

## BIOETHICS & GENETIC MODIFICATION

John Bryant



## GLOSSARY

- **DNA** – the chemical of which genes are made; order of building blocks (bases) constitutes a code
- **Gene** – a specific instruction or recipe within a DNA molecule
- **Genome** – an organism's entire genetic complement
- **Protein** – proteins are a cell's 'working molecules'; most genes encode (i.e. contain the recipes for ) proteins
- **Enzyme** – a particular type of protein which carries out a biochemical reaction; we have thousands of them, each with its own role.

## INTRODUCTION

- **Science and society**
  - How should wider society make use of scientific knowledge? Includes 'philosophical use'
- **Science and ethics**
  - Are there issues of 'right' and 'wrong'?
  - 'We can – but does that mean we ought to?'
  - Are there limits to the use of scientific knowledge?
- **Science, ethics and religion**
  - Does a religious faith help us make decisions? If so, how? Is there a Christian approach to bioethics?

## DEVELOPMENT OF BIOETHICS

### Medical ethics

Nurnberg trials  
Transplant surgery

### Biotechnology

GM (1973)  
Many applications

### Environment

Rachel Carson  
V R Potter (1971)

### Dates

Bacteria: 1973  
Animals: ca 1980  
Plants: 1983  
First product: 1977

Isolation of a fraction from cauliflower mosaic-virus-infected protoplasts which is active in the synthesis of (+) and (-) strand viral-DNA and reverse transcription of primed RNA templates

Thomas CM, Hull R, Bryant JA, Maule AJ  
*NUCLEIC ACIDS RESEARCH* 13: 4557-4576 (1985)

Plant enzymes but not *Agrobacterium* VirD2 mediate T-DNA ligation in vitro

Ziemiencowicz A, Tinland B, Bryant J, Gloeckler V, Hohn B  
*MOLECULAR AND CELLULAR BIOLOGY* 20: 6317-6322 (2000)

## WHAT IS INVOLVED?

- At its most basic, GM involves removing a gene from one DNA molecule and inserting it in to another ('recombinant DNA')
- The DNA molecule with its newly inserted gene ('the gene of interest') is then introduced into an appropriate host cell
- That host cell has now been genetically modified



## PAUSE FOR THOUGHT

- Are there any ethical objections (Christian or otherwise) to the process of genetic modification itself?
- New ethical issues – or 'old' issues with a new slant?
- Natural versus Un-natural?
- Does the Bible say anything relevant?
- Asilomar conference (1975)
- Risk was the main ethical concern

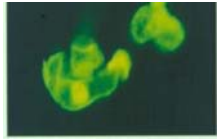
## APPLICATIONS 1



### Research

- Gene function
- Gene and Genome organisation
- Genetic diseases
- Sequencing
- Genome projects
- Evolution
- etc

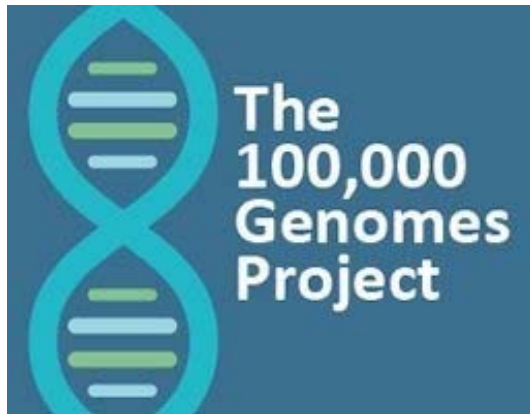
## EXAMPLES



Gerardas Dambrauskas, David Brice, John Bryant



Picture by Sara Burton, John Bryant, Jack Van't Hof



The  
100,000  
Genomes  
Project

Genomics  
england

## APPLICATIONS 2

- Any gene to any organism – in theory at least
- Pharmaceuticals – insulin, human growth hormone, vaccines
- 'Design' of mainly micro-organisms for specific jobs
  - Synthetic Biology (SynBio)
  - iGEM competition
- Pharming' – GM animals (more recently, plants)
- Developing treatments – e.g. GM mice carrying human 'disease genes'

### APPLICATIONS 3

- Human genetics

Genetic selection of embryos (NB Not GM)



### APPLICATIONS 3

- Human genetics

Gene therapy – provides a cure for a genetic disease by inserting working copies of the gene into appropriate cells. E.g. Immune deficiency. Not risk-free

This is somatic cell gene therapy

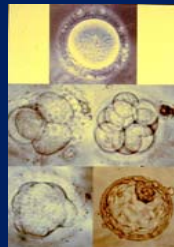
### APPLICATIONS 3

- Human genetics

But what about 'germ-line' (heritable) gene therapy?  
It is entirely feasible to use GM techniques on human embryos; the 'new' gene would be inherited

Raises the possibility of genetic enhancement

GM of humans is forbidden under UK law with one exception, namely mitochondrial replacement



## APPLICATIONS 4

- Genetic modification of crop plants
  - Disease resistance
  - Pest resistance
  - Herbicide tolerance
  - Drought tolerance
- First commercial growth 1995 in USA; crops bred by GM techniques now grown in 27 countries, occupying about 15% of agricultural land.
- In 2016, hectareage in less developed and developing countries exceeded for the first time the hectareage in developed countries
- Opposition in some countries continues – often aggressive and very unpleasant



## SO

- Can we develop a Christian (bio)ethical approach to genetic modification?
- We can find no **direct** guidance in the Bible – nor should we expect to do so. There are no rules here.
- We must therefore resort to principles
- Love God, love your neighbour – expanding those principles gives us a virtue-ethics approach to the problem – and this, although based on those two great principles, may not be specifically Christian
- And it immediately becomes apparent that, unless we conclude that GM **itself** is wrong, then we have to evaluate each application of GM on its merits

## QUESTIONS & ANSWERS

- Is this a wise and virtuous use of scientific knowledge?
- Does it exhibit love and care for other people, individually and collectively?
- Does it pose any unacceptable risks to the environment?
- Are there animal welfare issues?
- We may therefore decide that some applications are wrong ... for me that will include GM of an embryo in order to enhance a future human being
- Equally, we may decide that some applications are right or desirable ... for me that will include use of GM to produce crops which require less pesticide and which secure the livelihoods of poor farmers
- But you may have other ideas

*... we should be more concerned with broader cultural trends that elevate liberalism to such an extent that children become rights that can be purchased according to parental desires and wishes.*

Celia Deane-Drummond,  
in *Genetics and Christian Ethics*, 2007

## THANKS TO

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