




EXPLORE OUR WORLD

SSERC BIOLOGY

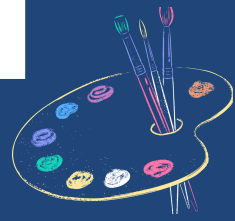


Fieldwork is a valuable part of the biology and environmental science curriculum. Its inherent interest for many young people can make it a powerful motivating influence. It can encourage an appreciation of living things and help develop an understanding of the relationships between living things and their environment. It can illustrate the practical need for conservation and thus contribute to their development as responsible citizens and effective contributors to environmental concerns.

(SSERC, Materials of Living Origin)



NATURE'S PAINT PALETTE



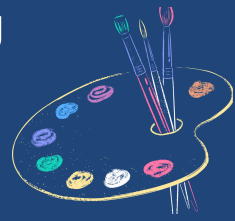
Challenge 3

You have joined a Nature Reserve Environmental team and a local artist, Marissa, has contacted you about sustainable paints she can use in her art work. Your task is to investigate natural pigments that can be extracted from local flora and share your findings with Marissa. You must include a detailed, replicable method and images to show the ink source and final colour on paper.

Outline of the task:

- Identify plant species in your local area using a variety of resources.
- Use extraction techniques to isolate the pigment.
- Investigate how to store and preserve the pigment over a period of time.
- Produce a sample paint palette that Marissa could use.
- Explore the wider Scottish folklore of the plants you find.

THE FORAGING CODE



Your responsibilities as a global citizen

"Only take what you need" is a good working principle when foraging. The Scottish Outdoor Access Code allows you to go onto most land as long as you behave responsibly. It is based on three principles:

1. Respect the interests of others
2. Care for the environment
3. Take responsibility for your own actions.



You will work in pairs for this protocol – however, this is only a guide and you might find suitable adaptations you can make to the protocol to improve the quality of your pigments.

Remember to note down any adaptations you make so future scientists/artists can replicate your method – this is good science practice. There are several steps from sample collection, identification, research, pigment extraction and pigment testing. Collate your findings as you progress so you can report back to Marissa with an accurate account of your research.

AIM

The aim of this experiment is to identify local flora and extract natural pigments.

METHODOLOGY AT A GLANCE

In this experiment, you will identify plants in your local environment and extract their pigments. You will then learn how to store these to minimise microbial contamination and growth. Prior to submitting your report to Marissa, you must test your samples to provide an indication of the expected range of colours she can achieve in her artwork.

MATERIALS REQUIRED (PER PAIR)

- Plant materials, e.g. leaves, berries, bark, lichen, food waste.
- Smartphone or device with the PlantNet app installed (for plant ID)
- Knife
- Chopping board
- 2x 250ml beaker
- Heat block
- Water
- Filter funnel & muslin / sieve
- Storage container, e.g. jar / universal
- Marker pen
- Gum arabic or honey
- 3ml pipettes or measuring cylinder
- Stirring rod
- Balance
- Spatula
- Antimicrobial agent, e.g. salt / tea tree oil / whole cloves / peppermint oil (one of these)
- Paper or card to test ink
- Paint brush

METHOD

EXTRACTION OF NATURAL PIGMENTS

Create paints following a traditional process that involves blending natural pigments, water, and binder (e.g. honey or gum arabic), to form portable natural inks.

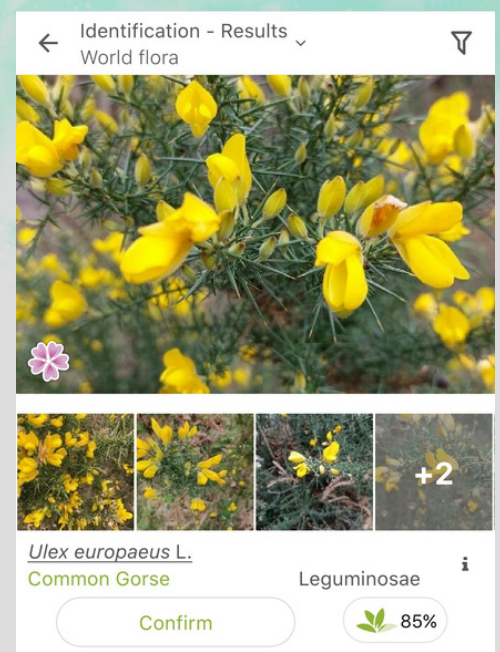
STEP 1

Identify a suitable location for foraging. Look for a range of materials, varying in colour, e.g. leaves, bark, berries, petals, lichen. Even food waste can provide a source of ink, e.g. avocado or onion skin, coffee, tea bags, red cabbage). Remember to read the health and safety advice associated with this guide.



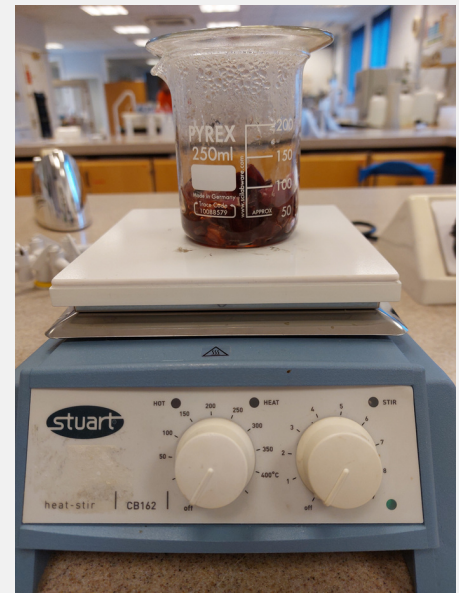
STEP 2

Use the PlantNet app to identify the plant you have taken your sample from. Take a photo of the sample and record the name in your lab book.



STEP 3

Chop your plant material into smaller pieces and add to a beaker along with enough water to cover the plant material. Place the beaker on a heat block for 30 minutes on a low-medium heat. Alternatively, if doing this in a kitchen, simmer in a pan (for 30 minutes) with enough water to cover the plant material. Transfer the plant material/water mix to the fridge until the next lesson - this will allow colours to intensify.



STEP 4

Filter the extract through muslin into a clean beaker.



STEP 5

At this stage, various modifiers can be added to the beaker to adjust the colour. Some suggestions are listed in the orange box. 1-2ml of the modifier can be added to the filtrate using a plastic pipette.

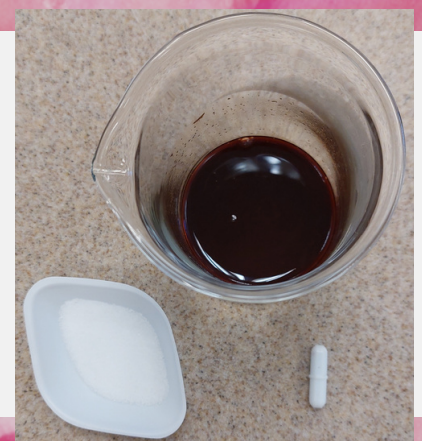
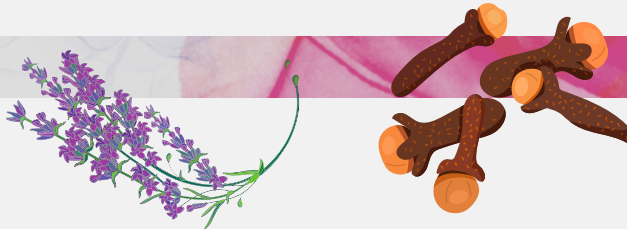
Modifiers include:

- lemon juice
- vinegar
- aluminium sulfate
- copper sulfate
- iron sulfate
- sodium carbonate.



STEP 6

Add 5g salt to the filtered extract. This will serve as a preservative to minimise microbial contamination. A variety of different natural anti-microbial agents can be used, including cloves or tea tree oil.



STEP 7

Add 10ml of gum arabic or honey to the filtered extract. This will allow the ink to thicken. Use a stirring rod to mix.



STEP 8

Pour the ink into a container, e.g. a universal or autoclaved glass jar.

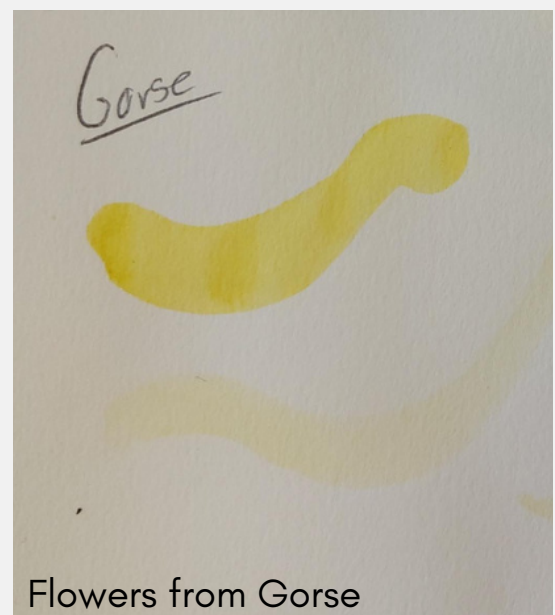


STEP 9

Test your ink preparations using a wooden splint (or paintbrush) and a piece of paper or card. Note changes as the ink dries on the paper. In your lab book, record the "ink source" alongside a swab of the ink.



Hawthorn berries



Flowers from Gorse

METHOD

TESTING YOUR PIGMENT

Now you have extracted your pigment, it is time to test it. Join forces with the rest of your class to create a colour display of the natural dyes you have produced. The medium you paint onto will impact the colour. The work by Ellie Irons, below, may inspire you.

Ellie Irons

ARTIST

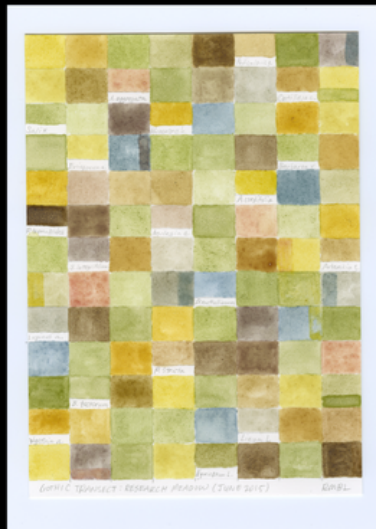
Ellie Irons was born in Northern California and studied art and environmental science. She is an artist passionate about public fieldwork and urban ecology. She has created artworks (see below) using pigments she has extracted from wild plants in various geographical locations.



Brooklyn, Summer 2015



Colorado, Summer 2016



REPORTING

RESEARCHING YOUR PLANTS

You are ready to submit your report to Marissa on local flora she can use to create a colour palette for her artwork. As part of your report, you must include some interesting facts about the plants you have chosen to include. Why not delve into Scottish folklore and learn more about the history of our native plants? The [Scottish Wildlife Trust](#) has some interesting articles to get you started.

PLANT

HEATHER



STORY

White heather is lucky, don't you know? The story goes that a warrior left to fight in a battle, promising to marry his partner upon his return. The day never came and, instead, a messenger carrying a sprig of purple heather informed her of the warrior's death. She wandered the hills, inconsolable until the purple heather turned white. Those who stumble upon white heather are blessed with good fortune. Or so the story goes...



REFERENCES

The methodology and background information was sourced from:

Logan, J. (2018), *Make Ink: A forager's guide to natural inkmaking*, Abrams, New York.

The [Scottish Outdoor Access Code](#) website was used for outdoor access information.

The [Scottish Wildlife Trust](#) website was used to learn about Scottish Folklore.

The following book provided background information to relevant Scottish plants:
Kenicer, G.J. (2018), *Scottish Plant Lore: An illustrated flora*, Royal Botanic Garden, Edinburgh.

[Young STEM Leader Programme](#) at SSERC

[STEM Ambassadors in Scotland](#) at SSERC

