Giraffes are living proof that cells' pressure matters

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Physicists from the Curie Institute, France, explored the relative impact of the mechanical pressure induced by dividing cells in biological tissues. This approach complements traditional studies on genetic and biochemical signalling mechanisms to explain experimental observations of how biological tissues evolve. This work, recently published in *European Physical Journal E*, could have significant implications for the understanding of cancer growth.

Jonas Ranft and team created a two-component mathematical model accounting for both the cells and the fluid caught in between. On the one hand, cells are modelled as behaving like a dividing fluid subject to expansion. On the other hand, the interstitial fluid is akin to an ideal fluid that cannot be compressed. This model is designed to elucidate the nature of mechanical pressure exerted upon dividing cells by their surrounding tissues, referred to as homeostatic pressure.

It replaces a previous single-component model they developed last year. Its assumption: the homeostatic pressure is proportional to the fluid pressure within the tissue. If that were the case, very tall organisms such as giraffes could not exist, because the cells in their lower body would die under pressure.

Thanks to the two-component model, the authors found that it is the cells' pressure and not the interstitial fluid's pressure that influences the level of cell division. When there are as many new cells created from cell division as cells dying from programmed cell death, or apoptosis, the homeostatic pressure is balanced. This leads to a steady state of the biological tissue. Going one step further, the authors pinpointed the range of fluid pressure required to drive cell flow within the body.

Such models could help gain a greater understanding of the importance of the disruption of homeostatic pressure in biological tissues caused by cancer cells that are characterised by abnormal levels of cell proliferation.

More information: Ranft J, Prost J, Jülicher F, Joanny FJ (2012), Tissue dynamics with permeation, *European Physical Journal E* 35: 46, DOI 10.1140/epje/i2012-12046-5

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