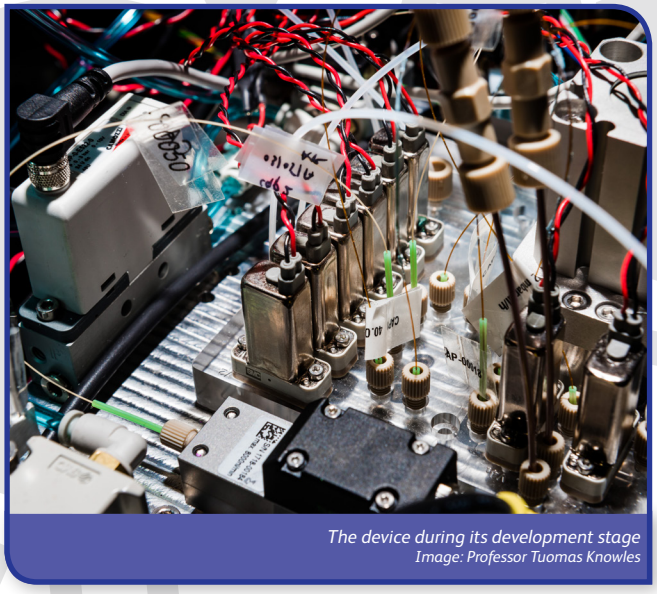
Fluidic Analytics: innovative protein analysis technology

Fluidic Analytics, a spin-out company established in 2013 following BBSRC-funded research at the University of Cambridge, has developed a new device that can characterise protein behaviour at volumes one thousand times smaller than conventional analytical techniques.

The first device produced by the company, known as Fluidity One, enables researchers to characterise proteins in their native state, improving the quality and quantity of data available to researchers.

The company now employs 25 people at its base in Cambridge where the device is manufactured, and aims to launch a range of instruments that will greatly expand the capabilities of researchers within the protein science field.

The technologies underpinning the company's first device were developed by Professor Tuomas Knowles and his team at University of Cambridge after they were awarded a BBSRC grant in 2012 to examine new methods of analysing protein assembly.



The device during its development stage
Image: Professor Tuomas Knowles

Understanding basic biological structures

Understanding and measuring the initial steps of protein assembly is a major challenge for researchers. This is in part due to the size of protein molecules - roughly a few nanometres in diameter - and the diversity of individual proteins that interact with one another during the assembly process.

Research that is able to shed light on the initial stages of a protein's life cycle, its size and how it interacts with other molecules would revolutionise the way we understand basic biological structures and certain diseases such as Parkinson's and Alzheimer's[1].

Developing the Platform

An investment of £320K from BBSRC allowed Knowles to assemble a team of researchers to examine new ways of obtaining accurate, quantitative protein behaviour data. In particular, Knowles was interested in how to capture the exact moment when individual proteins first bind to one another and assemble into larger structures.

"We really set out to ask whether we could do these measurements in a fundamentally different way. It turns out that actually one very simple way of gaining additional information and overcoming some of the limitations of conventional surface-based biosensing methods is simply to work with much smaller volumes than are used in conventional measurements." says Professor Knowles. Using a technique known as microfluidics, Knowles developed a novel methodology that was able to capture individual proteins within a few nanolitres of water. In such small volumes of water the physical properties of proteins could be closely controlled, allowing the team to analyse protein behaviour on a scale comparable to a human cell[3].

Supporting different disciplines

The novel methodology developed by Knowles' team evolved into a device that could measure the interactions between proteins and, crucially, interactions between proteins and other types of molecules. Their success attracted the interest of researchers studying such systems. "We had quite a lot of interest from collaborators and then from researchers who were less closely connected to us about trying to repeat these types of experiments; but ultimately we were approached by people with problems in completely separate fields," says Knowles.

IMPACT SUMMARY

Fluidic Analytics, a spin-out company established in 2013 following BBSRC-funded research led by Professor Tuomas Knowles at the University of Cambridge, has developed a new device that can characterise protein behaviour at volumes one thousand times smaller than conventional analytical techniques.

The device, known as Fluidity One, vastly improves the quality and quantity of data available to researchers. It is based on a novel approach that enables researchers to isolate individual proteins within nanolitres of water. Fluidic Analytics was spun out to manufacture and sell the new device.

The company now employs 25 people at its base in Cambridge, where Fluidity One is manufactured, and has already received £5.3M in Series B venture capital funding to develop tools that have applications spanning clinical diagnostics and consumer healthcare.

PROTEINS

Proteins are a group of biological molecules that regulate the structure and function of cells, tissues and organs in every living thing.

Each individual protein is made of a sequence of amino acids. Different proteins have different amino acid sequences, which determine the 3D structure of the protein and the role it plays within the cell. Proteins can also bind to one another to assemble complex structures with a particular function. In certain diseases such as Parkinson's and Alzheimer's disease, proteins aggregate together to form pathological structures. Understanding protein structure and function enables researchers to explore the fundamental processes of life[2].

On the back of these successes, Knowles and his team were able to secure an investment of £60K from EPSRC and a further €1.5M from the European Research Council to continue their research. In addition to government funding, Knowles benefitted from a philanthropic grant donated to the Cambridge Department of Chemistry by The Frances and Augustus Newman Foundation. The grant, worth £250K, helped to establish the Sir Rodney Sweetnam Laboratory, a facility dedicated to understanding protein assembly and misfolding using microfabrication and microfluidic techniques [4].

"We are delighted that we were able to do this research, which really would not have been possible without the grant from the BBSRC," Knowles adds.

Fluidic Analytics

When it became clear that their hand-built device could only be accessed by specialist microfluidics laboratories due to the technical difficulty of the measurements, Knowles set out to explore new ways of making the technology more widely available and accessible to the community, including making the device more user-friendly.

In 2013 Knowles partnered with serial entrepreneur Dr Andrew Lynn and founded Fluidic Analytics to design, develop, manufacture and sell a microfluidics instrument that offered a unique set of capabilities and a user-friendly experience to the wider bioscience community. The device, named Fluidity One, allows proteins to be studied in their native state offering many advantages over conventional protein characterisation techniques such as PAGE and ThT florescence assays[5].

In addition to Fluidity One, Fluidic Analytics aims to add to its product range by developing new tools and technologies that address other questions within the protein science field. The company has already received £5.3M in Series B venture capitalist funding to develop these technologies, ultimately aspiring to produce tools that have applications spanning clinical diagnostics and consumer healthcare[6].

"It is very exciting to be involved in projects that further our understanding of fundamental bioscience and to also develop novel technologies that enable researchers to carry out measurements that will greatly improve their own research," says Knowles.

Fluidity One offers a unique set of capabilities for measuring protein behaviour as well as a user-friendly experience to the wider bioscience community
Image: Fluidic Analytics Ltd

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