In silico and in vitro Models of Angiogenesis: unravelling the role of the extracellular matrix

From 2013-04-01 to 2018-03-31, closed project

Objective

Angiogenesis, the formation of new blood vessels from the existing vasculature, is a process that is fundamental to normal tissue growth, wound repair and disease. The control of angiogenesis is of utmost importance for tissue regenerative therapies as well as cancer treatment, however this remains a challenge. The extracellular matrix (ECM) is one of the key controlling factors of angiogenesis. The mechanisms through which the ECM exerts its influence are poorly understood. MAtrix will create unprecedented opportunities for unraveling the role of the ECM in angiogenesis. It will do so by creating a highly innovative, multiscale in silico model that provides quantitative, subcellular resolution on cell-matrix interaction, which is key to the understanding of cell migration. In this way, MAtrix goes substantially beyond the state of the art in terms of computational models of angiogenesis. It will integrate mechanisms of ECM-mediated cell migration and relate them to intracellular regulatory mechanisms of angiogenesis.

Apart from its innovation in terms of computational modelling, MAtrix' impact is related to its interdisciplinarity, involving computer simulations and in vitro experiments. This will enable to investigate research hypotheses on the role of the ECM in angiogenesis that are generated by the in silico model. State of the art technologies (fluorescence microscopy, cell and ECM mechanics, biomaterials design) will be applied –in conjunction with the in silico model- to quantify cell-ECM mechanical interaction at a subcellular level and the dynamics of cell migration. In vitro experiments will be performed for a broad range of biomaterials and their characteristics. In this way, MAtrix will deliver a proof-of-concept that an in silico model can help in identifying and prioritising biomaterials characteristics, relevant for angiogenesis. MAtrix' findings can have a major impact on the development of therapies that want to control the angiogenic response.

Related information

Report Summaries

Final Report Summary - MATRIX (In silico and in vitro Models of Angiogenesis: unravelling the role of the extracellular matrix)
**Principal Investigator**

Hans Pol S Van Oosterwyck  
Tel.: +3216327067  
Fax: +3216327994

**Host Institution**

KATHOLIEKE UNIVERSITEIT LEUVEN  
OUDE MARKT 13  
3000 LEUVEN  
Belgium

*EU contribution:* EUR 1 497 400

**Activity type:** Higher or Secondary Education Establishments

**Administrative contact:** Tine Heylen  
Tel.: +3216326520  
Fax: +3216326515

**Beneficiaries**

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