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How do generalized jamming transitions affect collective migration in confluent tissues?

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Recent experiments have demonstrated that tissues involved in embryonic development, lung function, wound healing, and cancer progression are close to fluid-to-solid, or “jamming” transitions. Theoretical models for confluent 2D tissues have also been shown to exhibit continuous rigidity transitions. However, *in vivo* biological systems can differ in significant ways from the simple 2D models. For example, many tissues are three-dimensional, mechanically heterogeneous, and/or composed of mechanosensitive cells interspersed with extracellular matrix. We have extended existing models for confluent tissues to capture these features, and we find interesting predictions for collective cell motion that are ultimately related to an underlying generalized jamming transition. For example, in 2D, we find that heterogeneous mixtures of cells spontaneously self-organize into rigid regions of stiffer cells interspersed with string-like groups of soft cells, reminiscent of cellular streaming seen in cancer. We also find that alignment interactions (of the sort often explored in self-propelled particle models) alter the transition and generate interesting flocked liquid and flocked solid collective migration patterns. Our model predicts that 3D tissues also exhibit a jamming transition governed by cell shape, as well as history-dependent aging, and we are currently exploring whether ECM-like interactions in 3D models might help explain compressional stiffening seen in experiments on human tissue.