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Effective solutions

We need to focus on simplicity not complexity in medical device design believes **Michael Phillips**, **Renfrew Group International's** (RGI) Design Development Director

"People don't want technology, they want what technology does," says Michael Phillips, by attempting to make medical devices do more, medical designers are at-risk of undermining their fundamental purpose of these devices – to make people better.

For Michael and the design team, the beauty of well-designed technology isn't in its complexity, but its simplicity. "The art of great industrial design is in creating the efficient and effective interface between human and device," he says. "It's about satisfying all the senses." Nowhere is this more important than in the world of medical devices, where products should be judged on their useability and their effectiveness. It's not designers who will make this final judgement, it's users.

"The better the products we create, the more clinicians are likely to adopt them or the more patients are likely to use them," he says. "They are not going to be effective if they stay in the packet or in the cupboard. Further, if devices are not appealing to use, then it is well understood that compliance, or adherence to a medical regime or treatment will suffer."

Phillips' has been developing a design philosophy as part of the team at Renfrew Group international (RGI), a company that for over 30 years has established a reputation for the development of innovative medical devices. As design development director, Michael Phillips is a passionate advocate for the humanisation of technology – focusing on the outcome - not the

object. It all starts with the patient and how the science is delivered to the patient. We talk about The Design of Science (how the science is to be applied most effectively in the real world) and The Science of Design (a systematic and collaborative approach to problem solving).

Health services across the world are facing increasing pressures of a growing and ageing population. These demographic shifts are providing the inspiration for much innovation, with a greater focus on devices that enable self-monitoring and improved self-care. The purpose is to keep people out of hospital in the first place and safely discharge patients from hospital as quickly as possible, and improve their quality of life at home. With no clinician on hand, patients must



go it alone. "We have to create products that are simple, intuitive and beautifully designed to ensure patients use them," says Phillips.

The changing demands of the medical device industry have seen RGI reposition itself more towards technology consultancy, developing both hardware and the software. The aim is to provide smart, responsive and individualised experiences, Phillips says. "If the patient wants to use your device, they will," states Phillips. "It's human nature to adopt something properly if we perceive it to be beneficial to us."

A focus on the patient is hardly unique, but often too low a priority. Phillips explains how this influences every aspect of the design and development process. A current project with UCL and Royal Free on the development of a Bio Artificial Liver device, makes the careful inclusion of the needs of the very vulnerable patients, susceptible and sensitive to their environment, via close collaboration of a patient involvement group, whilst the science is being applied. In another example, RGI developed a single,

low-cost injector device that could be used by patients to self-administer a vaccine. Created in partnership with innovative biotech company Nemaura Pharma, the solid-dose injector device has potential life-changing applications in the developing world where shipping and storage of refrigerated vaccines is difficult.

Understanding the application and the potential user was integral to the process, says Phillips. "We needed our design to take the fear out of the anticipation of the needle going into an arm," he says. The solution was the development of a contact surface with several blunted triangular forms which distracts the patient as the needle goes in. Once the dose has been administered, the needle retracts to minimise injury or secondary usage risks. "Being conscious of the potential barriers to the product being used effectively is fundamental to developing our approach," he adds.

In an area where device costs are high, functional design pioneered by RGI can provide additional benefits, Phillips explains. "Products

which are engaging will last longer, be looked after longer and kept longer," he says. Because of the tendency for devices to be reused or repaired the environmental impact can be lessened.

Healthcare providers will benefit as devices need to be replaced less frequently.

In developing effective solutions, RGI needs to understand the science in detail, a process that begins almost as soon as a brief is delivered. "We start to get 'under the skin' of the science – and understand how everything works at a fundamental level immediately," Phillips says. The business benefits from its own labs, increased in capacity at its new premises in Leicester, where this analysis can take place. The process is essential at ensuring designers understand the make-up of the chemistry, the physics, the requirements of the device and any specific challenges they may face when it comes to developing prototypes. It's also about ensuring that the needs of both the patient and the clinician aren't compromised. "It helps us put the end-user at the front of everybody's mind," says Phillips.



Opposite | One of the labs at the new Renfrew Studios
Below | Collaborative Design with University College London Medical School on BioArtificial Liver Machine



RGI has the capabilities to support a product throughout its development lifecycle. At its Leicester base, the business has production facilities, including precision machine tools for experimental mould making in addition to high quality moulding facilities in-house. They have product assembly facilities for small to medium batch production of devices and equipment and large-scale assembly areas for room-sized sized

diagnostic machines and laboratory equipment. RGI is proud of its ISO 13485 accreditation, recognising its commitment to quality and process.

While RGI has established an international reputation for excellence in product design, positioning itself as a technology consultancy, means they develop technology that people want. Alongside providing services to innovative start-ups the business works closely with



academic partners, including UCL and the Universities of Leicester and Nottingham.

Phillips is particularly enthusiastic when talking about the potential for the Midlands area. He describes how its strengths in traditional manufacturing, pharmaceutical research and life science makes it an attractive location for investment and development. To embrace the potential of areas like the East Midlands, Phillips believes that as a country we need to reconsider our investment strategy. We should move away from a disproportionate focus on digital technology, and invest in areas where we still have an advantage, he believes. "We need to maintain our strengths in developing the equipment that enables the interaction between the machine (the digital) and the body," he says.

One of the biggest challenges in the medical device industry is the long-lead times it takes for products to be adopted, which can often be measured in decades. This can cause problems for developers, with IP in a precarious state as the opportunity to maximise returns diminishes the longer a product takes to get to market. While acknowledging the need for firm regulation in the UK and a lack of harmonisation across territories are not new problems, they're increasingly biting into the advantage of UK companies and inhibiting their ability to innovate, Phillips believes.

It's a situation that isn't being helped by the way new projects are funded, he says. "To make a genuine impact national funding needs to be multiplied many times to make a real-world impact." While positive about the impact organisations like Innovate UK are having, he considers the current grant

Opposite, top to bottom | Self administering, Micro Injector for Nemaura Pharma Ltd
| Nemaura Pharma Ltd. Pain reduction via distraction

funding model could be improved. "If 100 companies answer a call out and only three are successful, the other 97 have wasted countless hours that could have been better spent." What's the solution? "Apart from as a nation being courageous with the level of funding, a much earlier filtration stage would result in a greater impact on the economy."

As one of the UK's most established medical device design consultancies, RGI is well-placed to comment on the current and future state of medical device design in the UK. It's driven by a belief, says Phillips, that we can achieve more if we focus on the right things. "Most people just want stuff that works really well," says Phillips. "We want it to perform, and do what it promises to do reliably and easily." He should know, RGI has been delivering that for over 30 years. |

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Renfrew Group have been working with UCL and manufacturers as well as patient and clinical groups on the design of a workstation for a highly innovative cryopreservable BioArtificial Liver (UCLBAL) for the treatment of patients with liver failure.

The machine, the first of its kind, will buy time for a patient's liver to improve or if damage to the liver is irreversible, buy time in providing a "bridge-to-transplant" until liver transplantation can be arranged.

The program which is working toward first 'in man' trials, is led by Clare Selden PhD, Professor of Experimental Hepatology of The Liver Group at UCL Medical School, Royal Free Hospital Campus.

Supported by the UCL Translational Research Office, Prof. Selden received a National Institute for Health Research (NIHR) i4i award to fund this research project. *The views expressed in this article are those of the author(s) and not necessarily those of the NHS, the NIHR www.nihr.ac.uk or the Department of Health and Social Care.*



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