Leigh Gabel

Dr. Leigh Gabel joined the Faculty of Kinesiology in 2021 and is also a full member of the McCaig Institute for Bone and Joint Health and the Alberta Children's Hospital Research Institute. Dr. Gabel completed her PhD in Experimental Medicine at the University of British Columbia. Since then, she has continued her research in child health and wellness, and has received several awards, most recently the CIHR Fellowship in 2021.

Her research examines the development of the musculoskeletal system across the lifespan using advanced medical imaging (HR-pQCT, pQCT, DXA). I examine sex- and maturity-related differences in bone and muscle development in children and adolescents. My research also focuses on understanding the impact of loading (physical activity, exercise) and unloading (sedentary time, microgravity) on skeletal adaptation.

Matt Jordan

Dr. Matt Jordan is originally from Ottawa, Canada. He was an elite athlete in triathlon and long track speed skating prior to following his passion for strength training. Matt is a former strength & conditioning coach, sport physiologist, and integrated support team lead with the Canadian Sport Institute Calgary where he worked with several of Canada's Olympic sports. He has also consulted with numerous professional sports organizations from the NHL, NBA, NFL, and MLB.

Dr. Jordan received his degrees from the University of Calgary and is a certified Strength and Conditioning Specialist through the National Strength & Conditioning Association.

Dr. Jordan's primary research interests are assessing neuromuscular adaptations to resistance training in athletes with a special focus on primary and secondary knee injury prevention and optimizing rehabilitation. He employs whole-body biomechanical and neuromuscular assessments to measure the effects of resistance training on basic muscle properties such as the force-velocity relationship and force-length relationship. Additional research interests include optimizing training load for performance and injury prevention, assessing neuromuscular performance in speed/power athletes, and evaluating the physiological determinants of muscle strength and power for health and fitness.

DIRECTOR'S MESSAGE

Since 1981, the University of Calgary has had a Human Performance Laboratory. I have been part of this lab since 1985 and became its director in 2000. Despite this long history, I never gave the name "Human Performance Laboratory" too much thought, especially not the words "Human Performance", after all, most of my research is on the molecular and cellular level.

This all changed on February 19th, 2018. I remember the date, because it was not only my birthday, but also the birthday of Jennifer Doudna who on that evening gave a keynote lecture at the Biophysical Society Congress in San Francisco. I wanted to see Jennifer Doudna and I convinced my group to join me by telling them that Jennifer would be a future Nobel Prize winner.

Indeed, Dr. Doudna was awarded the Nobel Prize in Chemistry in 2020 for her work on CRISPR-Cas9. In her talk, Dr. Doudna explored and discussed the future of human gene editing with CRISPR-Cas9 and how it might help eliminate inherited diseases. Specifically, she was talking about tackling sickle cell disease, a disease that damages the red blood cells and leads to premature death, a disease also that is caused by a single mutation in a (the β-globin) gene. She was also hinting at non-disease related areas of gene editing, for example human height, muscularity, and other attributes that could lead to increases in Human Performance.

Gene editing in humans raises many questions of a fundamental ethical nature, particularly since the technique is easy to use and apply. While we might accept the idea of curing a disease using CRISPR-Cas9, are we equally comfortable about increasing a child's growth, or producing genetically modified athletes with superior muscles, strength, and speed. Most athletes who win gold medals at Olympic Games have some genetic advantage over the average person that allows them to stand out, to perform better physically. But what is Human Performance if we can genetically enhance it? Are we entering an era where only genetically altered athletes have a chance of succeeding in international sports, at Olympic Games? Where are the limits of what is acceptable, and who decides what those limits are?

Human Performance might soon take on a different meaning from what it has today, and we, as researchers working at the leading edge of human health, mobility, quality of life into old age, and athletic performance, we need to be prepared to be part of that discussion. Gene editing has the potential to do wonders for humanity, while at the same time might change in a profound way what it means to be human. Scientists in Human Performance starting their careers now will be faced with challenges not imagined just a decade ago. Be prepared for an exciting, challenging, and somewhat scary time where you want to be part of the discussion what Human Performance is.

UNIVERSITY OF CALGARY

The full version of the Annual Report can be found at www.ucalgary.ca/hpl

It has been another exciting and successful year for the Human Performance Lab, and the faculty of Kinesiology, once again, ranked number 1 in terms of research in North America in its category. All this is only possible through the generous support of our families and friends, the faculty of Kinesiology, the University of Calgary, and all our external sponsors who have believed in our dream of being an internationally leading research laboratory for the past 40 years. We are dedicated to continuing this dream. My sincere thanks to all of you.

Walter Herzog

Director

AWARDS & HONOURS

Members of the Human Performance Laboratory that were honoured for their scientific contributions:

External Honours

Walter Herzog	Journal of Biomechanical Engineering Editor's Choice Paper https://doi.org/10.1115/1.4045660
Walter Herzog	Named Award: Dr. Walter Herzog Young Investigator Award, Brazilian Society for Biomechanics

Special Appointments

Carolyn Emery	Chair Scientific Committee Sport Physiotherapy Canada Congress

External Awards

Tyler Cluff	National New Investigator Award, Heart and Stroke Foundation
Carolyn Emery	Canadian Physiotherapy Association Medal of Distinction
Carolyn Emery	Killam Annual Professors Award, Killam Trust Foundation
Ash Kolstad	Frederick Banting and Charles Best Canada Graduate Scholarships 2021
Jason Tabor	Frederick Banting and Charles Best Canada Graduate Scholarships 2021
Walter Herzog	Researcher of the Year Award, Alberta Science and Technology Leadership Foundation
Martin MacInnis	Journal of Sport and Health Science Outstanding Reviewer Award
Heron Medeiros	Young Investigator Award, Brazilian Society for Biomechanics Conference
Raylene Reimer	Earle Willard McHenry Award for Distinguished Service in Nutrition, Canadian Nutrition Society

SUPPORT

Our work was financially supported by many different sources, the University of Calgary, government grants, industry and non-government sources and external student support. The corresponding amounts in Canadian dollars were:

University	**$3,.3M**	**29%**
Gov. Grants	**$3.3M**	**29%**
Industry	**$4.5M**	**39%**
Students - External	**$378,000**	**3%**
Total	**$11.53M**	

For 2021, the average research dollars available per faculty members was about $769,033. We thank all supporters of our work, the Faculty of Kinesiology, the University of Calgary, all granting agencies, industry, and our major sponsor, Engineered Air.

Rare Bone Fractures in Post-Menopausal Women

Researchers in the Faculty of Kinesiology and the McCaig Institute for Bone and Joint Health are examining a very rare type of fracture for those with osteoporosis, known as an atypical femoral fracture. Dr. Brent Edwards and his team are studying the cause of these fatigue fractures, known as atypical femoral fractures, that occur in the thigh bone, to help prevent this injury.

The most common osteoporotic fractures occur because of a low energy event, like a fall from standing, where the applied load exceeds the strength of the bone. A fatigue fracture is different. These fractures do not occur because of a single event, but happen because of overuse, like a repetitive strain injury that creates a stress fracture in athletes.

Edwards' team studies how repetitive stress causes damage within biological tissues including bone, a process known as mechanical fatigue. They perform basic experiments on tissues to enhance our understanding of how osteoporotic drugs affect the mechanical fatigue process, and applied experiments in humans for the development of treatments and interventions to improve bone quality and decrease injury risk.

"With this research we hope to define the mechanism of atypical femoral fracture, so that we can create safe and effective therapeutic strategies to prevent these injuries and develop advanced medical imaging approaches to identify individuals that may be at a high risk of fracture," says Edwards.