

In2biotech Roadshow

North East Victoria

30 Nov – 3 December, 2010



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In2biotech Roadshow

Year 2

North East Victoria region, 30 November – 3 December 2010

In 2010 **In2science** in conjunction with **Get into Genes** ran a biotechnology-based outreach program (**In2biotech**) to engage students in science through interaction with Peer Mentors from the **In2science** program. The roadshow went to schools in NE Victoria. The **In2biotech** program is offered to government schools and is free of charge.

As regional schools do not have access to the **In2science** Peer Mentoring program on a weekly basis, a roadshow was deemed the best method of allowing students to interact with Peer Mentors as science role models. **Biotechnology and climate change** were selected as themes for this roadshow. Teachers often find it difficult to incorporate biotechnology into their classroom teaching, citing lack of equipment and expert knowledge as limiting factors. Students and teachers alike need to know about the ways in which biotechnology is being used to help Australia adapt to climate change. Students in Year 9 and Year 10 were targeted for involvement as these are students making decisions about areas of future study at VCE and beyond. The program was also aimed at teachers to introduce them to the topic and build their interest and confidence in this area of science. School students also gain an opportunity to talk to the Peer Mentors about university and careers.

Materials for the **In2biotech** workshop were developed utilising some activities and research examples that are presented as part of the **Get into Genes** program.

The North East region of Victoria generally regarded as a dryland area is characterised by a diverse climate and topography, and the agricultural practices conducted in this area reflect this diversity. With the vast agricultural industry involved in grain, dairy, beef, and sheep, along with horticultural production.

Livestock is by far the largest industry in the North East region, the largest portion of this being beef cattle, and livestock products including wool and milk rates the second biggest industry in the region. Crop production is also important to North Eastern Victoria, encompassing pasture, hay and grain. Fruit production including grapes for the making of wine interstate is also a growing industry.

Trip summary

Seven schools were invited to participate in the incursion. Six schools accepted the invitation:

Alexandra Secondary College
Myrtleford P-12 College
Bright P-12 College

Beechworth Secondary College
Wangaratta High School
Euroa Secondary College

Schools were keen to be involved in the activity and were extremely grateful of the visits indicating these types of activity are rarely offered to the more remote and smaller schools. At each school there was a very warm welcome and support. School students seemed genuinely interested and exited about the activity.

Approximately 2.5 hours was spent at each school which included set up time, presentation, 1.5 hour workshop, plenary and pack up.

Comments were extremely positive from teachers, students and Peer Mentors about the **In2biotech** experience.

The feedback quoted in this report comes from **evaluation forms** completed at the end of the workshop, by students and teachers.

Trip leader: Barbara Dinsdale, Coordinator In2science, La Trobe University.

Attending students (Peer Mentors):

Tenille Butera, 3rd Year Bachelor of Biological Science (La Trobe University),

Shainie Jesurasan, Masters in Biotechnology/MBA (La Trobe University),

Rhiannon Jacobs, 3rd Year Bachelor of Science (University of Melbourne),

Shaun Khoo, 5th Year Bachelor of Science/Bachelor of Arts (University of Melbourne).

Itinerary:

date	AM (session time)	PM (session time)
Tues 30/11		Alexandra Secondary College (13:4-15:30)
Wed 1/12	Myrtleford P-12 College (9:00-11:00)	Bright P-12 College (13:45-15:30)
Thurs 2/12	Beechworth Secondary College (9:00-10:40)	
Fri 3/12	Wangaratta High School (9:00 – 11:00)	Euroa Secondary College (13:45-15:20)

(Approximately forty minutes spent setting up and packing up prior to and after each school workshop)

Activity Aims:

- To engage high school students from regional schools in a hands-on science/biotechnology workshop that supports school-based learning
- To allow students to interact with role model science Peer Mentors
- To raise students' aspirations in science particularly agriculture and biotechnology
- To promote links between the schools and the three In2science universities
- Empowerment of teachers with new curriculum areas, through interaction with university students, and
- To offer a free program to schools.

Predicted Outcomes for Schools:

- Teachers with a greater knowledge of biotechnology applications for climate change mitigation and ideas for teaching biotechnology in the classroom
- Students with a greater awareness of climate change and applications of biotechnology in agriculture
- Scientifically motivated and enthused students, and
- Teachers able to interact with young scientists and update their skills (especially valuable where non-specialists are teaching science).

Activity sequence

The program started with a 20 minute PowerPoint **presentation** to introduce the students to biotechnology and climate change. Workshop structure and safety considerations were outlined at the beginning of each session. This was followed by four **activity stations** each lasting approximately 20 minutes. Students wore lab coats, gloves and safety goggles for some workstations. The activity stations worked well with Peer Mentors introducing students to an aspect of biotechnology and its uses.

The stations were:

1. Biofuels



Here students made biodiesel using vegetable oil, methanol and potassium hydroxide as a catalyst. They considered how burning biodiesel can produce energy. Students then worked together to create a list of 'advantages' and 'disadvantages' of using biofuels. This activity generated much discussion and argument.

2. Dairy Cows



At this workstation students looked at the ways the quality of milk produced from dairy cows can be improved through selective breeding and analysis of bulls' phenotypic traits. Students looked at the role of variation in animal reproduction and inheritance and compared genotype and phenotype.

3. DNA – get it out!



Students extracted DNA from wheat germ, using common kitchen ingredients and chemicals such as wheatgerm, bicarbonate of soda, washing detergent and methylated spirits. For many students this was the first time they had 'seen' DNA and they gained a sense of achievement and excitement as they precipitated DNA in the final step of the protocol. Many were amazed that the DNA was so long and stringy.

4. Gel electrophoresis



Students learned how to load DNA into an agarose gel and how different-sized fragments of DNA are separated by electrophoresis. Students enjoyed being able to use equipment that was not available at school. They learned how to accurately use a micropipette, which measures volumes as small as one microlitre, or 1/1000th of a millilitre. At the end of the session students observed how the different coloured dyes moved at different rates through the gel, which acts like a 'molecular sieve' according to the size of molecule that makes up the respective colours.

In all activities the students were encouraged to think about how the different applications of biotechnology can be used in solving the problems associated with climate change.

After the activity stations all the students were brought back together for a **plenary session**. Here they were asked about what they had learned that they didn't know before the session. Students were then presented with another example of agricultural biotechnology – genetic engineering. Some students had heard about genetic engineering and the debate about its safety and usefulness. Students were encouraged to ask questions and engage in discussion.

Summary of school visits in North East Victoria

In2biotech session at Alexandra Secondary College

Thirty six Year 8 students attended the session at Alexandra High School, along with several staff members.

The teachers were extremely positive about the program and generously provided assistance with materials and set up. They were keen for the Peer Mentors to reveal to their students the positive aspects of attending university in Melbourne, particularly in the field of science.

Half the students indicated they had 'a little' prior knowledge of biotechnology before the session and 33% the students said they had no knowledge of biotechnology. Despite this low base of self-reported knowledge of biotechnology, most (97%) students commented that they had some or a lot of interest in science.

The initial 20 minute introductory talk was enthusiastically received however, the most popular aspect of the workshop was the hands-on activities, with 81% of students rating them 'interesting'. This pattern was repeated in all schools, providing evidence that the most effective way to engage students in science is to provide hands-on learning opportunities and minimise one-way 'transmission' of information.

At each workstation a Peer Mentor lead students through the activity. The aim was to spark students' interest in applications of biotechnology for mitigating the effects of climate change.

Teachers commented that the sessions were excellent and had the students thoroughly engaged.

School students filled in evaluations on the day and their feedback was very positive. Following are some of the comments from students:

"It was good and I really want to do science because I find it fun."

"Had great fun."

"I like micropipettes!"

Forty percent commented that they were more interested in studying science beyond Year 10 after the session, with 46% now considering it. Gel Electrophoresis was the most popular workstation amongst Alexandra students with 38% rating it their favourite activity.

Although reporting that prior to the workshop all teachers at Alexandra felt confident teaching biotechnology, teachers did acknowledge they were now more likely to teach biotechnology in their classrooms after the session.



Alexandra students learning about gel electrophoresis and how it is used to create a DNA fingerprint

In2biotech session at Myrtleford P-12 College

Twenty five Year 9 Myrtleford P-12 College students took part in In2biotech. The mostly male dominated class was incredibly enthusiastic and keen to learn all they could from our travelling team. With 50% of the students reporting *'no prior knowledge'* about biotechnology and the other 50% of students reporting only *'very little prior knowledge'*.

Just over 85% percent of students commented that they had some or a lot of interest in science.

Students were engaged and inquisitive with all willing to ask questions during the workstations, not only about the scientific applications they were undertaking but also about the mentors' university experiences and their fields of study.

Their teacher rated all aspects of the workshop as being *'excellent'* and commented specifically on the level of student engagement the likes of which they had not witnessed before.

Again the activity stations were the most popular aspect of the program with 83% of students finding them *'interesting'*. Myrtleford students enjoyed the DNA Extraction the most, with 21% of the students tied at second place for biofuels.

Forty seven percent said that they were more interested in studying science after the session.

Students commented:
"It has changed my perspective on science."



Myrtleford students learning how to select genetic traits in cows for improved dairy products



Myrtleford students extracting some wheat germ DNA.

In2biotech session with Bright P-12 College

The visit to Bright P-12 College provided students and several teachers the opportunity to learn a little more about biotechnology and it's applications to tackle climate change.

Teachers gave very positive feedback during the event. They were asking questions and actively participated at activity stations alongside the 30 'Head start' Year 9 students. This class was an accelerated Year 8 group that was starting on the following year's curriculum a few weeks earlier.

When surveyed, 42% of the students said that they were now more interested in pursuing science at VCE after the session.

Once again the favourite aspect of the program was the activity stations, and the favourite activity tied between the DNA extraction and Gel Electrophoresis station with 31% rating each of these as the most interesting.

Teachers here were the least confident about their knowledge on the topic of biotechnology prior to the workshop, however, commenting that they were now more likely to teach it to their class once they had taken part in **In2biotech**.

Students attending commented:

"It was very interesting we learnt a lot of interesting facts."

"Fun and learned heaps."

"The mentors were good at their job and didn't use big words so it was understandable."

"FANTASTIC!"



Bright P-12 students extract DNA from wheat germ, while also learning about the structure of DNA.



Rhiannon and Bright P-12 students loading an agarose gel.

In2biotech session at Beechworth Secondary College

At Beechworth Secondary College the session was run for a group of 34 Year 9 students, and staff members.

Students were very keen to get started, and there was a buzz of excitement as they moved around the activity stations.

Beechworth staff commented on the high levels of engagement of their students.

Thirty eight per cent of the students said they *'knew nothing'* about biotechnology before the session and 59% indicated they *'knew a little'*. This cohort had the highest proportion of students (14%) indicating they had no interest in science. Pleasingly, in response to the question *"After having done this activity are you more interested in taking Science at VCE?"*, 41% of students said *'yes'* and 38% of students said *'maybe'*.

The workstations were again the most popular aspect of the session with 93% of students indicating they found it 'interesting'. Beechworth students found the DNA extraction activity the most enjoyable.

Comments included:

"It was very informative and I would like to do something like that again."

"All the activities were fun and very good."

"I now have more interest in science and learning a lot. It was an interesting session."

"It was very informative and I would like to do something like that again."



Beechworth students making biofuel.

In2biotech session at Wangaratta High School

Wangaratta High School saw a class of Year 7's and Year 10 chemistry students work together to learn a little more about biotechnology. The Year 10's were keen to work alongside the younger scientists announcing that "they could learn something from the younger school mates".

Twenty Year 7, ten Year 10 students and two teachers participated in the biotechnology workshop. With teachers and students alike incredibly passionate about science.

Just over half of the students (53%) said they knew a little about biotechnology prior to the session. When asked what their level of interest was in science, 47% commented they had 'some' interest, and 47% said they had 'a lot' of interest.



Wangaratta students extract DNA from wheatgerm.

All students reported enjoying the introductory presentation rating it either 'interesting' (90%) or 'ok' (10%), and evident by all the discussion and participation it generated. Thirty eight per cent of students expressed that their favourite activity station was Gel Electrophoresis, with 28% voting for DNA Extraction.

During the plenary students asked thoughtful questions about genetic engineering and biotechnology particularly in regard to positive action towards climate change.

Students commented:

"Very good and interesting.", "Pretty cool."

Almost half (48%) of students stated that after **In2biotech** they were more interested in taking Science at VCE. This was the highest score for this question out of all the schools.

The teachers were very appreciative of the workshop being run for their keen science students and they commented on the high quality of the activities and level of engagement of their students. There was also much discussion about the steps taken by the school to engage the students and nurture their curiosity through implemented curriculum and with the new "science centre" Wangaratta High School is building for their students. The **In2biotech** team was lucky enough to be given a grand tour of the new, environmentally friendly, energy efficient, very impressive laboratories while still under construction.

In2biotech session at Euroa Secondary College

We were welcomed to Euroa Secondary College by a group of 26 energetic year 9 students.

Like the other previous schools the introductory presentation gave the students some background on biotechnology and its possible implications for dealing with climate change. This led to much discussion and consequently excitement about the workstations to come.

Hands-on workstations were easily the favourite of the students, with the Gel Electrophoresis the most popular at 32%.

Although the teachers at Euroa felt very confident about teaching biotechnology to their class, 65% of the students reported having no prior knowledge about biotechnology before the session, and only 4% felt that they did know a lot about biotechnology. Consequent discussions with the teachers about follow up things that can be covered in future classes with these students and upon completion of the In2biotech session saw teachers then comment that they were now more likely to teach biotechnology in their classes after the session.



Euroa student loading a well with a micropipette.

Peer Mentors' contribution to the event

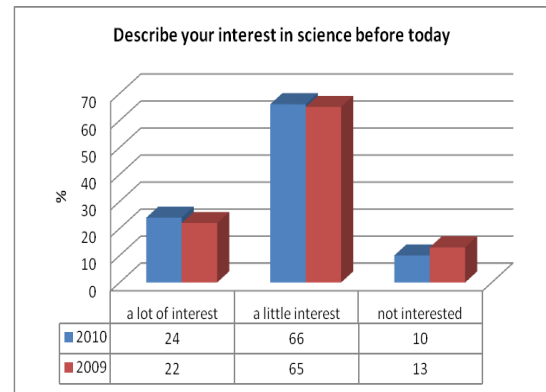
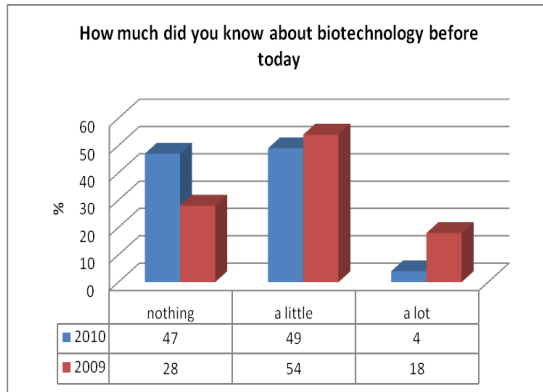
The four Mentors did a fantastic job during the visits and were professional, enthusiastic and very hard working throughout the roadshow. They ran the activity stations safely and with a high level of technical competency. They asked questions to determine students' prior knowledge and adapted their explanations accordingly. They demonstrated their passion for science and learning and engaged students in discussions about careers in science and what it's like studying science at university.

Shainie Jesurasan has completed 4 years as a Peer Mentor and demonstrated the ability to fine tune her presentations and to reflect maturely on her practice. This was Shainie's second roadshow and her experience was invaluable. The others had not previously volunteered for a roadshow but had vast experience as In2science Peer Mentors volunteers. Shaun Khoo has also been a Mentor for 4 years and was able to use his experience interacting with students to challenge more able students to think deeply about complex concepts. Tenille Butera and Rhiannon Jacobs were both very excited to be using this as another opportunity to visit more schools as they are both keen to become science teachers and continue to inspire future scientists. They interacted effectively with the students and were reliable and conscientious members of the **In2biotech** team.

Mentors commented that the trip was challenging and tiring but great fun and they valued the opportunity to participate.

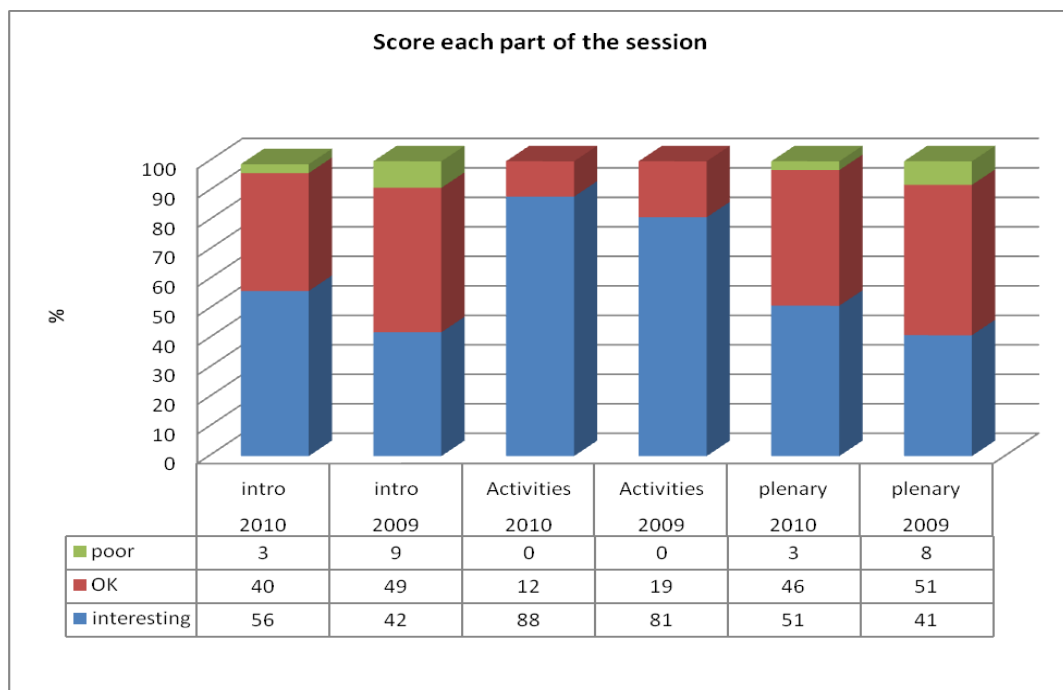
Summary Results

Results from student feedback (n=181 students, n=6 teachers):

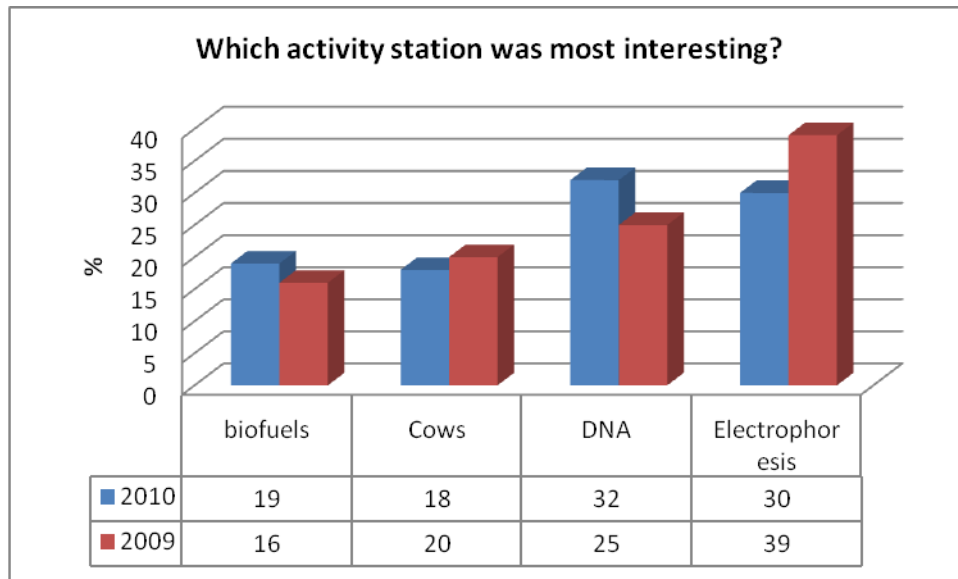


As was found with In2biotech 2009, the majority of the students commented they knew little or nothing about the topic prior to the visit. Across all six school just 10% of students said they were not interested in science with the majority having some interest (66%) or a lot of interest (24%). These figures are marginally higher (in terms of interest in science) and slightly lower for not interested in science from 2009 figures. Many of the students who participated in **In2biotech** were selected by their teachers as having expressed interest in science. Data is not available on how the different schools selected participants for the program.

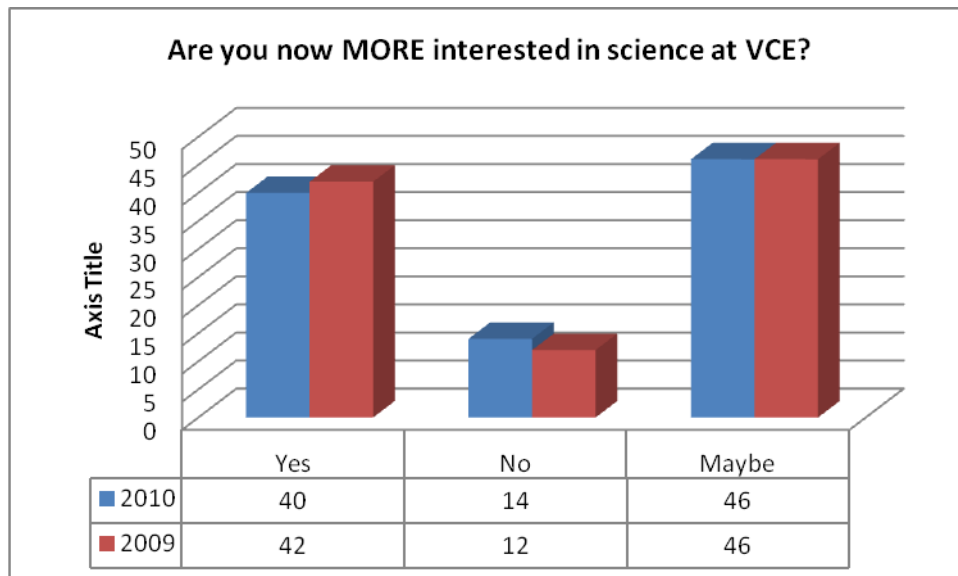
Students' attitudes to all aspects of the program (Introduction, Activities, and Plenary) was positive. As predicted, almost all (88%) of the students found the activity workstations the most enjoyable aspect of the session.



DNA extraction was the most popular activity with 32% of the vote. Gel electrophoresis was the next most popular with 30% followed closely by Biofuels (19%) and Cows (18%).



The sessions had a positive impact upon the students with 40% of them saying they were now **more** interested in pursuing sciences beyond Yr10 and 46% saying they '*may be*' more interested. Only 14% of participants said they were not more interested in taking Science at VCE after the **In2biotech** activity.



Teachers were appreciative of being offered the In2biotech program and gave positive feedback on its quality and effectiveness. Most teachers (100%) rated the program '*Excellent*' in terms of student learning and engagement. Half (50%) of the teachers were already '*Very confident*' teaching biotechnology in the classroom, but even so 100% said they were more likely to teach biotechnology as a result of participating in In2biotech.

The **planned outcomes** were listed at the start of this document and the extent to which they were achieved is noted in the table below:

Predicted Outcomes for Schools	Evidence of achievement
Teachers with a greater knowledge of biotechnology applications for climate change mitigation and ideas for teaching biotechnology in the classroom.	Teachers had the opportunity to learn about the topic and 100% stated they were more likely to teach biotechnology in their classroom after the workshop. They also gained an understanding of resources available and how to use them.
Students with a greater awareness of climate change and applications of biotechnology in agriculture.	47% of students said they knew nothing about biotechnology prior to the sessions. Many students made positive comments about having a better understanding of biotechnology and the potential benefits it could bring in mitigating climate change.
Scientifically motivated and enthused students.	Students were enthusiastic and engaged in the activities and many described the workshop as 'fun', 'cool' and 'interesting'. 40% of students said they were now more interested in pursuing sciences beyond Year 10 and 46% saying they ' <i>may be</i> ' more interested. 100% of teachers rated In2biotech as ' <i>Excellent</i> ' in terms of student learning and engagement.
Teachers able to interact with young scientists and update their skills (especially valuable where non-specialists are teaching science).	All teachers participated in the activity stations and gained an insight into the topic and the kinds of learning activities that students find most engaging.

Conclusion

Based upon feedback from all stakeholders the program of visits this year was deemed a success with all planned outcomes being achieved.

This is the second year that Get into Genes and In2science have collaborated on a roadshow, and the planning and preparation ran smoothly with effective communication between John McDonald (In2science) and Joe Oreo (Get into Genes).

The numbers of students participating in the sessions at each varied from 26 to 36. Some of the schools only had a small student population and this had an impact upon the numbers involved. Most of the schools selected students to participate in the activity or particular classes rather than involving whole year groups.

Peer Mentors did an excellent job of presenting material and engaging with the students and teachers in the schools. The quality of these undergraduate students in both their knowledge and their communication skills was imperative and for this event appropriate students were selected. All were a credit to their university.

All schools participating in In2biotech were government schools.

Barbra Dinsdale
In2science Coordinator
La Trobe University

Acknowledgements

Thanks to staff at **Alexandra Secondary College, Myrtleford P-12 College, Bright P-12 College, Beechworth secondary College, Wangaratta Secondary College and Euroa Secondary College** for hosting the In2biotech workshops and providing some materials and consumables.

Consumables and equipment for the Gel Electrophoresis and DNA Extraction activities were provided by **Get into Genes**.

Huge thanks goes to the four university students who gave up their time to run the activities and without whom the roadshow would not take place.

Car hire was provided by the **La Trobe University's Department of Agricultural Science**.