Technology Strategy Board

Driving Innovation

Funding New Innovations in Synthetic Biology

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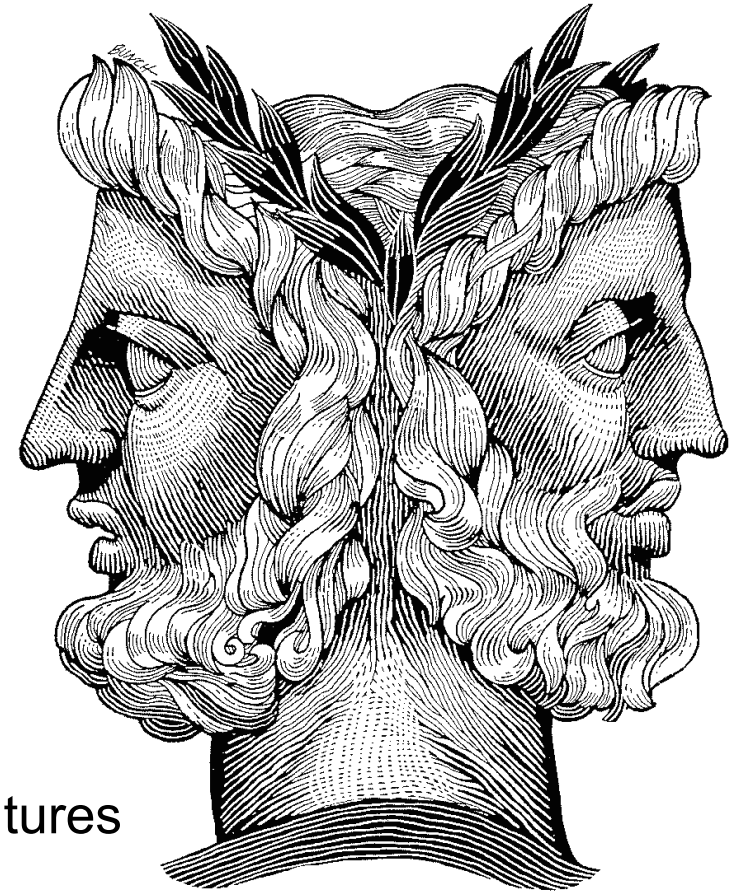
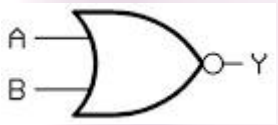
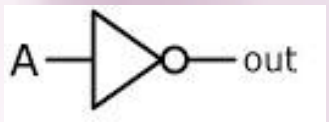
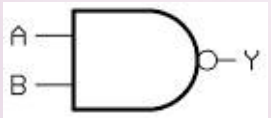


- Transitions and change
- The past and the future
- Represented a “middle ground” between cultures
- God of gates
- Initiator of financial enterprises







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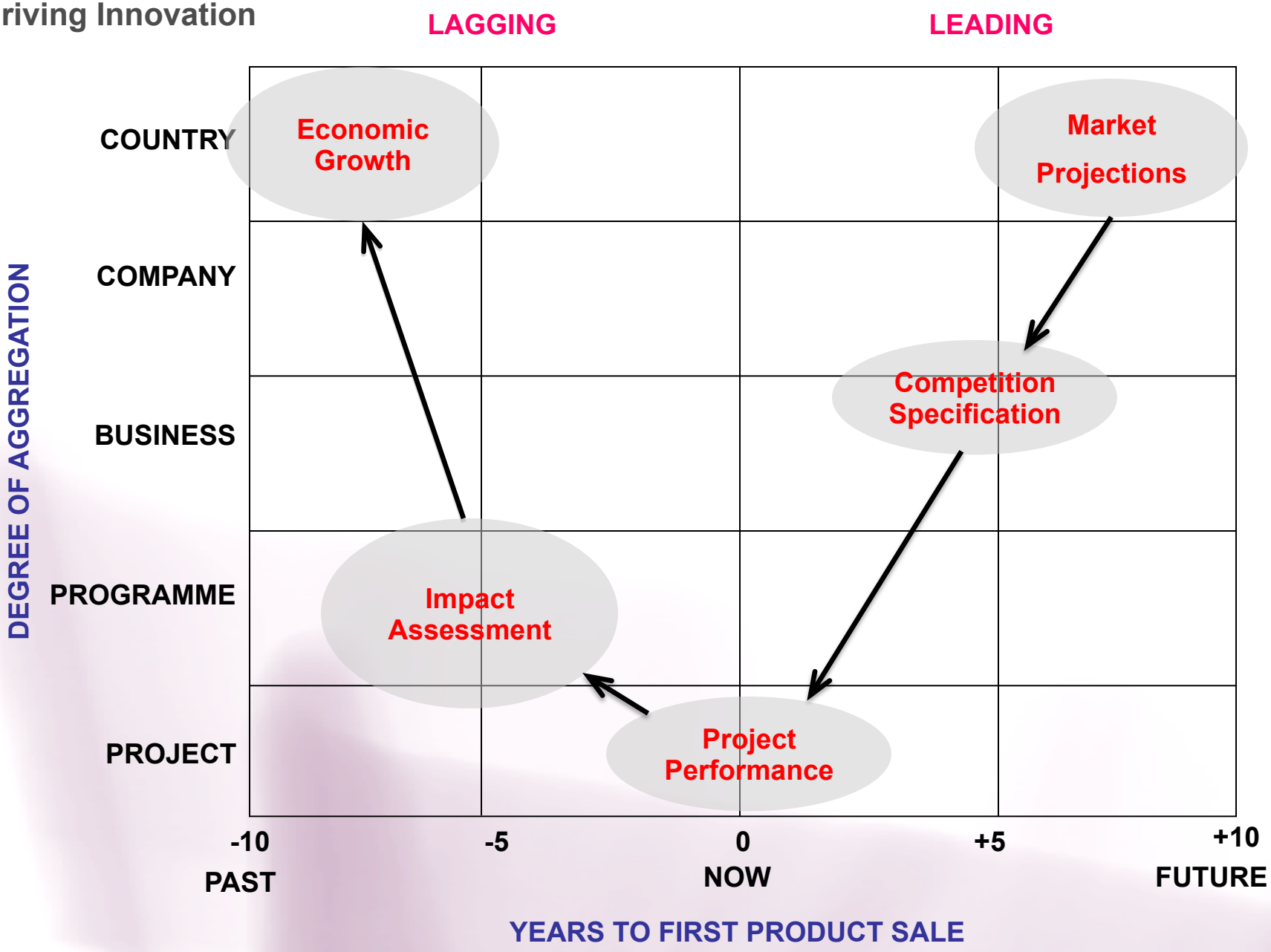

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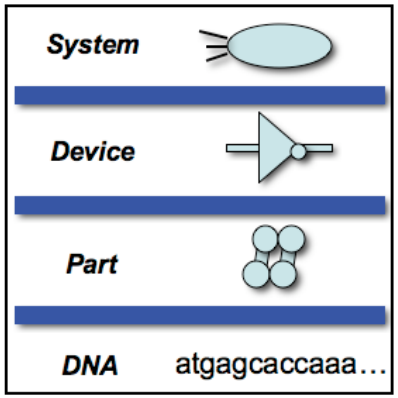
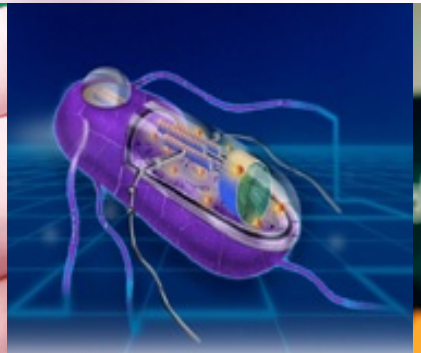
“The design and engineering of biologically based parts, novel devices and systems, and well as the redesign of existing natural biological systems”





Global value of synthetic biology market by end user, 2011-2016 ($million)

End user industry	2010	2011	2016	CAGR% 2011-2016
Diagnostics / pharmaceuticals	902.1	1,314.7	**5373.3**	32.5
Chemicals	125.4	185.0	**2783.9**	72.0
R&D	73.1	82.8	**265.4**	26.2
Agriculture	26.7	36.1	**307.9**	53.5
Energy	19.6	25.8	**2108.1**	141.2
TOTAL	1146.9	1644.4	**10,838.6**	25.8

Source: Synthetic Biology. Global Emerging Markets, BIO0bbB, BCC Research; ISBN: 1-59623-834-8, November 2011

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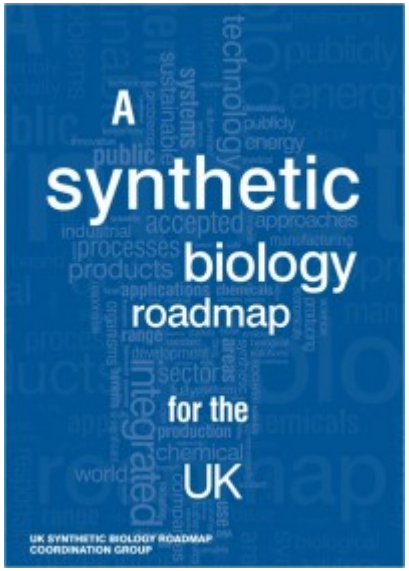
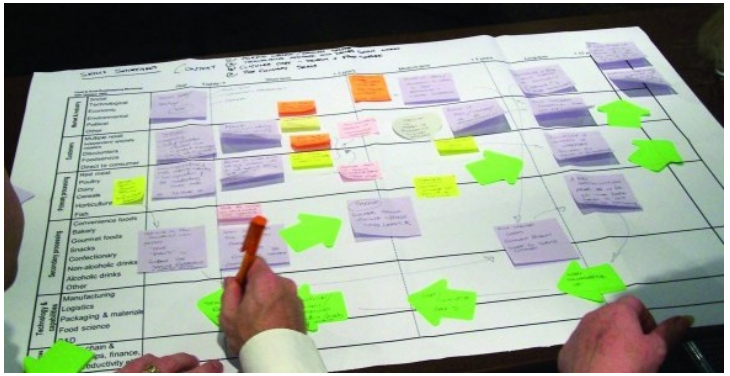
A synthetic biology roadmap for the UK





- Invest in a network of multidisciplinary centres to establish an outstanding UK synthetic biology resource
- Build a skilled, energised and well-funded UK-wide synthetic biology community
- Invest to accelerate technology responsibly to market
- Assume a leading international role
- Establish a leadership council

UK Synthetic Biology Leadership Council

• Provide a visible point for strategic co-ordination between the funding agencies, the research community, industry and other stakeholder including societal and ethical representatives;

• Create the conditions that allow the UK to become a world leading industrial hub in Synthetic Biology;

• Influence the development of policy and regulations to anticipate the developmental requirements of this emerging technology;

• Be open and transparent, with one ‘open’ meeting held each year and all agendas and records of decisions taken to be made public.

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UK Synthetic Biology Leadership Council

Lionel Clarke
Shell

=

David Willetts
Minister for Universities and Science

Janet Bainbridge
UK Trade and Investment

Belinda Clarke
Technology
Strategy Board

Dale Sanders
John Innes
Centre

Richard Kitney
Imperial College
London

Janet Thornton
European
Bioinformatics Institute

Carol Boyer-Spooner,
Chemistry Innovation
Knowledge Transfer
Network

BBSRC
bioscience for the future

Representing
RCUK

Simon Dolan
GlaxoSmithKline

Joyce Tait
ESRC Innogen Centre
University of
Edinburgh

Sharmila Nebhrajani
Association of Medical
Research Charities

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Advancing the Industrial Feasibility Application of Synthetic Biology

- Collaborative, business-led projects, up to £500,000
- Designed to help address the challenges to commercialisation
- Demonstrate the feasibility of using synthetic biology to create novel or improved products or processes
- Rational and targeted design / redesign of biological systems
- Analysis of socio-economic and regulatory enablers and constraints to commercialisation
- Outputs; evidence to inform future developments

BBSRC bioscience for the future

EPSRC Engineering and Physical Sciences Research Council

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

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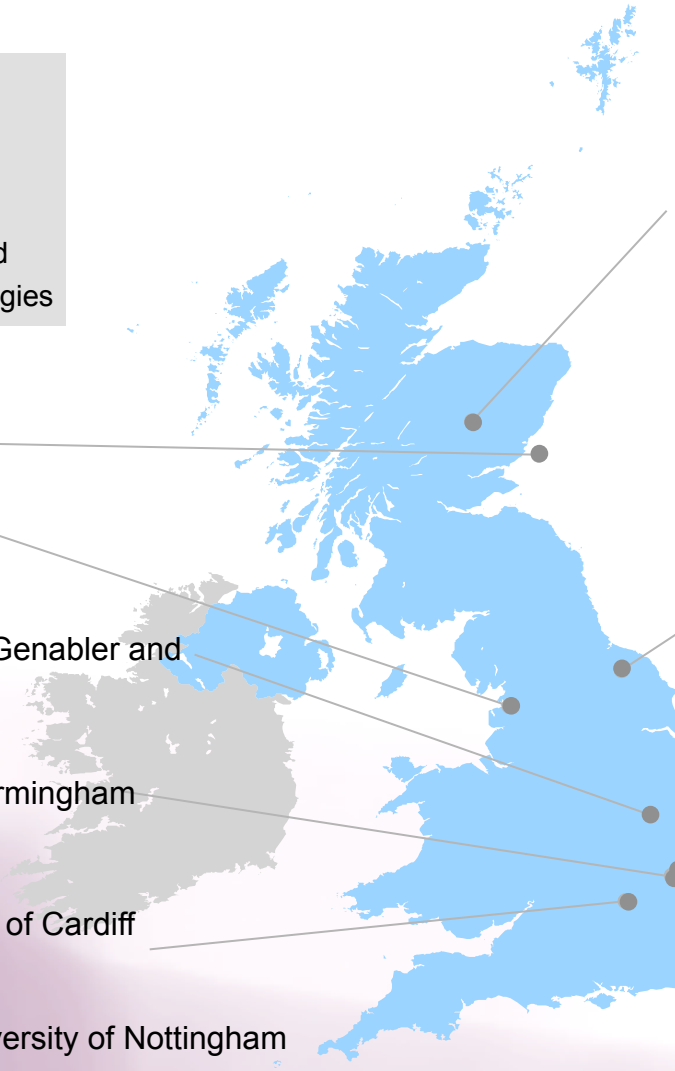
Application Area

- Bioenergy
- Biomedicine/Health
- Food Security
- Industrial Biotechnology-Inspired
- New Synthetic Biology Technologies



Ingenza Ltd., Lucite and University of Cambridge

Ingenza Ltd. and University of Edinburgh

Ingenza Ltd., Universities of Aberdeen and Edinburgh

Synpromics Ltd., Genabler and University of Edinburgh

Demuris Ltd. and JIC

Unilever, Croda and JIC

Unilever R&D Colworth, Genabler and University of Edinburgh

GSK and University of Birmingham

Oxitec Ltd and University of Cardiff

Green Biologics and University of Nottingham

Croda Europe Ltd. and University of Newcastle

Cambimune Ltd. and Cambivac

Celbius and University of Northumbria

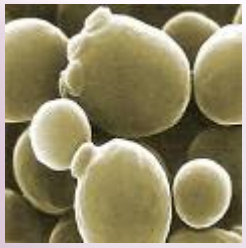
Synthace Ltd. and University of Manchester

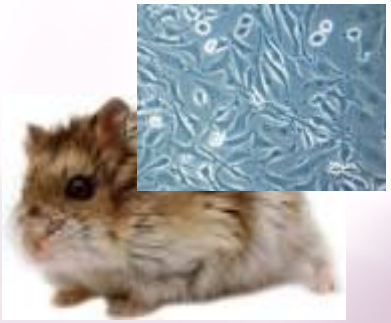
Prokarium and University of Birmingham

Some reflections.....

- A paradigm shift towards synthetic biology....or Molecular Biology 2.0?
- Poor representation of engineering and design / build / test concept
- Some were focussed on reducing empiricism in metabolic engineering projects, not synthetic biology
- A range of application areas; in decreasing order: chemicals, healthcare, energy/fuels
- Good spread of company size, maturity, geographical location
- Of the 45 UK HEIs undertaking synbio research, 24 were involved in project consortia
- Improvements needed in the awareness and approach to Responsible Innovation
- Range of chassis – bacteria, plants, insects, yeast and mammalian cell lines



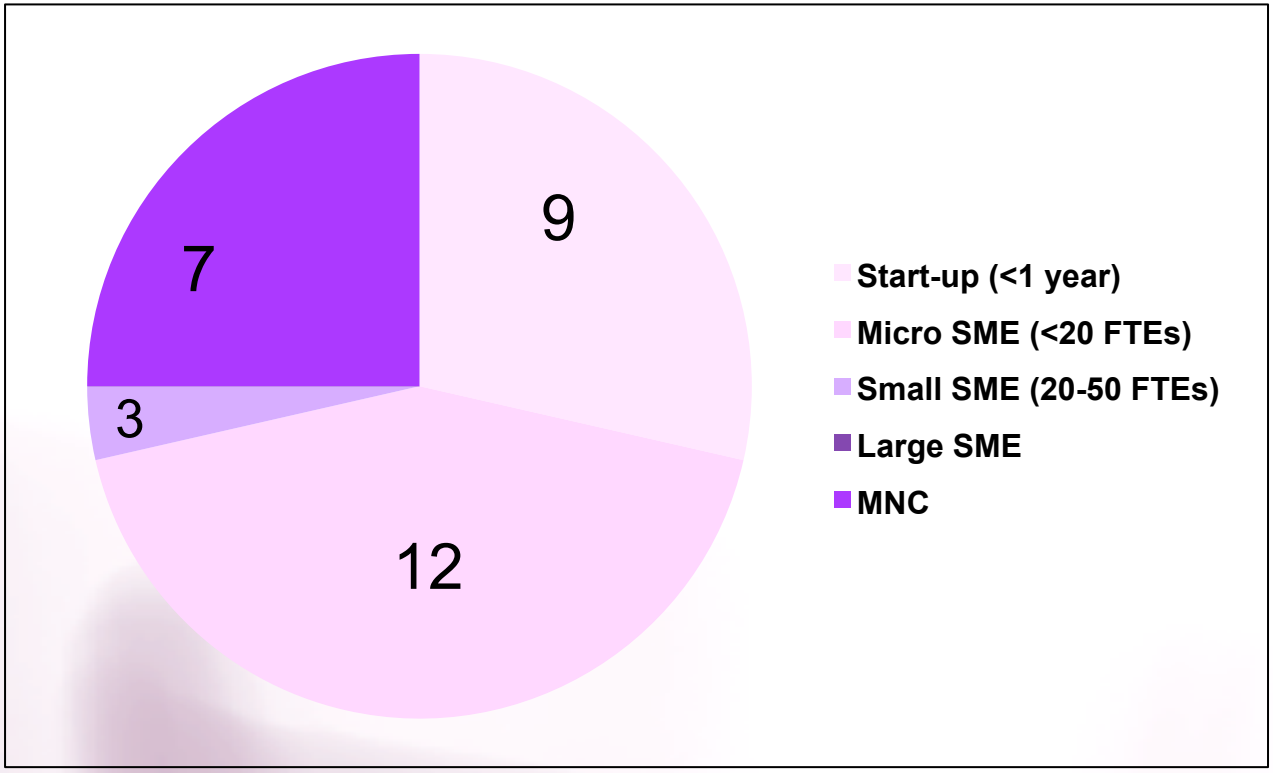


Responsible Innovation Framework

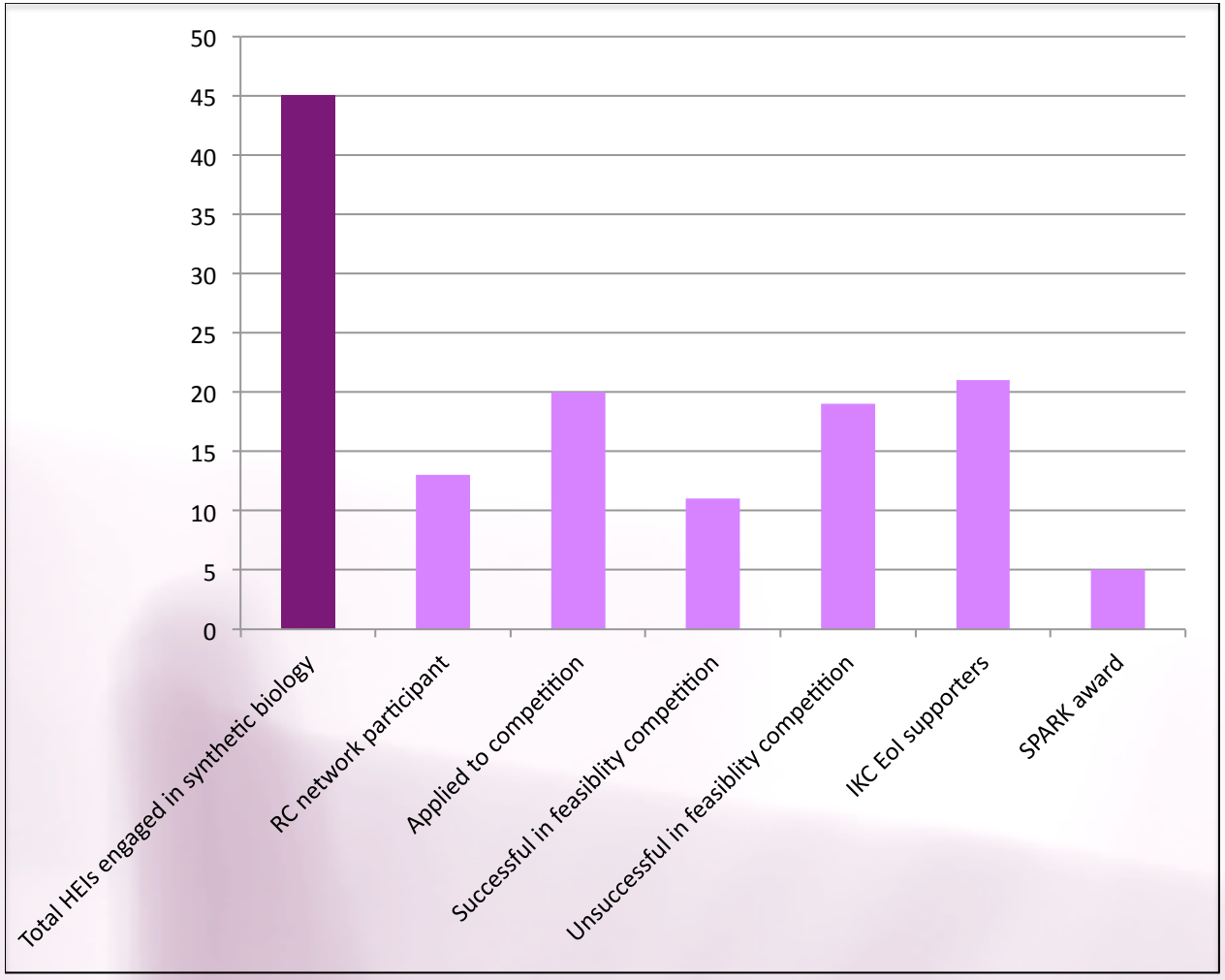
- Synthetic biology national roadmap calls for “responsible acceleration” of technologies to market
- Responsible Innovation Framework developed in-house (with external consultation)
- Additional Appendix added to the competition application form, requiring appraisals of potential social, ethical, legal, regulatory and environmental issues
- Separate RIF assessment panel convened
- Variable capability within the UK synbio community to articulate responsible innovation issues
- Ongoing “RIF mentoring” (not monitoring) throughout project duration
- Cohort building activities planned around RI within the UK
- Deliberation and consultation over the summer for RIF 2.0

The UK's industrial synthetic biology landscape



- 16 companies won industrial feasibility funding (19 involved in unsuccessful proposals)
- A further 10 registered for the competition but didn't submit proposals

The HEI synthetic biology landscape



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Synthetic Biology Special Interest Group

Building the community

Networking

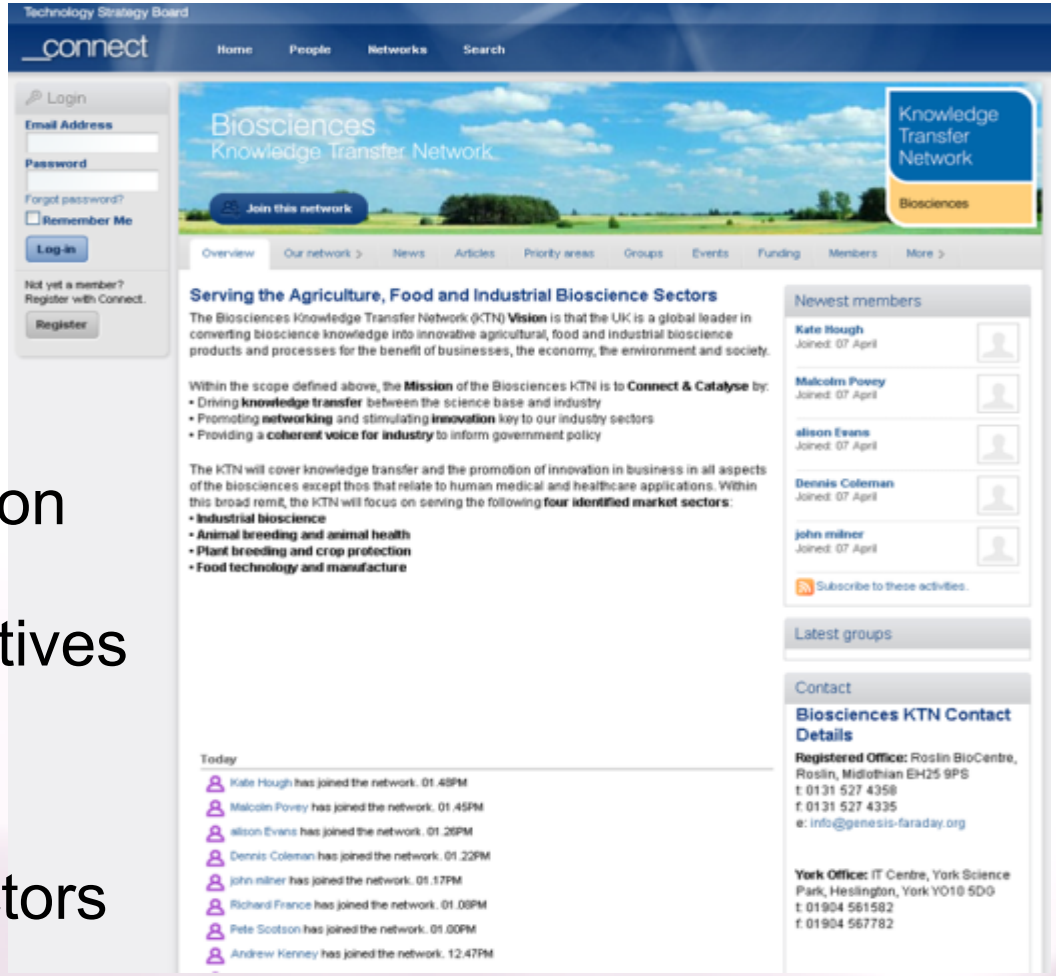
Signposting

Facilitating collaboration

Supporting initiatives

Knowledge exchange

Connecting across sectors and disciplines



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Interest at a high level from HMG

- Funding through the Autumn Statement (£50M), underpinning the "Synthetic Biology For Growth) programme
- Personal interest from the Science Minister – 8 Great Technologies
- Significant RC funding to date (and ongoing)
- UK is hosting DNA 6.0 and SynBioBeta (July 2013)
- Synbio SIG has > 650 members
- Synthetic Biology IKC to be announced
- Call currently open for Multi Disciplinary Centres for synthetic biology

The Yang

Interest at a high level from HMG

- The pressure is on to deliver!

Future Activities

- IKC shortlisted proposals currently being assessed

- A new competition for synthetic biology
  - Scoping now – have your say! Scoping workshop, consortium building.....

- Harnessing the innovative technologies from HEI
  - Knowledge Transfer Partnerships (open call)
  - Industrial Partnership Awards (open call)
  - 12 SPARK awards currently available (midnight June 14th deadline)

- Discussion with BSI about standards for synthetic biology
  (what are the functions of various types of standards at different stages in the emergence of new technologies?)

- Where is the value capture and creation for UK plc?
  - Future growth areas to emphasise investment strategy
  - Where are the bottlenecks?
  - Build competitive advantage
  - Benchmarking for sector growth and impact analysis

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TSB Bioscience Strategy 2012 - 2015

1) Characterisation and discovery tools:

- Commercialisation of sequencing technology focused on genomics
- Phenotyping technology
- Integration of "omics" technology
- Bio-imaging, biosensors, probes/ markers and diagnostic platforms

2) Production and processing:

- Metabolic engineering
- Novel manufacturing processes for bio-product or biological production systems
- Formulation and delivery of bio-products (inc. functional food and pharma)

3) Bio-Informatics:

- Approaches to organise, filter and interpret bio data (inc system modelling and visualisation) with a focus on user driven design

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Thank you for your attention