



BIOMANUFACTURING

A GoBio Bioeconomy Opportunity Report

Report Aims:

1. Define biomanufacturing, its processes and products
2. Outline challenges, opportunities and trends associated with biomanufacturing
3. Map researchers and businesses associated with this opportunity in Norfolk and Suffolk
4. List available sources of funding and other support

WWW.GOBIO.UK

WWW.INNOVATIONNEWANGLIA.COM

WWW.HETHELINNOVATION.COM



About Innovation New Anglia

Innovation New Anglia is an innovation-led business support programme operating throughout Norfolk & Suffolk. Through a range of tools such as online support, a collaborative learning platform, innovation grants & emerging sector networks, the program aims to help entrepreneurs & researchers' start-up businesses, and for SMEs to harness their innovation potential.

For more information on the project please visit: www.innovationnewanglia.com

About ERDF

The Innovation New Anglia programme is part financed by the England European Regional Development Fund, as part of the European Structural and Investment Funds Growth Programme 2014-2020. The Department for Communities and Local Government is the Managing Authority for ERDF. Established by the European Union, ERDF funds help local areas stimulate their economic development by investing in projects which will support innovation, business, create jobs and local community regeneration.

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We welcome feedback on the issues raised by this study and comments should be sent to: ahunter@hethelinnovation.com

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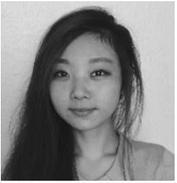
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In his position at Innovation New Anglia Aaron works with bioeconomy organisations across private and public sectors to develop new products and services and otherwise improve their capacity for innovation.



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BIOECONOMY DEVELOPMENT ASSOCIATE

Melissa graduated in 2015 with a BSc in Medical Biochemistry from the University of Leicester. Since then, she has worked at Carbosynth Ltd, a carbohydrate, nucleoside and fine chemicals specialist company, and is now taking her PhD in the Department of Chemistry at UEA.

Through her internship position at Hethel innovation, Melissa has worked closely with Aaron to develop resources that will support the development of our regional bioeconomy.

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What is biomanufacturing?

BIOMANUFACTURING REFERS TO ANY TYPE OF MANUFACTURING THAT USES EITHER NATURAL OR SYNTHETIC BIOLOGY SYSTEMS TO PRODUCE DESIRABLE MATERIALS. THESE SYSTEMS INCLUDE INDIVIDUAL CELLS, MICROBES, PLANTS AND ANIMALS, AND WITH MODERN TOOLS THEY PROMISE TO PROVIDE AN EVEN MORE DIVERSE RANGE OF PRODUCTS.

As new technology platforms such as high-throughput sequencing, genome editing and synthetic biology become more accessible, this century could see a proliferation of new modes of bio-based manufacturing.

Some of the popular products of biomanufacturing include:



BIOFUELS AND BIOENERGY

Biofuels are fuels derived from organic biomass, including products such as bioethanol, biodiesel and biogas. These fuels can be obtained from plant matter, as well as more recent 'third-generation' biofuels which are sourced from microalgae.



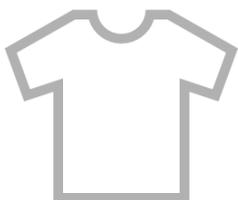
INDUSTRIAL BIOCHEMICALS

Beyond fuel chemicals, a range of bio-derived chemical products can be made, for example platform chemicals which support a number of industries; biosurfactants, which can be used in home and personal care product manufacturing; and in the food and drink industry in areas such as ingredients and supplements.



BIOPHARMACEUTICALS

At the higher ranges of value and complexity are biopharmaceutical products, which can be used to treat disease. The production of complex biologic drugs is now being enabled by improvements to cellular biomanufacturing platforms, which promise to treat new diseases more effectively and specifically.



BIOMATERIALS

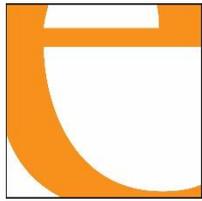
Of course, biomanufacturing platforms such as trees, cows and sheep have been in use for millennia, to produce biomaterials such as timber, leather and wool. New approaches promise greater scalability with fewer animal welfare and environmental concerns: for example the production of spider silk threads in engineered yeast.

Biomanufacturing process stages

Although the range of biomanufacturing products is extremely diverse, there is a common set of stages in the modern biomanufacturing process:

ORGANISM SELECTION / ENGINEERING

There are an increasing number of different production systems available for biomanufacturing; these include **microbial** systems such as bacteria, microalgae and yeast; **cellular** systems such as mammalian and plant cell lines optimised for bioproduction; **multicellular** systems such as whole plants and animals; and **cell-free** systems made up of the enzymes or other components of a bioproduction pathway, without the rest of the cell.



evolva

These systems have different advantages and disadvantages, and the best system to use will depend on the desired end product: for example, well-understood and fast-growing systems like yeast are used for the production of many chemicals, for example by Swiss bioengineering company **Evolva**, who uses yeast to make food, ingredients and health products. However, more complex products such as biologics often require more process stages and so cell lines or whole plants and animals are often more appropriate.

Advances in metabolic engineering technologies and associated software platforms are also enabling a new industry to develop around organism engineering and improvement; businesses such as **Ginkgo Bioworks** and **Zymergen** in the US and **Synthace** in the UK all provide tools to help create organisms with improved or brand-new metabolic pathways.

GROWTH AND PRODUCTION

With single-celled production systems, organism growth is often carried out in a **bioreactor**. Bioreactors come in several types (Figure 1) depending on the type of organism, but all are designed to control and influence the growth of the organism to maximise production, varying parameters such as temperature, pH, oxygen and availability of growth substrate such as sugars. Photosynthetic systems such as algae are grown in photobioreactors, which also modulate the amount of available light.

Larger organisms such as plants and animals can be grown in the conventional way, but consideration must be given to regulatory restrictions in the case of transgenic animals and particularly plants.

Once the systems reach an appropriate stage in growth, production of the desired materials can begin; this either happens naturally or can be induced by placing the organism in certain conditions. It is notable that cell-free systems, by contrast, do not require this stage, as they are ready to produce immediately.

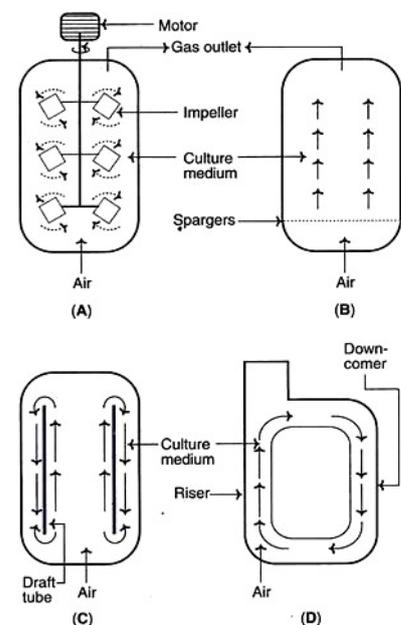


FIGURE 1. COMMON TYPES OF BIOREACTOR, INCLUDING CONTINUOUS STIRRED (A), BUBBLE COLUMN (B), INTERNAL-LOOP AIRLIFT (C) AND EXTERNAL-LOOP AIRLIFT (D).

DOWNSTREAM PROCESSING

Once the organism has created the desired product, the next stages are recovery of the product and then any downstream processing to prepare that product for sale. It has been identified as a bottleneck in many advanced biomanufacturing processes, particularly in the production of therapeutic compounds which require a high level of purification¹.

As downstream processing can account for more than 85% of total production costs in a biomanufacturing process², this must be addressed if biomanufacturing industry as a whole is to become cost-competitive with other conventional chemical manufacturing processes.

Downstream processing of **multicellular systems** usually involves age-old processes such as crop harvesting, distillation or (in the case of animals) milking, shearing or bloodletting! In **cell-based systems**, by contrast, downstream processing often involves centrifugation of biomass and chromatographic separation before the product is purified and formulated using further biological or chemical processes.

Algae-based systems are particularly difficult to recover product from since algae is small and a similar density to water; solutions such as membrane harvesting and sedimentation centrifugation have been developed to address this³.

¹ **EvoBioTalent** (2016) The Future of Biomanufacturing. [LINK](#) accessed 03 February 2018

² **Lye et al.** (2009) Shrinking the Costs of Bioprocess Development. [LINK](#) accessed 03 February 2018

³ **Zhang et al.** (2014) Progress and Perspectives of Large Scale Algae Biomass Harvesting: A Case Study at the ATP Testbed. [LINK](#) accessed 03 February 2014.

Challenges, opportunities and trends

Increasing interest and investment in biomanufacturing systems is being driven by a number of global and national challenges, opportunities and trends:

Global

A SUSTAINABLE FUTURE

Although major global efforts to transition industries away from petrochemical-based sources, 80% of global energy is still obtained from fossil fuels. A rapidly developing world also presents challenges for environmental management beyond the effects of greenhouse gases. The variety and overall amount of chemicals produced worldwide is going to continue growing rapidly (Figure 2; CIEL 2013), and the sales to emerging economies raises the risk of spillages and other incidents.

Pressure is continually growing to find ways of preventing and mitigating the fallout from the global appetite for chemicals; global industrial biotechnology markets have accordingly been projected to grow from £150bn in 2009 to £360bn in 2025⁴.

DIGITISATION, AUTOMATION AND MODELLING

Like many industries today, biomanufacturing has begun to capture the benefits of digitisation. New and innovative biotechnologies involved in genomics, synthetic biology and bioengineering are opening up the world of big data analytics, AI and smart computing technologies in a biological context. Combined with DNA sequencing and gene editing technologies these are allowing synthetic biologists to program cells at will, and dedicated tools allow for metabolic engineering that leads to the development of previously unimaginable products⁵.

Furthermore, bioreactor automation in process monitoring, analytics and new computational capabilities have allowed for better real-time feedback for large-scale processes, improving biomass propagation and optimising metabolic activity.

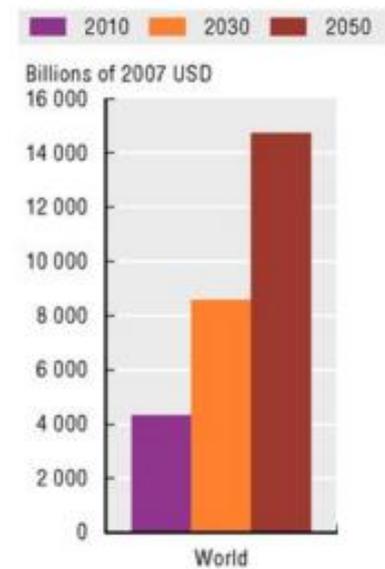


FIGURE 2. WORLD CHEMICAL PRODUCTION, 2010-2050. SOURCE: OECD (2012)

⁴ **HM Government** (2009) Maximising UK Opportunities from Industrial Biotechnology in a Low Carbon Economy. [LINK](#) accessed 03 February 2018

⁵ **Bioprocess International** (2017) The Era of Digital Biomanufacturing. [LINK](#) accessed 03 February 2018.

PRESSURE ON DOWNSTREAM PROCESSING

Continuous downstream purification was identified as the number 1 area end-users want equipment suppliers to focus on in the Bioplan Associates Annual Report⁶, a highly regarded industry periodical. As upstream biotechnology technologies have continued to improve, downstream processes have in many cases failed to keep up.

New advances in areas like purification promise to resolve these issues, with technologies such as continuous chromatography (pictured) and acoustic separation delivering improvements to many downstream processes.



⁶ **Bioprocess Online** (2017) Biopharmaceutical Trends – Opportunities for the New Year. [LINK](#) accessed 03 February 2018.

National

PUBLIC VIEWS ON INDUSTRIAL BIOTECHNOLOGY

In the UK, life science technologies and discoveries have frequently suffered from bad public relations, from the MMR vaccine to GM foods. As an emerging field, biomanufacturing and industrial biotechnology specialists must engage the public in a dialogue about the science, particularly regarding synthetic biology: the BBSRC in 2010 found that while members of the public were enthusiastic about the possibilities of synthetic biology, there were fears about controlling the field to prevent misuse, as well as questions regarding who was driving the development of the technology⁷.

UK RENEWABLES MILESTONES

Since the introduction of the 2009 EU Renewable Energy Directive, the UK has made progress in terms of renewable energy sources: in 2005, just 1% of the UK's energy came from renewable sources, but this had increased to 15% by 2013 of which biofuels supplied around a third⁸.

The majority of this improvement came from biomass electricity from wood pellet incineration as it was cheap to convert conventional coal burning refineries to burn biomass; significant amounts were also attributed to landfill gas and waste incineration.

On 07 June 2017, National Grid announced that renewable energy set a record high for energy generation as wind, hydro, solar and biomass combined to produce just over 50% of the UK's energy demands⁹.

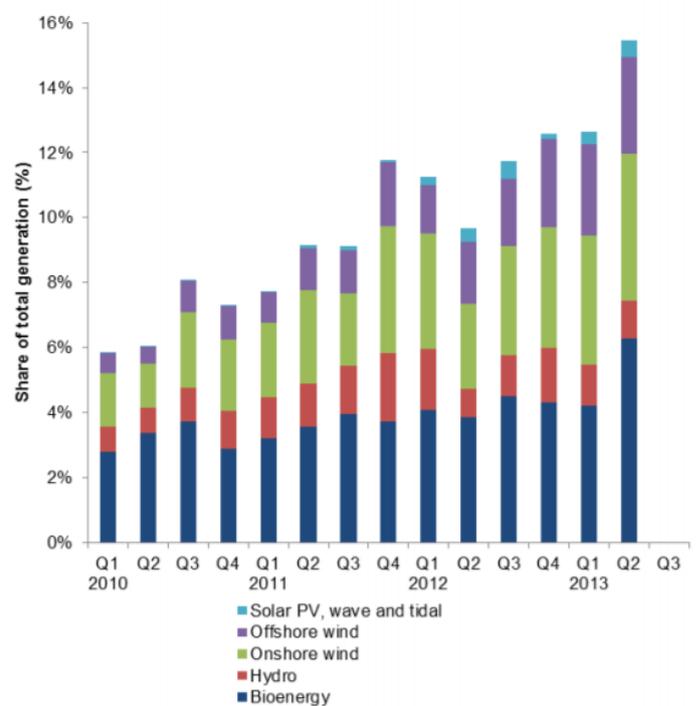


FIGURE 3. RENEWABLE ENERGY SHARE BY SOURCE.
SOURCE: DECC (2013)

⁷ BBSRC (2010) Synthetic Biology Dialogue. [LINK](#) accessed 03 February 2018.

⁸ Department of Energy & Climate Change (2013)

⁹ Bioenergy News (2017)

Regional case studies

PLANT-BASED BIOMANUFACTURING: LEAF EXPRESSION SYSTEMS



Recent developments in the region signal a move towards a more concerted, locally commercialised footing, such as the formation of **Leaf Expression Systems**, a contract R&D organisation making use of Hypertrans® plant biotechnology developed from John Innes Centre research. Leaf Systems' operations could support the development of bioproduction processes of a range of high-value proteins, such as vaccines.

Other potential applications of the technology piloted by Leaf Expression Systems include:

- Production of complex proteins, such as antibodies or enzymes for research applications.
- Production of antigens including virus-like particles for vaccine development or nanotechnology.
- Rapid prototyping and surge production in response to external circumstances.
- Metabolic pathway engineering to generate complex biochemicals that are difficult or impossible to synthesise chemically or are only found in rare species or trace amounts in nature.

BUILDING BIOMANUFACTURING CAPACITY: DNA FOUNDRY

As part of the UK Government's broader push to improve capacity for new biotechnologies, Earlham Institute at Norwich Research Park received funding to build upon their National Capability in Genomics by adding a state-of-the-art DNA Foundry to their technology portfolio.



The DNA Foundry at EI provides an efficient, automated DNA assembly platform that assembles synthetic DNA sequences which are then verified by the institutes world-class DNA sequencing capabilities.

Sector innovation map

Based on the challenges, opportunities and trends outlined above, we have created a sector innovation map (Figure 4). Going outwards from the centre of the map are the trends that are driving the sector; the areas of research that align with these trends; the potential products which can result from these areas of research; the businesses who could put these technologies into the world; and finally the markets and end users who would make use of the technologies.

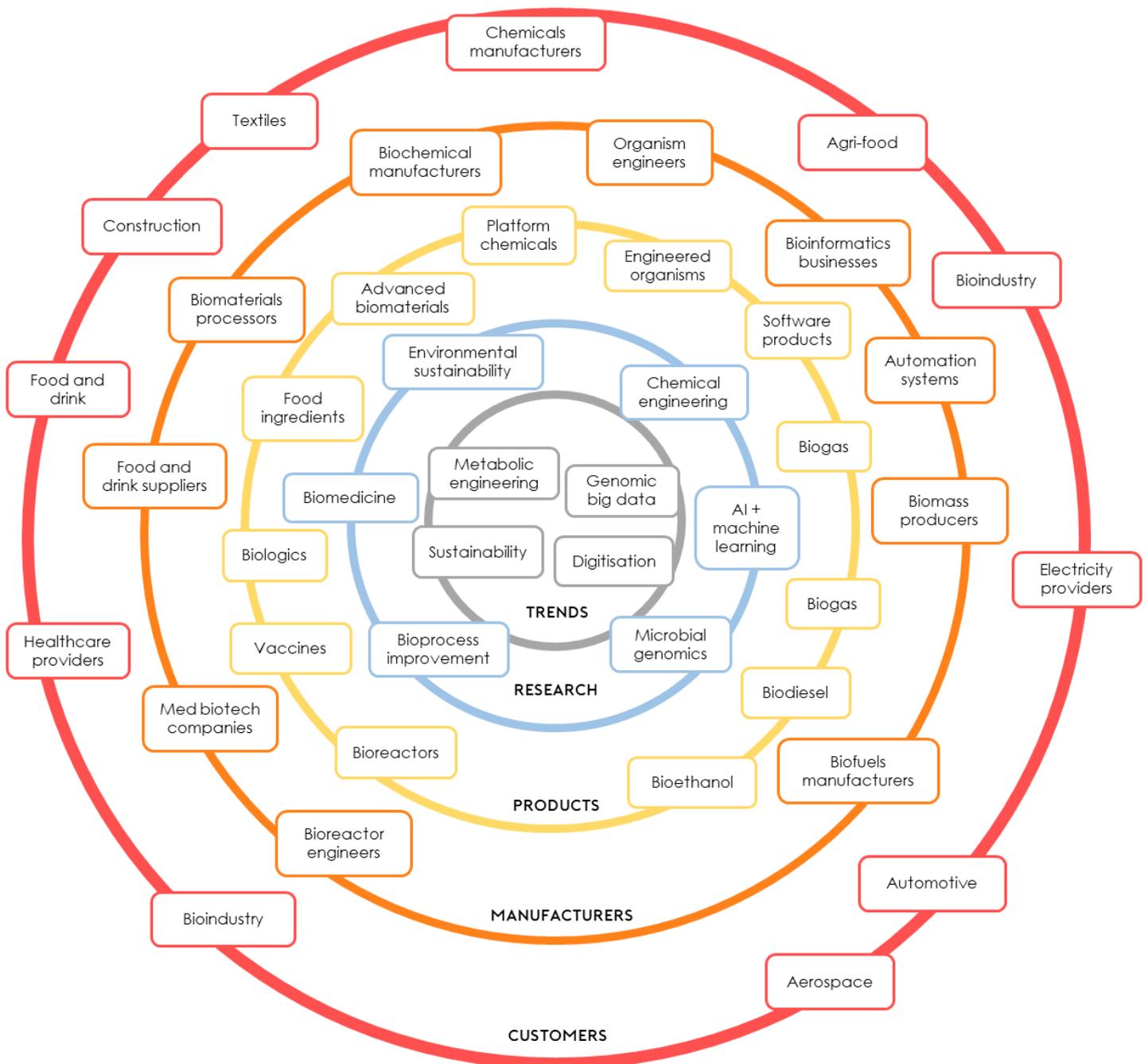


FIGURE 4. BIOMANUFACTURING OPPORTUNITY INNOVATION MAP, INCLUDING (OUTWARDS FROM CENTRE) KEY TRENDS, AREAS OF RESEARCH, PRODUCT AREAS, PRODUCING AND END-USER BUSINESSES.

Biomanufacturing in Norfolk, Suffolk and the wider East of England

Research Institutions

In Norfolk, Suffolk and the wider East of England there are a number of research groups and institutions that are leading the way in characterising new bioprocesses and developing new biomanufacturing platforms.

A selection of these research-focused organisations is shown geographically in Figure 5, and listed in more detail in Table 1. A more detailed list of some of the key researchers can be found in Appendix 1.

FIGURE 5. BIOMANUFACTURING RESEARCH INSTITUTIONS IN THE EAST OF ENGLAND.



KEY

1. John Innes Centre
2. Earlham Institute
3. University of East Anglia
4. University of Cambridge
5. University of Suffolk
6. Rothamsted Research

TABLE 1. BIOMANUFACTURING RESEARCH INSTITUTIONS IN THE EAST OF ENGLAND

 Earlham Institute	<p>The Earlham Institute (formerly known as The Genome Analysis Centre) applies computational science and biotechnology to understand living systems, including the genomic analysis of biomanufacturing organisms such as plants and microbes</p>
<p>http://earlham.ac.uk/</p>	
 John Innes Centre	<p>The John Innes Centre is the top-ranked research institute for plant science, and directly addresses BBSRC objectives in food security, human health and industrial biotechnology, including novel plant-based biomanufacturing platforms.</p>
<p>www.jic.ac.uk</p>	
 ROTHAMSTED RESEARCH	<p>Rothamsted Research is one of the oldest agricultural research institutions in the world and helps to address fundamental challenges about crop productivity, including the development of higher-value plant products.</p>
<p>www.rothamsted.ac.uk</p>	
 UNIVERSITY OF CAMBRIDGE	<p>The University of Cambridge hosts many world-leading researchers in areas related to the biomanufacturing, including a Department of Chemical Engineering and Biotechnology. Cambridge also benefits from a thriving start-up ecosystem.</p>
<p>http://www.cam.ac.uk/</p>	
 University of Suffolk	<p>University of Suffolk researchers investigate key areas of interest for high-value biomanufacturing, including regenerative medicine and stem cell biology.</p>
<p>https://www.uos.ac.uk/</p>	
 University of East Anglia	<p>The University of East Anglia plays home to many internationally recognised microbiologists who play a key role in understanding their metabolic processes, paving the way to exciting applications such as in the search for new antibiotics.</p>
<p>https://www.uea.ac.uk/health-sciences</p>	

Businesses

The businesses working in biomanufacturing and associated fields in Norfolk, Suffolk and the wider East of England include those operating in both plant and health-related microbiome activities.

A list of the companies associated with biomanufacturing in the East of England can be found in Appendix 2, and Figure 6 shows those companies on a map of the region.



FIGURE 6. BIOMANUFACTURING COMPANIES IN THE EAST OF ENGLAND.

Funding landscape

For new and established businesses working in med tech and med biotech, there are a range of regional, national and international funding schemes.

Private investment

Anglia Capital Group

<http://www.angliacapitalgroup.co.uk/home.php>

Formed in the Spring of 2014, Anglia Capital Group is a sister company to Cambridge Capital Group.

Anglia Capital Group is a leading group of business angel investors in Norfolk and Suffolk established to support spinouts, new ventures and growth businesses in exciting new fields such as the microbiome.

Cambridge Capital Group

<http://www.angliacapitalgroup.co.uk/pages/about.php>

Cambridge Capital Group is a leading business angel group of over 70 investors and private venture funds who have been investing in hi-tech businesses and backing technology start-ups in the region since 2001. Members have invested several million pounds in more than 40 live portfolio companies in the Cambridge technology cluster.

Foundation East

<http://www.foundationeast.org/>

Foundation East is a membership organisation that lends money to business owners across the counties of Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk, Suffolk and neighbouring areas, offering loans up to £100,000 to both start up and growing enterprises.

Private/Public Funding

British Business Bank

<http://british-business-bank.co.uk/>

The British Business Bank is a government-owned business development bank dedicated to making finance markets work better for smaller businesses. Through more than 80 partners the Bank offers a large range of loan and equity finance options for SMEs to grow and scale their businesses.

The FSE Group

<http://www.thefsegroup.com/finance-east>

Finance East is The FSE Group's regional funding organisation for the six counties of the East of England. Since establishment in 2009, it has supported over 100 companies through the Regional Growth Loan Scheme, agreeing more than £13m of loans and leveraging a further £27m of other finance into growth orientated SMEs. Companies supported have created nearly 450 new jobs in the region.

Key Features:

- Loan Amount: £50,000 – £200,000
- Business Location: East of England – Essex, Suffolk, Norfolk, Cambridgeshire, Bedfordshire, Hertfordshire
- Loan Term: Min 2 yrs; Max 5 yrs
- Turnover: Typically, minimum £100,000 per annum

Growing Business Fund

<http://www.newanglia.co.uk/growing-business-fund/>

The New Anglia Local Enterprise Partnership is calling for local businesses wanting to grow and create new jobs to apply for grants through the Growing Business Fund.

The Fund is made up of two programmes: a Small Grant Scheme, for grants between £5,000 and £25,000, and a larger scheme for grants between £25,000 and £500,000.

Public Funding

BBSRC Funding

<http://www.bbsrc.ac.uk/funding/filter/>

The Biotechnology and Biological Sciences Research Council regularly issues calls for funding for basic, translational and applied research in biosciences, including biomanufacturing.

EPSRC Funding

<https://www.epsrc.ac.uk/funding/>

The EPSRC is the main UK government funding body for research and training in the engineering and physical sciences space. Offering a variety of schemes including the Manufacturing the Future challenge theme, which invites investigator-led proposals which address key research challenges facing manufacturing in the UK today, with up to £3.2 million available.

European Investment Bank (EIB)

<http://www.eib.org/about/index.htm>

The EIB provides finance and expertise for sound and sustainable investment projects which contribute to furthering EU policy objectives. The EIB finances projects in most sectors. Eligible projects contribute to EU economic policy objectives:

- Development of a competitive, innovative and knowledge-based European economy
- Natural and urban environment schemes (water, waste, cleaner air, urban transport etc.)
- Development of small and medium sized enterprises

Horizon 2020

<https://ec.europa.eu/easme/en/horizons-2020-sme-instrument>

The European Commission is looking for small/medium businesses with global ambitions, actively investing in innovation and eager to grow.

The H2020 SME Instrument is designed to support those SMEs with an innovative technology or product who are seeking proof of marketability.

Innovate UK

<https://interact.innovateuk.org/>

Innovate UK provides funding for projects which are led by business. The principal objective of the support is to stimulate R&D and innovation activity, encouraging businesses to develop innovative products, processes and services with future commercial potential.

Nesta

<http://www.nesta.org.uk/>

Nesta is an innovation foundation, operating globally using their knowledge, networks, funding and skills to back new ideas and tackle challenges across various sectors, including education, healthcare, the arts, technology, and economic policies. They offer support through grant funding, direct investments, or challenge prizes, which includes the Longitude Prize; a £1m prize fund with a theme to solve antimicrobial resistance.

SBRI Healthcare

<http://sbrihealthcare.co.uk/>

The Small Business Research Initiative for Healthcare is an NHS England initiative which aims to promote UK economic growth whilst addressing unmet health needs, and enhancing the take up of known best practice. The organisation regularly posts competitions relating to specific health needs on their website, including areas such as medicines manufacturing.

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BBSRC (2010) Synthetic Biology Dialogue. [LINK](#) accessed 03 February 2018.

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HM Government (2009) Maximising UK Opportunities from Industrial Biotechnology in a Low Carbon Economy. [LINK](#) accessed 03 February 2018

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Zhang et al. (2014) Progress and Perspectives of Large Scale Algae Biomass Harvesting: A Case Study at the ATP Testbed. [LINK](#) accessed 03 February 2018.

Appendix 1. Biomanufacturing researchers in the East of England

Institution	Name	Research area
Earlham Institute	Nicola Patron	Industrial Biotechnology
	Daniel Swan	High-throughput Sequencing
	Anthony West	High-throughput Sequencing
John Innes Centre	Professor Anne Osbourn	High-value Products from Plants
	Professor Cathie Martin	Plant Bioactives
	Dr Penny Hundleby	Plant Bioengineering
	Dr Giulia Pergolizzi	Carbohydrate Biology
	Professor Rob Field	Carbohydrate Biology
	Prof Mervyn Bibb	Antibiotic Production
	Prof Barrie Wilkinson	Natural Microbial Products
Rothamsted Research	Dr Alex Pudney	Microbial Biocatalysts
University of East Anglia	Dr Ben Miller	Plant Synthetic Biology
	Dr Melissa Salmon	Metabolic Engineering
	Dr Amit Sachdeva	Non-natural Amino Acids
	Professor Sarah O'Connor	Plant Synthetic Biology
	Dr Tom Clarke	Microbial Biotechnology
	Dr Susan Matthews	Algae Products
	Dr Aram Saeed	Biopharmaceuticals
University of Cambridge	Sir David Baulcombe	Plant Synthetic Biology
	Professor Jim Haseloff	Plant Synthetic Biology
University of Suffolk	Dr Federica Masieri	Regenerative Medicine
	Cátia Marques	Stem Cell Biology
	Dr Aida Rajic	Regenerative Medicine

Appendix 2. Biomanufacturing businesses in the East of England

Name	Type of business	Postcode	website
A M A Waste Management	Waste Management	PE31 6BU	www.amawaste.co.uk/contact
Abbey Chemicals	Chemicals Distribution	NR31 0JJ	http://www.abbeychemicals.co.uk
Abcam plc	Antibody manufacturing	CB4 0FL	https://www.abcamplc.com
Abel energy	Bioenergy + CHP	IP25 6JB	https://www.abelenergy.co.uk
Abzena	Biopharmaceutical	CB22 3AT	http://www.abzena.com/
Ace Management Group Ltd	Waste Management	NR2 4LH	www.acementmanagementgroup.com
Advanced Water Treatment (UK) Ltd	Water Treatment	PE38 0QR	www.advancedwatertreatment.co.uk
Advion Biosciences	Sensors and Analytics	NR9 3DB	https://advion.com/
Airproducts	Biofuels	NR18 9JD	http://www.airproducts.co.uk/
Algaris	Bioreactor	SG1 2FX	http://aglaris.co.uk/
Alpha Chase Engineering Services Limited	Conveyor Systems	PE316TN	
Alpheco Limited	Waste Processing	IP12 4QR	www.alpheco.co.uk
Ambit Projects	Food Processing Equipment	PE30 4BF	www.ambitprojects.co.uk
Amgen	Biopharmaceutical	CB4 0WD	amgen.co.uk
Anglian Water	Water Treatment	PE34 4BZ	www.anglianwater.co.uk
Aquaflow WTS Ltd	Water Treatment	NR10 5AF	www.aquaflow.co.uk
Armutra Limited	Storage Tank Manufacturing	NR31 0RB	
Asynt Ltd	Laboratory Equipment	CB7 5RJ	www.asynt.com
Auto smart	Chemicals Manufacturing	NR6 6AY	www.autosmart.co.uk/
Baco-Compak Ltd	Waste Management	PE32 1EX	bacocompaktd.co.uk/
Bactevo	Biotechnology	CB1 3LB	http://www.bactevo.com
Bagnall and Morris	Waste Management	NR5 9JA	bagnallandmorris.com/
Baxter Healthcare	Medical Technologies	IP24 3SE	www.baxterhealthcare.co.uk/
Biomass Anglia	Biomass Energy	NR148FB	www.re-sourceenergy.co.uk
Biopharm Services	Biopharmaceutical	HP5 1SD	https://biopharmservices.com
Biosynergy	Biologic production	CB25 9QR	http://www.biosynergieurope.com/
Brewers barn	Home brewing	IP1 2ET	https://www.brewersbarn.co.uk/
Briar Chemicals	Chemical manufacturing	NR6 5AP	www.briarchemicals.com
British sugar	Biomass	PE33 9QG	www.britishsugar.co.uk
British Sugar Plc	Biomass Energy	PE33 9QG	www.britishsugar.co.uk
Bulk resources Ltd	Chemicals Manufacturing	NR30 1HP	www.chemtek.co.uk/
Burton's timber	Timber	NR16 2JZ	http://www.burtonstimber.co.uk
Cam Bioreactors Ltd	Bioreactors	CB9 8BD	
Cambio	Molecular biology supplier	CB23 8AR	https://www.cambio.co.uk
Cambridge Biopolymers	Biopolymers	CB22 4FB	www.cambridge-biopolymers.com

Cambridge Nanolitic Limited	Materials Manufacturer	CB9 8QU	www.nanolitic.com
Cantab Biopharmaceuticals Ltd	Bio-suppliers	CB4 0GN	N/A
Cebo UK Ltd	Chemicals Manufacturing	NR31 7RQ	www.cebo-uk.com/
Chemtek Ltd	Chemicals Distribution	NR33 1XH	www.chemtek.co.uk
Coda	Medical plastics manufacturing	NR28 0AJ	https://www.coda-plastics.co.uk/
Colorifix	synthetic biology	CB23 7ZW	http://www.colorifix.com/
Crescendo biologics	Transgenic platforms	CB22 3AT	https://www.crescendobiologics.com
East Coast Waste	Waste Management	NR31 0LS	http://www.eastcoastwaste.co.uk/index.php
Ecotechnilin	Biocomposites Manufacturer	PE28OEY	www.ecotechnilin.com
Edu-lab	Molecular biology supplier	PE38 9GA	http://www.edulab.com
Flo-Mech	Food Processing Equipment	PE2 5YA	www.flo-mech.com
Forbes Technologies Ltd	Storage Tank Manufacturing	PE33 9AS	www.forbesgroup.co.uk
Gamble Plant Norfolk	Waste Management	NR21 7DY	http://www.gambleplantnorfolk.co.uk/contact-us
Glazewing Waste Disposal Ltd	Waste Disposal	PE33 9RR	http://www.glazewing.co.uk/
Gurney Environmental Ltd	Water Treatment	PE30 2HZ	www.gurneyenvironmental.com
GW pharmaceuticals	Biopharmaceutical	CB24 9BZ	https://www.gwpharm.com
Hexeal Chemicals Ltd	Chemicals Manufacturing	NR13 6LJ	http://www.hexchem.co.uk/
Horizon bioscience	translational genomics	CB25 9TL	https://www.horizondiscovery.com
Humpty Dumpty Brewery	Brewery	NR13 3TZ	http://humptydumptybrewery.com/
i4innovation	Industrial Design	IP24 3RR	www.i4innovation.co.uk
Iceni Brewery Limited	Brewery	IP265HB	www.icenibrewery.co.uk
Industrial Water Jetting Systems	Waste Processing	IP30 9QS	www.iwjs.co.uk
Jackson ImmunoResearch Europe Ltd	ImmunoResearch supplier	CB8 7SY	https://jireurope.com/
Jays total waste management	Waste Management	NR5 0TH	http://www.jaystotalwaste.co.uk/
Jeyes	FMCG manufacturer	IP24 1HF	http://www.jeyes.com/en-gb
Kamstrup	Sensors and Analytics	CO10 7GB	www.kamstrup.com
Landfill Systems	Waste Processing	IP7 7HR	www.landfillsystems.co.uk
Leaf expression systems	contract manufacturing	NR4 7UJ	http://leafexpressionsystems.co.uk/
Lintott Control Systems	Automation and Control Systems	NR5 9JD	www.lintottcs.co.uk
M Gaze & Co Ltd	Waste Management	NR14 6NZ	www.localfast.co.uk/
Matrix Microscience Limited	Sensors and Analytics	CB8 7NY	
Melford Laboratories Ltd	Chemicals Manufacturing	IP7 7LE	www.melford.co.uk
Micro-Robotics Limited	Sensors and Analytics	CB5 8PY	www.microrobotics.co.uk
Munton ingredients	malt manufacturing	IP14 2AG	http://www.muntongiredients.com
Nestor Pharma	Pharmaceuticals	IP28 7AX	http://www.nestorpharma.com
Network waste solutions	Waste Management	PE30 2JG	www.networkwaste.co.uk/
Norwich Waste disposal	Waste Disposal	NR4 6LL	norwichwastedisposal.co.uk/
Ohana waste management	Waste Management	NR21 7PL	
Olympus Automation Limited	Food Processing Equipment	PE26YN	http://www.oalgroup.com/

OncoLytika	Biotech consultancy	CB6 3FL	https://www.oncolytika.com
P & S Automation Limited	Automation and Control Systems	CM9 8PN	www.pandsautomation.com
PBL Technology	Technology Commercialisation	NR4 7UH	www.pbltechnology.com
PCE Automation Limited	Automation and Control Systems	NR34 7TE	www.pce-automation.co.uk
PersephoneBio	Bioactives Manufacturing	NR7 0LB	persephonebio.co.uk/
Plant bioscience	Biotech Commercialisation	NR4 7UH	http://www.pbltechnology.com/
Polar Systems Ltd	Food Processing Equipment	PE30 4LA	www.polar-systems.co.uk
Porvair Plc	Filtration Equipment Manufacturing	PE30 2JN	www.porvair.com
Prometic	Bioseparations	CB23 7AJ	http://prometic.com
Prosynth	Chemical manufacturing	CO10 0BD	http://www.prosynth.com/
Risa Waste	Waste Management	NR9 5LY	www.risawaste.co.uk/
Romil Ltd	Chemicals Manufacturing	CB25 9QT	www.romil.com
Sensient	Colorant manufacturer	PE30 4LA	https://www.sensientindustrial.com/
Sensient Colors UK Ltd	Chemicals Manufacturing	PE30 4LA	www.sensient.com/colors
Sentec Limited	Sensors and Analytics	CB4 1YG	www.sentec.co.uk
Simple Solution Chemicals	Chemicals Manufacturing	NR20 3JF	
Snetterton Renewable Energy Plant	Biorefinery	NR16 2JZ	https://www.snettertonbiomass.com/
Southern group laboratory	culture reagent supplier	NN17 5JX	www.sglab.co.uk/
Swedish Biomimetics 3000	CRO / CMO	NR14 8FB	www.swedishbiomimetics3000.com
Swift Waste management	Waste Management	NR4 6BY	
Syne Qua Non	Biotechnology/biometrics	IP22 4GT	
Tebu bio	Cell line development	PE1 5TX	www.tebu-bio.com/
The Pall Ring Company	Mass Transfer Equipment Manufacturing	PE33 9AS	www.pallrings.co.uk
Tipple's Brewery	Brewery	NR13 6NS	www.tipplesbrewery.com
Winter's Brewery	Brewery	NR6 6QZ	www.wintersbrewery.com
Witton Chemical	Chemicals Manufacturing	IP28 7AT	www.witton.com
Xybella Limited	Automation and Control Systems	IP2 8SJ	www.xybella.com
Zembra	Biorefinery	NR29 3BP	http://zembragroup.com
A M A Waste Management	Waste Management	PE31 6BU	www.amawaste.co.uk/contact

Further reading

This report on Microbiome Products forms part of GoBio's Opportunity Report series. Covering the full extent of the biomass value chain, we're also looking to define the possible roles enabling disciplines such as engineering, biology and tech can play in realising the potential of our bioeconomy assets.

Other reports in the series include:



ADVANCED BIOMATERIALS



A BIOMASS INNOVATION CHAIN



BIOMEDICAL DIAGNOSTICS



DIGITAL HEALTH + CARE



MICROBIOME PRODUCTS