Breakthrough Removes Obstacles in Biotechnology

By Mona Akbari

Researchers at CAMBIA™ have made a breakthrough in biotechnology by successfully transferring genes to plants using several bacteria other than *Agrobacterium tumefaciens* or *At*, that so far has been considered the only microbe capable of such gene transfer. The discovery has earned the scientists a publication in *Nature*, one of science's most prestigious journals.

The finding is particularly significant since using *At* for gene transfer to plants is covered by complex patenting laws that has prevented its use by many organizations worldwide. The new technology is an exciting alternative, since it will be available through an 'open-source' license that has no commercial restrictions, but requires a commitment to sharing improvements.

Agrobacterium is commonly found in soil and naturally parasitizes plants by inserting its bacterial genes into the plant's genome. The inserted segment, referred to as T-DNA, is present in *At* as part of a larger circular DNA fragment known as the Ti plasmid. Until now it has not been conclusively shown that the Ti plasmid can be used in other bacteria for gene transfer to plants.

The team at CAMBIA introduced a specially modified Ti plasmid into three different types of bacteria, *Rhizobium*, *Sinorhizobium* and *Mesorhizobium,* that are closely related to *At*, to test whether these bacteria would allow gene transfer to plants. Another fragment of DNA or vector was also introduced into the bacteria. It contained several components including the transferring T-DNA, as well as a gene for *GUSPlus ™* that allows a colour test in plant material to ensure that gene transfer has occurred.

The altered bacteria were grown on leaf pieces of tobacco and tested for gene transfer by the use of the *GUSplus* activity colour test, which clearly showed the characteristics associated with successful gene transfer. As expected, *GUSplus* activity was not observed in control experiments where the bacteria contained the vector but not the Ti plasmid. Once the tobacco plants were regenerated from the leaf discs, further tests also confirmed that the T-DNA had integrated into sites within the plant genome.

Sinorhizobium was also able to mediate gene transfer in other plants such as rice and the model plant *Arabidopsis thaliana*, while *Rhizobium* allowed gene transfer to *Arabidopsis.* All regenerated plants from these experiments were conclusively shown to have T-DNA integrated into their genomes.

It is extremely useful that *Sinorhizobium* is able transfer genes to a range of plant tissues in both broad-leafed dicotyledonous and narrow-leafed monocotyledonous plants. Many important crops have been resistant to gene transfer by *At* and this new technology may provide the answer.

CAMBIA has applied for a patent on this technology and offers TransBacter™, the collective name it has given these bacteria, as an 'open-source' alternative to the international community. This will be achieved through an innovative license concept, called BIOS – Biological Innovation for Open Society – which is based on precedents in computer software, but has been adapted for patented technology to ensure sharing of improvements.