

Numerical simulations of propulsion mechanisms in the *Listeria* bacterium

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Background:

The *Listeria* bacterium moves through cells by forming a comet tail that propels the bacterium. The comet tail forms by polymerization and cross linking of an actin gel. The details of how this process occurs are not well understood. The problem is important, because similar processes play a role in all cell motility.

It has been shown (e.g. Noireaux *et al*, *Biophys J.* **78** 2000 1643) that comet tail formation can be reproduced in the laboratory by immersing enzyme coated beads in an appropriate medium. A chemo-mechanical process involving stress driven polymerization and depolymerization of actin gel is believed to be the underlying cause of comet tail formation

We have developed computer simulation methods to model this process. The two figures show results of preliminary numerical simulations.

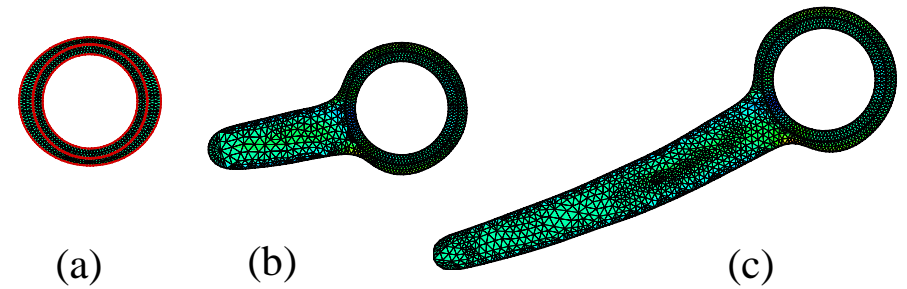


Fig. 1: Finite element simulations showing the formation of a 'comet tail' on a bead coated by an Arp2/3 activating protein. (a), (b) and (c) show three successive time intervals.

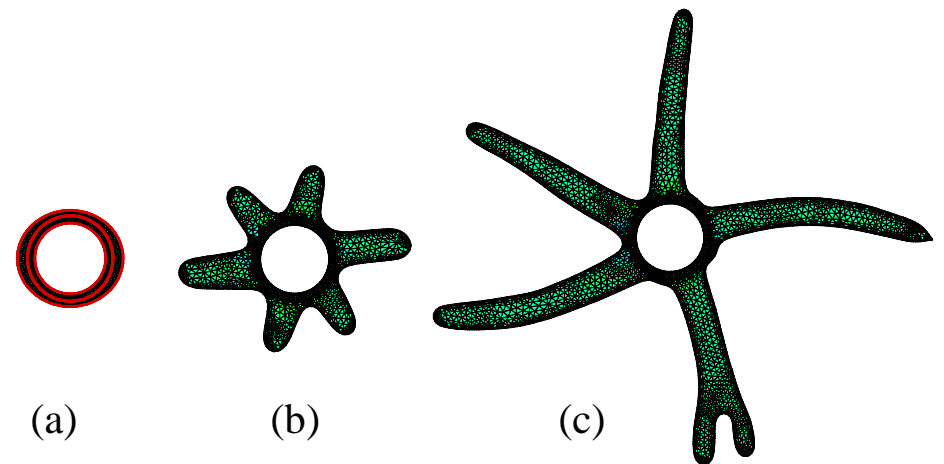


Fig. 2: In this simulation the energy of the interface between the actin network and the surrounding medium is $\frac{5}{3}$ of that shown in Fig. 1.

Numerical simulations of propu bacterium

a

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