

# Biomechanical modelling of musculoskeletal systems

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## Organisation

**Name of the organisation** Ghent University (UGent)

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**Country** Belgium

**Geographical Area** Flemish Region

## Partners and collaborations

Hull University

## SCOPE OF THE METHOD

<b>The Method relates to</b>	Animal health
<b>The Method is situated in</b>	Basic Research
<b>Type of method</b>	In silico

## DESCRIPTION

### Method keywords

biomechanica

simulation

mechanica

kinematica

anatomy

### **Scientific area keywords**

musculoskeletal

function

movement

functional performance

### **Method description**

Biomechanical modelling used to simulate functional performance of skeleton and muscle systems in vertebrates. For studying how tissues respond to mechanical loading during movement, we apply finite element modelling. For studying how muscles interact with skeletal elements, and how they make them move, we use multi body dynamics analysis. All involve using 3D data of internal anatomy (can be obtained from  $\mu$ CT scanning of preserved specimens) and material properties (available from literature, if not has to be measured on a fresh cadaver). Computer models then simulate strain and stress during mechanical loading (finite element modelling) and how muscles transfer contraction force onto skeletal elements, and how they interact with each other (multi body dynamics analysis). The methods allow to perform sensitivity analysis to estimate variation, by varying the input parameters. In that way, the number of specimens that would need to be used for in vivo measurements or sacrificed can be substantially reduced (but not completely avoided, as the models always requires some kind of validation).

### **Lab equipment**

$\mu$ CT scanner ;

Computer running specific software: Amira (3D reconstruction of  $\mu$ CT data), FEBio (finite element modelling), Adams (multi body dynamics analysis).

### **Method status**

History of use

## **PROS, CONS & FUTURE POTENTIAL**

### **Advantages**

Reduces number of specimens to be used in experiments or additional animals to be sacrificed for particular studies.

## Challenges

Validation of computer models so that they reliably mimic realistic systems of living animals.

## REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

### References

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