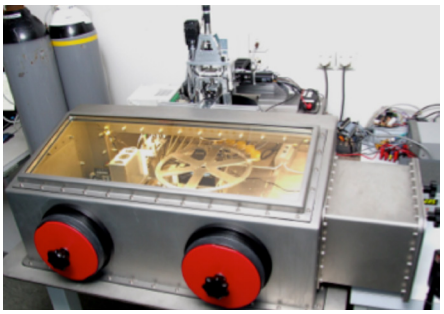

Institute for Human Centered Engineering
HuCE – BME Lab
Project Description

Novel Physiological Robot Reactor System (PRRS)

The PRRS is a near-physiological robot reactor system for engineering articular cartilaginous tissue-scaffold constructs. A mechanical stimulation unit will be able to apply loads and pressures in the same order of magnitude as in human joints and an ambient control unit will allow carrying out all work in an environment encountered in articular joints.

Highly complex motion patterns, e.g. of the knee-joint, can be closely simulated by individual control of each of the axis of a 4-dof-robot. Highly accurate force-feedback and motion systems are controlled by ultra-fast FPGA and real-time components which continuously monitor all system-parameters. Sample containers will be placed on a carrousel, which allows for individual piloting of the containers with their own stimulation pattern. These components are integrated in a sterile surrounding in which humidity, temperature, gas-mixture (O2, CO2), and pressure are actively controlled.

The robot reactor system will be designed as a screening tool for investigating cell-material interactions in a near-physiological environment in vitro, so that finally only a very limited number of in vivo experiments will be required for advancing cartilage repair.

Results
The complex physiological motion and load pattern of a knee joint were closely traced by the precisely controlled robot axes. A large range of loading forces between less than 1 N and more then 300 N in longitudinal and 100 N in lateral direction were achieved, closely matching the physiological forces encountered in the knee. The motion controls provide a position accuracy of about 10 mm. Within the PRRS, the climate is accurately controlled and maintained (deviations of less than 0.2% and 0.2°C from given gas concentrations and temperature, respectively).

Project Partner
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