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Cellular forces : adhering, shaping, sensing and dividing

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Propositions

accompanying the thesis

Cellular Forces

Adhering, Shaping, Sensing and Dividing

1. Stiffness variations in a (human) body are often reported as understood, but its research is still in its infancy.

Chapter 1 of this thesis

2. The stress bearing state at a focal adhesion is an order of magnitude larger than was previously measured.

Chapter 2 of this thesis

3. The extracellular shape of a cell depends on the orientation and contractility of the internal actin cytoskeleton.

Chapter 3 of this thesis

4. The protein p130Cas is a mechanosensor, which only localizes to focal adhesions in a sufficiently stiff extracellular environment.

Chapter 4 of this thesis

5. During cell division, cellular pulling forces are released and cells push outwards while progressing through mitosis.

Chapter 5 of this thesis

6. Progress in the debate on the origin of cell differentiation depending on substrate properties needs new techniques that are capable of independent control of stiffness and molecular stoichiometry.

Trappmann et al., Nat. Mater. 11, 642 (2012)

7. Durotaxis in fibroblasts and the increase of cellular forces with substrate stiffness are the outcome of a global mechanosensing process rather than a local cellular response on the scale of a protein complex.

Sochol et al., *Soft Matter* **7**, 4606 (2011)
Trichet et al., *Proc. Natl. Acad. Sci. USA* **109**, 6933 (2012)
8. The discovery of induced pluripotent stem cells and understanding of the response of stem cells to varying extracellular stiffness will transform regenerative medicine.

Takahashi & Yamanaka, *Cell* **126**, 663 (2006)
Swift et al., *Science* **341**, 1240104 (2013)
9. The development of organs-on-chips will not only revolutionize science and medical treatments, but also cause a massive reorganization in the pharmaceutical industry.

Van de Stolpe & den Toonder, *Lab Chip* **13**, 3449 (2013)
10. Universities need to educate students and on the same premises researchers need to function at the top of their fields: it has been tested multiple times, yet the Dutch government cannot obtain these two goals for the price of one.