



Sustainability



Fieldwork Robotics



Exscientia



Nandi Proteins

news from the frontier

October 2021

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WANT MORE NEWS? Please contact [Andrew Johnson](#), communications and investor relations director if you would like updates when they happen

FRONTIER IP, OUR PORTFOLIO AND SUSTAINABILITY

The United Nations Climate Change Conference, COP26, in Glasgow at the end of this month will bring a renewed focus on the [importance of science, technology and innovation](#) in achieving sustainability. So now seems like a good time to set out our approach.

Sustainability is a natural consequence of what we do. Our aim is to create high-value businesses from science and technology with strong commercial potential, working closely with industry partners to understand market requirements. Innovation cannot make an impact if it fails to find demand.

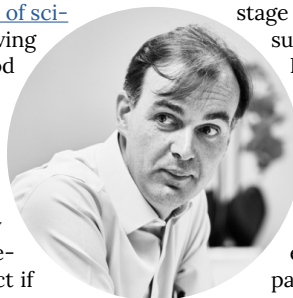
Fortunately, our partners also appreciate the opportunities that are now arising as a result. Companies in our portfolio have the potential to make a real differ-

ence, not just to the environment, but to society as well.

Because much of our portfolio is at a very early stage of development, we have committed to supporting the United Nations Sustainable Development Goals. They set targets to be achieved by 2030, and so provide the right framework for the forward-looking nature of our business. You can find out more about how we and our portfolio align later in this newsletter.

Exscientia listed on Nasdaq at the top end of its pricing range, valuing the company at \$2.9 billion. It's a great UK success story, and we were a founding shareholder. We are confident it will continue to go from strength to strength.

Neil Crabb, Chief Executive Officer



EXSCIENTIA ENJOYS SUCCESSFUL NASDAQ IPO

Exscientia, a leader in using artificial intelligence to discover new drugs, successfully completed one of the all-time biggest IPOs by a European biotech company earlier this month when it listed on the Nasdaq Global Select Market.

The company raised a total of \$464.7 million in gross proceeds from a public offer and private placements with SoftBank and the Bill & Melinda Gates Foundation. The sum is believed to be the most raised by a European biotech when floating. Exscientia is behind the first three AI-designed drugs to enter human clinical trials.

At the offer price of \$22 a share, Exscientia was valued at \$2.9 billion -- large enough for Exscientia to be one of the UK's biggest biopharmaceutical companies behind AstraZeneca and GlaxoSmithKline.

The Bill & Melinda Gates Foundation made its \$35 million investment in Exscientia as part of a \$70 million collaboration to develop anti-viral therapeutics against coronaviruses and other viruses with pandemic potential. The company closed at \$27.1 on the first day of trading, a rise of 23 per cent.

The proceeds of the float will be used to develop its AI drug discovery platform, which reduces drug discovery time by up to 70 per cent, and to expand the pipeline of drug candidates.



CAMGRAPHIC RAISES £1.6m FOR HIGH-SPEED GRAPHENE PHOTONICS

Camgraphic is to accelerate development and scale up of its high-speed, low-energy graphene-based photonics after raising £1.6 million from new and existing investors.

The company, which is now valued at £7.2 million post money, is initially focused on optical transceivers, a core component used in fibre-optic telecommunication

networks to transmit and receive data.

Camgraphic's transceivers have the potential to become a core enabling technology for 5G networks and beyond, with the technology having attracted significant interest from major companies in the sector. Current versions of the technology have indicated speeds of 100Gbps per lane across multi-

ple wavebands in laboratory conditions -- around twice that of equivalent technologies.

They also consume at least 75 per cent less energy, so have the potential to support efforts to reduce CO2 emissions, and should prove cheap and scalable. The company is developing the technology under licence from the University of Cambridge.

"THE INDUSTRY DOESN'T ALWAYS TAKE INGREDIENTS TO THE NEXT LEVEL. THE CORE OF NANDI'S DNA IS IMPROVING THEM."

Nandi Protein's new Chief Executive Officer David Flower on his plans for the Company.

The "disruptive" potential of proteins taken to new levels persuaded David Flower to become Nandi Proteins' Chief Executive Officer after 25 years in the food trade working for major public and venture capital backed companies.

Nandi's technology creates customised proteins to replace undesirable or unwanted ingredients in a very wide range of foods. These include fat, gluten and E-number additives, in a wide range of existing foods and the plant-based offerings of the future. There is also the potential for the company to make a significant environmental impact. By replacing meat with specialised protein-based ingredients, Nandi could help companies cut emissions linked to animal farming, and reduce their dependency on chemical additives, such as E-475, a widely-used palm oil-based emulsifier.

"People have asked, 'Why Nandi Proteins?'" he says. "The answer is the industry is good at taking ingredients and using them, but it doesn't always look to take them to the next level. The core of Nandi's DNA is taking existing proteins, both animal and plant, and improving them."

David's initial work has been to define strategy and ensure the technology can be scaled up. "The key to the strategy is to focus on what the end customer wants, to focus on what has been proven, and to focus on the ingredients where there is a clear route to market."

Three sets of ingredients are at the forefront of the company's development efforts.

First, are the fava-bean based replacements for egg whites to help create the right texture for mycoprotein-based meat alternatives and gluten-free bakery products. The appeal for manufacturers looking to use them is that their standard vegetarian products will also be suitable for vegans. "Nobody else can do this," says David, and there's a cost benefit too – fava beans are cheaper than egg whites.

Second, are ingredients based on whey proteins to replace E-number emulsifiers in a host of foodstuffs, so the products are cleaner and less dependent on chemical additives.

And third are collagen-based fat and meat replacements. Manufacturers are interested because they could move red-label products to amber label and reduce the number of animals they need to use in their products – resulting in significant cuts to their CO2 emissions.

Customers want these products, says David, so the next stage is to provide them with samples in big enough volumes they can use on their own production lines, and to prove the technology can be scaled up. To these ends, Nandi is looking for further funding to grow its team and to build a pilot plant. This will be increasingly important as the company grows, develops new ingredient, and seeks new customers.

"At the moment, we are producing at a small scale in our laboratory research facility," says David. "We can only produce about a 100 grammes of powdered ingredients a day. The pilot plant will allow us to produce up to two kilograms a day – basically, we are scaling up from a one-bedroom flat to a two-bedroom bungalow."

As well as allowing Nandi to make greater volumes of its product, the pilot plant will also allow Nandi to test its technology and processes at a scale big enough to be sure they will work in a customer's factory. "We know that if it works in a pilot plant with a plate heat exchanger of 50 litres capacity, then it will work in manufacturing plant with a plate heat exchanger of 5,000 litres capacity. The process is the same."

Nandi has attracted strong interest from major companies, and will be looking to sign heads of agreement with licensing partners in the coming months.

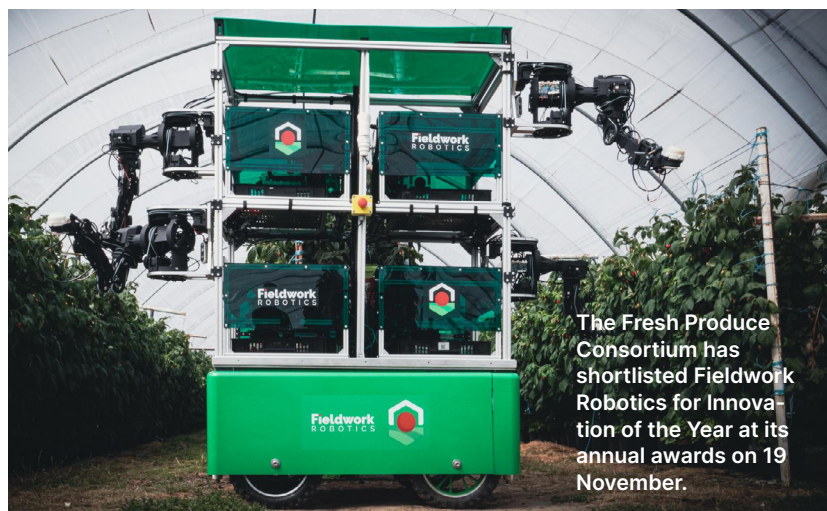


Nandi Proteins
Chief Executive
David Flower

Having spent his career at senior levels for companies such as the Boon Rawd Brewing Company, maker of Singha Beer, and Kerry Foods, where he was managing director of Home Baking, and a spell at venture capital firm Bridgepoint, David also wanted the opportunity to be involved in a small firm.

"Although I had grown businesses within a Plc and venture capital structure," he says, "I'd never built a business from an early stage. That was one of the attractions of joining Nandi after 25 years in the food trade."

FIELDWORK IN RUNNING FOR PRODUCE INNOVATION OF THE YEAR AWARD



ALUSID TO EXHIBIT AT THE DESIGN MUSEUM

Alusid's success in creating desirable and practical tiles from recycled industrial waste ceramics, glass and glaze has been recognised by the Design Museum. The company is to exhibit its Principle range of mass-produced tiles, made from 95 per cent recycled material at an exhibition called Waste Age: What Can Design Do? alongside world-famous designers such as Stella McCartney.

The exhibition aims to explore how designers are redefining fashion, construction, food, electronics, packaging and more through designing out waste and creating a more circular economy.

The exhibition opens on 23 October at the Design Museum, 224-238 Kensington High Street, London W8 6AG.

the
**DESIGN
MUSEUM**

FRONTIER IP AND SUSTAINABILITY: WHY WE ARE SUPPORTING THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

Frontier IP seeks to create high-value businesses from intellectual property developed by universities, academics, scientists and engineers. Given the importance of science and technology in tackling some of the pressing problems we face today and the opportunities that arise as a result, it follows that sustainability is a natural consequence of what we do.

We currently focus on four clusters: artificial intelligence and robotics; food and agritech; engineered particles and materials; and pathogens and cell imaging. They are intrinsically linked to better social and environmental outcomes. And our approach is also reinforced through collaboration with industry partners, who see sustainability as central to meeting future customer needs and demands.



Between them, our portfolio companies are developing technologies designed to provide better healthcare, more sustainable materials, agriculture, food and industrial infrastructure, and reduce CO2 emissions -- among others. We are aligning the Group and our portfolio to the United Nations Sustainable Development Goals (UN SDGs).

The 17 UN SDGs were adopted by all UN

members in 2015. They set a series of ambitious targets to be met by 2030. As well as governments, many of our industrial collaborators are also aligned. The SDGs are forward-looking and provide a widely-used framework for countries, industries and companies to show how they can make a positive impact.

Several of our companies are at an early stage of developing their technology. The potential is promising, but success is not guaranteed. Frontier IP is itself a small company employing 16 people. This means our approach to the UN SDGs and how we align to them and measure our performance are expected to evolve over time. The Group aligns to six Goals, and our portfolio companies to a total of 11.

THE UNITED NATIONS' SUSTAINABILITY GOALS: HOW FRONTIER IP GROUP ALIGNS

3 GOOD HEALTH AND WELL-BEING



Eight companies in our portfolio are developing technologies directly designed to prevent or treat diseases. Most obviously are those in our pathogens and cell imaging, and robotics and AI clusters. Others have indirect impacts.

5 GENDER EQUALITY



We continue to be committed to equal opportunities when it comes to recruitment, appointing and development. At the year-end, 50 per cent of our team were women and women were represented at all levels within the Group.

8 DECENT WORK AND ECONOMIC GROWTH



Our business model is expressly designed to support productive activities, decent job creation, entrepreneurship, creativity and innovation. We are developing and growing early-stage businesses with the potential to be much more across all clusters.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



At the heart of our business model is promoting innovation -- identifying science and technology with the potential for positive commercial, societal and environmental impacts. We are currently working with 17 portfolio companies and across two projects to fulfill these ends.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION



Seven of our portfolio companies are developing technologies directly involved in this Goal. It maps to our engineered particles and materials, food and agritech, and robotics and AI clusters. Others contribute to the goal indirectly.

13 CLIMATE ACTION



We believe technologies being developed by our portfolio companies could have significant impact on efforts to tackle climate change. They include Pulsiv's power conversion technology, Camgraphic, and Nandi Proteins.

OUR PORTFOLIO AND THE UN SDGs: HOW COMPANIES ALIGN

ALUSID: Alusid creates beautiful, premium-quality tiles and architectural surfaces from recycled industrial waste ceramics, glass and other materials. Most of these materials would otherwise end in landfill. Its processes also use up to 29 per cent less CO₂ than other processes.

The company aligns to SDG 9 and SDG 12 because its processes emit less CO₂ than conventional tile making and recycled materials -- and the products themselves can also be recycled, supporting the circular economy.



AMPROLOGIX: Amprologix's new families of antibiotics are aimed at tackling antimicrobial resistant MRSA and other superbugs. Initial focus is on Epidermicin N01, which is derived from bacteria found on human skin, and the company is working with industrial biotechnology and synthetic biology firm Ingenza on development.

The World Health Organisation has said antimicrobial resistance is one of the top 10 threats to human health globally. Amprologix maps to SDG 3, good health and well being.



AQUAINSILICO:

AquaInSilico is developing software tools able to optimise waste water treatment. This includes improved recycling of substances such as phosphorus and nutrients across a very wide range of industries. The company is an United Nations Develop Programme Ocean Innovator and is involved in a project to help conserve one of the world's most diverse marine environments around Cape Verde and improve water quality to the inhabitants.



CAMBRIDGE RAMAN IMAGING: Cambridge Raman Imaging (CRI)'s novel medical imaging technology is based on graphene-based ultra-fast lasers. It aims to detect and monitor tumours more rapidly and accurately, also employing artificial intelligence to distinguish diseased and healthy tissue. CRI is part of pan-European project to develop new technologies to allow researchers to see diseases unfolding in near real time, opening the way for new treatments. CRI aligns to SDG 3.



CAMGRAPHIC: Camgraphic is focused on graphene-based photonics for high-speed communications and other applications. Initial work is focused on optical transceivers for data and telecommunications: tests indicate they can achieve speeds of 100Gbps, around twice that of equivalent technologies in laboratory conditions, while consuming 75 per cent less energy. By developing cheaper, faster, and more energy efficient photonics, Camgraphic technology could play a key part in the high-speed sustainable networks and smart cities of the future.



CELERUM: Celerum is looking to improve the efficiency of logistics and supply chains through artificial intelligence based on natural processes and behaviours, such as those shown by insects, fishes and evolution.

Although the technology is at an early stage, a project in Scotland showed it had the potential to cut carbon emissions by up to 40 per cent if suppliers and logistics firms were willing to collaborate and share loads, contributing to more efficient and sustainable infrastructure.



DES SOLUTIO: Des Solutio is working on safer and greener alternatives to the toxic solvents used to extract active ingredients by the pharmaceutical, personal care, household goods and food industries. It is creating new methods to use natural solvents found in a huge range of plants to replace substances such as ethanol currently used -- helping to make industry infrastructure more sustainable and promoting more responsible consumption and production.



ELUTE INTELLIGENCE: Elute Intelligence's software tools are designed to help users intelligently search, compare and analyse complex documents by mimicking the way people read. Its first commercial product reads patents, allowing users to search libraries and understand the results within minutes. It has also developed a COVID-19 reader to support academics researching the disease, and has plans to develop an enterprise wide search tool. As such, the company's tools help to enhance research, technological capabilities and innovation.



EXSCIENCIA: Exscientia is a world leader in using artificial intelligence to drive discovery -- taking years off the time taken by traditional drug discovery methods. The company is behind the first three AI-designed drugs to enter human clinical trials.

Exscientia has entered into a collaboration with the Bill & Melinda Gates Foundation to develop COVID-19 treatments and is working with EQRx, a company committed to developing and providing medicines at lower prices.



FIELDWORK ROBOTICS: Fieldwork Robotics is developing agricultural robot technology to harvest soft fruit and vegetables.

It has the potential to improve agricultural productivity by replacing human pickers with more skilled robot operators. More accurate picking and reduced human contact will also reduce food waste, and a lower reliance on migrant labour could also lead to fewer carbon emissions.



INSIGNALS NEUROTECH: InSignals Neurotech's wireless wearable devices are designed to precisely measure wrist rigidity to help surgeons place brain implants more accurately.

The first product is aimed at supporting treatment of Parkinson's disease. Parkinson's is the world's fastest-growing neurodegenerative disease. By 2040, it is predicted that 13 million people will become victims.



MOLENDOTECH: Molendotech's technology rapidly detects pathogens in water. Its Siren_{BW} kit, which can be used on site, cuts testing times from up to two days to under 30 minutes because samples do not need to be sent to a laboratory, enabling agencies to swiftly assess water quality.

The company has also developed novel methods to detect specific bacteria for use in industries such as food, where it has the potential to extend shelf life and reduce waste.



NANDI PROTEINS: Nandi Proteins technology creates customised ingredients based on vegetable and animal proteins. These can be used to replace undesirable ingredients, such as fat, gluten and E-number additives in processed foods, or those people do not want to consume: for example, replacing animal proteins, such as eggs, with vegetable proteins to turn vegetarian products vegan.

Nandi's technology has the potential to support plant-based meats and reduce chemicals in foods, supporting more sustainable agriculture and making affordable food more nutritious.



NTPE: NTPE is developing cellulose-based, low-cost, low-power, electronics to replace silicon in some applications. Called Paper-E, the novel technology means electronic circuits, sensors, semiconductors and even solar panels onto paper.

Cellulose is a natural, recyclable material. Its use can help reduce the severe environmental impact of silicon mining, use and disposal. The technology is at an early stage, but there are potential applications for medical biosensors and in education.



POREXPART: PoreXpert, a software and consultancy firm, has novel methods to model the voids within porous materials and how gases, liquids and colloidal suspensions behave within them. Applications include helping companies understand the nature of their oil and gas reserves to improve the efficiency of exploration and extraction. It is also being used to help maximise the lifespan of the UK's Advanced Gas Cooled nuclear reactors, which generate 20 per cent of the UK's energy without greenhouse gas emissions.



PULSIV: Many of the gadgets we use every-day waste about half the energy they need -- that's why power converters and devices get hot, and cooling fans start into life. The cause is inefficient power conversion. When multiplied by the billions of gadgets used worldwide, this means national energy systems are forced to generate much more electricity than is actually used. Pulsiv's novel technology converts more than 90 per cent of the electricity a device needs, in a smaller, lighter and cheaper to run form factor. Pulsiv has the potential to be a significant company if its technology is adopted at scale.



THE VACCINE GROUP: The Vaccine Group is using its novel vaccine platform as a basis for a wide range of vaccines, mainly for use in animals, targeted at zoonotic and economically-damaging diseases. Among those under development are vaccines to combat COVID-19, Ebola, Lassa fever, African Swine Fever, and porcine reproductive and respiratory syndrome virus. Effective animal vaccines support more sustainable agriculture and prevent the spread of diseases from animals to humans -- sometimes with devastating effect.



SUSTAINABLE DEVELOPMENT GOALS