Developing practical skills in drug discovery and screening for a diverse student population

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Background

- When challenged to deliver a science practical class on the topic of drug discovery for a diverse student population reading subjects ranging from anatomy to divinity (See Fig 1.), it is difficult to ensure the activities are both rigorous and accessible.
- We created simple but effective scientific tasks to help students understand the challenges of extracting potential drugs from natural products.
- Drug screening was simulated using proprietary drugs to develop student awareness of strengths and limitations of such analytical approaches.
- Through various iterations, we have found that very simple scientific practical skills are most effective and reliable in delivering an effective student learning experience.

Figure 1. Degree intentions of students attending drug discovery practical in one example year group.

As a result of Curriculum Reform, students at Aberdeen are encouraged to study some courses outwith their main discipline to provide educational breadth.

This may mean that a course's population can be exceptionally diverse.

Aims

- The aim was to design an accessible but rigorous laboratory practical that would introduce the students to the challenges of extracting and quantifying a potentially therapeutic molecule from natural products such as plant material.
- The session also aimed to introduce students to the issues surrounding some basic drug screening methods commonly used in sports or workplace environments.
- Students also had to undertake reading about the ethical issues surrounding drug screening and the problems involved in bringing a naturally-derived pharmaceutical to the market place.

Methods

- Students provided with pulped batches of a wide variety of fruit/vegetable samples.
- This allowed us to inexpensively use large amounts of plants-based material even during the winter term in the north of Scotland.
- Students aimed to extract and quantify ascorbic acid from their samples, with groups having different ones so we could compare across the class. We repeated some samples across groups to show how variable the results could be (See Fig. 2).
- Some samples were heat treated to show effects of processing.
- Used basic titration technique against DCPIP as all students from all backgrounds found this easy to understand.
- For the drug screening experiment, students had to test various over-the-counter (OTC) drugs with a variety of reagents to try and work out what their two unknown samples were (see Figs. 3, 4 & 5).
- Students were provided with a range of analgesics and antacid drugs to provide a variety of results.

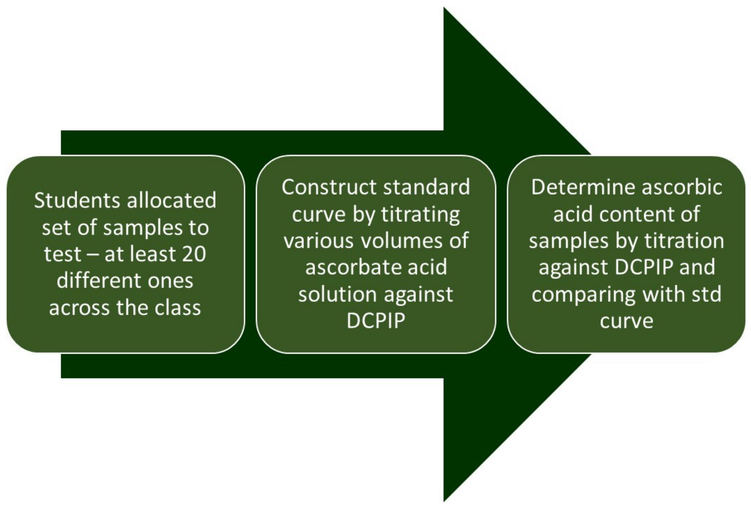

Figure 1. Outline protocol for natural product extraction and quantification.

We chose a simple but effective protocol that all students would understand but that would allow them to be accurate and undertake a large amount of practical experimental work.

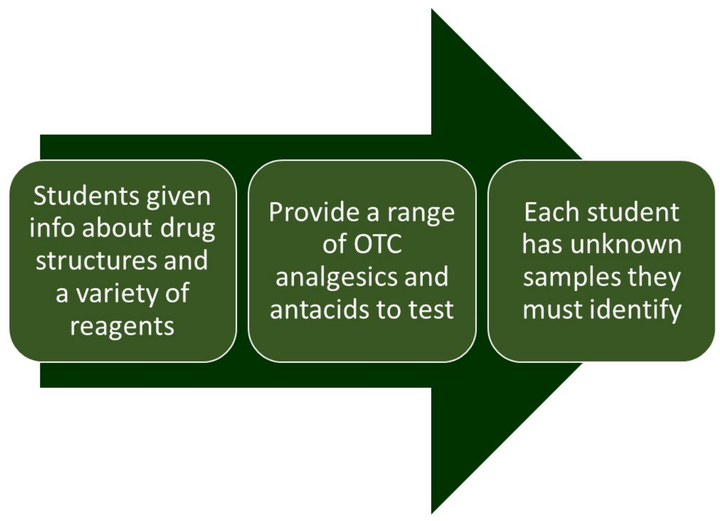

Figure 3. Outline protocol for drug screening experiment.

These pharmaceutical are easy to obtain in greater quantities for a larger class.

Most of the students can easily find out about their structures and modes of action.

Samples can be ground up to make it harder for the students to guess which is which.

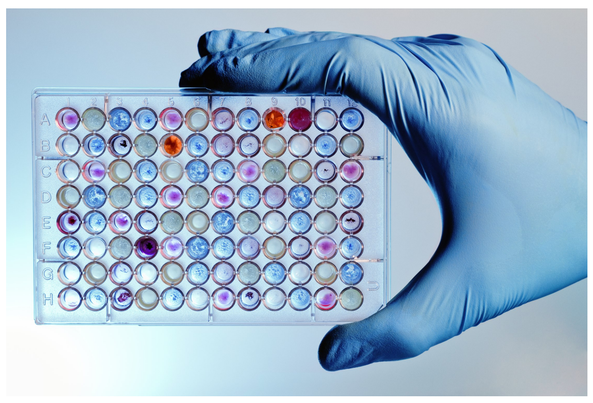

Figure 4. Example of 96 well plate screen.

Students tested samples in 96 or 48 well plates to more easily compare across all samples.

Students encouraged to think about how they will organise samples and most efficiently conduct the screen.

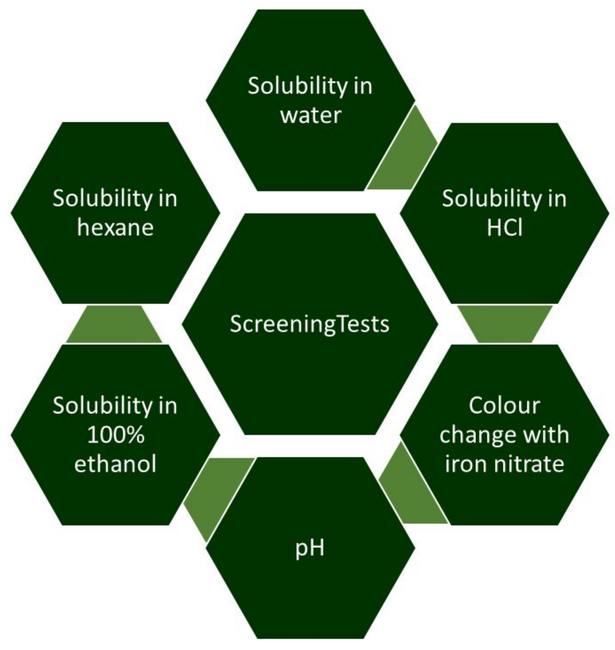

Figure 5. Basic screening tests students can use to identify samples.

Reagents used are cheap, easy to use and relatively safe when used for a class of over 100 students of varying abilities/backgrounds. Students are encouraged to look at the 'global' set of results and the accuracy/specificity of the test, rather than just relying on one piece of data.

Results & Conclusions

- This practical has one of the highest throughputs in terms of student numbers in our school but is relatively easy to set up and operated with a variety of different staff and student populations.
- Students feedback has been overwhelmingly positive from both anonymous class surveys and staff-student liaison committees.
- Students from non-science degrees indicate that they feel they can do the practical work and are not overwhelmed by joining a science class.
- Students focus more on accuracy and the wider issues surrounding the topic than worrying about how to operate expensive or complex equipment.
- Data gathered during the practical is written up by students for assessment in the form of an abstract that they might present at a scientific meeting.
- Students also have the chance to produce a short review article regarding the scientific evidence that supports the clinical effectiveness of a naturally-derived molecule of their choice.
- The robust nature of this practical and its accessibility have made it very popular amongst staff and students.