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Force sensing and transmission in human induced pluripotent stem-cell-derived pericytes

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Propositions

accompanying the thesis

Force sensing and transmission in human induced pluripotent stem-cell-derived pericytes

1. Despite extensive studies of pericytes there are still many important unsolved questions regarding their mechanobiology.

Chapter 1 of this thesis

2. The size of the microcontact printed features on top of hPAA hydrogels can be lowered to 2 μm by combining hPAA gels with a “stamp-off” protein printing approach.

Chapter 2 of this thesis

3. Pericytes strongly prefer fibronectin over laminin, pericytes recognize and align to fibronectin dots within a laminin substrate, pericytes apply forces to fibronectin deposits, and are able to sense variations in mechanical properties of the fibronectin deposits and respond to this by changing traction force, cell spreading area, and the size of cell matrix adhesions.

Chapter 3 of this thesis

4. α -smooth muscle actin recruitment to stress fibers in pericytes can be affected by the amount of available fibronectin and by its spatial arrangement.

Chapter 4 of this thesis

5. The arrangements of fibronectin deposits in the pericyte-endothelial interstitia suggest a mechanical linkage between the two cell types that would allow contractions or relaxation of the pericytes to affect vessel diameter.

Courtoy et al., J. Ultrastruct. Res (1983)

Armulik et al., Circ. Res (2005)

6. The role of pericytes in the regulation of capillary diameter and blood flow in response to synaptic transmission and the release of vasoactive mediators has been speculated for a long time, but has recently been experimentally supported.
Winkler et al., **Nature Neuroscience** (2011)
7. It is important to develop *in vitro* conditions that suppress expression of α -smooth muscle actin in pericytes and/or avoid proliferation of contaminating microvascular smooth muscle cells.
Nehls and Drenckhahn **J. Cell Biol.** (1991)
8. Studying the microvasculature *in vivo* remains difficult, thus, a combined approach using both *in vitro* and *in vivo* models have to be used synergistically to improve research rigor.
Myers and Lam **Annu.Rev.Biomed.Eng.** (2021)
9. Nothing stimulates creativity and innovation better than the absence of another choice.
10. Young scientists tend to forget that their career and way to success is a marathon and not a sprint.