LINNEAN SOCIETY OF NEW SOUTH WALES

LINN S'O'C' NEWS

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IN THIS ISSUE

INCLUDED WITH THIS ISSUE
Record of the Annual general Meeting, 20 March 2013
Form for donation to the Society's research funds
Registration form for Jenolan Caves Symposium
Program for Jenolan Caves Symposium

NEW MEMBERS

We welcome our new members:
Miss Linda H. Armbrecht, Macquarie University. Interests: Phytoplankton taxonomy/biodiversity, biological oceanography
Ms Jenny L. Giles, University of Queensland. Interests: Chondrichthytes biogerogrpaphy, phylogerography, systematics, fisheries, trade in shark/ray parts, primarily fins.
Mr. David McElroy, Sydney University. Interests: Ecology, pollution, human impacts.
Ms Haley Mills, Sydney University. Interests: Invasive species, zoology, behavioural interactions, ecology
Ms Anna Namyatova, University of NSW. Interests: Entomology, Heteroptera systematics

Ms Katie O'Dwyer, Otgo University. Interests, Ecology and evolution of trematode parasites and their snail hosts

Ms Alannah K Pearson, Australian National University. Interests: Palaeoanthropology, biological anthropology

Ms Sarah K. Pearson, Flinders University. Interests: Conservation genetics, animal sociality, molecular ecology

Ms Jennifer Sanger, University of Tasmania. Interests: Plant ecology, rainforest ecosystems, orchids, global change ecology

Mr. William Sowerby, Monash University. Interests: Evolutionary ecology, behavioural ecology, sexual selection, biology

Ms Margaret I. Stimpson. Interests: Anatomy, ecology and taxonomy of *Banksia spinulasa* and all things Proteacese

Dr. Kate Umbers, Macquarie University. Interests: Animal behaviour, evolution of coloration, population genetics, paternity, evolution of signaling

REGISTRATION FOR JENOLAN CAVES SYMPOSIUM

The Jenolan Caves Symposium will be held on Thursday 23rd and Friday 24th of May, 2013, at the Kanangra-Boyd Room, Caves House. The program and a form for registration for the Jenolan Caves Symposium is included with this newsletter. Or go to the website http://linneansocietynsw.org.au

PLANTS OF MAGNETIC ISLAND

The third edition of Plants of Magnetic Island by Betsy Jackes is now available online, or a hard copy can be ordered. Go to the website http://alumni.jcu.edu.au/netcommunity/PlantsOfMagIs3rdEdition

THE EVOLUTION OF MICROBIAL TOXINS AS A BLUEPRINT FOR DRUG DISCOVERY: a talk given to the Society by Prof. Brett Neilan.

The environment dictates the type of microbial organisms living in it but the identification of the bacterial organisms is only achieved at the molecular level. There are 30-40 different branches of the bacterial kingdom. Many of the bacteria cannot be cultured, so cannot be studied by conventional means.

Cyanobacteria ("blue-green algae") are the oldest form of life known and have been on earth for 2-3 billion years. The laminated stromatolites of Shark Bay are made of Cyanobacteria that have hardly changed through their long history. There are laminated microbial mats in hypersaline environments in Yellowstone National Park. Many Cyanobacteria are filamentous and some are unicellular, but they all function in the same way. They have a mucilaginous gel that traps sediment and the laminations consist of alternate layers of algal cells and sediment. The Cyanobacteria have a blue=green chlorophyll, different to the chlorophyll found in the plant kingdom.

In Antarctica, meltwater ponds have a great diversity of Cyanobacteria. "Mermaid's hair" is a filamentous epiphytic form found growing on sea grasses and large masses may break free. It produces a dermotoxin that would make you scratch. The roots of cycads contain the cyanobacterium *Nostoc* that produces the chemical DMAA, a small molecule that induces a neurological response like Parkinsons disease. DMAA is found in the fruits of the

cycad, and when fruit bats eat the fruits and natives eat the fruit bats, then they suffer the neurological symptoms. Cyanobacteria are widespread, and so is DMAA. Ascidians have a cyanobacterium that produces a toxin used as an anti-cancer drug.

There are more than 800 toxins produced by cyanobacteria and they have the potential for drug use. Actinomycetes (Actinobacte\ria) also produces a lot of toxins and one, *Streptomyces* is used for drugs. The Actinomycetes have a filamentous structure and produce many spores for distribution. Some cyanobacteria produce spores or heterocycts that are used for nitrogen fixation e.g., *Nostoc*. Some cyanobacteria are used for food production in China.

Fifty years ago, when water quality was poor, dirt in the pipes was blamed and the solution was an engineering one. Now, microbial films are recognised, using a microscope. If toxins are present, the genes responsible for their production can be identified. The toxins may be classified as liver toxins, neurotoxins or cytotoxins and Australia has all of them. *Mycrocystis* may cause liver damage, but most people do not die from it. Small children and animals are the most vulnerable. In China, where there is a high rate of hepatitis, the people are more vulnerable, for mycrocystin promotes tumour growth, i.e., liver cancer.

The question is: why does *Mycrocystis* produce this toxin? There were no livers around many millions of years ago when these cyanobacteria evolved. There have been big blooms of cyanobacteria in Lake Burragorang but toxins were not present. The genes for toxin production may be present but they are not functioning. The genes get switched on by a high light intensity and with a greater production of the toxin, it moves out into the water. In farm land, the river banks are largely cleared so that the light intensity is high.

Cells of *Microcystis* have hairlike appendages that take up nutrients and may connect with other cells of *Microcystis* and exchange DNA. In this way, non toxic cells may become toxic. *Cylindrospermopsis* produces a potent liver toxin. Saxitoxin, produced by *Anabena socialis* is the No.2 chemical weapon (ricin is No.1). The production of saxitoxin is regulated by the salinity in Australia and by pollutants in Brazil.

Now that we have all this information about natural toxins/drugs, we need to design non-natural versions or the source will soon be extinct. Taxal used to treat breast cancer comes from the yew tree that in now nearly extinct. The Australian Aborigines use a bark that contains penicillin to prevent infections. Many herbal remedies result from an endophyte in the plant. Now that we have isolated the genes responsible, we can use them for drug production. With stress, such as too much light, some of the products of photosynthesis get diverted into toxins.

MUCKING ABOUT IN BOATS OR MUCKING UP THE RIVER? A talk given by Mr David Edwards

Erosion of riverbanks upsets the landholders because they loose land. Boat users are offended if they are accused of causing the erosion: they blame it on waves created by the wind. Research has clearly demonstrate that large commercial vessels have an impact on river banks, but studies in the ‘60s and ‘70s suggested that the wakes from recreational boating activity were less important than waves created by wind. Recent changes in styles of boating activity and overall numbers may now represent a significant cause of bank erosion.

Fast ferries spurred work on bank erosion in the Swan River, Western Australia and in New Zealand. Slow boats create transverse waves. Fast boats create divergent waves and the faster the boat, the bigger the waves. As a boat passes, the second or third wave is the biggest. Are recreational boats an issue? Boat registrations have increased almost linearly, with a drop last year, probably due to the global downturn. Wind may generate large waves if blowing along a straight stretch of river.

Near Wisemans Ferry, where jet-ski activity goes on all the year, there is undercutting and one land owner has lost about 5 m of land. There is very little boating on the Colo River, and very little bank erosion: it is used as the control site. At Sackville, there is a caravan park and lots of boating activity. The diurnal tide range will also affect the rate of erosion. Summer is the peak boating period and winter is much quieter.

To measure erosion, plaster and resin erosion meters (PEM) that dissolve according to the amount of wave action were deployed at two levels on the bank: low and mid tide where they are underwater for a long or short time (respectively), and left for 10 or 11 days. At Bathurst Reach and Lower Portland, there was not much change from peak to quiet times. Wind waves make no difference and boat waves cause limited erosion. Measurements on a weekly time scale do show a difference: there is much more erosion on the weekends when there is more boating activity than on weekdays.

Another way of measuring erosion is to put pins a half meter long into the bank with only 10 cm sticking out then go back at intervals and measure the length sticking out. At Bathurst Reach, the erosion pins show that erosion over the summer weekends and Christmas was phenomenal. The base is eroded away and then the bank collapses. Unusually high tides and heavy rain lead to more bank collapses.

Resistance of the bank to erosion depends on the type of bank: soil and sand are very easily eroded but rock is very resistant. A rock bank can reflect the wave back, and if the other side of the river is soft sediment, it can suffer erosion from the original boat wave and the reflected wave as well. At Bathurst Reach, there is fine hard clay at the back of the bank, and when this is eroded away, it undercuts the bank and then the sandy layer above collapses. If the bank is all sand, it just all collapses.

The type of activity influences the amount of erosion. Fast boats and water skiers that are planing create the smallest waves. Slow heavy boats create much larger waves. Transitions speeds from fast to slow create the most problems. Towing inflatables produces big waves. There are different activities going on at the various locations along the river.

What can be done about it? Limiting some activities is considered the soft option. Establishing reed beds along the banks reduces waves and they can work. The land holders think vegetation causes bank erosion: they see the tree fall over but they do not see that the bank it is growing on has been undercut. With so many interested parties and such a complex situation, the solution to the problems are, well, problematic.

LINNEAN SOCIETY OF NEW SOUTH WALES

SECURITY HAS BEEN INCREASED at the Botanic Gardens: there is now a locked gate between the carpark and the Classroom. When you come to a lecture, just

WAIT AND SOMEONE WILL COME AND LET YOU IN.

PROGRAMME

Wednesday 17 April, at 6 pm, in the Classroom, Royal Botanic Gardens.
Enter through the gate to the Herbarium Carpark, on Mrs. Macquaries Rd.

PROF. MARK P. TAYLOR

Professor of Environmental Science, Faculty of Science, Macquarie University

LEAD: THE LEGACY THAT KEEPS ON GIVING

This talk will cover some of the issues, cases and on going challenges Australia faces in relation to environmental lead contamination. While one might have thought the 'lead issue' was all but over following the removal of lead from petrol and paint, nothing could be further from the truth. The likely lowering of acceptable blood lead exposures has raised the bar with respect to the management and response to lead incidents. However, these are not isolated issues as there remains a multitude of historic, ongoing and potential future examples of where either our knowledge is inadequate or the authorities care too little to take effective action. While environmental lead exposure is the primary topic of the talk, other relevant pollutants will be considered. The general two paradigms reign supreme: (i) no data no problem; (ii) the solution to pollution is dilution.

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Wednesday 15 May, at 6 pm, in the Classroom, Royal Botanic Gardens.
Enter through the gate to the Herbarium Carpark, on Mrs. Macquaries Rd.

Dr MIKE LETNIC

School of Biological, Environmental and Earth Sciences, University of New South Wales

KEYSTONE EFFECTS OF AUSTRALIA'S TOP PREDATOR: FOCUS ON THE DINGO

Top predators often have positive effects on biological diversity owing to their key functional roles in regulating trophic cascades and other ecological processes. Their loss has been identified as a major factor contributing to the decline of biodiversity in both aquatic and terrestrial systems. Consequently, restoring and maintaining the ecological function of top-order predators is a critical global imperative. The dingo is Australia's largest terrestrial predator. Their status is ambiguous owing to their relatively recent arrival on the continent, the damage they cause to livestock and their role as ecosystem architects. In this talk I will discuss the status and ecological role of dingoes, focusing particularly, on the strong regulatory effects they have on Australian ecosystems. A large body of research now indicates that dingoes regulate ecological cascades, particularly in arid Australia, and that the removal of dingoes results in an increase in the abundances and impacts of herbivores and an invasive

mesopredator, the red fox. The loss of dingoes has been linked to widespread losses of small and medium-sized native mammals and the depletion of plant biomass due to the effects of irrupting herbivore populations and increased predation rates by red foxes

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Wednesday 24 July, at 6 pm, in the Classroom, Royal Botanic Gardens.
Enter through the gate to the Herbarium Carpark, on Mrs. Macquaries Rd.

A/PROF. MIKE MANEFIELD

School of Biotechnology and Biomolecular Sciences, University of New South Wales

MICROBES MOVING MOUNTAINS

Unicellular organisms belonging to the bacterial and archaeal domains of life are influential in ways that most people never imagine. They are the oldest and most abundant inhabitants of the Earth and have been influencing the biogeochemistry of the planet long before heavy handed humans got in on the game. In this presentation three examples will be given of how the activity of microbes can be exploited to ameliorate some of the negative environmental impacts of human activity. The first example will discuss the ability of bacteria to break down common groundwater pollutants such as those under the Botany Industrial Park, Sydney. The second example will detail the ability of archaea to generate natural gas from renewable feedstock such as food waste, as illustrated by the EarthPower facility in Camellia, Sydney. The third example will describe the inner workings of a sewage treatment plant the likes upon which human civilisation is dependent, using a facility in St Mary's, Sydney. The overall goal of the presentation is to communicate the importance and utility of microbes (and microbiologists!) for continuing human occupancy of the planet.

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Wednesday 18 September, at 6 pm, in the Classroom, Royal Botanic Gardens.
Enter through the gate to the Herbarium Carpark, on Mrs. Macquaries Rd.

To be announced

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Wednesday 23 October, at 6 pm, in the Classroom, Royal Botanic Gardens.
Enter through the gate to the Herbarium Carpark, on Mrs. Macquaries Rd.

PROF. DAVID J. MABBERLEY

Executive Director, the Royal Botanic Gardens and Domain Trust

THE STORY OF THE APPLE

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Drinks will be served from 5.30 pm
EVERYONE WELCOMED