



Leaf



Notes



The Newsletter of Lee County Master Gardeners

Dear MG and Friends,

As a teacher and principal I always asked students and staff, "What did you do this summer?" As a MG, we can also stop a few minutes and reflect on what we have done this summer.

MG worked in our MG Demonstration Gardens at Kiesel Park, Grandma's Garden, The Wildflower Trail in Opelika, and the Butterfly Garden at The Preserve. These are beautiful gardens we maintain for the enjoyment of the citizenry. If you have not visited them, take time to go by as they have all expanded the plantings and matured beautifully.

Our Help Line started in March giving folks an opportunity to call or bring in questions or horticulture concerns and have one of us give advice or solve their problem.

In April, MG were busy with our Native Plant sale, a great opportunity to get a few more native azaleas in the soil before the hot summer.

In May, Lee County MG had the first and very successful Twilight Garden Tour. Over 150 people visited the three themed gardens to see the magic of plants and lighting at night while enjoying a catered meal at each garden.

Monthly, MG have learned from a series of programs on dealing with drought conditions in the landscape. The well attended most interesting series was sponsored jointly by MG and Auburn Parks and Recreations.

MG had a fabulous workshop on lighting which will get repeated because it was on a stormy night and many did not get to attend.

Oh, yes, we can't forget we had so much fun at a Pot-Luck dinner which included favorite flavorful dishes and outstanding desserts. Following lots of visiting and eating, three MG shared valuable information about Pollinator Gardens, a field trip opportunity to Petals from the Past, and Bee Keeping. A wonderful time was had and all loved the presentations.

On several Saturdays during spring and summer, MG have sold mulch that makes gardens look neat and tidy and keeps moisture in the soil. Look for more sales Saturdays in the fall.

MG also kept their own gardens, planting native plants, pulling weeds, and finding the right pollinator plants to keep our bees well fed.

Additionally, MG have given a \$1,000 horticulture scholarship to Auburn University and recently awarded a grant to OLLI for installing native traditional plants at their new home Sunny Slope.

Yes, MG have had a wonderful summer and look forward to cooler weather and getting those fall plants and vegetables in the soil. We hope you will join us in any of our projects.

Special thank you to all MG and friends that have contributed to a wonderful summer.

Nancy Golson,
President

Inside This Issue

Presidents message	1
Upcoming Meetings and Events	3
Feel Great While Gardening	4
Quarterly Quiz and Visual Puzzle	5
Where does all the Water Go when you Water a Plant?	6
Planting a Fall Vegetable Garden	7
Can Plants Hear?	8
Prepare for a bad Fall for Ticks	9-10
The AWOL Garden	11
Summer Potluck	12
Raindrops and Mushrooms	13-14
Quiz and Visual Puzzle Answers	15

Editors Note—Photos are by editor unless identified otherwise

Quarterly Quote

"To be overcome by the fragrance of flowers is a delectable form of defeat."

~ Beverly Nichols



Lee County Master Gardeners Assn
600 S. 7th St Suite 4
Phone: 877-829-5500
LCMGA is a 501(c) (3) Organization

Leaf Notes newsletter of the Lee County Master Gardeners is published by the Lee County Extension System and the Lee County Master Gardeners.

Published four times a year: Winter, Spring, Summer, and Fall

David Peterson, Editor

Tel: 815-276-9209

E-mail: davypeted@gmail.com

Master Gardeners are encouraged to submit articles, ideas, notices, etc. to:

Tara Barr, County Extension Coordinator

Tel 334-3353, Mobile 334-707-5143

E-mail: barrtar@aces.edu

2017 LCMG Officers

President: Nancy Golson,

[334- 334=728-5064](tel:334-334-728-5064)

Vice-President: Susan Price,

[703-725-0189](tel:703-725-0189)

Treasurer: Jim Disque,

[973-886-8693](tel:973-886-8693)

Membership: Anne Morgan,

[770-254-8708](tel:770-254-8708)

Secretary: Carola Pike,

carola.pike1@gmail.com

Training: Nancie: Gallagher,

[412-708-0099](tel:412-708-0099)

Advisory Council: Patti Householder,

[334-332-8044](tel:334-332-8044)

Public Affairs: Raleine Sillman,

[334- 663-1948](tel:334-663-1948)

Programs : Pat Giordano

[334-329-7099](tel:334-329-7099)

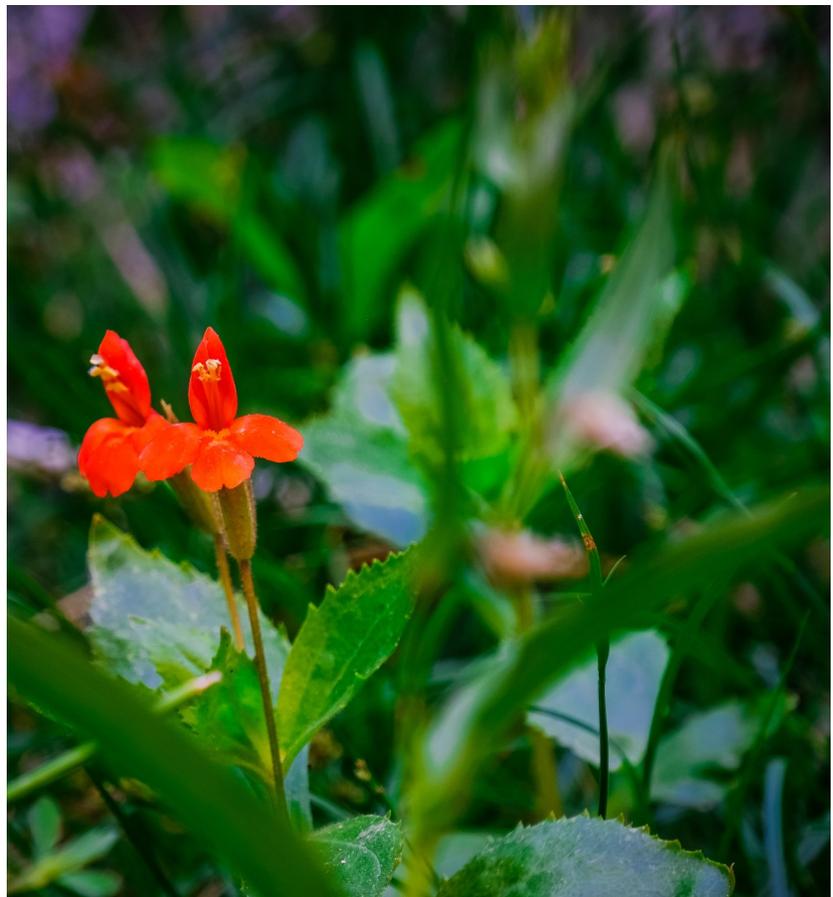
The Master Gardeners Program educates volunteers in science-based gardening and landscape practices and helps them effectively extend research-based information to the public as Master Gardeners. The Master Gardener's role is primarily that of “educator.”

There are many different ways our volunteers in Lee County help the Alabama Extension System (ACES) expand outreach to the community. We construct and maintain community demonstration gardens and help implement community projects. A variety of garden-related programs and workshops are offered to the public.

Scarlet Monkeyflower—Family Phrymaceae

Erytharumthe Cardinalis

Photographed in Zion National Park, Utah





Upcoming Meetings and Events

Future meeting programs :

Sept 6 - Developing a natural landscape plan for your home—Charlene Le Blue—AU School of Architecture—presenter

Oct 4 - Grant project reviews—updates from LCMG 2017 grants

Additional Events of Interest

'**Fall Gardening Extravaganza**' is coming in September 2017! The Tallapoosa County Extension office and Tallapoosa County Master Gardeners are proud to host another grand event. The 2017 event will be on **Friday, September 29th** again at Central Alabama Community College in Alexander City. This year's line-up will feature Felder Rushing, Carol Reese, Chris VanCleave and Sara Van Beck. All details can be found at <http://offices.aces.edu/tallapoosa/fall-gardening-extravaganza/>. All registration will be handled by calling us at 256-825-1050. No Online Registration. Be sure to reserve your seat

Growing Hops & Home Brew Workshop Hosted by Alabama Cooperative Extension System
Wednesday September 20th 2017 3:00 p.m. to 7:30 p.m. Lee County Extension Office 600 S. 7th Street, Suite 4, Opelika AL Topics to be discussed: Hops Varieties in the South • How to Grow & Harvest Hops • Major Pest & Disease Issues • How to Process Hops for Brewing How to Home Brew from Start to Finish • Liquor Laws in Alabama *Tour and Dinner Included Following the Workshop at the Red Clay Brewing Company To sign-up or for more information, contact the Lee County Extension office at (334) 749-3354. Cost is \$15 per person and includes dinner. Pre-Registration and Payment is required by Friday, September 15th.

64th Annual Fall Flower Show Calling all Gardeners and Photographers

The Alabama National Fair and Flower Show in Montgomery, Alabama is coming October 27-November 5, 2017. This is the time to be thinking and planning what plants and flowers to have ready to enter. Spring and summer are the perfect time to take pictures for the Photography Division. This year the Photography Division will have a special Section for youth ages 12-18. Remember--- it's free to enter any Division. Contact Rose Winkler, General Flower Show Chairman, for information and forms. 334-270-0884 or rmwinkler45@yahoo.com



Feel Great While Gardening

Can you tend your plot without joint pain? That's the question we posed to three expert gardeners and fellow arthritis sufferers. Here, their tips for cultivating habits that will help you— and your plants — thrive!

Getting Started:

Time it right. Plan your gardening for when you have the most energy and flexibility, says Patty Cassidy, master gardener and author of "The Illustrated Practical Guide to Gardening for Seniors." Like to get outside early? "Give your joints an hour or two to wake up first," notes Cassidy, who is also a Portland, OR based registered horticultural therapist.

Shield your skin. "Find a gardening hat that you like and that's washable, so you'll always wear it," says Susan Littlefield, a horticultural editor for the National Gardening Association who has osteoarthritis (OA) in multiple joints. Wear sunscreen, too, since some meds can cause sun sensitivity.

Dress for success. Steve Swain, who has both rheumatoid arthritis and OA, suggest wearing a padded, grip-friendly pair of gardening gloves, as well as shoes or work boots with ankle support and good traction. If your doctor recommends it, wear finger, wrist and /or back splints, says Swain, who is an assistive technologist for Purdue University's National Agr/Ability Project, a government-sponsored program that assists agricultural workers with disabilities.

Loosen up! Walk around and stretch before, during and after you garden; ask your doctor or a physical therapist to recommend a stretching routine. Cassidy warms up stiff, achy hands — her own OA trouble spots — with stretches.

Pick joint-friendly foliage. Buy young plants rather than seeds, says Littlefield. Choose drought-resistant, easy-care perennials that grow best in your "hardiness Zone." "But remember that most still need to be cut back in the fall," notes Littlefield. Her solution? "I'm gradually replacing perennials with shrubs and ground cover, which need less attention.

Switch it up "Rotate tasks to change position and avoid repetitive motions," notes Littlefield. For instance, weed a row, then stand and rake." Also, to protect hip joints, try not to twist at odd angles.

Rethink your bulbs. To save your knees, choose small bulbs that don't need to be buried so deeply, such as grape hyacinth and crocus, says Littlefield. Or try a bulb planter, suggests Cassidy, which helps you dig holes and replace soil while standing.

Go vertical. If you have trouble bending or kneeling, planters that hang-from your windowsill, porch railing or trellis for vining plants and vegetables can bring your garden to a comfortable level, says Littlefield.

Water wisely Rather than dragging a hose or toting a heavy watering can, consider a soaker hose or sprinkler system, says Swain. "If you don't have a water source close to your plantings, set out containers to collect rainwater to use where you'll need it."

Rake right. Instead of lifting bundles into a wheelbarrow, Littlefield rakes grass clippings and fallen leaves onto a tarp, then pull the debris to her mulch pile.

Weed with ease. "Pulling weeds takes less force when the ground is wet— such as after a heavy rain or watering," Cassidy notes.

Mulch more. Lay wood chips, straw, or black plastic sheeting around and between plants to discourage weed growth. Added benefit: "This conserves soil moisture, so you'll need to water less," says Cassidy.

(From the Arthritis/Health Monitor, submitted by Carol Womer)



Visual Puzzle

Can you spot the insect on this plant?



Quarterly Quiz

Do you know this vine ?



Vine



Vine Flower



Where Does All the Water Go When You Water a Plant?

A physicist explains the intricate hydraulic system inside plants

By Helen Czerski

Wall Street Journal May 12, 2017

May is a fabulous time to be outside. The plant world is enthusiastically covering our gardens and fields with luxurious green architecture, soaking up the sun's energy and investing it in new supplies of biological building materials.

I live in the city, where plants don't take priority, so I make sure that I don't miss out on the spectacle by filling my balcony with potted plants: herbs, tomatoes, roses and blueberries. Biology takes care of most of the hard work by itself, but I make one essential contribution: water. And every time I get out the watering can, I'm astonished by the contrast between the simple act of pouring water onto soil and the sophistication of what the plant does with it.

A plant is just an engine for turning water and carbon dioxide into oxygen and sugars, a process known as photosynthesis. But even though this mechanism defines a plant, less than 1% of the water sucked up by the roots is used in this way. The other 99% forms a slow upward fountain that starts at the roots, flows up inside the stem and then evaporates from tiny holes on the leaves. This seems tremendously wasteful until you consider the benefit: access to carbon dioxide.

Those little holes on the leaves allow carbon dioxide in, but they also happen to let water out. During the day (when the holes, called stomata, are open), every plant we look at is sucking water upward through a thin fragile system of plumbing that ends at the leaves. This throughput of water is the sacrifice necessary to maintain the carbon-dioxide supply. But if it's just passing through, why is the loss of water so serious?

If I forget to water for a few days, the neglect is embarrassingly obvious to everyone. The tomatoes go first, wilting and then dramatically flopping over, triggering immediate guilt. And while I'm rushing to make it up to them with liters of aqueous elixir, the real truth of a plant is evident: The water isn't just flowing passively through this beautiful green structure that happens to contain a photosynthesis factory. It's holding it up.

Plant cells are made of fairly squishy stuff, with very little rigidity. So the plant fills them with water, pushing the soft innards out against the elastic cell wall. Just as a car tire becomes hard when you fill it with air, the plant cells become robust little bricks when you fill them with water. A typical car tire might be filled to twice atmospheric pressure, but the pressure in a typical plant cell might be five or six atmospheres.

It's all about natural hydraulics. Take the water away from a small plant, and the structure flops over. This method has its limits, though—bigger plants grow a woody reinforcement, a natural polymer called lignin, which takes over the structural support. That's why trees don't wilt.

This system of hydraulic architecture gives us a final twist in the tale. My plants seem fixed in shape, but they're not. At the base of some leaves, there's a small section of stem that can move the leaf around, either to close it at night or to track the sun. By pumping water out of the cells on the top side of this section (shrinking them) and into the cells on the underside (puffing them up), the plant can raise the leaf upward.

That hydraulic system allows plants to move in response to their surroundings. Sunflower buds, for instance, follow the sun across the sky using these little cellular pumps. The same system also opens and closes the stomata.

As a kid, I found watering plants a pretty dull chore. But as an adult, I find it endlessly fascinating because I love imagining where the water is going to go.

When you next see a little green shoot poking out from the sidewalk, spare it an extra thought. A plant isn't just a static green object. It's a little living factory, fueled, supported and moved by one molecule: water.



ILLUSTRATION: BRIAN STAUFFER



Planting a Fall Vegetable Garden

By Mallory Kelley, Regional Extension Agent

If your summer vegetable garden was a bust, you're not alone. The cool late spring weather was wonderful and all this rain after the drought in the fall was much needed, but the problems they caused on our summer vegetables has been severe. If your tomatoes, peppers, beans and squash didn't survive, don't give up, you must try again and why not with a fall garden? Fall vegetables are really my favorite to grow and I have just about decided I will leave the peppers and tomatoes to my grandfather and avoid the summer heat, afternoon rain showers and weeding all together and take my turn providing for the family in the fall. We are blessed by our warm Alabama climate that we can grow vegetables year round.

Many cool-season vegetables, such as carrots, broccoli, cauliflower, collards, lettuce and brussels sprouts, produce their best flavor and quality when they are maturing during cool weather. In Alabama, the spring temperatures often heat up quickly causing vegetables such as lettuce and spinach to bolt (flower) or develop a bitter flavor. This is why planting these veggies late in the summer or early fall when we are transitioning to cooler temps is more ideal than in the spring.

Growing a productive fall vegetable garden requires thoughtful planning and good cultural practices. In Alabama, August and September are the ideal months for planting a fall garden. For a more accurate planting schedule, determine the average date of the first killing frost in the fall, and then count backward from the frost date, using the number of days to maturity to determine the best time to plant in your area.

Alabama in August and September is usually hot and dry. If you choose to plant your fall veggies from seed during these months you must be careful to keep the soil moist. Incorporating organic matter into the soil will help add nutrients and increase water holding capacity.

Lettuce and spinach seeds will not germinate if the soil temperature exceeds 85 degrees F so for these you may need to wait a bit longer before sowing or plant from transplants. Also remember to mulch the garden to moderate moisture levels as September and October are our driest months with very little rainfall.

You can extend your summer vegetable crop and your semi-hardy vegetables on into the fall and winter easily by protecting them from frost. In Alabama, we often enjoy several weeks of good growing conditions after the first frost. Cover growing beds, rows or individual plants with burlap or a floating row cover supported by stakes or wire to keep the material from directly touching the plants.

Most hardy vegetables require little or no frost protection, but semi-hardy vegetables should be protected or harvested before a heavy freeze. Root crops such as carrots and radishes should be harvested or mulched heavily before a hard freeze. Mulched root crops can often be harvested well into the winter, and during mild winters, harvest may continue until spring.

So, if your summer garden was a flop or your wanting to continue your progress of home vegetables into this fall and winter, it's not too late. There is still time to plant, especially the HARDY vegetables that can withstand a light frost such as: Broccoli, Brussels Sprouts, Cabbage, Carrots, Collards, Kale, Kohlrabi, Onions, Radishes, Spinach and Turnips.



Can Plants Hear?

Flora may be able to detect the sounds of flowing water and munching insects. Pseudoscientific claims that music helps plants grow have been made for decades, despite evidence that is shaky at best. Yet new research suggests some flora may be capable of sensing sounds, such as the gurgle of water through a pipe or the buzzing of insects.

In a recent study, Monica Gagliano, an evolutionary biologist at the University of Western Australia, and her colleagues placed pea seedlings in pots shaped like an upsidedown Y. One arm of each pot was placed in either a tray of water or a coiled plastic tube through which water flowed; the other arm had dry soil. The roots grew toward the arm of the pipe with the fluid, regardless of whether it was easily accessible or hidden inside the tubing. “They just knew the water was there, even if the only thing to detect was the sound of it flowing inside the pipe,” Gagliano says. Yet when the seedlings were given a choice between the water tube and some moistened soil, their roots favored the latter. She hypothesizes that these plants use sound waves to detect water at a distance but follow moisture gradients to home in on their target when it is closer.

The research, reported earlier this year in *Oecologia*, is not the first to suggest flora can detect and interpret sounds. A 2014 study showed the rock cress *Arabidopsis* can distinguish between caterpillar chewing sounds and wind vibrations—the plant produced more chemical toxins after “hearing” a recording of feeding insects. “We tend to underestimate plants because their responses are usually less visible to us. But leaves turn out to be extremely sensitive vibration detectors,” says lead study author Heidi M. Appel, an environmental scientist now at the University of Toledo.

Another hint that plants can hear comes from the phenomenon of “buzz pollination,” in which a bee buzzing at a particular frequency has been shown to stimulate pollen release. Michael Schöner, a biologist at University of Greifswald in Germany, who was not involved in the new research, believes that plants may have organs that can perceive noises. “Sound vibrations could trigger a response of the plant via mechanoreceptors—these could be very fine, hairy structures, anything that could work like a membrane,” he says.

This research raises questions about whether acoustic pollution affects plants as well as animals, Gagliano observes: “Noise could block information channels between plants, for example, when they need to warn each other of insects.” So next time you turn on a leaf blower or a hedge trimmer in your garden, consider the lilies.

Marta Zaraska Scientific American May 2017

Western Columbine

Aquilegia Formosa

Photographed in Zion National Park, Utah



"Flowers are the sweetest things God ever made and forgot to put a soul into."

~ Henry Beecher



Prepare for a Bad Summer/Fall for Ticks

By Sumathi Reddy

Mild winters and big deer and mice populations mean more ticks and higher rates of Lyme disease diagnoses

Milder winters, burgeoning mice and deer populations and a bumper acorn crop from two years ago mean this year's tick season is expected to be bad and more widespread, experts say. With that comes the threat of more tick-borne diseases, including the most common, Lyme disease.

States like Connecticut—home to the town of Old Lyme where the disease was first diagnosed—are already reporting a higher number of ticks infected with the *Borrelia burgdorferi* bacterium, which causes Lyme disease, as well as other tick-borne pathogens. The deer or blacklegged tick can transmit up to seven pathogens that cause human diseases, including Lyme disease.

The state collects ticks from residents, and of the more than 800 received thus far this year, nearly 38% have tested positive for Lyme disease, compared with an average of about 27% in the past five years for the full season, said Goudarz Molaei, a research scientist at the Center for Vector Biology and Zoonotic Diseases, part of the Connecticut Agricultural Experiment Station, a state-owned research facility.

Lyme disease is the most common vector-borne disease in the U.S.

Symptoms can include a ring-like rash, along with flulike symptoms, muscle and joint aches and swollen lymph nodes. It is usually diagnosed based on symptoms or a blood test. It is treated with antibiotics. Longer-term infections can cause more serious symptoms, including arthritis, severe muscle pain and headaches, heart palpitations, brain inflammation and nerve pain. Diagnosis and treatment of Lyme disease is controversial with many differences of opinion between patient groups and doctors.

About 10% of ticks have tested positive for the pathogen that causes Babesiosis, a malaria-like disease, and 5% have tested positive for the bacteria that causes Anaplasmosis, a flulike disease that can be fatal if left untreated. Due to the ticks' tiny size, they can be difficult to see.



Approximate size of an adult deer tick

“This problem is going to stay with us and it is going to get worse,” said Dr. Molaei. Milder winters and no snow cover or frost means more ticks survive, he said.

The harbinger of how bad a tick season is going to be is the acorn supply, said Richard S. Ostfeld, a senior scientist at the Cary Institute of Ecosystem Studies in Millbrook, N.Y., who has been monitoring local tick populations and their hosts for 25 years.



Prepare for a Bad Summer/Fall for Ticks

-Continued

In 2015 there was a bumper acorn crop, he said, which led to an explosion of white-footed mice last summer. That meant more hosts for baby ticks to latch onto. The mice are what infect some ticks with Lyme and other diseases.

“Ticks survive really well when they feed on a mouse compared to other animal hosts so more ticks survive to the nymph stage,” said Dr. Ostfeld. “So our expectation is that we should have an unusually large number of infected nymph-stage ticks starting next month.”

Ticks have a two-year life cycle and feed from hosts three times during that period. Most cases of Lyme disease in people are transmitted by nymph-stage ticks. The adult ticks also feed on deer so deer populations help adult ticks reproduce, although the deer don't infect the ticks and when they bite humans they are bigger and easier to detect and remove.

How to Avoid Ticks and Prevent Lyme Disease

Avoid tall grass, leaf piles and wooded areas. Stay in the center of walking and hiking trail

-**Use** repellent that contains DEET — 20% or more — on skin and clothing.

-If camping or hiking, **treat** clothing and gear with permethrin

-When working outside or walking in the woods, **wear** long sleeves and long pants and stick your pants inside your socks. Wear lighter colored clothing so you can see ticks more easily.

-Do a thorough **tick check** of the body using a mirror. Make sure to check hard-to-reach areas, including under the arms, behind the ears, inside the belly button, behind the knees and in the groin area. A lice comb can help for checking hair.

-**Showering** or bathing after spending time outside can wash off ticks that haven't latched on yet.

-**Check** pets and clothing and equipment that has been outside for crawling ticks.

-**Drying clothes** on high heat for 10 minutes can kill ticks. Add additional drying time for wet clothes.

-Regularly **mow or trim your lawn** to avoid tall grass and rake leaves.

-Place a **3-foot wide barrier** of gravel or wood chips between the lawn and wooded areas. Try to maintain a 9-foot barrier between the wood chips and areas such as the patio, garden and play areas.

-Try to **plant crops** that deer don't like or erect an 8-foot fence to keep them out.

-**Spray** your yard with acaricides or tick pesticides to help reduce the number of ticks.

Sources: CDC; Connecticut Agricultural Experiment Station; Patricia DeLaMora, Weill Cornell Medicine, Manhattan, New York; Jorge Parada, Loyola University Medical Center, Maywood, Illinois.

Appeared in the Apr. 25, 2017, print edition as 'Prepare for The Summer Invasion Of the Ticks How to Avoid Ticks and Help Prevent Lyme Disease.'



The AWOL Garden

At the Santa Fe, NM Botanical Garden

Editors note—during a recent visit to the new Santa Fe Botanical Garden, we saw this display and thought that it’s message should be brought to the attention of Master Gardeners.



The Garden

AWOL is an installation created by Michael Mamingha. The following words have been printed on signs and planted in the garden:

“acorn, ash, buttercup, dandelion, fern, ivy, mistletoe, nectar, pasture and willow”.

Each states a word that has been dropped from the most recent edition of the Oxford Junior Dictionary, being deemed as no longer relevant to modern childhood. These signs are placed in an unplanted barren area of the garden, reflecting their absence.

Words replacing them in the dictionary include **blog, broadband, celebrity, chatroom, mp3 player and voicemail.**

This replacement of words describing nature with words describing technology reflects a changing relationship to nature in modern society.

Do you agree with the Oxford Junior Dictionary?

Photos from the Santa Fe Botanical Garden



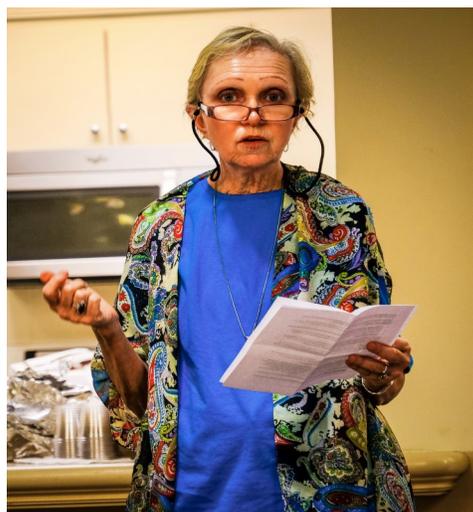


2017 Summer Potluck

On August 17, 2017 LCMG held it's annual summer potluck at Holy Trinity Episcopal Church.

Program speakers were, Julia Freeman, Debbie Murphy, and Cathy Shepard.

Photos are from this event.



Julia Freeman

Gave a presentation on the Spri-AMGA meeting She shared information about Million Pollinator Gardens and how we can participate in making our own home gardens and our LCMGA demonstration gardens into pollinator gardens. For more information go to <http://millionpollinatorgardens.org/>



Debbie Murphy

Shared about her home bee keeping with her husband. Their honey was provided for a tasty treat as Debbie gave details about bee keeping and urged the audience to consider the challenge.



Cathy Shepard

Spoke about Petals from the Past, the upcoming field trip on October 26 and the availability of advice on plants and planting with many native shrubs and perennials available for sale.



Raindrops and Mushrooms: Physics on a Small Scale

By Helen Czerski
WSJ August 19, 2017

Though we can't see it, mushrooms are firing minuscule cannons right under our noses. What's going on in that tiny world?

Dusk on a summer evening is the perfect time for a walk. Even in a city park, the greenery provides a warm oasis of calm and a chance to appreciate the details of nature that get lost in the sunshine. My favorite half-hidden treasures are the mushrooms, bulbous and placid, poking out from underneath fallen logs and piles of leaves and looking as though they don't quite belong out here in the light. But their serenity is deceptive. These mushrooms have a job to do, and evolution has given them a spectacularly clever mechanism for doing it. The task: to eject their spores and get them as far away as possible. The solution, hidden inside every mature mushroom you see: millions of minuscule cannons, powered by water.

We generally see water as passive, but it can shape-shift pretty rapidly when the situation calls for it. It is at its most beautiful when free: splashing, falling or jetting, sculpted by the ongoing tussle between its surface and the surroundings. Water molecules are spectacularly attractive to each other, so the ones that sit at the edge of a water droplet are constantly being pulled inward toward the rest of the crowd.

This means that the water surface behaves like an elastic sheet, continually pulling the surface into the smoothest shape possible. We call this surface tension.

One easy way to annoy a physicist is to show her a cartoon of a raindrop with a pointy end. Raindrops do not have pointy ends. Any temporary spike will get snatched back into the drop as quickly as possible, as surface tension corrects the anomaly.

The reality is far more interesting. As a raindrop is pulled through the air by gravity, it is buffeted and distorted. The push of the air and the pull of surface tension compete, flattening it out and making it wobble continually. Smaller raindrops are more spherical, because the dominant force at work depends on their size. The smaller a droplet, the more the inward pull of surface tension matters.

'A mushroom cannon can pack a mighty punch.'

And this is where the mushrooms get their firepower, because they have shrunk their operations to the tiny scales where surface tension is in charge. By using two microscopic droplets, each far smaller than the smallest raindrop, a mushroom cannon can pack a mighty punch.

The spore starts out gently attached to the end of a stalk, up inside the gills on the underside of the mushroom. Water vapor condenses out of the air, and because the right surfaces are covered in a sugary substance, two liquid drops of water form. One spreads out over the flat back of the spore, and the other is a tiny sphere just below.

The spore itself is less than a thousandth of an inch across, which means that both droplets have very highly curved surfaces. Having so much surface for such a tiny volume of water comes with a huge energy price tag. The molecules at the surface, which don't have other water molecules as neighbors in every direction, need some extra juice because they're held away from the crowd. The droplets grow slowly, storing up that energy.



Raindrops and Mushrooms: Physics on a Small Scale

(Continued)

The end, when it comes, takes less than a millisecond. As the spherical droplet touches the flatter one, a new combined surface is formed, one with a very deep, sharp notch in it. This is exactly the sort of pointy shape that surface tension gets to work on very quickly, and at these tiny scales, this force absolutely dominates.

As the notch snaps out of existence, the tiny sphere is yanked upward into the flatter droplet stuck to the spore, to make one new smooth drop. That upward momentum jerks the spore off its stalk, propelling it into the air at a huge speed for such a tiny object. The spore flies free (although plowing through the surrounding air soon slows its pace), and it drifts downward and out of the gills, escaping on to the breeze.

So on these summer evenings, I walk through the woods near where I live, looking out for mushrooms and thinking about the world that's far too small for me to see. The laws of physics are the same, however big you are, but the world of the small is a very different place.



ILLUSTRATION: BRIAN STAUFFER



Answer to Quiz on Page 2

Cucurbita foetidissima is commonly known as buffalo gourd and is native to the southwest, it's often recognized by its fetid odor and bitter gourds. Despite its odor, various Native American and Mexican tribes have used buffalo gourd for at least nine thousand years. It has been used traditionally in various ways as a food, cosmetic, detergent, insecticide and ritualistic rattle, to name a few. As research discovers the important resources of buffalo gourd's past, it can be expected this plant will become a valuable asset to the future.

The Medicinal Plants of the Southwest (MPSW)

Photos show vine growing and ancient Church in Pecos National Historic Park, NM



Answer to Visual Puzzle on Page 5



See upper left above lavender flower—antennas of what may be a bee.