BIOCHEMICAL SOCIETY

Café Scientifique

Royal Society of Biology

CAN WE GIVE NEW BIOTECH THE GREEN LIGHT?

WELCOME

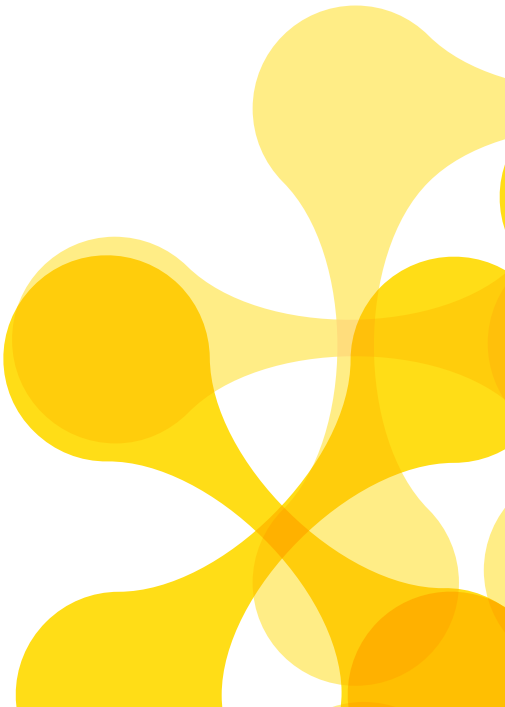
Can you be *green* and in favour of cutting edge biotechnology? With a population explosion and subsequent food production crisis, climate change and environmental damage on the horizon, how can we innovate to conserve the human population, food sources and our environment?

Using novel examples of biotechnology, today's speakers Professor Helen Sang, Dr Louise Horsfall and Dr Donald Bruce will discuss and debate whether technology such as genetic engineering could be used to solve some of the world's biggest challenges, and whether using it could be considered a green approach?

This event has been organized by the Biochemical Society, Royal Society of Biology and Glasgow Café Scientifique as part of Glasgow Science Festival 2016.

We hope you enjoy the lively talks and thought provoking debate.

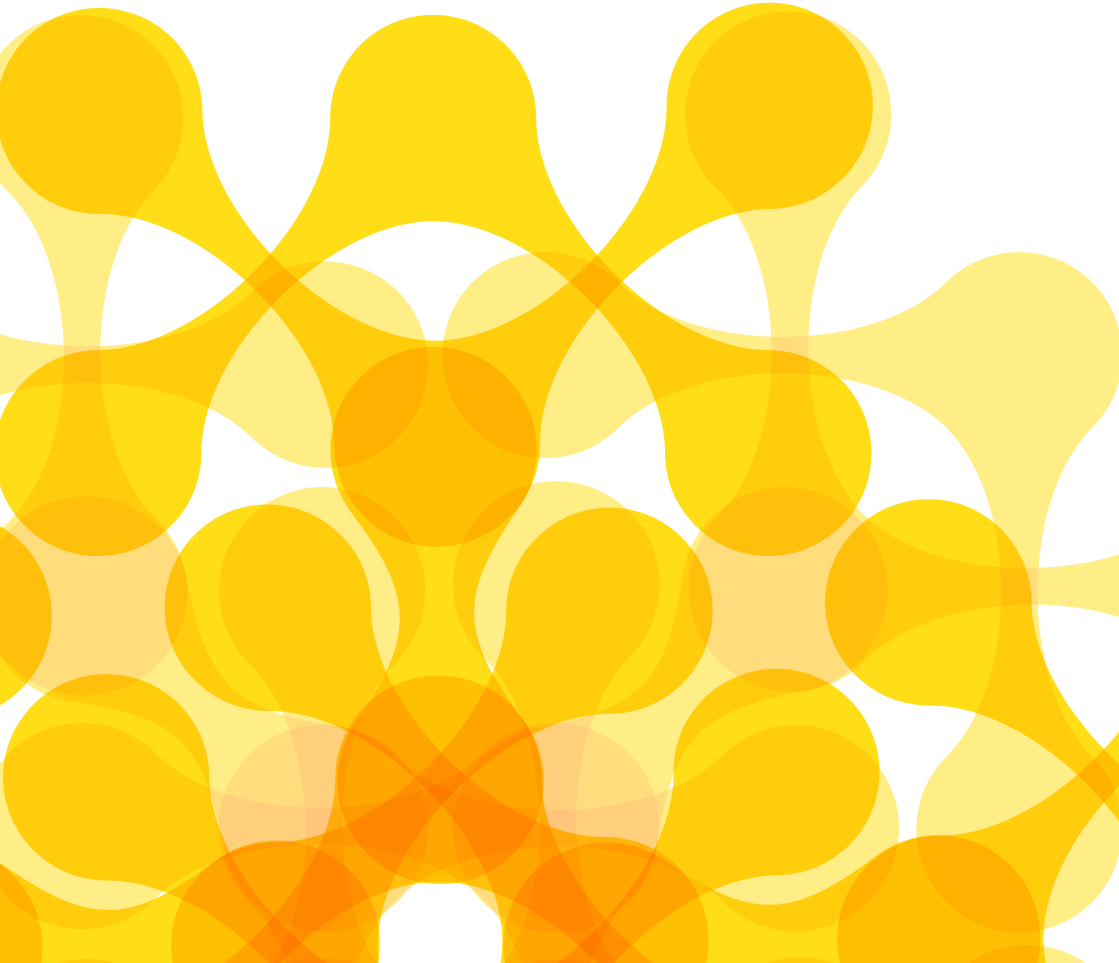
#GlaSciFest



WHAT IS BIOTECHNOLOGY?

Biotechnology uses molecular processes found in nature to produce new products and functions that could improve our health and our planet. People have been using biotechnology for thousands of years, using fermentation to produce wine, bread and beer and using selective breeding of plants and animals to produce improved food products.

Today, we use biotechnology to produce medicines and vaccines and to develop and grow improved crops and livestock as demand increases. Researchers are looking to use biotechnology to develop alternatives to fossil fuels that might be economically advantageous and reduce our carbon footprint.



Genetic engineering

Genetic modification involves deliberately altering an organism's genetic composition. By adding new sections of DNA or genes to an organism, or making small, targeted genetic changes, scientists are able to give it one or more new characteristics. For example, plants have been made resistant to insect pests that otherwise attack them, or to damage by herbicides used against nearby weeds.

Synthetic biology

Synthetic biology is a relatively new development and has no single definition. It is based on the idea that engineering approaches can be used to study biological systems. Using the knowledge gained, new systems that do not exist in nature can be designed and constructed, or existing ones adapted. The potential uses of synthetic biology are far reaching, and the impact of these uses could be profound. This raises questions of ethics and discussions are taking place around potential applications of synthetic biology, such as who should decide on how and when it should be used.

HOW IT WORKS
Genetic Engineering

Scientists identify and isolate a gene in an organism or design a novel gene in the laboratory that they show confers a beneficial trait. They then introduce this gene or genetic trait into another organism that lacks this trait. Genes are transferred using a range of molecular methods: a common method in animals is to use a modified virus that can carry an extra gene and insert it into the chromosomes of an animal, resulting in addition of the novel gene that can then be inherited by the offspring of the altered animal. Scientists must ensure that the correct cells are targeted, and that the gene can be activated once it is inside the cells. This process must be achieved without any harmful side effects.

HOW IT WORKS
Synthetic Biology

Synthetic biology is essentially made up of two processes; organisms are either designed from scratch, or the existing organisms are stripped back to remove DNA that is not essential for the desired function. Synthetic biology uses engineering approaches to create new biological systems, for example with off-the-shelf standardised parts such as BioBricks. BioBricks are pre-made sequences of DNA with specific functions, and are commercially available for researchers to order. They can be combined to build more complex sequences (hence the building bricks concept), which can then be incorporated into living cells to construct a new genome.

ABOUT THE SPEAKERS

Professor Helen Sang FRSB is a research professor at The Roslin Institute, University of Edinburgh. She has been involved in developing technologies for genetic engineering of the chicken, for use as a research tool to understand the development of the chicken embryo as a model of development of the human embryo, and for applications in biotechnology. These biotechnology applications may be for production of protein drugs (often called "biologics", for example insulin or Herceptin) in the eggs of genetically engineered hens or to introduce useful genetic changes. A main focus of this last application is to confer resistance to major infectious diseases affecting farmed chickens.

"We are developing increasingly efficient and sophisticated tools for genetic engineering of farmed animals including chickens. These tools will allow us to improve the ability of chickens to resist major diseases, for example bird flu, which led to devastating losses in the USA in 2015. Bird flu outbreaks are also a potential threat to human health as bird flu can cross over to humans and cause pandemic outbreaks. The first drug for treatment of a human disease made in the eggs of genetically engineered hens has just been licensed for use in patients. If we are happy to accept a drug made in a genetically engineered (GE) chicken should eating meat and eggs from GE chickens also be acceptable? Many of the genetic changes we could make using GE technologies are indistinguishable from genetic differences present in different breeds of chickens: should we move on from regulating GE as a technology to regulating the products by assessing risks?"

http://www.roslin.ed.ac.uk/helen-sang/

Dr Louise Horsfall MRSB is a Lecturer in Biotechnology at the University of Edinburgh. She is interested in multidisciplinary challenges involving biotechnology, synthetic biology, novel enzymes and protein engineering. She is currently the elected co-chair of the Bioengineering and Bioprocessing Section of the European Federation of Biotechnology and a member of the EPSRC's Early Career Forum in Manufacturing Research.

"I believe we have already given biotech the green light. We rely on it to produce key medicines, such as antibiotics and insulin, and we use it to produce staple foods, like bread and cheese. These scientific achievements often get overlooked, as they've become so widely accepted that they are no longer thought of as biotechnology. Recent advances in biotech and the need for cleaner, greener solutions have allowed scientists to think big and bio when it comes to tackling some of the major challenges faced by the world today. Some of the proposals being put forward may sound like science fiction and others have obvious drawbacks but providing we have scientific excellence, creativity and dialogue then I believe biotech should continue to be given the green light."

Twitter - @lehorsfall http://horsfall.bio.ed.ac.uk

Dr Donald Bruce is managing director of the independent consultancy Edinethics Ltd., working on the ethics and public engagement of emerging technologies. He has doctorates in chemistry and in theology. After working for 15 years as a chemist in nuclear energy research, risk regulation and energy policy, he became Director of the Church of Scotland's Society, Religion and Technology Project (SRT) from 1992-2007. In this role he did pioneering ethical assessment of many emerging technologies including GM crops and animals, cloning and stem cells. He has since worked extensively on nanomedicine and related technologies in a series of EC projects, and also on synthetic biology, human enhancement, potential alternatives to using animals in medical research and the emerging techniques of genome editing. He is currently a partner in the NanoAthero EC FP7 project on nanodevices to detect and treat atherosclerosis. He was a former member of the Scottish Science Advisory Committee, the Societal Issues Panel of Engineering and Physical Sciences Research Council, the Public Affairs advisory group of Biotechnology Research Council, the Nanotechnology Engagement Group and the bioethics working group of the Conference of European Churches. He has been a member of the Advisory Board of the Institute of Nanotechnology and the Edinburgh University Research Ethics Committee.

"When genetically modified (GM) crops began commercial use in 1996, this was expected to bring about a revolution in crop and animal production. But, although GM made a worldwide impact in four major crops, its use has stagnated. The rhetoric of claims for unprecedented precision and unlimited scope have not been delivered. Arguably the bigger revolutions it heralded were its widespread public rejection in Europe and the recognition of the need to engage reflexively with publics about novel technologies. The public and retailer rejection had many facets, including that GM foods brought no tangible benefits to consumers, were perceived to carry environmental and health risks, and they were imposed without choice.

In the last five years, genome editing techniques have emerged as powerful tools which may at last be capable of achieving the precision and scope that GM promised, and may make possible modifications in food animals, not hitherto regarded as worthwhile by the major livestock breeders, as well as reinvigorating medical applications with large animals. Genome editing makes alterations within the genome of the organism itself, without adding any foreign genes. Will this remove the ethical concerns over GM crops and animals and would they now find acceptance with the European public? I will revisit some key ethical criteria and insights from our original Engineering Genesis study of 1998, and assesses how gene editing affects these. For example, would avoiding mixing genes overcome concerns over violating evolved or God-given 'barriers', or just be seen as scientists tampering with genes? How much will it depends on whether the applications that will be developed are perceived as having direct human (or animal) benefits, to outweigh perceived risks?"

http://www.edinethics.co.uk/

ABOUT THE ORGANISERS

The Biochemical Society works to promote the molecular biosciences; facilitating the sharing of expertise, supporting the advancement of biochemistry and molecular biology and raising awareness of their importance in addressing societal grand challenges.

The Royal Society of Biology is a single unified voice for biology: advising Government and influencing policy; advancing education and professional development; supporting our members, and engaging and encouraging public interest in the life sciences. The Society represents a diverse membership of individuals, learned societies and other organisations.

Glasgow Café Scientifique is a place where, for the price of a cup of coffee or a glass of wine, anyone can come to explore the latest ideas in science and technology. Meetings have taken place in cafes, bars, restaurants and even theatres, but always outside a traditional academic context. Currently, some seventy or so cafés meet regularly to hear scientists or writers on science talk about their work and discuss it with diverse audiences. Café Scientifique is a forum for debating science issues, not a shop window for science. We are committed to promoting public engagement with science and to making science accountable.

FURTHER LINKS AND INFORMATION

How genetic engineering works
ABPI Schools
www.abpischools.org.uk/page/modules/geneticengineering/how.cfm?coSiteNavigation_allTopic=1

Ethical issues in genetic engineering
Action Bioscience
www.actionbioscience.org/biotechnology/glenn.html

What is synthetic biology?
SynBIC
www.synbicite.com/synthetic-biology/what-synthetic-biology/

Synthetic biology 101
Synthetic Biology Project
www.synbioproject.org/topics/synbio101/

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