# BIOLOGIC

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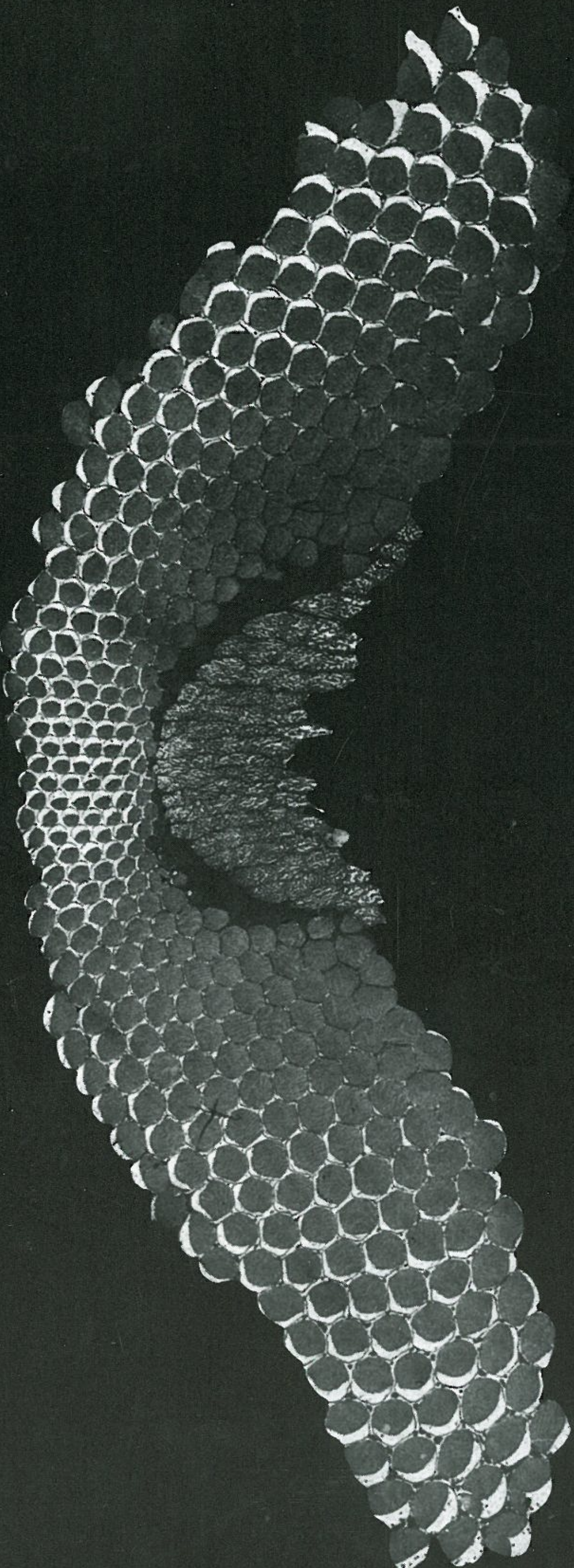

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*Cover photograph.* A low-powered electron micrograph, taken by Dr David Blest, of a transverse section of the deepest layer of light receptors in the tiered principal retina of the jumping spider. See story on page 9.

## *FROM THE DIRECTOR'S DESK*

The past few months have been of considerable importance to the School as the new strategic plan has come into effect and the extensions to the main laboratory building, to house the neuroscience groups, have commenced. In addition the School has benefited from strategic funding provided by the University to develop research in ecosystem dynamics and visual sciences.

The funds for ecosystem research will enable the School to develop a major program of research into ecosystem structure and function. The research will be focussed on developing a body of ecological theory on which the conservation and management of areas of natural and semi-natural vegetation can be based. Discussions are underway to link this activity with other groups in the University, notably in the Centre for Resource and Environmental Studies, the Research School of Pacific Studies, the Faculty of Science and the Centre for Information Science Research, and also with CSIRO.

The additional funds for visual science have been provided to the Centre for Visual Sciences and will be used primarily to provide post-doctoral fellowships and other support posts for Professor Levick and Professor Snyder. One additional post to work with Professor Horridge is also being funded by the Centre for Information Science. These extra resources will be of great importance in developing a well balanced overall research program for the Centre, and will enable the new laboratories to be used with maximum effectiveness.

The School performed well in the last round of National Research Fellowship announcements. Of the eight NRFs awarded to the University, RSBS obtained five. Additionally, two new QEII Fellows will begin work in the School this year.

**Ralph Slatyer**

*The Director of the School, Professor Ralph Slatyer, FAA, FRS.*

# The virus from Snowy River

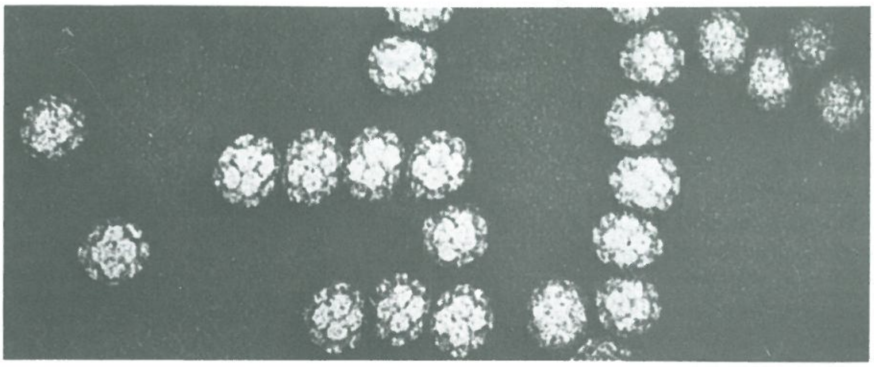
High in the alps of Kosciusko National Park lives a microbe called turnip yellow mosaic virus. The name 'turnip' is a link with northern Europe where the virus was first found. But it seems that about 30,000 years ago the virus migrated to Australia, possibly in the seeds of a weed called *Cardamine,* which is a member of the cabbage family. *Cardamine* now lives around the alpine lakes above the Snowy River and turnip yellow mosaic virus produces yellow patterns in the leaves of some of the plants.

Members of the School's Plant Molecular Biology Group have recently tamed turnip yellow mosaic virus and uncovered its innermost secrets. Under the cliffs of Carruthers Peak that rise above Club Lake the scientists took one sample from a *Cardamine* plant. Dr Paul Keese then used the sample to unravel the genetic sequence of the virus's single strand of nucleic acid. Turnip yellow mosaic is the first indigenous Australian virus to have had its genetic code revealed.

The virus is a member of the tymovirus family. These infect a wide range of wild plants. Therefore Dr Keese and other members of the group can study, at the molecular level, how viruses adapt to different plants. They hope to find what mutations allow a virus to infect a new species of host.

During evolution the gene sequences of organisms change; individual nucleotides which combine to make the gene, change because of chemical or physical damage or poor copying; strings of nucleotides may be deleted, inserted or moved. Comparing the gene sequences of related viruses reveals such changes.

Molecular biologists can determine whether any of the changes are responsible for the ability to attack particular plants by interchanging parts of different sequences and testing which plants they infect or, alternatively, by changing individual nucleotides, one at a time, and testing the new, engineered viruses.



*An electron micrograph of particles of turnip yellow mosaic virus.*

Discovering how a virus acquires a new host may provide clues about how plants resist infection. This is particularly important in the study of disease in crop plants. If scientists can find how a virus has adapted to life in a crop, that information could be used to counter the adaptation. The group will compare the way tymoviruses evolve in wild plants with studies of how other viruses invade domesticated plants.

In addition to Dr Keese, the members of the team studying the ecology and evolution of viruses are Dr Adrian Gibbs, Dr Drew Meek, Ms Anne Mackenzie, Ms Marjo Torronen, Ms Jennie Howe, and two students, Mr Shouwei Ding and Ms Marlene Orosio-Keese. As well as determining the genetic sequence for turnip yellow mosaic virus they have also completed similar work on two other tymoviruses, one from Trinidad and the other from Cornwall in Britain. Seven other members of the family, four from Australia, are currently having their sequences analysed.

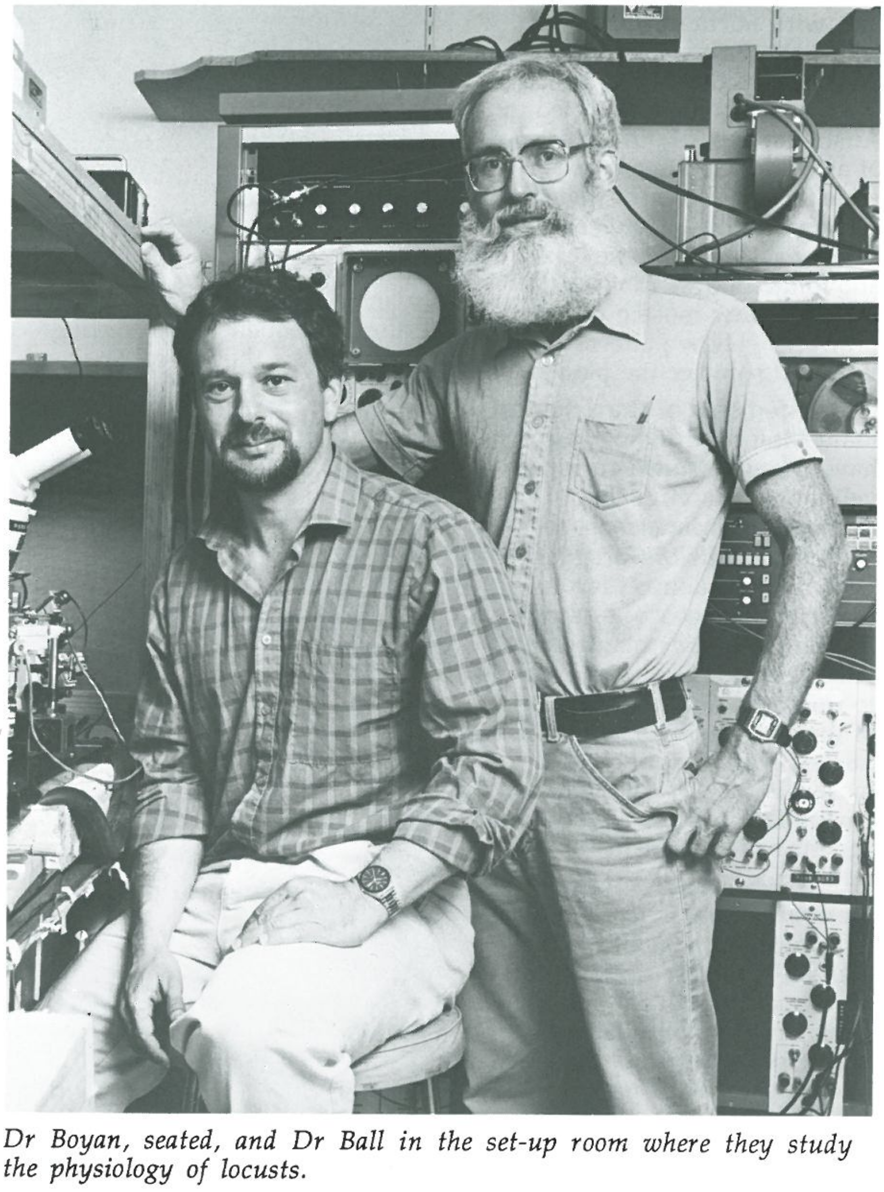
*Dr Paul Keese, right, and Dr Drew Meek looking for turnip yellow mosaic virus on the slopes of Carruthers Peak in Kosciusko National Park. In the background is Club Lake.*

# Tracing the nerve cells of a locust

Reflexes such as the knee jerk are controlled by nerve cells. However, even in such a simple reflex, it is difficult to study the complex electrical activity in the circuit of nerve cells (or neurons) which control it. The neural interactions controlling more complex movements in mammals are mostly beyond present recording and analytical techniques.

Invertebrates perform many of the movements we find in mammals, such as walking, flying and jumping. But these movements are controlled by simpler nervous systems than those in mammals, consisting of a smaller number of cells, many of which are large (one-twentieth of a millimetre) and can be individually identified. As experimental subjects, one group of invertebrates, the locusts, has the additional advantage of being plentiful and easily reared.

For these reasons, laboratories all over the world have investigated various aspects of nerve-cell function in locusts, and a large body of information has accumulated over the past 20 years. This is valuable because many principles of neural function first established using insects or other invertebrates have recently been found to apply to vertebrates as well.



*Dr Boyan, seated, and Dr Ball in the set-up room where they study the physiology of locusts.*

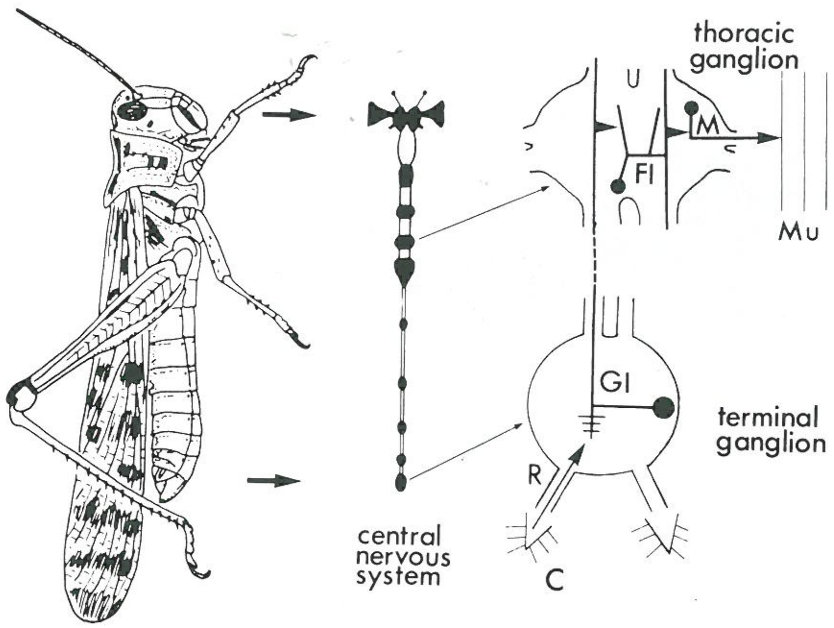
Dr George Boyan in the Molecular Neurobiology Group of the School has recently completed the difficult task of mapping the electrical interactions of one stimulus-response system in the locust. He traced the circuit from the receptors on the tail to the motor neurons controlling flight. Collaborating with Dr Boyan were Dr Eldon Ball, also of the Molecular Neurobiology Group, and Dr Les Williams, a visiting fellow from the Max Planck Institute in Germany, both of whom have been working on the anatomy of the neurons.

At the tip of the locust's abdomen are sense organs called cerci, which are covered with sensory hairs. These hairs monitor the locust's speed and movement during either walking or flight. They are also sensitive to sound, so they alert the locust to the presence of predators. The diagram shows the series of neural connections from the cerci to the wing muscles. Only certain cells make connections with one another and these same connections can be seen in all locusts.

In order to do the experiments a restrained locust is dissected to expose the central nervous system, which is then probed with dye-filled glass micropipettes with tips so fine that they cannot be clearly seen, even under the microscope. Dr Boyan likens this process to trying to push a knitting needle through a dish of spaghetti to stab one particular unseen strand.

Once a cell responding to wind has been found in the terminal ganglion a second micropipette is inserted into a thoracic ganglion and moved about in search of cells showing activity correlated to that recorded by the first pipette. A direct connection between the cells can be confirmed by passing current into the first impaled cell and producing an alteration in the electrical activity of the second. Once the experiment is concluded, the cells are filled with a fluorescent yellow dye, which allows them to be visually identified.

A possible application of such knowledge is to robotics. The locust offers one relatively simple solution, produced by millions of years of selection and evolution, to the problem of how to design a machine that can respond to sensory stimulation. Electrical engineers are now examining such systems to see how they have solved the problems of information reception and processing. In businesses and industries that require automated responses to events and the environment, the locust could become a model for useful electronic devices.




*The central nervous system of the locust consists of a chain of ganglia, each a small brain composed of several thousand nerve cells. Each hair on a cercus has its own receptor neuron (R in the diagram), a single cell which extends into the terminal ganglion of the central nervous system. Within the terminal ganglion an electrical signal in the sensory neuron is transmitted to a giant interneuron (GI), which carries the signal rapidly forward within the central nervous system to the thoracic ganglia which control the flight muscles. Within these ganglia the giant interneuron activates a flight interneuron (FI), which in turn activates a motor neuron (M). This motor neuron extends from the ganglion to the muscles (Mu) and controls their contraction.*

# Healthy bees

*Dr Denis Anderson in Auckland.*

Honey bees are probably the nation's most valuable insects. The diseases of these bees probably cost Australia millions of dollars. The cost is not just in the production of honey but also because bees pollinate crops and fruit trees.

Domestic honey bees have many different viruses that do not seem to affect the native sweat bees, *Trigona*. Many of these viruses are distant relatives of the viruses that cause foot-and-mouth disease, the common cold and polio. The breeding and selection of honey bees for their productive qualities may have made them more susceptible to disease.

An expert on bee diseases from the New Zealand Department of Scientific and Industrial Research in Auckland, Dr Denis Anderson, paid a welcome return visit to the School last November. Dr Anderson did his PhD in the School on the ecology of honey-bee viruses.

He has since been surveying the bee diseases of New Zealand and Fiji. In both places he found many of the pathogens known throughout the world; also, one or two previously unknown. It was for research into one of the new viruses - one that may be causing half-moon disorder - that he returned to Canberra.

# Different sorts of teamwork

## *A team of twenty-one*

At the last count, Dr Barry Rolfe had assembled 21 people in the School's biological nitrogen fixation group, 'a number sufficient to make some sort of international impact'. They included postdoctoral fellows, PhD students, visitors, lab assistants and technicians. Dr Rolfe said the size of his laboratory was comparable to a small lab in the USA.

The research focus of the group has recently shifted from a detailed study of the *Rhizobium* bacteria that fix nitrogen in legumes' root nodules to the molecular analysis of plant resistance to disease. Dr Rolfe believes that only a reasonably large team can contain the diverse skills needed to compete in the fundamental pursuit of knowledge at the highest international levels. At the same time the team can carry out applied research that meets national needs and also feeds back ideas to help solve fundamental problems. The laboratory also nurtures the young Australian scientists who will pursue both types of research in the future.

Dr Rolfe has been building up his *Rhizobium* program in the School for 14 years. The current members of the group are five postdoctoral fellows, Dr Greg Bender, Dr Michael Djordjevic, Dr Steven Djordjevic, Dr Murali Nayudu, and Dr Jeremy Weinman, five PhD students, Mr Tony Arioli, Mr Jim Gray, Ms Kate LeStrange, Ms Wendy Lewis and Ms Lucy Sargent, a visiting fellow from the USA, Professor Jerry Johnson, two visiting scholars from Germany, Ms Petra Gross, and China, Mr Li Likun, three technical officers, Mrs Elena Gartner, Mrs Jan McIver and Ms Marie Oakes, and five laboratory technicians, Mrs Jennifer Bolton-Gibbs, Ms Tanya Brown, Ms Louise Currie, Ms Juliet Miller and Ms Anne Moten.

To sustain this team Dr Rolfe has obtained many grants from outside the University.

*Some of the members of Dr Rolfe's team. Top row, fromleft, Dr Murali Nayudu, Mr Tony Arioli, Dr Barry Rolfe, Dr Greg Bender, Mr Hancai Chen; second row, Ms Louise Currie, Miss Tracey McIver, Mrs Elena Gartner, Mrs Jan McIver, Ms Petra Gross, Dr Steven Djordjevic, Dr Michael Djordjevic, Mrs Jennifer Bolton-Gibbs, Miss Wendy Lewis, Dr Jacek Plazinski; seated, Mrs Shizhen Huang, Ms Lucy Sargent, Ms Juliet Miller, Ms Tanya Brown, Ms Marie Oakes.*

Funding for research into acid-tolerant *Rhizobium* has come from the Australian Meat and Livestock Research Corporation and the Australian Wool Board Trust Fund, for a genetic study of legume nodulation from the Agrigenetics Research Corporation in the USA, for research (with Professor Brian Gunning of the School's Plant Cell Biology Group) into improving the nutrient value of a fern, *Azolla,* from the Australian Centre for International Agricultural Research, for the development of the supernodulating soybean (with a former ANU botanist, Dr Peter Gresshoff) from the Department of Industry, Technology and Commerce, and for a study of plant defences against infection (with Dr John Redmond of Macquarie University) from a Victorian biotechnology company, Betatene Ltd. The last two contracts were arranged by the University's marketing company, Anutech Pty Ltd.

Maintaining this outside funding means that Dr Rolfe spends quite a bit of time writing grant applications. 'Grant-writing helps to focus ideas and gives a perspective on the literature in the field,' he said. It forces him to plan five years ahead and decide 'the real questions you need to ask.'

Dr Rolfe foresaw the end for any Australian scientist who was not prepared to spend time writing for grants. The days of guaranteed funding, regardless of the scientific importance of the research, had gone, he said. Australia was following the American trend where scientists had to justify their research costs each year. This increased competition for research funds would benefit the best scientists.

Dr Rolfe also spends a substantial amount of his time maintaining a national and international network of contacts. Within Australia he

*continued overleaf*

# Small can be effective

Dr George Miklos has a small molecular genetics group and an extensive international network of contacts. He spends almost no time on grant applications. 'I don't think that is a very efficient use of my prime brain time,' he said. 'Given the present structure of the Institute of Advanced Studies, it is the function of the Director to allocate funding. I put together a research mission statement, the Director has it evaluated and on that basis funds it to the appropriate level. I can then get on with my job of doing experiments at the bench.'

Dr Miklos has chosen to tackle aspects of brain structure and function using genetic engineering techniques. He said that one of the most exciting areas in biology is the molecular structure of the brain. The modern recombinant DNA technologies which have already engulfed and enriched other areas of biology have now been focussed on neurobiology.

'The situation is akin to a molecular blitzkrieg that brushes aside cherished ideas, mechanisms and even personalities in its path,' he said. 'It is interesting to watch the inflexibility of some classical neurobiology labs. First they thought recombinant DNA of the brain was a fad. Then, when it wouldn't go away, they chose to ignore it. Now they are so far behind that they are unable to even comprehend these fast moving technologies and so cannot utilise the information which is published. It's the dinosaur story all over again for them.'

*continued overleaf*

*Members of and visitors to the School's Molecular Neurobiology laboratory. From left, Mrs Elizabeth Cipe, Miss Fiona Hall, Dr Gert de Couet, Ms Jane Olsen and Dr George Miklos.*

# Different sorts of teamwork

## Small can be effective

*continued from page 7*

Dr Miklos has studied the genetics of the brain of the fruit fly, *Drosophila melanogaster*, which he compares to a 100,000-neuron mini-computer. He clones and sequences the genes which he believes wire up the brain circuits. Since nearly 40 percent of the proteins in the fly brain are similar to those in the human brain, he finds it a particularly exciting avenue of research.

'However,' he said, 'We are still at the very beginning and as yet we know next to nothing about how any brain is wired up or how it works. It is essential to obtain hard molecular data on selected aspects of brain structure and function and this will only come from discoveries that are appreciated at the bench. This is most easily done in a small lab.

'When a lab gets too big, the group leader can no longer spend sufficient time thinking about science, but is forced to allocate time to non-intellectual organizational matters such as funding, striving to maintain laboratory space and equipment, and job applications.'

But given the complex nature of modern scientific research a minimum 'critical mass' of staff is essential. Dr Miklos has created a critical mass by networking. His small group of scientists, students and technicians in the School collaborates with scientists in leading universities in the United States - Harvard, Stanford, Princeton, Yale, Washington University - and in Europe - Freiburg in West Germany, Imperial College in London, and the University of Glasgow in Scotland. In Australia he collaborates with Dr Ian Young in the John Curtin School of Medical Research at ANU and Dr Len Kelly at the University of Melbourne.

Dr Miklos has found the national and international collaboration simpler and more productive than spending valuable research time managing a large laboratory. His group in Canberra has expertise in genetics and molecular biology and this is shared with the neuroanatomical, neurophysiological, embryological, behavioural and microelectronics expertise of the overseas laboratories. 'The other labs have complementary techniques and equipment. Instead of trying to buy all that expertise and equipment and bring it to Australia, why not leave it where it is and network?' he said.

According to a recent issue of the American journal, *Science*, such international networking is catching on in Europe. Networking has become the most important shift in science policy in the 1980s. Travel and joint experiments are cheaper and more diplomatic than the alternative of setting up and running major research centres. Science administrators see increasing travel and bilateral exchanges within Europe as a means of keeping European scientists from joining the brain drain to the United States.

To maintain his network, Dr Miklos gives a priority to travel, visitors and the use of the telephone, at the expense of laboratory hands and consumable items.

# A team of twenty-one

*continued from page 7*

regularly communicates with the New South Wales Department of Agriculture, the CSIRO, the University of Melbourne and Macquarie University. Overseas he has collaborators at the University of Leiden in the Netherlands and at universities in Colorado, Michigan and Illinois in the USA.

The quality of the research in his own laboratory puts Dr Rolfe in a position of strength within this network. 'We have something to offer,' he said. Since Australia was 'off the beaten track', Australian scientists had to work harder to be noticed overseas.

To communicate effectively with other partners in the network the group uses well-planned telephone calls and facsimile transmissions. Dr Rolfe spends at least one month a year travelling out of Canberra. He said, 'A $2,000 plane ticket may be more value than a lot of phone calls because in one day's discussion you can cover a greater depth of material than is possible on the phone.'

To keep the team on the right track Dr Rolfe spends a lot of his time planning and suggesting directions for research, and co-ordinating activity. Often he finds he can rarely spend more than two hours at the laboratory bench without disturbance. He said, 'I have to know where everything's going and make sure things happen.' His experience has given him an intuitive sense of fruitful areas to explore and allows him to build mental models of the problems.

# The eyes of jumping spiders

Jumping spiders are very visual creatures. They stalk their prey using their eyes, they recognise each other by visual signals and when they mate the recognition of patterns is very important.

To do these jobs each spider has eight eyes, the two enormous eyes at the front being the most important. The lateral eyes merely detect movement and produce a reflex that turns the spider so that the two principal eyes see the object of interest.

The structure of the jumping spider's principal eyes is most unusual and unique in the animal kingdom. The eye has a large lens at the outer end of a long, fluid-filled tube, which acts something like a small telescope. At the inner end of the tube is a retina made up of four tiers of light receptors. Muscles move the retina so that it can cover a field of view of 22 degrees. The telephoto optics was studied a few years ago by a former PhD student, Dr David Williams, and a lecturer in mathematics at the Australian Defence Force Academy, Dr Peter McIntyre.

*Mrs Margrit Carter and Dr David Blest.*

The unusual structure aroused the curiosity of the leader of the School's Developmental Neurobiology Group, Dr David Blest. He wanted to know how such a unique and complex organ, that efficiently performs such an important task, could have evolved. Early stages of the eye's evolution might no longer exist in related spiders.

But the growth and development of an individual animal sometimes recapitulates the sequence of the evolution of the species. With the help of a technician, Mrs Margrit Carter, Dr Blest looked at the growth of the tiered retinas in spiderlings to try to find some clues to their evolution.

In the days after hatching, each retina of the young spider changes in shape from hemispherical, with a single layer of receptors, to form a distorted ellipse and then, when viewed from the front, a boomerang shape. This folding produces the deeper, four-tiered retina because receptors at the margins of the hemisphere come to be on top of those in the middle.

Of the four tiers of the retina, the hindmost layer is the only one well-organised to evaluate an image. The function of the other three layers is not clear. But the shape of the retina solves the problem of light of different wavelengths being focused at different distances from the lens. The receptors at the back of the eye sense green light, while those at the front sense ultraviolet light.

To further his study of jumping spiders, Dr Blest spent some time in 1984 and 1987 at the Smithsonian Tropical Research Institute in Panama. Whereas there are only 15 to 20 species of jumping spiders in Canberra, around the edges of a small rainforest clearing in Panama there could be some 50 species.

The collection of data about the forms of the retinas of different species of spiders allowed Dr Blest to draw up an evolutionary tree for jumping spiders, tracing their divergence from a hypothetical web-building ancestor. For the last century these spiders have largely resisted taxonomists' attempts at classification. The study of the jumping spiders' unique eyes has allowed a tentative picture of the spiders' origins to be drawn.

# Work experience

*At the end of last year, Gayle Williams, left, a final-year student at Hawker College, gained a week's work experience in the Plant Molecular Biology Group. She is shown purifying virus particles.*

# Staff retreat to coast

*Professor Richard Mark, Dr Bill Creaser, Dr David Shaw, Professor Ian Cowan and Dr Stuart Letham during the retreat of scientific staff at Batemans Bay.*

The School has recently begun a series of management 'retreats' in which members of staff discuss the management of the School and ways to improve research productivity and job satisfaction.

The School Secretary, Mr Chris Buller, said, 'The School has taken a new approach to getting the staff as a whole talking about how we go about research. This has been done by taking people out of their normal work environment for a few days and allowing them to mull over the issues in a more relaxed fashion.'

The School's business and technical manager, Mr Peter Firth, has played a co-ordinating role in the three retreats so far. For two days he and the head technicians went to Batemans Bay where they discussed the strengths and weaknesses of the way the School was organised.

They concluded that there needed to be more communication within and between research groups and between the different categories of staff.

Most tenured members of the scientific staff, together with Mr Buller and Mr Firth, went to Batemans Bay for two days in October. The University's training and development officer, Mr Les Bohm, acted as facilitator for discussions.

Most members of the Plant Molecular Biology Group - scientists, students, technicians and clerical staff - also 'retreated' to the University's farm at Kioloa in November. A great number of suggestions for improving administrative, scientific and social communication were sorted out. Since the meeting there had been more co-operation and openness between members of the group.

*Fellowship winners, from left. Standing: Dr David McCurdy, Dr John Evans, Dr Janet Gorst. Seated: Professor Brian Gunning, Dr Barry Rolfe, Dr Jeremy Weinman, Dr Graham Farquhar. Absent: Dr Adrian Gibbs, Dr Richard Williamson, Dr Paul Keese.*

# Fellowship winners

The School has won a large share of the 1988 research fellowships. Five of the eight National Research Fellowship grants awarded to ANU have gone to the School. Its talented young scientists have also won two of the prestigious Queen Elizabeth II Fellowships.

The National Research Fellowships were awarded to:

A project proposed by Dr Adrian Gibbs, of the Plant Molecular Biology Group, on the molecular biology of plant viruses (see story on page 3). The fellow is Dr Paul Keese, who came to ANU from the University of Adelaide.

A project proposed by Professor Brian Gunning, of the Plant Cell Biology Group, on regenerating whole plants from tissue cultures of plant cells. Dr Janet Gorst will to take up the fellowship.

A project proposed by Dr Richard Williamson, of the Plant Cell Biology Group, on microtubules in plant cells. Microtubules are part of the cytoskeleton and are important for cell division and shape determination in plant cells.

A project proposed by Dr Graham Farquhar, of the Plant Environmental Biology Group, that aims to identify the plant genes that control the efficient use of water (see *Biologic* no. 2).

A project proposed by Dr Barry Rolfe, of the Plant Molecular Biology Group, on the genetic analysis of the competitiveness of strains of the bacterium, *Rhizobium*. The fellow is Dr Jeremy Weinman.

The two Queen Elizabeth II Fellows are Dr David McCurdy and Dr John Evans. Their fellowships last two years. Dr McCurdy is presently a Postdoctoral Fellow in the Plant Cell Biology Group. For the QEII Fellowship he will collaborate with Dr Williamson on a study of actins in plants.

Dr Evans has begun work with Professor Ian Cowan, of the Plant Environmental Biology Group. Until recently he worked in the CSIRO Division of Plant Industry. His interest is the qualities of plants that enable them to thrive in bright sunshine or shade.

# Plan supports School

The University's Strategic Plan has voted more than $1 million to the School over the next three years. The plan, approved last year by the University Council, is a means of redirecting the University's academic priorities within a tight budgetary framework. New initiatives and expanded activities are financed through the redeploy-ment of resources.

The plan will support the expansion of two areas of research in the School: in visual sciences and in the dynamics of ecosystems.

Following a School review of the plant sciences last year, one new tenured position, funded by the School, was established in the Ecosystem Dynamics Group. Funds from the Strategic Plan will be added to the School's increased commitment and so the size of the group will increase from three staff in 1987 to eight or nine in 1989.

Last year the University established the Centre for Visual Sciences to bring together strong research teams from different research schools. The centre is a joint venture of the Research School of Biological Sciences, the John Curtin School of Medical Research and the Research School of Physical Sciences. The centre will be housed in a new building to be erected as an extension to to the RSBS building.

## History

The Research School of Biological Sciences (RSBS), established in 1968, is one of the younger and smaller research schools in the Institute of Advanced Studies. It grew from very modest beginnings and now has some 65 academic staff, 70 graduate students and about 150 technical and support staff.

## Scope of research

The School concentrates on a limited number of key research topics. It is thus possible to tackle problems with well-structured and adequately funded research groups and address these on a long-term basis at a level which keeps the School at the forefront of international developments.

## Mode of operation

RSBS is divided into nine research groups, each with one or more tenured staff at their core. Group membership changes as research interest evolve. At present the groups are: Developmental Neurobiology, Ecosystem Dynamics, Plant Cell Biology, Plant Environmental Biology, Plant Molecular Biology, Population Genetics, Molecular Genetics, Molecular Neurobiology and Visual Sciences.

## Strategy

The School has a sectional strategic plan which highlights:
* further focussing on a limited number of topics;
* a regular review of resource allocation within the School:
* the rapid dispersion of the concepts and techniques of molecular biology through most of the School;
* establishment of major research thrusts in the molecular analysis of plant performance and in ecosystem dynamics.

## Collaboration

RSBS staff have a wide range of personal collaborations with researchers in Australia and overseas. The School fosters interaction with other universities and CSIRO with a view to increasing the value and effectiveness of Australian biological research.

# New ideas on plant evolution

A new approach to determining the ancestry of plant species by comparing their genetic sequences is producing new and unexpected ideas on the evolution of different types of plants.

The methods and initial results were discussed at a workshop on molecular taxonomy and the evolution of plants last November. The workshop was organised by the School's Plant Molecular Biology Group.

One of the guests at the workshop was Dr Elizabeth Zimmer from Louisiana State University. Dr Zimmer is an expert in the study of higher-plant lineages, using genetic materials. She takes nucleic acid from ribosomes, small organelles in the cell that translate the information coded in nucleic acids into proteins. Ribosomes, because of the vital function they perform, maintain ancient genetic information. By comparing the sequences of ribosomal nucleic acids, Dr Zimmer can measure the degree of similarity or difference between species.

The other special guest at the workshop was Professor Peter Martin from the University of Adelaide. He has been studying the links between higher plants by looking at the amino-acid sequences of a part of an enzyme, *Rubisco,* that is vital to the process of photosynthesis.

The workshop demonstrated that significant areas of plant taxonomy are being rejuvenated by the new techniques of molecular biology and computerised means of handling information. The 70 participants were plant scientists from research institutions in Canberra and other parts of Australia.

*Participants in the plant taxonomy workshop. From left, Dr Elizabeth Zimmer from Louisiana State University, Dr John Andrews, who has recently joined the School's Plant Molecular Biology Group from the Australian Institute of Marine Science, and Professor Peter Martin from the University of Adelaide.*