1.0 Introduction

Not all scientists fit the stereotype of a middle-aged male with glasses and a lab coat!

The *Young Tassie Scientist* program is aimed at raising awareness of the role undertaken by young scientists in different areas of scientific research in Tasmania.

It involves developing profiles of selected scientists and publicising these during *National Science Week*. Scientists also participate in key *National Science Week* events and present talks to school groups at both primary and secondary levels.

In 2004, the *Young Tassie Scientist* program will also involve science/art collaborations with students from the University of Tasmania's School of Fine Arts, who will create artworks inspired by the scientists' research, resulting in an exhibition "*eMerging*" at Salamanca Arts Centre during *National Science Week* and the following *Tasmanian Living Artists Week*. School students are also invited to create artworks based on the science themes; these will form a concurrent exhibition, "*eLemental*," on display at venues in Hobart, Launceston, Devonport and Burnie.

The *Young Tassie Scientist* program raises awareness of the value and relevance of science, engineering, technology and innovation; it assists in making connections between studying science and resulting jobs and careers; it helps to build a scientifically literate society - and it celebrates the excitement of science and innovation!

2.0 YOUNG TASSIE SCIENTISTS IN THE CLASSROOM

LINKS TO THE ESSENTIAL LEARNINGS

Thinking:

>> Inquiry:
Students will have the opportunity to ask questions of visiting scientists, during their visit, or by email – they may be interested in an aspect of the research, or in why the scientist chose to follow a particular topic or career path.

Communicating:

>> Being Information Literate

>> Being Arts Literate
Students will be able to access information about the *Young Tassie Scientists* and their work on the website, through links to other relevant sources of information, by email. They will then be able to share meanings of key ideas and present their own interpretations by creating artworks (paintings, drawings, collages or digital images).

Personal Futures:

>> Building and Maintaining Identity and Relationships

>> Creating and Pursuing Goals
Students will hear personal stories of *Young Tassie Scientists* - what influenced them to study science, why they chose their particular career pathway, what their goals are and how they plan to achieve them.

Social Responsibility

>> Building Social Capital
Students will learn of the interdependence of individuals, groups, institutions and organisations, all of which are involved in some way in the scientific process – whether this is on a personal level (friends and colleagues), on an academic level (universities and research organisations) or an applied level (industries and communities). They will have the opportunity to discuss and assess the social capital of the science being presented, in addition to its relevance in daily life.

World Futures:

>> Understanding Systems
Your students will have the opportunity to learn about systems in the biological, chemical and physical areas, for example, phytoplankton affecting climate change and artificial intelligence driving wind power systems.

Read about the innovative work of these twelve *Young Tassie Scientists* who are not only making progress in their chosen field, but also have fascinating stories to tell.

Go to the suggested websites to find more information on the scientists and their research.

Invite a *Young Tassie Scientist* to come and speak at your school before or during *National Science Week* (14 - 22 August).

For bookings, contact Fiona Taylor at the University of Tasmania's Faculty of Science, Engineering & Technology ph: 6226 2845 email: Fiona.Taylor@utas.edu.au

Involve your class in *eLemental,* the science art exhibition for school students, and create your own science-inspired artwork (painting, drawing, collage or digital image).

See section 5.0 for competition guidelines or for more information, contact Kim Menadue ph: 0419 983202 email: jexsouth@netspace.net.au

Visit the *eMerging* and *eLemental* art exhibitions inspired by the work of the *Young Tassie Scientists* and held during *National Science Week* (see www.scienceweek.info.au for details of dates and venues).

3.0 Science Themes

3.1 Exploring the Oceans

The Scientist

Tomas Remenyi BSc-BCom,
Institute of Antarctic and Southern Ocean Studies, School of Maths and Physics, University of Tasmania

Armed with a double degree in Science and Commerce from Deakin University, Victoria, and with majors in analytical chemistry, economics and management, Tom moved to Tasmania in 2004 to pursue his interest in Antarctica. He is enrolled in Honours at the Institute of Antarctic and Southern Ocean Studies in Hobart.

"In Years 11 and 12 I chose subjects that interested me, because if you enjoy something you will be good at it," says Tom. "I always enjoyed science and for a long time I was only going to do a science degree when I started uni."

But when he got to university, Tom decided to enrol in a double degree, combining science and commerce.

"I felt there were far too many scientists in the media who had little or no knowledge of how commerce worked. If I could understand commerce, I could make my research look more appealing and exciting to the public by understanding economics and management."

The double degree gave Tom a broader understanding of the world, as he learned to look at it through two perspectives: the scientific and the commercial. And as a bonus he earned two degrees in only four years of study.

"A combined degree effectively 'saved' me two years of study," he says.

For his Honours research, Tom is now investigating the morphology of foraminifera.

"'Forams' are microscopic, single-celled organisms that form a shell, similar to snails, and live throughout the world's oceans. When they die, they form fossils in deep-sea sediments and can be used in palaeoceanography, the study of ancient ocean systems, to identify how widespread sea-ice was in the past or past sea surface temperature."

Sea-ice extent is a useful tool that helps scientists determine global palaeoclimates. A more extensive sea ice zone in the past indicates cooler conditions than present, and a smaller sea ice zone indicates warmer conditions than present.

Tom loves both the ocean and the challenge of figuring out how things work; a combination that ties in perfectly with his research project. "I love getting my hands dirty as well as having to think analytically and solve problems." When he completes his Honours degree at the end of this year, Tom hopes to become an oceanographer and travel the world with his research.

More About the Work:

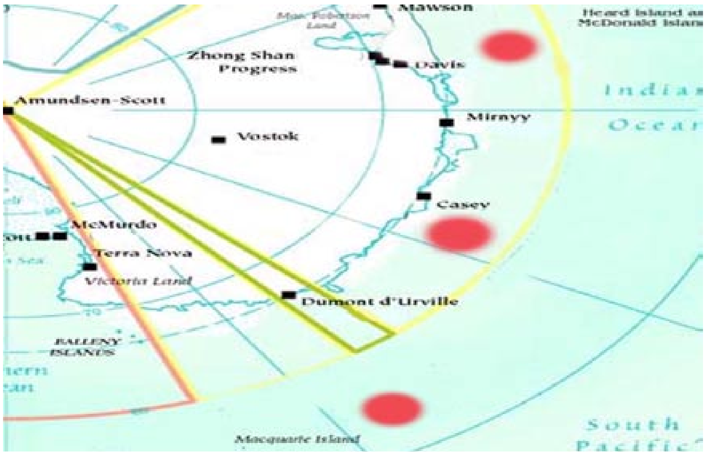
Key words:
Foramifera, sediments, paleoceanography, sea ice

Foramifera (or forams for short) are tiny single-celled organisms that have shells (also called tests). These shells can be made of material that ranges from calcium carbonate to sand grains.

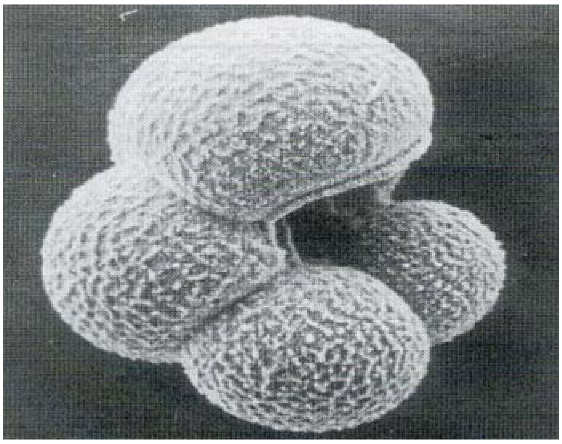
Forams are found in a wide range of marine environments, from the intertidal zone to deep sea regions. After death, the numbers of foram shells that are found in sediment samples can reach tens of thousands of individuals per cubic centimeter.

The two major groups of forams are benthic which means they live in sediments on the sea floor, or planktonic which means they live in the upper waters of the oceans.

Tom is looking for a particular type of planktonic foram called *Neogloboquadrina pachyderma* which is related to sea ice in Antarctica. This organism has 32 different forms (or morphotypes) depending on where it is found. So far, it has been identified from subtropical and northern Antarctic regions, Subantarctic and Antarctic regions.



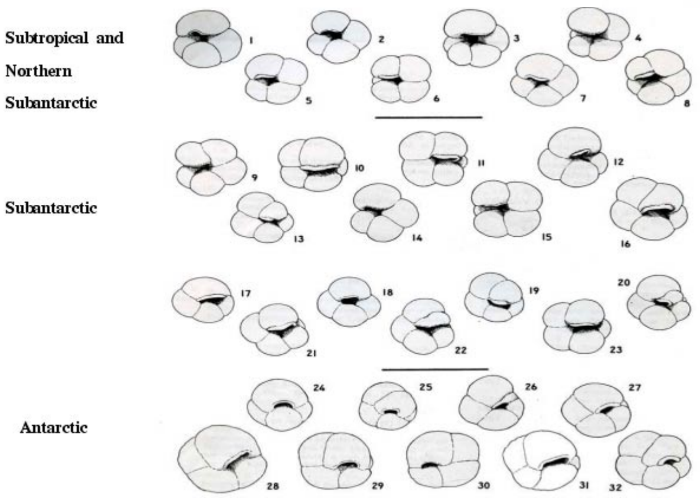
Locations of Tom's sample sites



The foram, *Neogloboquadrina pachyderma*

While these forams might appear the same, there are a number of subtle differences. By studying the structures of the shells, Tom, after many hours of looking down the microscope, can identify features that distinguish between different morphotypes.

Morphotype variation of *N.pachyderma*



He is particularly interested in why different morphotypes are found in different environments, and which ones are related to sea ice.

Because different forms of forams are found in different environments, paleontolgists can use these fossils to determine environments in the past. Looking at the chemistry of the shell is particularly useful as it reflects the chemistry of the water in which it grew. Tom is measuring the amounts of ^{16}O radio-isotopes in foram shells which provides information on the water temperature in the past. This data will help scientists understand how climate and ocean current have changes in the past – and may change in the future.

Websites:

Introduction to the Foramifera
http://www.ucmp.berkeley.edu/foram/foramintro.html

Foram Facts
http://www.ucmp.berkeley.edu/fosrec/Wetmore.html

Foramifera
http://oceanworld.tamu.edu/students/forams/index.html

Foram Gallery
http://www.microscopy-uk.org.uk/mag/artmar00/forwim.html

Paleoclimatology
http://www.ngdc.noaa.gov/paleo/globalwarming/paleo.html

Institute of Antarctic and Southern Ocean Studies
http://www.antcrc.utas.edu.au/iasos

The Scientist:

Mike Grose BSc, BAntStud(Hons),
Institute of Antarctic and Southern Ocean Studies, School of Maths and Physics, University of Tasmania

Mike is currently in his first year of a PhD at the University of Tasmania and the Bureau of Meteorology looking at the biological production of natural greenhouse gases and ozone depleting gases in the ocean, and their release into the atmospheric system.

Mike, who was born in Hobart, has previously completed a degree in biological science, and then honours in Antarctic & Southern Ocean studies, where his project was looking at measuring productivity (photosynthesis) in the ocean using new technology.

After honours he participated in several marine science voyages to Antarctica, which he found really exciting and a great way to meet other scientists, and then started a Masters degree – a project on Antarctic sea ice. His masters work was used to make an improved estimate of the biomass of microscopic plants (algae) contained in the sea ice of the Australian Antarctic Territory.

“This is a very large amount of biomass, comparable to the massive forests of the world, and an important variable in the biological and chemical cycles of the world system,” Mike says.

After travelling for a couple of years overseas, Mike returned early this year with a renewed enthusiasm for science.

Mike was interested in science from an early age, and got involved through learning from enthusiastic teachers, reading science books and “taking an interest in the fascinating world of science history and research,” he says.

“All the previous work I have been involved with has happened through meeting science researchers, taking an interest in areas of science research and putting my hand up to become involved,” he says. “Through meeting people and cooperating with the exciting science community, opportunities to do interesting things become available.”

His current PhD work interests him for three reasons: firstly the opportunity to work on an interesting scientific question and discover things that have never been found before. Secondly, the chance to contribute to our knowledge about our world and climate which is very valuable to know as we head into the future, and thirdly, the chance to work with interesting and intelligent scientists in a challenging and stimulating environment.

“I find looking for answers to science questions very interesting and challenging, more of a goal and ambition than just a job,” he says.

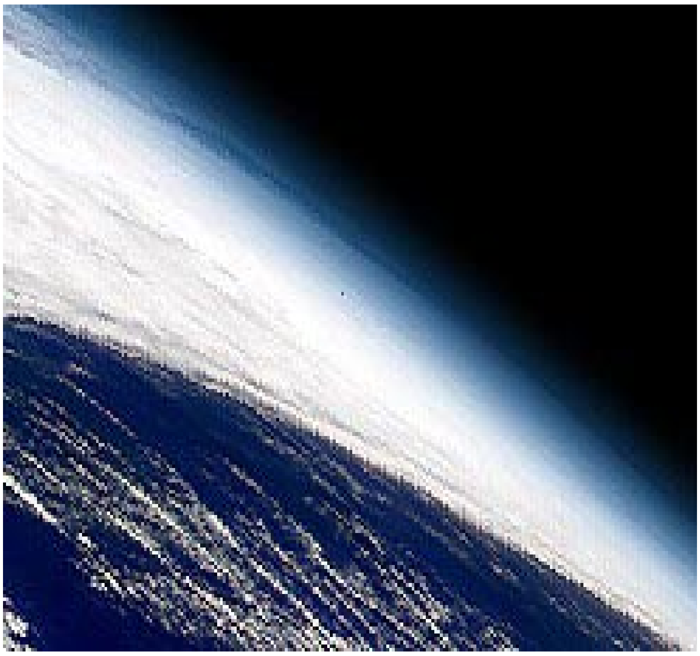
“Working in science research can be very exciting because you can contribute to new ideas and help make new discoveries and help us understand our world. I really enjoy working on a project that has a long term goal of increasing our understanding and knowledge.”

More About the Work:

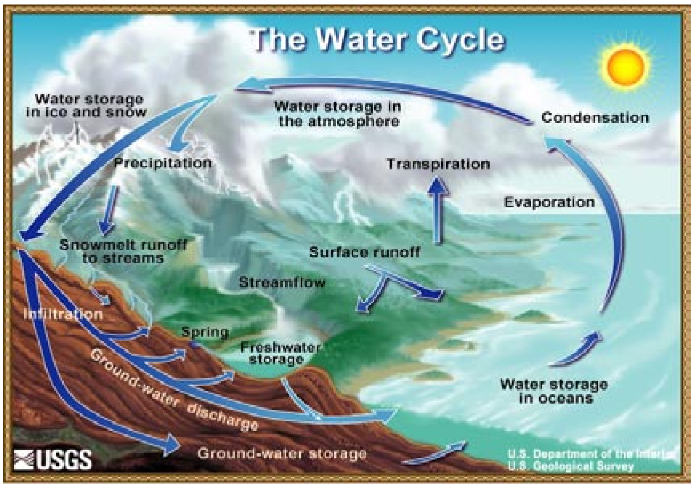
Key words: Phytoplankton, climate, atmosphere, ocean, methyl halides

Mike is studying gases important to our environment (in particular, methyl halides) and the microscopic plants in the oceans (phytoplankton) that produce them. This work involves having an understanding of the two key parts of our climate system – the atmosphere and the ocean.

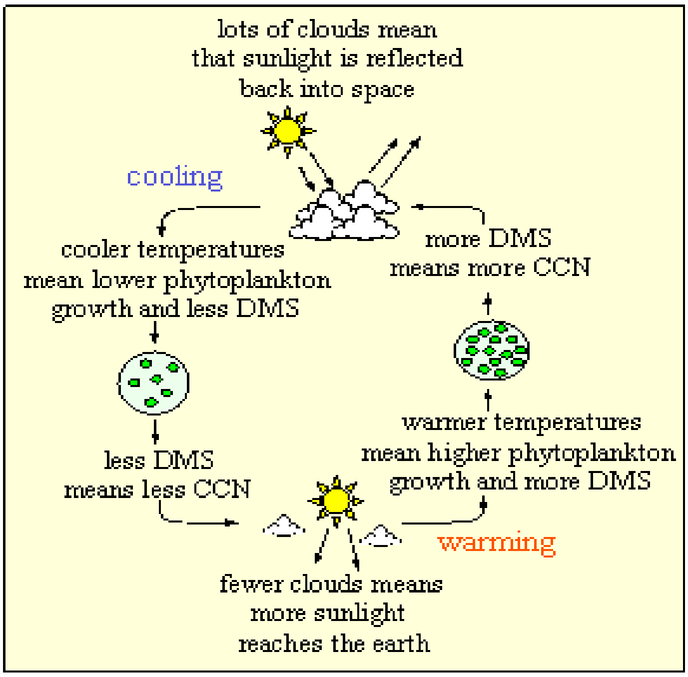
The atmosphere viewed from space



Reactions occur in both the atmosphere and the ocean – for example, in the atmosphere, the ozone cycle ensures a continuous supply of ozone to protect us from the harmful effects of ultraviolet radiation; and in the ocean, nutrient cycling is vital for all marine life. There are some cycles that occur between both the atmosphere and the ocean, such as the water cycle.



Other cycles involve the tiny plants, or phytoplankton, that live in the ocean. Certain species of these phytoplankton produce a gas known as dimethyl sulphide which is released into the atmosphere forming clouds. These clouds create shade, which means there is less light for these phytoplankton to grow leading to fewer phytoplankton and consequently less dimethyl sulphide produced, and so fewer clouds – all in one giant, 'feedback loop'.



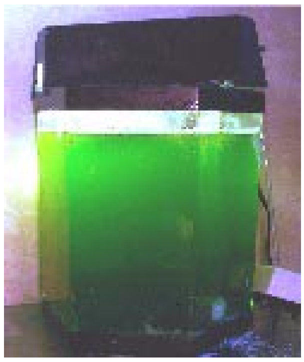
Mike is looking at the types of phytoplankton that produce other types of gases – namely, methyl halides, in particular:

Methyl bromide –
a gas that depletes ozone and is a greenhouse gas

Methyl chloride –
a gas that also depletes ozone

Methyl iodide – a gas that depletes ozone and makes clouds (like dimethyl sulphide).

He will be taking measurements in the field of methyl halides in the air (at Cape Grim Baseline air Pollution Station) and in the sea and at the sea surface, as well as investigating phytoplankton ecology in coastal waters, and looking for correlations between the levels of methyl halides and the phytoplankton.



As well as looking at what is going on in nature, Michael will do controlled experiments in the laboratory, including measuring the production of methyl halides from phytoplankton grown in a sealed tank, and the enzymes in phytoplankton cells used in the production of methyl halides.

Websites:

Managing the Water Cycle
http://www.sydneywater.com.au/html/education/water_cycle/index.cfm

Water Science for Schools
http://wwwga.usgs.gov/edu/helptopics.html

The Ozone Hole Tour
http://www.atm.ch.cam.ac.uk/tour/part1.html

Understanding Ozone levels
http://www.atmosphere.mpg.de/enid/lb.html

Greenhouse Gases Online
http://www.ghgonline.org/carbondioxide.htm

Greenhouse Gas Lab
http://www.koshland-science-museum.org/teachers/postvgw-act008.jsp

Dimethyl Sulphide
http://www.co2science.org/subject/d/summaries/dms.htm

Gases from phytoplankton
http://www.atmosphere.mpg.de/enid/e2c7ee356945cfd86d26f7d93ded8ac1,55a304092d09/1vj.html

Institute of Antarctic and Southern Ocean Studies
http://www.antcrc.utas.edu.au/iasos

3.2
SAVING THE ENVIRONMENT

The Scientist:

Tim Jordan BAppSc(Hons),
School of Chemistry, University of Tasmania

Tim grew up in Launceston where he went to Riverside High School and then Launceston College. At college, Tim's studies included maths, computing, and geography, but it was chemistry that really "clicked", motivating him to enrol in a Bachelor of Applied Science at the University of Tasmania and to major in chemistry.

In the third year of his degree, Tim's interests really started to sway towards environmental chemistry, and he became involved in a project investigating industrial solvent emissions at Bell Bay on the Tamar River.

"After the Bell Bay project, I enrolled to do a fourth year of my degree, the Honours year, and got into air pollution. This is a major problem in Launceston's air, and most of it comes from combustion sources like wood heaters and cars."

Tim was awarded First Class Honours for his research and has now expanded his ideas into a PhD project looking at wood smoke composition.

Tim's research involves a combination of laboratory work, field trips to collect air and sediment samples, and a fair bit of manual labour. To get started, he had to design and build a wood heater testing facility on campus! His work also involves travel opportunities, with regular trips to the Australian Nuclear Science and Technology Organisation in Sydney to measure radiocarbon levels in airborne particulate matter to determine fossil versus wood heater contributions. He has also studied a semester abroad as an exchange student in Sweden, where lectures were conducted in English just for him.

"One of the best things about my degree and my research is the way in which I can combine my personal interests – travel, the environment and wilderness – with my work," he says.

Tim's enthusiasm and dedication has certainly paid off. As an undergraduate student has was regularly placed on the Dean's Roll of Excellence for outstanding achievement. In 1999 he was awarded the Royal Australian Chemical Institute 3rd Year Prize for most outstanding graduate in Chemistry at the University of Tasmania, and in 2001 was awarded the Dean's Citation and the University Medal for outstanding academic performance in undergraduate and honours courses.

More about the work:

Key words: Air pollution, wood heaters, combustion sources

The main focus of the project is to investigate the effect of woodheaters on the wintertime air pollution in Launceston; this is been done in three parts:

1. To estimate historical pollution levels by determining levels of certain pollutants in the sediments of the Tamar River.
2. To obtain a "chemical fingerprint" of woodsmoke.
3. To determine how much of the pollution comes from woodheaters.

Tim says "Despite the majority of my work being chemistry and laboratory based, I have had experience collecting mud samples from the Tamar River, building a woodheater testing rig, and have travelled to Lucas Heights near Sydney (yes, that is where the nuclear reactor is!) to do carbon-14 'dating' on the air pollution."

Results have shown that it is possible to tell the difference between clean-burning and smokey woodheaters by comparing their 'fingerprints'. The carbon-14 dating showed that woodheaters contribute around 85-95% of airborne pollution during the winter. Unfortunately, the results from the historical work were inconclusive.

The project is part of the Analytical and Environmental Chemistry program at the School of

Chemistry, University of Tasmania.

Websites:

Less Wood Heaters – Less Pollution in Launceston
http://www.deh.gov.au/minister/env/2003/mr19sep203.html

University of Tasmania, School of Chemistry
http://www.scieng.utas.edu.au/chem

The Scientist

Nina Hamilton BEnvDes,
School of Architecture, University of Tasmania

Little did Nina's ancestors know, when they arrived in Tasmania six generations ago, that their ambitious great-great-great-great grand-daughter would seek a career in the world of architecture. When considering her career options as a student at St. Michael's Collegiate School in Hobart, Nina wanted to do something that incorporated her love for Tasmania's natural environment, culture and identity. Architecture fitted all criteria.

"I was even more inspired to do architecture when I learned it was a male-dominated occupation. I thought, 'Right, this is something that women can do just as well".

Nina enrolled in the Bachelor of Environmental Design at the University's Launceston campus, which brings together a combination of arts, sciences, technology and environmental awareness.

She loved the course, but at the end of her first degree wasn't sure which direction she wanted her career to go in. Taking some time out, Nina worked in a CD shop but kept in touch with her architecture friends and colleagues. After two years she was ready to get back into it and is now enrolled in a Master of Design by Research. She is investigating how architectural design can enhance buildings to fit with the characteristics of Tasmania's wilderness; her case studies include visitor facilities at the Bay of Fires and Lake St. Clair.

During her degree, Nina has also worked as a volunteer for the United Nations Development Program in India. The program teaches locals to construct disaster-resistant buildings, after cyclones wiped out their coastal villages in 1999.

"Working as a volunteer abroad was something I had always wanted to do," says Nina, "and the opportunity to go to India was perfect. It gave me the chance to travel and to use the skills I'd gained from my degree."

Nina is now in the final stages of her Master's research. She would like to find employment lecturing or tutoring in architecture, and to get involved in architecture journalism. She would also like to return to India with a group of students to work on more volunteer projects.

More About The Project

Key words: Landscape, architecture, tourism

The purpose of the study is to focus on tourist architecture in the Tasmanian landscape and to assess how architectural solutions can derive from and respond to the Tasmanian landscape and culture. It is anticipated the research will ensure that future design for tourism in the Tasmanian landscape can evoke a 'sense of place' and enhance the visitor experience, through the values and attributes of the architecture. The outcome of the research will result in public documentation for Cooperative Research Centre for Sustainable Tourism and Tourism Tasmania. It is anticipated that architects, designers and tourism operators will refer to the document as a reference tool. This research is for anyone involved or interested in planning and designing tourism infrastructure at all levels.

The aim is not to create a current or up-to-date set of guidelines for the design of tourist facilities; these become outdated, as we design for a particular moment in time. Rather, the aim is to suggest 'non' rules, which act as a guide, rather than a set of rules to adhere to, which will inform future design for tourism in Tasmania. Much time and careful thinking is required through the design process. A project cannot be delivered in a hurry and the consultation process between designers and client is important. As designers, architects seek to create something for that period of time, something that might represent the way of thinking, or philosophies.

Bay of Fires Lodge: image found at: http://archrecord.construction.com/projects/portfolio/archives/0107ecolodge.asp

Case Studies:

1. Strahan Visitor Centre
2. Lake St Clair Visitor centre
3. Bay of Fires Lodge
4. Peppermint Bay Facility
5. Tahune Visitor Centre

These include a variety of landscapes, building topologies and user groups. Nina will be interviewing architects, using the results of visitor surveys and reviewing newspaper and journal articles as part of her research.

Australian households on average produce more than 15 tonnes of greenhouse gas per home each year. Our 7 million households produce over 105 million tonnes annually, which contributes over 20 percent of Australia's total greenhouse gas emissions.

Websites:

The Royal Australian Institute of Architects
http://www.architecture.com.au

Sustainable Tourism CRC
http://www.crctourism.com.au

Design and Lifestyle for the Future
http://www.greenhouse.gov.au/yourhome/

School of Architecture, University of Tasmania
http://www.arch.utas.edu.au.au

Passive solar heating – saves on non-renewable energy, Examples of sustainable designs: image from: http://www.greenhouse.gov.au/yourhome/

The Scientist

Claire Trenham BSc,
School of Maths and Physics,
University of Tasmania

Claire is from Kettering, south of Hobart, and went to Woodbridge District High School from Kinder to Grade 10, and then to Hobart College. "Woodbridge is a small school with only about 40 students in each grade," says Claire. "For me the transition from high school to college was a greater challenge than starting uni."

After excelling in the sciences and mathematics in high school, Claire studied maths and the physical sciences at pre-tertiary level in college. Her teachers encouraged her to continue on to do engineering or science at university, and she enrolled to do a BSc.

"I was always interested by how things worked, colours and prisms and crystals and flames, all sorts of things that you look at and think 'I wonder why...' as a kid. I've always absolutely loved patterns and finding order in things, be it numbers, colours, letters, and these led me easily into an enjoyment of mathematics, even mathematical puzzles and word puzzles in my spare time!"

At university, Claire majored in maths and physics. She also studied chemistry in the first two years. She is now enrolled in Honours in mathematics, where she is working on an applied maths project.

"My thesis topic is actually mathematical modelling of chemical combustion, so there's still a bit of physics, and even chemistry, thrown in," she says.

For Claire, the thing she most enjoys about maths and physics is seeing the patterns in the world and by studying those patterns to learn how the world works.

"It's an awesome feeling to know and understand why things happen, even little things like rainbows. To me, the 'privilege' of knowledge obtained by studying these sciences far outweighs the effort required to do so. That's why I study science. I find the applied maths, such as calculus, chaos (related to my project) and fluid mechanics, the most interesting, as in these subjects I see the direct application to 'real life' and learn how to solve the problems that nature throws up at us when we don't understand them intuitively in some sense, particularly chaos!"

More About the Work

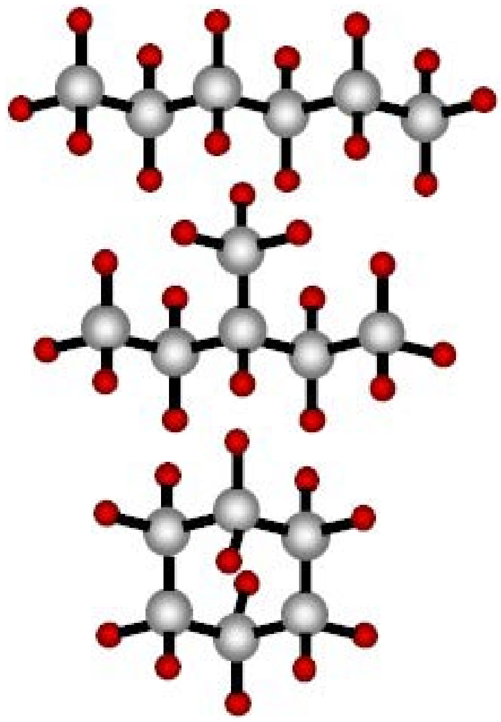
Key words: Chemical combustion, equations, chaos

Claire says: What I do is formulate equations that describe a physical system [in this case, chemical combustion] and code them on the computer. The computer solves the equations or does whatever needs doing and tells me how the system behaves and whether there's chaos, which I can then analyse.

Chemical combustion:

Combustion in every day language means burning. For chemical combustion to happen there must be a two ingredients: **Fuel** (e.g. wood) and **oxygen**. This chemical reaction produces **heat** and usually **light** (e.g. a candle flame). Many of the common items that burn (e.g. wood, coal, gas), are organic. When something is organic it means it is (or was) alive and is made up of carbon, hydrogen and oxygen. These three elements form the basis of life! There are many many combinations of carbon, hydrogen and oxygen, and the different ways these three elements are combined make up the different kinds of organic fuel.

The many combinations of carbon, hydrogen and oxygen are examples of nature's patterns. The whole natural world can be described in patterns and orders of patterns, from different rocks and minerals, to snowflakes, to flowers, to the burning of organic matter, to the movement of our winds and oceans.



Examples of the different combinations of carbon (grey) and hydrogen (red) and oxygen (usually not shown)

Chaos Theory

Chaos theory attempts to explain the fact that complex and unpredictable results can and will occur in systems that are sensitive to their initial conditions. A common example of this is known as the Butterfly Effect. It states that, in theory, the flutter of a butterfly's wings in China could, in fact, actually effect weather patterns in New York City, thousands of miles away. In other words, it is possible that a very small occurrence can produce unpredictable and sometimes drastic results by triggering a series of increasingly significant events.

Websites:

NASA combustion science
http://quest.arc.nasa.gov/space/teachers/microgravity/MGprim1.html

Exploring conditions needed for combustion to occur
http://www.pbs.org/wgbh/nova/teachers/activities/2908_fire3.html

The Chaos Experience
http://library.thinkquest.org/3120

Talking Up Science
http://www.hsn.csiro.au/talkup/topics.html

School of Maths and Physics, University of Tasmania
www.utas.edu.au/maths
www.utas.edu.au/physics

3.3
Generating Energy for the Future

The Scientist

Cameron Potter **BE(Hons),**
School of Engineering, University of Tasmania,
& Hydro Tasmania

Mention artificial intelligence and most people's minds will be drawn to thoughts of robots behaving like humans, but Cameron Potter is using this greatly misunderstood technology to get the most out of renewable energy sources.

Cameron completed a Degree in communications engineering and gained Honours in power engineering, before beginning his PhD, all at the University of Tasmania.

In technical terms, his PhD focuses on optimal dispatch for hydro and wind power generation, while in layman's terms it is looking into the use of artificial intelligence applications in power systems. It is a subject Cameron chose after casual employment with Hydro Tasmania drew his attention to the value of power.

"In the world there is a rising demand for power, but there's not always the power to meet it, for example during the New York blackout of 2003," Cameron says. "As resources run low, the world is looking for new and environmentally friendly solutions to power generation."

Cameron is working closely with the University, due to its high level of expertise, and Hydro Tasmania, which is set to benefit from his work but is also allowing him to retain the valuable intellectual property on the research. He says that although wind farm development is on the rise, nobody has the technology to accurately predict the short-term energy available from this form of power generation.

"Because of the nature of wind, in five minutes you can lose 50 per cent of the energy," he says. "If you lost that much total power in a power grid, without expecting it, you could have power blackouts every 15 minutes."

Cameron believes that the answer could lie in artificial intelligence, which originated in the 60s and 70s alongside the ground-breaking development of computers that could emulate thought and make decisions.

"Artificial intelligence allows you to control and model things that are extremely complex. It's everywhere - you can't buy electrical goods that don't have some type of artificial intelligence, even just a timer on a rice cooker that makes the decision that the rice is cooked is a form of A.I. [artificial intelligence]. I like the idea of making a machine do something of which it wouldn't normally be capable."

Cameron said that his research involves working with Hydro Tasmania to develop a system to enable better wind prediction for a more stable power system.

"In reality, power is an amorphus blob – it doesn't matter to the user how it is produced, just as long as electricity is there," he says. "Wind power is clean and under utilised but has a problem of maintaining a stable base. Trying to control a power system with 20 per cent wind power has been described as like driving an articulated lorry without steering or brakes - very difficult!"

"This research project is about trying to provide the steering wheel and brakes. You can't control the wind, but you can try to predict what the wind will do."

Cameron says that the use of artificial intelligence in this area is a new development.

"No-one has used this method in wind forecasting before; instead they've used mathematics, rules and breeding solutions."

More About the Work

Key words:
Artificial intelligence, Renewable energy

What is A.I?
Artificial intelligence is a science that attempts to enable machines to do things, that would require intelligence to be done by a human. The first successful intelligence systems were "expert systems". Creating these involved taking the knowledge of an expert and using it to develop heuristics (if-then rules) that the computer can apply. These are useful as an experts knowledge is not lost, and often the tasks assigned to the expert system are menial tasks that don't warrant the time of the expert, yet need the experts knowledge to complete.

What is Renewable Energy?
Renewable energy is a source of energy that can be tapped and yet will not degrade or become depleted. Most renewable energy comes from the elements of the earth. The sun provides solar power, the wind provides wind generation and water provides various forms of hydro power. There are several key points to renewable energy. It does not produce greenhouse emissions and it is cost effective (once installed), however, the installation costs are high, making such constructions an expensive option. The other major issue is that as these systems rely upon energy coming from uncontrolled sources, accurate prediction is essential.

Why is Renewable Energy so important Especially to Tasmania?
The use of renewable energy makes sense on a global scale as it is environmentally neutral while traditional sources (such as fossil fuels) are not sustainable and have detrimental effects on the environment. However, in order to be able to compete, a power generator must be cost efficient. In time, more countries will insist upon renewable energy as pressure builds, but until then, a renewable generator in a deregulated (non-controlled) market will have to compete with all other electricity producers. Tasmania will soon be connecting to the national grid of Australia (Basslink) and this means that Hydro Tasmania will have to compete with fossil fuel based generators.

Specifics of The Research
Several breakthroughs have been achieved such that the forecasts being obtained over very short periods are significantly better than the approaches that are presently being used. The reason for this is due to the structure of the system being used. It very closely models the way a human thinks and can learn and then draw general conclusions (on a very small area of interest). This technique is called an artificial neural fuzzy inference system. It works in two steps, the first step takes in the data and finds mathematical patterns that fit the data as well as possible. Then it creates fuzzy rules, which are basically similar to yes/no questions, but instead can handle various levels of "correctness".

Websites

Wind Power Resources
http://www.bwea.com/edu/teachers.html

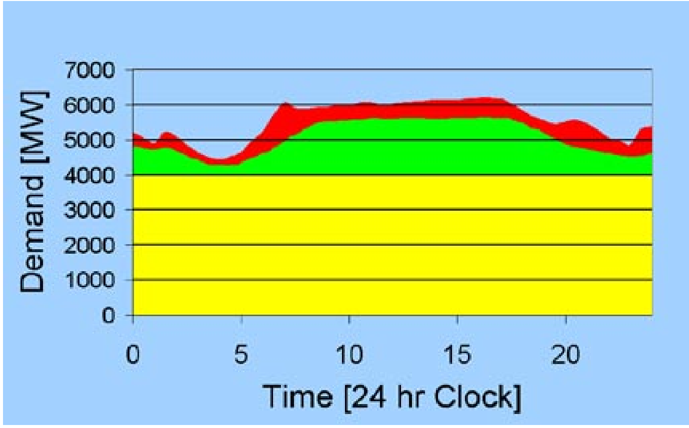
Renewable and Non-Renewable Energy Sources
Energy Information Administration
http://www.eia.doe.gov/kids/kidscorner.html

Making Wind Power More Efficient
http://www.innovations-report.com/html/ reports/ energy_engineering/report-19063.html

Hydro Tasmania
http://hydro.com.au

School of Engineering, University of Tasmania
http://www.utas.edu.au/eng

Overview of Power System Operations



The demand for power over a 24hr period can be broken down into three parts:

The BASE load is the load that is constantly there. It is best thought of as the power that must be supplied at all times of the day.

The MIDDLE load makes up for the major peaks and troughs of the daily load pattern. It changes, but not too quickly.

The PEAK load is a small but varying load that accounts for the small fluctuations in demand. A generator must be able to adapt to changing situations very rapidly in order to efficiently supply peak load.

A Windfarm at Woolnorth, northwestern Tasmania

The Scientist

Denis Visentin BSc (Hons),
School of Computing, University of Tasmania

Denis is a native Launcestonian who moved to Hobart to do Engineering at the University of Tasmania. Before long he realised his real interest lay in physics, so he switched degrees after one year to instead do a Bachelor of Science.

“I’ve always been interested in the fundamentals, and found physics a fantastic way to understand the world,” Denis says.

Denis majored in physics in the third year of his science degree, and after Honours in fourth year he returned to Launceston to lecture in physics and electronics at the University, not to mention get married and have two children. Always keen to conduct more research, he commenced a PhD part-time in 2001, which soon became full-time.

“My PhD project is in computational physics and investigates numerical modelling of proposed controlled fusion reactors.” This involves developing theoretical models of confined plasmas under magnetic fields and performing computer simulations.

The results from Denis’s research will help to determine whether novel reactors are feasible and whether existing reactors in the USA can use the new technique.

“Fusion is ‘Big Science’, it’s a multi-billion dollar worldwide project and, if feasible, will revolutionise our world. It’s amazing to think that one researcher in Tasmania with a PC can make a valuable contribution. You don’t necessarily need huge resources to tackle these problems.”

When he completes his PhD, Denis hopes to do something radically different, applying the computer modelling skills he has developed in a new area of research. And stay in academia?

“Who knows? I enjoy passing on the expertise and inspiring the next group of scientists, but there are exciting opportunities in industry as well.”

More about the Work

Key words:
Fusion, Plasma, Rotating Magnetic Field

RMF Current Drive in Confined Plasmas

Current fusion research involves using rotating magnetic fields in order to produce a workable fusion reactor for energy production. This project requires that a computer simulation be produced of a proposed fusion reactor using two rotating magnetic fields. It is hoped that this will support the feasibility of the reactor and convince experimenters in the U.S.A. to modify existing and future reactors to include a second rotating magnetic field.

Controlled Nuclear Fusion

A controlled nuclear fusion reactor for feasible energy production requires that a plasma (an extremely hot ionised gas, separated into electrons and ions) be contained for a significant time by a magnetic field. One method is to use an external rotating magnetic field (RMF) to drive a current in the plasma by entraining the electrons. One of the major problems with RMF current drive is the motion of the ions in the plasma. They will undergo collisions with the electrons and spin up, decreasing the current and the plasma equilibrium.

A proposed method of controlling the ion motion, called the Clemente scheme, is to provide a second RMF to drive the ions in the opposite direction to the electrons, thereby maintaining the plasma current.

The project involves producing a theoretical model of the plasma under the influence of two counter-rotating magnetic fields. A numerical simulation is then produced for this model in order to determine the feasibility (or otherwise) of the Clemente scheme.

Simulation Results

The Clemente scheme requires that the electrons 'see' one RMF and the ions 'see' the other. This weird behaviour has been shown theoretically to be the case if the collision frequency of the plasma is smaller than the frequency of the applied RMFs.

Initially the results from the simulation have shown that the Clemente scheme can work, where the electrons are driven by one RMF and the ions by the other, but only under specific starting conditions for the ion fluid. A completely new approach was tried, by allowing the frequency of the RMF to change. This allowed the reactor to be operational for much more general starting conditions.

Further work involves improving the model to allow the plasma to move freely, and hence test that special plasma configurations called Field Reversed Configurations (FRC) are confined by the two RMFs. It is hoped that the results from this research will be taken up by experimenters at the University of Washington, where the TCS (Translation Confinement and Sustainment) experiment is underway.

Websites:

Plasma Physics and Fusion Energy
http://ffden-2.phys.uaf.edu/introplasma11-17-98.pdf

Laboratory Plasmas
http://public.lanl.gov/alp/plasma/plasma_lab.html

School of Computing, University of Tasmania
http://www.comp.utas.edu.au

3.4 Discovering How Plants Grow:

The Scientist:

Will Bignell Third-Year Student (BAgrSc), School of Agricultural Science, University of Tasmania

A Grade 12 agricultural science assignment sparked Will Bignell's passionate research into the growth of wasabi in Tasmania. The assignment was the start of a five-year trial that has the science student exporting wasabi to top Australian restaurants while also completing his third year of an Agricultural Science degree at the University of Tasmania.

A seventh-generation Bothwell farmer, Will has a solid background in the traditional farming aspects of wool and prime lambs and has no plans to leave the land. However, his passion for developing new enterprises and crops has helped his 2000 wasabi trials develop into a business on the side.

Wasabi, a herb used as a garnish or paste in Japanese cuisine, had been grown in soil in Tasmania since the 1990s. Will decided to try growing it in a river on his property because the water was similar to the traditional growing regions of Japan. He conducted extensive literature research and also took advantage of a family holiday in New Zealand to meet researches at Lincoln University and Crop and Food New Zealand..

He then approached the Department of Primary Industry, Water and Environment for seeds and plants and developed the wasabi trial in a space the size of a speedboat on a headrace that was diverted off the river on his home farm.

"The aim of the trials was to try and mimic the traditional graded river gravel beds that are used in Japan," Will says.

"The water is crucial to having a successful crop. It has to be between 8 – 13 degrees Celsius and very clean. If the temperature rises too high then disease creeps in and over a couple of months will decimate the crop. Disease is a major issue for the whole Tasmanian Industry and we are trying to develop growing systems that minimise the chance of disease occurring."

Having worked the family farm for a year before beginning his degree, Will believes he has an understanding of the many challenges and opportunities available to farmers. For this reason, he sees a lot of career opportunities for himself and other agricultural science students.

"Agricultural Science is not about how to gather sheep or plough a paddock quicker. It's more to do with the collection of cutting edge science and then applying it to develop more sustainable production systems for the food and fibre that modern day society demands."

"There are also plenty of major companies in Tasmania in need of scientific technical personnel and lots of opportunities for work placements in agricultural science for both high school students and university students so that they can get a feel for the industry."

For now, Will plans to continue his degree and wasabi production, while planning to later focus on wool and meat production on the farm. "I plan to head home to my family farm, but would like to use my degree to work in Industry for a few years before heading home, there are heaps of opportunities in Ag."

More about the Work:

Key words:
Wasabi, Brassicaceae, nutrient requirements

Wasabi is a perennial herb belonging to the same family of plants as broccoli, cabbage and mustards, the Brassicaceae.

In its natural environment in Japan it grows alongside mountain streams. It produces a thickened stem, similar to a small brussel sprout. As the stem grows, lower leaves fall off. The stem has a very pungent smell and flavour when made into a paste.

Traditionally the primary use of wasabi is a condiment for use with Japanese dishes such as raw fish (sushi and sushimi) and noodle (soba) dishes. Because of a low supply of fresh wasabi, substitutes made of mixtures of horse radish mustard and food colouring have taken the place of freshly prepared wasabi.

Wasabi can be produced both as a ground plant or a water grown plant. The water grown plants are cultivated in raised beds above flowing water and generally produce a higher quality product than the ground grown plants. Wasabi does not grow in stagnant water or water with a low oxygen content, thus a continuous water supply of constant flow and temperature is needed.

Will's work has included investigating nutrient requirements of wasabi, controlling disease particularly the fungi *Pythium*/*Phytophora* and *Fusarium*), and designing beds.

(including comparing the traditional Japanese Heichi and Tatamiishi plant beds with his own industrial 'Bignelli' beds, made from amongst other things, Besser blocks.

Websites:
Department of Primary Industry,
Water and Environment
http://www.dpiwe.tas.gov.au

What is Wasabi?
http://www.wasabi.co.nz/meet.html

About Wasabi
http://www.freshwasabi.com/about.htm

Wasabi
http://member.nifty.ne.jp/maryy/eng/wasabi.htm

School of Agricultural Science, University of Tasmania
http://www.utas.edu.au/agsci

The Scientist:

Lydia Turner **BAgrSc(Hons),**
School of Agricultural Science,
University of Tasmania, and the Tasmanian Institute of Agricultural Research (TIAR)

Lydia spent the first nine years of her life overseas and has lived in Tasmania ever since. Her family is based on the NW coast and she has just moved back there with her husband after going to university in Hobart, where she did a Bachelor of Agricultural Science with Honours.

She is now nearly half way through a PhD in the area of pasture agronomy at the University of Tasmania's Cradle Coast Campus. Her project aims to extend current knowledge of the physiology and management of 2 different perennial grass species and to assess their suitability for the dairy industry in southern Australia.

"In the Tasmanian dairy industry today, pastures primarily consist of one perennial grass species, widely regarded as the 'best' for the industry. It is likely that other species will prove to be appropriate alternatives in terms of agronomic potential, particularly under dryland management, that is, without a lot of irrigation," Lydia says.

Her PhD topic came about because a thorough investigation of these alternative grass species is necessary to assess them as potential replacements for perennial ryegrass in the dairy pastures of southern Australia.

Her research is field and glasshouse based, with associated laboratory work, and each experiment takes from 4 months to over a year to complete.

"At school it never crossed my mind to consider Agricultural Science as a potential career, but 2 weeks of work experience in the Primary Industry Placement Programme with a leading pasture agronomy researcher showed me it was a promising option and I haven't looked back," Lydia says.

"As a 'researcher in training' I love the fact I can find out new things that will really benefit farmers, not only on locally, but potentially on an international level," she says.

More About the Work:

Key words: Pasture, Perennial ryegrass, Cocksfoot, Prairie grass

The dairy industry in southern Australia is pasture based – which is very different to dairy systems in many other countries, where conditions may force farmers to house cow indoors over winter and feed them alternate food types, or where low feed prices mean it is more economical to feed a large amount of grain.

Perennial ryegrass

In temperate Australia, one grass species called perennial ryegrass has been promoted and accepted as the 'best' grass for the dairy industry – usually sown with white clover. However, there are problems associated with using this species in southern Australia, including the inability to survive or grow under dry and/or hot conditions, the requirement for high amounts of water and fertile soils, and the susceptibility to many pathogens and insect pests.

No matter how much more research is done on perennial ryegrass, the fact that the Australian environment isn't suitable for this species cannot be altered. Even in Tasmania, where we have the highest rainfall in the country, lack of rain during summer means ryegrass becomes dormant without irrigation.

Alternate species

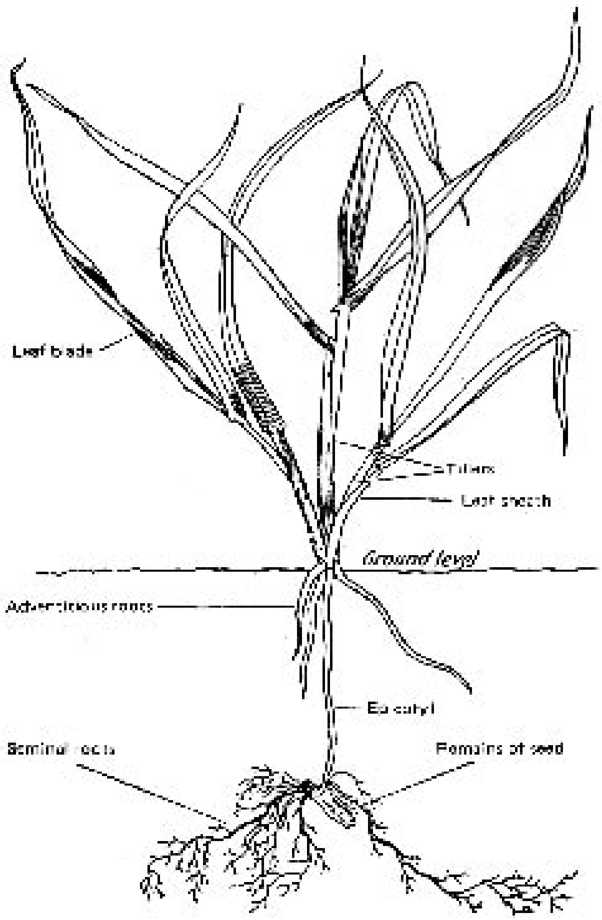
There are alternate species from other parts of the world (i.e. the Mediterranean) that are better suited to the environment here than perennial ryegrass. These include Cocksfoot (also known as Orchardgrass in the Northern Hemisphere) and Prairie grass

The Project

Lydia says "My PhD topic came about because we believe a thorough investigation of these alternative species is necessary to assess the grasses as potential replacements for perennial ryegrass in the dairy pastures of southern Australia. I am investigating the physiology and management of cocksfoot and prairie grass to assess their suitability for use in the dairy industry."

Grass characteristics (or physiology)

The characteristics of pasture are very important, as they're closely linked with the amount and quality of milk produced each day (which of course translates to dollars). The characteristics we aim to understand and improve through research include quality (carbohydrates, protein, energy, digestibility, minerals), yield (how much a grass can produce each year and in different seasons), persistence (how long a perennial grass will last as a dense, healthy pasture – will the farmer need to resow a paddock after 2 years or will the grass persist for over 10?), and utilisation (how much of the grass in a paddock is actually eaten and converted into milk).



Structure of a plant

Management

Management is an important consideration in grass research – particularly for the dairy industry. The three aspects of grazing management are interval (when to graze), intensity (how hard to graze) and duration (how long to graze). Under good management, the yield, quality, persistence and utilisation of a grass species can be maximised – but this requires a clear understanding of how pasture plants grow and what they require for optimal performance. Each grass species calls for a unique set of guidelines in terms of best management, and while these guidelines have already been established for ryegrass, further work is needed for cocksfoot and prairie grass.

Current Studies

These studies are both field and glasshouse based, and include:

- Yield comparison of alternate species with perennial ryegrass
- Quality comparison
- Importance of carbohydrates in regrowth of cocksfoot and prairie grass
- Investigation of 3 species' response to/recovery from drought conditions
- Animal acceptance/palatability of cocksfoot and prairie grass
- Root patterns during establishment – do they affect speed of establishment?

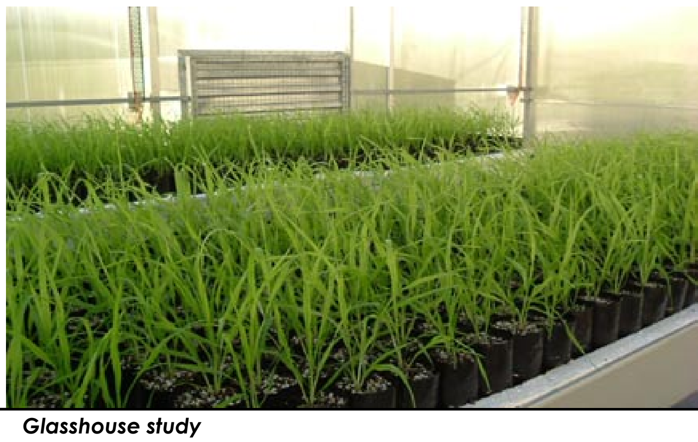
Websites:

Department of Primary Industry,
Water and Environment
http://www.dpiwe.tas.gov.au

Tasmanian Institute of Agricultural Research
http://www.tiar.tas.edu.au

School of Agricultural Science, University of Tasmania
http://www.utas.edu.au/agsci

Field study



Glasshouse study

The Scientist:

Corinne Jager **BSc(Hons)**,
School of Plant Science, University of Tasmania

Corinne grew up in Dover - a small country town one hour south of Hobart. She went to the local district school until grade ten and then moved to Hobart for college and university.

When Corinne began her degree she was originally interested in how the human body worked so she took human biology subjects. At the same time she enrolled in plant science, which eventually became her major, followed by honours in genetics.

"I became interested in research when I took the plant science research project as a third year course and enjoyed the hands on aspect and the freedom of organising my own work," Corinne says.

Corinne is currently in her last year of her PhD in plant science. The focus of her work is the interaction between the 'classical' plant hormones and the steroid hormones (brassinosteroids) in relation to plant growth and development.

This involves research in the lab and glasshouse and producing papers for publication in scientific journals.

"The majority of my work is analysing endogenous levels of plant hormones in normal plants and then comparing them to levels in brassinosteroid mutants (the mutant plant doesn't have any brassinosteroids). This enables me to determine what plant processes brassinosteroids are involved in," Corinne says.

To analyse the hormone levels, Corinne extracts them from the plant by grinding and filtering the plant tissue, and then analyses the samples using HPLC (high performance liquid chromotography) and GC-MS (gas chromatography - mass spectrometry). She also uses radiolabelled plant hormones to determine how and where the hormones are moved and metabolised throughout the plant.

Garden pea field experiments

Corinne's work has found that plants lacking these brassinosteroid hormones also have altered levels of other growth hormones, such as auxin and gibberellins, showing that brassinosteroids are important for maintaining normal plant growth and development.

"One of the great things about science is that there are so many areas that you can work in, many of which you are unaware of during school. I love that I am studying something as basic as plant growth yet so much is still unknown, so all my findings are new and exciting," Corinne says.

The only other similar research to Corinne's is carried out overseas, so there are great opportunities for her in networking and travel. Corinne believes that scientists are very important people because they are behind the majority of breakthroughs in our society.

More About the Work:

Key words:
Plant growth, Hormones, Brassinosteroids

Hormones are important in regulating all aspects of our body, from our energy levels to deciding when we mature from girls and boys into women and men. Just like animals, plants use hormones for normal healthy growth.

Garden pea field experiments

Brassinosteroids (BRs) are a relatively new group of plant hormones that are involved in diverse processes including cell growth, stem elongation, vascular tissue development, and regulation of gene expression. This project is characterizing several new brassinosteroid-related mutants of pea, and examining the interaction of BRs with other plant hormones, including gibberellins and auxin.

Brassinosteroids, are one of six types of plant hormones and are considered to be very important for promoting plant growth - at every stage, from germinating, growing branches, flowering, dying back to regenerating. In addition, they are involved such diverse processes as stem elongation, vascular tissue development, and regulation of gene expression.

The study of these hormones is very important because if we understand how plants regulate their growth we can create plants that have superior growing abilities and for example, are resistant to certain problems like drought. By comparing the growth of plants with and without specific brassinosteroids and observing at what stage the plant has growing difficulties, scientists can learn the purpose of that particular brassinosteroid.

Most of these studies are conducted on peas because peas have been used in plant science for many years and plant scientists have a great deal of knowledge about their genes.

Corinne's project involves characterizing several new brassinosteroid-related mutants of pea, and examining the interaction of brassinosteroids with other plant hormones, including gibberellins and auxin.

Websites:

Brassinosteroids, a new class of phytohormones
http://www.ias.ac.in/currsci/may252002/1239.pdf

School of Plant Science, University of Tasmania
http://www.utas.edu.au/plantsci

The Scientist

Paul Armstrong **BAppSc(Hons),**
School of Aquaculture, University of Tasmania

Paul's youth was spent in Launceston, and in grade five, his dad presented him with his first fish tank.

"I kept heaps of fish as a kid," he says.

It is therefore not surprising to find that Paul has ended up linking his scientific interests to the aquaculture industry. He is two years into his PhD looking at the links between nutrients and phytoplankton blooms in the Huon estuary – particularly around aquaculture areas. The Huon Estuary is the major area for salmon farming in Tasmania.

The main aim of his project is determine which types of nitrogen are most important for phytoplankton blooms in the Huon Estuary. One of the specific aims of his project is to investigate the nitrogen uptake capabilities and strategies of *Gymnodinium catenatum* – a toxic dinoflagellate species that has bloomed in the estuary in recent years.

His PhD is being done through the School of Aquaculture in Launceston, and CSIRO Marine Research in Hobart.

Paul finds the environmental aspects of science particularly interesting, and believes his outdoor interests – he is a keen bushwalker, surfer and snorkeller – have led him to working in science.

"I think it is important to understand and maintain our environment, and especially understand how what we do impacts the environment," he says.

Paul particularly enjoys the field work involved in the science he does.

"I like to get out there and see what is going on," he says.

Paul has always had an interest in aquaculture and in 2001 he completed his honours on seahorse genetics at the School of Aquaculture in Launceston. He says he would like to focus his future efforts on working with the aquaculture industry in helping it manage the impacts that it has on the environment and as a result of this, become a more sustainable industry.

Paul finds the challenges of working in science, the variety of things he is able to do, and the problem solving nature of his work enjoyable. He spends time in the laboratory, has recently just finished his field work and is now in the process of writing chapters of his thesis.

More about the Work

Key Words:
Phytoplankton, *Gymnodinium catenatum*, algal blooms, nitrogen uptake

The Huon Estuary is the major area for salmon farming in Tasmania. The recent Huon Estuary study identified several key areas that required further understanding if the estuary was to be more effectively managed. One of the key areas was the link between nutrients and phytoplankton blooms in the estuary.

The Huon Estuary study suggests that phytoplankton growth is limited primarily by nitrogen. The main objective of this project is to determine which nitrogen sources: nitrate (NO^3), ammonia (NH^4) and urea are important for supporting phytoplankton growth in the Huon Estuary. A more specific aim within this project is to investigate the nitrogen uptake capabilities and strategies of one the main dinoflagellate species *Gymnodinium catenatum* that has bloomed in the estuary in recent years.

Paul says "We are specifically looking at *G. catenatum* for several reasons. It is still not known why it blooms in some years and not others and when it does why it blooms at far higher biomasses than any other species recorded in the Huon to date. Studying *G. catenatum* will also help us understand the bloom dynamics of other dinoflagellate species that cause problems in the Huon Estuary (such as Noctiluca scintillans)."

N. scintillans also causes red tides, blooms of this species have dramatically increased in frequency and duration in southeastern Australian coast waters since the early 1990s.

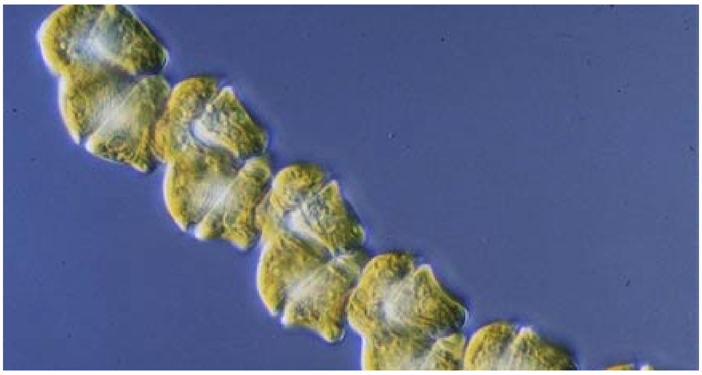
Websites:

Huon Estuary Study
http://www.marine.csiro.au/research/sme/huonest/summary.html

Algal Bloom Dynamics
http://www.nwfsc.noaa.gov/hab/HABs_Toxins/Phytoplankton/AlgalDynamics.htm

What are Harmful Algal Blooms?
http://www.whoi.edu/redtide/whathabs/whathabs.html

School of Aquaculture, University of Tasmania
http://www.utas.edu.au/aqua



Gymnodinium

Noctiluca scintillans ingesting Gymnodinium catenatum.

Gymnodinium

3.5
Investigating the Human Body

The Scientist

Cassandra Saunders BBiomedSc,
School of Human Life Science, University of Tasmania

The mysteries of the human body and potential of making a life-saving discovery helped lure Cassandra Saunders to study human life sciences and now draw her towards a career teaching others to delve into the same unchartered waters.

Cassandra completed a Bachelor of Biomedical Science at the University of Tasmania in 2003, where she has recently completed her honours degree (first class honours) in biomedical science and is hoping to begin her PhD in the near future.

Cassandra's fascination with science began in high school and was fuelled by her own interest, rather than the influence of family or friends.

"Human-based science is so interesting because the human body is so diverse and complex," she states.

"We still know so little about the normal physiological processes within the human body, let alone the processes involved in disease states and their possible treatments. I believe that there are no limits to what we can learn.

"Knowing that there is so much to be discovered keeps you motivated and inspired. I would be thrilled to make a ground-breaking discovery at some point in the future."

Cassandra is currently employed as a researcher at the university, and a tutor in molecular biology and metabolic biochemistry.

After completing her PhD, she will consider working overseas or entering the academic ranks. "I'd like to go back into the University institution at some point in the future as a lecturer so that I can inspire others and help to train the next generation of researchers.

Gaining overseas experience is also an option. "There are lots of opportunities to work overseas in Europe and the United States if you so choose to do so. But Australia is also at the forefront of medical research so it is a great place to work if you're passionate about this area of science."

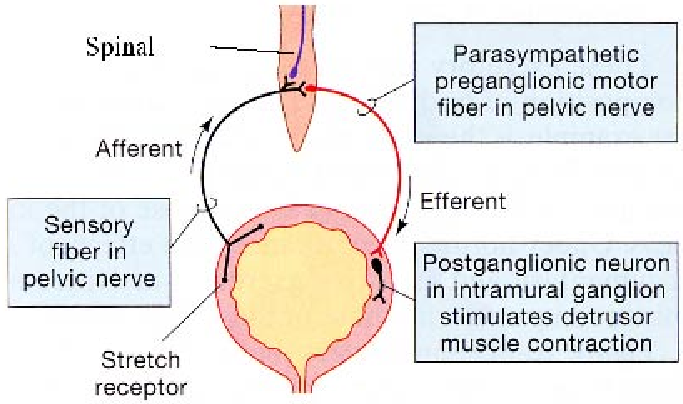
More about the Work:

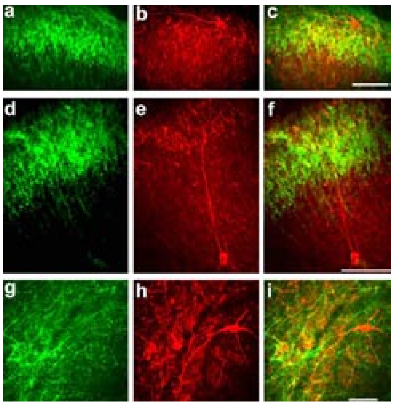
Key words:
Capsaicin, nervous system, urology

Cassandra's honours research project focused on the chilli (capsaicin) receptors in the rat urinary bladder and lumbosacral spinal cord, which play a pivotal role in the process of micturition, or urination. She explains that the bladder wall is inundated with sensory nerves and as the bladder fills these nerves become stimulated, resulting in the output of chemical messages to the spinal cord. This in turn causes the release of a substance called neurokinin 1 (NK1) which is transmitted back to the bladder wall via ingoing nerves and, ultimately, resulting in bladder muscle contraction and urination.

Micturition Process (from power point presentation)

A large proportion of these sensory fibres innervating





General distribution of the sensory fibres (SP, VR1 and NK1 receptors) in the rat lumbosacral spinal cord and bladder. Looking under the microscope with fluorescence light the sensory fibres fluoresce green and red.

the urinary bladder have recently been found to be susceptible to the excitatory, sensory blocking and neurotoxic actions of capsaicin, the pungent principle in Mexican red peppers, which may aid in the treatment of a common urological complaint known as detrusor hyperreflexia.

Websites:

Health Benefits of Capsaicin
http://www.whfoods.com/genpage.php?tname=foodspice&dbid=29

Use of capsicum
(active ingredient capsaicin) in managing pain
http://www.cancer.org/docroot/ETO/content/ETO_5_3X_Capsicum.asp?sitearea=ETO

School of Health Science, University of Tasmania
http://www.healthsci.utas.edu.au

4.0 Ideas for you and your students!

Initial activities might centre around **Understanding** the science of the *Young Tassie Scientists*. Follow-up activities can focus on **Interpreting** the science in an artistic way.

Your students have the opportunity to exhibit their artworks in the schools student exhibition *eLemental*. Through *eLemental* your students can witness how other school students from all over Tasmania as well as university art students (*eMerging* exhibition) have interpreted the same science.

4.1 Understanding the research of Young Tassie Scientists:

4.1.1 Key words and word puzzles:

Discuss the meaning of the key words relevant to each *Young Tassie Scientist*'s area of research and/or each science theme. The key words are listed at the end of each scientists' profile.

It's fun making puzzles with key words. We have provided an example of a word puzzle for the "Exploring the Oceans" theme. You can make your own puzzle for the other science themes with help from this website: http://school.discovery.com/customclassroom/userguide/puzzlemaker.html

Exploring the Oceans

W	C	W	K	T	S	I	M	E	H	C	O	E	G	P
S	C	S	T	N	E	M	I	D	E	S	P	T	A	H
Q	L	A	J	R	C	S	X	F	P	E	L	A	M	Y
P	M	I	R	D	S	H	T	O	Y	G	A	M	I	T
W	R	H	S	B	M	G	N	R	T	A	N	I	C	O
S	M	O	P	S	O	X	R	A	O	E	K	L	R	P
T	Z	T	T	O	O	N	H	M	H	C	T	C	O	L
Q	I	A	O	I	R	F	D	S	P	I	O	P	M	A
G	A	S	E	S	S	T	G	I	R	B	N	S	E	N
P	A	L	E	O	N	T	O	L	O	G	I	S	T	K
V	B	E	N	T	H	I	C	R	M	X	C	X	E	T
A	T	M	O	S	P	H	E	R	E	J	I	C	R	O
F	O	R	A	M	I	F	E	R	A	T	Y	D	W	N
S	E	D	I	L	A	H	L	Y	H	T	E	M	E	R
E	L	C	Y	C	R	E	T	A	W	P	G	H	X	C

ATMOSPHERE	BENTHIC	CARBON DIOXIDE
CLIMATE	FORAMIFERA	FORAMS
FOSSILS	GASES	GEOCHEMIST
HETEROTROPH	ICE AGE	METHYL HALIDES
MICROMETER	MORPHOTYPE	PALEONTOLOGIST
PHYTOPLANKTON	PLANKTONIC	PROTIST
SEDIMENTS	TEST	WATER CYCLE

4.1.2 Talk to a *Young Tassie Scientist*:

If you have invited a *Young Tassie Scientist* to your school, students can prepare for their visit by formulating questions they would like to ask the scientists about their research. Discussing and understanding the key words, and exploring the weblinks will help the students think of questions you would like to ask.

If you don't have a visit planned students can contact a *Young Tassie Scientist* on email.

Paul Armstrong	Plankton blooms in Huon Estuary	Paul.Armstrong@csiro.au
Will Bignell	Wasabi	C.W.Bignell@utas.edu.au
Michael Grose	Cape Grim phytoplankton and pollution	michael.grose@utas.edu.au
Nina Hamilton	Architecture and wilderness	nina.hamilton@utas.edu.au
Corinne Jager	Hormone interactions in peas	cjager@postoffice.utas.edu.au
Tim Jordan	Air pollution from wood heaters	Timothy.Jordan@utas.edu.au
Cameron Potter	Wind/power forecasting using A.I.	cameron.potter@utas.edu.au
Tomas Remenyi	Forams & sea ice distribution	tremenyi@postoffice.utas.edu.au
Cassie Saunders	Chilli receptors in bladder & spinal cord	cisaunde@postoffice.utas.edu.au
Claire Trenham	Modelling chemical combustion	c.trenham@utas.edu.au
Lydia Turner	Pasture species in dairy industry	Lydia.Wilson@utas.edu.au
Denis Visentin	Modelling to demonstrate nuclear fusion	Denis.Visentin@utas.edu.au

4.1.3
Discussion and debate topics:

1. How is this research relevant to your daily life and/or your life in the future?
2. What do some of the scientists have in common (e.g. necessary skills, application of their research, background education i.e. maths/ biology/chemistry)?
3. What do some of the research topics have in common?
4. How will this research help future generations?
5. What are the pros and cons of technologoy used or developed in the research?

4.2
Interpreting the research of the Young Tassie Scientists

A picture tells a thousand words….

The follow-up activities can be used to create artworks for the *eLementa*l exhibition and competition. Artwork can demonstrate students' understanding of the science. Artworks can be created individually, in groups or as a class. The possibilities for interpretation are infinite!

Some ideas (we are sure you have plenty more!)

4.2.1
Forging links between art and science

We are inviting you to participate in the student art exhibition *eLemental*. What are some of the common skills used by artists and scientists? For example, think of the skills and process the *Young Tassie Scientists* employed to undertake their research. As an artist, what skills are required before and during the creative process?

4.2.2
Illustrating what you have learned

- If you were to meet someone from another planet who didn't understand words - how would you explain your understanding of the science theme?
- Draw an aspect of the science theme on micro and/or macro scales – how would it look to an ant? Or a giant?
- Show through a collage how this science is relevant to you.
- What would the future look like if this science was used in everyday life?

5.0 Competition Guidelines

science in Salamanca
Celebrating art and science

National Science Week August 14 - 22 2004

eLemental: student artworks exploring science

August 14-29 2004

Invite a *Young Tassie Scientist* to visit your school. Create a 2D artwork based on their work. Selected artworks will be exhibited at Salamanca Arts Centre, the University of Tasmania, the Imaginarium Science Centre and Burne Civic Centre during *National Science Week* and *Tasmanian Living Artists Week*. *eLemental* will be exhibited simultaneously with *eMerging*, an exhibition by University of Tasmania Arts School also inspired from the research of the*Young Tassie Scientists.*

Scientific Themes:

Exploring the Oceans:

- Tomas Remenyi (IASOS, Hons, Hobart) Forams & past sea ice distribution.
- Michael Grose (IASOS, PhD, Hobart) Cape Grim phytoplankton.

Saving the Environment:

- Tim Jordan (Chemistry, PhD, Launceston) Air pollution from wood heaters.
- Nina Hamilton (Architecture, Masters, Launceston) Architecture and wilderness.
- Claire Trenham (Maths&Physics, Hons, Hobart) Modelling chemical combustion.

Generating Energy for the Future:

- Cameron Potter (Engineering, PhD, Hobart) Wind/power forecasting using artificial intelligence.
- Denis Visentin (Computing, PhD, Launceston) Modelling to demonstrate nuclear fusion.

Discovering How Plants Grow:

- Corinne Jager (Plant Science, PhD, Hobart) Hormone interactions in peas.
- Lydia Turner (TIAR, PhD, Burnie) Pasture species in dairy industry.
- Will Bignell (Ag. Science, 3rd year student, Hobart) Growing Wasabi.
- Paul Armstrong (Aquaculture, PhD, Hobart) Plankton blooms

Investigating the Human Body:

- Cassie Saunders (Human Life Sci, Hons, Launceston) Chilli receptors.

Artwork Guidelines:

- Size: at least A3
- Paper: mounted on thick cardboard
- Style: 2D image, painting, drawing, collage, digital image
- Subject: must be based on the work of one or more of the Young Tassie Scientists

Deadline for artworks is 11th of August:

- Mail to Faculty of Science, Engineering & Technology, University of Tasmania, Private Bag 50, Hobart 7001
- Artworks must include student's name, class, school and scientific theme

Awards:

Prizes will be awarded on a regional basis for primary and secondary schools in the categories of:

- Best communication of scientific ideas through art
- School with the highest percentage participation

For more information and a school resource kit, contact:

Kim Menadue Ph: 0419 983202
email: jexsouth@netspace.net.au

Website: www.youngtassiescientists.com

Science in Salamanca

Celebrating art and science

Science in Salamanca is a community celebration of art and science.

Through the selected scientific themes, the aesthetics of science and scientific data will be highlighted, and the visitor will gain an increased awareness of the processes involved in scientific research and artistic interpretation. Using the Arts as a communication tool will stimulate thought on issues that affect daily life, resulting in a better-informed community and the adoption of new social values, which would not be possible using scientific facts alone. By building links, we break down barriers and find hidden synergies…

…visitors to *Science in Salamanca* will understand that, far from being worlds apart, art and science are closely linked through observation, imagination, creativity, communication and evaluation, -