Technology Strategy Board
Driving Innovation

Results of competition:
Sustainable high-value chemical manufacture through industrial biotechnology 2 - Technical Feasibility

Total available funding for this competition was £1m from the Technology Strategy Board.

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
A.W Jenkinson Forest Products (lead) Bangor University Momentive Speciality Chemicals UK Limited	High-value chemicals from Sitka spruce bark	£181,584	127,990
Project description (provided by applicants)			
The proposed project will investigate the production of a value chain of products, including precursors used in the production of resins and adhesives for the construction industry, from underutilised UK ligno-cellulosic residues. The use of innovative mechanical pre-processing and enzyme mediated, aqueous fractionation of these residues in the proposed project will be used to upgrade these materials, specifically to produce fractions rich key target molecules as feedstocks for industry.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Aesica Pharmaceuticals Ltd (lead) Biocatalysts Limited Charnwood Technical Consulting Limited CatSci Limited	Dynamic Kinetic Resolution for the Improved Manufacture of an Active Pharmaceutical Ingredient	£195,054	141,150

Project description (provided by applicants)

A consortium comprising of Aesica Pharmaceuticals, Biocatalysts Ltd, CatScI Ltd and Charnwood Technical Consulting has been established as part of the Sustainable High-Value Chemical Manufacture through Industrial Biotechnology (IB) 2 competition from the Technology Strategy Board.

The key goal of the project is to identify novel IB routes to an active pharmaceutical ingredient (API) that is currently manufactured through traditional chemical manufacturing techniques. The new technology has the potential to significantly reduce manufacturing costs whilst concomitantly allowing an increased output of the API with less manufacturing equipment. Additionally, this will have the added benefits of generating a more sustainable process as it will be more energy efficient and less reliant on hydrocarbon based technologies. A successful project will allow the consortium to compete with manufacture in low-cost economies and help ensure that production of this critical API continues in the United Kingdom.

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Chirotech Technology Limited (lead) C-Tech Innovation Limited	Utilisation of Electrodialysis membranes for the recovery of amino acids from enzymatic reaction mixtures-(EDAM).	£191,263	135,624
Project description (provided by applicants)			
The purpose of the EDAM project is to test the feasibility of combining two well established technologies in order to develop an innovative process for the production and isolation of amino acids. Biocatalysis is a well established technology in the chemical and pharmaceutical industries, allowing the conversion of an amino acid precursor into a target amino acid using 1 or 2 enzymes. Electrodialysis membranes have been used for many years in the water purification industry, however wider applications of this technology remain under utilised. We propose to utilise a two enzyme reaction system to facilitate the production of amino acids. Subsequent application of a direct current electric field to the reaction mixture will then lead to electromigration of the charged amino acid species across an ion exchange membrane and product purification.			

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Matox Technologies Ltd (lead) University of Bath	LIGNATE-LIGNIN based epoxy resins from waste by-products.	£179,958	154,315
Project description (provided by applicants)			
Lignin is an inexpensive biopolymer derived from ligno-cellulosic biomass that has great potential as a biorenewable resource for materials applications, with over 1.1 million metric tonnes currently isolated annually from the pulping processes with the main use are a dispersant applications (~67.5%) and binder/adhesive applications (~32.5%). Presently, lignin is a low value material, with almost all lignin being burned (~50 million tonnes) to generate energy. This is due to it being is a non-heterogeneous polymer that lacks a defined primary structure which contains multiple functional groups. This structure renders it insoluble in many commonly employed industrial solvents which means it is difficult to selectively functionalise to prepare advanced polymeric materials with defined structure and function. LIGNATE will build upon recently developed patented surfactant based technology for the conversion of commercially available lignin into a reactive 'epoxy'-lignin-based polymer that can potentially be derivatised with a range of 'guest' molecules to afford lignin-based materials with controlled properties.			

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Pennog Limited (lead) Aberystwyth University Bangor Biocomposites Centre Biocatalysts Limited SRUC Seagarden	An innovative bio-refinery integration: Chitin production from crab shell waste.	£160,493	125,030
Project description (provided by applicants)			
This innovative project will integrate food industry waste with biorefining of a readily available non-food feedstock to overcome barriers for the production of high value chemicals with implications for the environment and rural economy. It will develop a process for the co-production of organic acid and chitin by co-fermenting the crab waste in combination with plant biomass using a microorganism which produces an organic acid resulting in solubilisation of protein and minerals and consequent buffering of the medium for an optimal fermentation. Protein degrading enzymes will be included for co-removal of proteins. Released minerals will reduce costs by enhancing production of the organic acids in the fermenting medium. The purified chitin will be assessed for its potential use as an agricultural bio-stimulant and as a raw material for producing both water treatment and personal and health care products. Economic models will be developed to determine the suitability of establishing full-scale biorefineries in rural communities within the UK and will take into account the value of co-products including organic acids and protein.			

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Plaxica Limited	No / Low Solvent Producton of D-Lactic Acid	£174,745	131,059
Project description (provided by applicants)			
Polylactic acid (PLA) is the most successful synthetic bioplastic, yet market penetration is hindered by its high cost and relatively poor performance in comparison to polymers derived from petrochemicals. Plaxica is developing a low cost route to improved PLA products with the necessary physical properties to allow them to be competitive with existing commodity polymers. These high performance materials require the large scale production of D-lactic acid, and this project focuses on improving current technology by aiming to completely eliminate (or at least, to greatly reduce) the use of organic petrochemical-derived solvents in Plaxica's existing Optipure process.			

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Protein Technologies Limited (lead) Arrayjet Limited	Multifunctional Bioinks	£194,416	145,812
Project description (provided by applicants)			
In 1949, Woodland and Silver filed US Patent #2,612,994 entitled "Article Classification Through the Medium of Identifying Patterns". The barcode had been born. The objective of this project is to employ Industrial Biotechnology to develop novel bioinks that will take the Identifying Pattern to the next level of technological utility. These inks will similarly be scanned by means of a simple, light-emitting device, however, by virtue of their biological composition will be able to provide the reader not just with existing 'static' information such as country of origin, but a new level of 'dynamic' information such as time elapsed since manufacture and the temperature ranges to which the product has been exposed. The applicants have already identified the requisite biocomponents to this end, and, in this project, will examine the feasibility of employing fermentation technology to create a new class of high-value chemicals based upon them. What is innovative about this project is that hitherto it has not been possible for the Identifying Pattern to impart information after it has been printed; bioinks will allow it to continue to generate information along the full length of the supply chain.			

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Puridify (lead) Prozomix Limited	High-flowrate nanofibre biocatlysis	£114,362	85,771
Project description (provided by applicants)			
This project seeks to apply a novel nanofibre material to industrial biocatalysis for the first time. The goal being to reduce the costs and environmental impact compared to traditional chemical synthesis. The results of the project will be a global product delivering revenues to two UK based companies who will re-invest the proceeds in research and development here in the UK.			