



## Biomechanical experimentation to improve the biofidelity of in silico models

**Commonly used acronym:** FIBEr

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### Organisation

**Name of the organisation** Katholieke Universiteit Leuven (KUL)

**Department** Mechanical Engineering

**Country** Belgium

**Geographical Area** Flemish Region

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**Department** Institute for Orthopedic Research and Training

**Country** Belgium

**Geographical Area** Flemish Region

### Partners and collaborations

Katholieke Universiteit Leuven (KUL), Katholieke Universiteit Leuven (KUL), Katholieke Universiteit Leuven (KUL), Katholieke Universiteit Leuven (KUL)

## SCOPE OF THE METHOD

<b>The Method relates to</b>	Animal health, Human health
<b>The Method is situated in</b>	Basic Research, Education and training, Translational - Applied Research
<b>Type of method</b>	In vitro - Ex vivo
<b>Specify the type of cells/tissues/organs</b>	a range of biological tissues that bear mechanical load

## DESCRIPTION

### Method keywords

tensile testing  
indentation testing  
compression testing  
micro-CT scanning  
multi-axial loading

### Scientific area keywords

mechanical testing

biomechanics  
parameter fitting  
finite element modeling

## Method description

FIBEr (Flanders Institute for Biomechanical Experimentation) is a laboratory that investigates the mechanical properties (stiffness, strength, microstructure) of biological tissue, in casu bones, muscles, ligaments, blood vessels, etc. A quantitative characterization of the mechanical behavior of biological tissue is crucial to understand mechanics-related pathologies (aneurysm formation, osteoporosis, ...) and provides us with the necessary building blocks for *in silico* testing of interacting mechanical devices and treatment methods. *In silico* testing not only reduces the need for animal testing, but also enables customized, patient-specific medical solutions. The tested material consists mainly of tissues from deceased donors, biopsies or laboratory animals (always upon ethical approval). The lab possesses several types of mechanical testing devices, each suited for testing different types of tissues and/or material properties. There is also a sample preparation room as well as a sample storage room for (cryo-)preservation. There are around 25 researchers, PhD students and master students that frequent the lab. Furthermore, projects are frequently performed for or in collaboration with biotech companies.

## Lab equipment

- planar biaxial tensile testing device ;
- triaxial testing device (extensio-inflation-torsion) ;
- micro-CT scanner ;
- nano-indentor ;
- micro-indentor ;
- dynamic uniaxial tensile device ;
- sample preparation room ;
- sample storage room.

## Method status

Still in development  
History of use  
Internally validated

## PROS, CONS & FUTURE POTENTIAL

### Advantages

A quantitative characterization of the mechanical behavior of biological tissue is crucial to understand mechanics-related pathologies (aneurysm formation, osteoporosis, ...) and provides us with the necessary building blocks for *in silico* testing of interacting mechanical devices and treatment methods. *In silico* testing not only reduces the need for animal testing, but also enables customized, patient-specific medical solutions.

### Challenges

Given the biological nature of the tissue, it is essential to perform the characterization in circumstances that mimic the *in vivo* conditions as closely as possible. FIBEr pays a lot of attention to applying loading conditions that are relevant for the *in vivo* loading situation, and to create a physiological testing environment (in terms of temperature, medium, etc.). Nevertheless, there will always be a discrepancy between *in vitro* and *in vivo* measured material properties.

## Modifications

FIBEr is continuously striving to further optimize testing protocols and to expand its portfolio to other mechanical testing methods.

## Future & Other applications

The vision of FIBEr is to become the reference center in Belgium and beyond for mechanical characterization of biological tissues and biomedical products, and to achieve worldwide recognition for the development of validated testing protocols.

## REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

### Links

[FIBEr website](#)

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