



# Foundations for a European SynBio

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# Agenda



- Understanding of Synthetic Biology
- The European SynBio community
- A roadmap for SynBio in Europe
- Challenges and possible ways-out
- Conclusions

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## What is Synthetic Biology about?

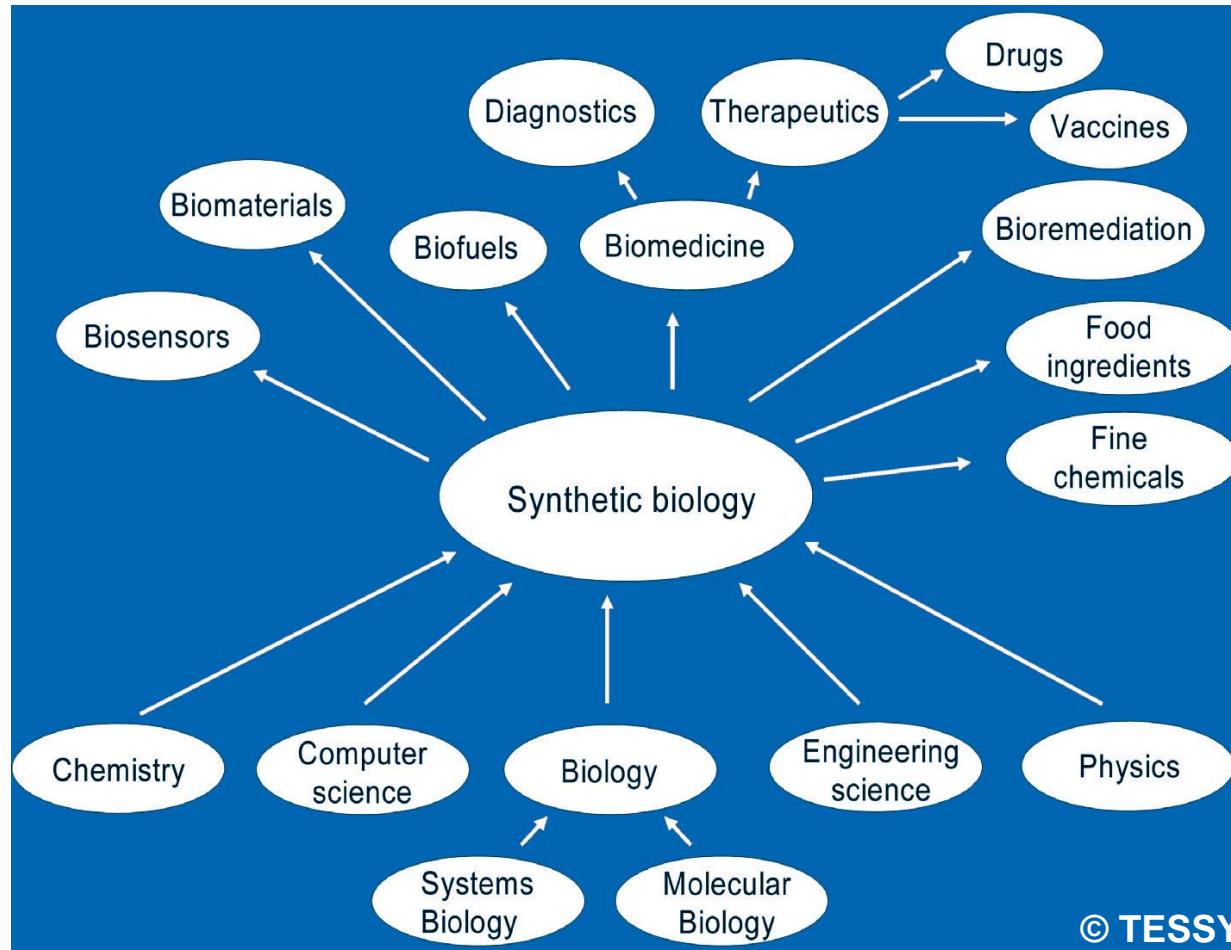


- (1) engineer and study biological systems that do not exist as such in nature, and
- (2) use this approach for
  - achieving better understanding of life processes,
  - generating and assembling functional modular components,
  - developing novel applications or processes.





# SynBio interdisciplinarity



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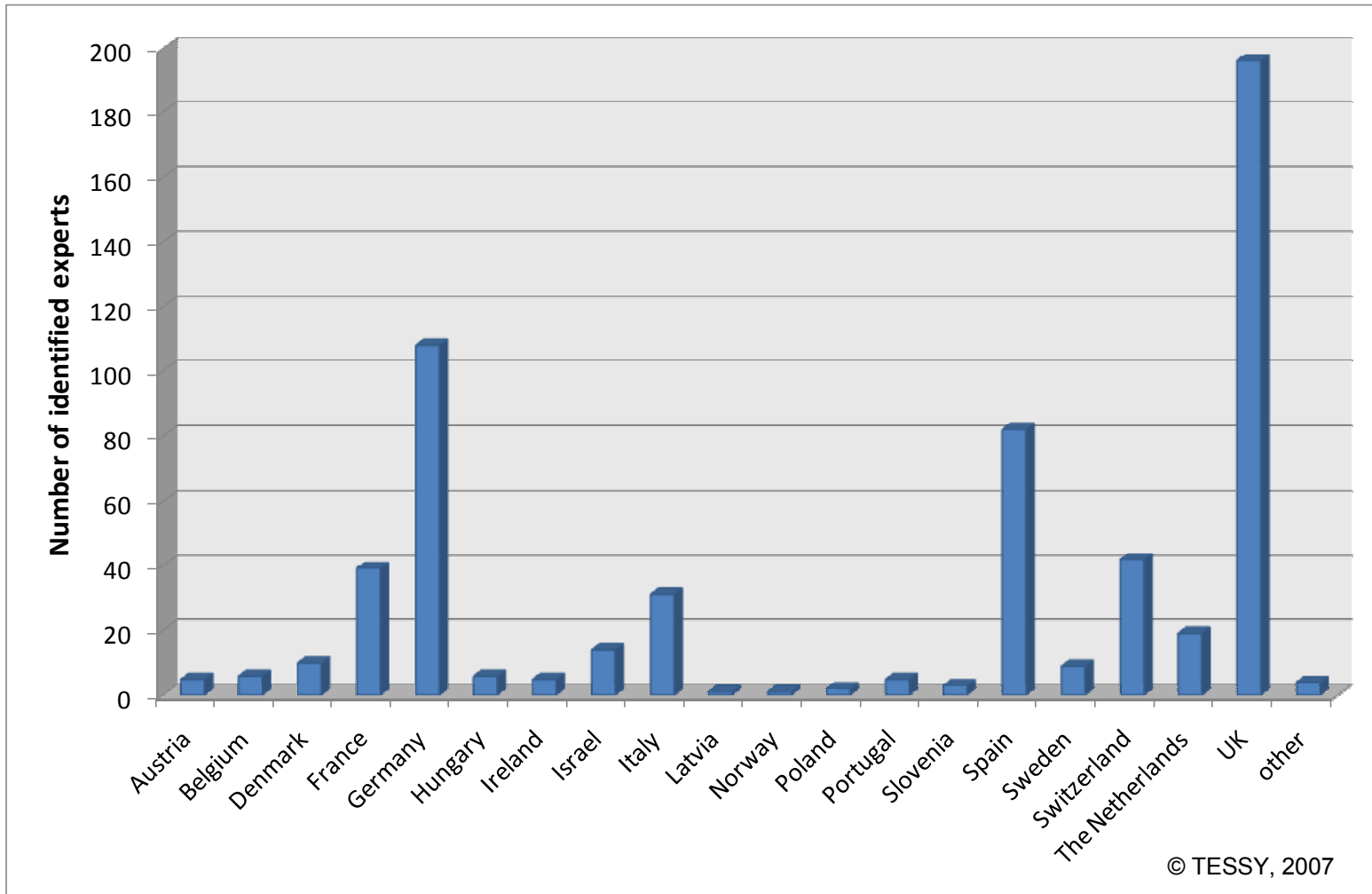
# The European SynBio community

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# European SynBio community: Distribution



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## European SynBio community: Composition



- 90 % Research institutions
  - 69 % Universities
  - 31 % Other public research institutions
- 7 % Industry
  - Mainly SME
  - Few large enterprises

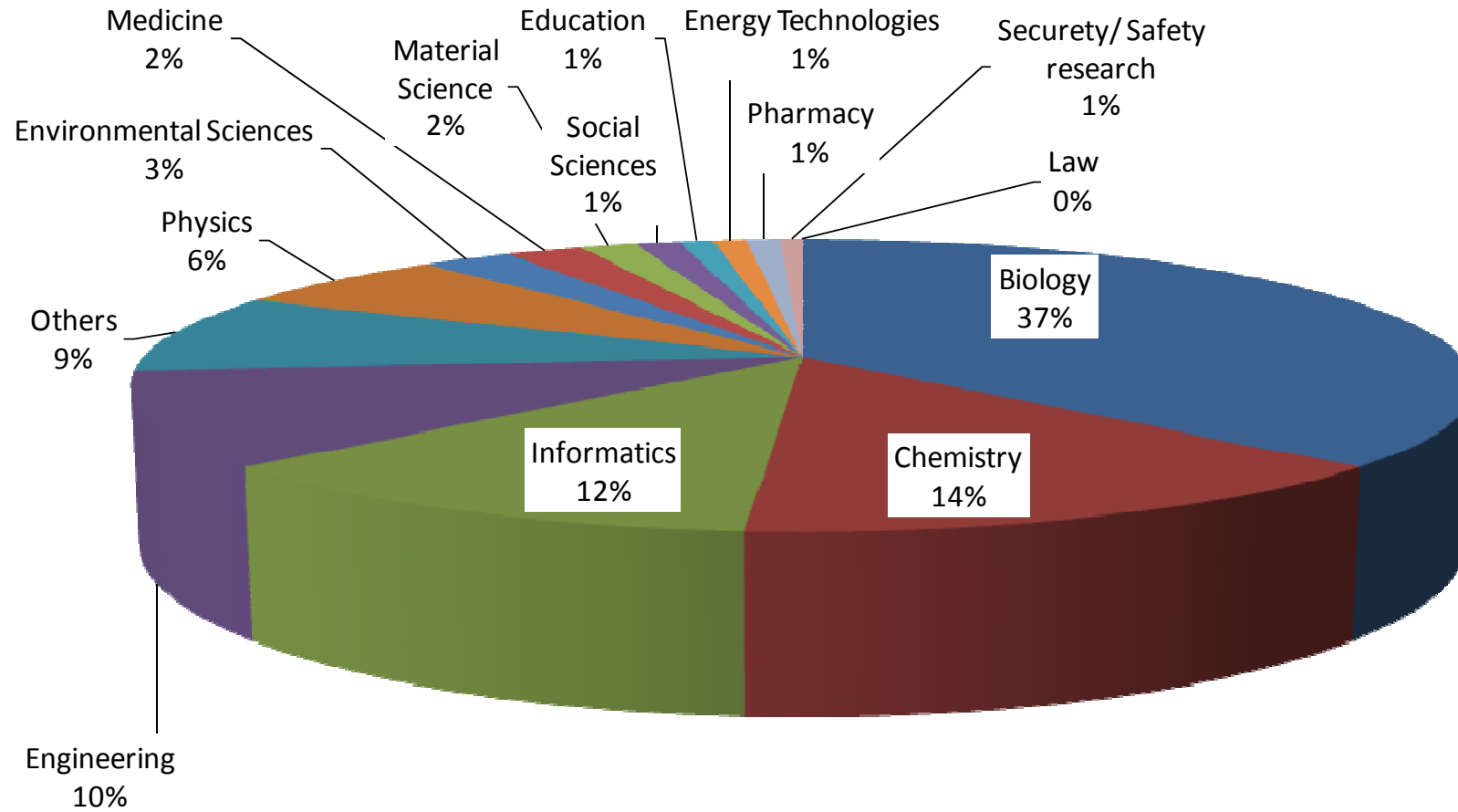
Source: Tessy Project 2007







# European SynBio community: Disciplines



Source: Tessy Project 2007







# A roadmap for SynBio in Europe

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## Elaboration of the SynBio roadmap



- Concept for SynBio roadmapping
  - Draft roadmap
  - Evaluation of draft roadmap
  - Final roadmap
- Roadmapping workshop at SB3.0, 2007
  - October 2007
  - Survey of 588 SynBio researchers in Europe
  - Presentation at stakeholder workshop, June 2008 Brussels

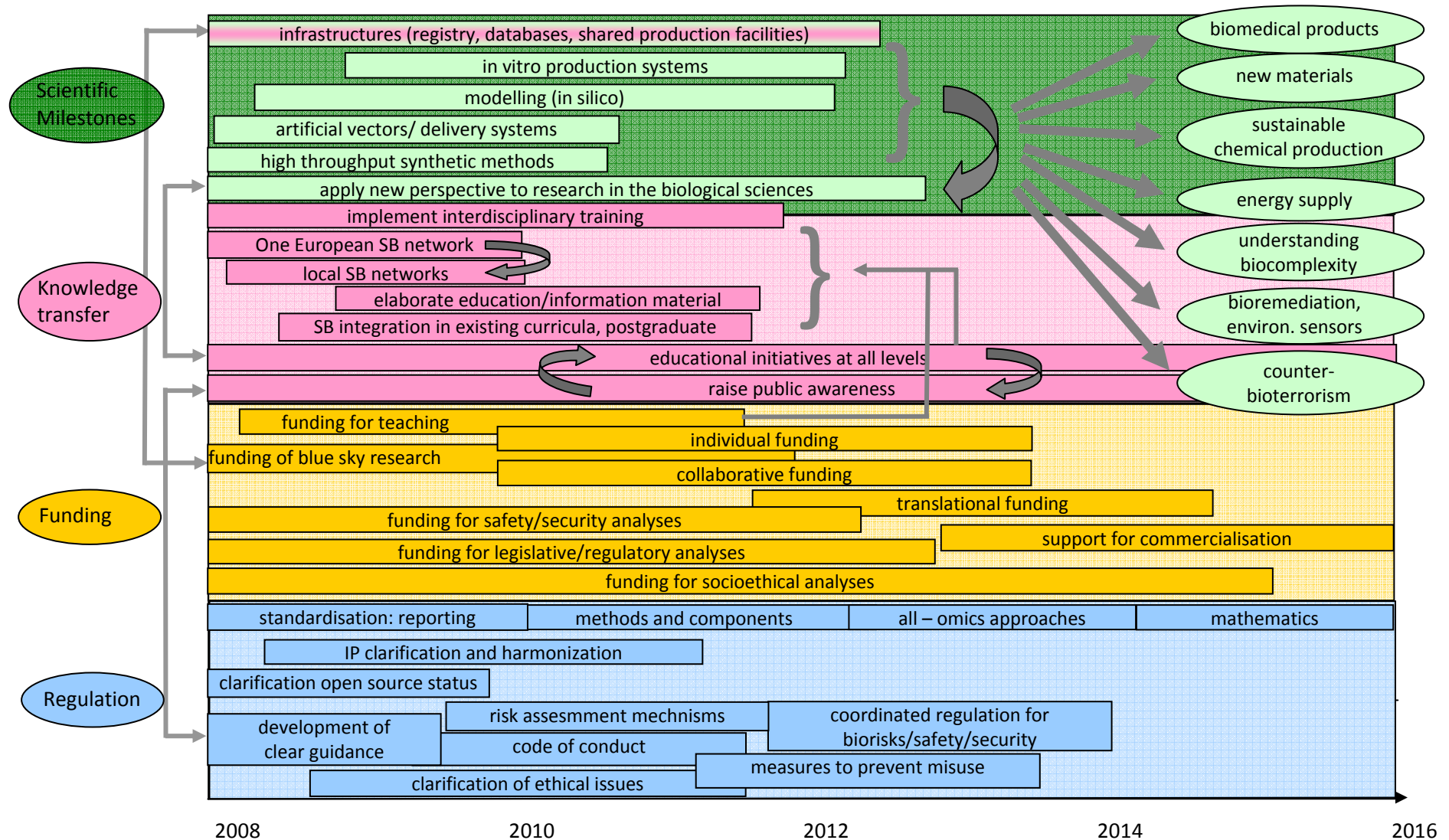
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# The SynBio roadmap

<http://www.tessy-europe.eu/documents.html>





## The SynBio roadmap – main features (1)



- Four interconnected fields:
  - Regulation
  - Funding
  - Knowledge transfer
  - Scientific milestones with clear chronology, however moving targets
- Progress in one fields depends on advances/changes in other fields
- Knowledge transfer as key element for generating public understanding and support
  - National networks facilitating communication of SnyBiologists
  - Linked to EU-networks for international exchange
  - Integrated with interdisciplinary educational measures at all levels

(Gaisser, S. Reiss, T. Lunkes. A., Müller, K, Bernauer H. (2009) EMBO rep. 10, Special Issue, S9 – S8)

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## The SynBio roadmap – main features (2)



“Without public support and understanding of research into synthetic biology, both funding and regulation are unlikely to support significant science advances”

(Gaisser, S. Reiss, T. Lunkes. A., Müller, K, Bernauer H. (2009) EMBO rep. 10, Special Issue, S9 – S8)





## Challenges and possible ways-out

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# Standardization and Intellectual Property



SB is based on a research culture of openness and sharing of results in registries

-> unclarity of patent issues

-> standardisation – guidance to be developed

activity	relevance factor	timing
clarification of open source status	3.13	short term
IP clarification and harmonization	3.03	short term
standardize components	3.0	short to mid term

Source: TESSY roadmap 2008

relevance factor: 0 (min.) - 4 (max.)







# Standards for Synthetic Biology



## Type of standards

- Standardized DNA formats
- Data exchange standards
- Standardized comprehensive datasheets of parts or devices
- Measurement standards
- Chassis standards
- Reporting standards

## Timeline

- Standards for reporting (2010)
- Standards for methods and components (2012)
- General standard for all „omics“ approaches (2014)
- Standards for underlying Mathematics (2014)

(based on: <http://bbf.openwetware.org/Standards/Technical.html>)





## IP rules for SynBio

- Balance interest of academia and industry: open source or protection?
- Clarification: what, how, when?
- International harmonization will take time
- Clarification at individual level requires IP awareness among academia
  - High risk of patent infringement due to open source characteristics
  - Identification of possible patent holders
  - Negotiate non-assertion for research purpose
- Develop license conditions for new parts





## Education and public perception



- SynBio urgently requires interdisciplinary skills
- Communication and information for raising public awareness

activity	relevance factor	timing
implement interdisciplinary training	3.37	short to mid term
establish SB networks	3.14	short term
SB integration in existing curricula	3.05	short to mid term
elaborate education/ information material	2.76	short to mid term
educational activities at all levels	2.66	short to long term
raise public awareness	2.62	short to long term

Source: TESSY roadmap 2008





## Relevance and Timing of Funding



activity	relevance factor	timing
blue sky funding	3.7	short term
collaborative funding	3.38	short to mid term
individual funding	3.35	short to mid term
translational funding	3.08	mid to long term
funding for teaching	3.0	short to mid term
support for commercialisation	2.63	long term
funding for context analyses (socioethical, legislative/regulatory, safety/security)	2.6	short to long term

Source: TESSY roadmap 2008

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## Requirements for funding activities



- Match calls with scientific needs and respond to current stage of development
- Match scientific and commercial interests
- Avoid “over-determination” of calls
- Include “context activities” (ELSI) from the beginning
- Consider national expertise in dedicated national calls
- Represent international perspective of SB and focus on European strengths (environment, industrial processing)
- Provide interdisciplinary structures and competences within funding agencies





# Conclusions

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## Success factors for SynBio in EU (1)



- Develop shared understanding of scope and limitations of SynBio (not a new term for “genomics”)
- Clarification of IP and standardization
- Integrated consideration of needs of sciences and industry *and* expectations of society → support awareness raising and communication of potentials and limitations







## Success factors for SynBio in EU (2)



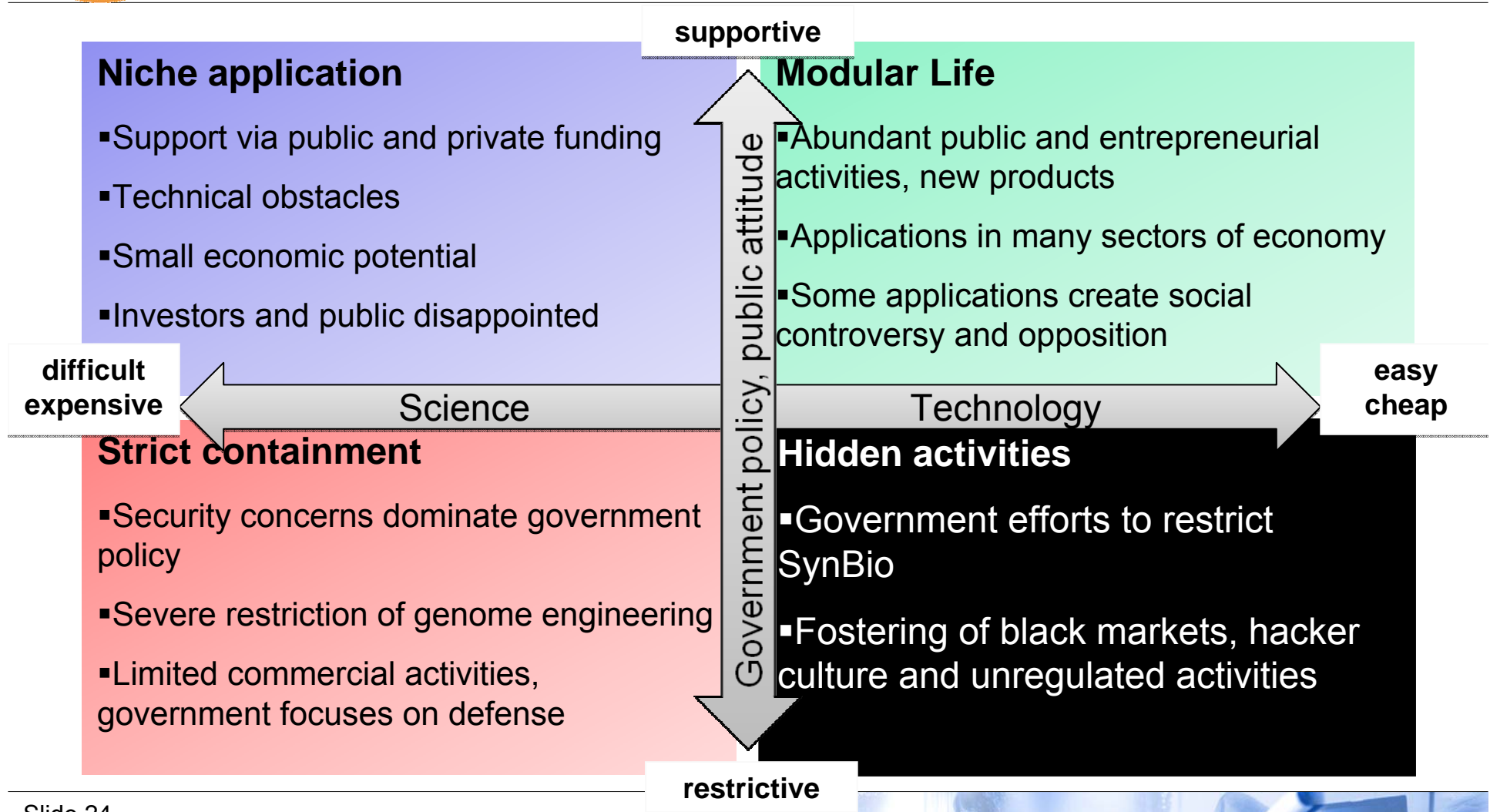
- Interdisciplinary education at all levels
- Mobilization and interdisciplinary integration of existing European strengths in all required disciplines – a European way
- Integrated strategy both on the European and a national level, e.g. ERA-Net SynBio
- Creative funding schemes:
  - blue sky
  - interdisciplinary, evolutionary, cooperative
- Proof of principle as immediate milestone

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# Possible futures of SynBio in Europe



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Source: Bio-era Report: Genomic Synthetis and Design Futures, 2007





# Additional information



**Towards a European Strategy for Synthetic Biology**

Specific Support Action within the [EU-NEST-Activities](#), [PATHFINDER initiative](#) "Synthetic Biology" 2005/2006

Funded by the European Union under Contract Nr. 043449

**Overview**

Synthetic biology (SB) is an emerging field promising high potential for research and development (R&D), and future applications beneficial for economy and society. The EU has started first measures to develop the field. However, research activities are scattered across European regions and across scientific disciplines and are concentrated in a relatively small number of working groups.

The Specific Support Action TESSY aims to fill this gap by setting up an event-based, investigative and participative process for the further development of SB in Europe. The core elements of TESSY will be a series of workshops which will be informed by fact-finding explorations (e.g. surveys, expert interviews).

The process will develop and implement

1. a common understanding and awareness of SB, its potentials and achievements, taking into account the results of previous analyses;
2. a European strategy for the development of SB with clear goals, milestones and suitable measures to accomplish it (roadmap);
3. stimulation activities for the mobilisation of public and private resources.

The work is undertaken in five workpackages (WPs).  
WP1 builds the interface to existing initiatives to make best use of the already existing knowledge base.  
WP2 is the roadmapping process. It includes two workshops, a fact-finding task and a phase of including feedback on the draft roadmap from the broad SB community, including researchers

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