PATIENTS EXPECTED TO BENEFIT FROM LONGER IMPLANT LIFETIMES AND REDUCED NEED FOR REVISION SURGERY

- **New smart sensors will aid soft tissue balancing and correct positioning of joint implants during surgery**
- **Wins Armourers Venture Prize Award**

New smart sensors, which assist in the soft tissue balancing and correct positioning of an orthopaedic implant during hip replacement, are expected to prolong implant lifetimes and reduce the chances of patients needing difficult revision surgery.

Currently, implant survival rates are 89 percent after 15 years, but drop to 58 percent after 25 years (Sodhi & Mont, Lancet 2019). Thus, for the younger patient in particular, it is crucial to improve implant survival lifetimes to reduce the need for multiple revision surgeries when they grow older.

New microfluidic force sensors are being developed within the University of Cambridge, in the laboratory of Professor Sohini Kar-Narayan in close collaboration with Mr Vikas Khanduja consultant orthopaedic surgeon at Addenbrooke's Cambridge University Hospitals NHS Trust. This initiative has won the Armourers and Brasiers Venture Prize.

"This is a key clinical unmet need, particularly for the hip joint," explained Mr Vikas Khanduja. "Improper implant positioning, where forces on the implant are not balanced, can lead to premature wear and necessitating complex and expensive revision procedures."

"Integrating sensors within the trial liners during surgery, will provide real-time objective feedback to facilitate soft tissue balancing and accurate implant placement, thereby potentially prolonging the longevity of the implant."

To facilitate commercialisation, the team has incorporated a spin-out company, ArtioSense Limited.

ArtioSense's smart sensor-embedded trial liners that fit in the hip implant will aid surgeons in determining the optimum, force-balanced positioning of the implant via real-time measurements obviating the sole reliance on 'feel' for positioning and balance.

Once the optimum position is set, the surgeon will remove the ArtioSense sensor-embedded liners, and fit in the final liner. Thus the ArtioSense product will only be used as a trial during surgery, and will not be left in the patient.

A market report by technology management consultancy IP Pragmatics revealed that over 2.1 million hip replacements are performed annually across the globe. This number is expected to grow further due to the increasing global life expectancy and a growing proportion of younger patients opting for elective joint replacement.

In the UK, the 2020 figure of around 80,000 hip replacements is expected to rise to around 96,000 by 2035. While in the US, the number of people undergoing primary total hip replacement procedures is expected to increase from 498,000 in 2020 to 850,000 in 2030 and 1,429,000 in 2040.

The ArtioSense sensors will be integrated directly into trial inserts that are already used during surgery. There is no need to change the surgical process and the sensors add functionality to the existing surgical workflow to improve outcomes.

“This makes our technology attractive to both the surgeon, as well as the implant manufacturers, who simply need to integrate our technology into an already existing manufacturing workflow, ” explained Professor Kar-Narayan. “In addition, the sensors will be fabricated from inexpensive materials so will not add significantly to costs.”

“ArtioSense is showing how research and innovation has the potential to improve the quality of life of patients receiving joint replacements,” said Professor Bill Bonfield, chairman of the Armourers and Brasiers Venture Prize judging panel. “Our prize looks to encourage scientific entrepreneurship in the UK and provide funding to help innovative developments like this realise their potential.”

“Our primary focus is on developing our smart trial liners for hip implants,” said Professor Kar-Narajan. “However, the technology is versatile and customisable, and can be applied to similar use in other joints such as the knee, shoulders and ankles and could be adapted for use in veterinary surgery as well.”

Along with Professor Sohini Kar-Narayan and Mr Vikas Khanduja, the co-founders include Dr Jehangir Cama, a biophysicist specialising in microfluidics, and Dr Alexander Samoshkin a biomedical technology transfer specialist.

ArtioSense wish to combine the £25,000 Venture Prize win with its planned seed-funding round to support the development and finalisation of product specifications, for the hip implant prosthesis, in advance of first-in-human trials.

A patent application covering ArtioSense’s microfluidic force sensing technology has been filed through Cambridge Enterprise (CE), the commercialisation arm of the University of Cambridge who are also assisting Artiosense with its commercialisation plans. Ends.

Notes to Editors

About Armourers and Brasiers’ Company

Alongside Professor Bonfield on the judging panel were materials scientist and entrepreneur Professor Sir Colin Humphreys, and other members of the Armourers and Brasiers’ Company with expertise in venture capital and commercialization of scientific research.

The Armourers and Brasiers’ Company is a leading supporter of Materials Science education and research in the UK. Its Venture Prize is aimed at helping scientists commercialise the early stage research and the exploitation of new and exciting ideas. The Company also seeks to encourage education in science from primary to postdoctoral levels supporting schools and universities throughout the UK.

About ArtioSense

Professor Sohini Kar-Narayan is Professor of Device & Energy Materials in the Department of Materials Science, University of Cambridge. Professor Kar-Narajan was recognised by the World Economic Forum as being ‘one of 40 exceptional young scientists under the age of 40’ in 2015, and as one of the Top 50 Women in Engineering in 2021 by the Women’s Engineering Society.

Mr. Vikas Khanduja is a Consultant Orthopaedic Surgeon & Research Lead (Elective) at Addenbrooke's - Cambridge University Hospital, specialising in hip surgery and has a particular interest in arthroscopic surgery of the hip. He has been instrumental in setting up & developing the tertiary referral service for Young Adult Hip Surgery in Cambridge and also leads the Cambridge Young Adult Hip Research Group. Mr. Khanduja is the recipient of the Arnott Medal presented by the RCS of England in 2013, the Insall Fellowship presented by the American Knee Society and Insall Foundation in 2014 and the Hunterian Professorship by RCS England in 2021. He also sits on the Executive Committee of the British Hip Society as the President and ESSKA as the Chair of European Hip Preservation Associates.

Dr Jehangir Cama, is a biophysicist with expertise in the development of microfluidic technologies for a range of biomedical applications.

Dr Alexander Samoshkin currently works as a Translational Technology Manager at the University of Cambridge (School of Clinical Medicine). He has previous experience in world-class biomedical research laboratories in the USA and Canada

ArtioSense's smart sensor-embedded trial liners operate by monitoring the change in capacitance of the electrodes as the fluid in the microfluidic channel is displaced in response to an applied force. Using a bespoke mechanical testing rig, it calibrates the capacitance change of these sensors based on known applied forces, and this calibration data is used to determine the forces applied to the sensors when they are embedded in the implant prosthesis. Importantly, the capacitance response to forces is linear over a wide range, aiding reliability.