Spinout Clyde Biosciences Limited cut the cost of drug development

Clyde Biosciences[1] is a spinout company from the University of Glasgow that has developed an automated system which provides powerful insights into the mechanisms and actions of drugs. It enables researchers to determine, early in the developmental process, those pharmaceutical compounds that will adversely affect human cells, especially heart tissue.

'The advantage of our system [cellOPTIQ] is that other technologies, such as microelectrode array, measure electrical activity in the solution outside of the cell – and as a consequence it is more difficult to interpret what's happening in the cell membrane,' says Dr Margaret Ann Craig, CEO of Clyde Biosciences and one of the company's founders. 'CellOPTIQ is cheaper, easier to use, and provides more highly relevant data. Out of up to 10,000 potential drugs, developed at huge expense over decades, only about four or five are successful in late clinical trials. cellOPTIQ can remove these failures at an early stage – cutting drug discovery time and costs.'

The company has now established two partnerships, with AstraZeneca and Johnson & Johnson, to use their systems to screen libraries of potential new drugs[2].

Around 10% of drugs entering phase I clinical trials are subsequently approved[3]. Drug development costs, including the costs of clinical trials, are significant (a 2010 study suggests an average cost of $1.8Bn per new drug[4]), and so any technology that identifies drugs which cause adverse side effects early in the process has the potential to save the pharmaceutical industry many millions in development costs.

Finding failures

At the University of Glasgow in August 2012, Professors Godfrey Smith of the Institute of Cardiovascular and Medical Sciences[5], and Professor Jonathan Cooper of the School of Engineering[6], together with colleagues Dr Margaret Ann Craig[7] and Dr Francis Burton[8], set up Clyde Biosciences to develop commercial applications based on their knowledge and experience of experimental cellular cardiology[9]. The aim was for the spinout company to offer the pharmaceutical and biotechnology industries a way of speeding up the process of drug discovery by determining at an earlier stage in the developmental process which candidates for new medicines are most likely to fail. Underpinning the technology was Smith and Cooper's research into the measurement of electrical activity in single cells – work that was primarily funded by two crucial BBSRC grants. Subsequently, the work received grants from EPSRC and the British Heart Foundation, as well as translational awards from Scottish Enterprise[10], The Royal Society of Edinburgh and the Royal Academy of Engineering. Existing methods of screening drugs for side-effects can be time consuming and costly and often result in pharmaceutical companies discovering too late in drug development process that particular compounds have adverse effects on humans. In discussions with industry leaders about factors constraining drug development, the researchers identified a need for more accurate screening of new drugs to find those that could cause an irregular heartbeat.

The testing for such side effects is most commonly performed at a late stage in the drug development process and is often only identified during clinical trials. Drawing on their earlier collaborative work in the design of novel cardiac assays, the team designed an instrument and appropriate software that could be used readily in industry – enabling assays to be performed in individual cells earlier in the development process[11].

IMPACT SUMMARY

Spinout company Clyde Biosciences Ltd was founded by researchers at the University of Glasgow to commercialise technology developed through BBSRC-funded research.

The company is developing its innovative 'cellOptiQ' system, which can help identify potential new drugs that adversely affect heart cells. The system will be used by the pharmaceutical industry to reduce the time and cost of drug discovery.

Clyde Biosciences' clients include major pharmaceutical companies AstraZeneca and Johnson & Johnson.

Dr Margaret Anne Craig, CEO, Clyde Biosciences.
Image: *Clyde Biosciences*

Using control, measurement, analysis and storage software designed by Burton, the optical instrumentation was able to measure small colour variations in cells loaded with voltage-sensitive dyes as they responded to changes in electrical activity. The instrument became known as cellOPTIQ. The assay method, which had already been developed by Smith and Cooper in earlier BBSRC-funded research, was translated into a stem-cell-derived heart model. Its behavior had the characteristics of human heart tissue. As new compounds were added to the assay system, it was possible to explore the effects that candidate drugs had on the electrical properties of beating heart-like cells.

Company development

Craig, a post-doctoral fellow at the Institute of Cardiovascular and Medical Sciences, stepped forward to advance the company. It progressed from having a simple prototype device with associated software, to a 'system' able to test large numbers of candidate drugs in a high throughput format. In order to hone her business skills Craig applied for, and was awarded, a BBSRC-Royal Society of Edinburgh Enterprise Fellowship.

Craig was already familiar with the work of the team, and with the support of the Enterprise Fellowship, she concentrated her energies on the commercialisation of the technology. The fellowship also provided her with guidance from industrial mentors, which helped put the company on a firm business foundation.

As one of the company's key founders, Craig became the CEO of Clyde Biosciences – with her colleagues making up the rest of the company's expert team. Dr Rob Wallis, a cardiovascular pharmacologist with over 30 years experience in the pharmaceutical industry and considerable experience of cardiac-toxicology testing, later joined the team.

With funding from the University of Glasgow's Challenge Fund, Craig built and tested the first cellOPTIQ prototype. The instrument used standard multi-well plates and measured trans-membrane cardiac electrophysiology in cardiac cells (including primary human and animal cardiac muscle cells as well as stem cell derived models).

In June 2012, Craig received the highly acclaimed Royal Academy of Engineering ERA Foundation[12] Entrepreneurship Award. The award was for £40,000 and acknowledged the entrepreneurial researcher work carried out at the university in the field of electro-technology. The award helped with the further development of the company.

'We've been working with Clyde Biosciences for three years providing an integrated package of account management support including a SMART: Scotland Award[13] and also help with innovation,' says Jim Watson, Director of Innovation and Enterprise Services, Scottish Enterprise. 'This is a great example of a company that is successfully exploiting its technology to create real commercial opportunities and we look forward to continuing to work with Clyde Biosciences to help it realise its ambitious growth plans.'

Professor Cooper comments, 'Important lessons come from the spinout process. The need for underpinning Research Council funding to enable the technology: for translational awards to create prototypes; for mentors and guidance from technology-transfer experts; for an individual champion with the drive to take the process forward; and for appropriate support from innovation awards at key moments to enable the proof of concept. All of this comes about from teams of interacting individuals working together with a common vision.'

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