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Active matter and fluid dynamics from the cell MICHAEL SHELLEY, Flatiron Institute (Simons Foundation) & Courant Institute (NYU) — Inside of cells, the nature of the forces that underlie important transport and developmental processes therein are often obscure. These forces are exerted through the activity of the cellular cytoskeleton, a collection of transitory biopolymers and their associated molecular motors. Fluid dynamics and fluid-structure interactions have a role to play in understanding the internal dynamics of cells; the fluidic cytoplasm both modulates and transmits forces generated by motion of the active cytoskeleton, while the induced flows can reveal how and where those forces are being produced. These same cytoskeletal components, when studied in vitro, outside of the cell, evince self-organizing dynamics reminiscent of the self-organization seen in mitotic spindles. I will talk about models, simulations, and experiments that use cellular fluid flows to understand positioning and dynamics of the mitotic spindle – the organelle that orchestrates the division of chromosomes – in early development.

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