Innovate UK

Driving innovation through engineering biology

Innovate UK's engineering biology projects from the UKRI Technology Missions Fund

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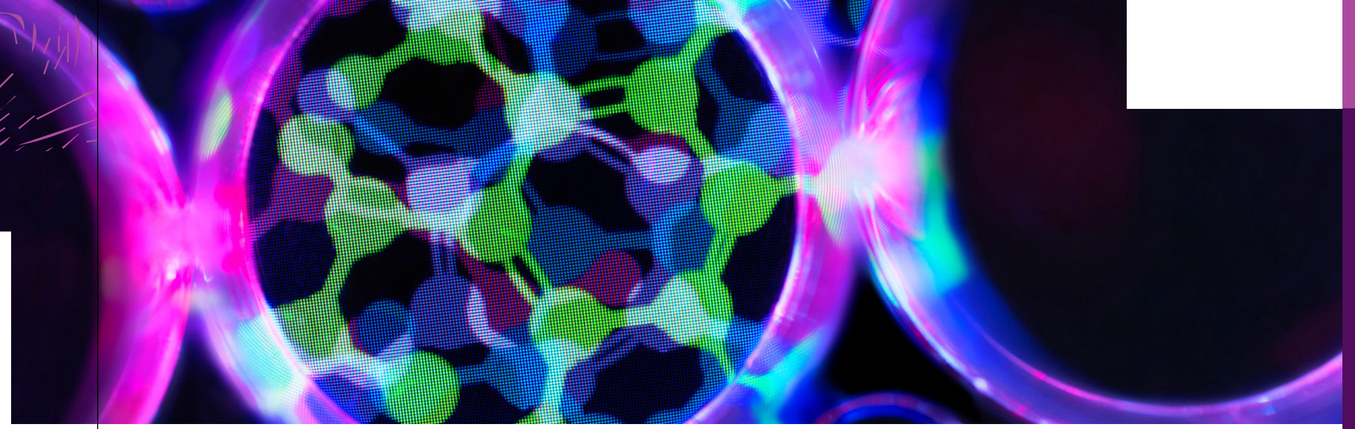
Driving innovation through engineering biology



Engineering biology uses engineering principles to re-design biological systems to create transformative improvements across many industries.

As a key enabling technology, it can help drive growth, productivity, and resilience across the UK economy. It is a rapidly growing field with potential for innovation and applications across key sectors including health, agriculture and food, energy, and environmental sustainability.

To unlock this potential, UKRI is investing £320m through its Technology Missions Fund (TMF) to drive progress in four critical technologies: AI, quantum technologies, future telecommunications, and engineering biology.

Innovate UK has delivered two industry-focused initiatives in engineering biology as part of this:

Accelerator – Feasibility

Supporting early-stage businesses and entrepreneurial researchers through an Accelerator, delivered by Science Creates, providing feasibility funding and tailored support to help turn high-potential engineering biology ideas into viable ventures.

CR&D

Supporting business-led Collaborative Research & Development (CR&D) projects developing engineering biology-inspired products, processes and services, designed to de-risk the adoption of new technologies that offer high market potential.

Over 60 companies have been supported to date across five application areas:

- Biomedicine
- Clean growth
- Food systems
- Environmental solutions
- Cross-cutting tools and services

This brochure provides an overview of Innovate UK's role within this programme and demonstrates how we've supported entrepreneurs, researchers and companies to develop breakthrough technologies and bring them closer to market. The brochure outlines some of the impact of these projects and highlights the role engineering biology can play in delivering a cleaner, healthier and more resilient future.

This work also supports the UK government's Modern Industrial Strategy, which prioritises frontier technologies with the greatest growth potential, such as engineering biology, to help drive innovation, economic growth and long-term resilience across sectors.

"Thanks to this funding, we're unlocking rapid, reliable access to correctly folded, active membrane proteins — one of the biggest challenges in drug discovery and structural biology. By combining AI-guided protein design with rapid, automated cell-free production on the eProtein Discovery™ system, we're accelerating access to critical materials that power innovation in drug discovery, biosensing, and synthetic biology."

Nuclera Page 58

"Innovate UK's support has been instrumental in transforming our concept into validated proof. It has opened doors for regulatory engagement and future pilots — a crucial step in accelerating sustainable bioaugmentation in water innovation."

PhotoClear Page 31

"The TMF funding provided the critical springboard needed to turn our concept into a functioning prototype, opening doors to pilot opportunities and commercial partnerships. It's been transformative for our team and technology."

Biofuel Evolution Page 16

"Innovate UK funding was vital in advancing the platform to the point that it could be demonstrated to customers and generate commercial traction."

BiologIC Technologies Page 46

"Combining AI and real-world data collection to produce cheaper and more scalable growth media ingredients helps us put our customers one step closer to making widely available and affordable cultivated meat a reality."

Multus Biotechnology Page 75

"The award not only helped to validate IMP023 as a viable biocatalyst for Iadademstat but also established a powerful, generalisable approach to making enzymes industrially relevant. With the support from Innovate UK, Imperagen is enabling faster, more sustainable manufacturing of complex drug compounds — bringing life-saving therapies to market with greater speed and lower environmental impact."

Imperagen Page 49

"This funding was essential for us to develop a prototype and although limited in monetary amount, this forced us to think about what was essential to address now to de-risk our technology and what we could do later with more funding. Importantly, receiving this award has given us the confidence to apply for further grants such as the Future Leaders Fellowship and approach investors with a working prototype."

Janus Biosciences Page 21

"The Innovate UK grant through the TMF has been instrumental in accelerating PentaBind's development of AI-designed aptamers for targeted drug delivery. It enabled us to complete a critical feasibility study, validate our AI platform, and initiate key collaborations across academia and industry. This support has significantly advanced our progress toward first-in-class therapeutics and positioned us to engage with future partners and investors."

PentaBind Page 30

"This project proved how our hybrid AI process simulations can transform how we approach R&D — reducing the number of experiments needed, improving outcomes, and helping companies get to scalable solutions more efficiently. It's a smarter, faster way to turn promising science into commercial reality."

New Wave Biotech Page 60

Building a UK-wide pipeline of engineering biology start-ups

ScienceCreates

The Engineering Biology Accelerator is an Innovate UK initiative, backed by over £800,000 in funding, and delivered by Science Creates. It is a fully-funded, equity-free programme designed to support innovators in commercialising engineering biology innovations. Since its launch in 2023, the programme has established itself as a national resource for nurturing deep tech entrepreneurship, accelerating the development of novel technologies addressing critical challenges in healthcare, climate, food and sustainability.

The nine-week, full-time programme is aimed at individuals with transformative ideas or very early-stage engineering biology companies, and is delivered in a flexible format, accessible to participants across the UK, helping drive the translation of UK world-leading science capability towards commercial opportunities.

Participants benefit from:

- **Nine in-person training days** across two bootcamps, focusing on commercialisation, IP, leadership, and venture development
- **12+ expert-led webinars** covering deep tech funding, legal frameworks, grant strategy, and more
- **10+ 1:1 advisory sessions** tailored to each founder's technical and business needs
- **Five pitch events,** including a final investor showcase historically attended by over 70 individuals from across the UK innovation ecosystem.

The programme is specifically designed to support early-stage commercialisation, often before a company is formally incorporated. It provides technical and business guidance, as well as leadership development and founder mindset coaching – helping scientists transition into entrepreneurs with confidence and clarity.

The impact to date

Across its first two cohorts, the Accelerator has already demonstrated strong results between September 2023 and December 2024 with:

35+ companies supported
with 17 new companies founded

£3.8m+
in equity investment
raised by participating companies

£2.1m+
in grant funding secured
by participating companies, including 20 feasibility grants

58% of companies grew their teams
following participation

More than **50%** of participants generated new IP

and over **20%** filed a patent within one year

10 alumni start-ups
have gone on to win innovation competitions and awards

Start-ups emerging from the programme are developing solutions in areas including advanced therapeutics, cell and gene therapy, sustainable food production, biomanufacturing, clean energy, and antimicrobial resistance.

Strategic focus and cohort composition

The Accelerator focuses on four priority application areas, aligned with the UKRI Technology Mission Fund's strategic objectives:

- Biomedicine
- Clean growth
- Food systems
- Environmental solutions

Participants are selected from across the UK, with previous cohorts representing 18 regions. The programme is open to both individuals with a viable commercial idea and very early-stage companies, ensuring broad accessibility and inclusivity within the field.

Each cohort forms a national peer group of founders working on technically ambitious ideas with strong societal relevance. Selection criteria prioritise scientific credibility, commercial potential and the alignment of ideas with engineering biology principles.

Programme delivery and founder experience

The programme is embedded within Science Creates' broader ecosystem and support infrastructure, which includes lab and office space, early-stage VC funding (through Science Creates Venture Capital), a strong industry network, and a growing national community of deep tech entrepreneurs.

The programme also includes:

- Psychometric evaluation and founder coaching, designed to build resilience and leadership capability
- Hands-on support with grant writing, including guidance on developing a grant strategy and applying for Innovate UK funding post-programme
- Connections to investors, industry partners, and technical experts, fostering long-term ecosystem engagement.

Programme alumni feedback has been consistently high. Graduates from the first cohort gave the programme a Net Promoter Score (NPS) of 83/100 and the second cohort received an NPS of 90/100. 98% of participants rated the programme as 'essential' or 'very important' to their founder development.

> **"The Accelerator was instrumental in helping me secure investment for our company. The high-quality workshops, exceptional pool of experienced delivery partners and the amazing programme team create the perfect environment for aspirational founders to thrive!"**
>
> **Dr Sahan Liyanagedera,** Co-founder of Biophoundry and a graduate from the second cohort

Building a national community

In addition to the Accelerator itself, Science Creates actively supports the growth of the UK's engineering biology community through national outreach and engagement.

In July 2025, a series of regional roadshows took place in Norwich, Bristol, Glasgow, Nottingham, and London. These free events offered access to insights from investors, academic founders, and legal and IP experts, and provided an opportunity for regional participants to engage with the Accelerator and the wider engineering biology network.

The road ahead

The programme will continue to serve as a launchpad for early-stage engineering biology ventures across the UK, contributing to the development of a high-quality, investment-ready pipeline of companies addressing some of the UK's most pressing scientific and societal challenges.

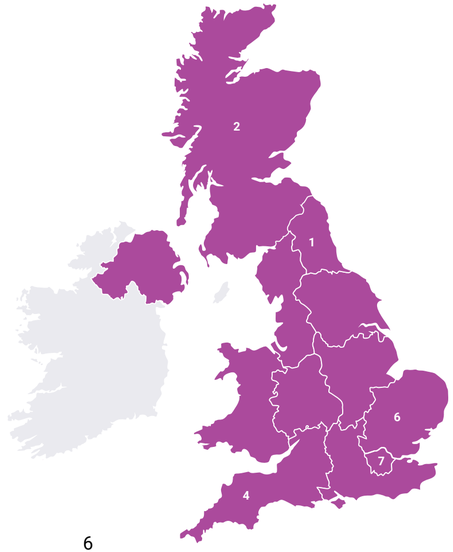
Feasibility project profiles

Feasibility portfolio

20
Projects funded

£902,351
Full project costs

£902,351
Amount of grant funding committed*



Geographic locations of project leads

East of England	6
London	7
North East	1
Scotland	2
South West	4
Grand Total	**20**

* Feasibility projects are funded at 100%, in accordance with Minimal Financial Assistance (MFA) rules.

A rapid cell-free phage discovery platform for scalable personalised antimicrobial therapies

Project lead: Biophoundry (formerly Katana Bioworks Ltd)

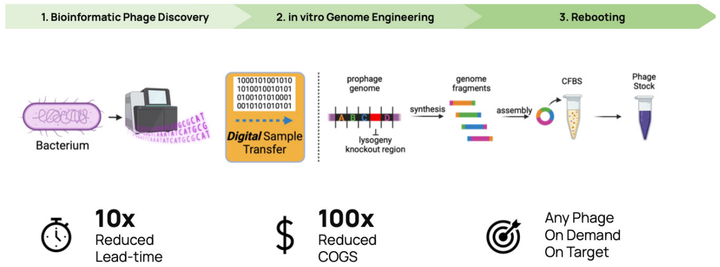
Funded amount: £49,098

Phage therapy is an essential strategy to mitigate the impact of antibiotic-resistance, providing a safe and effective solution to this critical issue. Currently, broad adoption and application of phage therapy is limited by the lead-time required to identify then manufacture phage, which can average around 171 days.

Biophoundrys Phax platform will tackle this by enabling scalable and tailored phage therapy that reduces costs and lead time. The Phax platform is a rapid lead-to-hit phage discovery workflow, pairing in silico phage prediction and cell-free bacteriophage synthesis (CFBS) to engineer personalised phage therapy on demand.

Benefit

Phax Automated Phage Discovery Unlocks Scale



Cell free carbon capture

Project lead: Medusa Materials Ltd

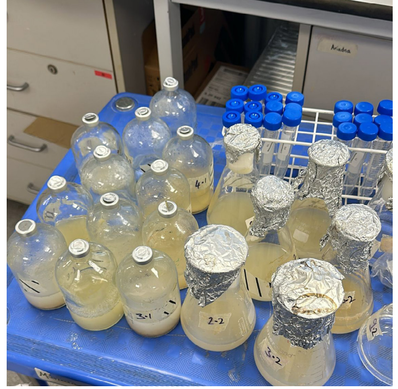
Funded amount: £37,938

Heavy industries like cement, steel, and glass generate over four billion tonnes of CO_2 annually, accounting for around 10% of global emissions, yet lack viable carbon capture and storage solutions (CCS). Traditional CCS methods are prohibitively expensive for industries operating on thin margins, and also present further issues around energy use.

Medusa Materials addresses this challenge with a breakthrough enzymatic carbon capture technology that harnesses carbonic anhydrase (CA), nature's most efficient CCO_2-processing enzyme. CA accelerates the conversion of CO_2 and water into bicarbonate ions by up to a million-fold compared to natural rates. Through mineral precipitation, these bicarbonate ions combine with calcium and other alkaline cations to form stable and solid products that can permanently sequester CO_2.

Medusa Materials' proprietary AI and machine learning platform designs and optimises both the chemical reaction design and enzyme manufacturing processes, reducing production costs while enhancing catalytic performance for industrial-scale deployment.
This integrated approach delivers a sustainable, profitable pathway for large-scale carbon capture that traditional CCS technologies cannot match.

ClimateTech BEBlock: Revolutionising waste management and energy generation



Project lead: Biofuel Evolution Ltd
Funded amount: £43,222

Despite intensifying global environmental challenges, process industries like food and beverage manufacturing remain major contributors to energy use and greenhouse gas emissions. On top of this, the UK's food and drink industry alone generates more than three million tonnes of food waste annually.

BEBlock was conceived in response to these challenges, offering a valuable step towards sustainable industrial practice. Developed by Biofuel Evolution in collaboration with experts in biochemical engineering, carbon capture and engineering biology, BEBlock is an innovative, decentralised bioenergy system designed to transform food and organic waste into renewable electricity and valuable by-products. The system integrates a bioreactor and microbial fuel cell to convert waste into bioelectricity, while exploring novel biological pathways that add commercial and environmental value.

The project has successfully demonstrated the production of both bioethanol and bioelectricity from mixed food waste using a semi-integrated prototype. This has allowed Biofuel Evolution to showcase the technology to industry stakeholders and strategic partners as a leading climate-tech solution for decentralised energy and waste management, and to move toward on-site trials.

The project has worked to strengthen academic and industry partnerships and accelerate its commercialisation roadmap, including patent preliminary process economic modelling, ahead of planned broader market uptake and a wider push to play a key role in net zero and sustainability ambitions by enabling waste valorisation at source.

Commercial feasibility and derisking industrial adoption

Project lead: Plurify Ltd
Funded amount: £45,674

Cell therapies are the next generation of medicines that can potentially cure many diseases, including diabetes, heart disease or cancer. While there are some promising approaches already, bringing these treatments to broad application requires improvements in the scale and cost.

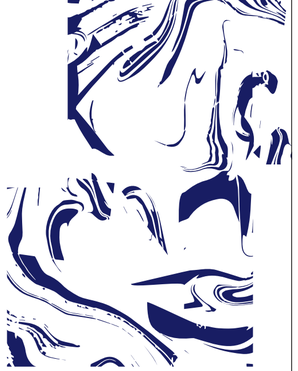
Pluripotent stem cell derived therapies have the power to tackle this and can be the key to treat some illnesses that are without a cure so far. However, making the right cell types (e.g. pancreatic cells, heart cells or immune cells) from stem cells can be difficult and lead to some unwanted cells that are either not beneficial for the patient or, in the worst case, dangerous. It's therefore vital to make sure that cells for therapeutic purposes are clean and safe to use.

Plurify is developing a new approach to ensure exactly that, with technology that can purify any specific cell type from a mixture of typical cells produced for therapy. This new method can therefore solve one of the key bottlenecks that have been holding back pluripotent stem cells from fulfilling their true potential for cell therapies.

Plurify aims to develop this technology into an efficient platform that can be applied quickly to many different cell types and make it possible to produce different cell therapies in the future. This project will aid understanding of the complex cell therapy market and develop a business model and strategy, as well as address some technical challenges that could slow down adoption of the technology by the wider industry.

Solving this key bottleneck in enabling more efficient manufacturing of purer cell therapy products for lower cost, more people can benefit from next generation therapies in the near future.

DBBHA-SEC: Evidencing technical feasibility of producing hyaluronic acid utilising a new highly productive strain of cyanobacteria by removing the secretion bottleneck



Project lead: Deep Blue Biotech Ltd
Funded amount: £38,117

Deep Blue Biotech (DBB) conducted a four-month feasibility study with the aim of developing a novel cyanobacteria manufacturing technology platform to deliver valuable, carbon-neutral chemicals which are better and cheaper than the ones they replace.

Cyanobacteria are the most efficient photosynthetic organisms on the planet and can be engineered to produce valuable chemicals. However previous efforts to commercialise cyanobacteria have failed, mostly due to slow growth and low or uneconomic yields.

The DBB technology leverages the rapid growth and high biomass accumulation of a recently identified, highly productive strain to enhance production capabilities, and exploit it for photosynthetic bioproduction of hyaluronic acid (HA). Production of HA in cyanobacteria has previously been hampered by incomplete secretion, causing growth defects in the strain and ultimately leading to low yields. This project focused on engineering efficient secretion pathways to boost the production yields, leading to commercially viable production rates, greatly simplifying the downstream process and significantly improving the costs of production.

DBB is now refining and scaling the proprietary metabolic engineering approach, further boosting the strain performance, with the goal of moving into the pilot phase in 2026 and generating expected internal revenues of £177m and profits of £35m through HA's domestic and localised supply chain by 2031.

Decarbonisation of the collagen supply chain by producing next-generation animal-free collagen inside plants

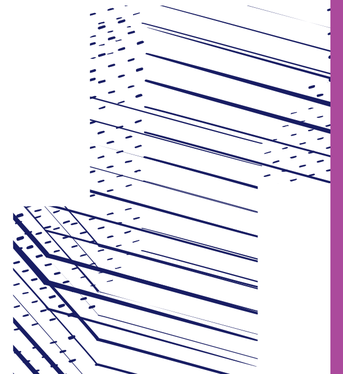
Project lead: Leafycoll Ltd
Funded amount: £50,000

LeafyColl is building the UK's first molecular farming platform for plant-made functional proteins, starting with collagen, to replace animal-based proteins and contribute to the UK's decarbonisation strategy.

Despite the £23bn collagen market, there is currently no true plant-based collagen, only misleading 'vegan collagen' products that lack actual collagen molecules. This has led to legal challenges for brands and growing consumer mistrust.

LeafyColl's proprietary molecular farming platform grows real human-identical collagen peptides entirely inside plants, delivering the safest and most effective collagen for food and skincare with the lowest environmental impact. Compared to animal collagen, the solution offers superior absorption, no allergens, and over 95% lower carbon emissions.

Based in Cambridge, and backed by entrepreneurs from Imperial College and the University of Edinburgh, LeafyColl is pioneering the UK's first low-emission, high-yield collagen supply chain that supports both decarbonisation and sustainable manufacturing goals across UK industry.



Demonstrating technical and commercial feasibility of a glycocalyx engineering technology targeting the microvascular system

Project lead: Dimension Biotechnologies Ltd

Funded amount: £41,457

Microvascular disease, which involves damage to the intricate networks of tiny blood vessels that surround every organ in the body and feed them with oxygen and nutrients, drives the development of other human diseases, from cardiometabolic and renal disease to critical illness. The problem is that microvascular disease is virtually undetectable until it impacts organ function and is challenging to treat, meaning there is a need for new diagnostic and therapeutic approaches.

This feasibility project explored an innovative approach to this challenge by targeting the endothelial glycocalyx, a sugar-rich mesh that coats the inner wall of all blood vessels in the body. This structure is fundamental to microvascular health and function, and its damage is key in the development of common diseases like sepsis, heart disease, stroke, pre-eclampsia, and kidney disease.

Measuring and restoring this layer provides a promising target for microvascular diagnostics and treatments, but has so far been an unresolved technical challenge. The only current method of measuring the glycocalyx biochemically is a tissue biopsy followed by expensive and impractical electron or fluorescence microscopy. This is invasive, slow, and expensive, rendering it useless in a clinical setting. No therapeutic targeting glycocalyx regeneration has been developed.

This project's novel approach instead involved detecting the endothelial glycocalyx, and engineering its structure, at the biochemical level. The project successfully demonstrated the technical feasibility of these approaches, and developed a plan for commercialisation by engaging the various possible target markets to showcase the potential for them to become powerful tools for microvascular diagnostics and treatment.

Development of 3D scaffold structures of various architecture for skin tissue regeneration

Project lead: Janus Biosciences Ltd

Funded amount: £31,012

Chronic wounds are becoming more common due to an ageing population, diabetes and sedentary lifestyles, while every year many adults and children are admitted to A&E departments suffering from acute wounds such as burns and scalds.

Severe skin injuries often require treatment with a split-thickness autograft, but alternative tissue engineering solutions are necessary in cases where there are not enough donor sites or where other health issues prevent autografting. Currently, there are several skin substitutes on the market but the vast majority are made from animal tissues which pose potential risks such as allergies, viral disease transfer, and moral and religious objections.

This project involved the development of a biocompatible skin substitute from a novel polymer, designed for a single procedure application usable by both doctors and nurses - thereby improving patient outcomes and reducing long-term care costs. This feasibility study focused on the development of a prototype product to help de-risk key areas of the technology, advance the innovation, and apply for further funding to refine the product towards commercialisation.

Development of SWIFTR technology for rapid on-farm detection of the Eimeria parasite

Project lead: Gain Holdings Ltd

Funded amount: £49,997

Developing solutions that will improve overall productivity, sustainability, and resilience in animal production is essential in modern agriculture and to ensure future food safety.

Coccidiosis, one of the most common intestinal diseases in poultry, is caused by the protozoan parasite Eimeria, which can cause clinical symptoms in chickens when the birds ingest a relatively large number of the protozoan parasite sporulated oocysts. As well as health issues to the chickens, the parasite causes significant economic losses to the farmers – with the global poultry industry losing approximately £10.4bn annually to coccidiosis. In the UK alone, coccidiosis costs farmers £99.2m each year, covering direct costs due to mortality, reduced growth rates and decreased feed conversion rates, as well as indirect prevention and treatment costs.

Current control of coccidiosis is based on the use of anticoccidial drugs or vaccines, but the overuse and misuse of these drugs has helped Eimeria develop resistance. As the industry looks to move away from using anticoccidial drugs in the near future, prevention of coccidiosis is a priority for farmers.

An important step to achieve prevention is to be able to detect and monitor Eimeria oocysts levels in poultry production accurately and in a timely manner. Current methods are lengthy and time consuming, around three days, and involve specialised equipment and trained personnel. Simplifying the detection and monitoring process and reducing the time to results will have a significant impact on disease management, prevention and animal welfare.

Gain Holdings is developing rapid 'point-of-test' devices for the identification of pathogens for the agricultural and food industry, using its patented SWIFTR technology. This project set out to demonstrate the technology's application to the detection of on-farm infections. Point-of-test tools that can detect Eimeria in animal production in as little as one hour will help farmers in the UK and worldwide reduce the burden of coccidiosis and reduce the economic losses associated with it.

Engineering bacteriophage for treating bacterial disease in potatoes

Project lead: Greenleaf Global Technologies Ltd

Funded amount: £49,212

The global population is expected to reach 10 billion by 2050 and it's estimated that global crop supply must increase by 35 to 56% by 2050 to meet food demand. Therefore, there is an urgent need for novel methods of pest control to increase crop productivity and reduce waste. The need for alternatives to traditional pesticides is also fuelled by their negative effects, such as risks for human health, plants, and the environment.

Some of the most damaging plant diseases are caused by bacteria.

Here, an attractive alternative to traditional pesticides to treat such plant diseases are bacteriophage, a type of beneficial virus that specifically infect a target bacterium. Greenleaf is aiming to set up a novel technological platform combining molecular biology, machine learning and synthetic biology to develop novel bacteriophage-based biopesticides to treat plant diseases with high efficiency and no detrimental effect on human health or the environment.

The technology will not be specifically tailored for the development of just a few bacteriophage-based biopesticides, but will be easily applicable to any plant disease caused by bacteria. The project aimed to provide a key technical breakthrough for the development of bacteriophage-based products not only against phytopathogenic bacteria, but also for other applications such as treating human or animal diseases.

Engineering cells to store atmospheric carbon dioxide for centuries

Project lead: Neo-Fossil Ltd
Funded amount: £34,979

Human activity has caused planetary climate change, increasing global temperatures by 1.1 °C, with an international target to limit warming to below 1.5 °C. In addition to phasing out fossil fuels, there is a need to remove 3.4 billion tonnes of carbon dioxide from the atmosphere by 2050, which will require a 1,300 fold increase in the current rate of atmospheric carbon dioxide removal.

Engineering biology experts Neo-Fossil is developing permanent biological carbon storage based on compounds found in plant fossils. By taking the plant DNA for target fossil compounds and engineering bacterial cells, the concept can produce a carbon negative biomaterial at scale.

Using engineering biology in an attempt to create novel carbon dioxide removal technology is incredibly new, but benefits from the scalability of industrial engineering biology, established cellular engineering knowledge and tools, and advances in metabolic engineering modelling and machine learning.

The project supported the establishment of a fully licensed lab, creating the first iteration of the modelling and machine learning platform, and starting the insertion of plant genes into bacteria. Following on from the project, Neo-Fossil has raised £190,000 in funding, joined carbon dioxide removal (Remove, IAGi) and biotech (Nucleate) accelerators, engaged with first customers, and been nominated for the Earthshot Prize 2025.

Neo-Fossil is now beginning to raise further investment to continue their R&D and commercial development by scaling biomaterial production in the UK with a pilot fermentation facility.

Feasibility study for the use Native Labs' AI tools in optimising cell culture media

Project lead: Native Labs Ltd
Funded amount: £49,993

Current biomanufacturing processes for engineering biology innovations are too expensive. This is due to a combination of factors, including labour-intensive workflows, long turnaround times, inconsistent quality, low yields, and the involvement of complex operations across multidisciplinary teams all working in silos.

In response to this challenge, Native Labs is focused on building embodied AI for biomanufacturing in an effort to drive innovation, achieve scale and support industrialisation, bringing engineering biology from bench to breakthrough.

This project centred around the further development of Native Labs' AI agent platform for new applications. The platform leverages multimodal biomanufacturing data to integrate data-driven decisions for real-time quality monitoring and process optimisation. It brings benefits to users that include being able to reduce personnel requirements, increase yields, and reduce deviations and failures by identifying them around five days in advance of occurring.

Working in collaboration with Imperial College, this project looked to validate the use of the platform in new applications to expand its capability, and progress the development of the AI technology further.

MadeSweetly – precision fermentation process for sweet protein production

Project lead: UBLII Ltd
Funded amount: £48,890

Excessive sugar consumption has led to serious health issues. In the UK, 17 million people are obese and five million live with diabetes, of which 24,000 die prematurely every year. This has led health experts to advocate for reduced sugar intake, resulting in heightened public awareness and government policies that have helped create a growing demand for healthy sugar alternatives that align with both consumer and governmental requirements for healthier living.

While various sugar alternatives exist, they often come with significant limitations. However, sweet-tasting proteins have emerged as a promising solution. Derived from West African berries and processed like other healthy food proteins, they show a remarkable sweetness profile up to 3,000 times higher than sugar. Furthermore, they are suited for the industry thanks to their stability under different conditions and pleasing taste profiles. Despite their great potential, they are yet to become mainstream due to their commercially unfeasible cost and scale, resulting from farming complexities, low yields, and intricate extraction processes.

To solve this, the MadeSweetly project focused on the transformative potential of engineering biology to create biological production systems that leverage cutting-edge genetic tools to engineer microorganisms for an optimal protein production platform. The solution offers

a high potential and safe non-model organism, engineered in ‘cell factories’ to produce these proteins cost effectively and ecologically, and help pave the way for the successful introduction of sweet proteins to the market at scale.

This project presents a holistic solution to address the issues associated with sugar and sweetener consumption with a bio-based solution. By offering this solution to effectively take on these challenges, the project aims to help tackle the issues associated with sugar and sweetener consumption and drive the advancement of the bioindustry within the UK.

Optimisation of miRNA loading in tissue-specific exosomes

Project lead: Excellio Labs Ltd
Funded amount: £49,974

Excellio Labs has established the technological foundations to build a scalable platform for drug delivery using engineered, target-specific exosomes. These nanovesicles, naturally produced by cells in the body, offer several advantages as drug delivery vehicles as they are safe, non-immunogenic, and capable of crossing biological barriers such as the blood-brain barrier.

The project aimed to optimise two critical components of exosome-based therapies: the loading of therapeutic cargo, and the scalable production of exosomes from diverse cell lineages. Focusing initially on nucleic acids such as miRNA, Excellio Labs then expanded the platform to broaden its therapeutic applicability by including siRNAs and small molecules.

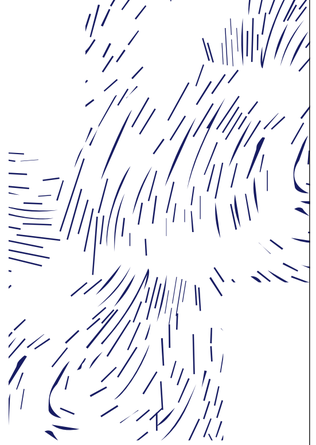
To enable precise tissue targeting, Excellio produced exosomes from a range of cell types derived from induced pluripotent stem cells (iPSCs). Each cell type exhibits distinct exosome characteristics, offering opportunities to fine-tune delivery to specific tissues or organs.

A key achievement was the development of a scalable exosome isolation process, combining tangential flow filtration (TFF) with size exclusion chromatography (SEC). This method delivers high-purity exosomes and is readily transferable to larger volumes, meeting clinical production standards and supporting future compliance with GMP.

The project also considered cargo loading side techniques – including electroporation, freeze-thaw, and lipid incubation – gaining insight into their respective efficiencies and scalability challenges.

While the technology is adaptable to multiple targets and diseases, Excellio’s current focus is oncology, particularly triple-negative breast cancer with metastasis to the brain. Exosomes are uniquely positioned to target hard-to-reach, late-stage cancers as, unlike cell-based therapies, they can cross the blood-brain barrier, penetrate solid tumours, and deliver therapeutic payloads with high precision and minimal toxicity – potentially transforming patient outcomes.

Project Paracelsus: Large language model-based knowledge graph creation from curated literature for accelerated metabolic engineering for foodtech R&D



Project lead: Intelligent Bio Ltd
Funded amount: £44,726

When it comes to working with complex biological data, researchers have commonly found traditional data analysis tools limited or hard to navigate effectively. A more efficient solution is needed.

For this project, Intelligent Bio looked to develop an innovative AI-driven approach to bioscience research to tackle this issue. Combining cutting-edge AI technology with a more user-centric design, the platform looks to streamline research processes and broaden the accessibility of high-level research tools.

The Paracelsus system leverages a unique large language model architecture to analyse and organise scientific data, enhancing information accessibility and accuracy for users. By integrating with the existing platform, the solution looks to provide a seamless experience that offers researchers a more intuitive way to engage with biological data, and represents a major step forward in synthetic biology research.

Proof of concept of a sustainable biofabricated crocodile exotic leather

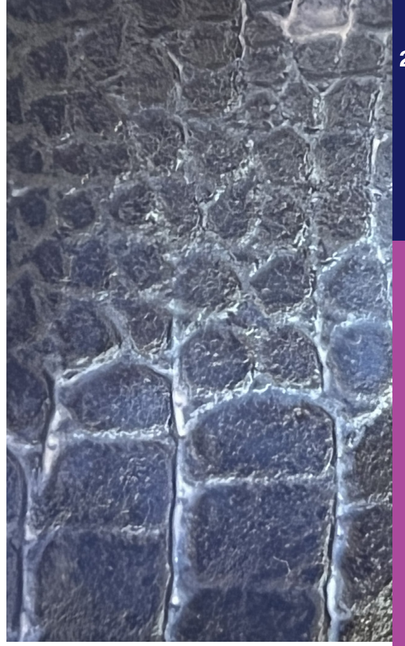
Project lead: Replica Biomaterials Ltd
Funded amount: £49,616

Replica Biomaterials is pioneering a sustainable, biofabricated alternative to exotic crocodile leather through the power of engineering biology, aiming to challenge one of the most environmentally and ethically controversial materials in the luxury fashion industry.

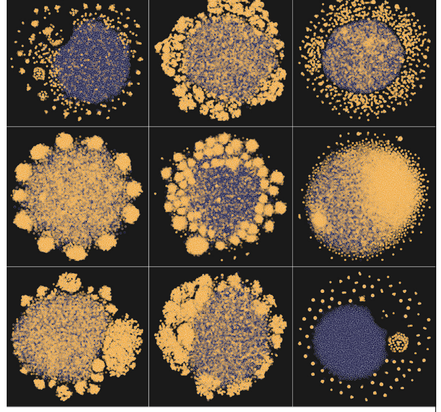
The project successfully developed recombinant DNA constructs and optimised microbial fermentation processes to produce key proteins that mimic natural crocodile skin. The process also integrates colour at DNA level during fabrication, avoiding harmful dyeing and aligning with luxury brands' sustainability goals.

By engaging directly with leading global fashion houses and gathering detailed market insights that confirmed strong interest in sustainable exotic leather alternatives, the project created its roadmap towards pilot production and the key adoption criteria needed to meet luxury standards.

By combining advanced synthetic biology, material science, and industry-driven insights, Replica Biomaterials is aiming to create an ethical, animal-free, and environmentally responsible solution for the luxury fashion sector. This feasibility study provided a foundation for the next phase of scaling up biofabrication processes, expanding product testing with brand partners, and moving towards market validation. Its success demonstrates how biotechnology can transform even the most traditional luxury materials into a sustainable alternative.



R&D for an integrated AI-wet laboratory platform that designs receptor-specific and cell-internalising aptamers



Project lead: PentaBind Ltd
Funded amount: £43,637

For the past two decades, conventional aptamer discovery methods have yielded a commercialisation success rate of under 20% and remained largely confined to academic settings, mainly because only a tiny fraction of the searchable sequence space can be explored. This bottleneck prolongs development timelines and drives up costs, delaying breakthroughs in both medical and industrial applications.

PentaBind is pioneering a novel project that combines proprietary wet-lab techniques with advanced AI to transform aptamer design. Aligned with the Engineering Biology Accelerator, this initiative addresses critical inefficiencies in current wet-lab R&D and unlocks the untapped potential of aptamers for diagnostics, therapeutics and bioprocessing.

At the heart of PentaBind's approach is an AI-driven aptamer design platform tightly integrated with a state-of-the-art wet lab. Rather than optimising solely for binding affinity, PentaBind's platform targets multiple functional criteria, opening new avenues for high-value aptamer applications. Leveraging a novel data-generation protocol and a streamlined processing pipeline, the multi-model AI reduces the effective search space by 38 orders of magnitude, dramatically accelerating discovery and cutting associated costs.

The project exemplifies how engineering biology can deliver real-world impact: it's faster; provides more cost-effective diagnostic assays; offers next-generation therapeutics; and gives continuous bioprocessing of key biomarkers to pre-empt disease onset. PentaBind already collaborates with emerging biotech ventures to advance these applications to benefit academia, industry and healthcare alike.

Sustainable bioaugmentation: Green additives to boost biological treatment of wastewater

Project lead: PhotoClear Ltd
Funded amount: £49,016

PhotoClear is developing next-generation bioaugmentation additives that enhance microbial performance in biological systems. This project considered the application of these biocompatible additives in wastewater treatment, a critical sector for environmental protection, circular resource recovery, and compliance with emerging regulatory standards.

The project focused on tackling inefficiencies in traditional biological wastewater treatment, particularly nutrient removal rates, energy use, and sludge management. By introducing tailored microbial enhancers to existing treatment systems such as activated sludge, PhotoClear aimed to unlock performance improvements without the need for infrastructure changes.

Following a programme of laboratory work, formulation development, and field validation with real wastewater samples, results demonstrated up to a fivefold increase in ammonium and phosphate uptake, as well as improved biomass aggregation – a key factor in reducing sludge volumes and treatment costs. These improvements not only support compliance with tighter phosphorus and nitrogen discharge targets, but also present a clear business case for utilities and industrial operators seeking low-disruption process upgrades.

Drawing on the expertise of partner laboratories, subcontractors, and sector advisors to ensure outcomes aligned with both technical feasibility and commercial relevance, Photoclear's additive platform demonstrated its strong applicability in the wastewater sector. The technology enables faster, cleaner, and more efficient microbial activity, enhancing existing biological processes rather than replacing them. With scalable manufacturing pathways and sustainable input materials, the platform offers environmental and economic benefits across multiple use cases.

Ahead of commercial deployment, the company is now planning larger-scale pilots and strategic partnerships with water utilities, water technology manufacturers, and regulatory bodies. The project highlights how biology-based innovations can support the UK's environmental and infrastructure goals, turning natural microbial processes into high-performance treatment solutions.

The development of novel immune cell binders

Project lead: Xterna Ltd
Funded amount: £45,816

90% of drugs fail in clinical trials, wasting billions of pounds and decades of research time. A large contributing factor to this poor success rate is the issue of drug mistargeting; too little of a drug reaches a diseased organ to be of any use and too much builds up in healthy tissues causing detrimental side effects. By helping guide drugs to exactly where they are intended to be, more game-changing therapeutics can be developed for the patients that need them the most.

Xterna is leveraging alternative nucleic acids for targeted drug delivery. A member of the inaugural Engineering Biology Accelerator, Xterna investigated a new approach to targeting the natural immune system to recognise and combat diseases like cancer.

Xterna's technology is built using a building block called xeno nucleic acids (XNAs), which have enhanced therapeutic-like properties and are widely used in the clinic for siRNA therapeutics. The project supports the drive for new nucleic acid technologies in a post-COVID world, and initial success has seen both a growth in staff and the securing of venture capital funding from leading biotech VCs across the globe.

CR&D project profiles

Collaborative research and development portfolio

48 Projects funded

£18.3m Full project costs

£12.5m Amount of grant funding committed

£5.8m Pledged co-investment

50 Business

2 Research & Technology Organisation (RTO)

11 Research mostly academic institutions

Geographic locations of project leads and partners

East Midlands	4	South East	8
East of England	12	South West	4
London	14	West Midlands	2
North East	3	Yorkshire and The Humber	4
North West	5		
Scotland	7	**Grand Total**	**63**

Building a VAST platform to rapidly engineer novel synthetic gene delivery vectors

Project lead: Deliver Biosciences Ltd
Funded amount: £334,545

Gene therapy covers a range of medicines which modify gene expression in cells to correct disease. This can be by stopping production of mutated genes, introducing normal healthy ones, or by providing completely new 'synthetic' genes. A limited set of approved gene therapies can already cure forms of blindness, muscular atrophy and cancer. Gene therapies need to be targeted to a particular set of cells and expression tightly controlled in time and space, as any modification to another cell may cause harm.

Achieving such specific and efficient gene delivery to cells inside the body has not previously been possible, and traditional laboratory methods add significant complexity and costs. This has limited the reach of gene therapies, as current examples cost up to £1.8m and can only be dosed in a handful of specialist centres, meaning therapies for rare or non-essential diseases may not pass cost-benefit thresholds.

In vivo gene therapy, where off-the-shelf delivery vectors are dosed into patients and modify cells inside them, can help solve these issues, but there is an urgent need for safe, efficient and specific delivery vectors for gene payloads. This project focuses on the expression of a synthetic gene designed to stimulate intracellular signalling on contact with cancer cells that can help T-cells kill lymphoma (in Chimeric Antigen Receptor (CAR)-T therapy). Deliver Biosciences is focused on engineering these technologies and has worked on a targeted lipid nanoparticle (tLNP) to deliver CARs specifically to T-cells, including a novel safe gene expression system called EDGE to use inside these tLNPs.

In this project, Deliver Biosciences built a screening process and system to speed up the discovery of EDGE constructs and new tLNPs. The system will be evaluated and validated for its capability to optimise new EDGE constructs for T-cells and two other types. This will build better prototypes for Deliver's pipeline and a screening process to quickly engineer and derisk new synthetic biology constructs to fulfil industry needs and open new markets for gene therapy.

CR&D: Biomedicine

Device for ultrafast, gold standard amplification and detection of nucleic acids using plasmonic thermocycling – accelerating genomics research and democratising gold-standard disease detection

Project lead: Rapidx Bio Ltd
Funded amount: £315,694

Quantitative-polymerase chain reaction (qPCR) is a powerful and extensively used tool that has been a cornerstone of genome sequencing, clinical laboratories, and precision medicine, with applications spanning personalised medicine, agricultural science, forensic science, and environmental science. However, traditional qPCR techniques have faced challenges in field applications due to the time-consuming thermocycling and time and resource-intensive pre-processing steps of filtration, lysis, extraction, and the purification of samples. These limitations have hindered its use in point-of-care settings for early cancer detection and disease diagnostics.

This project's game-changing solution comes through Plasmonic PCR, an emerging concept that employs gold nanoparticles thermocycled by powerful vertical cavity surface emitting laser diodes (VCSELS). This innovation enables detection of pathogens in under five minutes, which would drastically increase the speed of research synthetic biology, where thermocycling due to PCR and pre-processing requirements act as a bottleneck. Moreover, as a key example and proof of concept for its application in precision medicine, the project's preliminary data has already demonstrated the rapid lysis of bacteria and the quantification of unprocessed samples, outperforming traditional PCR methods.

The key to Plasmonic PCR's success lies in ultrafast thermocycling, enabling results in just minutes, and the ability to test unprocessed samples from various media, including saliva, urine, nasopharyngeal swabs, milk, blood, water, and air. This transformative technology significantly expands the application space for PCR, making it a broadly applicable tool accessible beyond the laboratory setting. The project has developed this concept into a battery-powered prototype, with a focus on speeding up genomics research and making precision medicine accessible to a broader audience.

Engineered signal peptides to enhance expression levels in cell and gene therapies

Project lead: Syngensys Ltd

Funded amount: £202,630

Cell and gene therapies (CGTs) offer hope for millions of people suffering currently incurable diseases. However, they are associated with off-target effects in patients and high costs per dose, which restricts promising products from reaching the market.

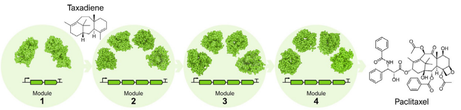
These issues can be addressed by reducing the dosage level required to achieve the required clinical outcome, with a promising way to enhance the potency of CGTs being to increase the level of therapeutic protein produced in the patient's target cells. This can be achieved by engineering the 'expression instructions' that are included on CGT products that collectively control the location, quantity and kinetics of protein production. One component of these instructions, the signal peptide, was known to be limiting in many therapeutic contexts, but there are few mechanisms for CGT manufacturers to replace endogenous poorly-performing elements with new improved, synthetic versions.

In this project, SynGenSys, a company that engineers novel genetic constructs to enhance CGT efficacy and safety, developed a platform technology to rapidly design optimised bespoke signal peptides for CGT products.

The project developed a new proprietary signal peptide design process via multiple design-build-test-learn cycles with example cell and gene therapy products.

In both cases, the final engineered constructs were shown to increase protein expression by more than 200% in the target cell type, compared to the signal peptides currently deployed in these therapies. The signal peptide engineering platform is now being utilised by both CGT manufacturers and biologics producers to rapidly design components that significantly enhance the level of therapeutic protein production in required target cell types. By enabling CGT product designers to replace their suboptimal endogenous signal peptides with built-for-purpose constructs, this project has facilitated development of an enabling technology that enhances therapeutic effectiveness, helping to reduce costs and increase safety.

Engineering a microbial platform for the sustainable production of paclitaxel



Project lead: 17CICADA Ltd

Project partner: University of Nottingham

Funded amount: £288,376

Paclitaxel (branded as Taxol) is one of the most important anticancer drugs and has been used to treat many different types of cancer. Global demand for paclitaxel is increasing, since cancer remains a leading cause of mortality worldwide, accounting for nearly one in six deaths. However, production currently relies on costly semi-synthetic chemistry, slow plant cell culture, or environmentally damaging extraction from yew trees.

The aim of this project was to produce commercial paclitaxel via bacterial strains which consume CO_2 and waste, paving the way for lower-cost, sustainable medical products. The project looked to bioengineer fast growing microbes to make paclitaxel, thereby lowering costs, shrinking the carbon footprint and making the medicine more affordable and accessible worldwide.

The project ran two engineering approaches concurrently to maximise the chances of success. In the first approach, microorganisms that feed on CO_2 were engineered to contain the plant paclitaxel biosynthetic pathway. In the second approach, waste-degrading microorganisms were screened for native paclitaxel production, with the intent of adding key paclitaxel biosynthetic genes to any identified strains. Certain microorganisms have previously been shown to produce taxanes, like paclitaxel, and are often able to grow on the waste materials, such as chitin (shellfish).

The first approach succeeded in generating a strain where five of the six required genetic modules were stably integrated into the CO_2-fixing microorganism, while the second approach generated an engineered waste-degrading microorganism which produced appreciable amounts of taxadiene, the core ring system of paclitaxel.

Scale-up studies with the CO_2-fixing microorganism and the novel paclitaxel production strain reached 15 litre reactor volume, generating the process data needed for larger installations. A life cycle and techno-economic assessment, using real fermentation outputs, projected a 15–20% cost saving compared with conventional paclitaxel production, alongside substantial carbon gains.

These technical advances have clarified a commercial trajectory, opening a new path to sustainable, cost-effective paclitaxel production and cancer treatment.

Engineering of nature-mimetic sub-micron crystalline protein depots to incorporate high cargo densities

Project lead: Cell Guidance Systems Ltd

Project partner: The Rosalind Franklin Institute

Funded amount: £201,978

Purified recombinant proteins are widely used in research, medicine, and industry, meaning cytokines, hormones and antibodies have been important in reshaping the field of medicine over the last half century. How these proteins are manufactured, stored and delivered to their site of action, such as diseased tissue, is fundamental to their utility.

This project has developed PODS, a nature-mimetic technology, that adds value to all aspects of a recombinant protein's life cycle. PODS are sub-micron scale cubic protein co-crystals containing a cargo protein, produced in insect cells. PODS utilise an innovative manufacturing technology to produce bioactive proteins incorporated into sub-micron scale protective crystals that greatly simplify the purification of the recombinant protein, as they are physically distinct from other components of the production cell. Storage instability is addressed as cargo proteins are stabilised within the crystal lattice and have high levels of stability over many months, even at elevated temperatures in aqueous suspension. Finally, following administration, the crystals are degraded by proteases providing a matrix-degradation, dissolution-based cargo release system that provides sustained release over a one-month period.

The project developed PODS for research and therapeutic applications, primarily for localised sustained release of cytokines. It demonstrated that PODS are able to harness phagocytic immune cells, such as monocytes, neutrophils and macrophages, to target the delivery of immunostimulatory cytokine proteins to cancer.

Further work will consider the packaging efficiency of cargo proteins into PODS, which, at around 1% of the total protein, is a limitation. Whilst this is sufficient for delivering highly potent proteins, other protein classes, such as antibodies and anti-microbial peptides, may require higher loading efficiency. Work will also look at differences in the industrial applications of PODS, such as the biomanufacturing of cultured meat, in which cost reductions enabled by increased cargo density would be highly advantageous.

CR&D: Biomedicine

Engineering synthetic polymer hydrogels for controlled delivery of extracellular vesicles as an advanced wound care therapy

Project lead: Evolution Therapeutics Ltd

Funded amount: £154,890

Inflammation is a normal defence mechanism used by the body's immune system to help protect from infection and to repair damage caused by injury. However, the benefits of inflammation are only realised when the response is turned off and the infected or damaged tissue is returned to normal. A failure to control inflammatory responses can lead to chronic inflammation and is the root cause of many of the inflammatory diseases, notably non-healing wounds.

Non-healing wounds have now become a major healthcare crisis. An estimated 3.8 million patients with wounds are managed by the NHS each year, with non-healing wound treatment reaching an annual cost of £5.6bn – the same as managing obesity. Current treatment still predominantly relies upon wound dressings, with leading care clinicians agreeing there is now a vital need for advanced therapies.

Evolution Therapeutics, a spin-out company from Aston University, is looking to transform the treatment of a wide range of inflammatory diseases through the development of a revolutionary new therapy that relies on the removal of immune cells that have done their protective job. As these unwanted cells die, they release small membrane bags called extracellular vesicles (EVs) which carry specific biomolecules that help to control inflammation and signal to activate the tissue repair response.

In this project, Evolution designed new EVs, which are loaded with these inflammation-modifying biomolecules, in order to 'kick-start' this stalled process. The project also looked to develop a biodegradable dressing that can be used in combination with these EVs, to act as a controllable delivery system for the therapy to help accelerate wound healing in patients.

Evolution's work aims to support a move towards active wound treatment, which could limit clinical and economic burdens to patients and the NHS alike, as well as helping to improve quality of life. If successful, the benefits of the therapy in the treatment of non-healing wounds may also potentially be applied to other inflammatory diseases in the future.

Genomic capture to combat the antimicrobial resistance crisis

Project lead: Bactobio Ltd

Funded amount: £348,062

Antimicrobial resistance (AMR) is a significant and growing threat to healthcare systems. Over 1.2 million people die from drug-resistant infections every year, a number which is expected to rise to 10 million by 2050. Resistance exists against all major antibiotic classes and no new classes have reached the clinic in 30 years. New drugs against deadly pathogens are needed now to ensure these infections remain treatable into the future.

Over 70% of antibiotics derive from the 1% of microbes that can readily be cultured in the laboratory. The remaining 99% unculturable microbes are a vast bioresource producing an estimated 95,000 new compound classes. Bactobio use breakthrough techniques in bio-engineering, next-generation sequencing, and machine learning to grow previously unculturable microbes and harvest them for new antibiotics. Pre-project data suggested there were over 100 microbial species that produced antibiotics against *Acinetobacter baumannii,* one of three WHO critical AMR pathogens responsible for over one million cases and over 400,000 deaths every year, especially in patients in intensive care.

To fully characterise these new antibiotics, there is a need to identify and extract the DNA responsible for their production, which is a significant bottleneck to antibiotic discovery. Antibiotic-producing Biosynthetic Gene Clusters (BGCs) are often large, making traditional cloning processes difficult or impossible.

In this project, Bactobio developed and applied an automated genomic DNA capture system to rapidly mine hit species for new antibiotic-producing BGCs. Through implementing automation of cloning design and high-throughput cloning, the project increased monthly production over 10-fold, whilst cloning BGCs larger than 100kb. With this increased efficiency, the project identified and produced at scale novel compounds targeting *A. baumannii.*

Post-project test results showed favourable toxicology and broad antibacterial activity. The tools that were implemented as part of this project are now key to how antimicrobial discovery is performed and continue to bring benefit as compounds are developed towards clinical trials.

CR&D: Biomedicine

Intracellular bacterial delivery of therapeutic proteins for treatment of cancer

Project lead: Prokarium Ltd

Project partner: Imperial College London

Funded amount: £300,136

Prokarium is a clinical-stage biotech company developing a new type of cancer treatment using live, tumour-targeting bacteria. These specially designed microbes are safe and, once they reach a tumour, help train the patient's immune system to recognise and destroy cancer cells.

To potentiate the inherent anti-tumour effects of these therapies, Prokarium are further programming the microorganisms to produce and release payloads, molecules that can drive the immune response against the cancer, directly inside the tumour where they can work best. This approach aims to avoid many of the unpleasant side effects caused by traditional cancer drugs, by acting only locally at the tumour site.

Through a partnership with Imperial College London's Biofoundry, Prokarium has developed a rapid and flexible experimental pipeline to design and optimise therapeutic payloads for delivery by bacteria.

In this project, Prokarium focused specifically on utilising the natural tendency of some bacteria to enter human cells in order to engineer a new 'Trojan horse' drug delivery system that is able to attack cancer cells from within, either eliminating cancer cells directly or promoting immune responses against them by activating or suppressing different elements of the immune system.

These microbes are an exciting new class of cancer treatments with a well-characterised manufacturing process designed to be low-cost, scalable, and potentially available off-the-shelf, making them broadly accessible.

Manufacturing scale up of clickmers, a novel class of therapeutic molecules

Project lead: APIS Assay Technologies Ltd

Funded amount: £57,802

Across the developed world, populations are rapidly ageing. This leads to increasing prevalence of cancer, chronic disease, and dementia, and means that novel and more effective therapies are required for healthy ageing.

Clickmers are short DNA sequences that can be chemically changed to improve their ability to bind proteins. Compared to existing aptamer solutions, whose DNA backbone cannot be changed, this means there are higher chances of selecting a Clickmer to bind the disease-causing protein of interest. Additionally, compared to antibodies, Clickmers provide opportunity for highly consistent, lower-cost, animal-free production, which helps lower treatment costs and improves accessibility across society. Clickmers are therefore attractive for targeting disease-causing proteins for which antibodies, small molecules, or aptamers have failed.

APIS plans to bring multiple Clickmer products to market by selling custom Clickmers to the pharmaceutical industry and APIS' own drug development, initially in the area of breast cancer. With approximately two million new cases per year, breast cancer is the most common cancer in women. There is currently a trend towards increased deals to fill innovation gaps in their drug pipelines, and selling custom Clickmers to the industry can provide an attractive new approach to drug development.

With this potential, there is therefore a need to increase the scale at which Clickmers can be manufactured, with APIS' initial focus being to optimise the manufacturing process and introduce quality controls to ensure high-quality, reliable supply. With the safety of future drugs in mind, APIS are also investigating and monitoring levels of purity and impurities in the manufactured Clickmers.

CR&D: Biomedicine

Scalable economic DNA synthesis by oligoseed amplification with novel DNA polymerase enzymes

Project lead: Nunabio Ltd

Project partner: University of York

Funded amount: £336,833

Engineered DNA is a mainstream component for cell and gene therapies, advanced diagnostics, and RNA vaccines. Hundreds of kilograms of DNA will soon be required globally each year, much more than current global capacity to supply it. However, the long-standing mainstream DNA production method, solid-phase phosphoramidite synthesis, is environmentally unsustainable and suffers from low accuracy and quality, limited DNA length and yield, and significant manufacturing delays. Today, reaching high DNA yields largely relies on manufacturing-level scale-up in bacteria or other cells, which is a costly manufacturing bottleneck.

The UK government's priority is for an escalation in molecular therapeutics and advanced diagnostics development and manufacture, and to build resilience against future pandemics. Nunabio's unique synthetic DNA production technology addresses these priorities as it promises to provide gram quantities of high-purity DNA feeding into these key applications.

The project focused on a scalable, commercially viable process and product, which will shorten DNA turnaround to between 12 and 16 hours – down from more than 72 hours with current solutions. This time saving has the potential to help each user save up to £1.4m a year and remove around 1.9 million litres of harmful phosphoramidite reagents from industrial use by 2029.

The RNA desktop biofoundry: End to end platform for RNA R&D, process development and manufacturing

Project lead: BiologIC Technologies Ltd

Funded amount: £139,999

Development and manufacturing of engineered biology on traditional equipment suffers from major limitations as the route from R&D through process development to manufacturing is highly inefficient, due to differences in equipment used at each stage, disaggregation of data and the requirement for specialised facilities and personnel.

To democratise development and manufacturing for end users, there is an urgent need for affordable tools that allow efficient design-build-test-learn loops and seamless transfer to manufacturing. There is also demand for a smart platform to improve yields, automate robust protocols and enable predictive scaling from R&D, through trials and to manufacturing at population scale.

This project advanced the development of this smart biofoundry platform concept. The platform, purpose-built for digitalisation of bioprocessing, enables full cyber-physical processing of biological products and their associated quality and process data. This opens the field to new software applications in Design of Experiments, quality design spaces, predictive analytics, advanced control and manufacturing scalability.

The smart platform aims to double the efficiency of design-build-test-learn loops for de novo construction, modification and scaling of biological products. It leverages AI, software and data to increase the efficiency of design space optimisation, while operating as a modular, inter-operable, extensible, upgradable end-to-end manufacturing system.

The cross-cutting technology provides fundamental infrastructure for modern biotechnology enterprises, delivering a wide range of engineered biology applications, including development and manufacturing of advanced therapies, materials, cellular agriculture and beyond.

This project also developed a small-scale, fully automated RNA biofoundry, demonstrating the productivity, democratisation and efficiency of translating the process to a scalable manufacturing set up. To achieve this outcome, BiologIC leveraged core platform modules for in vitro transcription (IVT) spectrophotometry and microbioreactor modules of the platform, developed a small-scale electroporation module, and interconnected all the modules using BiologIC's patented architecture design.

UNIVERCell: An engineered red blood cell line to unlock a new, universal therapeutic modality

Project lead: Scarlet Therapeutics Ltd

Funded amount: £330,306

Red blood cells (RBCs) circulate in the body for about four months and have a much longer half-life as compared to conventional medications. They do not have a nucleus or DNA and hence do not present the risk of uncontrolled cell division, i.e. cancer, thereby promising to be a safe therapeutic modality. However, the generation of RBCs at commercial levels has not been established so far due to the challenges of growing enough at commercially reasonable cost from donated stem cells.

Scarlet Therapeutics looked to develop a cell line that could help generate highly universal RBCs, which in turn could be used for transfusion, in the unmodified form, or to treat disease in a modified form. This project looked to pioneer the commercially viable production of RBCs from cell lines and manipulate them to contain therapeutic proteins of interest.

The project successfully generated more than 65 universal polyclonal cell lines using optimised cell culture methods, including lines that are 'highly universal'. The work also isolated 14 monoclonal lines from these polyclonal lines, made using GMP-grade supplements, future proofing the technology ready to take forward into a clinical trial.

These generated lines will be used to produce a new class of therapeutics based on highly universal RBCs, initially focused on developing treatments for rare metabolic diseases which are currently poorly treated. The project output also provides the foundation for future opportunities in the treatment of other indications and for meeting the high demand for blood transfusion, especially for rare blood types or those patients who require regular transfusions throughout life due to thalassemia or sickle cell disease.

A novel high-throughput scale-out fermentation array for isoprene bioprocess development

Project lead: Twig Bio Ltd
Project partner: University College London
Funded amount: £ 238,092

Isoprene is a high-value, bulk commodity chemical, widely used in the production of industrial rubbers, which represents around 95% of all isoprene use. Additionally, isoprene can be converted downstream to a wide range of useful isoprenoid product molecules (e.g. limonene, retinol), commonly used in high-value sectors like flavourings, pharmaceuticals, and beauty and fragrances.

However, isoprene is currently primarily produced via petroleum cracking, which is both cost-intensive and highly detrimental to the environment. The dependence on fossil fuels for isoprene production also leaves the market extremely susceptible to fluctuations in crude oil and gas prices, with this issue becoming increasingly apparent recently owing to COVID-19 supply chain issues and the Russian invasion of Ukraine severely impacting feedstock prices. The development of relatively cheap and sustainable isoprene production routes is therefore of great interest.

Bio-based manufacturing using microorganisms offers a sustainable alternative for the production of isoprene, but the development of suitable host strains for industrial scale biomanufacturing is slow and expensive. In this project, Twig's lab automation and machine learning platform enabled the rapid design, build and development of many highly productive and commercially viable strains. To select the top performer for scale-up, a custom miniature fermentation system was developed in collaboration with UCL, enabling high-throughput screening relevant to large-scale manufacturing.

The project successfully de-risked isoprene production and supported post-project engagement with commercial partners for scale-up. The isoprene strains also unlocked pathways to other molecules of interest, like limonene, retinol, and bakuchiol.

Accelerated, multi-parameter enzyme optimisation for the process scale-up of a novel pharmaceutical biocatalyst

Project lead: Imperagen Ltd
Funded amount: £233,588

With the pharmaceutical industry increasingly targeting more and more focused therapies, the complexity of drug candidates is ever-rising. Synthesising advanced compounds often requires lengthy, multi-step chemical processes which are costly, inefficient and reliant on metal catalysts, harsh solvents, and high energy input, rendering them environmentally unsustainable.

Enzymes offer a powerful alternative as they enable highly selective and efficient chemical transformations under mild conditions, and drastically reduce waste and energy usage. However, natural ('wild-type') enzymes are very rarely usable for economic manufacturing, as they are too slow, unstable or non-specific for the challenges of large-scale production. Enzyme engineering to optimise their properties for pharmaceutical manufacturing is well established, but improving their performance to the required levels is often an unpredictable and time-intensive process, limiting wider adoption.

Imperagen is looking to transform enzyme engineering through its proprietary Digital Enzyme Evolution™ platform. This integrated, digitalised system unifies AI-led protein design, advanced biotechnology, and laboratory automation to optimise enzymes with unprecedented speed, accuracy, and reliability.

The project focused on a bacterial enzyme, IMP023, capable of synthesising Iadademstat – a promising treatment for acute leukaemia. Conventional chemical synthesis of Iadademstat involves numerous complex stages with significant environmental drawbacks, but IMP023 dramatically simplifies the process to a single step, reducing energy consumption and chemical waste.

The wild-type IMP023 lacked the productivity and stability required for economically viable, large-scale manufacturing, so the project aimed to optimise the enzyme process while enhancing the underlying platform. Work focused on refining the AI-driven computational workflows and advancing capabilities to boost enzyme activity and stability under industrially relevant conditions. Through targeted AI-led evolution and process engineering, Imperagen successfully delivered a significantly improved, patent-pending variant of IMP023 - engineered for robust, scalable, and sustainable production of Iadademstat.

Advancing industrial biotechnology: Low-cost and performant microbial polyesters for sustainable packaging

Project lead: Shellworks Group Ltd
Funded amount: £222,646

Plastic pollution is a mounting global crisis, with over 380 million tonnes of plastic being produced annually and growing at 4% a year. Packaging is the largest contributor, accounting for 42% of primary plastic use in 2015, with over 400 million tonnes of greenhouse gas emitted yearly by the global plastic industry – more than the entire carbon footprint of the UK.

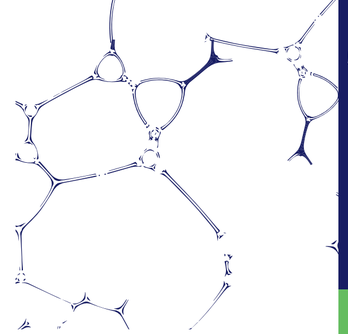
Recycling alone isn't a sufficient solution. Most plastic waste remains unrecycled due to food contamination, mixed materials, inadequate infrastructure, and weak demand for recycled content. Meanwhile, growing evidence links plastics to serious human health risks. Additives such as BPA, PFAS, and phthalates – commonly found in everyday packaging – are linked to hormone disruption, cancer, and reproductive harm. Microplastics are also now found in food, water, air, and even human tissue, with the full implications of these long-term exposures remain uncertain.

Addressing both environmental and health challenges requires a fundamental shift in material design. Shellworks, an award-winning biomaterials company, is pioneering a new generation of biomaterials that are plastic-free, non-toxic, and home-compostable. These mono-material solutions replicate the functionality of conventional plastics, while eliminating persistent waste, toxic additives, and microplastic pollution. Designed to integrate with existing waste systems, they also reduce the burden on recycling infrastructure and enable a cleaner end-of-life outcome.

This project extended Shellworks' biopolymer platform by using microbial biosynthesis and second and third generation feedstocks to develop novel biopolymers with enhanced performance properties. The innovation will enable broader application across packaging sectors where safety and sustainability are paramount.

The project outcomes support the UK's ambition to lead in sustainable packaging by addressing the environmental and human health consequences of plastic.

Chlorella sorokiniana genetic toolkit for sustainable algae oil production



Project lead: Phycobloom Ltd
Funded amount: £341,982

Biofuels are currently the only option for reducing the emissions of hard-to-decarbonise industries such as aviation and shipping. But current feedstocks, the source materials used to produce renewable fuels, all come with fundamental drawbacks. First-generation biofuels are extracted as vegetable oils from edible energy crops like soy and sugarcane, and therefore compete with food and feed for agricultural land, while second-generation biofuels come from non-edible crops or waste oils, but are not available at a scale large enough to service ever-growing demand. Third-generation biofuels improve on these weaknesses, for example algae absorb CO_2 and sunlight to produce oil, without displacing food production. The problem with algae is that extracting the oil from the biomass is currently energy intensive and expensive.

Phycobloom has devised an innovative solution to this problem by genetically engineering algae to release their oils of their own volition, which can be cheaply and easily collected. This not only renders biomass processing unnecessary, but as the algae are not killed and harvested they can continue to produce oil, greatly increasing efficiency.

Under the project, Phycobloom built the synthetic biology tools necessary to transfer a unique oil-secretion technique devised and demonstrated in a laboratory microalgae species to a more commercially promising species, a major step towards realising a scalable, simple and cost-competitive production method.

Developing a synthetic biology toolkit will be central to Phycobloom engineering and optimising commercially promising algae strains that produce third-generation biofuel feedstock. The project will also look to make the toolkit available to academia and industry for R&D towards exploiting algae for a myriad of other applications.

Machine learning accelerated pathway engineering for sustainable palmitic acid biomanufacture

Project lead: Twig Bio Ltd

Project partner: Centre for Process Innovation (CPI)

Funded amount: £351,915

Palm oil production is reliant on intensive farming which is subject to price volatility and causes biodiversity loss, with global supply issues due to COVID-19 and the Russian invasion of Ukraine having also caused price inflation for manufacturers. In addition, the global population will grow to 10 billion by 2050, consuming more and more products. As palmitic acid and palm oil derivatives are present in around 50% of packaged consumer products, it is a supply chain under pressure – meaning there is an increasing need for a more sustainable and resilient process for palmitic acid production.

Bio-based manufacturing through the use of microorganisms offers exciting potential for the production of palmitic acid. However, development of suitable host strains for industrial scale biomanufacturing is typically slow and expensive. It was in this context that Twig Bio pioneered an automated, machine learning approach. This innovation enabled precision strain engineering, significantly accelerating development through rapid design-build-test cycles. A key aspect of the strategy was the integration of strain stabilisation from the very beginning of the process, which ensured the developed strains were both scalable and stable under continuous fermentation conditions, making them suitable for industrial manufacturing applications.

Collaborating with CPI, the resulting strains underwent rigorous evaluation focused on process scale-up and commercial viability under real-world process conditions. This demonstrative phase highlighted the considerable benefits of Twig Bio's approach in advancing sustainable bio-based manufacturing processes, offering a new pathway forward from the challenges previously faced by traditional palm oil production.

NJA-1: A novel synthetic enzyme designed to transform polyolefin recycling

Project lead: Epoch Biodesign Ltd

Funded amount: £349,948

Plastic waste poses a significant global challenge, as traditional recycling methods often degrade material quality and only 9% of manufactured plastic is currently recycled. This inefficiency often leads to incineration or landfill, underscoring the urgent need for advanced, sustainable solutions.

Epoch Biodesign addresses this through a versatile, low-energy, low-cost enzymatic depolymerisation platform. This biological approach transforms diverse plastic waste into high-value, virgin-quality chemical building blocks. This method maintains the integrity of liberated molecules, enabling true cradle-to-cradle recycling.

This project supported the development of this unique enzyme engineering platform. The approach integrates cutting-edge engineering, biology, and AI to design enzymes for even the most challenging plastics. This project focused on using this to target and improve polyolefin recycling capabilities, developing crucial technology to tackle the most widely used plastic. This breakthrough overcomes the quality loss typical of conventional recycling, particularly for hard-to-recycle, multi-laminate plastics and plastic film, advancing sustainable plastic circularity. The expanded learnings from this work are now also being applied to optimise the enzymatic recycling of a wide range of plastics including Nylon 66, Nylon 6, and polyester, further advancing sustainable plastic circularity across multiple material types and the textile industry.

Epoch's technology integrates seamlessly into existing supply chains, handling any mix, colour, or form of plastic waste, even heavily contaminated and blended materials. By using engineering biology to convert complex waste into monomers that match fossil-based inputs in terms of performance and price, the result enables scaled circularity for plastic, without compromising on cost, quality, or performance. This broad applicability, coupled with a focus on innovation and industrial scale-up, positions Epoch Biodesign at the forefront of a truly circular economy for plastics.

Nylon circular – Biocatalysts for recycling of post-consumer nylon

Project lead: Evoralis Ltd

Project partner: University of Cambridge

Funded amount: £371,329

Each year, around 110 million tonnes of synthetic fibres are produced globally, yet less than 1% are recycled fibre-to-fibre. Instead, most textile waste is downcycled, incinerated, or landfilled.

Evoralis, a biotech spin-out from the University of Cambridge, is tackling this challenge by developing enzyme-based technology that enables true circularity for synthetic textiles. Using an ultrahigh-throughput microfluidic screening platform, Evoralis discover and evolve enzymes capable of depolymerising plastics like Nylon 6 and Nylon 66 into their original building blocks, making them reusable in new fibre production.

The project's technology, developed through advanced molecular biology, allows for recycling of complex blended textiles with significantly lower environmental impact than traditional methods. These biocatalysts are biodegradable, renewable, and operate under mild conditions, offering a cleaner, low-carbon alternative to chemical recycling.

The impact of this work extends beyond the lab. By enabling fibre-to-fibre recycling at scale, Evoralis can help reduce reliance on fossil-derived virgin materials, cut carbon emissions, and divert waste from landfill and incineration. Their UK-based operations create recycling jobs in local waste markets in the UK, creating employment in biotech roles and related fields. Internationally, finding greener and more efficient ways to recycle textile waste is essential, particularly in emerging economies where waste accumulation and landfill overflow are growing challenges. By enabling sustainable recycling solutions, the project aimed to contribute to reducing landfill dependence and supporting circular infrastructure globally.

P.A.I.N.T.S (Production of Alternative, Innovative and Natural-based Technologies for Styrene)

Project lead: Crown Paints Ltd

Project partners: University of Edinburgh, Impact Laboratories Ltd

Funded amount: £361,190

Project P.A.I.N.T.S is a collaboration between Hempel (Crown Paints Ltd), the University of Edinburgh and Impact Solutions which aimed to reduce the carbon footprint of the paints and coatings industry. The project focused on using bio-based styrene material in the production of paints and coatings instead of the petrochemically produced equivalent. Bio-based styrene has the potential to significantly reduce the industry's carbon footprint, but there is still uncertainty about product yields, and the initial toxicity of bio-styrene generated inside the cell presents a barrier to achieving the required production values.

To address these challenges, P.A.I.N.T.S used bio-derived feedstocks that undergo enzymatic conversion to produce bio-styrene, which will be used to create polymers following Hempel's existing formulations as a guide. The resulting high-performance styrene-acrylic emulsion paint formulations will have the potential to significantly lower environmental impact, and the process supports a 20% reduction in emissions.

The project used synthetic biology capabilities to genetically optimise the entire pathway, enabling the project to increase productivity and titres of bio-styrene from L-phenylalanine, and deliver predictable and consistent processes suitable for manufacturing at scale.

The project outcomes include a bioprocess for styrene production from waste feedstocks, an optimised and purpose-built protocol for creating bio-styrene-based polymers, a report detailing full characterisation of the bio-styrene monomer/polymer, and a life cycle, market analysis and route to commercialisation report.

Project P.A.I.N.T.S aligns with the UK government's aim to grow the bio-economy sector and enables the paints and coatings industry to become more environmentally sustainable, while better meeting the needs of customers who are increasingly concerned about the environmental impact of manufacturing. The potential impact of P.A.I.N.T.S is significant, as the project could significantly reduce the industry's carbon footprint while meeting the growing demand for environmentally sustainable products.

TRACE (Tracking and Recording Accurate Cellular Engineering)

Project lead: GitLife Biotech Ltd
Project partner: Colorfix Ltd
Funded amount: £172,886

Synthetic biology (SynBio) is a young and exciting field that combines many different scientific disciplines to redesign organisms for useful purposes by engineering them to perform new functions. SynBio has the potential to revolutionise many existing industries and resolve crises in agriculture, energy and healthcare. With a rapid expansion in the SynBio industry, there is an increasing need for the protection of UK commercial biological assets and IP – with traditional strategies not suitable for supporting the agile commercialisation of SynBio-generated biological assets. This leaves highly valuable assets vulnerable for extended periods of time, potentially delaying and complicating the scaling-up process and inhibiting commercialisation.

In this project, GitLife Biotech, a spin-out from Newcastle University, and Colorifx, a Norwich-based SME, looked to address these issues with a novel and innovative solution for faster scale-out and commercialisation of these innovations.

Work involved the development of a biosecurity system for engineered microorganisms, where a unique DNA sequence is inserted in the genome of organisms that acts as an identifying factor. This sequence is recorded along with all the engineering process information and the rightful owners of that particular strain on their cloud-based digital platform. As the DNA sequence is heritable and unique to a single owner entity, the biological asset can always be traced back to their rightful owner.

Colorifix send strains to customers who themselves grow the bacteria on site using Colorifix-developed fermenters. Given the distribution of these genetically modified organisms around the world, and their use by third parties, biosecurity is essential. In response, this project saw GitLife successfully validate the feasibility of using DNA barcoding (genosignatures) to track engineered strains at scale.

A new, novel bioreactor to power engineering biology

Project lead: Sterling Bio Machines Ltd
Project partner: Centre for Process Innovation (CPI)
Funded amount: £265,130

Synthetic biology offers exciting potential for the production of valuable chemicals and materials that can replace fossil fuel-based equivalents for more profitable and sustainable materials manufacturing. Bioreactors are an important component of this, but currently produce low yields and are difficult to scale. This results in resource-intensive, costly processes that are difficult and time consuming to commercialise.

Sterling Bio Machines' novel design reimagines bioreactors and provides superior control over conditions across the bioreactor volume, at all scales, enabling increased productivity and rapid process development from lab to commercial production scale. This project focused on theoretical feasibility demonstrated through proof-of-concept work ahead of proposed testing with mammalian cells for the initial target market, cultivated meat.

The project achieved significant milestones for adapting the commercial focus as better market insights were gained. Work included the successful building and testing of a filtration rig with a variety of cell lines, while a proof-of-concept reactor was constructed and tested with Chinese Hamster ovary cells. Following this, the project designed a full minimum viable product in preparation for induced Pluripotent Stem Cell (iPSC) testing.

As well as early commercial traction through new partnerships and potential customers, this work also supported the filing of a patent application and the building and testing of a product prototype and control system.

A rapid prototyping device for expression of membrane proteins

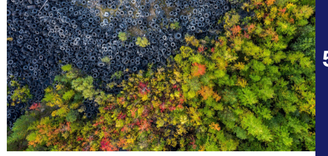
Project lead: Nuclera Ltd
Funded amount: £336,801

Membrane proteins are critical to fields such as drug discovery, biosensing, and synthetic biology, yet their production remains slow, complex, and costly using current methods. A solution is therefore needed to enable faster, more accessible, and cost-effective membrane protein expression.

In this project, Nuclera looked to enhance eProtein Discovery™, a rapid, automated protein optimisation and production system, to support the expression of membrane proteins, addressing a key bottleneck in the engineering biology landscape. The project integrated advanced methodologies to improve the stability, yield and purity of membrane proteins within 48 hours, while an AI-guided tool in development will look to leverage 3D structure prediction with domain and feature annotations. This allowed researchers to design structurally robust membrane proteins in silico, which can then be rapidly produced using eProtein Discovery™. These combined capabilities will therefore significantly streamline the membrane protein development pipeline.

By reducing barriers to membrane protein access and accelerating discovery workflows, this project catalysed innovation across the UK's engineering biology ecosystem and enables more researchers and start-ups to solve complex biological challenges efficiently. In collaboration with leading academic partners, looking to identify high-impact membrane protein case studies and rigorously validate the approach, project outcomes were disseminated through peer-reviewed publications and scientific conferences to assess validation and impact.

Automation and digitalisation technology for evolutionary development of microbial chassis



Project lead: Evolutor Ltd
Funded amount: £270,217

Irrespective of the huge advances that engineering biology continues to make, at its foundational level biology is fundamentally not an engineered system. Biological entities have been self-designing and self-iterating for billions of years, meaning engineering biology can still only scratch the surface of harnessing biological potential for human industry. Less than 1% of microbes are directly engineerable, and not a single microbial entity exists that is fully characterised at the genomic level.

As biomanufacturing sectors look to rapidly expand, the bottleneck of un-engineerability, and the time and cost required to remove this bottleneck, need to be overcome.

In response, Evolutor uses evolution-centric approaches for generating fit-for-purpose, industry-ready microbial production hosts. This microbe development philosophy is enabled by Evolutor's proprietary core tech stack, which amplifies, accelerates and digitalises the process of adaptive laboratory evolution. The stack includes integrated technologies, including a lab-scale bioreactor, proprietary molecular tools, and software and data moats for control and predictive modelling.

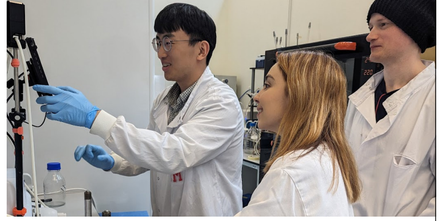
This project is a step towards the long-term ambition of a world-leading biofoundry centred around automated evolution, molecular tool deployment and generative AI.

At this later stage, the company will develop a diverse library of precision-evolved microbial chassis and multi-species systems that are pre-optimised for large-scale circular biomanufacturing use across all sectors. To reach this ambition, Evolutor is beginning with targeted vertical deployment of the unscaled core tech to solve a specific biomanufacturing problem: the inability of model microbial chassis systems to effectively utilise wastestream-derived feedstocks.
Using the core tech stack, Evolutor are developing waste-hungry microbes to convert end-of-life tyres into fermentation feedstock for new biochemical and biopolymer production.

Through this project, Evolutor iterated the hardware layer of the core tech stack for increased functionality and scalability, and demonstrated the components with proof-of-concept microbe evolution: evolving non-model microbes for rapid depolymerisation of rubber waste.

Evolutor is now focused on progressing evolved tyre-degrading bacteria into pilot demonstration scale, alongside continued microbe and core-tech development to realise long-term biofoundry ambitions.

Biomanufacturing downstream process optimisation and scaling with in-silico experimentation



Project lead: New Wave Biotech Ltd

Project partner: Multus Biotechnology Ltd

Funded amount: £244,923

Downstream processing (DSP) is one of the biggest bottlenecks in scaling synthetic biology. It accounts for up to 70% of production costs and contributes to long, failure-prone development cycles. Optimising DSP typically relies on expert intuition and months of trial-and-error experiments which can slow down innovation and make many promising technologies commercially unviable.

New Wave Biotech has developed simulation software that transforms how DSP optimisation is done, replacing slow, manual experimentation with fast, intelligent in-silico design. The platform combines mechanistic models with machine learning, allowing users to simulate billions of process configurations, predict performance metrics such as yield, cost, purity, and sustainability, and pinpoint the most promising options for targeted experimentation.

Partnering with Multus Biotechnology, work focused on applying the platform to an extracellular protein production use case to optimise DSP for cost, yield, and processing time. Over four optimisation cycles, each combining simulation, lab experiments, and retraining, the project reduced production costs by 55% and time by 37.4%, while improving yield by 8.6 times. These results were achieved using 92% fewer experiments than traditional methods.

Crucially, the platform could adapt DSP recommendations to batch-specific variation in the upstream process, ensuring each downstream strategy was tuned for real-world conditions. This adaptability improves scalability and robustness, reducing the risk of failure during scale-up, and proving that high-impact optimisation can be achieved with minimal data.

The positive results have helped boost commercial and investment traction, and allowed an expansion of product capabilities across different industries. It has also demonstrated a cost-efficient way to refine and scale bioprocesses, helping improve the economic case for growth media ingredients, and showcasing how digital tools can dramatically reduce the cost, time, and risk of bioprocess development.

CR&D: Cross-cutting tools and services

Continuous Oscillating Baffled Reactor-with-biocatalysts-for Accelerated-reactions (COBRA)

Project lead: Impact Laboratories Ltd

Project lead: University of Edinburgh

Funded amount: £377,692

Project COBRA is a multidisciplinary collaboration that brings together the University of Edinburgh's world-class expertise in enzyme engineering and immobilisation, with Impact Laboratories' patented COMB (Continuous Oscillating Moving Baffled) reactor technology. These capabilities offer the potential for a significant advancement in industrial processes that rely on immobilised enzymes such as biofuels, food and pharmaceuticals to accelerate chemical transformations and convert raw materials into valuable products.

COBRA offers broad applicability across diverse enzymatic pathways, helping make them commercially scalable and economically viable. Following demonstration of the core technology through this industrial research project, further exploration of its potential will continue. During the project, COBRA strengthened collaboration among consortium partners and is now building on the knowledge gained to identify other promising applications for the technology, such as the processing of lignocellulosic feedstocks.

Building on this foundation, Impact Laboratories are also exploring the application of engineering biology in the rapidly growing field of biodegradation testing for polymers in liquid formulations (PLFs), specialty polymers used in countless everyday products from shampoos and detergents to paints and adhesives. Impact Laboratories is developing novel testing approaches that combine enzyme immobilisation with continuous flow chemistry, dramatically reducing biodegradation timelines from months to hours.

Harnessing the power of engineering biology to develop and translate novel live biotherapeutics

Project lead: NCIMB Ltd
Project partner: GitLife Biotech Ltd
Funded amount: £219,170

In this collaborative project, NCIMB, an established Scottish biotechnology company, and GitLife Biotech (GLB), a spin-out from Newcastle University, looked to develop new innovative products and services using groundbreaking engineering biology protocols.

The project centred around the development of a new class of therapeutic based on living bacteria. Using engineering biology to enhance the functionality of a probiotic that has been used for several decades to support gut health, work focused on engineering a specific metabolite that plays a key physiological role in the gut - helping to maintain a balanced gut microbiome and gut health. Imbalance or dysbiosis of the gut microbiome is associated with a broad range of diseases, so developing a new engineered bacterial strain that can be used to maintain a healthy gut microbiome can therefore be used to prevent or treat disease.

The project used GLB's innovative cloud-based 'version control' and biosecurity platform that captures and organises biological data including DNA sequence produced during the project. The software links the data to the microbial strain using a unique, non-coding DNA sequence (GenoStamp™) which was introduced during the project. The DNA sequence differentiates the engineered strain from similar strains within the same species and, upon completion of the engineering process, strains will be DNA signed with GenoGuard™ to provide a mechanism to prove ownership and secure the engineered bio-asset.

The project aimed to deliver a novel engineered bacterial strain with clinical potential, complete with a transparent digital footprint and full ownership traceability. The potential health benefits add significant market value to a probiotic strain and the engineered therapeutic strain could be transformative for patients suffering from bowel cancer, inflammatory bowel disease or infection. There are also considerable spillover benefits for the version control and biosecurity platform in a wide range of products and applications that use engineered microbes.

CR&D: Cross-cutting tools and services

Non-conventional yeast strain optimisation for industrial protein production using deep learning

Project lead: HERlab Ltd
Project partner: University of Kent
Funded amount: £239,709

Synthetic biology has a potential to enable cheaper, cleaner, more economically and environmentally sustainable biomolecule production. Animal-free rennet (for cheese production), insulin (for medical purposes), and leghemoglobin (for alternative meat production) are all produced using fermentation – where a microorganism is modified into a mini-factory to produce a desired molecule. However, despite significant advances in fermentation, it remains difficult to achieve high titer, yield, and production rate of some proteins, resulting in high production costs and limiting their beneficial impact for businesses. Traditional fermentation methods are also labour-intensive and limited in the diversity of variants they can generate due to current regulatory constraints.

This project, led by HERlab, set out to address these challenges by improving the industrial production of human epidermal growth factor (hEGF), a protein crucial to regenerative medicine, tissue engineering, and cosmetics. Like other growth factors, hEGF is a highly expensive protein to produce due to its complicated production process in *E. coli* and costly purification. Yeast production systems have been shown to be more advantageous for hEGF production but their titers are not yet on par with *E. coli.*

The purpose of this project was to improve the cost efficiency of these yeast systems for hEGF production.

By evaluating the potential of in silico optimisation of regulatory sequences using recently developed deep learning models, the strategy focused on the development of a regulatory sequence diversity tool in order to understand, characterise and generate a new set of improved sequences for lab testing. An expression improvement of more than 300% was achieved using synthetic sequences in different (unconventional) yeast production systems, while scale-up experiments showed a stable production of hEGF.

The aim of the project was to create a pathway to the development of economically and environmentally sustainable production chassis for protein ingredients, critical to food, cosmetics, and pharmaceuticals markets, as well as driving innovation in this field to solve major production bottlenecks.

The manufacturing of de novo designed protein fibres

Project lead: Solena Materials Ltd

Project partner: Centre for Process Innovation (CPI)

Funded amount: £267,787

This project looked at developing innovative, and crucially, cost-effective methods for producing the next generation of protein-based fibres. These materials have the potential to transform multiple industries, including fashion, healthcare, and consumer goods, by offering high-performance, environmentally friendly alternatives to conventional fossil fuel-derived materials.

Solena leverages cutting-edge technologies such as computational and AI-driven protein design, laboratory automation, and a proprietary in-house screening platform to help accelerate the development of high-performance, sustainable protein-based fibres and precisely tailor their properties.

In collaboration with CPI, the project developed novel bioprocesses to manufacture these materials in a commercially viable way using an industrially relevant expression host, chosen for its robustness and high protein yields. The technology designs entirely new protein sequences from scratch, thereby avoiding the limitations often associated with natural proteins - not only enhancing protein secretion yields but also contributing to significantly lowering the cost of manufacturing.

The project's aims were to secure advanced bioprocesses, newly engineered recombinant protein expression strains, and a comprehensive final report. Together, these deliverables can support the growing demand for sustainable, high-performance materials, and represent a significant step forward in the development of next-generation biomaterials, with the potential to disrupt multiple sectors by replacing petrochemical-derived materials with bio-based alternatives.

Development of portable digital cloud-connected biosensor for real-time measurement and mapping of environmental contamination of UK rivers

Project lead: AquAffirm Ltd

Funded amount: £200,959

Contamination of UK rivers is a major environmental and health issue, with a recent report on water quality in rivers from parliament warning of a 'chemical cocktail' of sewage, slurry and plastic polluting English rivers, putting public health and nature at risk. Pollution from antibiotics was a particular concern, due to the growing prevalence of antibiotic resistance as a threat to human health. Although an important driver of antibiotic resistance is continuous exposure of bacteria to sublethal concentrations of antibiotics in natural environments, antibiotic pollutants are not currently tracked around the world.

Antibiotics enter rivers and waterways through various routes, including agricultural runoff (from use by farmers to treat livestock), sewage treatment plant discharge, improper disposal of unused medication, and in wastewater of pharmaceutical manufacturing plants. A significant consequence is the development of antibiotic-resistant bacteria: when antibiotics are present in the environment, bacteria can develop resistance, making it harder to treat infections in humans and animals. Additionally, antibiotic contamination can harm aquatic life and disrupt ecosystems, as well as harming beneficial bacteria and disrupting the food chain. With current river monitoring inadequate and outdated, new and better tools for monitoring are needed.

To address this need, AquAffirm has developed a platform centred around the world's first portable, digital, cloud-connected biosensor for real-time measurement and mapping of environmental contamination. The innovative test uses low-cost digital sensors in the form of test-strips, digital reader, and Android smartphone (loaded with the AquAffirm app) for rapid measurement of contaminant levels. Together with advanced mapping software and associated data analytics, the project aims to change the way contamination will be managed affordably and transparently.

In this project, the AquAffirm platform, which has already been demonstrated for measuring arsenic in South Asia, was adapted using synthetic biology to deliver a sensitive biosensor for measuring two antibiotics, ciprofloxacin and metronidazole, in the environment. Sensitive biological chemicals called aptamers were utilised and new chemistries demonstrated, with the results showing a significant advancement on current measuring technologies.

Engineering cyanobacteria into bio-solar cell factories for scalable carbon capture utilisation and storage

Project lead: CyanoCapture Ltd

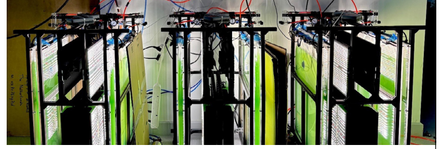
Project partner: University of Edinburgh

Funded amount: £278,111

CyanoCapture, in collaboration with the McCormick Lab at the University of Edinburgh, carried out a pioneering project focused on developing a sustainable, bio-based system for carbon capture and utilisation. Originally conceived as a carbon removal initiative, the project evolved to centre on the capture of CO_2 and its bioconversion into high-value proteins and chemicals using engineered cyanobacteria.

Conventional CO_2 capture technologies currently have several limitations, in that they are typically energy-intensive, chemically harsh, and reliant on costly storage infrastructure. Recognising these challenges, this project explored an innovative biological alternative. Focusing on Picosynechococcus sp. PCC 11901 (Syn11901), a fast-growing, genetically tractable cyanobacterium with strong potential for industrial application, several major breakthroughs were achieved throughout the project. A precise gene expression control system (CRISPRi) was constructed to enable the study and optimisation of CO_2 utilisation by the organism. New tools for gene editing were developed, allowing modifications to be made without leaving behind unwanted genetic markers. Finally, gene expression under high CO_2 conditions was analysed, and optimal genomic sites for gene integration were identified.

These advancements were applied to demonstrate proof-of-concept production of several high-value compounds and recombinant proteins. The project showed that photosynthetic microbes like Syn11901 can offer a sustainable way to capture CO_2 and make useful, high-value products. This could help reduce reliance on fossil fuels and chemical-intensive technologies, while opening new possibilities for green manufacturing and carbon reuse, supporting the UK's efforts to lead in biotechnology and climate innovation.



This project has opened new directions for microbial biotechnology and synthetic biology. The development of a functional CRISPRi system, genome editing tools, and transcriptomic insights in Syn11901 lays the groundwork for future academic research into photosynthetic metabolism, CO_2 utilisation, and strain optimisation for industrial biotechnology.

By demonstrating that engineered cyanobacteria can convert captured CO_2 into high-value compounds, including recombinant proteins, this project presents a scalable and eco-friendly alternative to traditional carbon capture. It also creates opportunities for sustainable production across sectors such as pharmaceuticals, food, and energy.

Optimisation of CAS-based rapid microbial biosensor

Project lead: CEXAL Ltd

Funded amount: £151,662

CEXAL is developing an advanced biosensing system aimed at overcoming the limitations of traditional microbiological testing methods. Through the 'Optimisation of CAS-based rapid microbial biosensor' initiative, the project successfully explored novel applications of CRISPR and CRISPR-alternative molecules, which exhibit intrinsic catalytic activity like CRISPR enzymes. These molecular tools have been integrated into portable, point-of-need biosensors, forming the foundation of a flexible platform - CasDuO (Dual-Cas9-Oligo).

The project resulted in a platform capable of rapid detection and quantification of microorganisms through nucleic acid sensing, delivering near-instantaneous results for high target concentrations and within 30 to 60 minutes for very low microbial loads in complex sample types.

This system produces clear, measurable signals upon detecting specific microorganisms, enabling fast and accurate on-site monitoring. Compared to existing techniques such as Loop-mediated Isothermal Amplification (LAMP), CasDuO demonstrated advantages in flexible design, multiplexing capability, and tailored specificity, including the ability to discriminate single-nucleotide variants. When non-CRISPR catalytic molecules were employed, the platform achieved this at a fraction of the cost due to its minimal reliance on complex protein synthesis.

Although originally developed for environmental monitoring, particularly for detecting low concentrations of pathogens in the field, the CasDuO platform has shown strong potential in clinical diagnostics in infectious disease detection, with emerging applications in pharmacogenomics and personalised medicine, due to its high-affinity binding and high-fidelity targeting capabilities.

With its speed, accuracy, and adaptability, CasDuO presents a compelling alternative to PCR, qPCR, and other standard molecular diagnostic assays.

A heterologous expression toolkit for large-scale production of novel antimicrobials from diverse microbes

Project lead: Bactobio Ltd
Funded amount: £345,944

The plant fungus *Zymoseptoria tritici* causes up to 50% yield loss in wheat crops. UK and EU farmers are disproportionately affected due to a climate increasingly favourable for the fungus, bans on synthetic fungicides that kept it at bay, and rising resistance to current methods of control. New fungicides are urgently required, but, for them to work against this backdrop of resistance, they must be chemically different from existing solutions. This means they must be discovered from previously unexplored sources or using novel chemical techniques.

Around 40% of agricultural fungicides were discovered from nature, with these natural chemicals used by microbes as defence mechanisms being identified from the 1% of microbes that readily grow in the lab. The remaining 99% of previously unculturable microbes are life's biggest unexplored bioresource. Bactobio are using breakthrough techniques in bio-engineering, next-generation sequencing, and machine learning to grow previously unculturable microbes and harvest them for new solutions. Using their recently developed toolkit to discover new fungicides, Bactobio were able to identify specific regions in microbial DNA responsible for production of new fungicides, and transfer these for production in a microbe that grows easily in the laboratory.

The project discovered two new fungicides and used these to engage four global agri-tech companies for downstream testing and identifying a route to commercialisation. Follow-on funding is now enabling tool development to systematically select compounds that meet agri-tech priorities, discover and patent additional fungicides, and secure out-licensing agreements.

Apoha: Cross-cutting technology to support adoption of synthetic biology food systems

Project lead: Apoha Ltd
Funded amount: £348,530

Synthetic biology is transforming food, promising more sustainable, tailored, and nutritious alternatives. But as the industry scales, innovators face a major bottleneck for how to rapidly understand and optimise what new ingredients actually do in real-world formulations. Today's analytical tools are too slow, narrow, or expensive to handle the complexity of modern food systems, so a new solution is needed.

Apoha, a London-based start-up pioneering sensory intelligence for matter, is looking to unlock breakthroughs in drug discovery, material design, and sustainable food by revealing how matter truly behaves.

From this project, Apoha's Liquid Brain® concept reads what matter actually does, rather than existing techniques that simply simulate molecular behaviour using structure or sequence. The system captures a hidden physical signal generated by molecular interactions, a direct readout of how ingredients behave, unlocking a powerful new data layer for AI. This sensing modality is powered by non-linear Lucassen waves discovered by the company's Co-Founder Dr Shamit Shrivastava. Built on this discovery, the platform physically 'touches' samples, detecting the behaviour of molecules and converting it into high-dimensional data in seconds.

The project has now turned this breakthrough into a customer-ready product, which helps food and synbio teams screen synthetic and plant-based ingredients, compare prototypes, optimise formulations, and de-risk scale-up - all using microlitre-scale samples, with no labels or simulation.

By measuring how ingredients actually behave, the platform helps customers move faster, reduce risk, and make more confident decisions. Applications currently include areas such as: bio-mimicry/bio-similarity (e.g. comparing taste and texture to traditional products); sensory digital twins; new product development (e.g. integrating novel ingredients); scale-up re-optimisation (e.g. reformulating with cost-effective materials); QA/QC across suppliers; and product optimisation for nutrition, quality, and function.

Development of edible hollow fibre bioreactor for cultivated meat production

Project lead: Kalvotech Ltd
Funded amount: £226,790

Cultivated meat represents an essential solution for sustainably meeting growing global meat demand, addressing critical issues like climate change, food security, animal welfare, and environmental sustainability. However, the current industrial approach relies heavily on stirred-tank reactors (STRs), which face limitations in high production costs, low efficiency, and the inability to directly produce structured meat products like steaks.

KalvoTech (KT) is pioneering innovative bioreactor technology to transform the way cultivated meat is produced. Under the project, KT's breakthrough technology, Edible Hollow Fibre Membrane Bioreactors (EHFMBs), offers a transformative alternative. Unlike traditional methods, KT's edible membranes simultaneously act as supportive scaffolds that mimic muscle structure and as a nutrient delivery system, similar to blood vessels in animals. This unique approach supports up to 20 times higher cell densities than STRs, thereby significantly lowering capital expenditure and operating expenses for equivalent yields. Furthermore, EHFMBs enable the direct formation of structured, steak-like cultivated meat without requiring additional processing steps, further reducing costs and complexity.

In this project, KT successfully developed a lab-scale proof-of-concept EHFMB, which achieved excellent cell growth and structured tissue formation. KT are now working to address key barriers to facilitate rapid industry adoption, such as scalability, ease of operation, and affordability, to become a global provider of essential technology that unlocks the potential of the rapidly expanding cultivated meat market – which is projected to reach $36.6bn by 2034.

Beyond commercial potential, this development directly supports UK strategic priorities within food systems, clean growth, and environmental sustainability, as well as strengthening the UK's global leadership in engineering biology.

Engineering of safe and efficient animal stem cell lines for cultivated meat production

Project lead: Quest Meat Ltd
Funded amount: £116,108

The world's population is expected to reach 9bn by 2050, but current food systems cannot feed this amount of people. Meat is particularly inefficient and damaging to the environment, so alternative production methods are needed.

Cultivated meat is a solution using cell culture to grow meat, similar to fermentation for beer. However, animal cells for making meat (muscle and fat) do not grow well in culture, so stem cell technologies are favourable because theoretically they can grow indefinitely and produce the enormous quantities of muscle and fat cells needed.

In this project Quest Meat is creating a safe way of growing cells from livestock to create food sustainably. Pluripotent stem cells are expanded in large numbers and then converted to muscle and fat cells using chemicals. They are genetically engineered and the chemicals are expensive, particularly for making meat, which needs to be at affordable prices for consumers. There are also questions about safety, regulatory compliance and consumer appeal of genetic engineering and chemicals in food systems.

This project's solution is a smart molecular technology that temporarily 'immortalises' the cells so that they can be expanded to enormous quantities, without permanently changing them. The technique does not genetically modify the cells and is controllable within the production process and so safety concerns that are associated with other permanently immortalised cells are eliminated.

Guided Biotics® for control of clostridium perfringens in food

Project lead: Folium Food Science Ltd

Project partner: University of Nottingham

Funded amount: £243,343

As many as 600 million people fall ill every year because of ingesting contaminated food, resulting in potentially 420,000 annual deaths worldwide. This problem is only set to worsen in the face of antimicrobial resistance (AMR), which is likely to be responsible for 10 million deaths a year by 2050, as once curable diseases become untreatable and life endangering. The importance of food safety has therefore never been higher for human and animal health.

Significant scientific evidence demonstrates that the use of antibiotics in non-clinical settings, such as agriculture, is a major contributor to the emergence of resistant bacteria and their spread to humans, meaning sustainable alternatives to antibiotics are required in these settings.

As with human diets, 'good bacteria' help animals to have better health and to grow faster, and can be provided in their diet as a probiotic. Folium Science has developed a range of health-promoting probiotic additives to animal feed that are augmented with a technology that allows the specific removal of certain pathogenic bacteria.

Unlike antibiotics and other solutions, the technology used in this project does not generate resistance and leaves the beneficial population of gut bacteria untouched. This technology is called Guided Biotics(r) (GBs(r)) and has already been applied to precisely eliminate the foodborne pathogen Salmonella from chickens. *Clostridium perfringens* (Cp) is one of the most common causes of foodborne disease in the USA, behind only Norovirus and Salmonella, and is responsible for severe disease and death in farm animals – with an estimated annual cost of $6bn to the poultry market alone.

Folium Science is aiming to build on its portfolio of GB(r) products by developing a solution to eliminate Cp, offering an effective and sustainable alternative to antibiotics and representing a momentous step forward in improving food production, security and quality.

Microbial-derived solutions for enhanced crop protection through synthetic microbial communities

Project lead: BugBiome Ltd

Funded amount: £230,283

BugBiome is pioneering next-generation crop protection by integrating microbiology, entomology, and data science. Under this project, BugBiome developed a cutting-edge platform that discovers bioinsecticides by harnessing naturally occurring microbes, bacteria and fungi that produce insect-active metabolites.

The microbial-based solutions within the platform offer a targeted, environmentally responsible alternative to conventional chemical insecticides. Unlike traditional products that often harm pollinators and beneficial insects, the BugBiome approach preserves biodiversity while delivering effective pest control, helping to empower farmers to tackle pests with safer, more sustainable tools for protecting their crops.

At the heart of the project's innovation is the novel microbial screening platform. Traditional methods are often limited, as they focus narrowly on pest mortality, missing subtle but important effects such as disrupted development, behavioural changes, or suppressed reproduction. BugBiome's platform instead uses high-resolution phenotyping and advanced analytics to detect these nuanced responses, revealing novel modes of action and enabling targeted pest control. This technology and expertise helps unlock a far more effective and sustainable pest protection solution for crops.

Optimisation of extracellular lipid production and downstream processing for a palm oil alternative

Project lead: Sun Bear Biofuture Ltd

Project partner: The Biorenewables Development Centre Ltd

Funded amount: £366,902

Palm oil is in food, cosmetics and biofuels, and in 50% of our supermarket products. Unique in the vegetable oil market, it melts in your mouth, is great for cooking and is a high-yielding crop. However, it is one of the biggest carbon emitters due to loss of tropical rainforest and peatland to make way for plantations, contributing over 500 million tonnes of CO2e, over 1% global emissions, from 19 million hectares of tropical land. It has caused significant habitat loss, including for the Orangutan and Sun Bear, and all too often smallholder farmers do not receive a fair price for their produce.

The UK government has committed to reaching net zero by 2050. With 20% of UK emissions stemming from agriculture and the food supply chain, these emissions must be tackled if we are to reach net zero.

Sun Bear Biofuture is using synthetic biology and precision fermentation to make an alternative to palm oil. They are optimising a naturally oil-producing yeast strain to produce their oil from food waste quickly and efficiently. Their process saves 4kg CO_2 and 2000m^2 of land for every kg of palm oil – a saving in both cases of 80%.

Working with the Biorenewables Development Centre, this project aims to optimise their strain's ability to produce fats and test separation methods for scaling production. Conventional downstream processing is prohibitively expensive for scaling fermentation processes in fats so finding a scalable alternative is vital to create maximum environmental impact. This project will enable a sustainable palm oil alternative to be produced domestically at scale in the UK, creating jobs in biotechnology and food production and reversing a substantial trade deficit.

This builds on the work carried out as part of Sun Bear Biofuture's Fast Start project 'alternative feedstock for precision fermentation of oil', which has allowed them to prove expression of key enzymes in their yeast strain for the metabolism of starch.

PRIME – Protein recombination improvement through multidisciplinary engineering

Project lead: Multus Biotechnology Ltd

Funded amount: £230,435

Biomanufacturing is essential for producing the next generation of therapies, sustainable foods, and advanced materials. However, the industry's progress is often constrained by the slow, expensive, and resource-intensive process of developing bespoke cell culture media, the critical nutrient solutions that enable cells to grow.

The PRIME project aims to solve this industry-wide challenge by developing a revolutionary, end-to-end platform that automates the engineering and optimisation of vital proteins, which are key ingredients in high-performance cell culture media.

By integrating high-throughput robotics and advanced analytics, this platform revolutionises the development cycle and can deliver an eightfold increase in bioprocess throughput, as well as making the R&D pipeline 12 times faster. This breakthrough performance and efficiency supported the design and validation of novel, high-value ingredients at a previously unattainable speed, successfully produced market-ready proteins, and generated valuable new intellectual property in novel production strains.

This powerful platform accelerates the creation of high-performance, resource-efficient cell culture media which can empower the global bioeconomy, shorten the time to market and improve supply chain security for companies creating essential products.

Process development and cost-effective manufacture of recombinant hormone for livestock reproduction

Project lead: Biodivide Ltd

Project partner: Genesis Manufacturing Ltd

Funded amount: £128,810

Reproductive success in livestock is essential for the economic livelihood of producers and ultimately affects the consumer cost of meat and other animal products. In many livestock production systems, poor fertility is a major factor that limits productivity. As a result, assisted reproduction, such as in vitro fertilisation (IVF), underscores a move to more sustainable livestock production strategies.

Follicle Stimulating Hormone (FSH) is a vital component of fertility as, without FSH, follicles will not be stimulated to produce eggs and won't ovulate. Currently, all FSH products on the market for livestock reproduction use ovine or porcine pituitary gland tissue as the raw starting material. However, many products on the market have experienced manufacturing delays for the last two years due to raw material unavailability.

FSH is a heterodimer consisting of non-covalently bound alpha and beta subunits that requires complex glycosylation post-translational modifications for biological activity that is only achievable in mammalian cells. This project focused on the process development of recombinant FSH using a cost-effective mammalian expression platform. It also supported the development of an effective manufacturing process that is affordable for livestock reproduction.

TUBERGENE: A pipeline to produce gene-edited potatoes to enhance consumer satisfaction

Project lead: B-Hive Innovations Ltd

Project partners: Branston Ltd, James Hutton Institute, James Hutton Ltd

Funded amount: £331,397

Focused on addressing key challenges for potato growers and consumers, the TUBERGENE project set out to develop gene-edited potato varieties with improved quality traits and reduced waste. Work focused on sequencing and assembling a fully haplotype-resolved genome for Maris Piper, the UK's most popular potato variety with consumers.

Building on this foundation, James Hutton Institute developed a CRISPR editing pipeline and undertook work to optimise the protocols needed for protoplast transfection, regeneration, and screening - steps that are critical for generating stable edited potato lines. The team also carried out targeted sequencing of 45 commercial potato varieties to identify natural genetic variation linked to key quality traits, providing insights that will inform both future gene editing and conventional breeding strategies across the sector.

Recognising the need for public engagement and communication, the project included a dissemination event and contributions to Defra's regulatory working group, helping to raise awareness and inform early discussions about the role of precision breeding in UK agriculture.

The project has helped lay the foundations for further innovation, with plans to complete development of edited Maris Piper lines and begin field trials – thereby moving the UK closer to the commercialisation of gene-edited potatoes that deliver benefits in quality, sustainability, and consumer satisfaction.

Yield improvement through synthetic biology for a palm oil alternative from fermentation

Project lead: Sun Bear Biofuture Ltd

Project partner: The Biorenewables Development Centre Ltd

Funded amount: £186,471

Palm oil is everywhere. It is in food, cosmetics and biofuels, including 50% of our supermarket products. It is unique and highly popular in the vegetable oil market both for consumer taste, and cooking versatility – as well as being a high-yielding crop. However, palm oil is also one of the biggest carbon emitters, due to loss of tropical rainforest and peatland to make way for plantations. It contributes over 500 million tonnes of CO2e, around 1% of global emissions, from 19 million hectares of tropical land. It has also caused significant habitat loss for animal species including the orangutan and sun bear.

In response to these issues and in line with net zero commitments, recognising that 20% of UK emissions stem from agriculture and the food supply chain means these emissions must be tackled and replaced with more sustainable alternative products.

Sun Bear Biofuture is using synthetic biology and precision fermentation to make an alternative to palm oil. Building on previous projects to develop yeast modification capabilities, this project focuses on optimising a naturally oil-producing yeast strain to produce oil from food waste quickly and efficiently. The process saves four kilograms of CO_2 and 2,000m^2 of land for every kilogram of palm oil – a saving in both cases of 80%. Work took place with the RLA Lab at Imperial College London to optimise the strain's ability to produce fats quickly and efficiently.

Feedstock costs are prohibitively expensive for scaling fermentation processes in fats, and maximising lipid yield is vital in order to have the greatest environmental impact. This project will enable a sustainable palm oil alternative to be produced domestically at scale in the UK, looking to create jobs in biotechnology and food production and reversing a substantial trade deficit.

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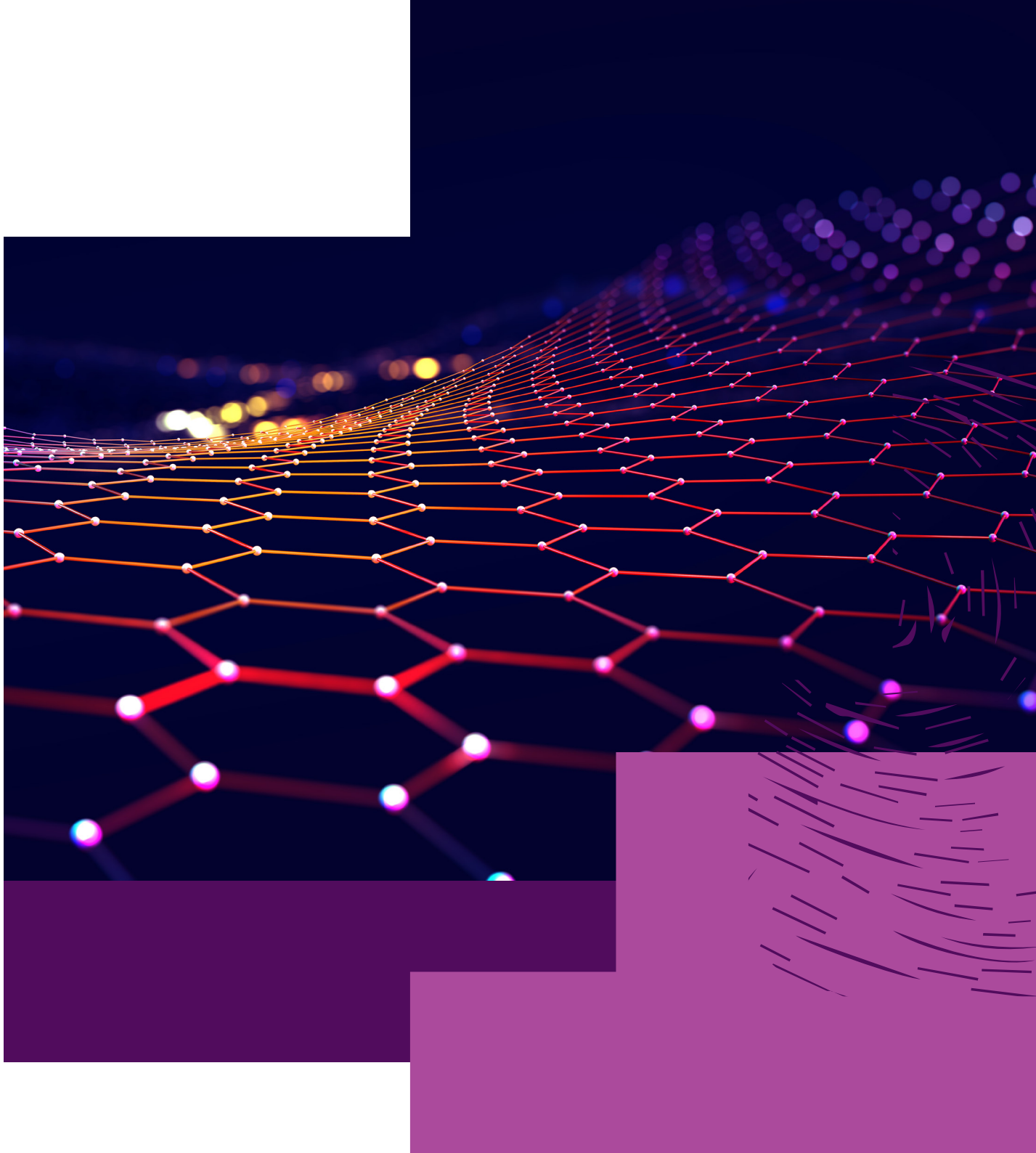

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