DNA barcoding brings ‘real-life science’ into the classroom

Squishing up strawberries with some kitchen detergent is about as close as most kids get to DNA at school, says science educator Pauline Charman.

But now, as part of The Australian Barcode for Life Project, high-school students will have, in their own words, ‘an opportunity to work with technology we’ve never heard of before’ to undertake ‘science that can make an actual difference.’

In 2019, Ms Charman learnt about miniPCR machines, a safe and portable version of the equipment used by scientists to make millions or more copies of a DNA sample so that it can be analysed in detail. Her discovery sparked a big idea: a project to inspire school students to engage with STEM subjects (science, technology, engineering and mathematics) by contributing to the work of conservation scientists as they identify, map and monitor native species.

‘My dream is to give much needed hope to our young people by allowing them to actively and tangibly contribute to securing what’s left of Australia’s biodiversity,’ Ms Charman said.

Ms Charman launched The Australian Barcode for Life Project at the Resilient Landscapes Biodiversity Conference held at the University of Western Australia in September 2021.

DNA barcoding allows scientists to identify an organism by using PCR to ‘amplify’ a short sequence of its DNA, called a ‘barcode’, which is then compared with a library of DNA barcodes of known species.

As part of the Australian Barcode for Life Project, students from participating schools will use DNA barcoding to identify and document the plant species they encounter in the neighbourhoods around their schools. This information can then be developed into a digital living atlas, which will provide an ongoing and dynamic record of the species in that area.

The project will give students the opportunity to move beyond simply digesting the content of the STEM curriculum, Ms Chapman said. Instead, the project encourages them to work with real scientists, on a real project, using real equipment.

Biobarcode at the Biodiversity Conference

For the launch, Ms Charman brought together 32 students from eight schools: Willetton Senior High School, Melville Senior High School, John Curtin College of the Arts, Kingsway Christian High School, St Joseph’s School, St Hilda’s School, Cecil Andrew’s College and Presbyterian Ladies’ College.

With the help of a team of postgraduate students – Ms Chapman’s ‘passionate science ambassadors’ – the students learnt the techniques involved in DNA barcoding in the laboratories of the School of Molecular Sciences at the University of Western Australia.

The students extracted DNA from plant tissue, used the miniPCR machines to amplify the DNA present in the samples, and then visualised the DNA molecules present using gel electrophoresis and staining. Then, in a FaceBook Live event streamed during the conference, the students demonstrated the steps involved in DNA barcoding to their online audience, before presenting their plans for future research to hundreds of conference delegates in the final session of the day.

The students of Kingsway Christian College, in Perth's northern suburbs, aim to be the first scientists to sequence the genome of the dancing spider orchid *Caladenia discoidea*, which they discovered in an area by their school that was subsequently cleared for a carpark.

Dr Siew Fong Yap, Head of Science at the college, said the chance to sequence the orchid's genome was exciting because it put students at the cutting-edge of science, where they could discover something that was not yet in their text books.

An important part of science education was helping students to make the connection between what they were learning in the laboratory and its relevance in the real world. Students need to feel that what they are doing is not just something to pass a test or get a degree.

Connecting with the Australian Barcode for Life Project also gives secondary science teachers a chance to extend their training and to incorporate the talent and expertise of the tertiary sector into their curriculum, Dr Fong Yap said.

For their DNA barcoding project, the students from John Curtin College of the Arts in Fremantle plan to collect plant samples from three sites around their school, including one area known as 'the badlands', on the limestone ridge behind the school.

'It's always amazing to be given such hands-on, practical opportunities to learn in ways that you didn't know existed,' said Ashton. 'The PCR machines, the gel electrophoresis, I don't think I ever would have learnt about that or, if I did, I probably wouldn't have been as interested in it as I have been throughout this process.'

'Now is the prime time that we're meant to be choosing which kind of job pathway we want to go down,' adds Mia. 'Actually getting to experience the possible pathways that you can have later on in life makes so much more of an impact on you than just being told about it.'