

What to look for outdoors in Autumn

The Science of Autumn Colour

This resource sheet is probably more suitable for children aged 6-11 but if you've a fascinated 4 or 5 year old, I'm sure they'll enjoy it too!

Gold, purple, brown, yellow, orange, red – and green! All these colours are shouting at us in autumn.

But what is going on inside the leaves?

✓ We know the leaves are about to fall (in America, people call the autumn 'fall').

Colours within leaves

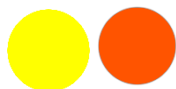
Using specialised equipment and chemical analysis, scientists have found that in leaves there are 4 substances each with a distinctive colour.



A green substance that captures energy from light. It is the worker.



It is **chlorophyll**. 'Chloro' is green, and 'phyll' leaf.



Yellow and orange substances that help chlorophyll to capture light energy. They are the helpers.



Yellow The yellow substances are **xanthophylls**. We say zan'-thoh-fills. 'Xantho' is yellow.

Orange The orange substances are called **carotenoids** (a bit like carrots!).



'Blue to red' substances (which includes purple) that protect the leaf.



They hide the leaves from herbivores that can't see red: they camouflage the leaves.



They are **anthocyanins**. We say an-thoh-sigh'-anins. 'Antho' is an ancient-Greek word meaning flower and 'cyan' is a shade of blue: blue ink for printers is labelled 'cyan' (we say sigh-ann'). Anthocyanins are found in 'red to blue' flowers where they *attract* insect pollinators.



Brown substances that preserve plant parts. They protect the leaf from light damage and their bitter taste deters animals from eating the leaves.



They are **tannins**.

Tannins are used to soften and to preserve leather. Tannins are found in most parts of plants and, in leaves, it is held in their waxy surfaces. There is lots of tannin in oak bark which used to be a major source of tannins for leather working.

So what is happening in autumn?

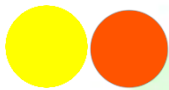


Chlorophyll masks the xanthophylls and carotenoids.

Chlorophyll is precious, and it has to be continually renewed.

In autumn, the tree stops renewing chlorophyll. Daylight hours are reducing and it is no longer worth using the chlorophyll to capture the reduced light energy.

Any remaining chlorophyll is broken down into its elements and they are taken back into the main body of the tree to be stored until needed in spring.



Xanthophylls and carotenoids are revealed when the chlorophyll is no longer there.



Anthocyanins start to be produced in the leaves turning them red or purple. The anthocyanins will hide the leaves from herbivores.



Gradually all the pigments fade and only the brown tannin is left.

Some trees are slower than others to stop renewing the chlorophyll in their leaves. Their leaves will still be green. Also, a tree might stop renewing the chlorophyll in some leaves before others so that it has some green leaves and some yellow/orange or even red/purple leaves.



Here is a dogwood leaf that I noticed. See how a leaf above must have shaded the part that is now yellow. The shaded part would have been getting too little light for it to be worth renewing the chlorophyll in it. Without the chlorophyll to mask it, we now see the yellow of the xanthophylls.

We can also see that purple anthocyanins have begun to be made in the rest of the leaf.



Chlorophyll, xanthophylls, carotenoids, anthocyanins and tannins are all **pigments**.

Pigments are substances that determine what colour we see.



Pigments work in a particular way: they determine what colour we see by absorbing some colours (wavelengths of light), and reflecting others.



For more things to do and more information about trees, see Hello Trees Resource Sheets at <http://hellotrees.co.uk/>