**Why Leaves Change Color**

By Jan Bowers, Bristlecone Chapter (abridged version)

So much beauty in autumn yet always with a hint of sadness that the year is drawing to a close. Often at this season I remember a poem by Gerard Manley Hopkins that begins, “Margaret are you grieving/Over Goldengrove unleaving,” one of the few poems I once tried to learn by heart. Margaret cries over falling leaves, the poet says, because this will be her fate, too: ”It is Margaret you mourn for.”

“Spring and Fall” is one of the most poignant poems in English, and I love it dearly; nevertheless, I cannot help thinking that maybe what Margaret really needed at that point was not a poem but a brisk dose of science. Nothing like immersion in plant physiology to counteract our natural bent toward autumn melancholy.

Leaves can contain several kinds of pigments, primarily chlorophylls, which are green; xanthophylls, which are yellow; carotenoids, which are orange; and tannins, which are brown. In autumn, if temperature, moisture, and sunlight are favorable, leaves of certain species manufacture anthocyanins, which are red.

Chlorophyll is of the course the pigment that absorbs the sunlight that provides the energy for the greatest miracle on our planet, the conversion of carbon dioxide and water into oxygen and carbohydrates. Chlorophyll is not a stable molecule; it decomposes in bright sunlight and must be constantly synthesized anew. Plant physiologists have estimated that worldwide 1000 million tons of chlorophyll are synthesized and degraded every year. Not only are there a lot of individual leaves out there, but every leaf continually renews its supply of chlorophyll as long as it remains green. But, as Margaret discovered to her regret, nothing remains green forever. When nights lengthen in autumn, a layer of corky tissue gradually forms where leaf stalk meets twig, and water and nutrients can no longer flow into the leaf.

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**Why Leaves Change Color – continued**

in autumn, a layer of corky tissue gradually forms where leaf stalk meets twig, and water and nutrients can no longer flow into the leaf. Once its nutrient supply is disrupted, the leaf cannot continue to synthesize chlorophyll. As chlorophyll production declines, the green color of the leaf fades and other pigments are revealed, such as the yellow of xanthophylls in birch and cottonwood, and, at high elevations, the red of anthocyanins in red-osier dogwood and fireweed. As green pigment fades, the role of the leaf changes from manufacturing carbohydrates to recovering nutrients, especially nitrogen.

Chlorophyll itself cannot be exported from the leaf; it is a large and not especially mobile molecule. But the nitrogen that is attached to chlorophyll by chemical bonds can be exported, or at least some of it can. If nitrogen is to be moved from the leaf into longer-lived parts of the plant, the chlorophyll molecule must be broken down. As chlorophyll is split into smaller molecules with the assistance of enzymes, the leaf becomes vulnerable to light damage—no big deal in a leaf that is doomed to drop anyway, you might think, but before it drops the leaf has a job to do, and the recovery of nitrogen within the leaf is carefully organized to minimize light damage until the job is done.

In the final stage of breakdown, small colorless molecules called NCCs are made in vacuoles, which are storage bubbles within leaf cells. NCCs are effective antioxidants, but you need not feast on yellow cottonwood leaves to get their disease-fighting benefits. It turns out that pretty much the same process of chlorophyll breakdown occurs in ripening fruits, and NCCs therefore become concentrated in the red or yellow skins of apples and pears. Speaking as a grandmother, I’m pleased to inform you that your grandmother was right after all: an apple a day does indeed help keep the doctor away. And if that’s not a cheering thought in autumn, I don’t know what is.

**Adventures in Propagation**

**USE OF CUTTINGS – By Becky Mannion**

Back again! After a month of computer virus and other problems I am finally well enough to get back into action! This will be a short one, I have plenty of excuses, but I just ran out of time is all. We will start with cuttings this time with woody shrubs.

There’s a list of things you need to start out with cuttings. You will need trays and soilless soil. You can get soilless soil at the hardware store, it is called compost.

But before you start with that, you need to gather your raw materials. First we don’t put our cuttings in pots, we use trays. These trays are good for seeds as well as cuttings, but if all you have are pots you can start there. Use your clippers or even your scissors to gather your raw materials. Take branches, not clippings. The real work will be done at the nursery or at home where you can pull up a chair (or milk crate) put things on a table and concentrate on your work.

Work outside if you can since you will be creating quite a bit of “compost” if you are doing it right. (and why should you give yourself another job to do) Pull off the first sub branch. Cut off the growing tip, strip off 80% of the leaves, dip it in root hormone and stick it in the tray. If you are having trouble sticking it in the soil, use a chop stick to first make a hole, put in your cutting and press the soil around it.

Hormone treatment - I can’t say if it works or not. I haven’t seen a difference between what we start with or without hormone. If you are not getting the results you want first, then you can try the hormone to see if maybe that will work. Some things, particularly living things are unpredictable in their results.

There are several ways to remove a cutting from a branch. First and foremost, rip it off the branch. With the right plant it should have a tail on it. Second, the cuttings should be 4 to 6 inches. If longer then that, cut it into two. The uninjured one has just as much a chance to grow as the injured one. Then there is the cutting with a T base. This has proved less effective than the injury one. I did a large collection of one plant and of all the cuttings; the T’s didn’t make it.

Now and through January is the best time to start your cuttings. Most woody shrubs are dormant or semi dormant. Later we will cover naked shrubs, vines, root cuttings and anything else I can find. Until next month.

### Event Information on the Web


Jepson Chapter Updates

• Pacific Coast Iris Workshop
Pacific Coast Iris and its hybrids are one of the most sought-after native perennials. Both are low-growing beardless forms that bloom in early spring in a mélange of hues from white through pale cream to apricot, blue to purplish red. Needing little summer water after their second year in the ground, these irises are prized in rock gardens, woodland settings and under native oaks.

Iris needs to be divided periodically to look their best, and December is the perfect time for this task. On December 11, the Jepson Chapter is sponsoring a two-hour workshop to divide the iris growing at the Botanic Garden. Meet at 9:30 AM at the garden entrance. The park ranger will waive the entrance fee to the State Park. Clippers and gloves will be provided, but you can bring your own if you prefer.

We will replant a portion of the iris and pot the remainder. Participants will go through the whole process: division, trimming, potting and labeling, and be rewarded with an iris to bring home. Arrive rain or shine because we will have a protected work area. RSVP for this workshop by calling Dan at 707.980.4416 or datadcj@gmail.com.

• Fall Plant Sale Report
Our fall sale was held for the first time in conjunction with the City’s Arbor Day event at City Park. Big thanks to Mario Giuliani of the Benicia Community Services Department for organizing this event and going out of his way to accommodate our chapter’s sale.

The sale was a big success due to the great teamwork of our volunteers. Gene Doherty rented a truck to haul our plants to City Park. Sue and John Dean appeared from Sebastopol on both Friday and Saturday to help haul plants. Karen Prow took time off from classes and a Merritt College sale to help. It was great seeing you all again. Belinda Smith researched and printed new plant signs and they were a big help to our volunteers as well as the buyers. Becky Mannion, Barbara Reiley, and Steve Goetz helped all the way through. Gene was at the information booth all day and brought in eight new members. Bert Johnson helped identify plants with lost tags and was a valuable resource for our buyers.

Other member of our volunteer team included Dan Jenson, Sue Maddux, Joni Grisham, Linda Sonner, Norma Deaner and Jane Boegner, By Sue Wickham

• January Talk on Jepson Prairie
Ben Wallace of the Solano Land Trust will be the featured speaker at our General Membership meeting in Benicia’s Heritage Presbyterian Church on January 24th at 7 pm. He will present the results of 10 years of monitoring that volunteers have done at Jepson Prairie and invite all to become docents at the Prairie. Docent training begins in February and covers the plants and invertebrates that live in the vernal pools. The docents provide tours of the pools for a limited number of months and are trained by UC-Natural Resource Reserve System.

Remembering George A. Harris (1923-2010)
It is with immense sadness that we report the death of one of our pioneer members, George A Harris, on October 2nd of T-cell lymphoma. George served as our Chapter Co-Secretary with his wife Jean in 2000-2001. Together, they located a place for our monthly Chapter meetings, and made their home available for Chapter officer’s meetings.

George was involved in many worthwhile volunteer activities for our Chapter and the community. He designed the shelf and solar fan system at our BSRA greenhouse which allowed needed air flow around the seedlings. With Gary Brogan, they assembled the greenhouse and storage shed. When Gary was working on the layout for the Botanic Garden, he was hindered by the lack of a good topographical map. George, on his own, borrowed some survey equipment, which allowed development of the Garden’s topographic map which is serving us well to this day. George was a Master Gardener, a crossing guard for Robert Semple School, and volunteered with the Habitat for Community.

George was a "90 Day Wonder", a term used to describe fast track people during World War II. He was in an accelerated degree program for military leadership, graduated in 1944, and served in the Navy till 1946. A year later, he received his master's degree in mechanical engineering and became accomplished as a design engineer in a variety of industries, including computer-peripheral equipment, planetarium, optical lens and aerospace equipment.

By Gary Brogan and Norma Deaner
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