

Journey in the Academic and Research world of Australasia

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CAMBIA

CAMBIA is an Australian-based international, non-profit research institute pioneering the concepts of biological open source, modelled after the successful open source software movement. It is adapting licensing and distributive collaboration aspects of the open source movement to enhance transparency, accessibility and capability to use patented technology, public domain science, life sciences know-how and materials.

For more than a decade, CAMBIA has been creating new tools and enabling technologies to foster innovation and a spirit of collaboration in the life sciences field. It has done this by catalysing a community of innovators to produce high quality and relevant biological technologies in a new, protected, universally accessible commons.

CAMBIA is motivated by the fact that the poor or excluded communities of the world make up more than four billion of the world's population. The potential for biotechnology to impact on the major issues of developing countries such as sustainable food production, environmental degradation and insufficient medical conditions is high.

Yet, much of modern science, particularly the biotechnology and other high tech industries have evolved to high capital and high margin applications. The current drivers in technological development are intellectual property regimes, which have seen an explosion of patenting with the result being the private appropriation of enabling technologies thus blocking access by others to use these building blocks of discovery.

Cambia's activities

Patent lens

CAMBIA's Patent Lens is set to bring together data from the world's patent systems, sharing it and subjecting it to the rigors of the informed public eye. The key features of the Patent Lens are:

- An open access, internationally integrated patent database, which contains all of the latest U.S. patent applications, life sciences patents from Europe along with patents applications filed under the international Patent Cooperation Treaty.
- Opportunities for public engagement in patent annotation, commentary and navigation.

The Patent Lens is a global resource for increasing patent transparency. Based on one of the world's largest free, full-text integrated patent databases, the Patent Lens also provides tutorials, information on patent policies, and news and views in the world of IP. The Patent Lens currently houses over 5.5 million patents and patent applications from the USPTO, EPO and WIPO. The USPTO collection has recently been expanded to cover all patents, not just the life sciences. The Patent Lens also has legal status.

BIOFORGE & BIOS Licenses

The BioForge is an Internet-based distributive community, based around a platform of tools to allow scientists in diverse locations to work together, and with those who can apply and use their research.

BioForge creates a dynamic, protected commons of new enabling technologies available to all for improvement and to use in new innovations, both commercial and non-commercial.

BiOS (Biological Open Source) licenses are designed to enable the sharing of the capability to use patented and non-patented technology, which may include materials and methods, within a "protected commons".

Research and Technology

CAMBIA conducts research in areas of strategic importance for sustainable agriculture. In general, CAMBIA is developing tools capable of enabling more innovation in agricultural production, and now public health, through the use of molecular biology. There are the main research programs in CAMBIA:

- The Agrobacterium-independent TransBacter™ plant transformation system was published in Nature on 10 February 2005.
- GUS and GUSplus™ from CAMBIA's latest β -glucuronidase reporter gene system are used in pCAMBIA vectors.
- Diversity Arrays™ Technology (DArT) is a patented method for high throughput, sequence-independent genotyping.

Molecular Technologies

New Transformation Method

TransBacter™ is a new method for transferring genes to plants, which focuses on the use of non-pathogenic bacteria outside the genus *Agrobacterium* for gene transfer to plants. The complexity of the patent landscape surrounding *Agrobacterium* has created both real and perceived obstacles to the effective use of this technology for agricultural improvements by many public and private organizations worldwide.

To address this restrictive environment, bacteria outside the *Agrobacterium* genus have successfully been modified to mediate gene transfer to a number of diverse plants. See Nature paper and detailed information about the technology and licensing in the Transbacter project link at www.BioForge.org.

In addition to affording a versatile 'open source' platform for plant biotechnology, the TransBacter alternative to *Agrobacterium*-mediated technology for crop improvement may lead to new uses of natural bacteria-plant interactions to achieve plant transformation.

New Genes of Interest

Historically CAMBIA is strongly associated with the β -glucuronidase gene (*gusA*) from *E.coli*. There are thousands of publications documenting its extensive use and versatility as a marker gene for plant genetic transformation and molecular physiology studies.

More recently the hydrolytic capabilities of the *gusA* gene have been exploited to release aglycones from glucuronides. This principle can be exploited widely either to increase phloem transportability of novel, second-generation hydrolytic enzymes with improved characteristics (e.g. secretability into the apoplast of plant tissues, improved higher thermal and chemical stability to expand on existing histochemical assay conditions, variants in substrate specificity and processability).

A different approach consists in the development of transport mechanisms based on substrate-specific permeases, to trap the substrates in the cell. Phloem-translocatable, bioactive pro-compounds are being developed as target substrates for the activating enzymes.

These enzymes may also find broad industrial and medical uses, so they are being placed into [BioForge](http://www.BioForge.org) projects.

Gene Switches

An essential element toward the goal of ecologically sound, sustainable agricultural practices is the use of tissue-specific, controllable gene switches. The fusion of activating genes (whose products activate pro-compounds) to tissue-specificity conferring promoters is straightforward, although the search can be labor-intensive and intellectual property issues must also be analysed.

Tissue-specific promoters, many of which have been isolated and their intellectual property status cleared, complement the chemical switches.

pCAMBIA vectors

CAMBIA has constructed a suite of modular DNA vectors for plant transformation research.

Functional Genomics

Rice as a model species

Through many years of troubleshooting this technology in Asia for the Rockefeller Foundation and via our in-house research, CAMBIA has developed a very efficient transformation system for rice, and a new alternative system, [Transbacter](http://www.BioForge.org), providing wide FTO. The principal two [reporter genes](http://www.BioForge.org) used in this work (GUS and GUSPlus™) were also developed by CAMBIA scientists and are available for license from CAMBIA. They have captured a large number of genomic regions using a specially adapted "enhancer trap" that employs a transcriptional activator to generate transactivator "pattern" lines. Using a range of reporter constructs developed at CAMBIA for monitoring the activity of a transactivator.

Transcriptional Activators

CAMBIA is using an enhancer trap strategy adapted from one originally developed in *Drosophila*, where the enhancer trap element carries a gene encoding a transcriptional activator protein that activates gene expression via its recognition of, and binding to, a specific DNA target recognition sequence. A description of a similar system can be found on <http://www.plantsci.cam.ac.uk/Haseloff>.

Molecular Apomixis

Clonal reproduction of plants via seed, known as apomixis, has the potential to forever change plant breeding technology. Apomixis would allow farmers to perpetuate, cheaply and undiminished, the high yield

gains from hybrids. This could provide the farmer with greater autonomy and choice in planting future generations and enable capture of the advantages of superior cultivars adapted to local conditions.

Further Information

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