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Annex C – SSAC Engineering Biology Report – Roundtable presentations

SSAC Engineering Biology Roundtable

4 March 2025

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SSAC Engineering Biology Roundtable Introduction to SSAC

Professor Julian Jones
SSAC Chair

SSAC – Who are we?

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- SSAC was created in 2002

- **Council** – currently chaired by Julian Jones; along with 10 members plus 2 associate members and 5 *ex officio* CSA; Chief Scientist (Health); CSA ENRA; Chief Social Policy Adviser and CSA (Marine).

- **Supported by Secretariat** – in the Science Advice and Engagement team within SG Industrial Transformation and Office of the Chief Scientific Adviser Division – **contact: scottishscience@gov.scot**

Distinctive features of SSAC

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- a remit that cuts across all sectors and policy areas;
- we provide independent science advice at “arm’s length” to SG;
- we have no disciplinary or sectoral “agenda”;
- we operate as a “collective” (i.e. Members have a responsibility to provide checks and balances within the Council);
- our combined knowledge of Scottish science skills and context enables us to ensure that advice commissioned from outside Scotland is appropriate to the Scottish context

Principles of engagement:

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- Our focus is on *science* advice, where science includes social and economic disciplines;
- We need to be thinking of future needs and highlighting the potential value of science;
- We can be both reactive (responding to requests from within SG) and proactive (identifying topics we think are opportunities or risks for Scotland);
- In developing Terms of Reference for specific pieces of work we take into account the broader landscape of advice available (e.g. Centres of Expertise, other advisory committees and organisations, the RSE etc)

Recent reports:

All reports can be found here:
https://scottishscience.org.uk/publications

SSAC Engineering Biology Roundtable Overview of project

Professor Louise Horsfall
SSAC Project Lead

Definition of Engineering Biology

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The **UK Government** defines Engineering Biology as:

"the design, scaling and commercialisation of biology-derived products and services that can transform sectors or produce existing products more sustainably. It draws on the tools of synthetic biology to create the next wave of innovation in the bioeconomy"

Synthetic Biology is the design, engineering and re-engineering of biologically based parts, devices and systems.

Goals of the project

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- Review **current Scottish expertise and collaborations** in Engineering Biology.
- Highlight the **future opportunities** in Engineering Biology that are best aligned to the existing and potential strengths of Scottish industries.
- Set out the **actions** that the collective ecosystem should look to progress in order to position Scotland to maximise the emerging economic opportunities, including setting out where the respective ownership of relevant actions best sit.

Project overview

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Landscaping
- Academic
- Industrial
- International

Stakeholder identification and survey distribution

Survey response analysis

Roundtable discussion

- Post roundtable feedback/review opportunity
- Follow-up 1-1 interviews
- Report drafting and publication
- Presentation to Scottish Government
- Distribution to stakeholders + publish on SSAC website

Deans of Research at Scottish Universities

UKRI Engineering Biology funding

IBioIC
Scottish Enterprise
PitchBook

Existing reports and roadmaps
UK National Vision for Engineering Biology

National strategies context

UK

- **UK Innovation Strategy: leading the future by creating it** (2021)
  - Engineering Biology was one of seven critical technology families
- **The Science and Technology Framework** (2023)
  - Engineering Biology is named as one of five critical technologies to the UK
  - **National Vision for Engineering Biology** - £2 bn over next 10 years

Scotland

- **National Innovation Strategy 2023 to 2033** (2023)
  - Innovation themes: *Energy Transition, Health & Life Sciences, Data & Digital Technologies, Advanced Manufacturing*
  - European-style national innovation cluster building approach
- **Life Sciences Strategy for Scotland** (in preparation, 2025)
- **National Plan for Industrial Biotechnology** (June 2022 update)


HOUSE OF LORDS

Science and Technology Committee

1st Report of Session 2024–25

Don't fail to scale: seizing the opportunity of engineering biology

Ordered to be printed 10 December 2024 and published 14 January 2025

Published by the Authority of the House of Lords

UK House of Lords Science and Technology Committee Inquiry (Jan 2025)

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SSAC Engineering Biology Roundtable Summary of information collated

Fiona Bunn
Working Group member

Academic landscape- current funding

The Scottish HEIs perform well in research grant income from UKRI, charitable and other sources.

Through the UK Government's Technology Mission Fund, £70 million was invested into six mission-led engineering biology hubs for five years:

- Lead on **Engineered Genetic Control Systems for Advanced Therapeutics** Hub (Edinburgh)
- Partners in Cranfield-led hub **Environmental Biotechnology Innovation Centre** (Edinburgh, Heriot-Watt, Glasgow)
- Partner in Nottingham-led **GlycoCell Engineering Biology** Hub (Dundee)
- Partner in Portsmouth-led **Preventing Plastic Pollution with Engineering Biology** Hub (Edinburgh)

A further £30 million was invested into twenty-two mission-led awards, for two years:

- Scottish academics are partners and leads in 5 mission awards

Training and skills- Higher education

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Multi-disciplinary field with complex skills landscape

Taught postgraduate courses:

- MSc in Synthetic Biology & Biotechnology (University of Edinburgh)
- MSc in Systems and Synthetic Biology (University of Edinburgh)
- Nine MSc courses in Biotechnology/Industrial Biotechnology across six universities & IBioIC **(scholarships through the SFC 'Highly Skilled Workforce PGT programme' until 2019/20)**
- Broad range of opportunities in physical sciences, informatics, AI/data science and engineering

Doctoral training:

Scotland did not host any of the five UKRI Engineering Biology/Synthetic Biology Centres for Doctoral training (CDTs) that were funded between 2014-2024

UKRI launched the call for a new £17 million Doctoral Focal award in "**Engineering Biology**" in January 2025

Existing relevant doctoral training opportunities:

BBSRC Doctoral training programmes (DTPs)/landscape awards:

- **EASTBIO DTP/DLA:** led by University of Edinburgh, with 10 Scottish partner universities and institutions (2012-2032)
- **NorthWestBio DTP:** including University of Glasgow, University of Strathclyde, Moredun Research institute, James Hutton Institute and IBioIC (2023-2028)

Collaborative training partnership (CTP):

- **IBioIC** funds industrially relevant PhD projects in collaboration with other DTP/DLA partners

EPSRC Centres for doctoral training (CDT's):

- **Engineered Tissues for Discovery, Industry and Medicine,** University of Glasgow (2019-2027)
- **Green Industrial Futures,** Heriot-Watt University (2024-2032)
- **Cyber-physical systems for Medicines development and Manufacturing,** University of Strathclyde (2024-2032)

Training and skills- Further education

- **Foundation apprenticeships** in '*Scientific Technologies*' offered at school (SCQF level 6)
- **Modern Apprenticeships** scheme (SCQF Level 5-7)
  - *e.g. Engineering (Manufacturing); Process Manufacturing; Industrial Applications; Life Science and Related Science Industries (technical); Science Industries Quality Technician; Scientific, Technical and Formulation Processing*
- IBioIC **Higher National Diploma (HND)** in Industrial Biotechnology (SCQF level 8)
  - *Intending to prepare students for employment in careers such as Science Laboratory Technician; Research Scientist; Process Operator and Production Scientist.*
- Biosciences relevant **NQ/HNC courses** and **SWAP courses** (higher education for adult learners) offered by New College Lanarkshire (SCQF levels 4-7).
- **In-work and CPD opportunities** e.g.
  - *The Manufacturing Skills Academy, in the National Manufacturing Institute Scotland facility*
  - *IBioIC training courses for academia and industry in fermentation, bioprocessing, process costing and bioinformatics*

Facilities and Infrastructure

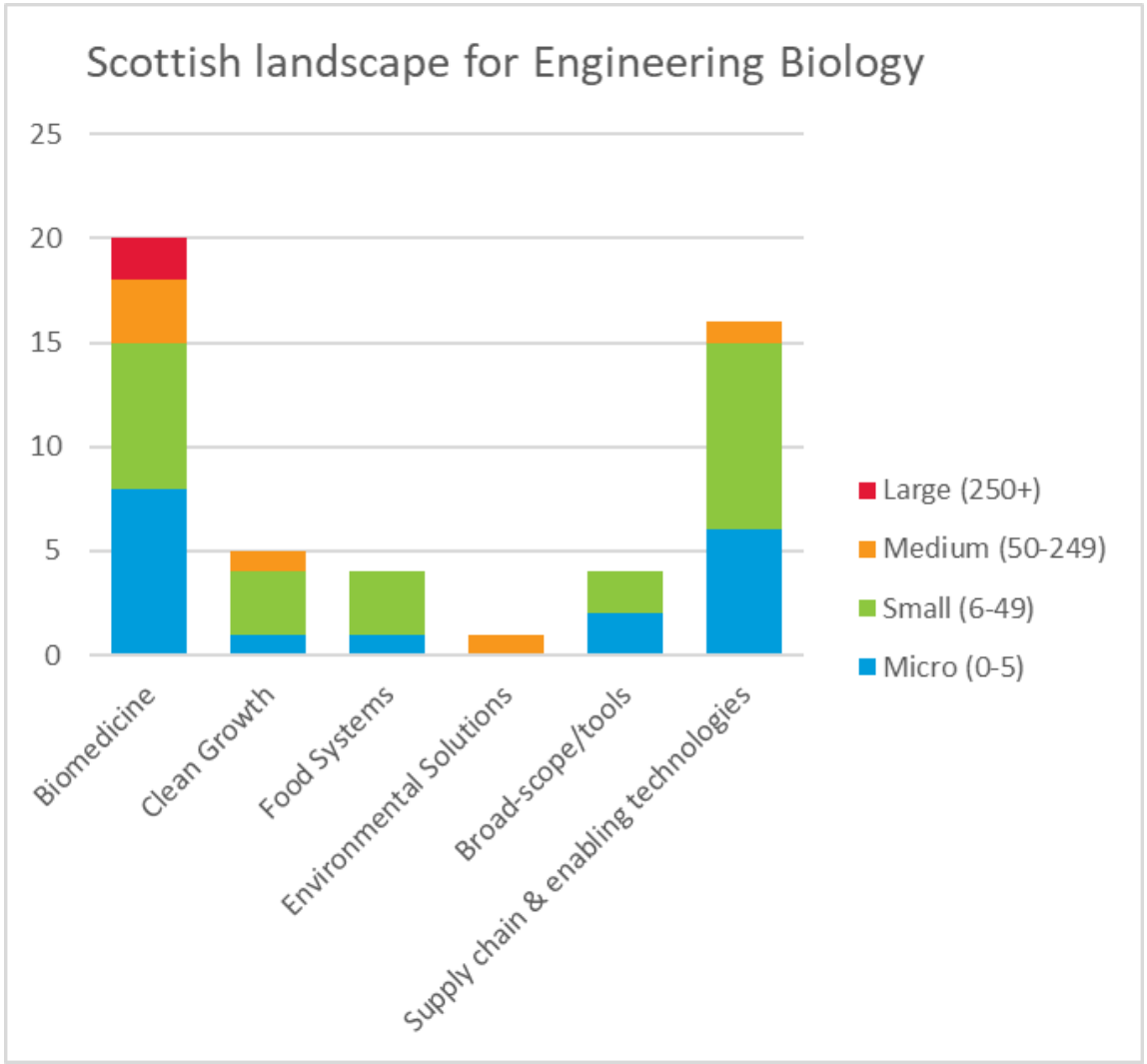
- **Edinburgh Genome Foundry** (Edinburgh)
- **IBioIC FlexBio Bioprocess scale up facilities** (Heriot-Watt)
- **Several multi-omics facilities**
  - e.g. EdinOmics, Glasgow Polyomics, FingerPrints Proteomics Dundee
- **Culture collections:**
  - NCIMB (Aberdeen)
  - Culture Collection of Algae and Protozoa (Scottish Association for Marine Science)
- **European Centre for Marine Biotechnology Incubator** (Scottish Association for Marine Science)
- **Scottish Biologics Facility** (Aberdeen)
- **Advanced Plant Growth Centre** (Dundee)
- **National Phenotypic Screening centre** (Dundee)
- **MRC Protein Phosphorylation and Ubiquitylation Unit (MRC PPU)** (Dundee)
- **Drug Discovery Unit** (Dundee)
- **Roslin Institute animal research facilities** (Roslin)
- **Medicines Manufacturing Innovation Centre** (CPI, Renfrewshire)
- **National Robotarium** (Heriot-Watt)
- **The National Manufacturing Institute Scotland (NMIS)** (Strathclyde)

IBioIC Flex Bio facility

Edinburgh Genome Foundry

Industrial landscape

- Dominated by Small and Micro companies, with greatest depth in Biomedicine sector.
- Public sector remains the most frequent investor in business innovation:
  - Through enterprise and skills agencies, the Scottish Funding Council, Skills Development Scotland and the Scottish National Investment Bank (the Bank)
- 5 Scottish-based companies are leading UKRI Engineering Biology collaborative R&D projects.
- Broad supporting landscape of companies applying some form of industrial biotechnology (~200).



Emerging themes

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Translation: Scotland's performance in accessing competitive research project-funding, and producing academic output is strong, but we underperform in translation to commercial impact relative to the rest of the UK (not just in Engineering Biology)

Retention: There is currently strong pressure for successful Scottish companies and researchers in Engineering Biology to relocate to the "Golden Triangle" (Oxford-Cambridge-London), or internationally (e.g. to the US, EU etc.)

Implementation: Lots of enthusiasm for Scotland's abundant natural resources and potential for a sustainable bio-based and circular economy, but debate over appropriate applications
e.g. *competing uses for feedstocks, factoring in carbon/economic cost of transport to centralised processing facilities, suitable economic models and products for small distributed biorefineries*

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Break-out session 1

Strengths, opportunities and challenges

What are the key existing and potential strengths in Scotland's research and industry that could contribute to broader national and international goals, both within and out with the field of Engineering Biology?

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Industrial Biotechnology

Fundamental research

Advanced therapies and medicines manufacturing

AI/data-driven Engineering Biology

Renewable energy availability

Where are the greatest opportunities in Engineering Biology in the next 10-20 years for Scotland?

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Sustainable Biomanufacturing

Food systems and supply chains

Advanced therapies and medicines manufacturing

AI/data-driven Engineering Biology

Circular economy and Net Zero goals

What are the risks and barriers to stability and growth in the Scottish Engineering Biology sector?

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- Skills shortages
- Investment
  - Stability, culture of risk aversion, small scale compared to global competitors
- Regulation
  - Legislative discrepancies with key partners (England, Europe)
  - Lack of confidence over regulatory future
  - Immigration laws restricting access to international talent
- Facilities
  - Laboratory space for post-university companies
  - Scale-up facilities: Availability and access (especially to EU scale-up facilities post-Brexit)
  - Access to facilities is costly for small enterprises
- “Offshoring” of companies
- Public perceptions and market acceptance
- Resource availability and scale
  - Seasonal biomass, often remote, cannot reach significant scale without direct competition with food crops

Break-out session 2

Actions and policies

What skills will be needed in the Scottish workforce to support the expanding Engineering Biology sector in the next two decades?

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Consider the full educational landscape, including but not limited to school, apprenticeship pathways, further and higher education, upskilling and reskilling for in-work and career changers

- Highly-skilled researchers (PhD level+)
- Technical production staff
- Engineering (*general, chemical, (bio)process*)
- Digital/data skills *(Data science, AI, software developers)*
- Legal expertise (*regulatory frameworks, patent law)*
- Quality Control and biosafety
- Clinical Trial skills
- Business development
- Social and economic sciences
- Carbon accounting + LCA
- Automation skills
- General numeracy

What actions are required, and by whom, to ensure Scotland maximizes the benefits of Engineering Biology for the Scottish economy?

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- Innovation support
- Funding and investment, public and private
- Public-private partnerships
- Infrastructure
- Regulation and policy
- Standards/responsible research and innovation
- Collaborations, partnerships and networks
- Industry-academia
- Social dimensions
- Skills

Who is relevant in the scope of the project?

- Scottish Government
- Scottish National Investment Bank
- Scottish Funding Council
- Skills Development Scotland
- Scottish Enterprise
- Innovation centres (IBioIC, Catapults etc.)
- Academic communities and councils
- Industry networks
- Bio-foundries/facilities

Organisations outside the scope of our recommendations:

- UKRI/Innovate UK
- UK Government

What role do you see for public-private partnerships in advancing Scotland's engineering biology sector?

What models or examples could we look to for successful collaboration?

Public-Private Partnership is the general term for partnerships between a government agency and a private-sector company, which involve everything from operating facilities and providing services on behalf of the public, to flexible methods of financing these services[1]

1. https://www.gov.uk/government/publications/public-private-partnerships/public-private-partnerships