

## The Microbiome: Research to Revenue

The microbiome - defined as the community of microbial organisms living in specific niches on human or animal hosts – is of increasing interest as a target for pharmaceutical, agrochemical and nutraceutical intervention. The first One Nucleus Life Science Leadership Seminar to tackle this fast-moving research area was held on Thursday 2 March. Appropriately, the venue was the Norwich Research Park, home of several major institutes with research interests in this area: the Institute of Food Research, the John Innes Centre and the Earlham Institute, which focuses on genomics. In 2018, the Institute of Food Research will be combining with research teams from the other institutes and with scientists and clinicians from the University of East Anglia and the Norfolk and Norwich Hospital to form a centre for food science, gut biology and health known as the Quadram Institute. This seminar was held to coincide with a 'topping-out' ceremony in which the last cement was poured into the state-of-the-art building that will accommodate the new institute.

### Speakers included:

- **Ian Charles**, Quadram Institute, Norwich, UK
- **Abel Ureta-Vidal**, Eagle Genomics, Hinxton, Cambridge, UK
- **Mike Salter**, AB Agri, Peterborough, UK
- **Denise Kelly**, Seventure Partners, Paris, France
- **Stephen France**, SkinBiotix, Manchester, UK
- **Martin Stocks**, Procarta Biosystems, Norwich, UK

The seminar included a Keynote Address from **Rt Hon George Freeman**, MP for Mid Norfolk and Under-Secretary of State for Life Sciences from 2014-16. Before leaving the meeting for the topping-out ceremony, he highlighted the many opportunities offered for ambitious scientists and companies in the growing life science cluster in Norwich. The challenges ahead include not only thriving, despite Brexit, but extending the benefits available beyond the city of Norwich into his own relatively poor, rural constituency where there had been a significant majority to leave the EU.

## Summary of Key Points

Speakers from the Norwich Research Park, companies of all sizes and investors described the market opportunities arising from recent research into the human and animal microbiomes and their interactions with their hosts. The broad areas highlighted included:

- Understanding the communities of microbes that are found in and on our bodies – our microbiomes – may prove as critical for healthcare as understanding human genomics
- The explosion of research in this field has been driven by ultra-high throughput genome sequencing
- The human gut microbiome is the most mature sector, with many companies involved and products in development for promoting human and animal health as well as treating overt disease
- The cluster of relevant research institutes in Norwich – and particularly the new Quadram Institute - make it one of the best places in the UK for companies working in this sector

## The Microbiome: Preventive Healthcare in Norwich

The first session, with a short talk from Sally Ann Forsyth, CEO of Norwich Research Park and a longer one from Quadram Institute director-designate Ian Charles, introduced some of the opportunities available to companies and academics there. The new Institute will have four broad research themes: gut and microbiome, food safety, food innovation and healthy ageing. The gut microbiome is at the centre of the first theme and an important aspect of the others. Linking food innovation and quality to health across the human lifespan provides opportunities for preventing disease before it develops, and products that alter the microbiome can play an important role here. The Institute will house the entire endoscopy department of the Norfolk and Norwich hospital, generating tens of thousands of samples annually for clinical research and taking a leading part in clinical trials. There are already 62 companies based on the Research Park and there is room for many more.

## The Microbiome: Research Trends and Market Showcase

The explosion of interest in the microbiome as a therapeutic target in recent years has been driven by technical developments: it is now possible to sequence the genomes of a complex mixture of micro-organisms very rapidly and to culture and identify previously intractable bacteria from a wide variety of sources. Microbiomics is a 'big data' discipline. The human gut microbiome is currently the best-studied microbiome; many companies are exploiting this knowledge to develop prebiotic and probiotic therapies for many conditions, not all gastrointestinal. It will also be an important focus of the work of the new Quadram Institute. Away from the gut, researchers are targeting the microbial population of human skin to develop treatments for serious diseases such as psoriasis as well as more common irritations. This is one illustration of the way in which companies working in this area are blurring the distinction between curing disease and promoting health: many products that target the microbiome will be better classed as lifestyle medications or 'nutraceuticals' rather than pharmaceuticals.

Some of the best-known multinational companies are becoming big players in the microbiome field, and, perhaps unsurprisingly, these include general chemical or consumer-based companies as well as the pharma giants. Both Unilever and Nestle are developing product ranges that target the human microbiome, with Unilever focusing on

the skin microbiome and Nestle tackling metabolic disorders through modulating microbes in the gut. And both large and small companies in this field have a key role to play in tackling the threat of antimicrobial resistance. Prebiotics and probiotics are being developed to improve livestock health, reducing the need for antibiotics in feed, and the soil microbiome is one of the most promising sources for the novel human antibiotics that we desperately need.

## **The Microbiome: Investors and Startups**

There are plenty of opportunities for small and startup companies in the microbiome field, but it is self-evident that, unlike the pharma, agri-food and consumer healthcare giants, these companies can do little without first raising funds. They are likely to turn to venture capital companies such as Seventure Partners, based in Paris, and London-based Arix Bioscience, both of which have set up dedicated funds to invest in microbiome-related businesses. Both companies have a global reach and aim to invest in innovative companies with a strong academic research record. The risks inherent in this fast-moving research area were highlighted recently by the failure of a high-profile clinical trial of Ceres' probiotic for *Clostridium difficile* infection, but the outlook remains positive. Both Arix and Seventure are actively seeking to increase their portfolio and are particularly interested in investing in UK-based and European companies.

They may not have needed to look far; the last few talks of the day came from innovative companies working in the UK, some months old or younger. SkinBioTherapeutics was spun out from Dr Catherine O'Neill's lab at the University of Manchester, and is developing probiotic preparations of healthy skin microbes for topical application to repair damaged skin and control infection. One of the companies based on the Norwich Science Park, Procarta, has developed a nanoparticle that harnesses the bacterial stress response to kill certain species of bacteria. Its targets include *Clostridium difficile* infection and Crohn's disease, the latter through selectively depleting Enterobacteriaceae from the patients' gut microbiomes.

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