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Simulation of Cell Adhesion using a Particle Transport Model
JENNIFER CHESNUTT, JEFFREY MARSHALL, University of Iowa — An efficient computational method for simulation of cell adhesion through protein binding forces is discussed. In this method, the cells are represented by deformable elastic particles, and the protein binding is represented by a rate equation. The method is first developed for collision and adhesion of two similar cells impacting on each other from opposite directions. The computational method is then applied in a particle-transport model for a cloud of interacting and colliding cells, each of which are represented by particles of finite size. One application might include red blood cells adhering together to form rouleaux, which are chains of red blood cells that are found in different parts of the circulatory system. Other potential applications include adhesion of platelets to a blood vessel wall or mechanical heart valve, which is a precursor of thrombosis formation, or adhesion of cancer cells to organ walls in the lymphatic, circulatory, digestive or pulmonary systems.

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