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Profile

- Hip research focus on the development of osteoarthritis and pre-arthritic deformities like femoroacetabular impingement
- Spine research is focused on disc degeneration models and tissue-engineered disc regeneration and the treatment of osteo porotic fractures
- The shoulder & elbow team is working on statistical shape modeling of shoulder morphology, rotator cuff regeneration incl. stem cells and the investigation of surgical techniques and implants
- The main focus of knee research is the regenerative treatment of the anterior cruciate ligament; prosthetic infections and anti-infectious implants are also research topics
- Arthrosis of the ankle joint, innovative treatment of ankle fractures and AMIC plastic in osteochondral lesions is the main focus in foot & ankle research
- Orthogeriatrics investigates the impact of orthogeratric pathways and rehabilitations protocols on the clinical outcome in geriatric patients
- Translational medicine is the latest research field which will come to focus the during the next years
- External Partners: Musculoskeletal Research Unit, Vetsuisse Faculty, University of Zürich, Zürich, Switzerland; Department of Small Animals, Division of Diagnostic Imaging, Vetsuisse Faculty, University of Zürich, Zürich, Switzerland; AO Research Institute, Davos; RMS Foundation, Bettlach; SUVA

Grants

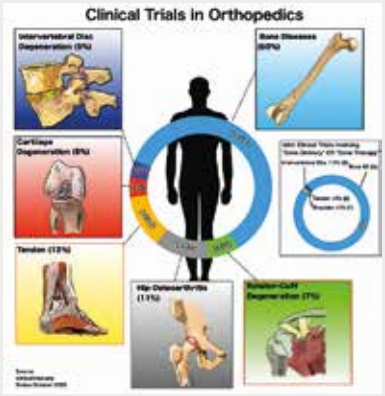
- Gantenbein B, Wöltje M. Swiss National Science Foundation (SNF): «Fibre-based 3D implants from regenerated silk fibroin for intervertebral disc regeneration» 2019 – 2022
- Gantenbein B, and the consortium of "disc4all": «Training network to advance integrated computational simulations in translational medicine, applied to intervertebral disc degeneration (Disc4All) », Nov 2020 – Oct 2024
- Hofstetter W, Klenke FM. Alfred & Anneliese Sutter-Stöttner Stiftung, Münchwilen, Schweiz Heilung von Defekten in osteo-porotischen Knochen unter Behandlung mit Bisphosphonaten 2019-2021

Highlights

Highlights of the Tissue Engineering, Orthopaedics & Mechanobiology (TOM) Group: Induced pluripotent stem cells - iPSCs

The Tissue Engineering, Orthopaedics & Mechanobiology (TOM) Group of the Department of Orthopedics and Traumatology, and the Department for BioMedical Research (DBMR), at University of Bern, conducts translational research in the intersection of tissue engineering, biology and applied clinical research. The group is knowledgeable in musculoskeletal connective tissues, such as bone, cartilage, ligaments and tendons.
Most recently, three key topics were established.
The first topic is on the isolation and culture of specific progenitor cells. This progenitor cell research is financed by iPspine, a 16 M € research project, which was funded to the consortiums leader Prof. Marianna Tryfonidou, a veterinarian from the University Medical Center (UMC) Utrecht & Universiteit Utrecht (https://cordis.europa.eu/project/id/825925). The iPSpine partners, which include both universities and companies, joined together in January 2019 to begin researching a new, advanced therapy for the treatment of LBP caused by disc deterioration. The

ultimate aim of this project is to investigate and develop a new advanced biological therapy using a type of cell called induced pluripotent stem cells (iPSCs) (https://ipspine.eu). Over the next five years, the iPSpine partners want to show that iPSCs can work as a therapeutic strategy. This will start with basic laboratory research to create the cells and will continue on into a preclinical animal model. By the end of the project, the therapy should be ready for advancement to the first clinical trial in people.
Within this highly cross-disciplinary consortium our group was able to isolate primary cells isolated from human trauma IVDs with written consent from patients. These cells were then isolated from the primary tissue, cell sorted using a cell surface marker and delivered to consortium partners at the INSERM in Montpellier and Nantes, France. These partners at INSERM were then able to derive novel iPS cell lines from these primary cells. These cell lines will provide valuable information to future generation researchers and whether these can be used for future cell therapy to possibly cure degenerated IVDs.



Gantenbein et al. Front Bioeng Biotechnol 8: 1320. https://doi.org/10.3389/fbioe.2020.598466

Silk for IVD repair - Silk scaffolds for intervertebral disc repair

A second highlight is the investigation into engineered silk scaffolds for IVD repair. Previous research by the TOM group investigated on the usage of silk for the production of a scaffold for IVD repair, which would recruit or activate existing cells of the degenerated disc or novel cells would be seeded de novo. Here, a new project funded by the Swiss National Science has just been started that targets regeneration of the IVD by using "cross-linked growth-factors and engineered" silk fibres and using knitting techniques developed by Dr. Michael Wöltje at the "Technische Universität Dresden, Institut für Textilmaschinen und Textile Hochleistungswerktofftechnik", Dresden, Germany.
http://p3.snf.ch/project-192674.

Artificial Intelligence (AI) and 3D organ culture to model IVD degeneration

The third key topic was just started in Nov 2020, which involves artificial intelligence, statistical shape modelling and finite element modelling and organ culture models for IVD regeneration: The 4M € funded "Disc4All" project aims to tackle this issue through collaborative expertise of clinicians; computational physicists and biologists; geneticists; computer scientists; cell and molecular biologists; microbiologists; bioinformaticians; and industrial partners (https://cordis.europa.eu/project/id/955735). It provides interdisciplinary training in data curation and integration; experimental and theoretical/computational modelling; computer algorithm development; tool generation; and model and simulation platforms to transparently integrate primary data for enhanced clinical interpretations through models and simulations. The consortium is lead by the biomedical engineer Prof. Jérôme Noailly from the Universitad Pompeu Fabra (UPF) in Barcelona, Spain (https://www.upf.edu/web/disc4all). The Disc4All ESRs will provide a new generation of internationally mobile professionals with unique skill sets for the development of thriving careers in translational research applied to multifactorial disorders. The TOM group is proud to host and train two of the total 15 financed PhD candidates, and contribute with molecular investigations using 3D primary cell culture and specific organ culture models.

A new International training Network has been started for 15 new Early Stage Researchers (ESR) on discogenic low back pain.