Musculoskeletal Conditions

Addressing the world's greatest source of disability

The backbone of everyday health

Musculoskeletal conditions affect 1.7 billion people globally, and are the leading contributor to disability worldwide. They involve more than 150 disorders that affect the joints, bones, muscles and supporting connective tissue. Musculoskeletal conditions are the biggest driver worldwide of rehabilitation need, and are associated with an increased risk of developing other non-infectious diseases, including mental health disorders. They were responsible for a global economic burden of USD 2.1 trillion – or 1.41 per cent of world GDP – in 2021[1]. This burden is projected to rise due to an ageing population worldwide, and economic and population growth in developing countries.

1. Qiu et al. The global macroeconomic burden of musculoskeletal disorders. International Journal of Surgery 111(11):p 7857-7866, November 2025. | DOI: 10.1097/JS9.0000000000003072

Advancing research from lab to clinic

The QUT Centre for Biomedical Technologies is advancing musculoskeletal research from fundamental science to clinical translation.

We are:

- engineering scaffold-guided bone and cartilage regeneration technologies, benefiting tens of thousands of patients worldwide
- developing biofabricated and 3D-printed implants that repair large bone defects and restore joint function,
- advancing osteoarthritis treatment and prevention strategies
- designing computational patient-specific models to virtually test implants, treatments and surgical approaches
- pioneering implant concepts that enhance fracture healing and reduce complications
- leading in orthopaedic surgery research, with recognised expertise in robotic joint surgery
- devising innovative bone cancer models to personalise treatments and accelerate drug development.

#1 in Australia for biomedical engineering

170,000+ patients helped by our researchers' musculoskeletal devices

25+ Chief Investigators in musculoskeletal research

We discover, develop and deliver the next frontier of biomedical technologies, including new implants for improved healing, for better patient treatment and quality of life.

QUT Centre for Biomedical Technologies

Case Studies

Improved mattresses for everyday sleep and spinal surgery

Associate Professor Paige Little is applying her expertise in spine biomechanics to develop better mattresses for consumers and spinal surgery patients. Her skills in simulation, modelling, non-invasive patient imaging and advanced manufacturing have helped Sealy Australia design mattresses that support spinal alignment and enhance sleep quality for customers of the brand. Professor Little has also developed an innovative digital workflow that allows the design and manufacture of bespoke surgical theatre mattresses. Spinal surgery patients must lie for prolonged periods in positions that put pressure on vital organs and soft tissues, risking permanent damage for those with atypical anatomy, most of whom are children. The custom mattresses, produced by Sealy, have been successfully used during the surgeries of 20 spinal patients at the Queensland Children's Hospital.

Better treatments for bone cancer

Associate Professor Nathalie Bock and Dr Jacqui McGovern are transforming how we study cancers that affect the skeleton. The researchers are developing 3D tissue models that replicate the bone microenvironment, enabling them to investigate how tumour cells interact with surrounding bone and soft tissue. These models provide a more accurate platform for pre-clinical testing of new oncology drugs, reducing the high failure rates seen for these drug candidates in clinical trials. The shift from animal testing to advanced in vitro systems is also more ethical and stays ahead of upcoming regulatory changes. Beyond drug screening, Professor Bock has revealed that a common prostate cancer treatment can inadvertently promote tumour growth in bone, informing safer treatment strategies for metastasised prostate cancer. Dr McGovern is exploring targeted delivery systems to concentrate chemotherapy in bone tissue, minimising side effects.

Development of joint biomechanics solutions

Professor Peter Pivonka and Associate Professor Saulo Martelli are providing tailored solutions for musculoskeletal disorders through advanced computational techniques. Professor Pivonka has developed tools that use virtual patient avatars to simulate treatments for osteoporosis, allowing clinicians to determine the most effective therapy for the individual, while Associate Professor Martelli has created models that enable computational trials of orthopaedic devices. These methods are based on their fundamental research into the biomechanics of joints such as the shoulder, knee and hip. Professor Pivonka uses mechanobiology and multiscale modelling to explore how bone adapts to mechanical stimuli, while Professor Martelli integrates computational modelling and experimental methods to uncover fundamental insights across multiple scales, from cellular to whole-body.

Clinical research solutions for osteoarthritis

CBT researchers are advancing innovative treatments for osteoarthritis – a condition affecting over half-a-billion people worldwide. **Professor Travis Klein's** team has developed a bioadhesive that can help repair cartilage injuries, one of the major causes of osteoarthritis. The hydrogel adheres to injured cartilage, holding it together while maintaining flexibility, and promoting tissue growth. Meanwhile, **Associate Professor Indira Prasadam** and **Professor Ross Crawford** are exploring cell-based therapies that repair joint tissues by targeting cellular crosstalk. They are testing a stem cell-derived substance known as the secretome – available in protein-, lipid-, and exosome-rich forms – to determine which best heals osteoarthritic joints. Together, these researchers are devising treatments that go beyond symptom relief to restore joint health and function.

Contact us

Centre for Biomedical Technologies

biomedtech@qut.edu.au

Find out more
research.qut.edu.au/cbt