Applications of phase field models in biological systems

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Shapes of complex geometry are ubiquitous in our natural environment. A few examples are snow flakes, crack patterns, microstructures in materials or th evein network in plant leaves. These shapes have in common that they are created by out-of-equilibrium phenomena and thus evolve in time. The understanding of a diverse array of phenomena involving complex time-dependent shapes in the physical and biological sciences has been greatly enhanced by a theoretical/computational framework rooted in statistical physics, that is commonly refered to as phase-field modeling. The main challenge in this field is to construct models which encompass the complexity of practically relevant materials or biological systems, are capable of making quantitatively accurate predictions and are mathematically simple enough to be solved on physically realistic time and length scales.

We present various applications in biological systems, including cell dynamics, viral capsides and bone remodeling.