Science and Technology FESTIVAL REVIEW

NOVEMBER 2012

Presentation Reviews from the Science and Technology Festival

Energy Sources For The Future

Featuring

Thomas Maschmeyer: FAA, FTSE Laboratory Of Advanced Catalysis For Sustainability

Mr Maschmeyer began his presentation by giving a brief outline on what he does. He is a catalystic chemist who focuses on sustainability. He defined sustainability as "Forms of progress that meet the needs of the present generation without compromising the needs of future generations". He also presented a quote from the UN Charter Of Human Rights that said: "Everyone has the right to a decent standard of living." This is what Mr Maschmeyer focuses on, creating a world where everyone (present and future) has a completely decent standard of living with no discrepancies. However, to fulfill that UN Charter, at our current rate, we would need way more resources than available on planet Earth.

Mr Maschmeyer is working with new technology that can make the most of our current resources. This means his technology aims at getting maximum efficiency to use every available bit of energy from resources. His major work is a machine that has the ability to extract oils from wood. After having a small amount of wood in very hot water for 5 minutes, a relative amount of sustainable oil is produced. Leading on from the talk of oil, Maschmeyer said that Australia alone has a similar amount of oil to the Middle-East. It is very surprising that we have this much, yet don't use it all! A similar machine to the one mentioned above has the ability to convert lignite (a bad quality coal) into a high quality coal for power generation. This would enable us to use the brown coal found all over the world to make a high quality black coal. This further helps politically. By doing this, coalfields are evened out, reducing tension between countries. When combining this technology with a piston, Machmeyer has designed a 'large piston machine'. This has 54% thermal efficiency, which is 3 times more than normal coal production. What his means is that much less energy is lost in the reactions. The machine also has half the usual carbon emissions and produces 1.5 GW per unit. It is similar to a large ship engine. The machines do not waste the coolant water. All the water used for cooling is heated up from the process and can be used for hot showers for 100,000 homes.

When Mr Maschmeyer finished his talk, the year 10s had to give their own pre-prepared presentations on a chosen sustainable energy source. Some of these included lignite (brown coal) energy production, geothermal energy, biomass, nuclear fission, wind power, black coal energy production, natural gas, biogas, solar cells and the future source of nuclear fusion. Overall, this whole event was very interesting and engaging. We all managed to learn a lot from Mr Maschmeyer's talk as well as the various presentations from the year 10s.

All reviews are written by Saahil Parekh and Ashan Karunagaran. Photographs taken by Darcy Pointon and Sam Evans.

Snake Tales

Featuring

Bob Withey

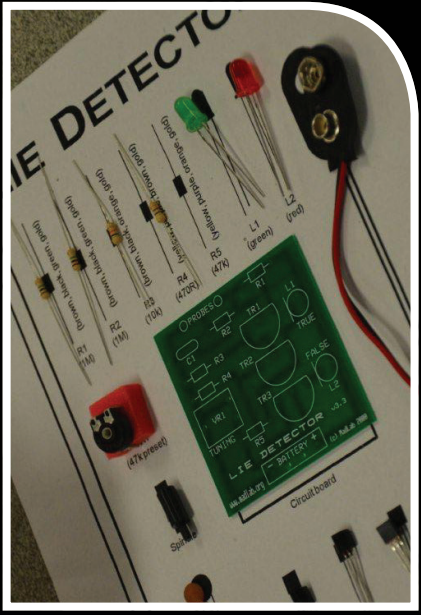
This was certainly the event looked forward to by many, many students! Our host, Bob Withey, began by talking to us about reptiles in general. He explained that law protects ALL reptiles in Australia, meaning that if you were to harm one your offence is punishable by law. Before moving to snakes he talked about turtles and tortoises. Any reptile with a shell is known as a 'shellian'. A tortoise is one example. However, what most people don't know is that there are NO wild tortoises in Australia. Also, tortoises are land animals and do not spend much time in the water. They are also a lot faster that turtles, have legs and feet and are herbivores. On the other hand there are turtles. These creatures are very much water animals. They have a flat shell for streamlined swimming and are carnivores. They can also hold their breath for up to 6 hours underwater! They have a weak shell, so it is susceptible to minor damage. This is because strong shells are heavy, and would not be appropriate for swimming. Turtles are different depending on whether they live in salt or freshwater. Saltwater turtles have flippers and are more robust; where as freshwater ones have webbed feet. Bob brought out a real turtle to show us, and a model tortoise. The next thing he brought out was a blue-tongued skink. There are 450 different species of skinks in Australia alone. This particular skink is very slow because of its short legs and long body. A very interesting fact he told us was that they are completely immune to venomous spiders like the funnel web and the red-back! He then showed us a bearded dragon. This is a creature that lives in southern Australia and doesn't do so well in colder climates. They live in trees and feed on insects and plants. Together the creatures eat 200,000 tons of grasshoppers each year! They have a long life of between 15 and 20 years. Now he moved on to snakes. There are only 600 venomous snake species in the world. Only 200 of those can kill, and only 140 of those are land snakes. In Australia we have 22 species of deadly snakes, 18 of which are in the world's top 20 deadliest snakes. The 'fierce snake' is the world's most venomous snake. He actually had one of these in a storage box right in front of us! Only a couple of drops of venom from this snake can kill 1000 fully grown men. However, it has never actually killed anyone, mainly because it lives in the desert. He had several other snakes in storage boxes, which he brought out later and let us examine at the end. The Snake Tails event was another engaging and entertaining experience.

Mad Lab

Featuring

Adam Selinger

This was a very simple and brief event that involved circuit building. As soon as the students entered the room, they were given a packet with circuit components and a circuit board as well as an instruction sheet to make a lie detector. They had to first read through everything and put the components in. The instructions were clear and the circuit board was clearly labeled with the positioning of components. The sheet also told them what components looked like and what they did in the circuit. To set up the circuit, the students had to touch two probes to a person's skin. A variable resistor was changed until the red LED lit up. Then, when the person was sweating a little bit (when they lied) the LED would get brighter. After they checked it worked, the students soldered in the components. It looked like a really fun and simple activity for them. They managed to easily learn about the basic ways a circuit works while creating something fun.



In Class Design Competition

Featuring

Internal

In this challenge, the students were given a set amount of blue foam cubes and skewers. In groups they had to construct the tallest and strongest possible tower. Marks were given for the stability, height and aesthetics of the tower. As well as building the tower, they had to make an A3 poster presenting their ideas, concepts and reasons for what they did. This was another very short task that taught the students about structural engineering.

Merrick Russell, Industrial Design Presenter

Stars And Planets

Featuring

Ben Newsome

This event was a very engaging and easy to understand presentation about space. Ben began by talking to us about space in general. Space is a dangerous place for a number of reasons. There are many micrometeorites. These are very tiny meteorites (like sand) that travel at very, very high speeds. Even though they are so small, they have the ability to do great damage to people and spacecraft. As well as this, the temperature is very deadly. It is a freezing -269°C, which will instantly kill any human that is not properly protected. The other danger is the fact that space is a vacuum. Ben explained the dangers of this by showing us an experiment that involved a bell jar (essentially a vacuum chamber) and a balloon. The bell jar consisted of a glass jar on top of a special plate. The balloon was put inside this and the air was sucked out with a hose. When all the air was out, the balloon expanded. This is because there is no air pressure pushing on the balloon to keep in deflated. In the normal atmosphere the pressure of all the air above the balloon prevents it from expanding. But in a vacuum where there is no pressure on the balloon, the air simply moves outwards. Ben next moved on to showing just how horrible a basic solar system model is. Because there were so many things wrong with the model, he was able to see what we as students knew about the solar system. The biggest issue was the scale. In the model, the planets and the sun were all similar sizes. We realised that the sun is actually A LOT bigger than the Earth. To give us a perspective, he showed us one of the colourful expanding balls. When that is fully expanded to about 1m across, it was a similar scale to the sun. Therefore, for the model to be correct, the sun would need to be that big while the planets would stay the same size (about 5cm diameter). The other issue with the model was that the planets rotated in a circular form instead of an elliptical form. Another issue was the distance between the planets. He explained how a distance measurement used in astronomy is an Astronomical Unit (AU) which is the distance between the Earth and the Sun. Pluto is 49 AU, meaning that in the model Pluto would have to be 49 time further than Earth. This simply proved how inaccurate these models are. He next talked about eclipses. There are two types: solar and lunar. A solar eclipse occurs when the moon is in between the sun and the Earth creating a shadow. The moon appears pink in an eclipse because the light bends, disperses and refracts in Earth's atmosphere, distorting the image. Next he showed a solar panel powering a fan. He explained how solar panels are used to power space craft, but when there is no light shining on the craft then the spacecraft use weapons grade plutonium! Next he demonstrated a sound scope. This is a satellite dish looking device that can be used to pick up small sounds far away. This is similar to the 'radio telescopes' used by scientists. These telescopes observe sound waves instead of light. This enables the scientists to observe things further away, but it is sometimes difficult because stray radio waves can interrupt the data. He then showed us how a gyroscope works. He got one person to stand on a swivel board, and when they tried to turn themselves it was very difficult. However, when they held a wheel that was spinning and tilted it they rotated easily. This occurs because as you tilt the wheel, the force is pushing against you in the opposite direction, causing you to turn. The international space station uses 4 gyroscopes, which have a similar principle to this, to turn in space. Next he displayed a Lego Mindstorms robot that had a light sensor. Similar light sensors are used on other planets to detect the light reflected from rocks. After all this, Ben allowed the students to go around the room and play with these experiments and a few more minor ones. This talk was definitely knowledge expanding and engaging.

Energy Efficiency

Featuring

Les Kirkup and Mike Ford

This event was focused on what's called a Thermo-Electric Generator (TEG). The hosts ran a competition throughout the period in which the Year 10s had to (in groups) try and make the most efficient TEG. The TEG is a construction of aluminum and steel blocks arranged in a particular way along with other complex materials. It involved cooling down the underside of the rig as much as possible and heating up the top as much as possible. This would give the greatest temperature difference and the TEG acts as a power generator. It was connected to a multimeter, which is a device that records the power outage. To make the top as hot as possible, they had a high power lamp (this had to be a minimum 20cm away in the competition rules) and to cool

down the underside they used a fan. They also used a magnifying glass on the top to focus the heat directly. Afterwards they had to attach a resistor box to the 'circuit' to calculate the resistance the TEG had. Then they calculated the overall power generation and the efficiency. To find the power generation they used the formula POWER OUT = VOLATGE^2 / RESISTANCE. The team with the highest voltage created generated around 54 milli volts. To find the efficiency (which is what the whole event was about) they used the formula EFFICIENCY = POWER OUT / POWER IN. They found that in the end the TEG was a very *inefficient* power generation method. Too much power was used to power the fan and the light bulb and not enough was produced. The generator made about enough energy to power a wristwatch. Overall, this event was quite advanced and interesting and made it clear how hard some methods of power generation are.

Chemistry Hands On

Featuring

Holly Kershaw

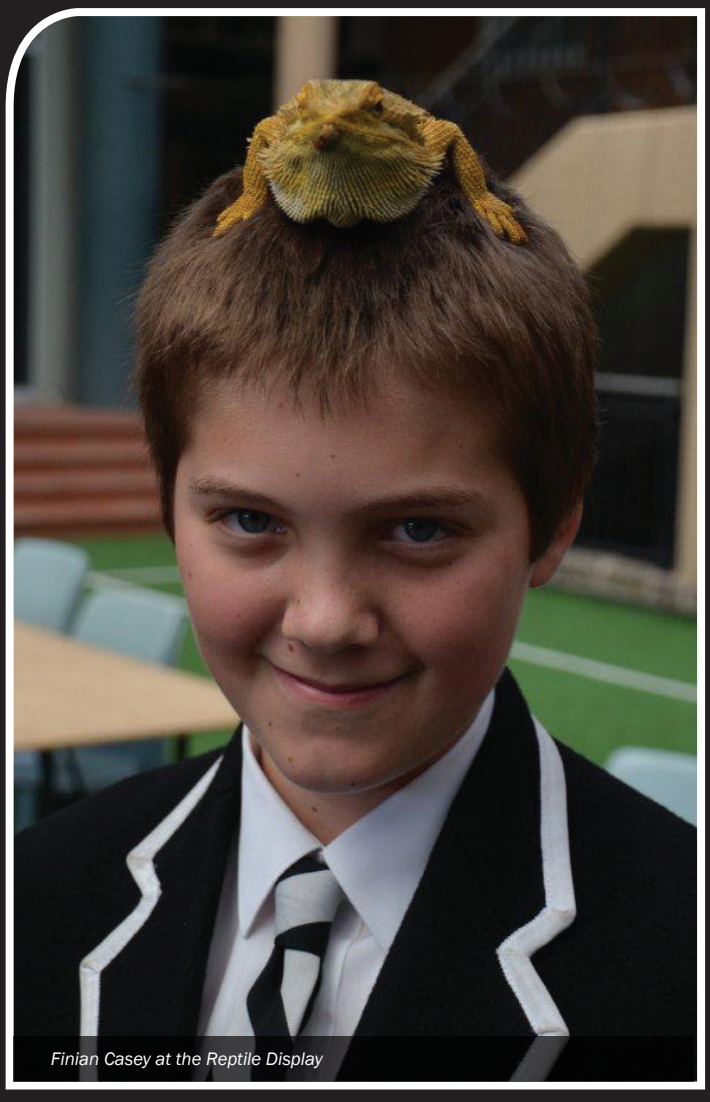
Holly Kershaw is a chemist – basically someone who studies what happens when various things are mixed together. She opened the event with a magic trick. Holly placed two cups on a table and put water in one. She then mixed them around and asked us to choose which one we thought had water. Next she put a piece of card on top of the cup and turned of the cup with the card, and put it on someone's head. As she slowly removed the card, we were all anticipating that all the water would come flowing out, but nothing happened. She tipped over the other cup that we didn't choose and that had nothing in it! So where did all the water go? A special polymer is the answer. In the cup she poured the water into, she had already placed a few granules of a special super absorbent chemical. This chemical can expand to 600 times its size from absorption! So, when she pored the water into the cup, the polymer absorbed it all. Next she showed us a simple experiment about carbon dioxide. She placed bi-carb soda in a balloon and vinegar in a flask. She put the balloon over the flask and dropped in the bi-carb. As this happened, the bi-carb reacted with the vinegar and started fizzing and bubbling. Then, the balloon stood up and started to expand. This is because the bi-carb and vinegar reaction produces carbon dioxide gas, which fills the balloon. Afterwards she showed us a more complex reaction. A sodium hydroxide and glucose solution was mixed with potassium permanganate (a purple liquid). As they mixed, 4 reactions occurred and so the colour of the liquid changed 4 times. Next she showed us a bottle of water that contained an 'indicator'. In chemistry we often can not see a reaction occur, so we use an indicator to help see it. These usually change colour depending on the chemicals in the liquid. In this particular experiment the indicator responded to oxygen. The bottle was left for a few hours allowing the oxygen to leave the water, so the water was clear. When she shook the bottle and mixed the oxygen in, the liquid turned blue because of the indicator. Next she demonstrated the use of universal indicator which changes colour depending on the pH of the liquid. Sodium hydroxide and the indicator made a pink colour (base) and when vinegar (acid) was added, it cancelled out to make a neutral liquid. She then got us into groups and told us to do an experiment involving skittles. 3 skittles were put into a triangle on a plate and water was poured in. When it was left for a while the colours spread out forming a cool 3-colour circle. When a sugar cube was placed in the middle. The colours were all forced out and a clear ring was formed around the cube. This was due to the density of the dissolved sugar pushing the colours away. This was a 'relaxing' and fun presentation that was very easy and clear to follow.

Insect Taxonomy

Featuring

Jacqui Love

In this fun event the hosts brought in a number of live insects and even more preserved insects in glass blocks. Jacqui mainly talked about stick insects in Australia. Stick insects are generally completely harmless creatures. There are a few species that are coloured red, orange or yellow that can be harmful. All stick insects have wings that don't enable them to fly but act as a deterrent to predators by scaring them. When a female stick insect is pregnant her belly becomes very, very large and she lays around 3 or 4 eggs per day. They get held in a pouch and flicked to the forest floor where they will hatch after several months. All stick insects reach adulthood within 1 year, and by then they would have shed their skin 7 times! They have a very short life of about 1 year and 8 months. When they shed their skin they eat it so that predators can't detect them. The biggest stick insects are called Titans and are about 15-20cm long. Jacqui then moved on to talking about insects in general. 75% of ALL animals on Earth are insects (excluding spiders). The biggest insect in the world is the Goliath Beetle which can live for up to 40 years (35 years is spent underground as a grub)! In general, insects live longer in cooler environments. Also, most species of venomous insects have the female as the venomous one (except the funnel web spider). Female spiders often eat the male spider after fertilization, providing nutrients for the eggs. On a completely different note, Australia has some of the world's healthiest bees because of our strict quarantine laws. Jacqui finished the presentation by allowing the students to get close to the insects and pat a huge cockroach, hold a large millipede and look at the stick insects and glassed creatures!



Finian Casey at the Reptile Display

Climate Change

Featuring

Erik van Sebille

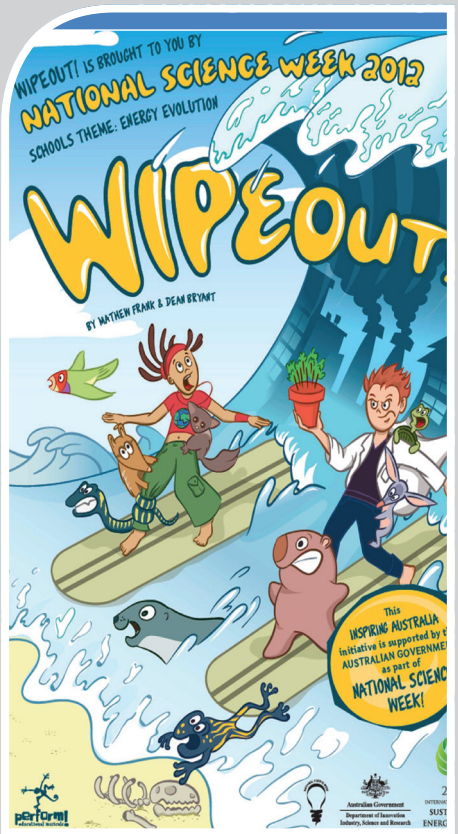
Erik based his presentation on the title "A Survivors Guide To The Climate Debate". He is a lecturer at UNSW and has a great interest in the connections of oceans, which adds to his knowledge of climate change. He began by saying that in the last 5 years, the media have severely distorted the facts about climate change. He moved on to talking about climate science and the greenhouse effect. The greenhouse effect is a natural process where gases in the atmosphere prevent a certain amount of heat, that is reflected off the Earth, from escaping and therefore keeps the Earth warm. Now, the climate change debate is actually not about the greenhouse effect (as we know it exists) but about the things climate change does to our world. 97% of scientists believe that climate change exists. The other 3% disagree for a number of reasons. Firstly, climate change is brought about mainly by the addition of CO_2 to the atmosphere. However, only 1% of our air is CO_2, so they argue how this can have any effect on us. In response to that, believers of climate change say that there is more carbon dioxide in other parts of the world, and there is a constant flux in the placement that causes the effects. There is generally 50 times more CO_2 in the oceans than the air. As the oceans absorb more CO_2 there are imbalances of carbon dioxide levels in the environment, and because it is a finely balanced system, the effects can be huge. Scientists also say that the addition of small amounts of carbon each year will eventually build up the CO_2 levels to a devastating level. Next Erik showed us a clip from 'An Inconvenient Truth' by Al Gore. We found that in the 650 000 years prior to now, CO_2 levels never went above 300 parts per million (ppm). Now, however, the CO_2 levels are rising dramatically at a high constant rate way above the 300ppm norm. He showed us a graph that portrayed this information. The graph also showed how temperature is very closely related to CO_2 levels, and therefore it will rise as the CO_2 rises. Next Erik showed us a clip from a film that argues the opposite, called 'The Great Global Warming Swindle'. This documentary talked about ice core readings. They claim that CO_2 has an 800 year lag to temperature, and so temperature is not that closely related to CO_2. They ask 'how can CO_2 affect temperature if temperature rises before it?'. Believers of global warming say that there is a 'feedback loop', where whenever temperature OR CO_2 rise, then the other will always follow soon after. After leaving the documentaries, Erik explained that climate change is a very slow and gradual process, and so the changes aren't always easily visible. This is because the oceans are a great contributor to climate change, and their processes are very slow moving. Projections of climate changes show that if we completely stop emitting CO_2, then the climate and CO_2 levels will return to the normal cycle and we will only have a 0.5 °C temperature increase by 2100. This brought up another major issue where scientists argue. Some say the temperature increase will benefit us, as many humans prefer living in warmer, tropical climates. However, others argue that the warmer temperatures promote disease growth and transfer. Erik finished up his talk by telling us that there are 3 main types of climate scientists. People who study the greenhouse effect focus on maths, physics and chemistry; people who study the impacts of climate change focus on geography and biology; and people who study the social impact of climate change focus on politics and psychology. Overall, Erik delivered an amazingly informative presentation.

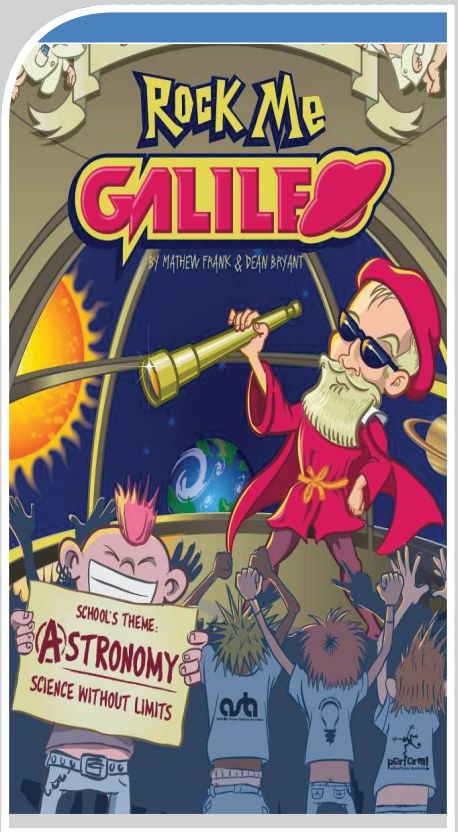
Wipeout The Musical

Featuring

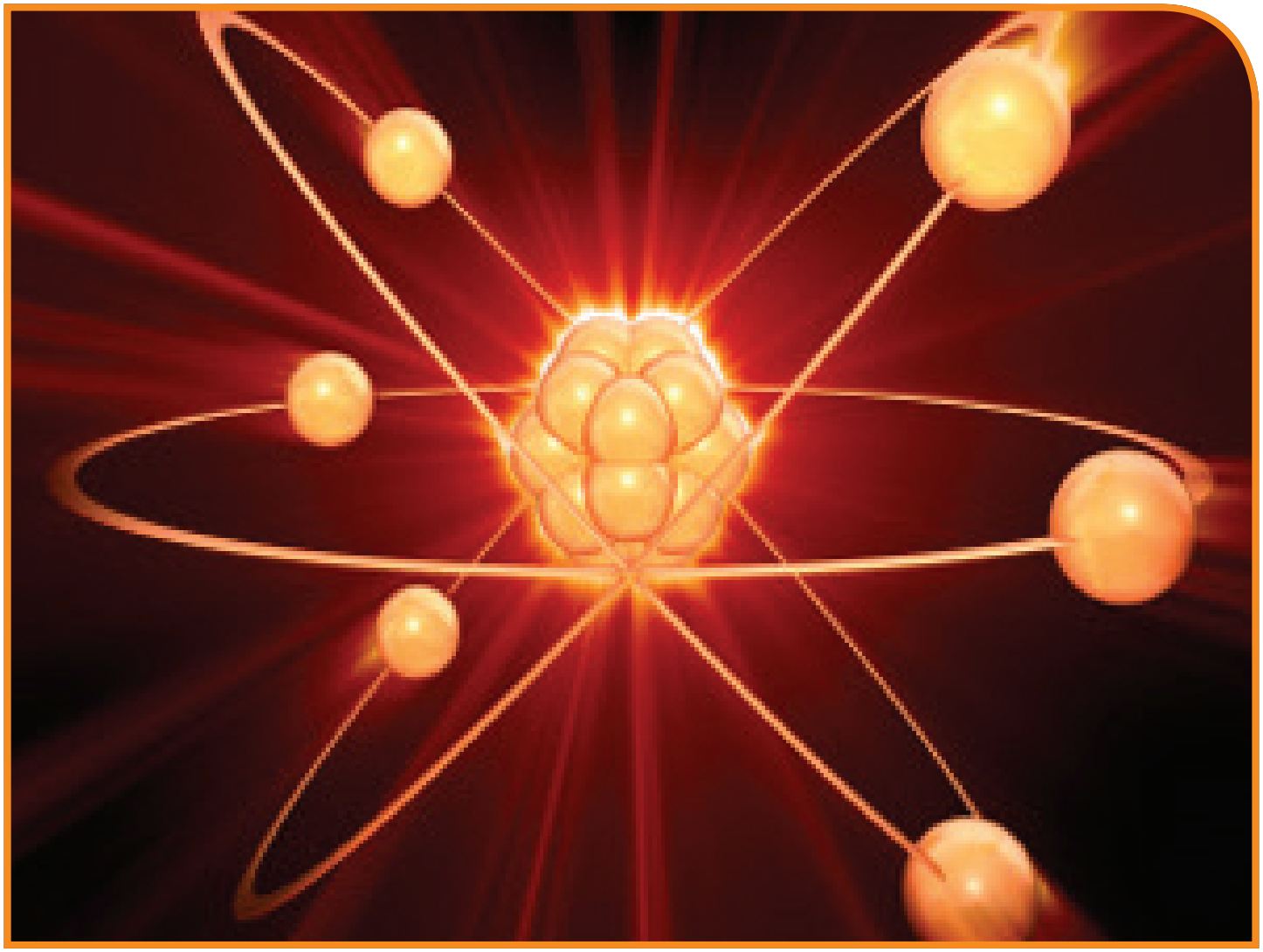
Matthew Frank and Dean Bryant

This was probably the most enjoyable event of the whole festival! The hosts performed a show to promote sustainable energy. The performance was about a show that was being broadcasted all over the world and set in 2022. At the beginning they got us all warmed up by getting us to shout and cheer for the 'cameras' (going by what the show was about). Throughout the show the main actors dressed up and acted as celebrities and they all promoted sustainable energy. They told us to pay close attention to the celebrities because we had to vote on our favourite one at the end. The hosts of the show were the actors playing "Delta Goodone" and "Joel Madman"! They then introduced their concept of 'climate cash'. Every time someone answered a question, they were given some 'climate cash' and at the end the person with the most cash was given a prize. Next they spoke about actual electricity facts. 1 out of every 5 people (around 2.5 billion) lives without electricity. Every year 2 million people are killed from the inhalation of fossil fuel fumes! Soon after this they sang their show theme song titled 'Wipeout' (not surprisingly). This song was about the possible issues of a wipeout of many species on Earth. Every 24 hours, 150-200 species of plants or animals go extinct! A very scary thought! They talked about how there have been 5 major extinctions in the past and the one that will occur next is called the 'Holocene Extinction'. This is not supposed to happen for a very long time, but at the rate we're going with our CO_2 emissions, it will be a lot sooner that we think! Next they brought out another 'celebrity', who was called "Lady Googoo". She talked and sang about how bad it would be to live without electricity.





The 'celebrity' after that was Julia Gillard. She spoke about the Great Barrier Reef. It brings in over $5 billion to the Australian economy each year. There are 125 species of sharks, 400 species of coral, 4000 species of molluscs and an almost uncountable number of fish species. She said how coral bleaching (whitening of coral from increase in water temperature) is a major issue affecting the Great Barrier Reef. After that they explained that since 1910 Australia's temperature has increased by 1°C. This may not seem like much, but minor temperature changes have huge effects on the environment. A major issue with the rising sea levels is freshwater areas being infested with salt, killing all the organisms. One-third of the Australian food supply relies on the Murray-Darling basin, and this would be greatly hindered if it was to be flooded with salt. The next 'celebrities' were "Justin Beeber" and Madonna. Justin sang about how all our precious bees were "once upon a time" and were "almost extinct by 2015" (the show IS set in 2022). Prince William and Kate Middleton were the next 'celebrities' and they talked about power generation and the greenhouse effect. The also sang an AC/DC song about the need for power. Soon after, Al from Home and Away was the next 'celebrity' and talked about similar things. Afterwards they returned to talking about energy issues, and said that there are over 600 petrol stations in Australia that use energy efficient bio-fuels. Also, Australia's emissions per capita have decreased over the last 20 years. Now came the end of the ecstatic show. The winner of the 'climate cash' competition was announced and given a Bigpond Movie Voucher! Then, they asked us to vote for our favourite celebrity, and Al from Home and Away took first place. This really was one of the most enjoyable events of the whole festival and also boosted our knowledge of the energy issues of today's world.



A Journey To Inner Space

Featuring

Tracey Getts – ANSTO

Tracey was originally an astrophysicist, but now works with nuclear science (hence why she works at ANSTO, the Australian Nuclear Science and Technology Organisation). She began by giving us a few interesting facts. She said that it would take over 100,000 years to travel to the nearest star, and that 99% of an atom is empty space (so a lot of the world is actually empty space). Next she asked us about what we thought about the word 'nuclear'. The group came up with the words: medicine, waste, green, radiation, power, uranium, bombs and reactors. It was quite clear that most of us had negative ideas about anything to do with the word nuclear. She then said the yabbies, iPods and King Cobras are all related to nuclear science. Now, what exactly is nuclear science? It is essentially the study of the nucleus of an atom. From here Tracey went through the basic structure of atoms, talking about the location and purpose of protons, neutrons and electrons. The nucleus is made up of protons and neutrons (the protons being positive and the neutrons being neutral keeping the protons together), and electrons (negatively charged) revolve around this nucleus. She then talked about the yabbies she mentioned at the beginning of the talk. Yabbies create their flesh from the food they eat. Because of this, they can examine the flesh of yabbies to see when there were dramatic changes in their diet.

Big Science Fun

Featuring

Fizzics Education

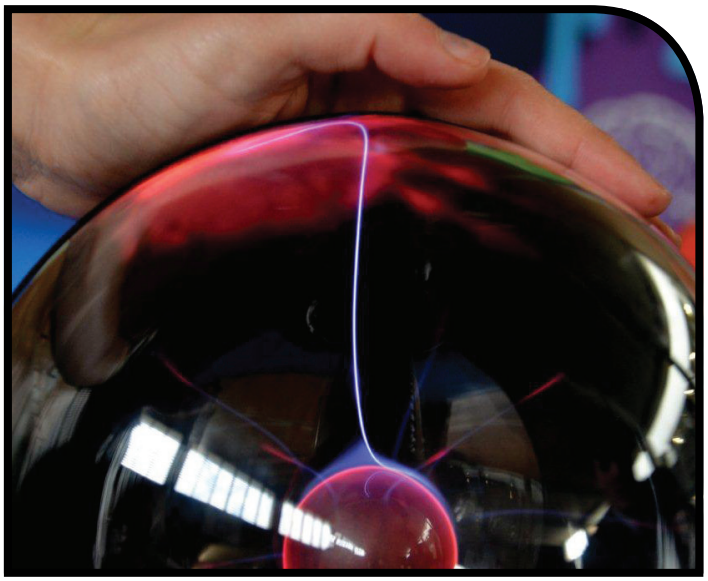
This was an amazing show encompassing all aspects of Science. Our host started off with a few experiments on pressure before moving on to electricity. Here he demonstrated a simple static electricity experiment where he used a special static electricity generating machine. It had a large metal ball on top with a piece of material under it that was rotating through it. As the host brought another metal ball close to the big one, there was a huge 'lightning' spark. Next was one of the most amazing experiments I have seen. It involved sound and a device called a Rubens Tube. The tube was basically a long horizontal metal pole that worked like a barbecue. The host set it up by lighting the flames on it like a BBQ, so there was one level stream of flames. On one end of the tube was a CD player with speakers. When he played a CD, the flames moved to the beat of the song. Very big pulse of sound cut a wave through the flames. It was amazing! The flames were even higher near the speaker because there was more energy from the sound. The movement of the flames all comes from the sound waves pushing them. On the topic of sound, he moved on to a slinky experiment that demonstrated how sound is a 'compression' or 'longitudinal' wave. The host held one end of a slinky while a volunteer held the other end. The host pushed and pulled the slinky, and we could see a section of the slinky that was closer together moving along the length of the slinky. This 'closer together section' represented sound, and showed how it travels. Next he did another experiment which involved making sound. He covered an aluminium rod in a special resin. He used a cloth to rub up and down the rod really quickly, and this generated a very high-pitched sound. This was really quite amazing as it wasn't expected that such a loud sound could come from rubbing a rod. After this he moved on to talking about light. He began by demonstrating a Newton's Colour Wheel. It was a disc that had various colours on it. When he spun he disc, it became grey because our eyes can not detect all the moving colours so fast. He then asked us to watch the disc again, but shake our heads from side to side. When we did this, we could actually see the individual colours, because our eyes have more time to detect them. After this he did another experiment involving fire. He asked for a volunteer, and with strong encouragement from the audience Mr Forsyth was chosen. He had to put on a large face protection shield and hold a lit up gas torch in front of him. The host put some flour into a funnel that was attached to a tube, and blew out of it so all the flour blew into the air. All the particles ignited together into a huge fireball that was big enough for us to feel the heat! He finished off the presentation with a good old liquid nitrogen experiment. Liquid nitrogen rests at about -196°C and doesn't exist naturally (it is created by man). Our host placed water in a plastic cup, and floated a bottle in the cup. He put a lid on the bottle, but it had a small hole in it. He then reached for the liquid nitrogen. It was surprising to us as to why he didn't wear gloves. Apparently, gloves are dangerous as liquid nitrogen can fall into them and do more damage. Anyway, he poured the nitrogen into the bottle and closed the lid, and the bottle started spinning really fast. This is because the nitrogen is becoming a gas and all being forced to escape out of one small hole. This was a fun and simple experiment to finish off the excellent presentation that encompassed most aspects of Science.

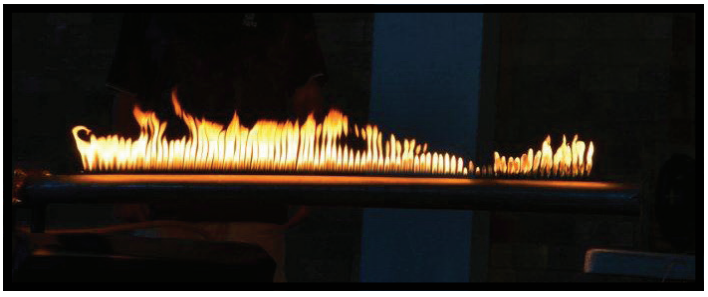
States Of Matter

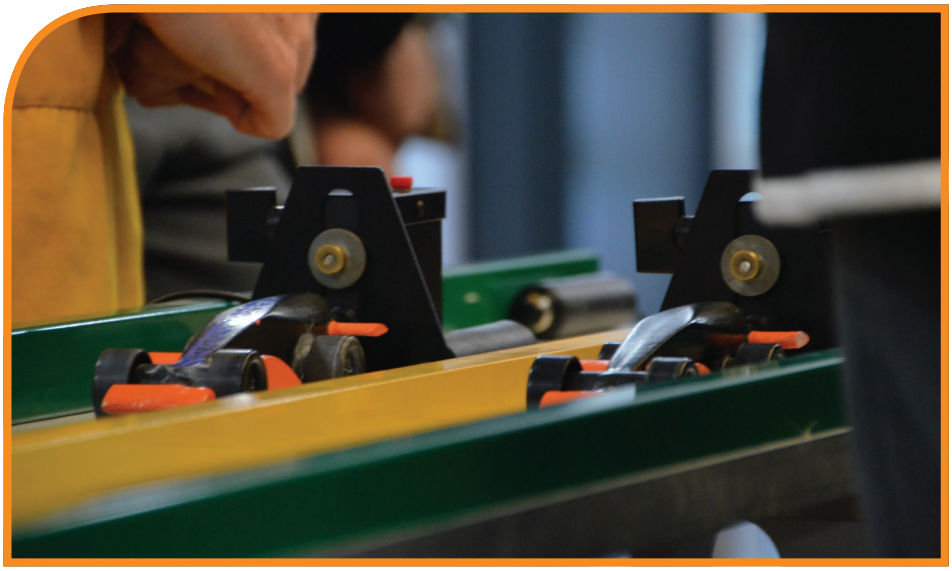
Featuring

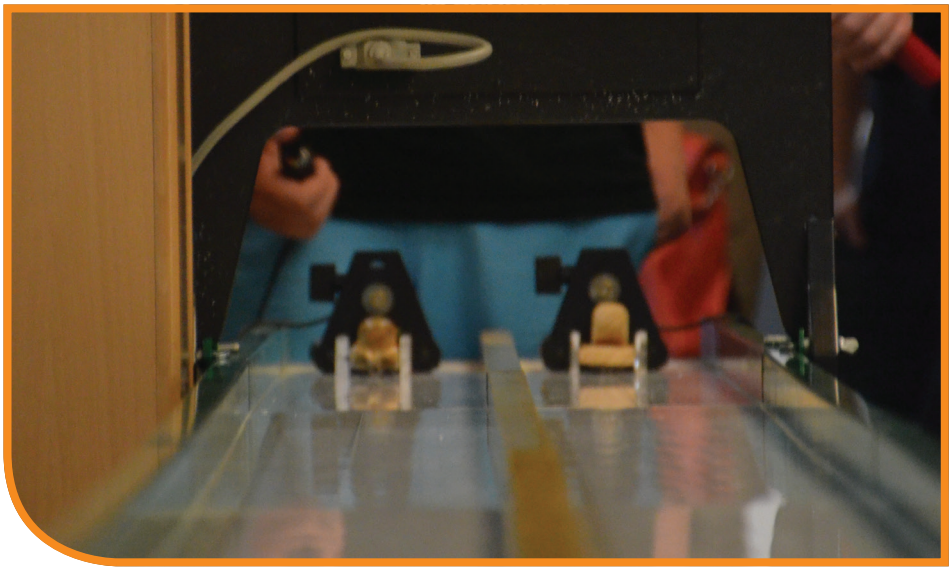
Ella Braden - CSIRO

Ella started off her presentation by giving us a few facts about the CSIRO. They actually invented the concepts of wireless Internet, and so, they get a $4 surcharge on every wi-if capable device in the world! Also, the CSIRO is working on a special photovoltaic fabric that can be built into devices and charge them from the Sun. However, this presentation was about states of matter. She showed us two black blocks. One felt rough and the other felt smooth. One felt cooler and the other was warmer. She placed an ice cube on both, and the ice cube on the one that felt cooler melted quickly! She told us afterwards that the colder one was made of a metal and the warmer one was made of a special foam that is used in the space shuttle. The metal one gains heat really quickly, so when she was touching it, all the heat from her hand warmed up the block and melted the ice. Next she placed some dry ice in a beaker. When she blew on the dry ice, carbon dioxide gas came out. This is because the dry ice was sublimating (changing from a solid to a gas without becoming a liquid. Dry ice freezes at -79°C, so it has a very low 'boiling point' which is about room temperature. She then put some of this dry ice in a balloon. She asked us to think up a hypothesis and we all said the balloon would expand. She tied up the balloon and several volunteers held and rubbed them. This heated up the ice, causing it to sublimate quickly and expand the balloon gradually. She then put some dry ice in a film canister and put the lid on. This time our hypothesis was that the canister would shoot up into the air. To make it more fun she even put a little foam rocket on one of the canisters. She left them for a while, and eventually they all shot up to the roof and, yet again, our hypothesis was correct. She then moved on to show us the basics of solids, liquids and gases. She had ping pong balls in a cage and used them to represent atoms. She showed us what the atoms looked like in the form of solids, liquids and gases. Continuing from this, she said that if atoms were increased to ping pong ball size, then a ping pong ball would roughly be the size of the Earth! This concluded the short but interesting talk on states of matter.









Motor sports Engineering

Featuring

Chris Bloomfield-Brown

Chris began with a simple introduction before talking about how engines work. They make power by burning fuel that creates pressure and turns a piston. The turbine in an engine is spun by hot air. Having more air in an engine creates more pressure, spins the turbine more and creates more power. He then talked to us about the most powerful F1 car. It is called the Benetton B186, and only has a 1.5 L turbo engine (which is very small compared to the bottom of the range Carson today's market!). However, it has over 1300 HorsePower because it uses a turbo. The engine only lasts for 45 minutes before it has to be replaced. He showed us a video of the engine running at full throttle, and all the tubes when completely red hot! He then talked about the fact that being a race car driver is very, very difficult. Chris said they are "like robots"! When they do laps, they can get their times consistent to within 0.1 of a second! Chris' job is to analyse race data and tell drivers where they can improve. F1 racing is a very expensive 'money sport'. The most money spent on an F1 team is on the tyres, brakes and, believe it or not, the food and hotel costs for the team members! Older V8 cars cost about $150 per lap, but newer cars can cost up to $15 000 per lap! Each team uses about 7-20 computers, which they use for very in-depth analysis and collection of race data. Chris showed us some of this data which looked very complex! Chris finished off by enforcing how race cars and road cars are completely opposite, and that driving safely on the roads is extremely important.

Space Shuttle

Featuring

Ivy Wong

Ivy began by telling us that the space shuttle program program (SSP) ran from 1981 to 2011, and was created to build the International Space Station (ISS) and to create a reusable form of space transportation (unlike the Russian Soyuz, which was single use). The space shuttle, however is “like a Boeing 747” and can be reused. The SSP ended because of the risk to human life and the high costs associated with space travel.

The shuttle begins its journey with a rocket lifting off in clear weather. Observers usually gather to watch these launches, but have to remain at least 10km away from the rocket. even there they can still feel the ground shaking because of the enormous energy present. Within two minutes, it reaches a height of 50km and a speed of 4600 km/h and all the fuel in the smaller tanks would have been consumed. Within 8 minutes, it is 100 km above the Earth and all the fuel in the larger tank is used. At this point, all the tanks detach from the shuttle, and fall to Earth. They deploy parachutes at about 3km above the Earth, fall into the ocean and are collected and reused. The shuttle itself then continues to space. It is as wide as a Boeing 747 and lands on a normal runway like a plane (part of the reusable aspect). 6 shuttles were built for the SSP: Endeavour, Enterprise, Discovery, Columbia, Challenger and Atlantis. Most shuttles travel around 200 million km in their lives. They are very big and can carry 7 people plus 25t of cargo, while the Russian Soyuz could carry only 3 people OR 2.5t of cargo (however, there were only 4 total deaths in the Soyuz Program compared to the 14 deaths in the SSP). The shuttles are constructed in a special building in the United States. The outside of one of the building walls has a huge US flag painted on it with striped the length of a bus! 37 out too the 135 shuttle missions went to the ISS. The shuttles were used as space labs, for servicing of other shuttles, for the placement of satellites and for the construction/servicing of the ISS. The shuttle ‘Discovery’ took the famous Hubble telescope into space. The Hubble is a 2.5m long optical telescope that takes highly detailed images of space. Scientists all over the world can apply for time using Hubble, where they have control of it and can use its data. Ivy and her tram used it to do more research into a galaxy that they discovered! These telescopes can see light that was emitted 6 billion years ago! This means our universe is extremely huge! Scientists are currently working on the James-Webb telescope which uses infra-red technology that can be used to see back just 200 million from the Big Bang, giving us a good view on the origin of the universe! It is 65m high and will automatically unfold in space. It is expected to launch in 2018 and $6 billion has already been spent on it. This telescope will also be used in the research of dark matter. This is the mysterious force that is commonly know as negative vacuum energy, and is causing our universe to expand. The Chandra X-Ray observatory is another telescope, but it was launched into its final orbit without humans. The space shuttle dropped it in a particular spot, and it used its own boosters to go higher than the space shuttle can safely travel. It has been working since 1999 and can not be serviced because it is too far away. It observes very hot regions like supernovas and colliding galaxy clusters. It also has special technology known as gravitational lensing that allows it to detect invisible matter (i.e. dark matter). So many people don’t see how the SSP has benefited us. The artificial heart is based on the fuel pump system used in the shuttle. Prosthetic limbs are made out of the lightweight, almost indestructible material used in the shuttle fuel tanks. The LEDs used to grow plants in the shuttle can be used to kill cancer cells. Special firefighting cameras are the same ones used to monitor the heat of the shuttle during re-entry. So there have been over 100 major benefits that have come from the SSP that save hundreds and thousands of lives. The SSP ended in August 2011, but NASA hopes to get shuttles running again from 2020. In 2020 they are aiming to have a 4 person multi-purpose vehicle to take us to Mars. Unmanned rovers like Juno and New Horizons expect to reach Jupiter and Pluto by 2015/2016. This was a very informative and interesting talk, which I personally think was one of my favourite events in the whole festival. Ivy finished her talk with a great quote: “To confine our attention to terrestrial matters is to limit the human spirit” - Stephen Hawking.

Ivy Wong

Sympathy For The Devil

Featuring

Kathy Belov

Although the title of this presentation seems like it will be some philosophical or religious talk on the devil, it is actually about the Tasmanian Devil. Kathy opened her talk by giving us basic facts about the devils. Males weigh about 7-13 kg while females weigh 4-9 kg. they are scavengers and clean up all the dead organisms. They have a very short 18 day pregnancy and give birth to around 30 young. Usually only 4 end up surviving. The babies are so small, that 4 newborns can fit on a 20c coin! The surviving babies continue growth in a pouch on the mother. They live for about 5 years and breed at ages 2, 3 and 4. They are the largest remaining carnivorous marsupials, but became extinction on the mainland about 3000 years ago because of dingoes. They are now an endangered species.
As a veterinary scientist, Kathy then talked about a diseases killing many Devils called the Devil Facial Tumour Disease. This is a horrible cancer that severely distorts the face and inhibits them from eating, letting them starve to death. The disease has caused an 85% decline in Devils and they are predicted to be extinct within 25 years. The tumours are highly contagious and nearly always fatal after lesions appear. However, they do not affect young Tasmanian Devils. Over 100,000 devils are infected, and their immune system does not react to the tumour at all, making it a lot more deadly. Their body doesn't recognise the tumour as foreign because the Devils share a certain gene that the tumour has too. Devils in north-west Tasmania are immune to the disease because they lack the gene that the other Devils share with the disease. There were several attempts at vaccines and skin grafts, however nothing has been fully successful yet. It is horrible how these poor creatures have to go through all this pain. Although this presentation was quite eye opening and saddening, it was very informative.

Cattle Dog Evolution

Featuring

Bill Ballard

Bill began his presentation by talking about evolution and Charles Darwin. Darwin spent most of his life working with evolution and published his famous book - 'Origin of Species' - in 1859. The book included chapters on: animal variation under domestication, animal variation in nature and the struggle for existence. Bill's talk was mainly about his cattle dog called Taz who he brought in for the presentation. Taz is valued at $25 000 and actually has a grand-son who sits with his owner on the Manly Fast Ferry! Cattle dogs are mainly show dogs and are an excellent representation of human induced change on animals (Darwin would refer to this as 'Animal variation under domestication'). Taz is a very resilient dog. He ran a marathon with Bill and finished first, even though they started 30 minutes before everyone else. During the marathon, Taz had to have vet checks every few km to check if he was alright. He even had to have obedience checks along the way to make sure he wasn't too tired and that he could still think straight! He has been bitten by venomous snakes and is now a very old, obedient dog. He has several children and is a very cheerful dog. An example of 'animal variation in nature' is his poor hearing (inherited from Dalmatians) and his eye disease (in most cattle dogs). Bill finished off by saying that it is important for dog owners and breeders to know the evolutionary history of their dogs to prevent inbreeding and to care for the animal better. Bill presented a great talk, which was made better by his amazing dog, Taz.

Bad Science Show

Featuring

Nicholas Johnson

Nicholas Johnson, Australia's 'Most Honest Con Man', was one of those presentations that everyone was talking about for days after it took place. I walked in halfway to find Nicholas talking about how the company that made Power Bands had been sued to point of near bankruptcy because people realised that they were just rubber bands with a silver sticker.

Nick then claimed he could read minds via telepathy, instinct, mentalism and ESP. Everyone in the hall was skeptical, but he proved all of them wrong. He picked 4 boys, and told all of them to pick a random page in a book. He correctly identified the first word, described a picture, stated the amount of words in a random sentence, and guessed the page number for all the different boys, without even looking at the book!

Nick then talked about the phenomenon of pareidolia. This is where the mind perceives something to be significant. This is used to explain the sightings of many ghosts in recent history. A combination of the angles of lighting and the position of other objects can create the illusion of a ghost.

The "Bad Science Show" concluded with Nick walking on broken glass and relating it to pressure. Because his weight is distributed evenly over the glass, it doesn't puncture his foot, no matter how painful it looks.

The "Bad Science Show" was one of the most unique and interesting presentations with the boys trying to read each other's minds long after the presentation was over.

Climate Change

Featuring

Andy Pittman

Climate Change is a very serious issue, and an issue that will affect our generations immensely in future years. Andy Pittman, with a wealth of experience behind him, did a very good job at explaining climate change in a very engaging and clear manner to a room full of Year 10 students. I walked in about halfway through to be hit with statistics and very interesting facts. At the moment there is an extra 15 786 000 joules of energy per square metre due to carbon emissions. This is the energy equivalent of 200 Billion hair – dryers running continuously for the past 30 years continuously. A mind blowing fact. This energy is warming the atmosphere, which is causing rising sea levels and increasing the annual average temperature. Pittman pointed out a scary amount of everyday factors that contribute to this: cars and other modes of transport, land clearance, all kinds of electricity and the list just goes on and on. Pittman then showed a graph which clearly showed the exponential increase of Greenhouse Gases in the last 42 000 years. A very scary thought. Since we were born, around 15 years ago, the amount of natural carbon dioxide in the atmosphere has increased 20% from its natural norm. Due to Greenhouse Gases like Methane, Carbon Dioxide and Water Vapour, it has not been warmer than now in the past 200- years. As of 2012, the temperature has risen 0.74 degrees in the past 20 years, but will rise 5 degrees in the next 90 years! If we carry on the way that we are, sea levels will rise 30 – 60cm and the rate of sea level rise will grow exponentially at an alarming rate in the next 100 years. If the ocean problems couldn't get any worse, the ocean absorbs 50% of all Carbon Dioxide emissions, which leads to carbonic acid, detrimental to all marine life. When it comes to mitigation, Australia should adapt to the projected changes and plan strategies. Climate change cannot be magically turned around, but we have to change based on the state of the environment. At school, we can recycle, compost and use alternate modes of transport. At home, it's all about managing electricity and turning things off once your finished with them. It can even come down to one's choice of car. Some cars are definitely cleaner choices than others. This presentation was an eye – opening experience about how this issue is becoming more and more prominent and the effects are starting to hit closer to home. It is a problem that our generation will have to combat and deal with. It will fall to us to come up with strategies and ideas to mitigate the effects of the enhanced greenhouse effect. When it comes to finding out more about climate change, we must all be careful to use trustworthy sources, and double check everything we find.

Biotechnology

Featuring

Dr Bill Walsh

Personally, "Biotechnology" was one of my favourite presentations of the festival. Although there was a lot of information, it was presented very well by Dr Bill Walsh, with props and good interaction from the audience.

The presentation centered around tissue engineering and osteoarthritis. Osteoarthritis, a type of arthritis, is a very big problem. At the end of every bone, there is soft tissue, for example, at the end of the femur, there is soft cartilage. Over time, this cartilage wears away and there is bone-to-bone contact. To demonstrate this, a cow leg, with all the muscle still on it, was passed around so everyone could see the tissue in its normal state. Osteoarthritis can be caused by playing sports, trauma, like a car accident, or even tumours. It was then explained that a synthetic material is put into the knee to somewhat repair it. It is injected into the focal legion of the knee to help the cartilage heal.

We then all got introduced to 'Tissue Engineering' which is the combination of cells and engineering to improve or replace biological functions. In simplest terms, this would involve taking a suitable material, taking the relevant cells and sort of growing them together to put back into the body. This would involve being familiar with patents.

Welcome to the world of patents!
A patent is legal protection for an invention. To obtain a patent, your idea has to be new and inventive. There are a few steps in acquiring your patent:

To get your medical patent into the market, you need to have a sufficient enough problem to solve.

You need a group of people with enough brainpower to do the job.

Hopefully, an idea will evolve out of the brainpower.

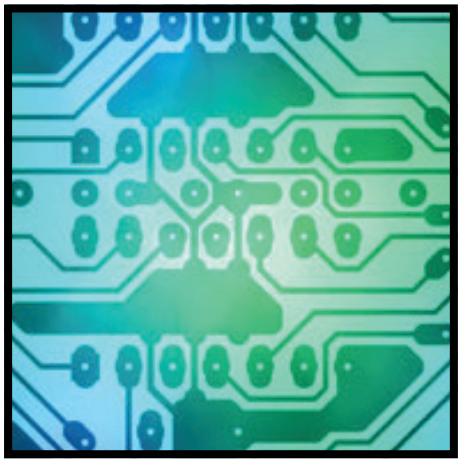
You need lots of money.

You need that 'special sauce' that will lead to success, whether it be your contacts, your timing etc.

Intellectual Ventures, a patent company, is working on a solution to osteoarthritis, and saving the trouble of having a full knee replacement. A graphic video of a knee reconstruction followed, where the whole process of drilling and sawing the bone was very visible. It was just coincidental that this presentation was right before lunch.

After the video, Dr Walsh asked students whether they had any ideas about solutions to arthritis. There were a lot of very good ideas. Josh Amos suggested inserting a rod between the femur and tibia. Another suggestion was a form of cushioning between the fibula and tibia. Jean – Luc Poidevin suggested creating artificial cartilage and putting it into the leg, a tissue engineering type idea. Matt Hardman came up with two brilliant suggestions. His first suggestion was a tissue engineering type idea about cartilage transplants. His second suggestion, Dr Walsh's favourite, was a self – releasing gel that releases whenever one needs to unload pressure.

In conclusion, osteoarthritis is a problem that will affect one in two people, and tissue engineering is something that will continue to develop as we go into the future. Everyone in the audience enjoyed this presentation, and the contributions at the end were among the best Dr Walsh has seen.


Electric Circuits

Featuring

Fergus McKenna

The "Electric Circuits" event started off with a wonderful introduction by Fergus McKenna. This brilliant start continued after Rafi Newell impressed our guests by knowing what CSIRO stood for. An introduction to electrons was completed with much contribution from the boys including electrons travel in an electric current through a circuit and one boy correctly identified the mass of an electron as 'very light'. An electron's mass is 0.000000000000 0000000000000000000911kg. The boys then opened up the boxes on the desk in front of them and got straight into building some circuits. This was a very hands – on experience with boys familiarising themselves with terms such as 'bulb', 'switch', 'resistor', 'capacitor', 'diode' etc. by actually using them to build the circuits. All boys involved had fun and were very proud once they successfully produced a light after their circuit construction.

Heart Parts

Featuring

Roman Greifeneder

Roman Greifeneder has over 19 years worth of experience in the medical device sector and this was evident during his very engaging presentation. The medical problem that he was addressing today was heart failure, which is the weakening of the heart. There are 400 000 cases of end stage heart failure in the USA, and only 2000 hearts available for transplant. 10% of the population that are 70 years and above are diagnosed with heart failure.

When it comes to medical devices, there are 3 classes: Simple, Moderate and Important. VentrAssist, an artificial heart, would fall under the 'Important' category. This device doesn't actually replace the heart, but assists, hence VentrAssist. This has proven to be a very successful solution to the problem of heart failure. There was a case of a 16 year old having heart problems. A mechanical heart assisted her heart for 1 year, until her original heart fully recovered, at which point the VentrAssist was removed. With this artificial heart, all action can be done, no matter how strenuous. One can play sport, travel, run etc. It is just like having a normal heart. The VentrAssist takes 8 hours of surgery to put in which includes spreading the chest.

The presentation concluded with a video of the insertion of the VentrAssist. It was very graphic, however explained a lot about the mechanics of VentrAssist that Greifeneder was talking about. A very interesting concept and a very good indication of just how much technology has benefitted medicine.

Fishy Tales

Featuring

Effie Howe

A bright, sunny morning saw the beginning of the Science and Technology Festival. "Fishy Tales", coordinated by the very passionate Effie Howe started the day. Entering the room, one would be stunned with how interesting the room looked. It was filled with different types of water creatures, from dragonfly larvae, to a family of Rainbow Fish. Boys rotated around 8 workstations, all of which had something different. At one station, boys were informed that 'Gambusia', a kind of mosquitofish, was introduced in the 1920s by Americans to control the mosquito population in Australia. However, after much study, it turns out that native species of Australia are just as effective at getting rid of mosquitos. So basically, the introduction of 'Gambusia', which is now a pest, was just pointless. It was then pointed out that Australia has a bad history with introduced species like the cane toad and rabbit turning into pests as well. Boys used a variety of instruments and explored different aspects of science, one of these being a Scanning Electron Microscope (SEM). Boys also looked at salinity and temperature of water and found out what conditions different fish live in. Another one of these stations was using a microscope to see very small fish eggs and little larvae, where all boys found their inner biologist. More colourfully, at the front of the room, one could find seahorse skeletons, and a fishbowl filled with maroon anemone. One of the activities, which everyone found enjoyable, was interacting with a hermit crab, and seeing its climbing skills. A ruler was placed just above the crab, and it was able to climb this ruler with ease. Fishy Tales was a very unique look into the art of fish ecology. It was very hands – on which added a lot of interest, and Effie was happy to answer the many questions that the boys had. A very positive start to the festival.

Forensic Flying Squad

I was surprised as I walked into the room to find 9 stations all with interesting looking things on each of them. With Effie Howe running this activity, you knew it would be hands on and fascinating. The boys were asked to solve a murder by rotating around the stations to try and find the evidence. They were given the background information and a case file of the crime. The boys got to work with all kinds of equipment including; microscopes, chromatography, deciphering fingerprints and using protein testers that showed different colours. Terry Christoforou summed it all up with 'Wow!' as he saw the video microscope – where the microscope projected its sight onto a laptop. A fun experience for all.

Sky Lab

Featuring

Shane Hengst

I managed to pop into Centenary Hall to see Sky Lab – sort of. I walked into the hall and saw a massive dome in middle of the floor. There was an entrance on the side which one had to crawl through to get into the dome. Basically, the dome was an inflatable planetarium. The audience was being taught simple astronomy and information about different stars and constellations. Stars were projected all over the roof and sides of the domes. Different images were labelled with arrows highlighting certain areas of importance. One could hear the laughter and gasps of Year 7s from the inside, and this pretty much told the whole story.

Insects

Featuring

Dr Dieter Hochuli

24 excited Year 7 boys walked into the "Insects" presentation chattering among themselves, all them trying to anticipate just what they would be doing. Dr Dieter Hochuli soon clarified everything once he started the presentation. 'Insects are the most successful animals on the planet.' This is what Dr Hochuli started the presentation with. If humans disappeared, insects wouldn't notice our absence at all. However, if insects disappeared, there would be massive impacts on us when it comes to food, water, pollution etc. Insects do a lot more than we think they do. The basic structure of an insect is their head, connecting to their thorax, which connects to their abdomen. Their thorax contains all their muscle. Dr Hochuli finally revealed exactly what the boys were going to do. They were 'Lassoing Locusts'. The boys actually used copper wire to gently put the locust on a leash in essence. The boys were lucky enough to use strobe lights and see close up how the locusts used their wings to fly. The strobe lights were used because at normal speed, the wings are impossible to keep up with. The strobe lights created a slow – motion effect which all boys found fascinating. Have you ever tried to smack a fly and missed? Almost everyone has. This is because insects have a very simple nervous system that responds very well to simple stimuli. Their nervous system is also the reason why such a small thing can do such clever things. Insects are very successful at using limited resources and making the most of what they have.

Dr Hochuli is a very funny man and very passionate about what he does. This made for a very good presentation with clearly explained information.

Invisibility

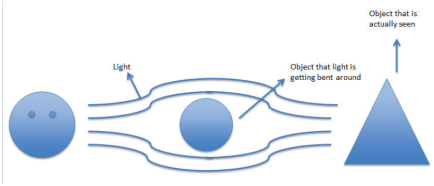
Featuring

Boris Kuhlemy

If you could have any superpower, what would it be? My response to this question was always invisibility, so I was very excited for this presentation and it didn't disappoint. Invisibility is something associated with fiction, like the invisibility cloak in *Harry Potter* and *The Invisible Man* by HG Wells. However, this presentation revealed that invisibility was actually possible in the real world. Boris Kuhlemy started off with talking about our sight. Basically, we see things via emission, absorption, reflection and refraction. So, the recipe for invisibility would be no emission, no absorption, no reflection, and no refraction. Light is a wave, and when waves slow down, they change direction. The refractive index quantifies how big or small this change is. To achieve no refraction, we need the refractive index of two objects to be the same. He demonstrated this by putting a substance that was 99% water and 1% 'scaffold' into the water. It was pretty much invisible. His next demonstration was a picture of a brick on top of aerogel, which has a refractive index slightly higher than air. It looked like the brick was levitating.

To achieve invisibility, we need to 'speed up' light. So how does one speed up light? The answer is by removing the space that light has to travel through by adding materials light can't go through. If you put silver in front of light, it undergoes diffraction. If you put a piece of 'invisible fibre' (a special type of glass), with little metal bits in it, there should be no refraction. The little metal bits would have to be 30 nanometres apart. This will be achievable in a few years with the correct type of glass and metal bits one – millionth the size of a human hair.

The invisibility cloak displayed in Harry Potter would involve bending light around objects as shown below:



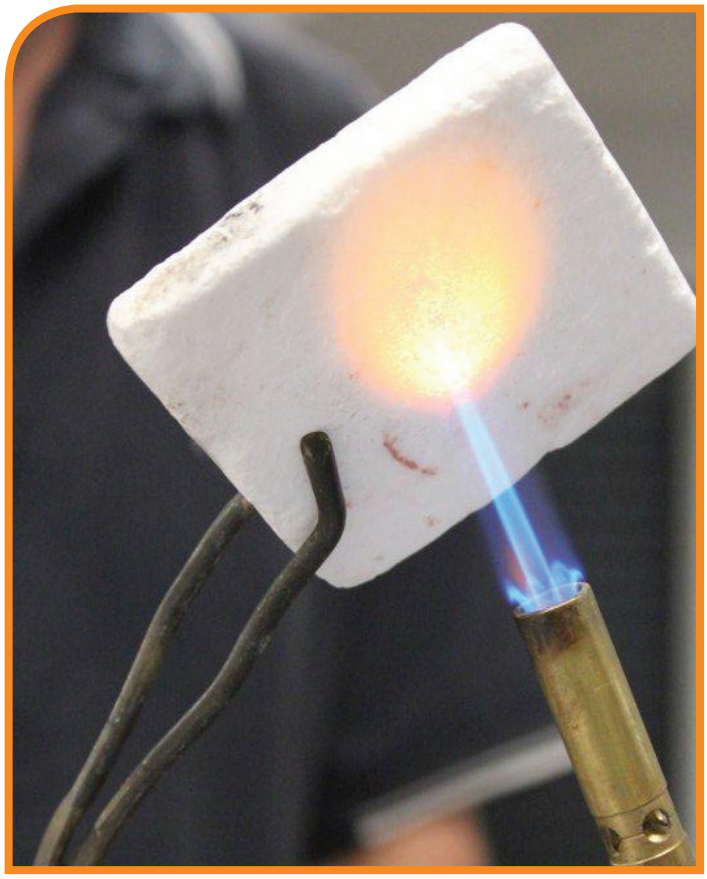
Another detailed diagram on the board clearly showed that making something invisible from one angle is easy enough, but making it invisible from other angles, while staying in the same place, is very difficult. In principle, it is possible, but it is just very hard. This presentation was one of my personal favourites and it was exciting to see something that I always saw as 'magic' so close to being reality.

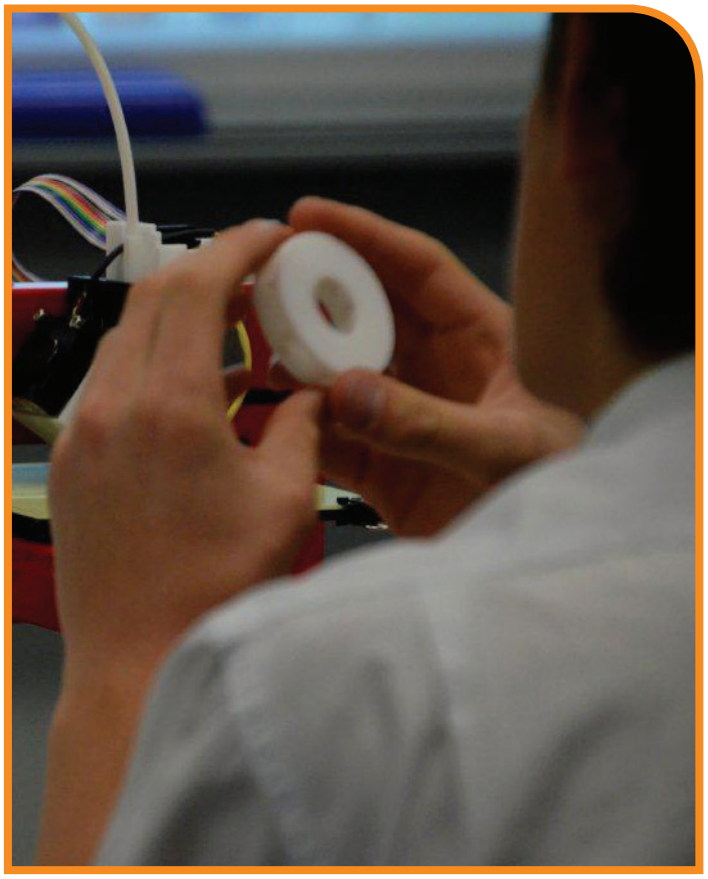
Shark Dissection

Featuring

Vincent Raoult

The title says it all, doesn't it? Everyone was buzzing with excitement as they took their seats. It turns out that 90% of sharks, 60 million of them a year, are wiped out around the planet, mainly due to long–lining. Raoult explained that it wasn't a matter of stopping fishing completely; it is a matter of doing it sustainably. There was excited muttering as he announced that he was going to bring the shark out, and a unanimous breath of awe as the slimy shark was placed on the table. Sharks tend to get slimy when they are caught; this is a protective mechanism. They avoid predators is by lying in the sand and burying themselves completely. Sharks don't have scales, they have 'denticles', which are as hard as steel, and were actually used as sandpaper 100 years ago. The vast majority of sharks have very good vision, but are colour blind. They compensate for this colour blindness by their smelling prowess. Whereas human noses serve 2 purposes; to take in oxygen and to smell, sharks only use their noses to smell. A common misconception about sharks is that human blood attracts sharks. If a shark was to follow the scent of human blood, it would purely be out of curiosity. However, the scent of fish blood would make the shark crazy with excitement. Shark hearing is also very good. This is enhanced by the fact that water travels over longer distances and more clearly in water. Raoult then made a professional slice through the shark's stomach to reveal an array of different organs, all different shapes and sizes. He pointed out the shark's liver, which can be up to 400kg. This is because a shark's liver produces a very unique oil that keeps the shark very buoyant in the water. When a shark has a very big liver, you know it is healthy. A shark's stomach, as we could very clearly see for ourselves, are very muscular, and can actually expand to the size of the shark's full abdomen. Then, we were faced with a problem. All the 'interesting stuff', as Raoult called it, was underneath the stomach; and, to get to it, we would have to cut it open. However, after persuasion by very keen year 9 students, he cut open the shark's stomach. One of the highlights of the presentation was Raoult taking a massive chunk of half digested fish out of the shark's stomach and proudly displaying it to the audience. Fascinatingly, one can tell the age of a shark by cutting a shark's vertebrae and looking at concentric growth rings, similar to a tree. In conclusion, this was a very good presentation that presented the information in a very clear manner. A warm round of applause indicated the end of the highly anticipated shark dissection, and it did not disappoint.





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