

Osteoporosis' effect on astronauts

Krembil researchers are helping NASA come up with better bone strength guidelines

By Wendy Haaf

DR. ANGELA CHEUNG isn't just a renowned osteoporosis researcher; you might say her expertise is out of this world. She and her team pioneered research to better understand how various factors affect bone health, which then helped NASA create guidelines for more accurately measuring bone strength in astronauts. The space agency wants to ensure the bone loss that occurs in space flight doesn't place them at risk of potentially dangerous fractures after returning to Earth. A hip fracture, for instance, can lead to permanent disability, including arthritis, and the need for long-term care.

A living tissue, bone is continually being remodelled by two teams of cells: osteoclasts, which tear it down, and osteoblasts, which rebuild it. If the "demolition crew" outpaces the "bricklayers,"

bone becomes weak, which is what happens in osteoporosis. (Weight-bearing exercise, like walking, prods the bricklayers to keep working, which is why low gravity causes bone loss.)

Typically, doctors use what's called dual X-ray absorptiometry to measure bone density, but it can't "see" whether the framework inside the bone is sturdy or spindly; soundly or shoddily constructed. However, high-resolution peripheral quantitative computer tomography (HR pQCT), which uses low-dose CT and sophisticated software, can provide information about a bone's structure, says Dr. Cheung.

Scanning may be a better way to evaluate astronauts, as you need both bone structure and mineral content to determine bone strength, she says. HR pQCT is sensitive enough to monitor whether bone loss treatments, such as medication, work in space flight.

Recently, NASA incorporated Dr. Cheung's recommendations into their guidelines for evaluating bone integrity – which are more important than ever with the advent of long-duration missions. So, thanks to Dr. Cheung and her colleagues, astronauts and osteoporosis patients alike will benefit from this research, and can be more confident about their future bone health.



Dr. Angela Cheung

→ Meet your future researchers

Soon-to-be scientists come to Krembil to train

Promising trainees come to Krembil from around the world to study with top scientists and physicians, and participate in leading-edge arthritis research. Here are four early-career researchers who are already on their way to becoming superstars in the field.



HELAL ENDISHA
PhD
United Kingdom

RESEARCH GOAL

“ Current therapies for osteoarthritis only ease symptoms like pain; our goal is to develop a disease-modifying tool that can stop cartilage destruction. In obesity, which is the number-one risk factor for osteoarthritis after aging, fat cells release harmful inflammatory molecules that can target the joints. I'm looking at the influence of obesity on osteoarthritis; specifically whether a molecule that we previously found is present at high levels in the joint fluid of people with advanced-stage osteoarthritis and contributes to joint destruction.”

KEY ACCOMPLISHMENTS

Found a common link between obesity and osteoarthritis – abnormalities in the production of a molecule that contributes to cartilage destruction.



ERIC GRACEY
PhD
New Zealand

RESEARCH GOAL

“ My goal is to understand spondyloarthritis in order to develop more effective treatments. In this type of arthritis, which starts when people are in their 20s or 30s, you get destruction of joints in the spine and limbs, but you also get fusion of the joints. The drugs we have now reduce symptoms, but they don't prevent joint fusion.”

KEY ACCOMPLISHMENTS

Discovered that an immune cell involved in inflammatory bowel disease plays a role in spondyloarthritis and pinpointed a potential target for treatment – a specific type of white blood cell.



AKIHIRO NAKAMURA
Rheumatologist,
PhD candidate
Japan

RESEARCH GOAL

“ I'm working on finding a new therapeutic target in ankylosing spondylitis. Ankylosing spondylitis has two main features – inflammation and abnormal bone formation in the joints of the spine. Currently, we don't have treatments that stop bone formation.”

KEY ACCOMPLISHMENTS

Co-discovered a small molecule that is now being tested as a prospective treatment for osteoarthritis in the spine and knees.



MEITAL YERUSHALMI
PhD candidate
Israel

RESEARCH GOAL

“ About 30 per cent of patients with psoriasis will eventually develop psoriatic arthritis. I'm looking at whether the skin microbiome – the community of bacteria on the surface of the psoriatic lesions – could be involved in triggering psoriatic arthritis.”

KEY ACCOMPLISHMENTS

Found an association between the diversity of surface skin bacteria on psoriatic lesions and inflammation severity, as well as a link between microbiome diversity and a gene that predisposes people to psoriasis.