THE ROYAL SOCIETY

Dock leaves soothe nettle stings: can chemistry explore this well-known remedy?

1. Project overview

Through this project students will be able to investigate the chemistry behind the well-known remedy of dock leaves being used to soothe stinging nettle stings. They will discover more about the pH of plants and neutralisation, learning about how the growing cycles and conditions may affect their results. Working with their STEM partner, students will be able to explore different variables that may affect pH, communicating their findings with the wider school community. Linking strongly to the curriculum, this project will enable teachers to inspire the next generation of chemists. Details of the investigative work required to support this project can be found in section 4.

Duration of project
2 terms minimum to cover seasonal variation. Easily repeatable year-on-year
Collaborative project run across multiple schools, each receiving own grant

2. Student involvement

This project is aimed at primary or younger secondary school students aged between 7 – 14, however, it could be adapted to suit other age groups and abilities. This project can be adapted to suit large groups, from clubs to whole year groups or larger, and we encourage projects to be as inclusive as possible. The project can be used to engage a wide variety of students in the school. For example:

1) older students mentoring younger years to engage with the observation and monitoring sections of the investigation
2) students with an interest in art and design helping to communicate the findings of the project to the wider school community via media such as video, posters etc.

3. STEM partner involvement

Funding will only be offered to schools that can demonstrate a strong partnership. The partnership can either be with one individual STEM partner or a team of STEM partners. If there is a team of STEM partners, one must be identified as the lead STEM partner for the application process and must have sustained and meaningful engagement (in-person or online) with the students and teacher throughout the duration of the project. Other STEM partners in the team can support the project, if needed, to provide specialist knowledge or to help spread the time commitment and ensure the students have regular STEM partner engagement. For a two-term project such as described here, we would expect a ***minimum of 7 in-person visits over the course of the project***, undertaken by any of the STEM partners involved. The STEM partner(s) will provide the students with relevant guidance and knowledge to help them with their investigations, as well as an insight into potential careers.

The main role of the STEM partner(s) is to support the planning, design and implementation of the investigation that the students will carry out. Examples of how the STEM partner(s) could support the implementation of the investigations include (but are not limited to):

- supporting students to form their own hypotheses
- supporting students to set up their investigations following the scientific method
- helping provide secondary research sources and support the understanding of technical information
- helping with data collection and identification

- helping the development and implementation of student plans to test the PH neutralising effects of plants
- helping with any building or design elements

Other activities that the STEM partner(s) could get involved with are:

- arranging a visit to their place of work
- providing an introductory talk to the project group, or whole school, regarding their career and the relevance of this to the project being undertaken; and
- supporting the students end of project presentations.

Examples of STEM partners that could support this project are university or industry-based researchers, with a degree or equivalent background in a subject such as chemistry, horticulture and plant sciences. Professionals who are working in chemistry or horticulture-based roles.

For more information about the STEM partner eligibility requirements and guidance on how to find a STEM partner, please read the What is the partnership page on our website.

4. Investigation options

The following investigations described in the plan below will underpin this project and help the students answer the project title question. Please note some of the investigations may need to take place in parallel rather than sequentially throughout the year. The individual investigations suggested may need to be adapted or altered, dependant on the school grounds and habitats available locally. Teachers can also add in additional investigations and other project elements as required.

Project plan	**Equipment suggestions**
Initial survey: Identify the habitats that nettles and dock leaves are found in and survey the school grounds (and/or local area) to see if students can identify areas where the plants are growing using visual observations. Ensure to take samples.	Plant guides Gardening gloves to handle samples
Secondary research: Carry out secondary research to learn about how stinging nettles 'sting', including the pH scale and neutralisation (can be done as a lesson activity). Use dilute acids and alkalis to create a visual pH scale learning pipetting skills.	Universal indicator pH charts Test tubes Test tube racks
Baseline investigation: Plan and undertake an investigation to determine the pH of both the nettles and dock leaves, considering variables such as the part of plant used (leaf, stem, root) etc. Make predictions as to whether the dock leaf could be used to neutralise the nettle, and then test the hypothesis using leaf extracts and see if the data confirms or disproves the original predictions.	Centrifuge, micropipettes, safety goggles If in a primary school: pestles and mortars spotting tiles ethanol

Investigation (please choose at least 2 of the following or add your own investigations in to create your full project plan)**:** 1. Does the pH of nettles differ? Comparing to the baseline data and process, test for the pH of nettle samples collected considering variables such as: • location (road, busy pavements, edge of fields etc) • stages of their life cycle? (seasons, flowering, dying back etc) • grown in different parts of the country (compare data with other schools taking part in the project using #PGprojectNettlepH) • cultivated (school grown) nettles with different soil / nutrition or water amounts Predict what effect each variable may have and suggest reasons for any differences in pH observed. 2. Repeat investigation 1 but for dock leaves. (share results using #PGprojectDockpH) 3. Explore if there are alternatives to treating nettle stings, and if so, how they work. Based on this research, propose and undertake a test to try other locally sourced materials (plants or food items etc) that could be used to neutralise the pH of the nettle stings.	Polytunnels, pots and soil to grow controlled samples of nettles and dock leaves, other gardening equipment if required. Various household substances to test.
Wider communication: Communicate the results to the wider school community via a public information campaign, Sharing information such as: if people are walking in the woods is there a particular item/sample they should carry with them in case they get stung?; methods could include information leaflets/posters, school assemblies, getting other years practically involved in the project, or a short film.	Please note: additional film grants towards a camera / software / microphones etc. are available to Partnership Grant holders.

A suggestion of essential equipment and supplies needed to undertake each of the parts of the project has been listed to assist you when putting together your budget. Please also consider any relevant additional costs permitted within the scheme, such as teacher cover, essential teacher CPD and/or travel costs for project related visits. For more guidance please read the eligibility and judging criteria page on our website.

5. Benefits and skills

Involvement in a long-term investigative project should enable students to have an in-depth experience of working scientifically as well as developing their general team working and communication skills.

Through this project the students will specifically learn about the chemistry of plants in a real-world context, gaining detailed knowledge about the pH and neutralisation processes between nettles and dock leaves and a broader understanding of how growing conditions and plant lifecycles can affect the

measured pH of a plant. They will learn skills in research, observation, identification, data capture, data analysis and problem solving. Dependant on the exact investigations and activities you propose to undertake, there may be additional benefits and skills you can identify in your application.

6. Legacy activities

It is important that Partnership Grant projects are sustainable, providing long-term benefits to your students and wider school community in terms of the teaching and learning of STEM subjects.
Your legacy activities could include (but are not limited to):

- repeating the project with successive year groups
- re-using the equipment to monitor and identify other plant species that may be able to be used to neutralise stinging nettles
- test out other variables for the dock leaves and nettles, such as variety and age of plant (new vs mature)
- expanding the project to include other schools in the area, loaning out any equipment to collate more evidence to compare with your own.

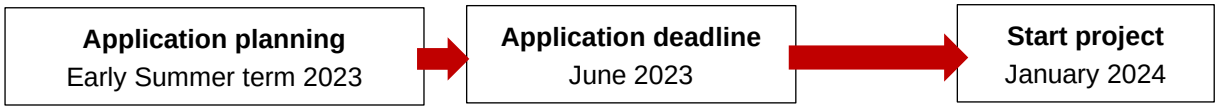
7. Next steps

1 - Securing your STEM partner

Using the information about STEM partners above, search for universities and businesses within reasonable travelling distance to you that might have suitable contacts to approach. A good route to finding these contacts is often your own school's Governors and student's parents, another is the national STEM Ambassador scheme. Once you have a few contacts in mind, write an email/letter inviting them to be involved in the project, providing clear and concise information about areas you need support with, the time commitment you are expecting, and the duration of the project. If you need further advice as to how to find a STEM partner, please contact the Schools Engagement team directly via education@royalsociety.org .

2 - How to start an application

This project is ideally started in the spring term to allow the project to run to the end of the academic year. To get the funding secured and paid in time, you will need to submit the full grant application for the June deadline in the academic year before. An example timeline is given below, and more information about The application process and timelines can be found on our website.



You can access the application form via the Royal Society's grant management system called Flexi Grant: https://grants.royalsociety.org/. When you first create your log-in and access Flexi Grant several grants will be visible on the screen. Please make sure you choose the ***Partnership Grants stage 1*** form to start.

3 - Where to get more information

You can find full information about the Partnership Grants scheme, including eligibility and judging criteria, application guidance and exemplar forms via our website: www.royalsociety.org/partnership

If you have specific questions about your project idea, STEM partner or application, please either attend one of our online training sessions or please contact the Schools Engagement team directly via education@royalsociety.org .