

Surface tension controls the onset of gyrification in brain organoids

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Abstract

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Recent experiments on brain organoids have confirmed that gyrification, i.e. the formation of the folded structures of the brain, is triggered by the inhomogeneous growth of the peripheral region [1]. We develop a mathematical model of brain organoids based on the theory of morphoelasticity. We perform a linear stability analysis of the radially symmetric configuration and we study the post-buckling behaviour through finite element simulations. We find that the process of gyrification is triggered by the cortex growth and modulated by the competition between two length scales: the radius of the organoid and the capillary length due to surface tension. Finally, we show that a solid model can reproduce the results of the in-vitro experiments.

References

- [1] E. Karzbrun, A. Kshirsagar, S. R. Cohen, J. H. Hanna and O. Reiner; *Human brain organoids on a chip reveal the physics of folding*, Nature physics, 2018, 14(5): 512-522, 2018.