Physics implications of shape on biological function

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Propositions

accompanying the thesis

'Physics Implications of Shape on Biological Function'

1. Shape in biology is showing up at all length scales, but a mathematical description is not always straightforward, and largely missing.

   Chapter 1 of this thesis

2. The morphology of dendritic spines can delay receptor escape long enough to enable the onset of biochemical processes, which leads to long-term stabilization of neuronal connectivity.

   Chapter 2 of this thesis

3. Localized initiation of a process by means of light opens our eyes for unexpected behavior, which was undiscovered in bulk experiments.

   Chapter 3 of this thesis

4. The forces exerted by a cell on a substrate can be inferred without resorting to traction force microscopy.

   Chapter 4 of this thesis

5. Holcman et al. should have spent more time on explaining their solution to the 'Narrow escape theory' as part of their argumentation appears untracable.

   Holcman et al., J. Math. Neurosc. **1**, 10 (2011)

6. As long as there is no definite proof of the existence of lipid rafts in living systems, the 'Lipid raft theory' should be regarded with sceptisism.

   Sezgin et al., Nat. Rev. Mol. Cell Biol. **18**, 6 (2017)

7. The ongoing transition in biophysics to experimentally consider 3D systems rather than 2D will bring greater understanding at the cost of simplicity in all stages of experiments.

   Fischer et al., Trends Cell Biol. **21**, 12 (2011)
   Shamir et al., Nat. Rev. Mol. Cell Biol. **15**, 10 (2014)

8. A minimal cell, created by removing genes from an organism, as done by Hutchison III et al., will not yield a cell simple enough to fully understand.

   Hutchison III et al., Science **351**, 6280 (2016)

9. In order to advance science as fast and efficiently as possible, we should focus all effort into developing artificial intelligence.

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