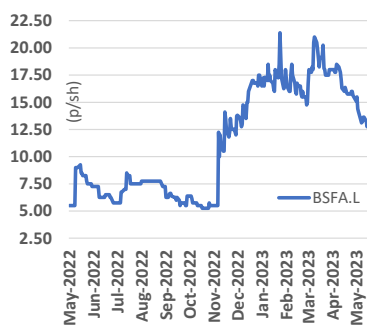


24th May 2023

Sector: Biotech

Market data

Markets	LSE Main Market
Ticker	BSFA
Price (p/sh)	12.75
12m High (p/sh)	21.4
12m Low (p/sh)	5.25
Ordinary shares (m)	103.5
Mkt Cap (£m)	12.9



Source: Alpha

Description

BSF Enterprise Plc is a biotech company focused on bringing the next generation of lab-grown tissues to the market. It aims to achieve this through an acquisition-led growth strategy and recently acquired the clinical and cellular agriculture company, 3D Bio Tissues.

www.bsferprise.com

Board & key management

Non-Exec Chairman	Min Yang
CEO & Director	Dr. Che Connon
Executive Director	Geoff Baker
NED	Dennis Ow
CFO	Graham Duncan

Corporate Broking

Damon Heath
 damon.heath@shardcapital.com
 020 7186 9952

Analyst

Joshua Higgins

BSF Enterprise Plc

Early Mover in UK Lab-grown Meat

BSF Enterprise Plc (BSF) is a biotechnology company focused on acquiring, combining, and building businesses in the lab-grown tissue space. It aims to achieve this through an acquisition-led growth strategy and has already acquired the tissue engineering and cellular agriculture company, 3D Bio Tissues. Our fair value equity valuation of £50m+ for this business is based on the funding activity of similar companies, as well as the superiority of the company's tech relative to these other players. The company has recently achieved a major milestone of producing the world's first known piece of 100% lab-grown meat, requiring zero scaffolding for mimicking taste and texture of traditional meat. The company have also successfully produced a 10 by 10cm piece of bio-engineered animal skin, providing a direct path for breaking into the lab-grown leather market. In a positive endorsement of the Group, early users of its flagship product City-Mix have reported that they are already using smaller amounts of expensive growth factors to conduct their cell culture, a US\$4 billion existing market which is expected to multiply alongside the rise in lab-grown meat.

- ▶ **Scarce investment opportunity.** BSF is one of only three listed companies in the world in the lab-grown Meat sector and the only one listed in the UK focused primarily on cell proliferation for both clinical use and human consumption.
- ▶ **Market Growth.** Lab-grown tissues have only recently begun to be used extensively beyond clinical cell growth. Like plant-based meat, the market for mass-produced cell culture is set to disrupt that of traditionally farmed meat, of which the latter has a current global market size of just under US\$1 trillion in annual revenue.
- ▶ **Animal welfare and the environment.** Historically, the market for lab-grown meat has used Foetal Bovine Serum (FBS), an expensive undefined growth media derived from calf foetuses. Through its innovation in cell media, BSF is targeting animal welfare issues much more directly than competitors, along with the environmental impacts of traditional farming.
- ▶ **Plant-based meat doesn't make the cut.** With the rise in living standards in developing countries, current forms of alternative proteins such as pea, soy, wheat, and mushrooms are not enough to significantly replace traditional meat farming. Sales growth for big plant-based players such as Beyond Meat in this market have curtailed since the initial boom in 2016-2018.
- ▶ **Scaffold-free meat.** Lab-grown meat and leather require both structure and cells for their texture, mouthfeel and strength. Synthetic or plant-based scaffolds are traditionally used for structure, but the resulting product may not feel natural. 3DBT's patented tissue templating process allows cells to create their own structure, producing a natural-feeling product.
- ▶ **Successful showcasing.** The company has now shown for the second time that using its patented tissue templating technology and growth media supplement, City-Mix, results in an output of 100% meat. This has resulted in significant interest from prospective clientele with the company now having reached its first distribution agreement and secured three new customers in May 2023 for City-Mix.
- ▶ **Demanding valuations.** Funding and valuations in lab-grown meat have exploded, with at least 3 unicorns already confirmed. We expect BSF to experience a similar uplift in the medium term as the company progresses through its patent applications and customer trials. The company appears to have market-leading tech, which we are confident will support its aim of reaching the highest tier of lab-grown meat valuations (£50m+) in the UK.
- ▶ **Valuation Range.** Our proposed fair value equity valuation is £50m+ which is mainly driven by funding activity for similar domestic companies. Based on the current market cap of the company, our valuation implies a minimum 262% upside. **We also believe BSF possesses a first-mover advantage, exhibiting superior technology and the potential to demand a valuation of at least £100m if it executes on its strategy of becoming a supplier to large international players.**
- ▶ **Extended runway to 2025.** The company recently (March 2023) raised £2.9m in further funding via an oversubscribed placing. This should carry the company forward by at least another 2 years, allowing them to focus on the sale and development of its products.

Disclaimer: Attention of readers is drawn to important disclaimers printed at the end of this document. *This document is published solely for information purposes and is not to be construed as a solicitation or an offer to buy or sell any securities, or related financial instruments. It does not constitute a personal recommendation as defined by the Financial Conduct Authority, nor does it take account of the particular investment objectives, financial situations or needs of individual investors.*

Contents

Investment Case	3
Introduction to BSF Enterprise Plc	5
Market Backdrop	7
Size of the meat market and its environmental impact	7
Plant-based meat doesn't make the cut	9
Lab-grown meat - the story and science	9
The lab-grown meat production process	10
Lab-grown Meat and Serum-Free Media markets	12
Serum-free media – potential market size	13
BSF Enterprise's business lines and development	14
Revenue model	14
Tissue Templating	14
Lab-grown Meat	14
Leather	16
Human Corneas	17
Serum-free media (SFM)	21
City-Mix customer base & value opportunity	22
Skincare	23
Valuation	24
Peer Analysis	24
Management and Board of Directors	29
Board of Directors	29
Risks	31
Summary Financials	33
FINANCIAL STATEMENTS	33
Income statement	33
Balance Sheet	34
Cash flow statement	35
Funding and Use of Proceeds	36
Glossary	37
Disclosures	38
Related Parties	38
Key shareholdings	38
Appendix	39
Potential size of the lab-grown Meat market	39
Corneal Transplantation – the donation process	40
Keratoprotheses – advantages and disadvantages	40
UK lab-grown meat companies and valuation methodology	41
BSF 2023 placing – Use of Proceeds	42
Disclaimer	43

Investment Case

- ▶ **Scarce investment opportunity.** BSF Enterprise Plc is a listed company that floated on the London Stock Exchange in October 2019. It is the only lab-grown meat company publicly listed in the UK. Its subsidiary, 3D Bio tissues, is a clinical and cellular agriculture company based in Newcastle. [BSF \(BSFA\) is trading at a £14m market cap \(May 2023\) and is now listed on the OTCQB Venture Market in the United States](#), providing a gateway to further capital. The other two listed lab-grown meat companies are Cult Food Science Corp (CULT) and Steakholder Foods Ltd (STKH). Both are exclusively focused on this space with the former a Canadian investment company holding a portfolio of equity holdings and debt instruments with various lab-grown meat companies, including an equity stake in BSF itself (purchased on October 30, 2021 – the Company acquired 1,356,852 common shares at a cost of \$170,639). The latter is an Israeli business listed on the NASDAQ, focused on 3D printing real steaks. With only 3 lab-grown meat companies publicly listed out of a possible 100+, this is a rare opportunity to gain exposure to this space.
- ▶ **Unprecedented milestones in lab-grown meat and leather.** Towards the end of 2022, 3DBT successfully produced a small fillet of 100% pork steak. This was repeated on a larger scale in January of this year. [No other company in the UK has successfully managed to grow and cook a piece of 100% meat without the use of artificial scaffolding](#). In May 2022, the company also successfully bio-engineered samples of animal skin tissue, measuring up to 10 by 10 cm in size and between 0.5 mm to 1 mm in thickness. These samples will be analysed to evaluate their potential as a substitute starting material for traditional leather products.
- ▶ **Opportunity to disrupt the trillion-dollar meat market.** The market for traditional meat is expected to grow to around US\$1.3tn by 2027, according to Statista. This is due to the rapid rise in living standards and population in developing parts of the world such as Africa and Asia. According to CULT Food Science Corp, a Canadian listed company focused on investment in cellular agriculture, the lab-grown meat market is expected to grow rapidly and account for over 22% of total meat consumption by 2035, with a total market value of approximately US\$352 billion annually. The market for cell media, a crucial component of lab-grown meat production, is also expected to grow and currently has a market value of around US\$4 billion.
- ▶ **Well diversified. BSF has multiple business streams with large market potential:** [lab-grown meat and leather](#) – real meat and leather grown from cells instead of traditional farming; [human corneas](#) – growing human corneas for transplants instead of using donors, where 3DBT is believed to be the first company in the world to grow/create a human cornea using no synthetic materials; [Serum-Free Media \(SFM\)](#) – cell growth media that is not derived from Foetal Bovine Serum, for which BSF provides a cell-boosting supplement; and a [lipopeptide etsyl \(Etsyl™\)](#) product for skincare, a peptide-based ingredient that has been shown to increase collagen production in human skin cells for skincare. BSF is currently tapping into the Asian skincare market using this product.
- ▶ **International companies achieving billion-dollar valuations.** Clean meat investment has exploded, with money raised in 2021 at US\$1.38bn, accounting for over 70% of hitherto investment. Today there are well over 100 active companies in the space globally, with at least 3 unicorns confirmed.
- ▶ **Board and management expertise.** BSF's management team has extensive experience in growing SMEs, specifically in regenerative medicine, stem cell bioprocessing, and tissue engineering. Dr Che Connon, Executive Director of the company, is highly regarded in these sectors and has been decorated with awards as a pioneer in tissue regeneration, having published over 100 papers and edited several books and received continuous research funding from the UK government since 2007. As a serial academic entrepreneur, Che has also successfully founded three bio-tech spinouts from Newcastle University, including Atelerix, a company providing an innovative solution for storing and transporting cells and tissues at room temperature; CellRev, a company devoted to revolutionizing the way cells are grown with its scalable bioprocessing technology; and 3DBT, the company now wholly owned by BSF. The board members also have significant experience in running public companies and

possess strong backgrounds in biomedicine and technology. They bring expertise in commercial and operational development, M&A, and sales. Che has been working on this tissue templating technology for 15 years.

- ▶ **Credible Partnerships.** 3DBT's has strong and collaborative relationships with several institutions in the life sciences space, including Newcastle University – a shareholder and birthplace of the company – and Qkine, a company specialising in high bioactivity growth factors which have the potential to replace and enhance the functionality of protein components in culture media.
- ▶ **Use of proceeds.** Alongside working capital, BSF has used its 2022 placing funds to increase 3DBT's lab production capacity and develop its City-Mix product, with the ability to produce 200 litres per month. The company has also filed national and international patent applications and produced a prototype of the UK's first full-scale lab-grown meat fillet. Furthermore, the £2.9m it has received via an oversubscribed placing in March 2023 will support the company in achieving further organic growth as it seeks to grow the business through its Go To Market strategy, as well as continuing to develop its trademark product, City-Mix.
- ▶ **Impediments to realisation of the investment case.** The company has just begun generating revenue, having secured its first client in early March 2022. As such, the future cash flows of the company are difficult to estimate, and it is currently uncertain as to when they will start generating recurring income. We should be able to have more clarity on their revenue generation in the coming months, with coverage on this to follow in subsequent updates.
- ▶ **Valuation range undemanding.** With our current proposed equity valuation over £50m+, mainly driven by funding activity for similar domestic businesses, our estimate implies a minimum 250%+ upside. BSF, ahead of the curve in technological prowess, enables customers to create 100% lab-grown meat and leather without plant-based scaffolds - [a distinctive edge that could boost its valuation to £100m or more should it partner with global heavyweights or traditional meat manufacturers](#). Contrasting with domestic rivals, who are mostly singularly focused on lab-grown meat or confined to a niche such as bioreactors or cell media, BSF has a much more diversified business, with applications for human corneas and skincare alongside lab-grown meat and leather. It is also the only publicly listed culture meat and leather company in the UK, thus one of the few ways to gain exposure to this market.

Introduction to BSF Enterprise Plc

BSF Enterprise Plc (LON: BSFA/BSF) is a biotechnology company focused on acquiring, combining, and building businesses in the lab-grown tissue space. The company's first and only acquisition so far is 3D Bio-Tissues (3DBT), a spin-out company from Newcastle University focused on pioneering UK-based clinical and cellular agriculture and unlocking the next generation of biotech solutions. This deal took place in May 2022 and was a £2.5m share-for-share transaction. As the sole owner of 3DBT, BSF in total employ 12 staff: 9 based in 3DBT's office in Newcastle-Upon-Tyne and 4 in BSF's head office in London, the latter of which are all C-suite executives whose profiles can be found in the Management and Board of Directors section further down in this report. The common party between the two is Dr. Che Connon, an Executive Director of BSF and the brains behind 3DBT's proprietary technology.

The company's primary focus is tissue growth using its trademark serum-free media product City-Mix. Serum is a critical component of the growth medium that provides essential nutrients for cell growth and multiplication. However, the most commonly used serum in cell culture today is Foetal Bovine Serum (FBS), an expensive and ethically questionable component due to its collection from foetal calf blood.

City-Mix is a newly innovated animal-free growth media supplement designed for companies using cell medias to replace FBS. Growth media is a critical part of cell culture, accounting for up to 80% of total operational costs. As such, it is imperative – particularly in the lab-grown meat industry – that the cost of this is kept to a minimum. What's more, with the movement away from FBS due to its extremely high price, we are also seeing potential animal cruelty slowly removed from the process.

City-Mix is a B2B product, meaning that its potential market will include existing meat producers and biotech firms performing cell culture for clinical use. The product facilitates muscle, fibroblast, and fat cell growth at rates comparable to traditional serum and has already received positive reception from potential customers in the industry.

Already, BSF has reached several milestones, including growing the world's first lab-grown cornea and the UK's first ever 100% meat fillet using City-Mix. The latter is particularly pivotal for the business given the explosion in lab-grown meat interest and is testament to how far ahead City-Mix is relative to other cell media products and the clean meat industry in general. By using this, a company can now produce real meat products without any artificial or plant-based scaffolds – a common component of current lab-grown meat products. [We know of no other company that has been able to achieve this so far](#), which is why we believe the company are well ahead of the curve with respect to product development.

BSF's products have received positive reception from over 60 potential customers in the industry. In May 2023, BSF reached both direct sales agreements and a distribution agreement for City-Mix. This included two with lab-grown meat companies and one with a biotech company. The initial revenues from these are expected to be relatively small at this early stage but should grow over time. Nevertheless, this is an important milestone for the Company and provides an excellent reference to the quality of its product. The company is also in talks with distributors in the UK, France, Canada, Australia, Switzerland, Italy, and the Netherlands, and has made positive progress in building its indirect sales network – which is preferable for the Biotech and Life Sciences markets – with the Company securing its first distribution partner, Abacus dx., a leading medical distributor owned by Diploma PLC. Furthermore, BSF have entered a contract with a leather company to test and develop lab-grown animal skin for leather production. The company is also progressing plans to roll out a web-based sales channel for City-Mix in the coming months to facilitate its direct sales model.

All operations of 3DBT lie under BSF, with the company reporting their financial results and corporate activity on a consolidated basis. Given that 3DBT is BSF's only investment so far, we use the names of both entities interchangeably when discussing the business as a whole and its strategy and technology.

3DBT, incorporated and registered in England and Wales, is a biotechnology spin out from Newcastle University founded by Professor Che Connors and Dr Ricardo Gouveia. 3DBT's research and product development is focused on producing biological tissue material, such as meat and skin, for clinical and consumer use. Additionally, specialised technology enables 3DBT to apply bio-focused manufacturing processes to generate complex structures such as corneas for the human eye.

BSF is split into 3 business segments: Tissue Templating, Serum-free media (SFM), and Skincare. A larger part of the business is intertwined, with its City-Mix solution being at the core of most of its innovations. Tissue Templating is responsible for activity in lab-grown meat, lab-grown leather, and human corneas, with the company's production of the former being a key driver of the company's success. Meanwhile, SFM deals with City-Mix itself, along with Skincare which involves the use of peptides to develop products such as face creams. This level of involvement in other industries sets BSF apart from other players in the market and provides the business with a significant level of diversification.

Since BSF's readmission on the London Stock Exchange, the 3D Bio-Tissues team has been busy expanding its production facility and progressing its patent applications. 3DBT's existing applications have now reached the national phase for a range of countries, and two new International Patent Applications have been filed for City-Mix™ relating to the application of the technology to produce skin, corneas, and meat.

Since the year-end, 3DBT has successfully produced a small 100% pork steak. This is a major step forward towards 3DBT's objective of producing what it believes to be the UK's first full-scale lab-grown meat fillet, which it expects to showcase in the coming months. 3DBT tested the product across a variety of attributes to ascertain their quality and similarity to conventional meat, with comprehensively positive results.

In its raw state the lab-grown steak exhibited structural integrity and resistance to breaking when being manipulated and compressed. Management believes the fillets resembled conventional farm grown meat to touch with similar consistency and elasticity and no obvious aroma.

BSF has the potential to take multiple routes with respect to its business model. One of the ways is licensing deals, whereby the company would sell the rights – most likely to an end manufacturer – to produce their products on an industrial scale. Further cash payments would be made for hitting certain milestones, followed by a royalty payment of all future product sold.

Another way would be a joint venture – similar to the first route but with the buyer contributing to IP development alongside 3DBT. Finally, there is direct selling, where the company would be responsible for all production and sell it straight to the customer.

Already the company have reached both direct sales agreements and a distribution agreement for City-Mix in May 2023, along with a contract to test and develop its lab-grown skin with a leather company. Several other potential customers are progressing to new business opportunities, as well as engagement with distributors in the UK, France, Canada, Australia, Switzerland, Italy and the Netherlands.

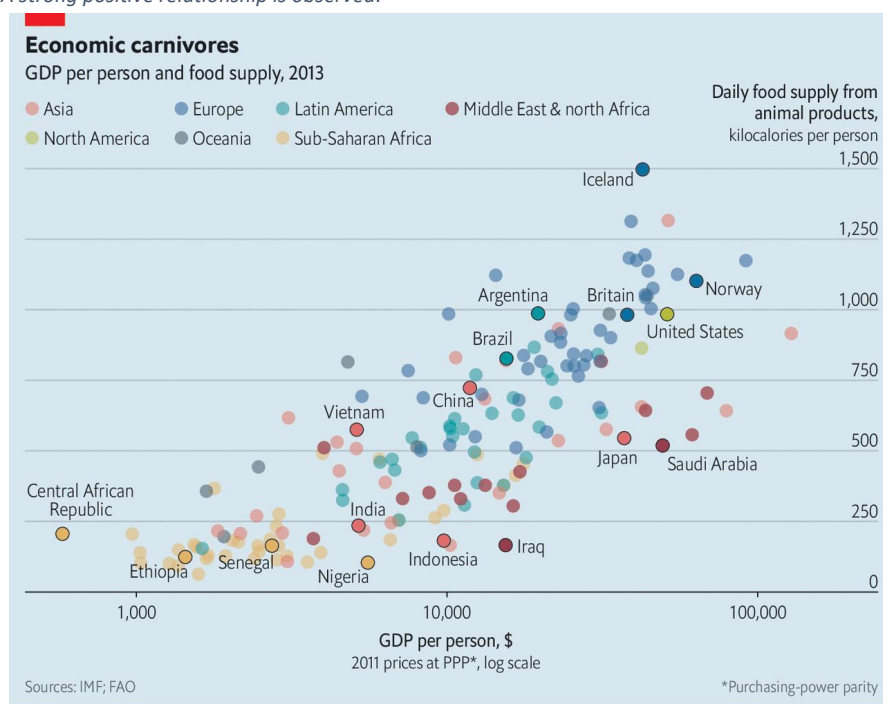
Market Backdrop

Size of the meat market and its environmental impact

As of 2021, the global meat market was worth just under US\$900bn annually, with meat generally considered a staple part of most rich-country diets. By 2027 this is expected to surge over 45% to around US\$1.3trn according to Statista, a platform dedicated to market and consumer data. This is mainly due to the rise in living standards and population in less economically developed parts of the world.

China is a case in point. Between 1960 and 2013, the population of China increased from around 654 million to 1.37 billion people, while GDP per capita went from US\$90 to just over US\$7000. During that same period, the average person in China went from eating 4kg of meat a year to 62kg, with half of the world’s pork now being consumed there today. Figure 1 shows the relationship between GDP and average meat consumption per capita for all countries, where a relatively strong positive correlation can be seen. In other words, when life gets better and people have more money in their pockets, people eat more meat.

Figure 1 – GDP per capita (PPP adjusted) plotted against daily food supply from animal products. A strong positive relationship is observed.



The Economist

Source: The Economist

Meanwhile, other regions are catching up. In Africa, where most of the population still eats little to no meat, economic growth will almost certainly result in higher meat consumption and is already the case in places like Senegal, where the number of chickens has increased from 24 million in 2000 to over 60 million today. Per-head consumption is not expected to rise drastically over the next 10 years in Africa, but with the population set to double to 2 billion people by the mid 2040s we will almost certainly see an overall rise.

Even India – a country renowned for its vegetarianism and where meat dishes are dubbed ‘non veg’ – is expected to eat much more meat in the coming years and is currently one of the world’s largest beef exporters.

Though widely believed to improve the lives and health of developing populations, greater meat consumption brings a plethora of issues for the planet, including a huge amount of greenhouse gases (GHGs), significant land use, deforestation, water pollution, zoonotic diseases, and biodiversity loss.

The FAO estimates that the meat and dairy industry currently produces around 7.1 billion tonnes of CO₂-equivalent GHGs every year, just under 15% of global emissions and more than all the driving and flying of every car, truck, and plane in the world. Two of the main causes of this is feed production, which requires energy and fertiliser, and enteric fermentation – essentially the belching of methane by farm animals which is released into the atmosphere. What's more, feeding these animals is incredibly inefficient. Cattle, for instance, consumes roughly 25 calories of food for every calorie of edible protein produced. This also causes mass deforestation, with around 45% of the world's total land being used for either livestock feed or grazing and almost four fifths of all agricultural land dedicated to feeding livestock with grains like soybean and corn.

And then there's disease. The trade and consumption of both wild and farmed animals has been identified as a risk factor for the emergence of zoonotic diseases – those that can be transmitted from animals to humans. Having just endured one of the largest pandemics in a century, with one of the main causes believed to be a wild animal sold at a food market, this topic is very much in the public eye. Attempts to curb the spread of disease using antibiotics does help, but there are still those such as methicillin-resistant *Staphylococcus aureus* (MRSA) and *Salmonella* which are antibiotic resistant.

Looking forward, there has been a dramatic movement towards veganism and vegetarianism in the rich world to address the risks above, along with an overall trend for cutting down on meat consumption. It is no secret that doing so results in a significant reduction in carbon footprint and puts the food industry on a better footing environmentally.

In fact, replacing traditional meat and animal products entirely would (BSF Enterprise):

- ▶ Eliminate the slaughter of 70 billion farm animals a year and the suffering of 47 billion factory farmed animals.
- ▶ Reduce GHGs emitted by meat production by 96%.
- ▶ Reduce land use for meat production by 99%, as well as water use by 96%.
- ▶ Significantly reduce the use of antibiotics – livestock agriculture is currently responsible for 66% of all antibiotics use.
- ▶ Halt deforestation.
- ▶ Reduce energy usage in meat production by up to 45%.

However, while veganism and vegetarianism have become popular solutions to address the environmental risks associated with meat production, they are not the only realistic options. It is also worth noting that the world will likely not eliminate the use of farmed meats altogether, and that meat consumption has continued to grow since 2010, with consumption in 2021 at just under 330 billion tons and per capita demand forecast to grow in every part of the world by 2031, according to Statista. As such, supplementing these alternatives with innovative solutions like lab-grown meat can help make significant strides towards a more sustainable food industry.

Plant-based meat doesn't make the cut

Plant-based meat is a type of food made from ingredients that mimic traditional meat in terms of taste, texture, and appearance. It is typically made from plant proteins such as pea, soy, and wheat, along with oils and other ingredients, and is marketed as a more sustainable and ethical alternative to traditional meat. The first commercially available products were veggie burgers and other meat alternatives, which began to appear on supermarket shelves in the 1980s and 1990s. However, it was not until the 2010s that plant-based meat began to gain significant traction, with the introduction of more realistic and meat-like products such as Beyond Meat and Impossible Foods' plant-based burgers, which have been advertised more directly towards meat-eaters and have helped popularize plant-based meat as a mainstream food option.

According to the Good Food Institute (GFI), a flagship non-profit organisation for promoting plant and cell-based alternatives to animal products, the global plant-based meat market grew by 18% from 2019 to 2020, reaching a value of US\$4.3 billion in 2020. This represents significant growth from a market value of US\$684 million in 2018. GFI also projects that the plant-based meat market will continue to grow in the coming years, with an expected value of US\$8.3 billion by 2025.

However, there is a growing consensus among the investment community that the momentum for plant-based meat has slowed down. For big players like Beyond Meat, revenue growth has flattened, with the company continuing to make significant losses and burn cash. This has resulted in the company's market cap plummeting from a US\$12.5 billion high in 2019 to just over US\$1.1bn now. What's more, some consumers are often put off by plant-based products as they are usually more expensive than real meat on a pound-for-pound basis, mainly due to plant-based meats not yet having the scale to reach cost parity and the existing meat industry already having a lot of governmental support in the form of farm subsidies. It's also worth mentioning that the current inflationary environment has not helped. And then there's quality: with currently no product out there perfectly replicating the taste and texture of meat, along with the question of how beneficial plant-based meat really is for people's health, we do not believe it can be relied on as the only alternative.

Needless to say, even with the rise of vegetarianism/veganism in Western parts of the world, there is still a huge elephant (or cow) in the room when it comes to the future of food. We have scoured the market for other emerging alternatives and, after much researching and conversation with industry experts, have found one in which we have confidence: lab-grown meat.

Lab-grown meat - the story and science

The idea of producing meat and dairy products without animal husbandry has been around for longer than most people might think. In early as 1894, lab-grown meat was pondered by a French chemistry professor named Pierre Eugene-Marcellin Berthelot, who claimed that by the beginning of the new millennium, humans would dine on meat grown from a lab rather than slaughter. In his 1897 science-fiction novel *Auf Zwei Planeten (Two Planets)*, Kurd Lasswitz, a then-renowned German writer and scientist, depicts a world in which Aliens from outer space bring a range of novelties to earth, including lab-grown meat.

Another advocate was none other than our own Winston Churchill. In a 1931 essay entitled "Fifty Years hence", Churchill predicts a point in time whereby animals would no longer be needed for mass-scale protein production. The former late prime minister prophesied that "we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium". Other nods to the idea include references in *Oryx and Crake* by Margaret Atwood, and even *Star Trek*.

Still, despite the opinion of a then-famed scientist and poet, renowned world leader, and references in pop fiction, the prospect of clean meat was not really taken seriously until the late 1990s/early 2000s. And even then, commercialisation was nothing more than a pipe dream.

Between 1999 and 2002, a team of scientists in the US funded by NASA embarked on producing the first known sample of lab-grown meat. Led by Morris Benjamin of Touro College in New York City, the group conducted an experiment whereby skeletal muscle cells from a goldfish were

isolated and bathed in a broth of nutrients. After a short passage of time, those cells began to multiply, paving way for the first piece of lab-grown meat ever.

Meanwhile, having spent years trying to achieve this same outcome, Dutch scientist Willem van Eelen obtained a patent from the European Union on a simple lab-grown meat production method in 1999, which has since been bought by US clean meat start up Hampton Creek.

In 2003, Dr. Ionat Zurr and Oron Catts, Australian biological artists, took the space one step further. Using the same method patented by Van Eelen, they decided to grow frog leg muscle and serve it up to diners in France, catching headlines and the attention of other enthusiasts.

By 2005, the first scientific article on lab-grown meat was published. Having received US\$2m from the Dutch government to accelerate this work, Jason Matheny, a Johns Hopkins University public health graduate, documented everything that had been done in this field so far and produced a blueprint for how a mass-produced lab-grown meat industry could work. 4 years later, a mere decade after Van Eelen filed the first ever patent in this space, this same study led to Mark Post, a Dutch physician and specialist of in-vitro tissue growth, to grow mouse muscles out of myosatellite cells anchored in a petri dish.

Later, having conducted many experiments and developed this process further, Post, along with his soon-to-be business partner Peter Verstrate, achieved the unthinkable. Backed by Sergey Brin, Cofounder of Google, the pair produced the world's first lab-grown beef burger in 2013, at a cost of US\$330,000. This was both cooked and eaten at a live conference in London, which would put them both on the map and lead to the cofounding of a company devoted to this new-born industry, Mosa Meats. The pair started the company in 2016, incidentally the same year The Good Food Institute was founded.

Since then, enthusiasm and investment in Clean Meat has flourished, and today there are well over 100 active companies in the space globally, all striving towards one common objective – disrupting the US\$1trn-a-year traditional farming industry. Watershed feats such as total legality granted to the sector in Singapore and the recent United States FDA 'no questions' pre-market approval with Upside Foods; the alignment and undercutting of production costs to that of slaughtered meat; and acceptance from the general population, all appear to be on the up. Funding has exploded, with money raised in 2021 at US\$1.38bn, accounting for over 70% of hitherto investment. What's more, flagship hubs like Silicon Valley, Maastricht and Tel Aviv have each produced at least one unicorn in the last few years alone.

All of this gives us confidence going forward and has led us to focus on the UK market more closely, given its spectacular track record with Life Sciences and with valuations still nowhere near the level of international counterparts.

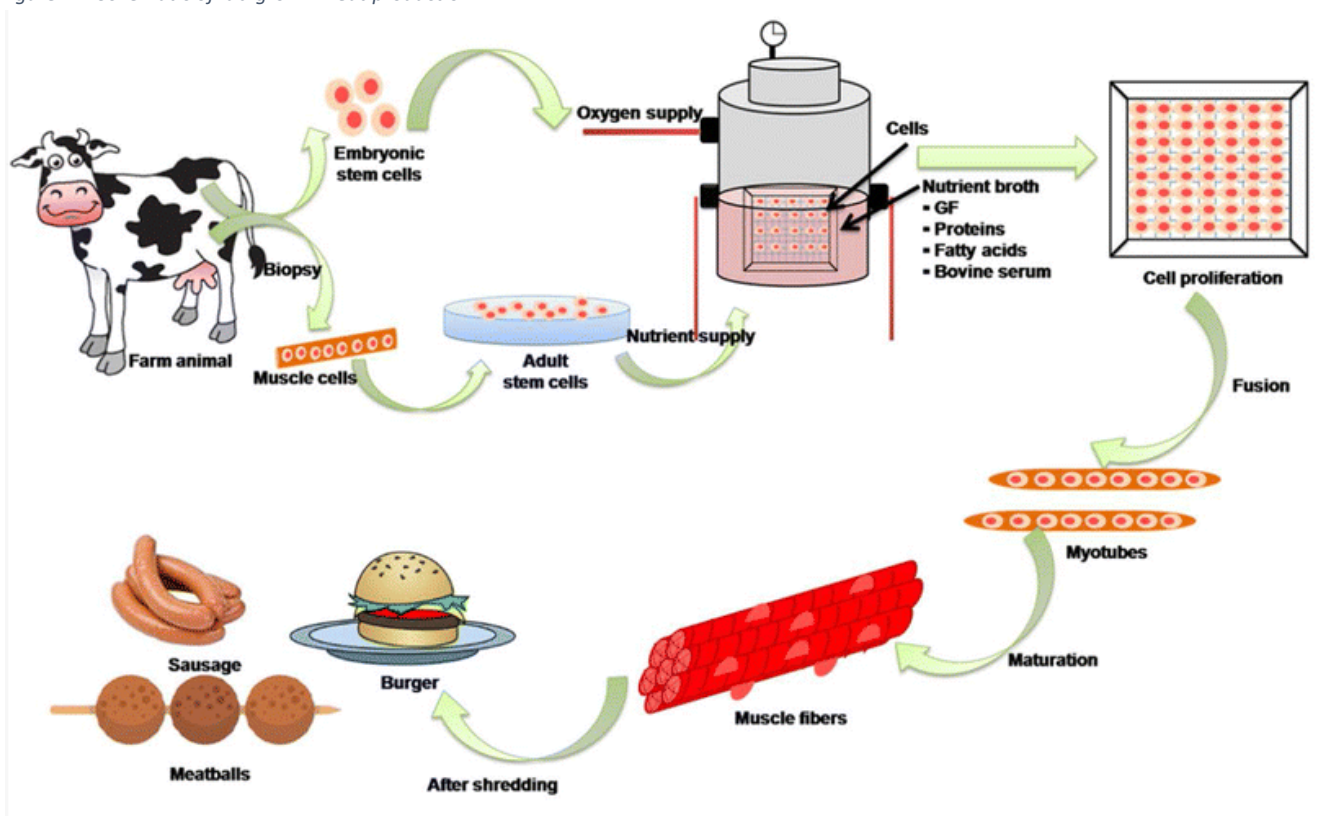
The lab-grown meat production process

1. The lab-grown meat production process is ultra-technical and does not follow just one route in terms of the apparatus and biomaterials used. However, using inspiration from Mark Post and Peter Vestrate's lab-grown burger back in 2013, we provide a high-level overview below:
2. Stem cells are extracted from an animal via a simple biopsy. This is normally carried out in a painless manner with the mammal under general anaesthetic. These cells are then banked.
3. They are then placed in a nutrient-rich medium/broth that feeds the cells and allows them to divide and grow in number. The medium typically consists of common nutrients that are needed for muscle/tissue growth, such as amino acids, vitamins, and proteins, to name a few. Historically, the medium used for this process has been Foetal Bovine Serum (FBS), an extremely expensive material widely considered to be unethical. BSF's trademark City-Mix is designed assist in replacing both this and other costly aspects of typical cell media and is discussed in further detail later.

4. After being submerged in the nutrient-rich broth, electrical currents are applied. This differentiates the cells into skeletal muscle, tissue, and fat that make up real meat. This is done via changes in the medium composition, which often goes hand in hand with cues from a (usually plant-based) scaffolding structure – the material used to house the cells and provide access to oxygen and nutrients. Myotubes and myofibers are also formed during this process, which extend in parallel through the length of a muscle.
5. Muscle fibres then form from this differentiation process, creating the fundamental building blocks for constructing the lab-grown product.
6. Once the real meat is fully formed, it is then harvested, prepared for the target product, and packaged appropriately.

Figure 2 below is a diagram of this process. Depending on the type of product used, this method is currently expected to take between 2-8 weeks.

Figure 2 - Schematic of lab-grown meat production



Source: ResearchGate

Additionally, there are many different types of stem cells which provide for a plethora of animal products. Cells from mammary glands, for instance, can be used for milk production, whilst liver cells can in practise be used to produce foie gras – one of the cruellest forms of traditional meat production.

Other than BSF, there are no known lab-grown meat companies producing meat without the use of plant-based or artificial scaffolds. While there are companies that specialize in scaffold-free cell culture technology, such as InSphero, N3d Biosciences and Synthecon, none of them are currently involved in the production or development of lab-grown meat. These companies provide 3D cell culture technology and related services for drug discovery, tissue engineering, and regenerative medicine applications only.

Lab-grown Meat and Serum-Free Media markets

As mentioned previously, the current size of the conventional meat and dairy market is worth just under a trillion dollars annually and is expected to grow in line with the rise in population and living standards, particularly for developing regions. As such, even capturing a small percentage of this is huge opportunity for the Clean Meat industry.

Cult Food Science (CULT) – a publicly-listed Canadian investment company specialising in lab-grown meat – estimates that lab-grown meat will account for around 22% of the total meat market by 2035, implying a total market value of US\$352 billion. See the Appendix for diagrams of the estimated size and decomposition of the global meat market in 2025 and 2035.

Of course, making this possible will require a colossal amount of biomaterial, including cell media – the nutrient broth used to feed the cells for lab-grown meat.

In 2021, the global cell culture media market was estimated to be worth just over US\$4 billion and is expected to rise to around US\$10 billion by 2030, according to a report by Grand View Research. Significant drivers of demand include R&D spending by pharmaceutical companies, cell-based vaccines, and the growth in stem cell research, particularly for lab-grown meat. A large part of the supply currently comes from Foetal Bovine Serum (FBS), with an estimated 500,000-800,000 litres produced a year. However, due to its source FBS has raised ethical concerns among scientific communities, including those from lab-grown meat who have largely pivoted towards plant-based alternatives.

Foetal Bovine Serum (FBS) – the coal of cell culture

Foetal Bovine Serum (FBS) is ubiquitously used in science, with millions of scientific studies having been conducted using this apparatus. Whilst also containing very few antibodies, it is rich in growth factors and can be used for multiplying almost any cell type, thus considered by many scientists to be the gold standard of growth media.

Despite this, FBS is expensive, wasteful, and widely considered unethical. Today, one litre of FBS costs between US\$300-\$400. Mark Post, Co-founder of Mosa Meat, estimates a staggering 50 litres of serum needed to produce a single burger, implying a minimum US\$20,000 input cost for just one patty.

What's more, even without cost complications involved, harvesting the serum involves extraction from the foetus of a pregnant bovine mammal, where growing just one kilogram of meat requires the input of an entire adult carcass. This clearly defeats the idea of removing animals from the production process and would be seen as a backwards move by an increasingly ethical consumer base.

Serum-Free Media as an FBS alternative

The initial challenge of weaning global science off this grisly material is coming up with an input that both undercuts and equates to FBS with respect to cost and performance, respectively. This requires an efficient production process, as well as a series of validation studies to show its equivalence – only then will it be widely accepted by the science community.

On a recent episode of the Lab-grown Meat and Future Food Podcast, Deniz Kent, PhD, CEO and Co-founder of Prolific Machines, a lab-grown meat company, recounts his entry into the space from cancer gene therapy, mentioning that in the beginning a lot of clean meat companies 'were just putting together meat cells using FBS so that they could reach their next funding round'. However, since then the industry has moved on. Mosa Meat used FBS for their showcase hamburger in 2013 and continued to do so right up until 2020. Since then, they have come up with a replacement which has lowered costs dramatically – the cost of its cell-based fat is now 1.5% of that in 2019, a whopping 88x reduction.

Other lab-grown meat companies have followed suit. Upside Foods – previously Memphis Meats – announced in December 2021 their use of animal component-free cell media which contains essentially the same nutrients as traditional animal growth feed. This also followed on from the

complete removal of FBS from their processes, which has resulted in the cost of their lab-grown chicken products now being comparable to premium animal-derived chicken and even less expensive than other traditional cuts of poultry. Additionally, they have made inroads into cutting down on the need for samples from live animals by adopting a process they call 'immortalisation', enabling them to draw from the same cell line for years.

Israel-based Future Meat Technologies has also produced an animal-free growth medium in partnership with Archer Daniels Midlands, an American multinational food processing and commodities company. Future Meat's method of finding the optimal media involves a robotic analytical system that scans through different proteins. Like Upside, they also have another innovation for cutting costs – a cleaning mechanism in its bioreactors, enabling growth media to be reused. Consequently, Future Meat now claims to have brought down the cost of its clean hamburgers by a factor of 28,000 and can produce a lab-grown chicken breast for as little as US\$7.50.

Serum-free media – potential market size

The use of cell media for lab-grown meat would pave way for a colossal jump in the size of the market, given its relatively small use currently. However, this means that the size of this market is unknown and difficult to estimate.

In addition, separating out the cell media market for lab-grown meat is difficult, given its relatively nascent use, and should be considered when observing our estimates below.

Using pork as a proxy – a key focus area for BSF thus far– we provide an example calculation below. This is based on expected market prices for cell media and current production levels of meat and is representative of what the market may look like in 2035.

Assumptions:

- ▶ Currently, the market price for cell media is around £200 per litre, much higher than the level needed to make mass-produced clean meat viable. Prices eventually need to be well below the £1 mark and so we assume this to be around £0.1
- ▶ 2021 figures from Statista suggest that global production of pork was around 110 million tonnes. This was mainly driven by China, who produced around 50 million.
- ▶ Note that we also align this with CULT's estimate earlier on and assume lab-grown pork to be 22% of the market by 2035, implying total production of 24.2 million tonnes.
- ▶ The total amount of pork produced by BSF earlier this year was 10 grams and took 1 litre of serum as input.

Potential market size calculation:

1. If BSF used 1 litre of media to produce 10 grams of pork in its showcase trial earlier this year, we can assume that it takes 0.1 litres of media to produce 1 gram of pork.
2. 24.2 million tonnes of pork were produced in 2021, which equals 24.2 trillion grams.
3. Using the 0.1 litres of media and multiplying this by the total pork produced in 2021, we end up with 2.42 trillion litres of pork media being needed in 2035.
4. Using the 2035 market price of £0.5, we then conclude that total addressable market from media could be as high as £240 billion.

Given the huge potential market and BSF's superior product and positioning as a supplement, we believe this is a fantastic opportunity for which the company is extremely well placed. Further down below, we draw on the above calculations to come up with a potential annual revenue figure for BSF from City-Mix, its main business line, in 10 years.

BSF Enterprise's business lines and development

Revenue model

Since BSF's listing on LSE's Main Market in May 2022, BSF has taken less than a year to reach its first commercial agreement with a customer, having executed the deal in March 2023. We therefore begin with an outline of how the company can generate revenue from any of its business lines. As mentioned in the introduction of this report, there are three routes which the company can take: a licensing deal, a joint venture, and/or direct sales.

BSF's licensing strategy would involve selling the rights to its technology to a manufacturer with the expressed interest in annual future royalties. BSF would retain ownership of its patented products but receive an initial payment and additional payments for hitting certain milestones, such as successful clinical trials. BSF would receive annual royalties for every sale made by the manufacturer. Alternatively, BSF could receive support from a joint venture – similar to a licensing deal, but with financial/operational support from the client – or sell its products directly to customers.

Tissue Templating

Tissue Templating is the area of the business which seeks to solve real-world problems using tissue growth technology. Applications of BSF's proprietary tech include the regrowth of human skin, for defects such as burns, surgery or disease; the manufacturing of real human corneas, to cater for uses in the corrective vision market; lab-grown meat, already discussed at length and an area of significant focus for the business; and lab-grown leather, a product which sits comfortably next to clean meat albeit with its own market altogether.

The fundamental building blocks of this business segment are combining scaffolds, cells, and biologically active molecules to create functional tissues. The company has a bottom-up approach which ranges from nanoscale to macro-scale accuracy of tissue construction and has a centralised manufacturing method, where hundreds of tissues can be used daily without the use of animal components.

Since its founding in 2018, the company has already made significant headway with this product line and seeks to commercialise this as soon as possible.

Lab-grown Meat

BSF's lab-grown Meat segment has already shown how far ahead of the market the company is with respect to its technology. As mentioned in the Serum-Free media (SFM) section earlier on, BSF has made significant progress in both its product development and proof of concept in the lab-grown meat space. In January 2023, BSF announced the successful growth of a small pork steak. This involved porcine cells being lab-grown in 3DBT's patented City-Mix to produce a 9x4x1cm fillet of pork with no plant-based scaffolding. This was a build-on from its breakthrough in November 2022 of being the first company in the UK to announce publicly the successful growth of a piece of 100% clean meat, where the company grew three smaller prototype fillets of lab-grown pork. The size of these were roughly 30mm in height and 15mm in diameter (smaller than a 5p piece), weighing five grams. These are major steps forward, with the company now aiming to use the results to produce another steak that will be publicly exhibited outside the lab setting and tasted by third parties.

This structure without scaffolding was achieved through culturing the fillets with City-Mix, their animal-free media supplement representing the next generation in growth agents.

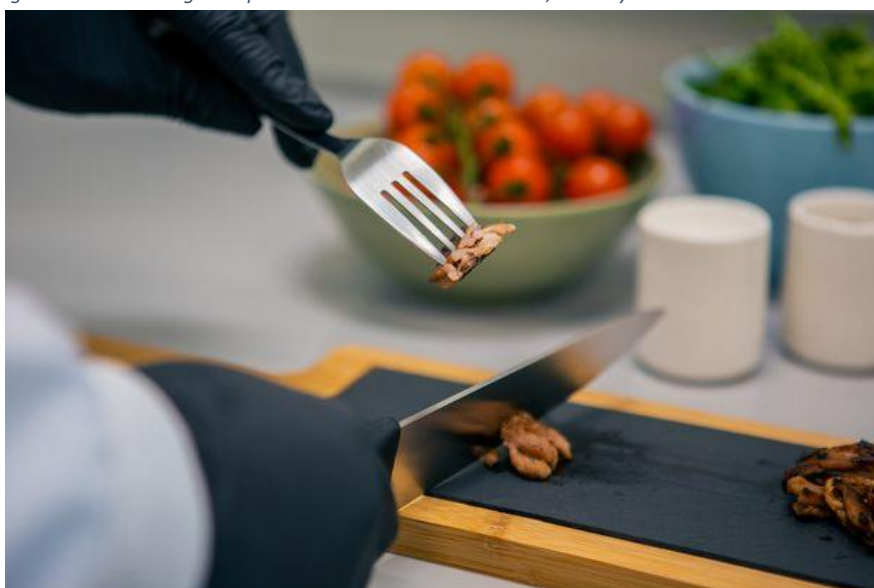
In its raw state the lab-grown steak exhibited structural integrity and resistance to breaking when being manipulated and compressed. The steak was then pan fried, cooking rapidly and throughout while maintaining integrity and shape and exhibiting only minimal shrinkage, as would be expected during the preparation of high-quality farm grown meat. It seared easily and showed heavy caramelisation with charring and crisping on the surface, with the aromas similar to those of barbecued meat. The company strongly believes the steak resembled conventional farm grown meat with similar consistency and elasticity and with no obvious aroma. This was reflected in the sensory perceptions experienced by those at BSF Enterprise upon trying the meat. Everything, from the smell and taste to the colour and texture, replicated meat.

These developments also imply a breakthrough into a pocket of the market that has thus far been extremely difficult to enter: steak. All clean meat that has been produced so far has been under-structured and/or – as mentioned previously – hybrid with plant-based additives. This means that the market is currently only suited to ground meat products, such as beef burgers and sausages.

Overall, these are believed to be the world’s first 100% lab-grown meat fillets to be produced, meaning that company are well ahead of the curve in terms of both texture and taste.

What’s more, because their trademark City-Mix was used in the media for this meat and did not use any scaffolding, this business segment has also showcased its Serum-Free media (SFM) product in the process.

Figure 3 – BSF’s lab-grown pork steak in their Newcastle lab, January 2023.



Source: Vegconomist/3D Bio-Tissues (3DBT)

In November 2022, 3DBT (BSF) agreed to partner with the growth factor company Qkine to help accelerate the creation of affordable lab-grown meat. Together, 3DBT and Qkine will work to optimise the effectiveness of animal-free cultures to reduce the dependence on other protein compounds, increase yields, and lower overall costs. This is expected to pave the way for advances in cellular agriculture in the UK and worldwide.

Qkine specialises in high bioactivity growth factors that have the potential to replace and enhance the functionality of protein components in culture media. An example of this is FGF2-G3, Qkine’s new tag-free form of the thermostable FGF-2 protein. This is an optimised version of the protein that does not degrade in culture media and is therefore tailored to regulated applications and industrial scale processes. This is a big step for both companies and puts them much closer to having a product that can be scaled at an industrial level. As mentioned earlier, the larger international players have both been investing time and resources into reducing waste and

readying the product for mass-scale production, and this partnership makes 3DBT very well positioned for this.

The collaboration will see 3DBT combine City-Mix with Qkine's growth-enabling protein engineering technology. Qkine's technology aids the growth of stem cell culture protocols while 3DBT's macromolecular crowding technology enhances the speed of development of protein components in culture media. Together these can help reduce the production time and costs for growing lab-grown meat, making it more accessible and affordable to a growing market that is centred on mass production.

This collaboration resulted in both companies winning one of four prestigious prizes at the 2022 EIT Food Venture Summit in November 2022. This was an event held in Lisbon and resulted in a cash prize of €100,000, which will be used to facilitate the work between the two companies, as well as direct support from EIT to fund the joint venture to commercialisation. This award was made in partnership with the European arm of The Good Food Institute – GFI Europe – and is indicative of this innovation being recognised for both its synergies and importance in the clean meat space.

Furthermore, this partnership is crucially important for 3DBT's product and positions them strongly as a potential supplier for the likes of Mosa Meat, Upside Foods, and other clean meat giants.

Leather

3DBT's leather segment is similar to lab-grown meat with respect to both the production method and its business purpose. It uses the same culturing process as the pork steaks produced in early 2023 and is an additional facet of the company's cultivate products. The output is full thickness skin, which is then formed into leather. This is of great significance as the leather industry is primarily driven by fashion, a multibillion-dollar business.

The leather industry is a global behemoth. The US exports around US\$3 billion in hide products each year from the 35 million cattle who end up in American slaughter plants. Globally, the market for leather is valued at more than US\$100 billion, with the leather goods market at over US\$250 billion and expected to be US\$400 billion by 2030, driven by an increasing number of High-Net-Worth Individuals (HNWIs) in places like China, coupled with the growing trend of designer & branded clothes in major markets, such as the U.S. and France.

Leather is essentially a by-product of traditional farming, with India and China being the two largest producers. Mainly derived from animal hides and skin, it is produced via a highly complex and multistep tanning process that converts hides into durable leather by using chemicals or plant-based tannins to stabilize the collagen fibres, ensuring resistance to decomposition and water damage.

Along with the environmental impacts of animal agribusiness, this process involves both high water consumption and water pollution. To create leather, animal skins – usually from cattle – must be soaked in a harsh lime to remove all the hair, fat and other undesirable content left over from the butchering process. They are then soaked in a vat of chromium, a caustic substance that is highly toxic. The chemicals used are often then dumped into local waterways, leaving both workers and children exposed and provoking health crises such as skin problems, respiratory illness, renal failure, and even blue baby syndrome.

It is therefore easy to see why leather alternatives such as vegan leather are preferable to original products. Demand for vegan substitutes has increased in recent years as a more sustainable alternative. Companies like Piñatex, for example, which produces leather-like material from pineapple leaf fibers, and MycoWorks, which uses mycelium, the root-like structure of mushrooms, to grow a leather-like material, have made significant inroads into the market and are now used worldwide by thousands of brands. However, most vegan leathers still consist of synthetic materials such as polyurethane (PU) or polyvinyl chloride (PVC), and while these are popular for vegan leather production due to their affordability and versatility, they still have significant environmental drawbacks and quality concerns. There is also the emerging use of

nanotechnology and 3D printing in the development of vegan leathers which is helping to improve their quality and performance, but this is still in very early stages of development.

We therefore believe that there is a significant gap to be filled by lab-grown leather. As well as environmental neutrality, this segment of the market is designed to perfectly replicate real leather and involves simply growing the leather itself without any slaughter or chemicals involved, shortening the process significantly and producing far less effluent.

Looking at the market dynamics, it has far less regulatory hurdles than lab-grown meat and lower barriers to entry given its already premium pricing and higher chance of consumer acceptance. This therefore means that it could hit the shelves of major retailers far quicker, presenting a significant opportunity for companies in this space.

BSF in particular is in a strong position given its progress with lab-grown tissues. In May 2022, the company successfully bio-engineered samples of animal skin tissue, using both its tissue templating technology and flagship growth agent City-Mix. These samples measured up to 10 by 10 cm in size and between 0.5 mm to 1 mm in thickness and have ultimately led to an agreement with a leather company to test and develop this lab-grown animal skin for leather production. As mentioned previously, the commercial model of this product will involve the company producing skin as input for the customer to then produce leather. The company is currently in talks with potential clients, with further updates to be provided in subsequent coverage.

Human Corneas

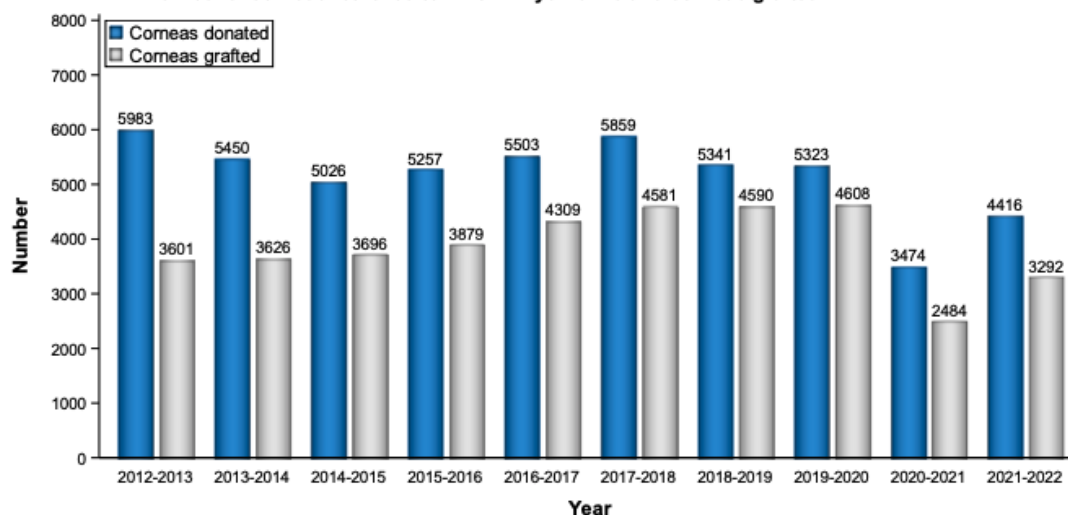
The company is working to solve the chronic supply-and-demand imbalance of human corneal transplants globally. Although there is a shortage for all organs in general, the issue is particularly acute for corneas as it is considered the world's most frequent type of transplantation.

The cornea is the outermost layer of the eye and plays an important role in focusing vision. Corneal transplantation (keratoplasty) restores visual function when corneal diseases – a leading cause of blindness – become too severe. For low-risk patients, keratoplasty is highly successful, but for those with high-risk indications such as recurrent or chronic inflammatory disorders, history of glaucoma and herpetic infections, or those with neovascularisation of the host bed, failure rates are much higher.

As of 2016, there were at least 12.7 million people globally awaiting a cornea transplant, with 185,000 transplants made annually, representing just 1 in 70 of demand being met. The waiting list is now believed to be at least 15 million. This has only been made worse by COVID-19 with donor and clinic availability having still not recovered in the UK (see Figure 4), meaning there is a wait time of at least several months.

Figure 4 - The number of human corneas donated against those grafted over time

Figure 10.1 Cornea programme in the UK, 1 April 2012 - 31 March 2022, Number of corneas retrieved to NHSBT Eye Banks and corneas grafted



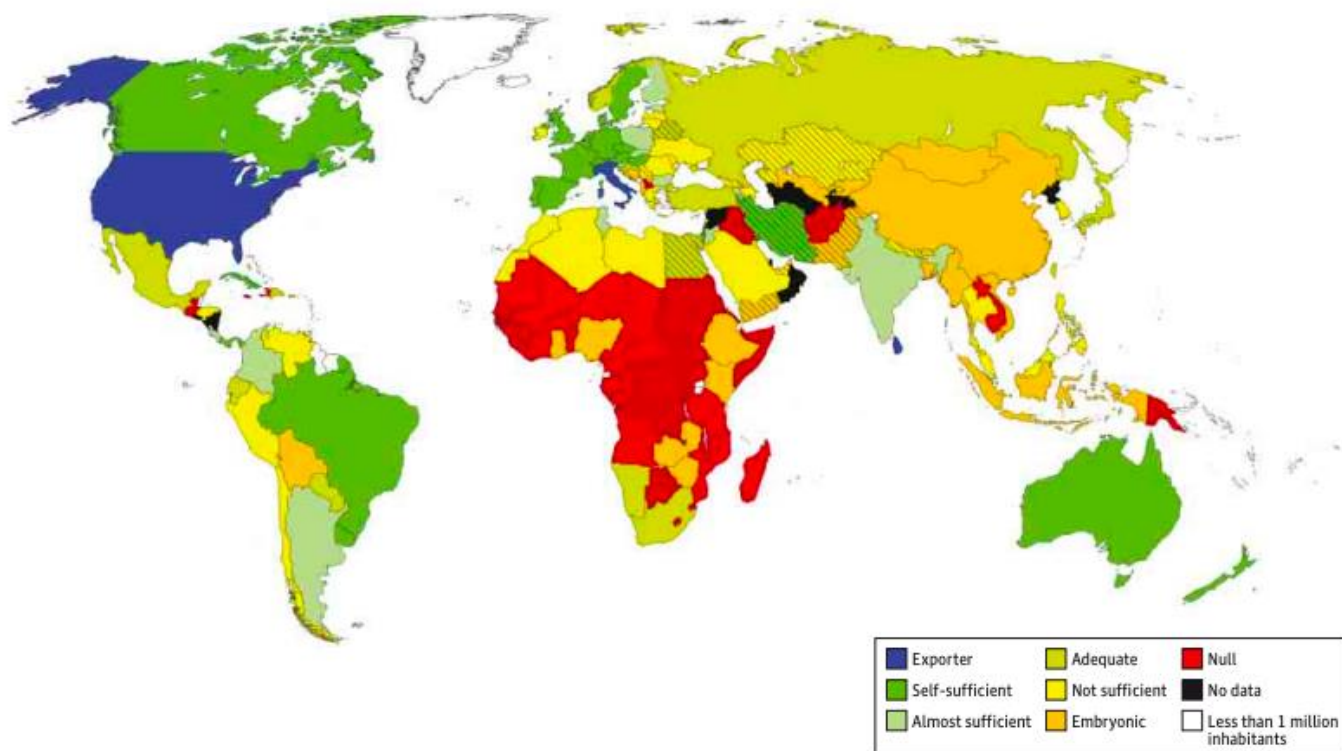
Source: NHS

One of the causes of the shortage is the lack of willingness to donate. On the NHS Organ Donor Register, 1 in 10 people have indicated that they do not wish to donate their corneas, making them the most rejected part of the body. Part of the reason for this is culture: people often view the eyes with more emotion and symbolism than other parts of the body.

Furthermore, the process of procuring corneas is extremely sensitive and time consuming. Using an extract from EyeWiki, we provide a high-level overview in the Appendix of how a cornea is obtained currently for transplantation.

Another contributing factor is limited healthcare infrastructure. Poorer countries with less developed healthcare systems usually have more severe shortages and must import from those with a surplus. See Figure 4 for a geographical representation. Again, cultural differences exacerbate this. Many Islamic countries for instance, rely heavily on imports partly because faith discourages Muslim people from donating. Japan also has had very low organ and tissue donation rates due to lack of knowledge about deceased organ donation, religious and cultural perspectives, and mistrust about the process.

Figure 5 - World map showing the supply and demand of corneal transplantation of 148 countries



Source: JAMA Ophthalmology

Methods such as selective replacement that involves using one cornea for multiple patients have been used to alleviate the problem. However, this naturally brings about strong ethical considerations and requires a more robust legal framework. As such, this cannot be wholly relied on for eliminating supply issues.

Manmade corneas (keratoplasty), such as the Boston Keratoprosthesis (KPro), have been developed as another potential solution. The KPro is made of acrylic plastic and is placed in the middle of a human donor cornea, secured to the eye with fine stitches. In cases where other corneal transplants have failed or where the eye is not severely inflamed, the KPro has shown good results. However, KPros are likely to extrude in cases of high inflammation or severe chemical burns, and there are post-transplant complications such as RPM formation and glaucoma. The KPro is also expensive and still requires a human corneal button for implantation. Refer to the Appendix for a table containing the advantages and disadvantages of keratoprotheses.

It is for these reasons that the field has turned to non-synthetic solutions such as 3D bioprinting. This is an additive manufacturing technology whereby cells are combined with a suitable biomaterial and deposited within micrometre precision, layer-by-layer, in order to generate tissue constructs for a variety of applications, including but not limited to tissue engineering (Mandrycky et al., 2016). By construction, this is not expected to involve any acrylic material at all, and as such removes the complications associated with current artificial corneas.

Prior to BSF's acquisition of 3DBT last year, the latter had already produced the world's first 3D printed human corneas back in 2018, with the goal of being to provide an unlimited supply in the future. Its current production process is below.

1. 3DBT's 'bio-ink' is derived from stem cells (human corneal stromal cells) from a healthy donor which is mixed with alginate and collagen.
2. This substance is then extruded around a premade scaffolding structure which mimics the shape of a real human cornea. This is done using the company's flagship tissue templating technology and means the shape will never be tarnished by human error and that this process can be done on an industrial scale.
3. The cells are left to grow on the scaffolding.
4. The cornea is banked and stored for clinical use.

As well as zero use of synthetic apparatus, the company can create 1000 corneas from just one donated cornea alone, meaning the donor material required is miniscule in comparison to a full donation of a cornea or the KPro. In addition, since the only involvement of a donor in this process is the appropriate stem cells, there is a clear pathway to a more efficient process that significantly increases supply and reduces wait times.

The size of this potential market is difficult to estimate as the cost of corneal transplantations vary hugely around the world. However, according to a report by Grand View Research published in 2021, the global corneal transplant market was valued at US\$613.8m in 2020. The report further estimates that the market will grow at a compound annual growth rate (CAGR) of 6.4% from 2021 to 2028. This is attributed to the increasing prevalence of corneal disorders, technological advancements, and the rising demand in emerging economies.

Given that the market is already constricted by supply, this means that – similar to the cell media industry – if 3D-printed corneas were to become a widely adopted alternative, the market size could increase significantly.

BSF already has interested parties looking to execute a deal. With its superior IP and dedicated team, the company is well positioned. The product is expected to hit the market in the next 3-5 years, with clinical trials expected to cost around £1m, for which the company is looking to fund half of this using grants. Updates on this business segment will be provided in further coverage.

Serum-free media (SFM)

As mentioned previously, BSF is split into 3 segments, all of which are mostly intertwined, with their SFM product being at the centre of a large part of their innovations.

BSF's SFM product is City-Mix, a supplemental material that is to be combined with animal-free growth media, the growth feed used to culture tissue, including muscle & fat cells for lab-grown meat and leather. This is a newly innovated formula that is food safe and designed to enhance the performance and yield of current xeno-free media, enabling companies to reduce costs when switching from Foetal Bovine Serum (FBS) and replacing other expensive growth factors. Growth media is a critical part of cell culture and tissue growth, accounting for around 80% of the manufacturing costs for lab-grown meat, making it imperative that this is kept to a minimum. As well as cost and ethics, lower batch-to-batch variation is another key benefit of City-Mix. Combining this with an animal-free media is expected to facilitate muscle, fibroblast, and fat cell growth at comparable rates to FBS.

In practice, this can be integrated with any existing media formulation and enables the user to use lower amounts of expensive growth factors, allowing them to reduce costs anywhere from 10x to 30x at the endpoint. Already the company has received extremely positive feedback from prospective clients, who have noticed that City-Mix has allowed them to reduce their use of albumin in their cell media, a costly growth factor. It also provides a greater result for cell growth, thus increasing the number of cells for the end user.

Throughout the growth cycle of the lab-grown meat industry, there has been a lot of pressure on companies to come up with a product quickly. This has meant a rush into manufacturing methods similar to plant-based meat which potentially compromised the quality of final products. For instance, many lab-grown meat companies are using plant-based scaffolds to mimic texture. The importance of this lies in the structure of tissues and how they grow – because tissues are not entirely made of cells and involve an extracellular matrix (ECM), adopting a plant-based scaffold results in a product that although contains animal cells, is still not 100% meat. Taking a chicken nugget as an example, this would mean having a plant-based nugget with embedded chicken cells.

As a result, a large quantity of lab-grown meat products out there are hybrid, rather than direct replacements to meat. There is therefore a danger that not much is being added to the alternative protein space, and that those who are only satisfied with full meat products are not going to make the switch. As such, the realisation of this in the market could be detrimental for lab-grown meat in the medium term.

The importance of a company being able to produce 100% meat also lies in the calibration with existing downstream processes of traditional meat producers compared to that of hybrid meat.

In 100% lab-grown meat production, the meat is produced entirely from animal cells and ECM that are grown in a lab setting. After the meat is harvested, they can then be processed into a final product that is similar to traditional meat, including cutting, grinding, and packaging. Additionally, because the meat is produced without any animal slaughter, there are no parts of the animal that need to be discarded or processed separately, also simplifying the process.

In contrast, hybrid lab-grown meat production involves combining animal cells with a plant-based scaffold to create a final product. If a traditional meat producer like Tyson Foods requires 100% meat as the final product, then the plant-based scaffolds may need to be removed during downstream processing. This could involve additional processing steps, such as washing, filtration, or separation, to remove the scaffold and purify the final product. Additionally, because the scaffold is composed of plant-based materials, it may introduce additional impurities or contaminants that need to be addressed during downstream processing.

While hybrid lab-grown meat production has the potential to reduce environmental impact and address ethical concerns alongside 100% lab-grown meat, the downstream processing steps required to create a high-quality final product may be more complex than for 100% lab-grown meat production. As with any emerging technology, further research and development are needed to optimize production processes and create a final product that is both sustainable and appealing to consumers.

Using City-Mix and its surrounding technology can create meat with both meat cells and the meat-based ECM. That is, by using BSF's growth media supplement and its tissue templating technology, 100% meat can be produced. This poses a huge opportunity for the company as it means little to no issues with feeding into the processes of a traditional meat producer. As mentioned previously, the performance of the supplement has now been showcased on two occasions which we explain in further detail in our analysis on their lab-grown Meat segment earlier on in this report. This is just one example of how far ahead BSF is in the market and shows that they are going to benefit not only from the rise in lab-grown meat, but also awareness of what makes a 100% meat product. To reiterate, we know of no other company that has achieved this milestone, making it a watershed achievement for the business.

It is also worth noting that the same dynamic exists for the company's leather segment – their 100% real skin product is likely to be a direct feedstock into the processes of traditional leather manufacturers. Meanwhile, this may not be the case for a hybrid product.

City-Mix customer base & value opportunity

City-Mix is a B2B product to be licensed and/or sold to lab-grown meat companies, traditional meat producers, and other biotechnology companies. As established earlier, the number of lab-grown meat players has already reached over 100 worldwide, providing scope for BSF to develop promising sales avenues. What's more, this product has already caught the attention of potential biotech firms.

Production wise, 3DBT more than doubled its lab capacity to 2,400 sq ft in September 2022. Management believes this provides the capacity to produce 200 litres per month of 3DBT's City-Mix (1000 litres once used in its diluted form). The lab facility will also enable 3DBT to produce additional lab-grown meat and leather to showcase to potential customers such as manufacturers, distributors and wholesalers that are looking to bring lab-grown meat and leather to the mass market. Its main customers are likely to be producers and retailers who may also seek a partnership. Already the company has reached out to around 60 potential customers, of which half have progressed to product trials and are looking to incorporate this into their processes. What's more, in May 2023 BSF reached both direct sales agreements and a distribution agreement for City-Mix. This included two with lab-grown meat companies and one with a biotech company. The initial revenues from these are expected to be relatively small at this early stage but should grow over time. Nevertheless, this is an important milestone for the Company and provides an excellent reference to the quality of its product. The company is also in talks with distributors in the UK, France, Canada, Australia, Switzerland, Italy, and the Netherlands, and has made positive progress in building its indirect sales network – which is preferable for the Biotech and Life Sciences markets – with the Company securing its first distribution partner, Abacus dx., a leading medical distributor owned by Diploma PLC. The company is also progressing plans to roll out a web-based sales channel for City-Mix in the coming months to facilitate its direct sales model.

Due to the early-stage nature of both the company and this segment, we have estimated a potential value opportunity for the company, rather than attempting to build a full-scale financial model. To do this, we have used the potential market size of media demand from the global pork market, as illustrated in the Serum-free media – potential market size section above. We then assume BSF take on a licensing deal with a manufacturer in this market and derive an estimate for the potential annual revenue for BSF. See below.

1. City-Mix accounting for 1% of the SFM market in 2035 would bring in a total annual revenue of approximately £2.4 billion (£240 billion x 1%) for the manufacturer.
2. If BSF enters a licensing deal at a 5% royalty rate, this would potentially give the company an annual revenue of £120 million (£2.4 billion x 5%).

It is worth noting that although these estimates represent a significant opportunity for the company from just a single business segment alone, they are heavily dependent on market prices and volume hitting required levels. Further estimates are to follow in subsequent coverage.

Skincare

BSF is also making inroads into the skincare market with its lipopeptide etsy (Etsyl™) product, a peptide-based ingredient that has been shown to increase collagen production in human skin cells. Collagen is an important protein that gives skin its elasticity and firmness, and as we age, our bodies produce less collagen, leading to the appearance of fine lines and wrinkles.

Lipopeptide etsy (LIPET) is commonly used in cosmetic skin creams to help reduce the appearance of aging and improve the overall health and appearance of the skin. Additionally, LIPET has been shown to have wound repair properties, making it useful in medical applications.

Notably, Etsyl™ is also a B2B product, which means that BSF Enterprise's clients will use the Etsyl™ to make their own skin and wound care products. The company has already secured a Material Transfer Agreement for the sale of up to 10kg of Etsyl™ to Natural Pharmaceuticals Australia, who are then going to sell it onto China. This suggests that there is demand for the product and that BSF Enterprise is making progress in bringing it to market, not least in a country with the largest aging population in the world.

Looking at the global skincare market as a whole, there is significant demand for skincare products, particularly those that target the signs of aging. The global skincare market was valued at approximately US\$135 billion in 2019 and is projected to continue to grow in the coming years. Factors driving this growth include increasing awareness of the importance of skincare, rising disposable incomes, and a growing aging population.

In this context, BSF Enterprise's focus on developing and marketing skincare products is well-aligned with current market trends. By leveraging the properties of LIPET, they have developed a unique ingredient that can be used in a variety of skincare and medical applications. With an estimated time to market of 6-12 months, they are well-positioned to take advantage of the growing demand for skincare products and become a key player in the global skincare market.

Peptides are short chains of amino acids that are similar to proteins but smaller in size. In recent years, peptides have become increasingly popular in skincare products due to their ability to target specific skin concerns and their overall skin-boosting benefits.

The use of peptides in skincare products is well-aligned with current market trends. Consumers are increasingly interested in personalized skincare solutions that target their specific skin concerns, and peptides offer a way to do just that. Furthermore, as consumers become more aware of the importance of preventative skincare, there is a growing demand for products that help to boost skin health and prevent signs of aging.

By incorporating peptides into their skincare products, BSF Enterprise is positioning themselves as a company that is at the forefront of skincare innovation. Peptides offer a unique way to address a variety of skin concerns and may help BSF Enterprise to differentiate themselves from other companies in the highly competitive skincare market. Furthermore, testing the product has resulted in positive results to date.

Valuation

Proposed equity valuation range:
£50m

Peer Analysis

As a company with nominal revenues, the use of earnings multiples and/or a DCF approach to value BSF is not appropriate and so will not be applied. Instead, our equity valuation range for the company mostly relies on the valuations of industry peers with similar business characteristics. Using fundraising activity over the last few years whilst also adjusting for different levels of business development and products, we arrive at a measure of where we believe the current valuation lies. In addition, given the dearth of publicly listed competitors, our analysis is focused mainly on private companies. The dataset used for this analysis consists of 2 publicly listed lab-grown Meat companies; 8 private companies in the UK lab-grown Meat landscape; and 5 major international players, whose markets are incidentally more developed than the UK.

Cult Food Science Corp & Steakholder Foods Ltd

Other than BSF, the only other publicly traded clean meat companies are Cult Food Science Corp (CULT) and Steakholder Foods Ltd (STKH). Both are exclusively focused on this space, with the former a Canadian investment company holding a portfolio of equity holdings and debt instruments with various lab-grown meat companies, including an equity stake in BSF itself (purchased on October 30, 2021 – the Company acquired 1,356,852 common shares at a cost of US\$170,639) and a convertible note in Unicorn Biotech, a Sheffield-based biomanufacturing company. Meanwhile, the latter is an Israeli business listed on the NASDAQ and is focused on 3D printing real steaks and in January 2023 secured a US\$6.5 million public offering to continue funding this technology.

In terms of business model, BSF likely sit between CULT and STKH. Like CULT, the company's aim is to eventually have a portfolio of companies within the cell culture space, but with the added benefit of working with them in order to grow and create synergies for building a lab-grown meat business collectively. Add the fact that both BSF and STKH are both involved in producing steak and the two start to sit closer together in terms of their products.

As of 28th February, CULT was trading at a market cap of C\$14.77 million (£9m), while STKH was trading at US\$14.95m (£12.41m). Like most growth stocks the pair were hit badly by the 2022 market rout and have declined 70% and 86% respectively since the beginning of 2022. The declines were mainly due to concerns around cash burn and in particular CULT's performance as a going concern. Their latest filings show STKH losing US\$6.6m as of June 2022 with an US\$8.5m cash balance, along with CULT reporting a similar predicament, albeit on a smaller magnitude. Since then, however, these companies have regained ground, with Canadian entrepreneur Marc Lustig acquiring 15% of CULT for just over USD\$750,000, along with STKH's closure of its Peace of Meat BV (PoM) subsidiary which is expected to reduce the company's expenses by around \$4.5 million annually. This has of course been welcomed by the market, with CULT doubling in value year to date, along with STKH recovering by 37% since its December low.

Relative to its two North American counterparts, BSF appears to have consistently managed cash well. The company had around £1m of cash in the bank as of September 2022, and in March 2023 alone reached an agreement with its first client and secured a further £2.9m in funding. This should see the company through to 2025 and allows them to focus their efforts entirely on developing and selling their products. Furthermore, we see their robustness and business milestones being reflected in the stock price, which is up well over 200% since November 2022.

As for CULT and STKH's similarity to BSF, we do not currently see them providing enough overlap, and have therefore not used them as a bearing for the valuation of the company this time round. Although, it is worth noting that they could reach a market cap similar to that of the IPO valuation of these companies, given their proven best-in-class technology and IP and the company's significantly extended runway.

International Companies

As mentioned previously, many lab-grown Meat companies are backed by venture capital or private equity firms with little information disclosed. To gain a better understanding of the investment appetite for lab-grown Meat internationally, we have included some anecdotal information on companies which have completed investment rounds over the last few years and have announced valuations to the press.

Mosa Meats, the company whose founders were responsible for the world’s first lab-grown beef burger in 2013, raised \$85m in a Series B round in February 2022. The company have been using this for its pilot production facility and is running 7,340 m² in facilities. Upside Foods, a company who recently received an FDA ‘no questions’ approval for their lab-grown chicken, raised US\$400m in Series C investment last year, with the Abu Dhabi Growth Fund and Baillie Gifford as key investors in the round. And EatJust, another American company but with large operations in Asia, raised US\$25m in a Venture Round last year, backed by C2 Capital Partners, a private equity firm with Alibaba as its anchor investor. Incidentally, the company have struck gold in Singapore – the only country currently to have fully legalised lab-grown meat for commercial consumption.

For clarity, the implied valuations have not been verified by the companies and have been garnered from various press reports, but it does give a high-level view of the investment community’s interest in the space. In addition, the exhibit below gives readers a basic understanding of the companies we have analysed in the international space, along with levels of capital that are being invested.

Figure 6 - Private International Valuations – Latest

Company	Financing Date	Round Size/Stage	Valuation	Recent activity	Main products
Mosa Meat (Holland)	February 2022	US\$85M/Series B	N/A	Founded in 2016. Working on a pilot production facility and has shrunk the cost of its lab-grown fat by 88x.	Beef hamburgers derived from myosatellite cells designed for mass production.
Upside Foods (USA)	April 2022	US\$400M/Series C	US\$1bn (Unicorn)	Founded in 2015. Became the first in the world to receive a ‘no questions’ letter from the FDA. Tyson Foods holds shares.	First product was lab-grown chicken derived from a fertilised heritage-breed chicken egg.
EatJust (USA)	August 2022	US\$25M/Venture Round	US\$1.2bn (Unicorn)	Founded in 2011. Now selling to Singapore and China and backed by Alibaba-ran investment vehicle.	Most famous for its JUST Egg, a plant-based egg substitute. Now also focused on lab-grown chicken.
Believer Meat (Formerly Future Meat Technologies) (Israel)	December 2021	US\$347M/Series B	US\$900M	Founded in 2018. Company claims to have produced a 110-gram chicken breast for US\$1.70. Tyson Foods holds shares.	Company produced the world’s first lab-grown lamb in 2022 using the immortalisation of fibroblasts.
Aleph Farms (Israel)	July 2021	US\$105M/Series B	US\$325M	Founded in 2017. Company has produced 3D-printed steak and is generating revenue.	Mainly focused on steak growth and uses an animal-free scaffold.

Source: Shard Capital, company reports.

Much like the UK market, each company in the table above have also shown little to no evidence of addressing the issue of plant-based scaffolds, providing a significant opportunity for BSF. The company's ability to create such an advanced growth media supplement that tackles this means that they are in prime position to become a supplier. Therefore, their products could underline and benefit hugely from the success of these companies altogether.

Of this list of players, we believe BSF to be more closely related to Aleph Farms due to its involvement in steak. Aleph Farms specializes in producing beef steak, with their "Aleph Zero" product – a lab-grown rib-eye. The company uses a unique 3D printing technology which mimics the conventional method of producing lab-grown meat. However, like all current clean meat technology, this is not currently commercially scalable and needs significant development, not least in their growth media. The company also still uses artificial scaffolding, which BSF have now overcome with their proprietary technology.

Although the UK market has not yet caught up to the likes of Silicon Valley, Tel Aviv and Maastricht, it is only a matter of time before this gap is shortened and we believe BSF is best placed to benefit from this. [As such, we believe BSF could demand at least a valuation of £100m if they were to become a supplier to a player like Aleph farms.](#)

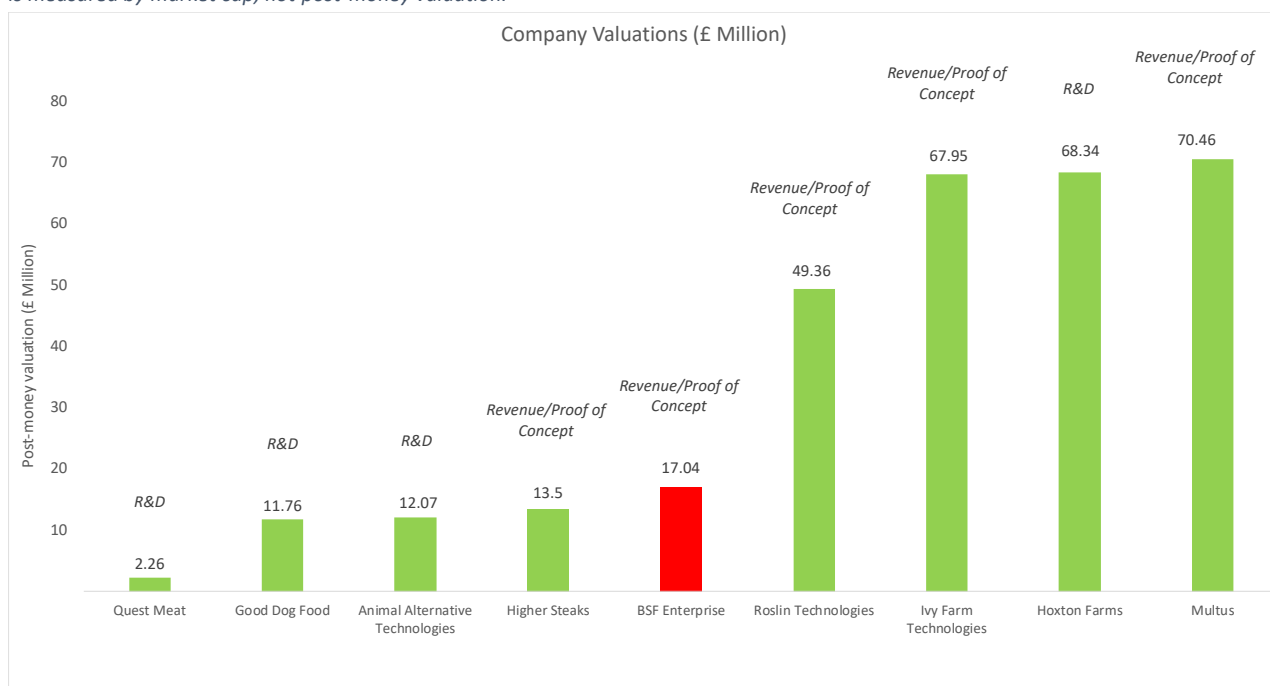
UK comparatives

Given the ambiguity of the financial performance of international players, along with the significant gulf between international valuations and the UK, we have deemed the most appropriate valuation range for BSF to sit at home for the near term.

Figure 7 below shows the most recent post-money valuations of domestic lab-grown Meat companies. The embryonic nature of this sector has meant that publicly disclosed valuations are often few and far between. As such, we have collected this data from public filings manually, using a list of companies from reputable platforms such as the Good Food Institute and estimating the valuations given available inputs. Refer to the Appendix for a full methodology. Additionally, unlike all other UK lab-grown meat companies, BSF is publicly traded, meaning that whilst we have used post-money valuation for the other players, we have taken market capitalisation for BSF.

BSF Enterprise Plc

Figure 7 - : Valuations of UK companies in the Lab-grown Meat sector, based on their most recent funding rounds as of 27/03/2023. Note that BSF is measured by market cap, not post-money valuation.



Source: Shard Capital

As can be seen in the graph, BSF's valuation sits slightly on the edge of the lower tier of the distribution which we believe is indicative of an overlooked opportunity given the company's superior products and position in the market.

All but one of these companies had at least one funding round in 2022, with Higher Steaks having its last equity financing in March 2021, a £2.5m Series A investment from Dismatrix Group/Planthesis Fund. Intuitively, most companies who have proof of concept and/or are generating revenue are generally commanding higher valuations than those still in R&D stage. The only exception to this is Hoxton Farms who we evaluate in further detail in the Appendix. Of course, whilst all operating within lab-grown meat, there are factors which we believe make BSF unique.

The company we deem most similar to BSF in terms of business focus and progress is Multus. Like BSF, a key focus for the company is the growth feed required to cultivate meat and company sells growth inputs to companies and organisations involved in cell culture. Their two main products are Proliferum M – a serum-free growth medium that can be used for different mammalian species' fibroblasts, myoblasts, and adipocytes – and an animal-free Vitronectin. The latter is usually present in animals and can be used with growth media to speed up the growth and proliferation of cells. Multus have also just recently raised almost £8m to build a production facility for these products – something which BSF has already done with City-Mix. What's more, there is no current information on Multus that suggests their products remove the need for plant-based scaffolds which, as discussed previously, does appear to be a kicker in terms of the texture and taste of the meat itself. Furthermore, given that BSF have just reached their first agreement for their City-Mix product, they are on the cusp of generating revenue.

Another area BSF appears to hold superiority is its diversification: skincare, leather, corneas, and skin are all strong contributors to the business' proposition, and although the focus is mainly on lab-grown meat, they are likely to provide additional streams of revenue and downside protection.

With all of this in mind, we believe BSF are now at least within the valuation range of the top lab-grown meat companies in the UK and that they are likely to reach levels similar to Multus very

soon. We therefore suggest that the company's potential valuation sits well within the higher end of the distribution (£50m-£70m) meaning that the stock is grossly undervalued currently, in our view. Definitively, we have taken the lower end of this range – £50m – as a conservative estimate.

Refer to the Appendix for details on the remaining companies in Figure 7.

Management and Board of Directors

Board of Directors

Min Yang – Non-Executive Chairman

Ms. Yang is an entrepreneur with over 30 years of experience in international business. Ms Yang's experience lies in the identification, acceleration and realisation of investments across a range of industries including but not limited to technology, property, and resources. She has commercialised numerous innovations in the telecommunications industry and built an Australasian telecommunications delivery company between China and Australia. Furthermore, she has led the development, marketing and commercialisation of a high-performance engine technology now being developed in China as an auxiliary power unit for electric engines. Ms Yang is currently the Executive Chairman of ASF Group Ltd (ASX: AFA) and Non-Executive Chairman of ActivEX Limited (ASX: AIV), Rey Resources Limited (ASX: REY) and Non-Executive Director of Key Petroleum Limited (ASX: KEY).

Geoffrey Robert Baker –Executive Director

Mr Baker is a qualified lawyer in Australia and Hong Kong with a Commerce degree (Accounting and Financial Management), a Law degree and Master of Business Administration (MBA). Mr Baker has extensive corporate and commercial legal and property expertise developed over 40 years of practising law and representing companies in Australia, China, Hong Kong, Japan and recently the UK and Europe. Mr Baker also co-authored a number of books including the critically acclaimed book "Think Like Chinese" first released in June 2008 (Federation Press, 2008). Mr Baker has commercialised a number of innovations including bio-medical apparatus for sleep-apnoea as well as high performance engine technology now being developed in China as an auxiliary power unit for electric engines. He is also a director of Redstrike Group Ltd, a sports marketing company in the UK, which promotes and markets various sports events and activities and sports related technologies world-wide. Mr Baker is currently also the Non-Executive Director of ASF Group Ltd (ASX: AFA), Rey Resources Limited (ASX: REY), ActivEX Limited (ASX: AIV) and Key Petroleum Limited (ASX: KEY).

Dr Che John Connon – CEO & Executive Director

Professor Connon is Director of Business Development for the Faculty of Medical Sciences, Newcastle University. He has lead an academic research team that seeks to engineer functional replacement tissues using a cell derived, bio-inspired approach. He was the first to 3D bio-print a human cornea and understand the bio-mechanical properties of the corneal stem cell niche. Professor Connon has received continuous UK government research funding since 2007 and has published over 100 papers in international journals and has edited several books in regenerative medicine, stem cell bioprocessing and hydrogels in tissue engineering. Professor Connon has embraced academic entrepreneurial activities and has successfully founded (and remains a Director of) three Bio-tech spin-outs from Newcastle University: Atelerix Ltd, a company that supplies hydrogels for the storage and shipment of cells at controlled room temperature for clinical and scientific purposes; CellulaREvolution Ltd, a company supplying technologies that assist in the manufacture of adherent cells for biotechnology needs; and 3D Bio-Tissues Ltd, a company that has developed a powerful platform that allows for the production of structured tissues and is now operating under BSF Enterprise Limited.

Dennis Kian Jing Ow - Independent Non-Executive Director

Dennis Kian Jing Ow – Independent Non-Executive Director Appointed on 5th August 2021, Dennis Ow has been an experienced corporate finance practitioner in the Asia market since 2003. He is a Sponsor Principal regulated under the Hong Kong SFC (Securities & Futures Commission) and is currently the Managing Director of FDB Financial Group Ltd based in Hong Kong and is responsible for its Asian Corporate Finance business. He was formerly the Head of numerous Investment Banking Division in Hong Kong including SinoPac Asia Securities Limited, Ping An of China Securities, South China Financial Holdings Limited and Guolian Securities International. Mr. Ow also worked as the Senior Business Manager of Asia Pacific for the London Stock Exchange for

over 2 years in which time he successfully brought numerous companies from Southeast Asia to AIM and two Main Market listings from Indonesia and the Philippines. Before joining the London Stock Exchange, Mr. Ow worked for over 5 years for an entity under a public listed American company called First Data Corporation specialising in global credit cards processing and money transfer, where he was responsible for their operations and business development for Greater China. Mr. Ow holds a Postgraduate Diploma in Management from the University of Technology, Sydney.

Graham Duncan – CFO

Graham is a highly experienced Chief Financial Officer with over 20 years of capital markets experience and is a Chartered Accountant (FCA CF qualified) holding a Corporate Finance Diploma issued by the ICAEW. He has specialized in advising UK-listed companies, with a strong focus on international business, particularly in financial services, the extractive industries, cleantech, support services, property, and leisure. Graham has advised on more than 40 AIM transactions in the last 15 years, and has extensive experience in financial reporting, IPOs, due diligence, acquisitions, exits, valuations, and fundraising. He is also experienced in reporting for companies listed on equity capital markets in the UK (AIM, NEX, and The Main Market in London) as well as overseas. Graham has a strong technical skill set including IFRS, UK GAAP, and UK stock exchange requirements, and a network of advisory and capital markets contacts in the UK and internationally. Additionally, he has spent 4 years in Hong Kong and provides interim and part-time FD services to both private and publicly listed companies.

Risks

Stage of commercialisation	BSF has successfully demonstrated the performance of its growth media supplement, City-Mix. However, the company may fail to prove its value proposition to the market through testing with prospective customers. Even if trials are successful, factors such as delayed delivery or reduced functionality may hinder value.
Cost of commercialisation	The current cost of media in the market is around £200 a litre which is well beyond the levels needed for mass lab-grown meat production. However, given that cost reduction is a key selling point for the company, this is likely to be something the company ends up benefitting from.
Lab apparatus providers	3DBT depends on third party suppliers to deliver its apparatus and/or raw materials to the lab facility. The actions of this supplier, such as an exit from the market or dramatic price increases, could have a material impact on the company's prospects.
Cost/economies of scale of lab-grown meat	Most if not all clean meat solutions are still much more expensive than conventionally produced meat. This presents an industry risk for BSF as the sales of their City-Mix/tissue templating products are heavily influenced by this market. This is however coming down.
Competition	The lab-grown meat market is experiencing rapid growth in investment and innovation, with the potential for new entrants or competitors that bring advances to the market. The group may fail to respond to or in timely manner which would negatively affect its positioning.
Adopter risk	There is a risk that lab-grown meat and BSF's other lab-grown products are not adopted as quickly as anticipated by industry bodies.
Pre revenue risk	The company is not yet consistently producing revenues. As such, the future cash flows of the company are extremely difficult to estimate, and it is currently uncertain as to when they will start generating recurring income.
Lack of acquisition opportunities	The company's success depends on the directors' ability to identify acquisition opportunities, which may not be possible or may result in substantial transaction costs. However, the board's considerable experience in corporate finance and managing acquired businesses should help mitigate these risks.
Risks inherent in an acquisition	The company and directors cannot guarantee that all significant risk factors can be identified or assessed in a potential target. Additionally, investing in the company's ordinary shares may not prove more beneficial than a direct investment in a target business. However, the board's relevant sector experience and corporate finance skills are essential to manage these risks.
Reliance on additional funding	The company is dependent on raising additional funds to bring its products to the commercial market and generate income, which may come from 3DBT's research activities or from its subsequent divestment. If this is not achieved, the company may not be able to pay expenses or make distributions on the ordinary shares. Nonetheless, the board's sector experience should help manage these risks.
Key personnel	The loss of key personnel could hinder the development of the group at a critical juncture. Given the high level of expertise within the group, the replacement of key individuals would be a lengthy and costly process.

Reliance on Licensing agreements

The Group may enter into various licensing supplier agreements. If the licence or distributor costs increase, or agreements are terminated, this could have a materially negative effect on the Group.

Source: BSF Enterprise, Shard Capital

Summary Financials

FINANCIAL STATEMENTS

Income statement

Figure 8 - Income statement

	Year ended 30 September 2022	Year ended 30 September 2021
	£	£
Continuing operations		
Other income	-	52,344
Administrative expenses	(927,322)	(110,669)
Operating loss	(927,322)	(58,325)
Finance expense – right-of use lease liabilities	(2,110)	-
Loss before taxation	(929,432)	(58,325)
Taxation	(607)	-
Loss for the year	(930,039)	(58,325)
Other comprehensive income for the year	-	-
Total comprehensive income for the year attributable to the equity owners	(930,039)	(58,325)
Earnings per share		
Basic and diluted (pence per share)	(2.06)	(0.29)

Source: BSF

Balance Sheet

Figure 9 - Balance sheet

	2022	2021
	£	£
Assets		
Non-current assets		
Property, plant and equipment	73,488	-
Right-of-use assets	223,560	-
Intangible assets	2,485,290	-
Total non-current assets	2,782,338	-
Current assets		
Cash and cash equivalents	1,061,529	359,868
Receivables and prepayments	132,762	41,578
Corporation tax receivable	33,950	-
Inventory	21,855	-
Total current assets	1,250,096	401,446
Total assets	4,032,434	401,446
Equity and liabilities		
Capital and reserves		
Share capital – issued and fully paid	781,884	203,400
Share capital – issued but unpaid	77,985	-
Share premium	3,711,576	407,984
Warrant reserve	12,537	-
Retained deficit	(1,001,020)	(246,568)
Total equity	3,582,962	364,816
Liabilities		
Current liabilities		
Trade and other payables	142,821	36,630
Taxes and social security	60,809	-
Lease liabilities	74,946	-
	278,576	36,630
Non-current liabilities		
Lease liabilities	156,933	-
Deferred tax	13,963	-
	170,896	-
Total liabilities	449,472	36,630
Total equity and liabilities	4,032,434	401,446

Source: BSF

Cash flow statement

Figure 10 - Cash flow statement

	2022	2021
	£	£
Cash flow from operating activities		
Loss before tax	(929,432)	(58,325)
Depreciation	21,522	-
Expense recognised on issue of restricted shares	175,587	-
Changes in working capital:		
Increase in trade and other payables	131,071	4,373
Decrease / (increase) in receivables	34,013	(31,241)
Decrease in related party balances	(100,000)	-
Net cash used in operating activities	(667,239)	(85,193)
Cash flow from investing activities		
Cash acquired on purchase of subsidiary	12,370	-
Acquisition of plant and equipment	(10,620)	-
Net cash from investing activities	1,750	-
Cash flow from financing activities		
Issue of shares	1,750,000	-
Costs of share issues	(368,817)	-
Repayment of lease liabilities	(14,033)	-
Net cash from financing activities	1,367,150	-
Net cash flow for the year	701,661	(85,193)
Cash and cash equivalents at beginning of the year	359,868	445,061
Cash and cash equivalents at end of the year	1,061,529	359,868

Source: BSF

Funding and Use of Proceeds

Prior to the reverse takeover (RTO) in May 2022, 3DBT was a standalone business receiving financial support from BSF Angel Funding Limited (BAFL), an entity ran and directed by Geoff Baker and Min Yang, both existing directors of BSF Enterprise. An initial investment of £100,000 was made back in 2019 in exchange for 10% of the business, with a further £400,000 in 2020 for another 40% shareholding. This enabled 3DBT to achieve many things, including hiring someone to help with reaching Proof of Concept for their human cornea segment; moving premises from Newcastle University to a bespoke laboratory space within the Newcastle Helix site; as well as obtaining the relevant equipment for expanding their R&D capacity for their new media supplement (City-Mix).

In May 2022, BSF – a SPAC that had been created with an initial £1m investment back in 2019, with the aim of acquiring and developing next-generation biotech businesses – conducted a reverse takeover (RTO) of 3DBT for £2.5m. This was a share-for-share transaction where all the shares of 3DBT (676,470) were purchased through the issue of 33,900,004 Consideration Shares by BSF, implying a 50:1 share exchange ratio. This was carried out after a raise in April 2022 of £1.75 million (7p per share) of new capital on the public market and brought the total number of shares in issue to 45,109,196 as of September 2022.

The fundraising gave 3DBT access to the funds required to hire more staff and develop their products further. Since then, 3DBT has more than doubled its lab production capacity to 2,400 sq ft, enabling them to produce 200 litres per month of City-Mix. Company funds have also been used for both national and international patent applications, as well as reaching the highly publicised milestone of producing a prototype of the UK's first full-scale lab-grown meat fillet. At the same time, the company have been using funds for general working capital purposes.

Finally, the company have very recently (March 2023) raised a further £2.9m on the open market. This was an oversubscribed placing of 17.2 million new shares at 17p a share, including 882,352 procured directly by the company at the same price. The price represented a 16% discount to BSF's closing price of 20.25p at the time. This has now given the company runway until 2025, allowing them to focus on development and the sale of its products via its Go To Market strategy. A detailed description of the use of proceeds for this placing can be found in the Appendix.

In April 2023, - just under 2 weeks after this placing -the company announced that it had entered into deeds of variation with each of the subscribers in respect of the subscription shares. As part of this, 264,739 subscription shares were to be allotted.

Following the March 2023 placing and subsequent deeds of variation, the total number of ordinary shares in the Company in issue on 12th April 2023 were 103,501,676.

Shareholder warrants

Total warrants after the March 2023 placing stand at 20,870,217, with 12,270,217 issued during the May 2022 placing and 8,600,000 issued in March 2023. The former are exercisable at the price of 15p per share at any time up and until the third anniversary of the May 2022 share admission on the London Stock Exchange, while the latter are exercisable at 34p per share and expire on the third anniversary of the March 2023 placing.

Glossary

Figure 11 - Glossary and key definitions

In vitro	A biological process taking place in a test tube, culture dish, or elsewhere outside a living organism.
Good Food Institute (GFI)	A non-profit think tank and international network of organizations working to accelerate alternative protein innovation.
Lab-grown Meat/Clean Meat/ In-vitro	Genuine animal meat (including seafood and organ meats) that is produced by cultivating animal cells directly, eliminating the need to raise and farm animals for food.
Scaffold-free meat	Meat produced in vitro without the use of a three-dimensional scaffold, using self-organizing cells that form into muscle tissue. This approach aims to produce meat that is more similar in texture and composition to conventional meat.
Foetal Calf Blood	The blood of an unborn calf that is extracted from a slaughtered pregnant female. This is normally then processed into Foetal Bovine Serum (FBS).
Foetal Bovine Serum (FBS)	A common component of animal cell culture media. It is harvested from bovine foetuses taken from pregnant cows during slaughter and commonly extracted by means of a cardiac puncture without any form of anaesthesia.
Media	Biological feed used to proliferate animal cells, containing a combination of nutrients that would otherwise exist in an animal's body.
Medical devices	Any instrument, apparatus, implement, machine, appliance, implant, reagent for in vitro use, software, material or other similar or related article, intended by the manufacturer to be used, alone or in combination for a medical purpose.
Cell line	A collection of genetically identical cells originating from one cell.
Myosatellite cells	Cells that have the potential for self-renewal and differentiation, which allows them to contribute to muscle growth and repair.
Glaucoma	A common eye condition where the optic nerve, which connects the eye to the brain, becomes damaged. Glaucoma can lead to loss of vision if not diagnosed and treated early.
Herpes simplex eye infections	An infection of the cornea that is caused by the Herpes Simplex Virus. The infection usually heals without damaging the eye, but more severe infections can lead to scarring of the cornea or blindness.
Corneal neovascularization	The extension of vascular capillaries within and into previously avascular regions of the cornea.
Keratoplasty	The process of corneal transplantation.
MMP (Mucous membrane pemphigoid)	A chronic, bilateral, progressive scarring and shrinkage of the conjunctiva with opacification of the cornea.
Conjunctiva	A thin, clear membrane that protects your eye.

Stevens-Johnson Syndrome	A disorder that causes painful blisters and lesions on the eye and can cause severe vision problems.
RPM (Retroprosthetic membrane) formation	The most common complication after Boston KPro implantation, obstructing the visual axis and reducing vision.
Extracellular matrix (ECM)	A complex mixture of proteins, carbohydrates, and other biomolecules that surrounds cells in tissues throughout the body. It provides a structural scaffold for cells to attach to, and it also plays important roles in cell signalling, differentiation, and migration.
FAO	Food and Agriculture Organization of the United Nations.

Source: Shard Capital

Disclosures

Related Parties

Key institutional investors include Barclays Direct Investing and Newcastle University. Shard Capital is currently a broker and placing agent for the company, and corporate broking services are expected to continue with this company. In addition, Shard currently holds 774,113 broker warrants - 447,761 exercisable at the price of 15p per share at any time up and until the third anniversary of the May 2022 share admission on the London Stock Exchange, and 326,352 exercisable at 34p per share and expire on the third anniversary of the March 2023 placing. All of these warrants are non-transferable.

Key shareholdings

The exhibit below outlines the holding of management and key shareholders of BSF.

Figure 12 - Key shareholdings

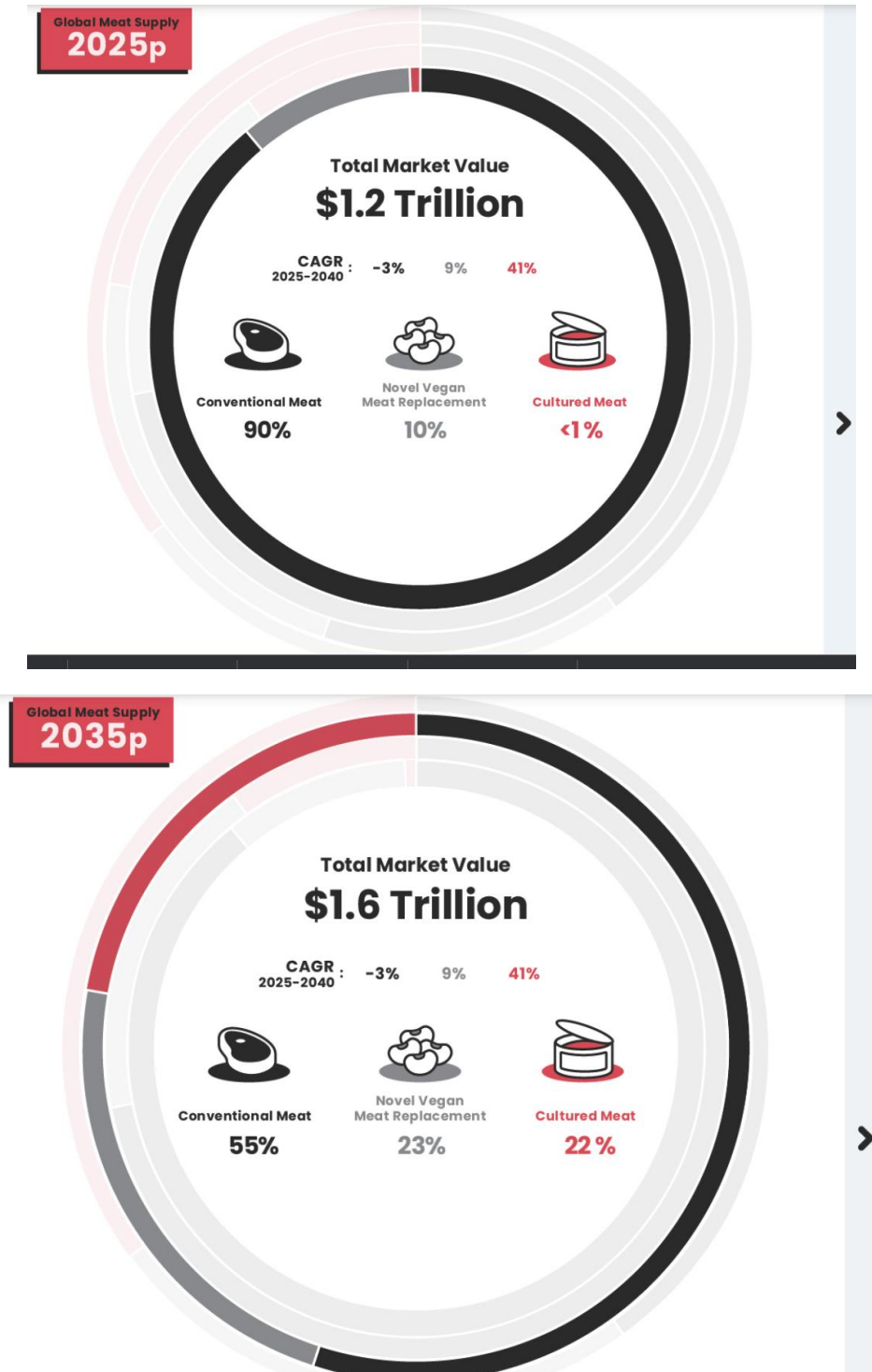
Shareholder	Shareholding
BSF ANGEL FUNDING LIMITED	19.31%
PROF CHE JOHN CONNON	15.03%
NEWCASTLE UNIVERSITY HOLDINGS LTD	8.04%
RICARDO GOUVEIA	2.47%
GEOFF BAKER	1.81%
MIN YANG	0.91%

Source: Company information

Appendix

Potential size of the lab-grown Meat market

Figure 13 - Potential size of the lab-grown Meat market



Source: CULT Food Science

Corneal Transplantation – the donation process

A cornea’s viability has a limited lifespan due to tear production stopping at death. A longer death-to-preservation time (DTPT) risks a failed transplant, meaning the donation of human corneas must begin almost immediately. In the US, the standard is to recover corneas within 8 hours of death. Once the donor dies, the following process takes place.

An eye bank receives a call from a hospital, informing them that the donor has died.

1. In countries where there is a legal requirement, the hospital must then contact the donor’s next of kin to obtain informed consent and a medical-social history of the donor. This helps the eye bank make a donor eligibility determination.
2. The eye bank obtains relevant medical records from the hospital, paying close attention to the circumstances of their death to ensure the tissue is safe and suitable for transplant.
3. Next, the cornea is extracted using a sterile technique and placed in storage to keep the tissue viable.
4. With BSF’s solution of using 3D-printed corneas, none of the above would be necessary, making the procurement process much smoother and less costly and time consuming.

Keratoprotheses – advantages and disadvantages

Figure 14 – Advantages and Disadvantages of Keratoprotheses.

Advantages	Disadvantages
Can restore meaningful vision in the most severe cases of corneal blindness where donor corneas fail	Uncomfortable to wear
Avoids religion, culture and policy problems	Transplantation process is complex; multiple surgeries and long-term topical medications often required
Overcomes immune rejection, immune graft risk and ocular surface disease	Limited field of view
Continuously evolving technologies	Unsatisfactory aesthetic appearance
Limited swellability therefore limited water accumulation and less light scattering	Potential for post-operative complications such as extrusion and glaucoma.

Source: ResearchGate

UK lab-grown meat companies and valuation methodology

Ivy Farm focuses on the mass production of pork, raising £10m in June last year in order to purchase a 600-litre bioreactor which aims to produce 12,000 tonnes of pork annually by 2025. Roslin Technologies is more devoted to working on stem cells themselves, specialising in reprogramming them to be pluripotent once extracted from an animal, although it does also mention pork production and bioreactors as part of its strategy. Higher Steaks are also going down the large-scale meat production route, aiming to sell hybrid products, not 100% meat. Meanwhile, the rest are still in R&D stage and/or are also highly specialised in areas that do not overlap as strongly with BSF as a company like Multus.

Hoxton Farms is the 2nd most valuable company, though there are some notable differences when comparing to BSF. Firstly, this company is exclusively focused on producing animal fat, which is a much more specific product than BSF's broad range of possibilities in both clean meat and clinic sectors such as human corneas. Second, Hoxton Farms' key value proposition is using machine learning and mathematical modelling to develop bioreactors and animal-free media, in which all except the latter BSF is not currently involved. Bioreactors in particular are a much more heavy-industry proposition than producing meat in a small-scale lab setting and require a significantly larger capital outlay, hence their US\$22m Series A round back in August 2022 which is being used to build a 13,000 sq. ft pilot plant and scale up its production facility. Compare this with BSF's recent expansion to a 2,400 sq. ft. lab production facility around the same time and the valuation of Hoxton Farms very much becomes a question of physical size.

The list of lab-grown meat companies along with their respective valuations in Figure 7 were derived using the following steps:

1. A universe of alternative protein companies was constructed by combining databases of lab-grown meat companies from the Good Food Institute (GFI), Pitchbook, Beauhurst and Crunchbase. Screening for UK-based lab-grown meat companies, we ended up with a list of 15, including BSF Enterprise.
2. Due to confidentiality of the fundraising of these companies and the embryonic nature of the sector in general, valuation data for these companies is sparse. Therefore, a manual approach was required. This involved collecting data on their latest equity raises from Companies House, including latest share price and total share capital.
3. Multiplying the former by the latter gives us the total post-money valuation. Note that this is still only an undiluted version as it does not include options and share equivalents.
4. Most if not all SMEs have employee share options and/or share equivalents on their cap table. This proportion of share capital is not included on public filings, and so we have had to assume a fixed percentage of each company's share capital to account for this. In this case, we have assumed 20% - that is, 20% of each of each company's share capital are options and/or share equivalents. This therefore requires that we divide the post-money valuation calculated in step 3 by 0.8 to give us the final figure for post-money valuation.

An example of the above is below.

Example:

1. Higher Steaks raised £2.5m back in May 2021 at a Seed share price of £3.76.
2. Total undiluted share capital after this was 2,872,691 shares.
3. Multiplying the two gives us a post-money valuation of £10.8m on an undiluted basis.
4. Using our options assumption of 20%, we then divide the undiluted post-money valuation of £10.8m by 0.8. This gives us a final post-money valuation of £13.5m.

BSF 2023 placing – Use of Proceeds

BSF's wholly owned subsidiary, 3D Bio Tissues ("3DBT"), is growing rapidly. With this in mind, the net proceeds of the Placing will be used to provide working capital to support the organic growth of the Company through:

- ▶ Continued development of the Company's lab-grown meat fillets, aimed at demonstrating the effectiveness of its patented City-Mix™ technology which has a number of advantages over traditional media used in the production of lab-grown meat.
- ▶ The ongoing expansion of 3DBT's City-Mix™ production capacity to support new business opportunities. 3DBT has engaged with over 60 cellular agriculture companies of which 26 have progressed to new business opportunities, representing a 43% conversion rate. From these 26 business opportunities, 22 product evaluations are already underway with a view to incorporating City-Mix™ into lab-grown media formulations.
- ▶ Serving new global target markets, including biotech companies, such as those working in gene therapy, stem cells and regenerative medicine; and life sciences companies. An indirect sales model is the preferred approach for the biotech and life sciences markets, and 3DBT is currently engaging with appropriate distributors in the UK, France, Canada, Australia, Switzerland, Italy and the Netherlands.
- ▶ Further development of 3DBT's lab-grown leather products.
- ▶ The advancement of 3DBT's cornea proposition, finalising the process for full thickness cornea production

Disclaimer

This document has been prepared and issued by Shard Capital Partners LLP ("Shard Capital"), which is authorised and regulated by the Financial Conduct Authority (FRN: 538762).

This document constitutes a minor non-monetary benefit. This document is a marketing communication and not independent research. As such, it has not been prepared in accordance with legal requirements designed to promote the independence of investment research.

This document is published solely for information purposes and is not to be construed as a solicitation or an offer to buy or sell any securities, or related financial instruments. It does not constitute a personal recommendation as defined by the Financial Conduct Authority, nor does it take account of the particular investment objectives, financial situations or needs of individual investors. The information contained herein is obtained from public information and sources considered reliable. However, the accuracy thereof cannot be guaranteed.

The information contained in this document is solely for use by those persons to whom it is addressed and may not be reproduced, further distributed to any other person or published, in whole or in part, for any purpose, at any time, without the prior written consent of Shard Capital. This document may not be distributed to any persons (or groups of persons) to whom such distribution would contravene the UK Financial Services and Markets Act 2000. This document is not directed at persons in any jurisdictions in which Shard Capital is prohibited or restricted by any legislation or regulation in those jurisdictions from making it available. Persons into whose possession this document comes should inform themselves about, and observe, any such restrictions.

Shard Capital or its employees may have a position in the securities and derivatives of the companies researched and this may impair the objectivity of this report. Shard Capital may act as principal in transactions in any relevant securities or provide advisory or other service to any issuer of relevant securities or any company connected therewith.

None of Shard Capital or any of its or their officers, employees or agents accept any responsibility or liability whatsoever for any loss however arising from any use of this document or its contents or otherwise arising in connection therewith. The value of the securities and the income from them may fluctuate. It should be remembered that past performance is not a guarantee of future performance. Investments may go down in value as well as up and you may not get back the full amount invested. The listing requirements for securities listed on AIM or ISDX are less demanding and trading in them may be less liquid than main markets. If you are unsure of the suitability of share dealing specifically for you then you should contact an Independent Financial Adviser, authorised by the Financial Conduct Authority.

By accepting this document, the recipient agrees to the foregoing disclaimer and to be bound by its limitations and restrictions.