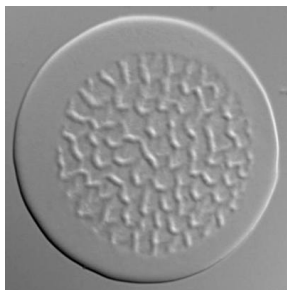
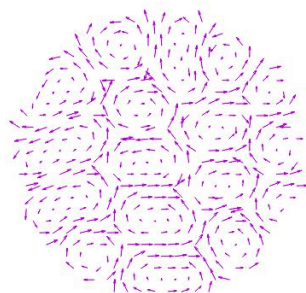


# Physics of membranes and rod like proteins



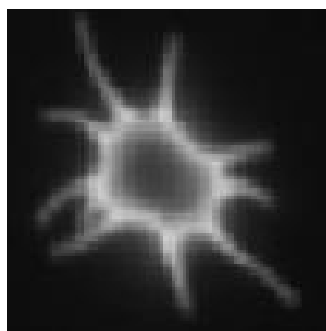
Prerna Lab (B'lore)



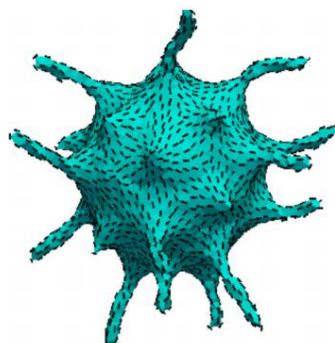
Our Model

Novel patterns on a colloidal membrane.

Saikia et al. (**Nature Communication**, 2017)



Erickson Lab (2009)



Our Model : Nematics on vesicle

FtsZ filaments on vesicle

G. Kumar, N. Ramakrishnan & A. Sain,  
(PRE, 2019)



Healthy Red blood cell

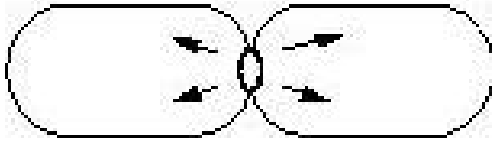


Sickle shaped RBC

Sickling of Red blood cells

A, Behera, G. Kumar, A. Sain  
(Soft Matter 2019)

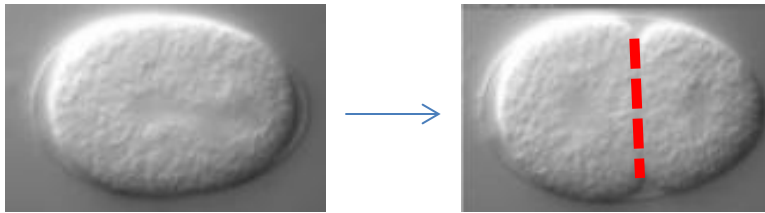
# Biological Physics : Cell division, active matter



## Cell division in bacteria

B. Ghosh & A.Sain, **PRL** (2008).

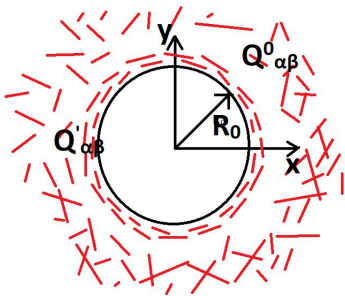
Highlight in **natureINDIA**



## Cell division in animal cells

A. Sain, M. Inamdar & F. Julicher (PRL,2015)

Hyman Lab, Dresden



## Hydrodynamic theory of cell division

Involves flows of active matter ..... ongoing research.

$$\sigma_{\alpha\beta} = 2\eta v_{\alpha\beta} - \beta_1 H_{\alpha\beta} + \zeta \Delta \mu Q_{\alpha\beta}$$

$$\frac{D}{Dt} Q_{\alpha\beta} = \beta_1 v_{\alpha\beta} + \frac{1}{\beta_2} H_{\alpha\beta}$$

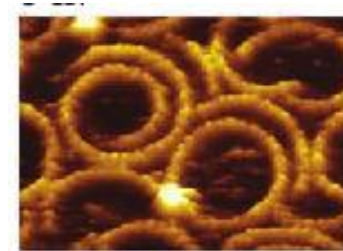
$$Q_{\alpha\beta} = \langle n_\alpha n_\beta - \frac{1}{3} \delta_{\alpha\beta} \rangle$$

Order Parameter, stress, velocity ..... continuum mechanics

# Single molecule Physics of biopolymers

## Polymers with intrinsic curvature

Surya K. Ghosh, Kulveer Singh, AS,  
PRE (2009).



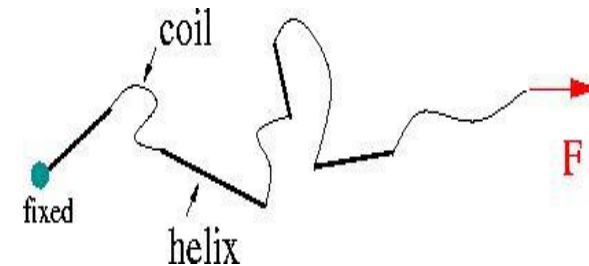
## Breakage of polymeric bonds

S. G. Das, D. Pescia, M. Biswas & AS  
PRE (2010), Highlight in **natureINDIA**



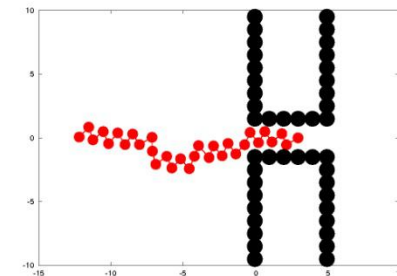
## Force extension behavior of ssDNA

Force extension behavior of polymers.  
Kulveer Singh, S. Kumar, AS, EPL (2012).



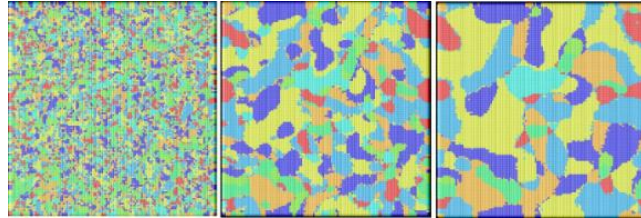
## Translocation of ssDNA through nano-pores

Kulveer Singh, & AS, EPL (2013),  
**Editor's Choice.**



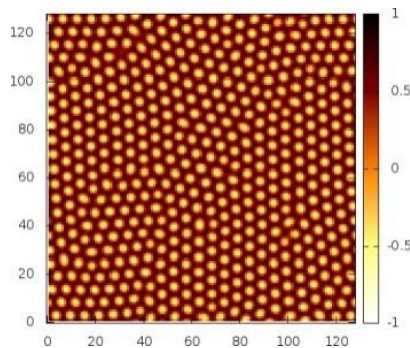
# Dynamics in Poly-crystalline materials

## Grain growth using quaternions.



Santidan Biswas, I. Samajdar, A. Haldar, AS  
J.Phys. Cond. Mat. (2011) Fast track, Highlight article.

## Dislocation dynamics in sheared poly-crystals (phase field crystal model).



Santidan Biswas, M. Grant, I. Samajdar, A. Haldar, AS  
**Scientific Reports** (2013).