Contributions of intercellular adhesion and cortical tension to tissue self-assembly

Malcolm S. Steinberg

Vertebrate embryonic body parts disassembled into fragments or even single cell suspensions are capable of reassembling into semblances of the original structure. Their behavior in doing so closely resembles the mutual spreading and coalescence of immiscible liquids approaching a configuration of minimal interfacial free energy. This has been explained as due to tissue surface tensions (TSTs) guiding the rearrangements of motile, mutually adhesive cells. TSTs, in turn, have been ascribed to either intercellular adhesions (the "differential adhesion hypothesis") or the contractility or cortical tensions of individual cells. Here we present evidence that both of these parameters contribute to TSTs, the ratio of adhesion energy to cortical tension determining which component dominates in any particular instance[1]. Moreover, in the case of cadherin-mediated adhesion, both components are dependent upon cortical actomyosin, so that they may not be independent agents even at the molecular level.

[1] Manning, ML, Foty, RA, Steinberg, MS and Schoetz, E-M, PNAS, 107: 12517-22, 2010.