Part 4 – Final Report Plain English Summary

You must submit a half to one page Plain English Summary of your research proposal that is not commercial in confidence, and that can be published on the World Wide Web. An electronic copy of the Plain English Summary must also be forwarded by e-mail (angela@crdc.org.au).

Naturally blue coloured cotton fibres would have value to the industry because they would alleviate the additional cost and environmental pollution caused when white fibres are dyed with indigo pigments to produce denim. Although some plants already make blue pigments in flowers, these are water soluble and highly dependent on the presence of other co-pigments and environment within cells and would not be suitable as dyes for cotton fibres. Bacteria however, make a range of blue pigments, including the indigo that is used to dye denim. This project attempted to isolate different genes from coloured bacteria and express them in plants to produce the blue pigments indigo and indigoidine.

Unfortunately we were never able to get indigo produced in plants despite trying several different strategies using different genes that could make the pigments in the common bacterium *E. coli* and targeting them to different compartments in the cell where the chemicals needed to generate the pigment are located.

More success was obtained in producing the pigment indigoidine that has the same colour as indigo, but a very different chemical structure. The genes for indigoidine production were previously unknown so we first had to clone and characterise them from the blue bacterium *Vogsella indigofera*. There were some very interesting features about the enzymes that make the blue pigment as they were similar to enzymes that normally make cyclic peptide structures with antibiotic activity produced by some bacteria and it was possible that the blue bacterium made indigoidine as an antibiotic compound or by-product of antibiotic production.

Once we had identified the 2-3 genes we thought necessary for the production of the blue pigment we developed gene constructs to express them in plants. We tried a number of plants including cotton, tobacco and Arabidopsis (a small weedy plant often used as an experimental model in modern plant science) but were only ever able to produce transgenic Arabidopsis plants containing these genes (as we later discovered, the blue pigment seems to be toxic to plants during tissue culture). The Aribidopsis plants were intensely pigmented – but very sick and many died or produced seed that had lost the genes and were no longer pigmented. New gene constructs have been developed to express each of the different indigoidine production genes independently, and particularly in Arabidopsis flower petals where it may not matter if the pigment produced is toxic, but we have yet to complete the experiment where the different genes are brought together by crossing to see if we can make the blue pigment in a controlled manner so that it can be passed on to its progeny.

Should we, over the next six months or so, be able to produce the pigment in Arabidospsis petals and make blue flowers we would be in a better position to approach the CRDC or Industry partners to translate this into a proof-of-concept in transgenic cotton plants and fibres.