

## APPLICATIONS

# Many facets meet on discovery

Hybrid science is both groundbreaking and hot among students, reports **Linda Vergnani**

**W**HEN electrical engineer Mandyam Srinivasan began studying the visual navigation mechanisms of honeybees, he was trying to “follow his heart” rather than find lucrative practical applications for his research.

Professor Srinivasan first got interested in “bug eyes” while doing a PhD in neurobiology. As a “curious zoologist”, he wanted to find out how much detail bees can see with their compound eyes and how they navigate and hover above flowers using visual cues. He found bees interpret the apparent motion of passing objects as distance and adjust their flight accordingly.

His biological research led to the development of a visual guidance system for a pilotless helicopter, enabling it to move at a constant height above the surface and land automatically.

The helicopter utilises cameras as the equivalent of insect eyes.

Seeing this as a way to extend the eyes and ears of soldiers in battlefields, the US Defence Advanced Research Projects Agency (DARPA) and other defence organisations in the US and Australia have poured \$4.5 million over five years into his research.

Professor Srinivasan, executive director of the centre for visual science and a Federation Fellow at the Australian National University, says: “One of the nice things about working at the interface of two disciplines is that it’s easier to do something that is novel and interesting.”

Subjects which bring together different disciplines such as biotechnology, microtechnology and astrobiology are among the most productive areas in science, and students are proving keen to enter these hybrid fields.

Other areas which have caught the public imagination include nanotechnology, photonics and proteomics.

Vicki Sara, chief executive officer of the Australian Research Council, says the cutting edge of science is frequently emerging from discoveries at the intersection of disciplines.

“In terms of career development and job opportunities for graduates, I think it is most important to have a substantial grounding in science or engineering and then have the flexibility to apply that in innovative areas that are developing with time,” Pro-

fessor Sara says. She says some of the most exciting developments in science are coming from a combination of information technology, robotics, mechatronics, nanotechnology and neuroscience.

For example, some of the research is aimed at trying to “mimic the functions of the central nervous system or sensory systems in terms of tiny, tiny machines”.

These machines could be developed to do anything from steering cars to repairing the functions of a damaged nervous system or performing hip replacements without invasive surgery.

Professor Sara says that gaining entry to these new fields requires a sound basic science or engineering education and then the flexibility to work with experts from other fields.

Students can do postgraduate research work which combines different sciences, but jobs in some of the newest fields might not be available for 10 years.

Professor Sara cites the work of Professor Srinivasan, a “really outstanding researcher”, as a prime example of the cutting edge of science.

Another key example is the work of Bob Clark, director of the ARC Special Research Centre for Quantum Computer Technology based at the University of NSW.

Professor Sara says: “What they are doing is looking at a whole different way of storing information in terms of change in an electron which would revolutionise the computer industry.”

She says Professor Clark’s team is in a “neck and neck race” with researchers in the US to develop the world’s first quantum computer.

Other fields such as forensics have captured the imagination of students because they have been glorified in television programs.

But Professor Sara warns “the opportunities for employment (in forensics) are quite limited if you want to follow through”.

She advises students who have a particular career in mind to see what courses are available and then speak to the head of department or dean as well as people who work in that field.

Astrobiology is one of the present hit courses. Malcolm Walter, director of the Australian Centre for Astrobiology based at Macquarie University,



**The eyes have it:** Professor Srinivasan at ANU with a robotic helicopter, inspired by the vision of bees

Picture: Kym Smith

says there has been an exponential growth curve in enrolments in the subject not only here but in North America. “Of course the sexy aspect of it relates to the origin of life and the distribution of life in the universe and that certainly captures everyone’s attention,” Professor Walter says.

“Astrobiology lies at the borders between earth sciences, biology, astronomy and chemistry predominantly, as well as aspects of physics. It’s a highly interdisciplinary science.”

He says planetary exploration has come to the forefront and captured the public imagination.

“There are incredible numbers to illustrate this. For example, the recent

landers on Mars attracted more than one billion hits to NASA’s website.”

Interest in astrobiology was being driven by the search for life on other planets as well as research into the origins of life.

Professor Walter says that at Australian student conferences people ask how they can become involved in planetary exploration or become astronauts. The introduction of astrobiology courses two years ago was an attempt to meet the demand.

At Macquarie University the entry point into astrobiology is third year and the subject is now “strikingly popular” with postgraduates.

Professor Srinivasan advises stu-

dents to follow their hearts rather than just look at employment possibilities.

“It frightens me sometimes when I look back at some of the decisions I made to get into these totally exotic and bizarre fields, that seemingly had no future, whereas students nowadays are much more wary,” he says.

“They worry about things like what the job market is and what their future income will be.

“We just looked into something that looked interesting and went into it. That would be my advice to young students: don’t think with your mind, think with your heart and as long as you enjoy what you are doing you will certainly come out ahead.”

► **Subjects which bring together different disciplines are among the most productive areas in science**