Soft geometry: the mathematical bases of cellular structures.

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To a large extent, the architecture of cellular structures is squishy - its materials combine the characteristics of both solid and liquid states (think agua viva). The mathematical description of squishy objects (often called soft matter), which therefore differs from that based on macroscopic phenomena, is the subject of these talks.

1. Lecture I. Overview of cellular architecture: an interplay between the molecular and the continuum: Polymers and membranes; Elastic rods, random walks and the theory of curves; Cellular applications of elastic rods; Force generation and locomotion; Cytoskeletal networks and elasticity.

2. Lecture II. More biological applications of elastic rods:Swimming and Stokesian hydrodynamics: Motion from geometry; Polymorphic transformations; Elastic theory of flagellar filaments.

3. Lecture III. Membrane geometry: Fluid membranes; Lipid membranes as continua; The role of curvature; How to incorporate the bilayer structure; Vesicle shape and energy; Fluctuations and entropic elasticity; Lipid-protein interactions and other complexities.

4. Lecture IV Membrane shapes: Forcing membranes; Catenoid and tether geometry; Plateau theory of junctions; Red blood cell shape and area-difference elasticity.

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