Dr Mary Garson at work—page 2
Cures for cancer and AIDS sought from under the sea
Developing anti-cancer and AIDS-fighting drugs from the sea

SIMPLE SEA SPONGES, humble starfish and common pippies could harbour in their chemical makeup the key to the most sought-after drugs in the world—the cures for cancer and AIDS.

A chemical found in a sea sponge has already provided the clue scientists needed to develop AZT, the anti-AIDS drug now being tested world-wide.

A Caribbean tunicate (or sea-squirt) has yielded a chemical which is now in its second phase of clinical trials in the USA as an anti-tumour agent.

Recently anti-cancer drug researchers have turned their focus to the sea to find why marine organisms appear to escape that most dreadful of diseases.

So Wollongong University lecturer in organic chemistry, Dr Mary Carson, believes the chances are high that a batch of specimens containing 116 simple sea creatures and plants, collected recently in the waters of the Illawarra, could contain the key to the breakthrough researchers have been seeking.

The watery Wollongong wildlife, now frozen and awaiting shipment, are part of a consignment of Australian marine organisms a team of scientists from Queensland's James Cook University is sending to the National Cancer Institute in Washington for testing.

When they aredefrosted and screened for chemicals which could be used against cancers, AIDS, herpes and other viruses or which act as antibodies, Dr Garson will be anxiously awaiting the result.

For Dr Garson—who returned on March 6 from a visit to the Washington Institute as part of a three-week American visit—has a dream of helping to set up a farm to grow marine organisms providing useful chemicals under carefully controlled conditions. (As a world leader in the field, she had been asked to report some of the answers she has found at an international conference on marine natural products that was held near Los Angeles.)

She envisages an aquaculture setup similar to the Queensland farms which now cultivate clams and prawns for the Asian food market. If that is not feasible, she would do laboratory research into how the chemicals which look most promising could be synthesised.

Dr Garson, who did her Ph.D. at Cambridge on chemicals from fungae which act as antibiotics, turned her attention to the chemicals in our smaller denizens of the sea when she arrived from England four years ago.

Her quest led her to ask for reasons why some algae produce chemicals which cause fish to frequent their habitat to spit them out. Why do some sponges which appear to be genetically the same have a different chemical makeup depending on whether they live in rough or still waters? Are these chemicals ‘defensive’ and, if so, do they hold the key to drugs which humans could use to fend off threats in their own environment in the form of disease?

With two years’ work at the Sir George Fisher Centre for Tropical and Marine Studies at Townsville under her scuba diving belt before she headed for Wollongong, Dr Garson has also tried to discover the most intimate of the sea dwellers’ secrets—how they synthesise the chemicals.

A $3,000 grant from the Leo and Jenny Leukaemia and Cancer Foundation has been used specifically to try to track down possible AIDS and cancer-fighting chemicals.

Despite being barely able to swim when she first came to Australia, Dr Garson took her investigations to the sea-bed after learning to scuba-dive in Townsville.

She helped the team of five Queensland scientists—who have been commissioned by the National Cancer Institute to collect 1 kg samples of 500 specimens annually over five years—to gather the Wollongong batch.

It was not easy. For instance, diving in the kelp bed off Wollongong’s Five Islands ‘felt like being in a washing machine with kelp’, according to Dr Garson.

But the results were good. The team collected a striking variety of sea life, from green, red and brown algae to starfish, shrimps, mussels and slate urchins.

Dr Garson believes this variety and the range of habitats from which the specimens were collected, increasing the likelihood of a great number of different chemicals being found, mean Wollongong could well be the spot to produce the organism which will give scientists a strong lead.

The Australian samples are among those the National Cancer Institute is using (from all over the world) to carry out some 20 million preliminary tests annually.

The tests are the most comprehensive so far. Chemicals will be tested for activity against over 100 strains of cancer.

Dr Garson would like to see Australia do something practical about developing drugs from the sea. After all, scientists at Sydney’s Roche Research Institute of Marine Pharmacology, which closed in 1981, were world pioneers in investigating how the secrets of marine organisms could be tapped to make medicines.

Dr Garson stresses that she and her colleagues do not take big samples when they are collecting—and they do not seek to harvest marine organisms to extract useful chemicals. She is concerned that she should not be seen as ripping off the marine environment.

Caring for AIDS victims

AN AIDS project research team, set up by The University of Wollongong in 1986, looks not so much at AIDS as a disease as on the psychological impact on people affected by the Human Immunodeficiency Virus (HIV). It is HIV which causes AIDS. The team was originally funded by the NSW Department of Health to conduct an evaluative study of counselling and support programs. The team was also to research the needs of those who provide care and support for AIDS-affected people.

The research team is headed by Associate Professor Linda Viney. Other members are Dr Rachel Henry, Dr Beverley Walker and Ms Lavinia Crooks. The research has been based on Linda Viney’s research program dealing with people’s emotional reactions to illness and injury.

This work has resulted in some 30 articles in technical journals, and the book Images of Illness (Krieger, 1983), which was written for both health professionals and lay people. Its theme is that, since people respond not to their illness itself but to the images of it which they create, they have the power to create new images. Professor Viney is currently revising her book, which will be re-issued in 1989.

Initially based in Sydney, the project is to be carried out over three years. It is a longitudinal study which assesses people’s psychological needs and how they are met, develops...
$1 million for Microwave Applications Research

THE Microwave Applications Research Centre at The University of Wollongong has received a $1 million investment for research. This is the largest single investment for research so far made by industry to the University.

Sir Russel Madigan, executive chairman of Muswellbrook Energy and Minerals Ltd, announced the investment on March 29. (The investment came almost exactly a year—missing just by two days—after the official opening of the Centre.) Sir Russel said that the sum was part of a program to invest in processes that would add to the value of Australian minerals.

Muswellbrook's gold exploration company had made the investment through its minerals processing division.

Mr Norton Jackson, a prominent metallurgist and engineer who heads Muswellbrook's mineral products division, travelled to Wollongong to sign the contract with representatives of Wollongong Uniadvice Ltd, the University's consulting company.

The $1 m contract with Uniadvice is to be spread over three years and to allow MEM to share in the outcome of the research.

Precise details as to the type of work in which MEM was investing are not forthcoming. Because of the potential value of the intellectual properties involved they are, for the time being at any rate, marked confidential. Mr Jackson did say, however, that MEM was particularly interested in three areas—assisted leaching of gold ores, direct smelting of some minerals, and rare-earth processing.

Muswellbrooks are clearly impressed with the Wollongong research. Mr Jackson described the team as a world leader, headed by the distinguished industrial scientist Professor Howard Wornor CBE, a former chief of research at BHP and CSR. A point Mr Jackson made was that Professor Wornor and his colleagues had discovered some surprising applications for microwave research which could prove to be of revolutionary significance to industry.

The Centre was opened in March 1987 at the back page.

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When the centre was opened in March 1987 it was envisaged that a large part of the research would be devoted to the drying of materials and to achieving temperatures not much higher than are involved in the cooking of foods. However, Professor Werner brought with him ideas and experimental data which pointed to the potential applications of microwave energy in the smelting of metals and sintering of some ceramics.

The Centre has rapidly expanded its research activities to cover not only the low-temperature applications of microwave energy but to use this field of electro-magnet energy to generate temperatures even higher than are normally involved in the smelting of metals including iron.

It now appears that there is hardly an area of chemical, metallurgical, ceramic and even biological engineering where microwave energy cannot play some useful role. Among the fields already explored are:

- The drying of cereals, fruits, wool, coals, minerals;
- 'Excitation' of different coals prior to charging to boilers;
- New uses for activated carbons;
- Precursor treatment of minerals ahead of leaching and smelting;
- Processing of rare earths;
- Processing of components of superconductors and super magnets;
- Sterilisation;
- Polymerisation.

The Centre was funded initially by allocations from The University of Wollongong, through Uniadvice, and contributions from the other two partners: Illawarra County Council and Industrial Microwave Applications Pty Ltd whose major initial contribution was in the form of a 40KW continuous microwave drive.

Caring for AIDS victims

counselling and support interventions and evaluates the efficacy of these interventions. Counselling psychologist, Ms Kerri Allwood, is providing some of the counselling.

The N.H. & M.R.C. Commonwealth AIDS Research Committee has approved funding for a further two years to permit the extension of this project to Melbourne and Canberra. The sum of $54,000 is being provided in 1988 and 1989 to enable this extension to the program. It will be used to employ another half-time psychologist and data collection staff in these centres.

The team also has a charter to provide education and support on a local level to assist in the reduction of HIV transmission in the Illawarra. Every two months it produces a newsletter designed to provide communication between those working on AIDS-related issues. This newsletter has been independently funded by the National AIDS Committee on AIDS (NACAIDS). It is available from Lavinia Crooks or Karon Slabb (042 27 0682).

The Wollongong AIDS Project has so far attracted approximately $250,000 in research funding, $78,000 from the NSW Department of Health, $108,000 from the Commonwealth AIDS Research Grants Committee, $2,000 from the National Advisory Council on AIDS and almost $60,000 from the Department of Employment and Industrial Relations for the employment of an Aboriginal trainee, Ms Karon Slabb, the Administrative Assistant to the project. As part of her traineeship, Karan is undertaking the Welfare Certificate offered by TAFE.

Psychosocial research of this kind competes with medical research for AIDS dollars. AIDS is going to be very costly, both economically and psychologically. The award of this funding to the team demonstrates a recognition of the psychological needs of AIDS patients and their carers. Given Wollongong's lower HIV infection levels, it is pleasing to see a team of researchers from this University attracting such financial support.

A picture of the team members appears on the back page.
Triumph for university and industry collaboration

A MAJOR PROGRAM of collaboration between The University of Wollongong and private industry has come to fruition with the release of a new analytical instrument. This device, called in honour of Australia's bicentenary the TRUBLUGLU meter, gives a direct readout of the levels of toxic plant chemicals known as glucosinolates in samples of crushed rapeseed.

The TRUBLUGLU meter designed and built in conjunction with a local Wollongong firm, Systrix Pty Ltd, can also measure the concentration of glucose in solutions—for examples, wine and fruit juices. The launch of the meter is the culmination of over two years' laboratory research by Dr Roger Truscott's group in the Department of Chemistry.

In 1985 The University of Wollongong joined with Pacific Seeds Ltd, Queensland, in a project aimed at improving the quality and yield of rapeseed, one of the major food crops in China. Rapeseed is widely grown for the production of cooking oil and China is the world's largest producer (5.3 million tonnes in 1985).

A proposal was submitted to the Australian Centre for International Agricultural Research (ACIAR), which agreed to fund the project to the tune of $266,000 over three years.

The objective of the program was simple: to develop a rapeseed variety for China with better quality and yield characteristics. But how to achieve this? The answer involved plant breeding.

Plant breeding is a long and tedious process involving the multiple crossing of plants displaying desirable characteristics with varieties commercially grown at present. The daughter plants must then be selected at each successive generation and only the best taken for further crossing.

When a feature such as improved plant height or vigour is being selected, the screening process can be accomplished easily by eye. But how can you check if a new plant has good seed quality characteristics? Since many thousands of plants must be examined in order to find the best for further breeding, a chemical test is needed, and one which is simple, inexpensive, rapid and accurate.

A tall order! In the case of rapeseed, improving the quality means removing toxic plant chemicals glucosinolates from the seed. (Anyone who has opened a bottle of mustard is familiar with the breakdown products of glucosinolates. In this case the acrid smell is due to a chemical called allyl isothiocyanate.)

Dr Truscott's research team has not only developed such a test, it has also developed a reflectance meter which provides a direct digital readout of the glucosinolate content in rapeseed.

This technology is at present being demonstrated at a number of agricultural research institutes in China by a postgraduate student from Dr Truscott's laboratory, Mr John Tholen. Institutes at Wuhan and Nanjing are
Nuclear winter
science and politics

IN 1983, Carl Sagan, Paul Ehrlich and others (writes Dr Brian Martin, from the Department of Science and Technology Studies) announced to the world a major new threat to life on earth. They called it nuclear winter. These scientists argued that months of freezing temperatures could result from a nuclear war. Nuclear explosions would cause fires, especially in cities, sending tonnes of soot into the atmosphere where it would block out the sun’s light. The proponents of the theory argued that more people could die from nuclear winter effects, especially induced starvation, than from the direct effects of blast, heat and fallout.

Atmospheric scientists and ecologists were the key figures in raising the issue of nuclear winter. They mustered computer models of complicated physical processes. Some of the nuclear-winter scientists also entered policy debates. Sagan argued for ‘deep cuts’ in nuclear weapons to bring numbers below what was necessary to trigger nuclear winter. A minority of scientists were not swept along by the enthusiasm for the nuclear-winter theory. They questioned some of its assumptions and focused on uncertainties in the conclusions.

For example, the proponents of nuclear winter used nuclear war scenarios which, typically, included the burning of large numbers of cities. The critics said these scenarios were not the most likely. Since an experimental test of the theory is unthinkable, there remains fertile ground for continuing debate.

The nuclear-winter debate illustrates how scientists come to scientific problems with various preconceptions, preferred methods of analysis and background concerns which can shape the way they define the problem, select evidence, build models, treat uncertainties and present results.

Through most of the debate over nuclear winter, the proponents have had a near-monopoly over scientific credibility. They have defined the issue as scientific, not affected by wider social issues. The critics have used scientific arguments, but some of them have also raised political factors.

The promotion of nuclear winter has declined in the past couple of years, probably due in part to the appearance of new studies showing that the effects may not be as great as originally claimed. Two atmospheric modellers have suggested that the effects are better described as ‘nuclear autumn’.

In most scientific debates—such as over nuclear power or pesticides—it is the ‘establishment’ scientists who claim to be above politics and the minority of critics who point out the social values associated with orthodox science. The nuclear-winter controversy is a reversal in that the scientific orthodoxy is linked to stands made by the peace movement, a group challenging the military establishment.

In some ways the controversy over nuclear winter has been a diversion. Many on both sides of the debate would agree that the effects of blast, heat and fallout alone are more than enough to justify the most strenuous efforts to avoid nuclear war. The key question is not the size of the effects, but what to do about the problems of war.

(Dr Martin’s full study on the science and politics of nuclear winter will appear in the journal Science and Public Policy.)
Some of our genes mutate rapidly

WE HAVE BEEN TAUGHT, writes Dr Ted Steele, of the Department of Biology, to think that our genes, composed of a chemical code located on chromosomes, are unchanging entities passed on faithfully from parent to offspring. On occasion a particular gene may change (mutate) to an abnormal type. This, however, is thought to be rare. The predominant picture we have is that of permanence, both in gene function and position (i.e., they are carried on a particular chromosome at a particular position).

Since the earliest years of this century the idea of genetic stability has been a cornerstone of genetics. Without such a concept many aspects of modern genetic research would be impossible to perform. This is illuminated by the following question: How do you characterise a reproducible fashion structures which may be constantly changing? In fact the case can be made that the concept of genetic stability may not only be tied to deep-seated needs of the human psyche but also to inherent methodological problems in systematically studying the process of molecular genetic change.

Physicists studying high energy interactions obtain their evidence for the transient existence of an elementary particle by the particular track it leaves in a cloud chamber. In the past dozen years molecular biologists and immunologists have developed similar tools for "immortalising" rapid genetic events which occur in certain somatic (body) cells of higher vertebrate animals. I will return to this particular methodology shortly.

The history, therefore, of mainstream 20th century genetics has been the systemic study of what might be called reproducible and easily characterised genes. There is no doubt that such genes are important for survival: it is these conservative genes which allow us to identify familiar relationships in structure and function among related members of a plant or animal group.

It is now possible, however, to think in terms of radical genes. Such genes are now being characterised, particularly in those somatic cells (lymphocytes) which make up the immune system. Thus lymphocytes can be isolated from the blood system as permanently dividing, genetically stable, cell line—the cells in these lines being representative of a particular genetic transition state which the cell previously evolved through (termed differentiation). The analogy therefore with the 'permanent' characteristic track of an elementary particle in a cloud chamber is particularly apt.

This genetic immortalisation technique (called cell fusion or hybridoma technology) has allowed immunologists and molecular biologists to study a process called somatic hypermutation. This occurs in the genes coding for the immune recognition molecules called antibodies. It is legitimate to label these genes as radical, as opposed to the more familiar conservative ones we usually study.

The overriding characteristic of these radical genes is their ability to both rearrange their relative position on chromosomes and to alter their genetic message at a very high rate (i.e., hypermutate). For antibody genes this process is intimately linked to environmental stimulation—it is switched on after exposure to a foreign life threatening agent (antigen) such as an invading bacterial or virus disease. Radical genes therefore can be considered the creative arm of an organism's genetic adaptive potential in a rapidly changing environment. They represent "open-ended" systems which allow rapid responses to the unexpected. For the immune system, each foreign microbe (particularly those which also change their genes rapidly such as influenza and AIDS viruses) is a source of unexpected stimuli to which the body must recognise and respond.

Wollongong Law Data Base

THE Australian Corporate Law Data Base project, set up at The University of Wollongong during 1987, was demonstrated in a display of high technology of the 20th anniversary celebrations of the Law Foundation of NSW earlier this year.

The project has been funded by the Law Foundation through a series of grants now totalling $66,000. It was established by Ken Hale and Jim Jackson from the University of Wollongong's Department of Accountancy and Legal Studies.

This unique database involves the application of computer technology to law and enables the sophisticated research into the increasingly complex area of Australian Corporate Law. It contains an analysis of over 2000 reported cases and 800 journal articles on corporate law from all Australian jurisdictions. An analysis of data from it has already concluded that there is a variation in an applicant's chances of success in an appeal in different states of Australia. CLIRS Limited carries the data base on its national computerised legal information retrieval system.

Also at the anniversary celebrations a book by Ken Hale and Jim Jackson was launched. Australian Corporate Law Reference 1986-87, A Digest of Cases and Journal Articles. This is their second book. The first was launched last year. It was entitled The Australian Corporate Law Reference.
Beach erosion, sea-level rise, rainfall and storminess

THERE IS little argument that 70 per cent of the world’s sandy beaches are eroding at average rates of between a half metre and a metre a year, and much of this retreat has been attributed to rising sea level. As sea level rises the base elevation of the watertable at the coastline is elevated. Water draining from the exposed lower beach face decreases sediment resistance to wave erosion leading to shoreline retreat of the order of 0.5 m for each 1 centimetre rise in sea level. Logically any factor, rainfall for example, that affects the position of the beach watertable can induce beach erosion. Additionally any factor, enhanced storminess for example, that increases wave energy will have a similar effect. These factors are the basis for a research study being conducted by Dr Edward Bryant in the Department of Geography, in the University of Wollongong.

A wide number of variables possibly linked to beach erosion was evaluated at Stanwell Park beach situated on the north Wollongong coastline. A detailed record of high-tide location was measured on this beach from 105 photographs from the period 1943-1980. This coastline also contains excellent measurements of monthly rainfall, barometric air pressure, sea surface temperature, sea level, storm waves, and atmospheric circulation as characterised by the latitude of the high-pressure cell over the east coast of Australia and the state of the Southern Oscillation.

The Southern Oscillation is a measure of the strength of trade winds across the tropical South Pacific Ocean. It has been linked to the occurrence of drought and heavy rainfall in Australia, as well as to climatic change every two to three years for 80 per cent of the globe. The figure shows the record of average high-tide position on Stanwell Park beach as well as the storm-wave record. Times when the high-tide line was eroded landward of its average position are shaded. There is an obvious correspondence between the incidence of storms and the location of the high-tide mark. As storm waves increase in height, the high-tide line shifts shoreward. This was most evident during the 1974 storms when the high-tide line eroded 40 metres shoreward of its mean position during the worse storms experienced along this coastline. The table shows the relationship between beach change and four environmental factors defined in research to date.

The table shows that storm waves and rainfall are better related than sea level to beach change. For each one-metre increase in average storm wave height, the high-tide mark will retreat landward by 0.62 m, while a 10 cm increase in seasonal rainfall results in 1.62 m of retreat. These environmental variables also relate to each other.

A scenario can be described that accounts for 30 to 40 per cent of the change in high-tide position on Stanwell Park beach. Beach erosion is induced by a combination of more poleward movement of high-pressure cells, warmer ocean water, high rainfall, storm waves and higher sea level.

More detailed analysis also indicates that the strength of tropical trade winds is also important. This latter relationship is significant. Together with the build up towards storminess in the preceding year, it allows us to predict nine to 12 months in advance whether Stanwell Park beach, and others in the Wollongong area, will enter an accretional or erosional phase.

One of the prime concerns of the next 50 to 100 years is the warming of the atmosphere due to increased CO₂ and other ‘greenhouse’ gases. This supposedly will lead to higher sea level and global beach erosion. Our results show that this sequence of events may be too simplistic. Sea level plays a very minor role in beach erosion on Stanwell Park. Natural changes in climatic and oceanographic variables, possibly unrelated to theorised CO₂-induced warming, should be considered as more important mechanisms controlling beach change.

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Wollongong attracts Macquarie University Accommodation Officer

The expansion of the student accommodation facilities in the University has attracted Robyn Wilkes, formerly an Accommodation Officer at Macquarie University, to move to Wollongong and take up the challenge of managing the new facilities.

Robyn Wilkes organised residential accommodation for students at Macquarie University from 1983 to 1987. Before that she worked in the Department of External Studies at the University of New England, organising orientation programs for external students. She has a Bachelor of Arts (Psychology) from the University of New England and is currently enrolled in a Master of Arts (Psychology) at the University of Sydney.
H ow do small, isolated populations of plants survive? Increasing development of bushland areas, dissection of the habitat by roads and railway lines, and disturbances such as fires all contribute to a reduction in the sizes of plant populations and to increasing isolation. Predicting how a plant population may respond to these pressures necessitates an understanding of many facets of plant biology, including genetics, breeding systems and pollination biology. An interdisciplinary approach is therefore essential.

The recent round of ARCS funding includes a grant to Dr Rob Whelan and Dr David Ayre (Biology Department) for an interdisciplinary study entitled: The Genetic Consequences of Plasticity of Mating Systems in the Proteaceae. This study will be one of the first integrated genetic and ecological investigations of any element of the Australian flora.

The title may seem imposing, but the research questions and the system under investigation are easily understood. 'Sex in banksias' might be an appropriate lay description.

The plant family Proteaceae includes the banksias, grevilleas, mountain devil and waratahs, among other groups. This plant family is a very important constituent of many Australian plant communities. It also provides a substantial part of the nursery and cut-flower industries. Understanding the regulation of reproductive success in natural populations is therefore of fundamental importance.

Flowers in species of Proteaceae typically occur densely packed in inflorescences. A single waratah head, for example, comprises over 150 individual flowers. The inflorescence of the old-man banksia, Banksia serrata, is even more impressive: nearly 2,000 flowers. Each of these flowers has the potential to produce a separate fruit which can contain two seeds. Who has ever seen 2,000 bumpy fruits on an old-man banksia cone? Inspection of May Gibbs's pictures (see the one in the next column) reveals the situation that is typical for plants in this family: only a handful of fruits from all those flowers.

The explanation for this apparent inefficiency of fruit production forms the underlying raison d'être for the research program. Recent research at the University of Wollongong leads us to believe that the answer will not be simple. A wide range of factors may be involved, including nutrient availability to plants, underlying breeding system of the plants (i.e., cross fertilisation vs self fertilisation) in relation to the activities of pollinators, population size (i.e., number of potential mates), and competition with other plant species for pollination.

We know that many of the flowers on an inflorescence receive pollination by animals. We know that birds and small marsupials are the most abundant visitors to Banksia inflorescences, and most movements of these pollinators must be within plants; i.e. self-pollinations. However, genetic studies have revealed that a very high proportion of the seeds in Banksia spinulosa cones results from cross-pollination. These results suggest that the Banksia plants are able to discriminate, to some extent, among different pollinations, allowing some seeds to be matured while others abort along the way.

How might a plant accomplish this discrimination? Is there a genetically based recognition of 'good' and 'bad' matings? Can a plant selectively allocate resources to the flowers which have received better matings? Are some developed seeds more successful than others by virtue of the particular mating producing them?

These are the sorts of questions awaiting the arrival of a Research Associate who will be appointed on the grant. Beverly Walker, who has just completed her Ph.D. in the Botany Department at the University of Western Australia, arrives at the University of Wollongong in April to take up the position. Her research background includes experience in population genetics, plant physiology and field ecology. These skills suit her to be part of the interdisciplinary team investigating the research questions outlined in this article.