



## **In2nanotech Outreach Program**

**North Central Victoria**

**24 – 27 November 2008**



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## **In2nanotech Outreach Program**

**Year 3/3**

**North Central Victoria 24 – 27 November 2008**

In2science in conjunction with Nanotechnology Victoria Ltd ran the final year of the nanotechnology-based roadshow (In2nanotech) to engage students in science through interaction with Peer Mentors from the In2science program. This year the roadshow went to seven schools in North Central Victoria.

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. Nanotechnology was selected as a theme for the roadshow as this is a field new to schools and teachers and is increasingly being included in the curriculum. Students in Y9 and Y10 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. Students also had an opportunity to talk to the Peer Mentors about university and careers.

### **Trip summary**

Seven schools were visited:

**Rochester Secondary College  
Shepparton High School  
McGuire College  
Numurkah Secondary College**

**Echuca College  
Kerang Tech High School  
Cohuna 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 2½ - 3 hours was spent at each school which included ½hr set up time, 2hr presentation and activity stations and ½hr pack up.

Several of the schools selected students to participate in the activity who had shown interest for science in the past.

Some of the schools in the region were running a Head Start program, whereby they roll over to the next year's timetable to make a start to the new year and making more productive use of the last few weeks at the end of the year.

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

**Trip leader:** John McDonald

**Attending students:**

**Leigh Sands**, 3<sup>rd</sup> Yr Nanotechnology/Science (La Trobe),  
**Daniel Langley**, 3<sup>rd</sup> Yr Nanotechnology/Science (La Trobe),  
**Emma Thornton**, 2<sup>nd</sup> Yr Nanotechnology/Science (La Trobe),  
**Rebecca Langley**, 4<sup>th</sup> Yr BSc/BA (La Trobe).

**Itinerary:**

date	Travel time to school	AM (session time)	Travel time to PM sch	PM (session time)	Travel time to accom	Accommodation
Mon 24/11	Depart 8.00am  2hrs 30 min 180km	<b>Rochester College</b> (11.00-12.40)	1 hr 10 mins 75km	<b>Shepparton HS</b> (1.48-3.18)	10 mins 3km	Shepparton
Tues 25/11	10 minutes 5km	<b>McGuire College</b> (9:05 - 10:40)	43 mins 37.7 km	<b>Numurkah SC</b> (1.15-3.20)	1hr 4 mins 70km	Echuca
Wed 26/11	10 mins 5km	<b>Echuca College</b> (9.00 -11.00)			1hr 44 mins 120km	Kerang
Thurs 27/11	10 mins 5km	<b>Kerang Technical HS</b> (9.10 - 11.10)	30 mins 30 km	<b>Cohuna College</b> (1.40-3.20)	<b>Return</b> 4hrs 267km	

*(Approximately 20-25 minutes spent setting up and packing up prior to and after each session)*

**Activity Aims:**

- To engage Year 9/10 students from regional schools in science/nanotechnology activities
- To enhance the learning in science
- To introduce students to a new field of science – nanotechnology and its applications
- To allow students to interact with role model science Peer Mentors
- To raise students' aspirations in science
- To promote links between schools and the two universities along with **NanoVic**
- To empower teachers with new curriculum areas, and
- To allow teachers to interact with university science students and update their skills (especially valuable where non-specialists are teaching science).

**Predicted Outcomes for Schools:**

- A new area of emerging science introduced into classrooms (nanotechnology)
- Teachers with a greater knowledge of a new curriculum area and ideas for delivery
- Students with a greater awareness of nanotechnology and its application
- Scientifically motivated and enthused students
- Teachers able to interact with young scientists and update their skills (especially valuable where non-specialists are teaching science), and
- Schools gain access to support in nanotechnology curriculum material.

## Activity sequence

As in previous years the following format was adopted.

The program started with a 15 minute PowerPoint **presentation** to introduce the students to nanotechnology and getting them to understand the scale at which nanotechnology operates.

This was followed by the **activity stations** each lasting approximately 20 minutes:

For the duration of the visits the resources were arranged for use into **four** activity stations, each run by one of the attending Peer Mentors.

The activity stations worked well with students being introduced to an aspect of nanotechnology and its uses. The stations were:

### 1. Cutting out harmful solar radiation - sun screens and glass



Here students discussed their knowledge of the electromagnetic spectrum. They looked at the problems associated with UV and IR rays and how nanotechnology layers in glass can reduce their effects. Students saw demonstrations of how glass can cut out the UV light using UV detection beads. They also learned how nanotechnology can make zinc sunscreens appear invisible on the skin.

### 2. Nanotechnology and textiles, water repellent smart surfaces



Students investigated the properties of Nano-Tex and compared it to standard fabric. They tested the fabrics under different spill-type conditions. Students also observed the properties of non-wetting surfaces on glass, wood and stone. 'Magic sand' was demonstrated and students asked to explain its properties in water.

### 3. Nanoparticles – Ferrofluids and magnetism, liquid crystals, gold nanoparticles



Students got to investigate the properties of Ferrofluids and liquid crystals. They had the opportunity to see if they could identify different temperature ranges exhibited by different liquid crystal sheets. Students also learnt about the influence of particle size on light and the fact they different nano-particle sizes of gold can give a different colour. Students were also introduced to their biomedical applications.

### 4. Memory Metal and iGlass



Students investigated the properties of memory wire and also had the opportunity to see if they could train the memory wire to learn a new shape. Students also observed the properties of iGlass and learned how electricity can be used to create switchable glass that can be opaque or clear.

After the activity stations all the students were brought back together for a **plenary session**. Here they were asked about what impressed them the most and what they thought would be the most useful to society. Following this there was the presentation of some other examples of nanotechnology including testing for water quality, Barracouta fish tank glass and the use of nanotechnology for transdermal drug delivery. A little time was also spent discussing the advantages and disadvantages that they saw for nanotechnology and some ethical considerations.

**Evaluations** were completed by both students and teachers. Four schools had time to complete them on the day of the visit.

## Summary of school visits in North Central Victoria

### In2nanotech session at **Rochester SC**

Students who participated were all in Y9. Approximately 40 students attended this session plus several staff members.

The staff were extremely positive about the program and had set up two rooms to use; one for the presentation and the other for the activity stations.

The initial 15 minute introductory talk was enthusiastically received. From the evaluations ten students indicated they had some prior knowledge of nanotechnology before the session.

This introductory session was followed up with the students being split into four groups and visiting each of activity stations in turn.

At each station the students were lead through the activity by one of the Mentors and at each station the aim was to get students thinking about the properties of the materials, trying to identify how they worked and then having a go at manipulating or testing the various properties.

Teachers commented that the session was excellent and engaged the students. They also noted that the students liked the 'magic sand'. Teachers said they had limited knowledge of nanotechnology prior to the visit and felt more confident to investigate it further.

School students filled in evaluations on the day. Their feedback was very positive with students commenting that *"it was interesting and fun. It also has made me like science and made me find it interesting"*, *"it was great; friendly and charismatic university students"*, *"very interesting, thanks"*, *"the liquid magnet and magic sand was awesome"*.

From the evaluations 62% of the students said they knew nothing about nanotechnology prior to the day. Students preferred the activity stations best, with 90% finding these *'interesting'*. Seventy one percent commented that they were more interested in studying science beyond Y10 after the session. Their favourite activity station was the nano textiles and water repellent surfaces (magic sand being a favourite of this activity), closely followed by the iGlass and Nitinol.

The school is looking to bring nanotechnology into their Y10 elective known as *'Physical Science A'*



*Leigh helps students test hydrophobic surfaces*



*John talks about the issue of managing IR and UV rays.*

### In2nanotech session at **Shepparton SC**

At this school students from Year 10 participated in the activity; approximately 40 students in total.

Students were very enthusiastic and willing to ask questions about the resources on display. They enjoyed testing the materials especially the smart surface coatings on different materials. 'Magic sand' was again a popular experiment.



*Emma demonstrates magnetic fields using ferrofluids*



*Rebecca demonstrates the properties of Protector glass*

### In2nanotech session at **McGuire College**

This session was run in the morning and was attended by approximately 40 students. These students were mostly from Y10 though several students (who had displayed interest in science) from lower year levels were able to attend.

Many of the science staff were able to attend the session and gave very positive feedback during the event. Teachers were asking questions and actively participated at each activity station.

Students too asked lots of questions and were keen participants. Several students remained at the end of the session to ask follow up questions about some of the resources they had seen.



*Students test liquid crystal sheets for heat sensitivity*

## In2nanotech session at **Numurkah SC**

At this school the session was run for a mixture of both Y9 and Y10 students, totalling approximately 30. Staff members were also able to attend and had a strong interest in establishing a nanotechnology elective for their students in 2009.

Both students and teachers expressed interest and enthusiasm for the activities and asked many questions. The feedback from the session was excellent with students commenting, *"I think it was excellent...great fun"*, *"I found it interesting seeing all the new things in science"*, *" I thought it was interesting and I learnt a bit about nanotechnology, "it was fun I enjoyed it. Great time"* and *"very good to let people know what was out there job wise after school"*.

Teachers too commented that they enjoyed the session, *"very user-friendly"*, *"enjoyed it"*.

48% of the students said they knew nothing about nanotechnology before the session with the rest indicating they knew something. 67% indicated that they had some interest in science and 29% said they had a lot of interest in science. The workstations were again the most popular aspect of the session with all but one student indicating they found it interesting. Numurkah students found the nanoparticles the most interesting work station enjoying testing the liquid crystal sheets and ferrofluids.

48% of the students said they were now more interested in science beyond Y10

Teachers at the school are looking to introduce nanotechnology into their Y9 program as a semester-long unit utilising *Access Nanotechnology* and *Nanobits kits*.



*Students test different spills on fabric.*



*Daniel explains how scientists use gold nanoparticles*

## In2nanotech session at **Echuca College**

This morning session was for approximately 40 Y10 students.

Once again the program was well received by both students and teachers alike. Teachers scored the session as excellent and of value to their students.

Teachers commented that they had not considered teaching nanotechnology as part of their science curriculum but felt that it was something they could investigate in the future.

Half the students said they knew nothing of nanotechnology prior to the session with the rest indicating they had some prior knowledge. When asked what their level of interest was in science, 42% commented they had '*a lot*' of interest, while 46% said they had some interest.

Once again the most popular aspect of the roadshow was the activity stations, with all but one student scoring it at the highest level. Students expressed that their favourite activity station was the nanoparticles with ferrofluids and liquid crystal displays.

Students commented that "*it was excellent*", "*it was so fun and interesting. I liked it*", "*it was well set out*" and "*it was really interesting and enjoyable*". Their only negative comments were that the session "*cut into recess*".

The response to the question '*are you now more interested in science at VCE after having the session?*' was very positive with 48% indicating '*yes*' and 48% indicating '*maybe*'.



*Students observe iGlass in operation.*



*Students test memory wire with Mentor Emma.*

### In2nanotech session at **Kerang Technical HS**

Kerang Tech HS had recently won one of NanoVic's \$500 prizes for schools looking to introduce nanotechnology into the curriculum. These prizes were offered through the In2science program. As a result teachers at the school were extremely keen to add to their knowledge and understanding of nanotechnology and they asked many questions both during and after the session. Teachers were looking for activities to include in their lessons and felt that this was an ideal opportunity to see some in action.

Teachers commented that they knew a little about nanotechnology beforehand and they thought the session was excellent; well presented and their students enjoyed it.

Just over half of the students knew nothing about the topic beforehand. At the end of the session, all of them felt it had helped them become more interested in continuing their studies of science, with 36% saying they were more interested and 60% saying they maybe more interested in sciences beyond Y10.

Students commented: *"I want some magic sand", "good fun, interesting", "very interesting", "needed a little more time at each station", "I learnt [that] many common items can have nanotechnology, very interesting" and "it was a great experience".*

Nano-textiles and water repellent smart surfaces were most popular along with the nanoparticles.

Teachers commented that it was not often that organisations visited their area to run activities due to their remote geographical location. Hence both staff and students put a lot of value on the visit.

### In2nanotech session at **Cohuna SC**

Cohuna was the last stop for the week and despite being tired the Peer Mentors put on a very good session.

Students attended the session from Y10, with different levels of interest in science; 62% expressing some interest in science while 26% expressed a lot of interest in science. Just under half knew nothing about the field of nanotechnology before, with 30% knowing just a little. Around a quarter of the students indicated that they knew a lot about the topic.

Again the students found the activity stations the best with 65% of students finding these interesting.



*Leigh Explains how iGlass works*



*Emma talks about the electromagnetic spectrum*

Most popular were the nanoparticles and the memory metal and iGlass.

Student comments on the session included: *"it was really good, thanks", "it was awesome", "it was good" and "not bad, had its interesting moments"*.

Of the students who attended, 26% commented 'yes' they were more interested in continuing their studies of science into VCE (42% said they 'maybe' more interested).



*Students experiment with 'magic sand'*



*Daniel demonstrates the memory wire*

### **Teachers PD sessions**

This year there were no requests for a formally run professional development session. However, most schools allowed their science teachers to attend the activity session with the students and many took the opportunity at the end of the roadshow to talk with the Mentors about nanotechnology, resources and integrating activities into their teaching.

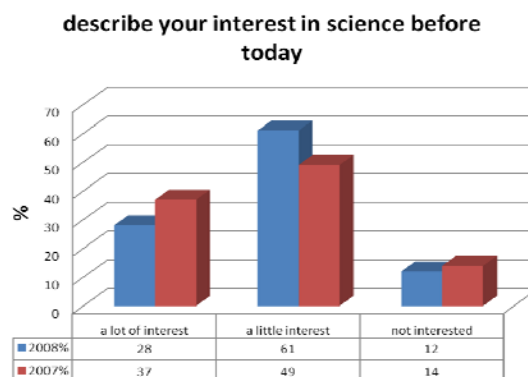
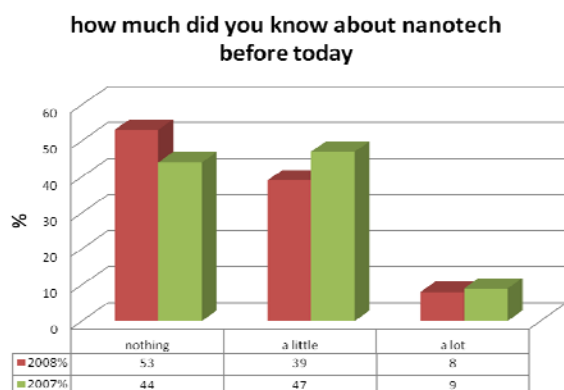
### **Mentors feedback**

As in previous years the four Mentors did a fantastic job during the visits and had lots of enthusiasm for every session. They ran the activity stations extremely well and were very good at conveying the concepts and ideas to the students. They were flexible in how they explained the technology, quickly getting a good grasp of the different ability levels of the students. Two of the Mentors have completed all three roadshows and therefore have been able to finetune their explanations to a high degree of relevance and accessibility. As these Mentors have been continuing their studies in nanotechnology they have a much broader knowledge base with each passing year of study and this is reflected in their interaction with both teachers and students.

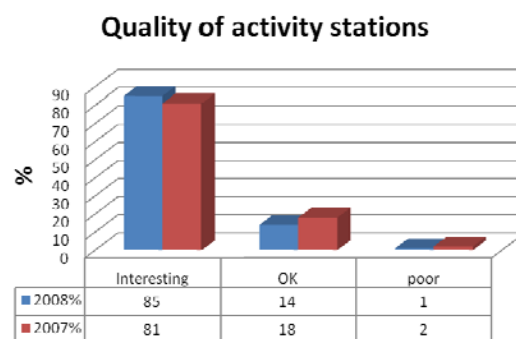
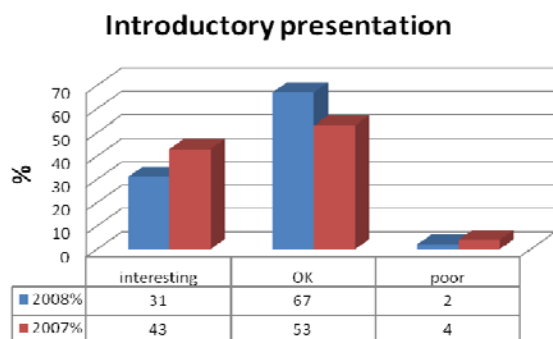
Mentors commented that the trip had been challenging and tiring but great fun.

## Results

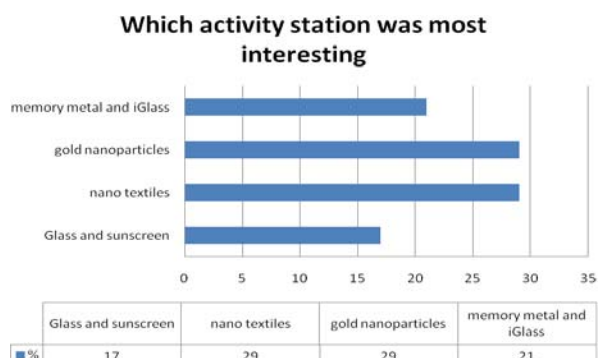
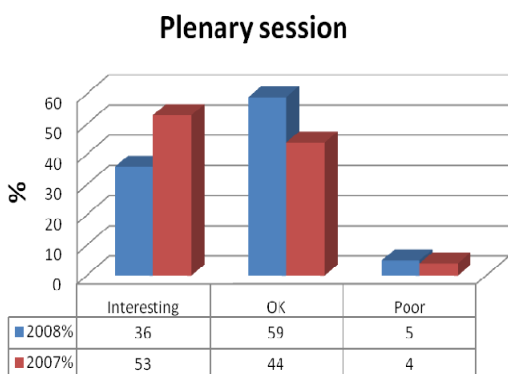
Evaluation results from students' feedback (2008 n=120, 2007 n=131):



Once again the majority of students knew little or nothing about nanotechnology prior to the visit. This made the session much more interesting for them as it was all new. Only a few students (12%) said they were not interested in science (down on 2007). The vast majority had some interest (61%) or a lot of interest (28%). This year the students seemed not to be as interested in science prior to the session as they were in 2007.

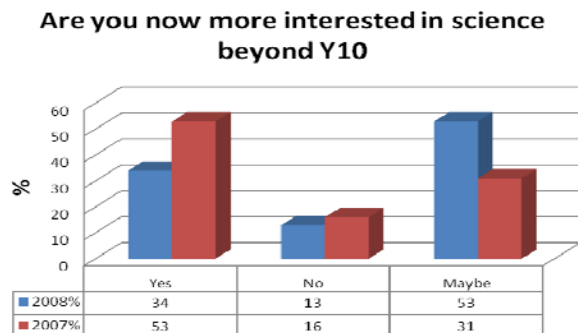


Students found the workstations the most enjoyable and interesting part of the session (85% - up slightly on 2007). The work stations appeared more popular possibly due to slight changes to their content.



Nanoparticles and ferrofluids tied with nano-textiles and water repellent surfaces for the most popular in 2008.

The sessions seemed to have had a positive impact upon the students with 34% of them saying they were now **more** interested in pursuing sciences beyond Yr10 and 53% saying they may be more interested. This is the reverse of 2007 though fewer students indicated an interest in science at the start of the session. There was a slight reduction in the number of students not interested in pursuing science after Y10 (3%).



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
Introduction of new areas of emerging science into classrooms (nanotechnology).	53% of the students said they knew nothing about nanotechnology prior to the sessions.
Empowerment of teachers with new curriculum area and ideas for delivery.	Teachers had the opportunity to learn about the topic and commented that they felt more confident of introducing the topic both into the VCE Chemistry curriculum and middle years teaching. They also gained an understanding of resources available and how to use them.
Students with a greater awareness of nanotechnology and its application	Many students made positive comments about having a better understanding of nanotechnology and the potential benefits it could bring.
Scientifically motivated and enthused students.	On the whole students seemed enthusiastic and engaged in the activity and many commented that they learnt more than they expected. Only 13% stated that they were now <u>not</u> interested in studying science in Y11 and beyond.
Teachers able to interact with young scientists and update their skills (especially valuable where non-specialists are teaching science).	Many teachers were able to participate in the activity stations and gain an insight into the topic. Many teachers asked questions and were keen to find out about obtaining resources. Several schools were looking to add nanotechnology to their curriculum from 2009.
Schools gain access to support in nanotechnology curriculum material.	This was done on the visits and schools were invited to maintain contact with the In2science program to follow up any questions they have. Kerang Tech HS won one of the four \$500 prizes offered by NanoVic to schools introducing nanotechnology into their curriculum

## **Challenge event**

Following the limited response to running an investigative challenge between the schools based upon nanotechnology it was decided that this component would not be run in 2008.

## **Conclusion**

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

Planning and preparation had gone smoothly and all schools were fully briefed as to what to expect and where ready for the visits.

The numbers of students participating in the sessions varied from 30 to approximately 40 and the smaller group sizes for the activity stations worked better. Many of the schools attended were only small and this had an impact upon the numbers involved. Most of the schools selected students to participate in the activity rather than involving whole year groups.

Peer Mentors did an excellent job of presenting material and engaging with the students in the schools. The quality of these 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.

Finding schools to participate was much easier than in 2007 as the geographical location of the schools made for easier planning. Schools were more accessible to each other.

All schools were government schools.

## **Overall review of the project 2006 - 2008**

Since the funding partnership for the In2nanotech roadshow was established with Nanotechnology Victoria Ltd in 2006 the program has visited a total of 19 regional schools in the Wimmera, Gippsland and North Central Victoria.

In2nanotech has also made presentations in the following In2science schools:

Eumemmering College, Coburg SHS, Northcote HS, Eltham HS (including staff professional development sessions), Viewbank Coll, Wodonga Middle Years College, the Mac. Robertson Girls HS, Pascoe Vale Girls College and Crusoe 7-10 SC.

Support has also been offered to numerous schools to help develop nanotechnology teaching units and materials.

Many In2science Mentors have made use of the resources to make presentations to students in their schools. Such discussions in schools by both Peer Mentors and the In2science manager have allowed more teachers to see the resources and students learn about aspects of nanotechnology. This has enabled the resources to be more widely used.

Some metropolitan schools have also asked to borrow the resources on a regular basis.

Schools have also arranged visits into La Trobe University to see the imaging instrumentation utilised in teaching nanotechnology.

The partnership with Nanotechnology Victoria has been an effective one with resources being shared and NanoVic offering prize money for In2science and In2nanotech schools developing nanotechnology into their curriculum. Schools each receiving \$500 were Balwyn HS, Northcote HS, Macleod College and Kerang Technical HS.

It is felt that the In2nanotech program has been successful in what it set out to achieve and helped raise awareness and interest in nanotechnology as a field of study for both teachers and students. Many schools are interested or have started implementing nanotechnology into their science curriculum. Both students and teachers are becoming increasingly aware of nanotechnology in society.

Schools continue to request information on nanotechnology and/or in-school presentations.

In2nanotech has contributed to the increased awareness of the field along with SHINE, Access Nanotechnology, Nanobits and the excellent work of NanoVic.

**Should funding become available it is felt that the roadshows continue in 2009 to maintain contact between regional schools and the universities.**

## Resource suppliers

Resources were obtained from a number of sources some being bought and some being kindly donated.

### Purchased materials -

**NiTinol memory wire, UV detection beads, magic sand, liquid crystal sheets and paper and Ferrofluids**

These were sourced from Education Innovations in the USA: [WWW.teachersource.com](http://WWW.teachersource.com)

Glassware was made up for containing the Ferrofluid to aid demonstration and to reduce the risk of spillages. The NiTinol was mounted on a steel dome for ease of demonstration.

Thanks go to the Dept. of Physics at La Trobe University for their help in making the resources into useable activities.

### Donated materials and resources:

All these products were donated by the companies involved:

**iGlass** from iGlass, Ballarat, Vic

V-Kool from **Protector Glass Industries** in Clayton, Vic

**ZinClear** products and sunscreens from **Antaria Ltd**, Welshpool, WA

Smart surface treatments, **Nanovations Pty Ltd**, NSW

**Nano-Tex and Neutraliser fabric** - Donated by **Nano-Tex**, St Kilda, Vic, and USA

**Gold nanoparticles** - These were sourced and made up in the **Chemistry Dept, La Trobe University**.

**Vehicle** - supplied by **La Trobe University**

