have two broad categories of defensive strategies that work to minimize being eaten. Many plants have structural defenses that ward off hungry herbivores: stems modified as thorns (e.g., Hawthorns and Honey Locust), leaves or stipules modified as spines (e.g. Barberries and Black Locust), epidermis-derived prickles (e.g., Roses and Greenbrier), or tough, hard to bite, leaves (e.g. American Holly). In addition, most plants have chemical defenses, molecules that are toxic or distasteful. The diversity of complex molecules made by the plant world is vast and, as discussed herein, many of these compounds have important applications in medicine.

It should be no surprise, therefore, to learn that Mayapple, *Podophyllum peltatum*, the 2025 VNPS Wildflower of the Year (Figure 1), has defensive compounds. The most notable Mayapple defensive compound is podophyllotoxin (Figure 2). Chemically similar molecules are also present in smaller quantities and, together, combinations of these related molecules are known as podophyllins. Podophyllins give Mayapple its reputation for being toxic, and except for ripe fruits, all parts of the plant are considered toxic. Toxicity, however, can be a relative thing; often, the distinction between detrimental poisonous and beneficial medicinal effects is merely a matter of dosage. In this article, medicinal qualities of podophyllotoxin and derived molecules will be explored.

Traditional/folk medicinal use of *Podophyllum*. Taken orally, podophyllins cause severe irritation to the mucous membranes that line the human digestive tract. Irritation to the stomach

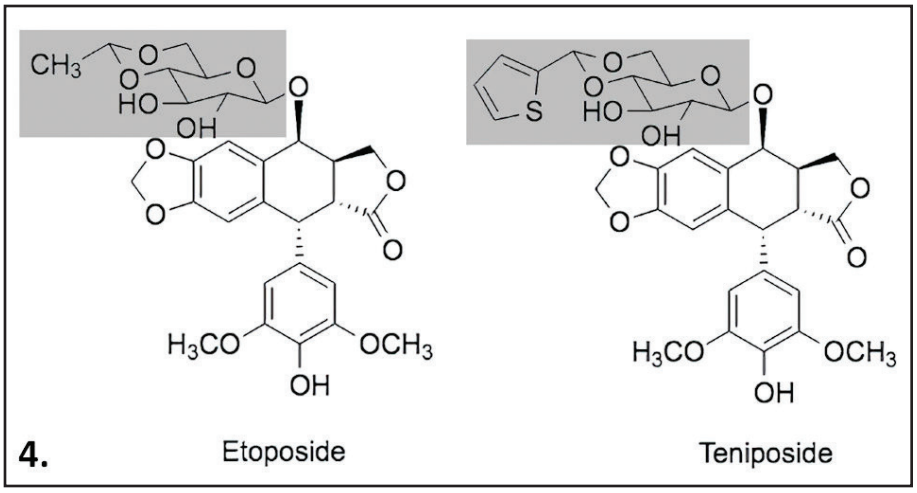


Figure 4. Etoposide and teniposide, two anticancer drugs derived from podophyllotoxin (unshaded portion of each diagram); both drugs act by disrupting topoisomerase enzymes, resulting in irreparable cuts in DNA during replication and transcription.

lining can lead to vomiting, and irritation of the intestinal tract can have a laxative effect. It is not hard to understand how strong gastrointestinal tract irritants protect Mayapples from herbivores. Of course, from a medical perspective, there are certain situations in which vomiting or easing bowel movements can relieve human suffering. Traditionally, oral ingestion of Mayapple was a common medicinal practice among Native Americans, a fact noted by early European explorers of eastern North America. In fact, early interest in Mayapple as medicine was important in its introduction to European gardens, a circumstance that led, eventually, to its being formally named by Linnaeus in 1753. Medical practice, however, favors other medicines that are much less inflammatory than crude preparations of Mayapple podophyllins. Oral consumption of Mayapple stems, leaves, and roots, should be avoided.

Topical applications. However, topical application of podophyllins is another matter; small volumes of podophyllins applied to the skin generate much less inflammation than oral consumption. Consequently, there was another Native American use of Mayapple—topical treatment of warts. Warts are localized proliferations of skin cells, the result of infection by the Human Papilloma Virus. This traditional use of Mayapple chemistry has been retained in modern medical practice. When applied topically to warts, podophyllins act by curbing the rapid rate of cell division (mitosis) of virus-infected cells that constitute the wart. The mechanism is fascinating. Microtubules are essential for mitosis, the process by which one cell becomes two (Figure 3). During mitosis, duplicated chromosomes attach to special microtubules that constitute the mitotic spindle, and it is the activity of these spindle microtubules that precisely partition the original cell's chromosomes into two genetically identical daughter cells. But when podophyllotoxin is present, it binds to microtubules and interferes with their activity. The effect is like throwing a monkey wrench into a finely tuned, intricate, machine. Put simply, in the

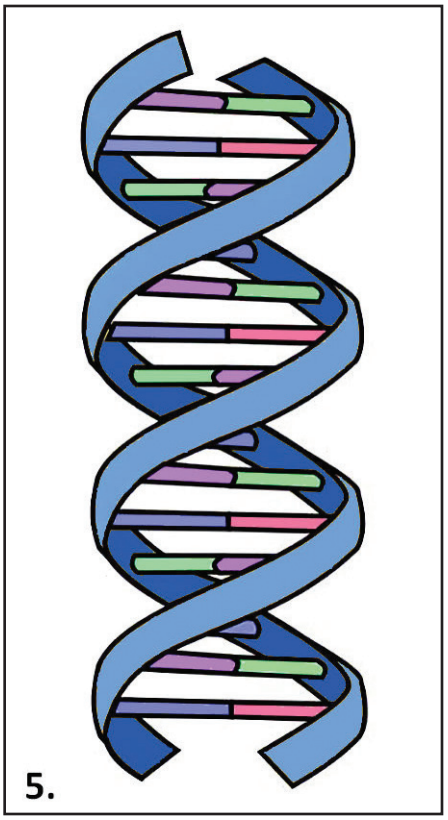


Figure 5. Small portion of a DNA molecule resembling a twisted ladder; sugar and phosphate molecules form the ladder-like rails; four different nitrogenous base molecules constitute the horizontal "rungs;" there are 10.5 nitrogenous base pairs for every 360 degree twist of the ladder-like rails when DNA is in its most stable configuration.

presence of podophyllotoxin, mitosis fails, new cells do not form, and wart growth is curtailed.

Cancer. In essence, cancer tumors are bits of tissue with rapid, out of control, rates of mitotic cell division. If podophyllotoxin can slow the growth of virus-infected wart cells by interfering with the mitotic spindle, perhaps the same drug could be applied therapeutically to slow the growth of cancerous tumors. In theory, the logic is sound, but in practice, since most tumors are internal, the highly irritating, inflammatory, properties of podophyllotoxin make this Mayapple molecule unsuited as a cancer treatment.

Nevertheless, decades of

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Podophyllotoxin

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experience have shown pharmaceutical chemists that alteration of one or another part of a drug molecule can influence its action in the body in myriad ways. Whereas podophyllotoxin is just too toxic, perhaps modified derivative molecules might be better tolerated yet still retain desired physiological activity. And that is exactly the case with two podophyllotoxin-derived molecules that have become important anti-cancer drugs: etoposide and teniposide. These derivatives of podophyllotoxin are illustrated in Figure 4. Note that etoposide differs from podophyllotoxin by attachment of two sugar molecules; teniposide also has the same extra sugars plus a sulfur-containing component. What strikes me as most remarkable about these two Mayapple-derived anti-cancer drugs is that their mode of action is completely different from that of unmodified podophyllotoxin.

Instead of interfering with the mitotic spindle of dividing cells, etoposide and teniposide directly attack the DNA of cancer cells, ultimately leading to cancer cell death. Etoposide and teniposide interfere with two fundamentals of DNA molecular biology: 1) DNA replication, the process of duplicating the DNA molecule in preparation for a subsequent mitotic cell division, and 2) DNA transcription, the process by which genes are copied as messenger RNA molecules that go on to provide the directions for synthesis of proteins. The full details are rather complicated, but what follows is a light-weight overview of DNA replication and DNA transcription, focusing on how these podophyllotoxin-derived drugs affect routine biochemistry of DNA.

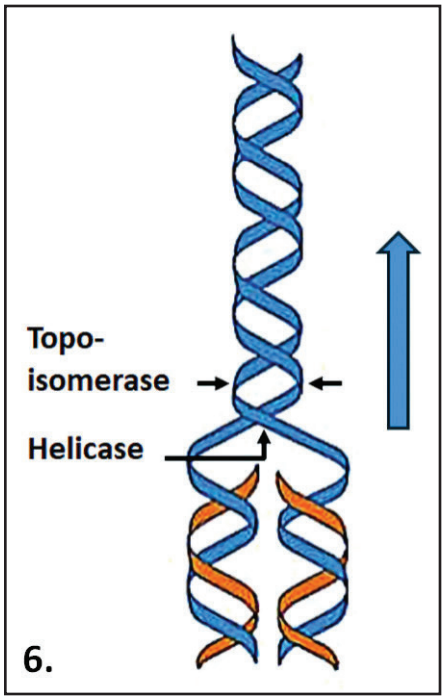

Figure 6. DNA replication, the process that duplicates DNA in preparation for cell division; original (upstream) DNA molecule above, two identical copies below (downstream); as helicase separates the two strands, upstream DNA becomes over-wound; repeatedly, topoisomerase relieves the stress of over-wound upstream DNA as replication proceeds.

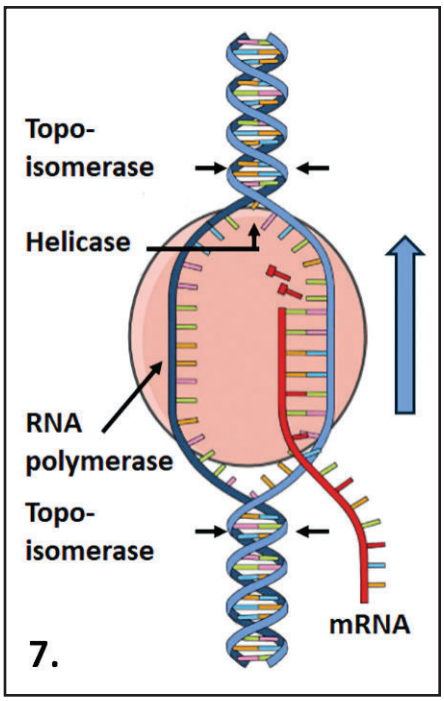

Figure 7. DNA transcription, the process by which genetic information of DNA is copied as mRNA which, later, directs the synthesis of proteins; as in replication, one upstream topoisomerase relieves the stress of over-wound DNA while another, downstream, topoisomerase, relieves the stress of under-wound DNA.

As shown by Watson and Crick nearly 75 years ago, DNA molecules are double-helix structures resembling, to some extent, a twisted ladder (Figure 5). The sides of the ladder are made of alternating phosphate and sugar molecules, and the rungs consist of four different nitrogenous base molecules, two bases per rung of the ladder. Genetic information resides in the sequence of base molecules. One thing that the processes of DNA replication and DNA transcription share is that the DNA double helix must be partitioned into separate strands so that enzymes can interact with DNA one strand at a time. For both replication (Figure 6) and transcription (Figure 7), an enzyme called helicase separates the two nitrogenous bases that constitute each rung of the ladder, thus allowing the two halves of the molecule to separate. But strand separation by helicase has an additional effect: adjacent, not yet separated, DNA becomes tightly twisted as the two half-DNA molecules separate from each other. "Upstream" tight twisting of DNA happens in both DNA replication and DNA transcription. In DNA transcription, the process of copying one DNA strand into a molecule of messenger RNA also leaves the "downstream" DNA loosely twisted.

DNA that is extra tight or

(See Turns out, page 11)

Despite Toxicity, White-tailed Deer sometimes consume Mayapple

Every now and then, observant naturalists may encounter colonies of Mayapple reduced to multitudes of naked stems and petioles emerging from the leaf litter of the forest floor, the result of deer eating the plant's toxic leaf blades. How can deer consume toxic plants? Certainly, multiple factors are involved. For one, deer browse selectively; they often consume small amounts of many different plants and thereby avoid exposure to large doses of particularly toxic (or distasteful) compounds—in essence, non- or less-toxic dietary items may dilute the impact of small amounts of toxic plant matter. Also, as is the case for many different herbivores, deer have symbiotic bacteria resident in their digestive tract; these gut microbes may contribute to the detoxification of various molecules of ingested plant matter. But deer do not rely completely on gut microbes, because they also have several versions of cytochrome P450, enzymes that are remarkably versatile in their ability to initiate the breakdown of complex toxic molecules. Deer are also known, periodically, to consume small amounts of clay; clay minerals bind toxic molecules, limiting the absorption of poisons into the blood stream. Finally, it must be acknowledged that a Mayapple colony, reduced to just stems and petioles, may be the work of multiple animals sampling Mayapple foliage over the course of multiple days, probably not a single deer mowing down vast amounts of foliage. Ecological interactions are often the sum of multiple factors. Podophyllotoxin should be considered an effective defense against herbivores under a wide variety of circumstances. But now and then, when deer populations are high and other foods are scarce, hungry deer may consume Mayapple leaves as an alternative to starvation. ❖

Turns out that a simple spring wildflower has some complex chemistry

(Continued from page 10)

extra loose in terms of rotational twist is not stable. Consequently, another enzyme called topoisomerase is critical for the smooth function of both DNA replication and transcription. Topoisomerase 1) binds to the extra tight or extra loose DNA, 2) cuts the DNA so it is free to rotate to its chemically stable amount of twist, and then, 3) rejoins the cut ends. The upstream and downstream topoisomerase enzymes differ slightly in detail, but both function in roughly the same way, over and over, while replication and transcription proceed. Both work by making temporary cuts in DNA that allows the DNA to assume a stable degree of twist and then rejoining the cut ends.

And what about the podophyllotoxin derivatives etoposide and teniposide? These molecules bind to topoisomerase and have no effect on topoisomerase making what should be *temporary* cuts in the DNA molecule, BUT etoposide and teniposide prevent the cut ends from rejoining—the DNA cuts become permanent! Said simply, in the presence of etoposide or teniposide, fundamental processes involving the molecular biology of DNA results in multiple cuts to the DNA molecule. Cells with chopped up DNA die, and this is true for both cancer cells and normal, healthy, cells. In essence, cancer cells are in overdrive; compared to normal, healthy, cells, cancer cells have much more rapid rates of DNA replication and DNA transcription. The key to successful intervention with etoposide and teniposide is for the physician to find a dose that causes significant death of cancer cells without harming, too much, the normal, healthy, cells of the body that are also undergoing DNA replication and DNA translation at relatively slow rates.

In conclusion. Ain't biology grand! Mayapples are pretty little spring wildflowers that, in order simply to survive, synthesize complex molecules that not only are capable of disrupting of the digestive physiology of potential herbivores but also can shut down the fundamental process of mitotic cell division and, with a bit of tweaking by talented chemists, can also cure cancer. Who knew? As Shakespeare once wrote, "There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy." And we should all be thankful that plant chemistry provides such a rich storehouse of effective medicines that, when used with care, alleviate human suffering. ❖

Botanizing with Marion

(Continued from page 7)

Virginia" developed by Marion in the 1980s and originally published as booklets. The taxonomy used in developing these checklists was based on the second edition of the *Atlas of the Virginia Flora.* You can use your Flora of Virginia App to cross-reference the scientific names. Also, other plant checklists for local areas are included in this category. The category of "Projects" provides the following information: The "Checklists" menu includes

- **Notable Women Botanists:** Background and link to Marion's 2024 article "Some Notable Women Botanists in the VAS: Their Roles in Supporting the Development of the Modern Flora of Virginia."
- **The Flora of Virginia:** Marion's article "My Journey with the Flora of Virginia" with links to seven education videos relating to use of the Flora of Virginia.
- **Finding Wildflowers of the Washington-Baltimore Area** (by Cris Fleming, Marion Lobstein, and Barbara Tufty): information on this book.
- **Spring Wildflowers of the Mid-Atlantic Region** (by Marion Lobstein, John deMary, and Susanne Lohr): background on content of this video and a link to view this video.
- **Native plants and Natural Areas**: selection of Marion's watercolor paintings of plants, animals, and landscapes.
- **Virginia Academy of Science:** Marion's activities that set the stage for the establishment of the Flora of Virginia Project.

Marion hopes sharing this information from her 43 years with VNPS, 37 years of teaching at NVCC and Blandy Experimental Farm, and 48 years with VAS will add to your knowledge and appreciation of the incredible flora of Virginia.

Marion would like to thank Mark and Donna Murphy and Linda Wilcox for their assistance in the 2021 initial setup and addition of information through 2024 as well as David Gorsline for continuing to work with development of this website. She is also grateful to Nancy Arrington, Nancy Vehrs, Deanna High, and Brigitte Hartke, *Wild News* editors for their editing and publishing of Marion's articles and to Nancy Vehrs for the use of her photograph as the banner image for the site. ❖

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