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Marangoni-driven chemotaxis, chemotactic collapse, and the Keller-Segel equation MICHAEL SHELLEY, HASSAN MASOUD, Applied Math Lab, Courant Institute, NYU — Almost by definition, chemotaxis involves the biased motion of *motile* particles along gradients of a chemical concentration field. Perhaps the most famous model for collective chemotaxis in mathematical biology is the Keller-Segel model, conceived to describe collective aggregation of slime mold colonies in response to an intrinsically produced, and diffusing, chemo-attractant. Heavily studied, particularly in 2D where the system is "super-critical", it has been proved that the KS model can develop finite-time singularities – so-called chemotactic collapse – of delta-function type. Here, we study the collective dynamics of *immotile* particles bound to a 2D interface above a 3D fluid. These particles are chemically active and produce a diffusing field that creates surface-tension gradients along the surface. The resultant Marangoni stresses create flows that carry the particles, possibly concentrating them. Remarkably, we show that this system involving 3D diffusion and fluid dynamics, exactly yields the 2D Keller-Segel model for the surface-flow of active particles. We discuss the consequences of collapse on the 3D fluid dynamics, and generalizations of the fluid-dynamical model.

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