If you're feeling overwhelmed or stressed right now, go to MRU's Early Support for help.

Remember: Monday, Oct 12 is a holiday!

BIOBEAT

Oct 6, 2020

Fall, the eponymous season

There are some amazing colours in and around Calgary right now. But why do leaves change colour and fall off? Here's our very own Associate Dean of Research, Dr. David Bird to tell us:

As deciduous (from Latin, decidu-us, 'to fall off') trees are now shedding their leaves we are forced to accept the awful truth: "Well Crap, there goes summer." Have you ever stopped to ask how and why trees are shedding their leaves? What are the biological processes underlying the changes in colour and the shedding of organs that just a few days earlier were firmly attached to branches and stems? First, let's step back and think about what leaves do for trees.

Deciduous leaves are solar panels having one purpose: capture light energy and store it as chemical energy in the form of sugars. And leaves are efficient - they maximize surface area to collect light energy while minimizing cost in the form of biomass. Leaves are broad, but flat: typically only 10-20 cells thick, but 10,000s to 100,000s of cells across! While this is a great adaptation for capturing sunlight, these thin, fragile, sugar-factories are not designed to survive freezing temperatures. Trees that have adapted to temperate climates abandon these fragile organs. But before doing so, much of the biomass in leaves is recycled, particularly nitrogen.

Over 70% of the proteins in leaves are found in chloroplasts, the organelle responsible for photosynthesis. Much of this protein is hydrolyzed and the amino acids are stored in the stems as storage proteins (Hm, is that how deer get their nutritional needs from eating branches in the winter?!). The breakdown of these proteins results in the loss of the major pigments, chlorophyll a and b, leaving behind only accessory pigments, mostly carotenoids, such as beta-carotene, a major pigment also found in carrots. The accessory pigments aren't as valuable to the plant, not containing any nitrogen. Hence, this is why senescing leaves take on yellows, oranges, and reds. The different colours that leaves can take on largely depends on the kinds of carotenes the particular species of tree makes and, as you can see for yourself, this varies from leaf to leaf even in an individual tree.

Leaf senescence is complex, involving the coordination of many biological processes not only of recycling proteins involved in photosynthesis, but also programmed cell death (apoptosis), and organizing the abscission zone – the location where the leaf will be severed from the tree. Abscission in itself is a highly coordinated process: a few layers of cells near the stem are triggered to undergo apoptosis, while an adjacent layer, nearest to the stem, secretes suberin, a waxy polymer that seals the site where the leaf had previously attached.

While much of the process of leaf senescence is understood at a biochemical and genetic level, it continues to be an area of intense study, with the potential of large economic rewards. For example, many crop plants such as soy bean will respond to mild drought by shedding their leaves (remember: disposable solar panels) in order to conserve water. Understanding and possibly tweaking these responses could lead to huge crop improvements.

THE LEAVES DON'T LAST LONG, GET OUTSIDE

Do you know what 'eponymous' means? Look it up :)