How cells get a skeleton

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The mechanism responsible for generating part of the skeletal support for the membrane in animal cells is not yet clearly understood. Now, Jean-François Joanny from the Physico Chemistry Curie Unit at the Curie Institute in Paris and colleagues have found that a well-defined layer beneath the cell outer membrane forms beyond a certain critical level of stress generated by motor proteins within the cellular system. These findings, which offer a new understanding of the formation of this so-called cortical layer, have just been published in the *European Physical Journal E.*

Active gels are ideal for modelling the similar material found in living cells' structure, made of a dynamic, filamentous scaffold. They are composed of components that take up energy and do directed work. Indeed, chemical energy is fed into the cells' constituents and is transformed into mechanical work through the assembly of its internal filaments, made of a polymer called actin, and a protein that functions as a tiny motor, called myosin. Both provide the active gel-like substance found in cells with a spontaneous tendency to contract. As a result, the cells can either maintain or change their shape, or even adhere, spread, divide and crawl.

In this study, the authors have created hydrodynamic models of active gels to model the cell cortex, whereby the active gel is polymerising at the surface and depolymerising throughout the gel as a whole. They first derived the equations providing a coarse-grained description of cortical dynamics, then calculated the configuration in which their model was in a steady state.

They found that for sufficiently high levels of contractile stress it consisted of a dense layer near the membrane, which abruptly cut off beyond a certain thickness. The key advance in their model is the inclusion of gel disassembly throughout the system, and the contractility due to molecular motors.

More information: J.-F. Joanny et al. (2013), The actin cortex as an active wetting layer, *European Physical Journal E.* DOI 10.1140/epje/i2013-13052-9

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