



Owe Orwar: Biopixlar is by no comparison the most important biotech instrument I have ever been involved in

We are doing a special feature for the first issue of our CEO Newsletter for 2021, presenting an interview with the Fluicell board member and advisor Owe Orwar. Aside from his involvement in Fluicell, Owe Orwar is also the CEO of Oblique Therapeutics AB and a Senior Researcher at Karolinska Institutet. Owe has over 20 years of experience as founder and inventor in several biotech companies and from leading roles in the pharma and biotech industry, including Global VP of R&D at Sanofi and President of R&D at Piramal Healthcare.

In addition to this, Owe has a long-standing academic career, which includes positions as postdoc at Stanford University, professor at Chalmers University of Technology, and guest professor at Institut Curie in Paris. During his research career, Owe has produced multiple publications in the world's leading scientific journals such as Science and Nature. Owe has received several international and national awards for his contributions as a scientist, including the Göran Gustafsson Prize in Chemistry in 2004, often considered as the most prestigious award for Swedish scientists.

Among his other achievements Owe, most closely identifies himself as an avid and visionary inventor, having filed close to 170 patent applications worldwide and with several products on the global market. He is also a co-inventor of Fluicell's technologies and products. We caught up with Owe to talk about his involvement in Fluicell and the potential and future opportunities he sees for the company.

You have a long experience from research and innovation, both from an academic setting and from the biotech and pharmaceutical industry, what made you engage in Fluicell?

The short answer is growth potential and excitement to see ground-breaking science becoming meaningful products. Fluicell is an innovation leader, they have developed completely new game-changing technologies based on digital fluidics and microfabrication sciences to control single cells.

How far is it possible to take these technologies?

I believe the answer is best captured in Biopixlar – a gamepad controlled single-cell bioprinter that builds 3D biological tissues one cell at the time with real life resolution. The bioprinting industry has never seen anything like it before. In my mind, it is the digital revolution in biology and medicine, and I think it has the potential to completely change the industry in the long run. We can draw similarities in the change from analog to digital photography or from regular cellphones to smartphones, that not only disrupted the technology landscape, but also saw major changes in businesses and markets.



Breakthrough technologies have a tremendous power to create dynamical change on markets and in society and this capacity will propel forever into the future.

What is going on right now, in front of our eyes, are new highly exciting technology and market trends in AI, quantum computing, as well as in single-cell technologies, just to mention a few. Much of this was science fiction 20 years ago but has now resulted in a multitude of new aspiring companies. A few of them will develop into market leaders that in the long run will become highly influential. Several people involved in Fluicell are pioneers in single-cell technologies. They were in Silicon Valley and elsewhere in the US when the field emerged and have since then made significant contributions to shape it, both scientifically and by inventing pioneering products. I am certain Fluicell has the technologies and people needed to make a major impact on the strong growing markets of single-cell biology, bioprinting, and regenerative medicine and that the company has the potential to become as big as anyone of the leading global tech dragons.

Fluicell is a dominant global player in open-volume microfluidics, the underlying patented platform technology that allows you to manipulate single cells in solution. Now with the inception of Biopixlar, the company has added a second platform technology which is 3D microorganization bioprinting. These platform technologies are scalable and can, in principle, be used to generate numerous new products, emerging from the same core.

The company has since 2015, in an enormous, dedicated effort led by CEO Dr. Victoire Viannay, and the CTO Dr. Gavin Jeffries, managed to box these technology areas, to put the foundation in

“I am certain Fluicell has the technologies and people needed to make a major impact on the strong growing markets of single-cell biology, bioprinting, and regenerative medicine and that the company has the potential to become as big as anyone of the leading global tech dragons.”

place and to secure IP and patents. Based on the domination in these two platform areas, the company is in a really sweet position for the future, and it is going to be extremely exciting to see how far Fluicell has come a few years from now.

These are all bold statements, what is it that gives Fluicell this potential?

First of all, I say it is the people, their drive, and their skills and commitment to make a difference. Fluicell is a company that has high ambition with the means to grow big and become market leaders. It is extremely rare to see a young company dominating two big technology fields, with so many and so strong patents accepted on major markets. They also have the capability and resources to constantly rejuvenate their IP and product portfolio. Furthermore, the company is extremely well managed, and has a highly experienced board and scientific advisors. They truly understand the connection between science, innovation, IP, products, and markets. The company is putting all the strategic fundamentals in place in the right order ensuring long-time growth.

What do you think are the unique success factors of Fluicell?

Fluicell has three critical assets that ensure long term healthy growth and success. The first is inventiveness, technological know-how and scientific acumen combined with the ability to transform new knowledge into meaningful innovations and patents. The second is the capability to turn this knowledge and inventiveness into products, and to do so in an effective way at very low cost. The third and final factor is scalability, market understanding and a broad spectrum of entry points into diversified markets.

As CEO Dr. Victoire Viannay has stated very clearly, all these points are proven, and the company has transformed from a local single-product company into a global 4-product company with several service offerings in just 5 years. Furthermore, a strong indicator of future success is the very high number of blue-chip companies and institutions that have been early adopters and customers. These include leading universities such as Oxford and Cambridge University, leading pharma companies such as Roche/Genentech, and Novartis, as well as leading research institutions such as NIH (US National Institute of Health), FDA (US Food and Drug Administration), and EMBL (European Molecular Biology Laboratory).

Today, we know Fluicell as an instrument and service provider for single cell biology, and bioprinting – but the potential goes a very far way beyond that.

Single-cell biology has gained a lot of attention during the last few years. Francis Collins, head of NIH, has for instance named single-cell analysis as the first of ten major breakthroughs for health

in the coming years. You started to explore this topic on a very early stage, what was it that sparked your interest in the field?

My Ph.D. advisors wanted to push the limits for physical, analytical, and biological sciences. A magic goal at that time was to understand the content of single cells, and how their individual function impacted collective cellular behavior in tissues. Just as the chase for the Higgs boson particle in physics, it was the hunt for absolute biological truth in the smallest functional units of life. My interest continued to grow at Stanford where I worked for Richard Zare together with Richard Scheller, and Daniel Chiu. We set out to perform characterization of single cells and even single vesicles. The results were widely recognized and resulted in three papers in Science. When I became professor at Chalmers, I continued to develop single-cell biology tools, which resulted in several products and patents. This includes the first single-cell DNA/RNA transfection instruments, a technology that was out-licensed to one of the world's leading scientific instrument companies and that has become a huge commercial success.

You are one of the inventors behind the Biopixlar platform, what do you think about the result?

Spectacular. I truly believe that Biopixlar will deliver what this industry has dreamt about for many years, namely the ability to very efficiently and conveniently create biological tissue that with high accuracy resembles human tissues. Biopixlar is based on our world-recognized open volume microfluidics technology but also on completely new ways of high-resolution 3D printing with molecular binders that we recently filed in a patent application. This is a type of 3D bioprinting that does not require any gel or matrix, which means that you can place cells side-by-side directly touching each other as the case in actual tissues and organs. The control over the types of cells and their location in the local environment when establishing tissues, is reminiscent of how color and position of pixels make up a digital image. This is what I refer to as the digital revolution in biology, as mentioned above.

The company has already showed amazing results for printing skin and liver models as well as printing of neuronal cells, just to give a few examples. According to the CEO Victoire Viannay, there is a rapidly growing market interest and much attention for the product, and it will be really interesting to see what the uptake will be.

What was it that led to the Biopixlar concept?

Biopixlar was invented and realized at Fluicell mainly by me, Drs. Gavin Jeffries, and Shijun Xu, based on our open-volume microfluidics platform. The trigger was that we saw extrusion or dispensing bioprinters, that were basically developed from regular inkjet and 3D printers from the 90s era, making a lot of noise and promise within

the scientific community. These types of bioprinters substitute the extrusion of a melting plastic, used in conventional 3D printing, with a gel containing cells. The challenge faced was how a bioprinter of this type could control the cell positioning required for making detailed and life-like biological tissues.

We clearly heard from the market and key opinion leaders that there is a strong need for high-resolution single cell 3D bioprinters. Working from our combined biology and technology backgrounds, we immediately realized that we could make a highly competitive next generation bioprinter, superior in terms of cell printing precision and tissue complexity. That is the story behind Biopixlar and how we originated single-cell 3D microorganization bioprinting. The Biopixlar technology was recently published in Scientific Reports, which is a freely available open access journal, and I invite everyone who is interested to take a closer look. Biopixlar is by no comparison the most important biotech instrument product I ever been involved in, based on the technology, IP and market potential. The realization and launch of the instrument made Fluicell an innovation leader in the field of bioprinting. But the value of the platform is so much more than just the instrument itself. Its real potential lies in that it is a platform technology, and the way that it enables Fluicell to develop completely new products and services which will take the company to the next level.

How do you see the future for bioprinting in medicine?

After spending almost 20 years in and with the pharma industry, I see a number of applications that can change our capabilities to create meaningful in vitro tissue models and game-changing products in regenerative medicine. In a wider context, if you can reproduce human tissues to mimic disease or to replace malfunctioning organs, then the applications are limitless. The latter is, in my opinion, much further away than it is often made out to be. Here you have to be extremely careful to not put false hope in patients and healthcare professionals. Creating a fully functional human organ such as liver or a heart which are large, highly complex vascularized, and innervated organs made up of different tissues and a multitude of different cell types is beyond the reach of any current bioprinting technology.

Fluicell has in their regenerative medicine programs found their own niche and, as has been explained by Victoire Viannay, we will see this area becoming more prominent in the company in the near future. The capabilities provided by Biopixlar in combination with Fluicell's single-cell bioprinting know how provides a fertile ground for clever engineering of disruptive new products. I can say without any doubt, that the cleverness and skills of our researchers and product developers are second to none in the industry.

February 9, 2021