BUILDING
THE HOSPITAL OF THE FUTURE

Clinical 3D imaging, computational modelling, 3D printing and advanced manufacturing (pictured above) will be combined as QUT researchers and Metro North Hospital and Health Service collaborate with industry partners to build the hospital of the future in Brisbane.

Researchers at QUT's *Institute of Health and Biomedical Innovation (IHBI)* are working to develop technologies and processes that will enable doctors to treat complex medical problems such as musculoskeletal injuries as well as bone and breast cancer. They will work at the Herston Biofabrication Institute to develop techniques encouraging regeneration of damaged bone, cartilage and other tissues.

The institute is at the core of a partnership between Metro North Hospital and Health Service and QUT.

BIOMATERIALS

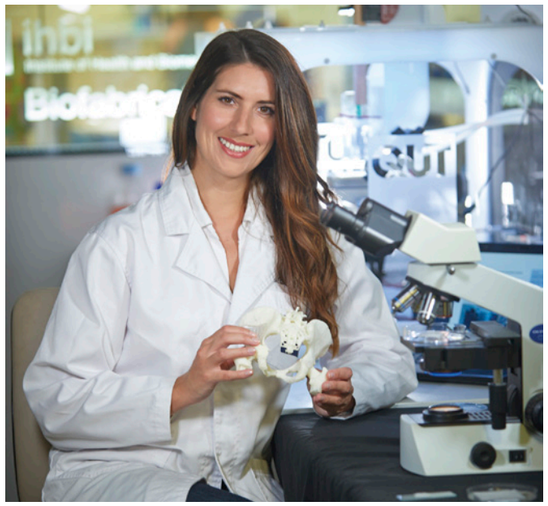
Researchers will develop biomaterials that can one day be implanted in the body to repair damage caused by disease or injury.

IHBI Professor Mia Woodruff is leading research that brings together experts in chemistry, biology, physics, technology, engineering and clinical practices. Up to 100 researchers are expected to work in the Herston Biofabrication Institute, co-located with the Royal Brisbane and Women's Hospital at the Herston Health Precinct.
Its location on a hospital campus will enable collaboration with clinical staff and provide a boost to the Herston precinct – already one of the largest integrated health, research and education precincts in Australia.

> ***The institute will be a catalyst for economic growth through development of new bioengineered products, medical devices and services, attracting industry partners to Queensland and developing and commercialising research and clinical applications.***

@qut_ihbi @DrMiaWoodruff
#biofabrication #bionic
#3Dprinting #3Dimaging

>> Pictured below Professor Mia Woodruff from IHBI



Professor Woodruff says the 3D-printed devices will include customised permanent metallic implants, biodegradable scaffolds, surgical guides and personalised prosthetics and bionics.

Scaffolds are 3D tissue structures designed to be implanted with a patient's own cells to encourage the correct tissue types to grow and repair a damaged site. In time, the scaffold will dissolve and be replaced by new tissue.

The technologies developed will eventually have application in every area of medicine as both implantable devices and as surgical tools. For example, recipients are likely to include patients with cancer excisions, burns, maxillofacial defects and orthopaedic conditions. Among the applications, scaffolds can be used to create prosthetic ears for children with microtia, a congenital condition in which the external ear is underdeveloped.

BIOFABRICATION

Research required to realise the potential of biofabrication focuses on clinical 3D imaging, computational medicine and computer modelling, and 3D printing and advanced manufacturing.

Clinical 3D imaging involves detailed scanning of a damaged body part, including potentially capturing a patient's range of motion, so a scaffold can be custom made as part of a personalised approach to treatment.

Computational medicine and computer modelling will assist in personalising surgical planning and anticipate the increasing use of robotics, machine learning and virtual and augmented reality in the clinic.

Professor Woodruff says advanced manufacturing relies on 3D printers and software that combine to provide precise control of the fabrication process and create implants that are medically suitable, easy to use in surgery and can be tailored to individual patients.

"The technology has many applications," Professor Woodruff says. "We will be able to personalise splints to improve tissue repair, develop temporary ear and nose prosthetics and design and print precise drill-and-saw guides for orthopaedic procedures."

The Herston Biofabrication Institute will feature a tissue engineering laboratory to study scaffold performance and tissue growth, and bioreactors to ensure a scaffold's degradation rate matches the body's healing processes.

COLLABORATION

Collaboration with colleagues at IHBI's Medical Engineering Research Facility, based at the Prince Charles Hospital, will enable implants to undergo pre-clinical testing. Histology facilities at IHBI will enable cell and tissue constructs to be analysed before being used in patients. A clinical scanning and visualisation laboratory with motion capture technology will be established at the new institute, enabling accurate measuring of patient information in 3D.

> ***Collaboration focuses on treating complex medical problems***

"The scanning will give healthcare professionals powerful tools to analyse the patient data and produce precise solutions," Professor Woodruff says. "Surgical 3D models used in virtual and augmented-reality environments will greatly assist in surgical planning and patient consultation.

"Another critical collaboration is working closely with the Therapeutic Goods Administration (TGA) and industry partners to enable appropriate regulation for new innovations."

QUT activity in biofabrication includes the establishment of the Australian Research Council Training Centre in Additive Biomanufacturing, under the leadership of IHBI Distinguished Professor Dietmar W Hutmacher. It aims to develop technologies that can be introduced in hospitals and clinics to treat damage and defects from injuries and disease. The centre will also train the next generation of engineers, clinicians and scientists, as they conduct research into 3D printers, the bioinks they use and their introduction into hospitals and clinics.

Author – Erik de Wit, Communications Program Coordinator | Institute of Health and Biomedical Innovation, **QUT**