

## **Themes Society of Biomechanics**

### **Methodological approaches for motion analysis**

This theme includes research dedicated to the development and validation of biomechanical methods and models for the study of human or animal movement at the multi-body scale. This concerns in particular:

- Kinematic and dynamic modeling
- Acquisition methods for kinematics, forces, and electromyography
- Musculoskeletal modeling (rigid or deformable) at the multi-body scale
- Optimal motion simulation / control

### **Biomechanics of healthy and pathological movement**

This theme covers the analysis and evaluation of locomotion, balance and grasping in populations (human and animal) with and without alterations. This concerns in particular:

- Study of the mechanisms and alterations of different activities such as locomotion, maintenance of balance and grasping
- Propose, optimize and evaluate preventive, surgical (orthopedics, neurosurgery, etc.) and rehabilitation interventions, including technical aids (wheelchairs, prostheses, orthotics, etc.)
- Measure, analyze and simulate biomechanical alterations in movement and compensation strategies; Develop and validate clinical assessment methods

### **Biomechanics of Sport and the Arts**

This theme covers any research applying the laws of mechanics to the sports and artistic movement with the main objective of improving the understanding of the gesture, improving performance, preventing injuries or improving the return to practice. This theme includes more particularly the following axes:

- Analysis of the sporting and artistic gesture by multi-segmental or integrated method
- Link between muscular, tendon or osteoarticular mechanical properties and the performance or risk of injury of athletes or artists
- Motor control and simulation of the sports gesture
- Interaction between the athlete or artist and their equipment or environment

### **Biomechanics of Human Interaction – Systems, Ergonomics and Robotics**

This theme deals with the interactions between humans and any physical system in connection with ergonomics and robotics. In particular, it includes the following areas:

- Analyses of physical interactions between humans and mechanical systems (such as collaborative robots, rehabilitation robots, passive or active exoskeletons)
- Design, control and command of anthropomorphic and/or bio-inspired robotic structures aimed at reproducing human or animal motor skills (locomotion, gripping, dextral manipulation, etc.)
- Evaluation and optimization of devices and techniques designed to reduce the incidence of musculoskeletal disorders for ergonomic purposes

### **Lesional Biomechanics and Traumatology**

This theme covers all areas of research dedicated to the understanding and modeling of injury mechanisms, by all types of experimental and numerical approaches. All energy levels and boundary conditions can be considered for the study of all types of injuries and traumatologies. By taking into account loading, the effects of geometry and material properties, but also physiological and cognitive parameters, muscle contractions or neuromotor control, she is interested in various fields such as:

- The ability of the human body to withstand a shock with short application times (dynamics undergone)
- Potentially injurious human movements (subject actor of his movement)
- Movements and positions in constrained quasi-static environments

### **Biological fluids and flows**

This theme focuses on the understanding of the role of fluids and structures involved in the dynamics of biological flows. Associated translational research implements these innovative concepts for diagnostic or prognostic purposes. This area of research typically includes:

- Flow dynamics at macroscopic and microscopic scales
- Interaction of organs, tissues and cells in contact with biological flows
- Medical devices interacting with biological flows

### **Cellular biomechanics and mechanobiology**

This theme aims to develop a fundamental understanding of biomechanics on a wide range of length and time scales, from the molecular to the cellular scale. In particular, it includes the following areas:

- Characterization and biomechanical simulation of cells, membranes and subcellular structures
- Effects of the environment on cellular and/or molecular response.
- Regenerative medicine

### **Tissue Biomechanics**

This theme concerns the imaging, characterization and modeling of soft and hard biological tissues. It also covers the development and characterization of prosthetic materials as well as their interactions with biological tissues. This concerns in particular:

- Study of the mechanical properties of biological tissues (ex vivo and in vivo characterization methods) and their evolution (growth, remodeling,...).
- Study of hard and soft tissues (bones, teeth, cartilage, tendons, muscles, fat,...)
- Numerical modeling and simulation (deformable bodies)
- Substitution/repair materials

## Themes special sessions

### Extreme sports

This special session is dedicated to the biomechanical and physiological study of extreme sports practices, characterized by demanding environments, high-intensity gestures and physical constraints sometimes close to human limits. It aims to highlight advances in movement analysis, the individualization of training strategies, the understanding of the physiology and biology of effort in extreme conditions, as well as the associated mechanisms of muscular and neuromuscular fatigue. Papers on disciplines such as mountaineering, climbing, skyrunning, canyoning, BMX, downhill and freeride mountain biking, freerun, highline, river kayaking, air sports (skydiving, paragliding, speed riding, base jumping), water sports (kite surfing, windsurfing, skimboarding), or freestyle practices (snowboarding, skiing, rollerblading, scooter, trampoline, skateboarding), ultra-endurance (ultra-trail running, ultra-cycling) are particularly encouraged. The objective of this theme is to bring together researchers and practitioners to better understand the risks, adaptations, performance and safety in these highly constrained activities.

### Medical Robotics / Flexible Robots

This theme offers new perspectives for the analysis, assistance and improvement of clinical procedures. Inspired by the mechanical properties of living tissue, flexible robots and robotic medical systems enable safer, more adaptive, and more complex interactions in line with the complexity of the human body. The goal is to explore how biomechanical modeling, advanced control, and materials engineering enable the development of robotic devices that can safely and adaptively interact with biological tissues. The expected contributions cover the following themes:

- Biomechanical modeling and identification of flexible robots
- Robot–tissue interaction
- Flexible Robot Design and Continuum
- Innovative actuators (pneumatic, hydraulic, electroactive) and smart materials
- Modeling and control for hyper-redundant and deformable systems
- Multimodal perception and data fusion (vision, strength, intraoperative imaging)
- Digital Twins and Personalized Planning in Robotic-Assisted Surgery

### Animal and plant growth

Since their birth, biological systems have evolved and, in particular, grown. This growth is strongly linked to mechanical stresses, as illustrated by the example of muscle mass gain in athletes. During this process, we can distinguish, depending on the tissue or organ studied, and depending on whether we are in the plant kingdom or in the animal kingdom, volume *growth* (or mass) which results in the addition of matter leading to an increase in volume (or mass), *morphogenesis* which results in the establishment of shapes and structures from the cellular to the organic scale, and *remodeling*, which results in an active change in the microstructure resulting in a variation in the properties of the organ or tissue. In addition, during the general growth process, it appears that residual deformations take place, which has a significant impact on the mechanical properties and behaviors of the tissues and organs concerned. This theme will thus offer a cross-look between plant biomechanics and animal biomechanics on these aspects.

**Biomechanist/Clinician Duo**

This theme, launched at the Marseille congress, was a real success. For the 2026 edition in Montpellier, extended slots will be reserved within the generic and special sessions for Biomechanics/Clinicians pairs. The objective is to offer a cross-section of various issues, allowing to put into perspective the relevance of co-constructing diagnostic, therapeutic, ... The presentations will be made in two voices. We are convinced of the importance of these collaborations and we are counting on you to show our community and more particularly young researchers that they are indispensable.