Waiting for a replacement organ that never comes is the heart breaking truth for 14% of patients requiring a liver transplant. The demand for replacement livers has always far outweighed the supply, with over 10,000 people waiting for a liver transplant in the EU alone. This means many patients can die, or otherwise become too sick to undergo surgery, during the wait. It is equally troubling that 6% of the EU population suffer from chronic long-term liver diseases. Available technologies for replicating healthy liver function still prove largely unsatisfactory in terms of reliability, predictability and consistency.

Thinking outside the body

One company positioning itself to help tackle these issues is The Electrospinning Company, an STFC spin-out that is now breaking new ground in the field of regenerative medicine by taking part in Re-liver – an exciting EU project which hopes to improve the treatment of liver-associated diseases and, ultimately, develop next-generation liver replacements. The three-year research project started out researching and developing non-therapeutic cellular in vitro solutions for biopharmaceutical research, and is leading on to the development of bioartifical liver organoids. These organoids consist of cells that provide liver cell functions, which could be used to treat liver-associated diseases such as Haemophilia. In addition, the Re-liver consortium is investigating and validating new diagnostic tools and further products in cell-based applications. The ultimate long-term goal is the development of innovative bioartifical organoids, which would supplement, or even eventually replace, lost liver activity.

Liver for longer

The Re-Liver project is funded by the EU Seventh Framework Programme (FP7/2007-2013) and carried out by a consortium of European research institutions and industrial partners. The Electrospinning Company’s contribution comes in the form of their electrospun 3D scaffolds composed from synthetic, biocompatible polymers, functionalised by academic partners at the University of Manchester. This means they are suitable to be put in the body, their structure mimicking the extra-cellular matrix of real human tissues. Made from medical grade, FDA-approved polymer fibres, the scaffolds are the ideal environment to provide basic structural support to the growth of 3D cells – in this case, functioning liver cells. The Electrospinning Company can also produce fibres that slowly dissolve in the body over time, which is ideal for potential applications where cells require a structure to cling to at first but will eventually become self-supporting over time.
Eyes on the prize
Refusing to limit itself to just one area of regenerative healthcare, The Electrospinning Company is also working in collaboration with the University of Sheffield to develop a simplified, affordable solution for corneal regeneration. This is required when a patient loses the cells that renew the corneal epithelium – the cells at the front of the eye that normally keep the cornea clear and scar-free. Left untreated, a scar-type tissue grows over the eye resulting in pain and eventual loss of vision. There is limited treatment available for this problem around the world due to the cost of the specialist facilities, expensive equipment and high-level of surgical skill required.

The Electrospinning Company has developed biodegradable, sterile electrospun membranes for the project, which can be used as an alternative to the human amniotic membrane. They can be stored for at least a year and are ready for use instantly. The first human pilot testing is forecast to take place sometime in the next year, with the hopes that success will mean a future where treatment for corneal problems is available to everyone, not matter where they are in the world or how much money they make.

About the company
The Electrospinning Company was established in 2010 to develop commercial products from IP developed at STFC’s Rutherford Appleton Laboratory. Since then the company has gone from strength to strength while enjoying the support of STFC in the form of both the Innovations Technology Access Centre (I-TAC) and ESA Business Incubation Centre Harwell (ESA BIC Harwell). The company has also attracted investment from various venture capital sources, including The Rainbow Seed Fund.

The company graduated from ESA BIC Harwell in June 2013, but remain located on the Harwell Oxford campus as an I-TAC tenant, where they rent labs, office space and high specification equipment for their research and development.

Below: Fibroblasts in a Mimetix scaffold developed by The Electrospinning Company

STFC spin-outs: what you need to know
The Science and Technology Facilities Council (STFC) manages a variety of large public science research facilities in the UK, putting it at the heart of global technology innovation. To maximise the impact of new technologies coming out of its facilities, STFC strategically commercialises promising technologies that have the potential to boost the UK economy.

This involves licensing out technologies or intellectual property (IP) into existing companies in well-established markets, or supporting the creation of a spin-out company for technologies with multiple applications or those which require further intensive R&D.

STFC has set up spin-out companies operating in a variety of market sectors including aerospace engineering, cleantech, security and defence, regenerative medicine and diagnostics. Once a company has been set up, STFC often supports these early stage SMEs via its incubation programmes, providing guidance on raising external investment and forming connections with campus, local and international business networks and partners.