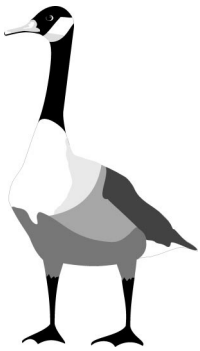
Stings and Things

an investigation into pH

by Dr Louise Naylor
of the University of Kent at Canterbury*

bbsrc
biotechnology and biological sciences research council

Being stung hurts! But why? And what can you do about it?



We've all heard of dock leaves being good for nettle stings but I bet you've never tried this folk remedy -

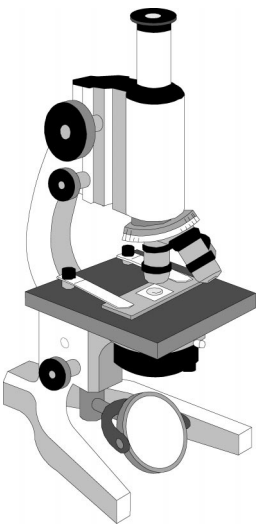
A plaster made of wilde malowe leaves is good to draw out the stinge.
The donge of a goose draweth out the venom of any wasps.
And salt and vinegar tempered with hony is very good.
Oyle of bay is good also for the stynge.

J de Cuba, Hortus Sanitatis, 1491

Would these remedies work? Is there any science behind such ancient cures?

Experiment 1 - how do nettles sting?

Ask the children to collect and study some nettles.



Remind them that, to avoid being stung, they need to wear protective gloves so that the nettles do not touch their skin (thick gardening gloves or plastic washing up gloves are ideal). You might prefer to collect some nettles and mount small pieces of nettle leaf onto microscope slides, adding a slide cover, *before* the investigation begins.

Let the children study the nettle pieces under a microscope and make observations. If you do not have access to a microscope, ask the children to study the photograph on **worksheet 1** and describe what they see. How do they think nettles might sting?

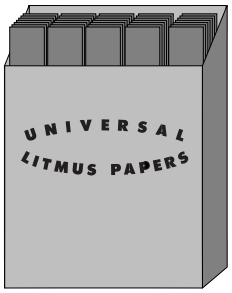
*(adapted from a COPUS funded project by Dr Frank Burnet and Mr Ray Newsam)

You can point out that, as the children are thinking about the problem and examining it closely, they are being **scientific**. The next thing a scientist would do is to develop a **hypothesis** - a description of what is happening or what will happen and why - and then test this hypothesis to see if it is correct.

Our hypothesis is:

that some stings are caused by substances that are acids and some are caused by substances that are bases (alkalis) and that we can treat a sting with the opposite substance.

Briefly, discuss acids and alkalis with the children and ask them to list as many acids and alkalis as they can.



Experiment 2 - testing household substances

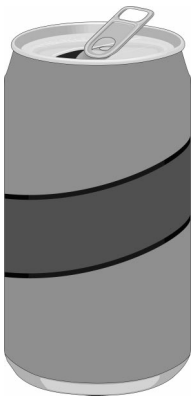
Purpose: to find a way of telling the difference between substances that are acid and those that are alkali.

Method: ask the children to take a piece of litmus paper (litmus paper can be blue or red) and dip it into the solution they want to test. If the **final** colour of the strip is **red**, the solution is **acid**. If it is **blue**, the solution is **alkali**.

1. Ask the children to test a range of common household goods using litmus paper to find out if they are acid or alkali*.

   Suggestions;
   Acid: vinegar; fizzy drinks such as lemonade; lemons and lemon juice.
   Alkali: diluted baking soda; milk; washing up liquid; toothpaste; soap.

Acid



Alkali

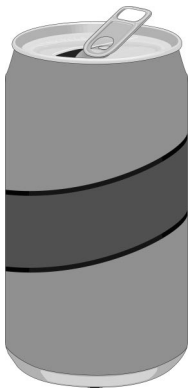
*** The Association for Science Education's primary science booklet *Be Safe!* contains useful guidelines on suitable substances for classroom investigations (p14-15).**

2. Now offer the children some **pH indicator strips**, explaining that scientists like to *measure things accurately* rather than just describing them. Their next step therefore, is to re-test each household substance using the special *sensitive* pH strips and to assign a number called a **pH value** to each one by *comparing* the colour of the strip to a pH colour chart.

   If the value is between pH1 and pH6 the substance is an **acid**.

   If it is between pH8 and pH11 it is an alkali.

   A substance with a pH of 7 is **neutral**.



pH value: _____

Acid or alkali _____

Experiment 3 - testing the pH of nettle venom and dock leaf sap

Purpose: to measure the pH of nettle venom.

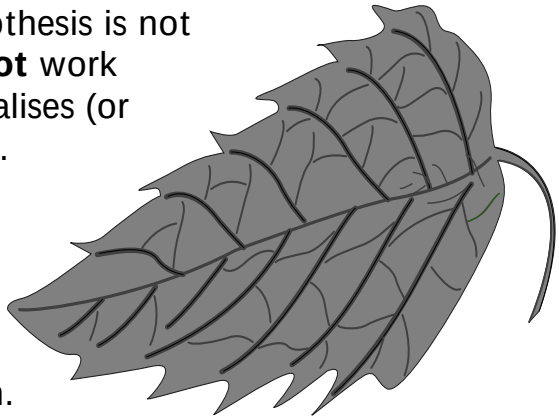
Method: ask the children to develop their own methods. Remind them that they should wear gloves whenever they handle the nettles. Allow them to choose from a selection of basic equipment including scissors, dishes and litmus paper strips. They should be encouraged to write an account of the investigation: *what they tested; the materials they used; their method; how they kept the test 'fair' and their results.*

The children should discover that nettle venom is **acid** (it actually contains *oxalic acid*).

Now ask them to repeat their experiment - this time testing **dock leaves** - to see if the hypothesis is correct.

Is the hypothesis correct in this case?

The answer is no. The children should discover that dock leaves are also **acidic**. Therefore the hypothesis is not proved in this case. The dock leaf does **not** work because it contains an alkali which neutralises (or cancels out) the acid of the nettle venom.



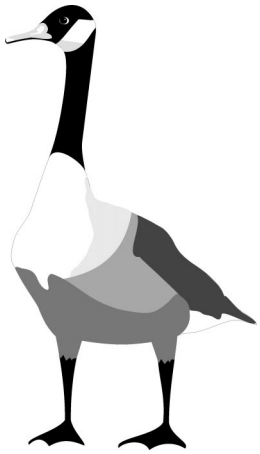
So how does it work?

Dock leaves actually help relieve a nettle sting because rubbing vigorously releases moist sap from the leaves which has a cooling, soothing effect on the skin.

Testing the hypothesis further

As a final exercise, the children might test their hypothesis further by predicting which of the household substances they have already examined should have a neutralising effect on a nettle sting.

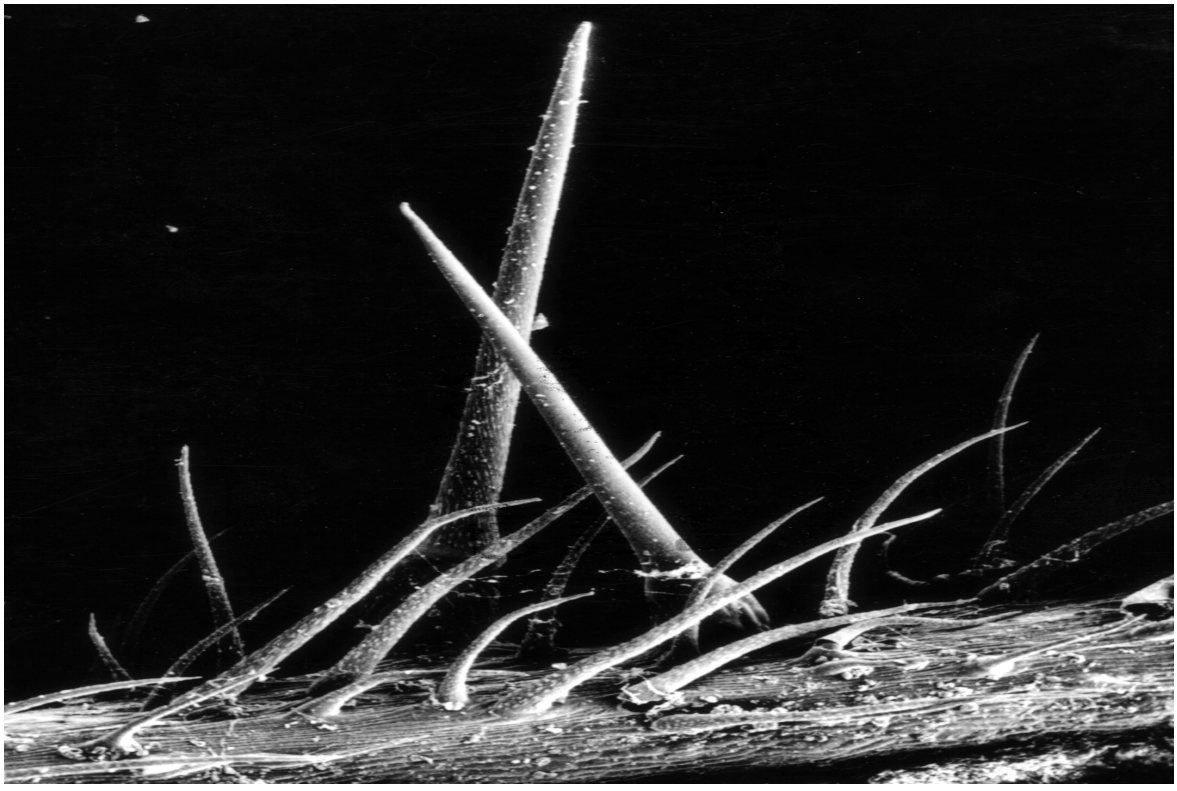
They should suggest that the substances which are alkaline like diluted baking soda, milk and toothpaste could have the desired effect.



Note: If you can find some goose dung and can bear the thought of testing it, you will find that it is alkaline and **will** therefore neutralise the acid venom of nettles and wasps and so relieve their stings. So the remedy suggested in 1491 would be effective ... if a little smelly!

Finally....

Leave the children with the thought that some remedies for stings do work well - but not because they neutralise the venom. Like the dock leaf, they work in other ways and for other reasons - to find out the 'how' and 'why' requires more experiments...and that's what science is all about.



Worksheet 1: A highly magnified image of the surface of a nettle stem.
Photo courtesy of the Mr Ray Newsam, University of Kent at Canterbury.