

## Summary

### Playing Democs Games to Explore Synthetic Biology

ESRC Genomics Policy and Research Forum  
August 2010



## About the ESRC Genomics Forum

Established in 2004 and based at the University of Edinburgh, the ESRC Genomics Forum pioneers new ways to promote and communicate social research on contemporary life science and ensures that research from the Genomics Network informs policy, scientific practice and public debate.

The Forum is part of the ESRC Genomics Network (EGN), a £25 million investment by the Economic and Social Research Council (ESRC) dedicated to examining the development and use of the science and technologies of genomics. The activities of the EGN encompass the whole field of genomics, covering areas as diverse as DNA profiling and identity politics, plant and animal genetics, personal genomics, embryonic stem cell research and synthetic biology.

The EGN spans five of the UK's leading universities, and involves over a hundred researchers, from professors to PhD students, as well as an international cast of visiting research fellows. It is one of the biggest social science investments in the ESRC's current portfolio, and has grown into the largest concentration for social scientific research on genomics in the world.

## Introduction

The Genomics Forum was awarded funding under the Scottish Government's Science Engagement Grants Scheme 2007-08 to run a public engagement programme on synthetic biology. The Forum contracted Edinethics Ltd. to devise a Democs card 'game' on synthetic biology which would be a resource to explore the issues widely with lay publics in Scotland. This summary reports the results of initial outreach using the Democs Synthetic Biology tool.

## Democs

Democs (DEliberative Meetings Of Citizens) is a novel form of lay participation on complex technical issues, devised by the New Economics Foundation in 2002. Democs games have been created on a wide range of issues from cloning to climate change, and have been used in government consultations such as the 'GM Nation?' debate in 2003. Democs is not a game played to win, but a semi-structured group discussion for 6-8 people over 1½-2 hours, through the medium of cards, which are dealt out and discussed in stages.

The players use the cards to discuss and form their own views, which may be agreed or divergent amongst the group. Their views are expressed in the final phase of the game by producing group statements or opinions, based on 'clusters' of selected cards. Each player also votes individually on a range of possible policy options, and (in this particular game) on the acceptability of eight potential applications of the technology.

Further information about Democs can be found at [www.neweconomics.org](http://www.neweconomics.org)

Cards and instructions for the Synthetic Biology Democs game can be downloaded from [www.genomicsnetwork.ac.uk/forum](http://www.genomicsnetwork.ac.uk/forum)

## Participants

This summary reports results from 15 games played in Scotland and England between November 2009 and March 2010, involving 82 participants. Democs is a qualitative tool and as such does not aim for representative sampling. The majority of participants were in the 18-30 age range, and many were science students with prior knowledge of synthetic biology. Others were students or researchers in related areas such as public health and communication.

Students and/or researchers from the following universities took part in the Democs sessions reported here:

- University of Bristol
- University of Glasgow
- Imperial College London
- Queen Margaret University, Edinburgh
- University of Edinburgh

Results are also included from sessions with:

- Dunscore Church of Scotland, Dumfriesshire.
- Society, Religion and Technology Project, Church of Scotland

All participants took part as individuals rather than on behalf of institutions.

## Results

### a) Policy

Five policy options were created for participants to vote on, with results as follows:

		I agree with this policy	I could live with this policy	I disagree with this policy	I don't know
1	<b>Synthetic biology should be stopped as it intervenes too far in nature, or is 'playing God'.</b>	0%	9%	84%	7%
2	<b>Synthetic biology should not be allowed as it poses too great a risk to health or the environment.</b>	1%	8%	88%	3%
3	<b>Synthetic biology may be used to make products (e.g. fuels, drugs), provided any organisms which are used are kept strictly contained.</b>	64%	32%	0%	4%
4	<b>Synthetic biology may be done, provided researchers are licensed, and that strict regulations apply to any released organisms.</b>	50%	30%	11%	9%
5	<b>Synthetic biology should be encouraged to develop with minimal regulation.</b>	5%	11%	71%	13%

Thus only one person wanted to stop synthetic biology either on principle or because it was too risky (Policy Options 1 or 2). However, most disagreed with leaving its development up to the

market with minimal regulation (Option 5). Almost everyone agreed with strict containment of any modified organisms (Option 3). However, most people also agreed or 'could live with' allowing organisms to be released under strict control, provided researchers were licensed (Option 4).

## b) Applications

In addition, eight possible applications of synthetic biology were voted on for their acceptability to participants:

		Yes	Possibly	Undecided	Doubtful	No
1	<b>Making biofuels from plant wastes</b>	75%	20%	3%	1%	0%
2	<b>Detecting pollutants in the environment</b>	58%	33%	3%	4%	1%
3	<b>Cleaning up pollutants in the environment</b>	51%	38%	10%	1%	0%
4	<b>Making new industrial materials</b>	61%	19%	12%	7%	1%
5	<b>Micro-organisms to make synthetic pharmaceuticals</b>	71%	23%	5%	2%	0%
6	<b>Creating synthetic viruses to research pandemic flu</b>	31%	37%	12%	17%	3%
7	<b>Genetically engineered biological devices to detect infections</b>	52%	40%	5%	3%	0%
8	<b>Enhancing food production by helping plants absorb nitrogen</b>	43%	42%	12%	3%	0%

For all applications the overwhelming majority of participants voted 'Yes' or 'Possibly' to the question 'Would this application be acceptable?'. Biofuels from plant wastes had the most specific support. Out of 537 total votes, only 4 'No' votes were cast and only 26 'Doubtful'. Virus research had the least 'Yes' votes (31%) and the most 'Doubtful' (17%), with nitrogen fixation in food crops also showing more uncertain support (43% 'Yes', 42% 'Possibly').

Notwithstanding the high degree of overall support, the voting patterns also suggest concern over potential risks and what existing economic and industrial interests might do with these innovations. Votes also suggest that potential human or environmental benefits would be strong reasons to proceed with most applications, but risks, questionable effectiveness or industrial practicalities might call the benefits into question.

The need to balance risks and benefits is a dominant thread in the comments across most of the applications. Participants' opinions varied about how well this can be handled, and about the level of risk that is justified. Many thought there needed to be quite strong regulation, or gave their support conditional on satisfactory testing for unintended consequences and side effects. On the other hand, some argued that you need to take some risks to learn anything, and that the benefits of synthetic biology were worth the risks.

## b) Issues

The 'cluster' subjects showed that participants were interested in underlying philosophical issues such as 'playing God', naturalness, and how humans relate to other organisms and to nature. However, it was seldom clear what participants' conclusions were on such issues. Interestingly, most of these philosophical questions came from groups consisting mainly of scientists.

The related issues of risks, ownership and regulation exercised the most groups. Again, many of the issues were presented as dilemmas or questions without drawing a conclusion. 'Amateur synbiologists' and 'garage biology' appeared to be a concern, along with the creation of viruses and (for some) the manipulation of life forms. However, again no definite recommendations were made on these points.

### c) Scottish results

There were small differences in the Policy votes from Scottish groups (32 participants) compared with the averages across the whole data set. However Applications votes were substantially different, with lower 'Yes' votes for all applications except 'Detecting pollutants in the environment'. At this stage not enough Scottish games have been played and results submitted to draw conclusions about specifically Scottish views on synthetic biology, especially given that fewer participants in Scotland than elsewhere were science students.

### d) Participant feedback

Most groups clearly enjoyed the experience of discussing synthetic biology, and doing so in a group context with different views. Participants found the Democs format a good way of achieving this. Many appreciated the chance to learn about a new area of technology and explore some of its implications.

## Conclusions

- Results from the project suggest that synthetic biology is a more difficult subject for the average citizen to engage with than the topics of previous Democs games, such as stem cell research or climate change. The synthetic biology Democs game has served to open up questions that people had not previously thought about, rather than helping to crystallise their thoughts about already known issues.
- It would be premature to draw strong conclusions from this small preliminary study about overall support for or concerns about synthetic biology amongst either UK or Scottish citizens. People are not familiar enough with the issues and will need more time to digest and reflect, highlighting the limitations (at least in the short term) of 'upstream engagement'.
- From this sample of people, there did not emerge a serious fundamental objection to the very idea of synthetic biology. While the sample was weighted towards science students, overall results were cautiously positive toward synthetic biology even amongst non-scientists. There was strong overall support in the voting for most potential applications, particularly from the scientific groups.
- There was little evidence of polarised views in this sample, whether unconditional optimism or pessimism. Risks were raised as often by scientists as by other participants. Virus research, 'garage biology' and the potential use of synthetic biology for terrorist purposes were all identified as problematic, suggesting that these issues need addressing in policy. Issues of monopolies, patenting and private ownership were all noted.
- The primary outcome of this project is the Democs Synthetic Biology game itself, which can now go on being used anywhere and at any time. The development of the stand-alone kits (hard copy and virtual) enables public engagement to continue in a way which time-limited public consultations cannot.
- A further aim of the grassroots model of engagement embodied in Democs is to stimulate a process of wider public deliberation on synthetic biology. Feedback suggests that participants have indeed 'gone away thinking'.
- As has been observed with previous Democs games, there is clearly a role for 'games' like this to help address the well-recognised need to train science and engineering students in ethical and social issues.

## Acknowledgements

This Synthetic Biology Democs game was commissioned by the Economic and Social Research Council (ESRC) Genomics Policy and Research Forum, based at the University of Edinburgh. The game was funded by the Scottish Government, with additional support from the Genomics Forum. The game was developed by independent consultants Edinethics Ltd in collaboration with the New Economics Foundation (nef).

This summary was prepared by Dr Christine Knight, Genomics Forum, based on a full project report by Dr Donald Bruce, Edinethics Ltd, available online at [www.genomicsnetwork.ac.uk/forum](http://www.genomicsnetwork.ac.uk/forum)

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