

# In vitro vascular invasion assay for the study of (the role of cellular forces in) sprouting angiogenesis

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## Organisation

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**Country** Belgium

**Geographical Area** Flemish Region

## SCOPE OF THE METHOD

<b>The Method relates to</b>	Human health
<b>The Method is situated in</b>	Basic Research
<b>Type of method</b>	In vitro - Ex vivo
<b>Specify the type of cells/tissues/organs</b>	Endothelial cells

## DESCRIPTION

## **Method keywords**

endothelial cells

live optical microscopy

extracellular matrix

hydrogel

Image analysis

matrix mechanics

traction force microscopy

## **Scientific area keywords**

microvascular biology

angiogenesis

cell mechanics

mechanobiology

bioengineering

biomechanics

biomaterials

## **Method description**

The method enables to quantitatively assess the invasion of endothelial cells in extracellular-matrix mimicking hydrogels, such as collagen or polyethylene glycol, and to measure the forces exerted by the cells that enable them to invade. Endothelial cells are seeded on the side of a hydrogel and cultured in pro-angiogenic medium to induce sprouting angiogenesis. Live cell imaging of endothelial cells is performed by means of confocal laser scanning microscopy. Fluorescent nanobeads are incorporated in the hydrogel to track the deformations of the hydrogel during endothelial invasion. Mechanical (elastic) properties of the hydrogel are measured. Cellular forces applied by the endothelial cells during invasion are inferred from the measured hydrogel deformations and mechanics.

## **Lab equipment**

Biosafety cabinet ;

Incubator ;

Confocal microscope.

### **Method status**

Published in peer reviewed journal

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

### **Advantages**

High resolution imaging of cell dynamics ;

Unique method to quantify cellular forces.

### **Challenges**

Extension to long-term imaging (several days) ;

More complex extracellular matrix environments (including co-culture systems) ;

Medium-to-high throughput screening is still challenging.

### **Future & Other applications**

The method enables to screen different micro-environments for their effect on vascular invasion / sprouting angiogenesis, which is among others, relevant for regenerative medicine and diseases that affect angiogenesis. It offers a unique way of exploring the role of (abnormal) cellular forces in the etiology of diseases that affect microcapillaries.

## **REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION**

### **References**

Vaeyens, M-M., Jorge Peñas, A., Barrasa Fano, J., Steuwe, C., Heck, T., Carmeliet, P., Roeflaers, M., Van Oosterwyck, H. (2020). Matrix deformations around angiogenic sprouts correlate to sprout

dynamics and suggest pulling activity. Angiogenesis. doi: 10.1007/s10456-020-09708-y

