

**PRIME MINISTER'S SCIENCE, ENGINEERING
AND INNOVATION COUNCIL**

SIXTH MEETING - 30 NOVEMBER 2000

WINNERS OF 2000 PRIME MINISTER'S PRIZE FOR SCIENCE

The inaugural Prime Minister's Prize for Science has been won by Dr Jim Peacock and Dr Liz Dennis, both from CSIRO Plant Industry Division in Canberra. Their discovery of the Flowering Switch Gene - in layperson's terms, the key gene that determines when plants stop their vegetative growth phase and start flowering – has global implications, from subsistence farmers in developing countries to the biggest western world wheat growers. The discovery has the potential to boost the productivity of the world's crops by billions of dollars per year and could also help increase the nutritional value of crops eaten by billions of the world's poorest people.

BIOTECHNOLOGY AND THE NEW AGRICULTURE

Dr Jim Peacock and Dr Liz Dennis, CSIRO Plant Industry, Canberra

Agriculture now is not an old economy pursuit. It is a new economy pursuit dependent upon cutting edge technologies like information technology and biotechnology for successful performance in the global agribusiness system.

Gene technology is one of these cutting edge technologies. It opens up possibilities in agriculture that were either not there or were going to take a long time to achieve.

In plant science, gene technology includes modification or manipulation of an existing gene; addition of a new gene; removing the activity of a gene; using genes as markers to flag desired gene sequences; and genomics.

It is important that our plant breeders have access to these techniques as they develop because without them, Australia will be limited or unable to produce varieties that meet future environmental, farming and consumer demands.

Gene technology is already speeding up traditional plant breeding through the application of gene markers. The resulting plants are not genetically modified.

Gene technology breeding allows us to identify the gene we want, isolate it and transform it into a crop plant. We can do that without transferring other unwanted genes as happens during conventional breeding eliminating the need for backcrossing.

Modifying, manipulating or switching off existing genes allows us to tailor characteristics of a plant to suit particular markets or environmental conditions.

Genomics allows us to study and understand the type and function of all the genes in a single plant. It is a major force of change in the future of agriculture — no other technology provides new knowledge with such speed and in such volume, and so it is vital that Australia is an active participant in plant genome projects.

New knowledge creates new opportunities. Taking these new opportunities and bringing them to a creative and meaningful product is the way forward for Australia.

One of the key features of this new knowledge and new economy in agriculture is the protection of intellectual property (IP). The patent system so important in manufacturing and information technology industries is now critical in agribusiness. IP is a way for Australia to remain competitive in global trade in agriculture. IP is a way to provide Australian agriculture with new tools to help make it truly sustainable while remaining profitable for our growers. It is a way for Australia to have control over its food supply, and to share the benefits of research.

Our research into the Flowering Switch Gene is an example of how new knowledge is providing new opportunities. CSIRO has applied for patents to this research. That way it benefits Australia, and we can also make it available to developing nations if needed.

The Flowering Switch (FLC) Gene is a key gene in determining when plants end their vegetative growth phase and start flowering. This discovery has direct implications for improving the performance of crops.

The Flowering Switch Gene is a repressor of flowering and the more gene product there is, the later the plant flowers.

Plants normally flower in response to environmental signals such as hours of daylight or a period of low temperature — a process called vernalisation. Vernalisation causes the Flowering Switch gene to be turned off and plants flower early.

We have shown that the FLC gene we isolated from the model plant *Arabidopsis* works in canola. We have also isolated the canola gene and shown that flowering in canola can be controlled by the same gene activity. Adverse weather conditions when crops are in flower cost farmers in Australia and worldwide heavy losses each year. In developing nations this can be devastating.

By manipulating the Flowering Switch Gene we aim to produce strains of canola, wheat and other crops that flower at the right time for the climate in which they are grown, so reducing the risk of yield losses. It could also be used to prevent plants such as pasture grasses, timber trees and horticultural crops like lettuce from flowering for long periods.

If Flowering Switch technology, with other biotechnology, were taken up worldwide, to either promote or retard flowering, it could add billions of tonnes to world crop output.

Most significantly it could make an important difference to the lives of subsistence farmers in developing countries.