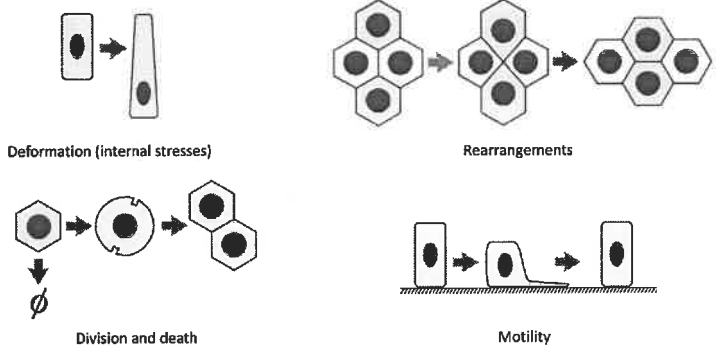


Solving the Mystery of Gastrulation

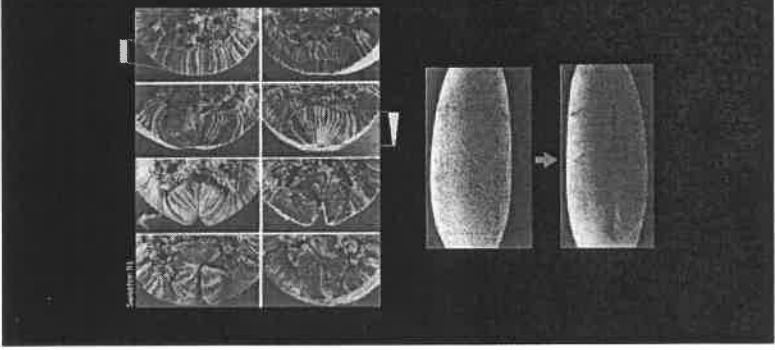
Konstantin Doubrovinski
November 2017
STARS



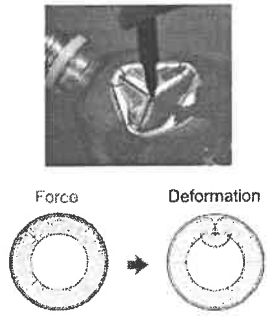
Cellular Processes (in Development)



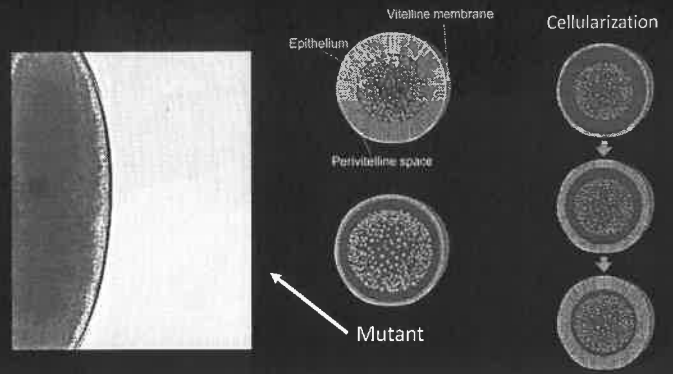
Gastrulation (Ventral Furrow)



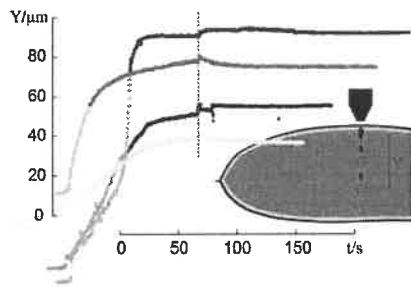
Dynamics = passive response + active forcing



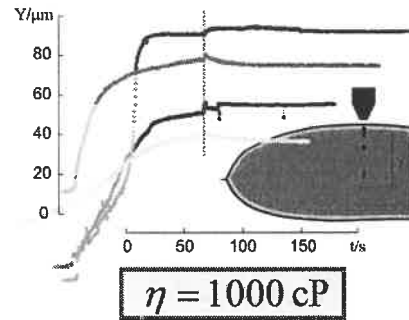
Ferrofluids: measuring tissue properties

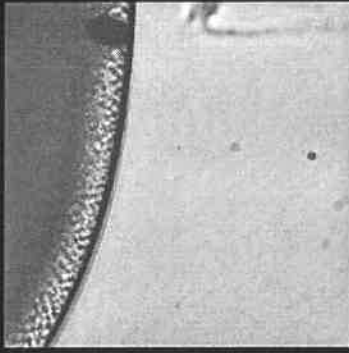


Viscous interior

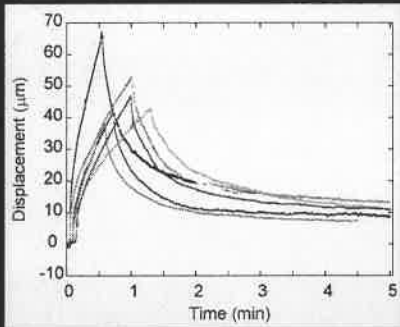


Viscous interior

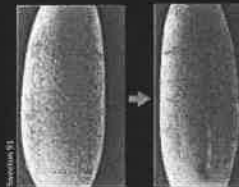




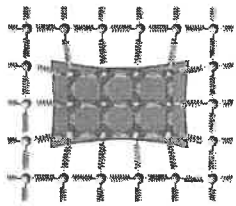
Following deformation imaging labeled membranes



Gastrulation (Ventral Furrow)

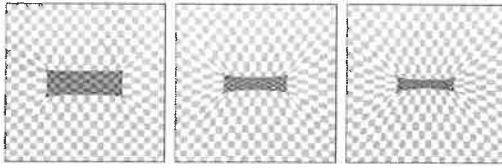


Implications for the dynamics

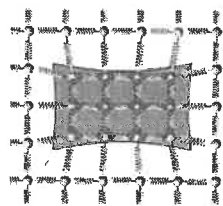


$$\eta \partial_t \mathbf{u} = \frac{Eh}{2(1+\sigma)} \nabla^2 \mathbf{u} + \frac{Eh}{2(1-\sigma)} \nabla \nabla \cdot \mathbf{u} + \nabla \cdot \boldsymbol{\mu}$$

$$\boldsymbol{\mu} = \mathbf{I} \mu_0$$

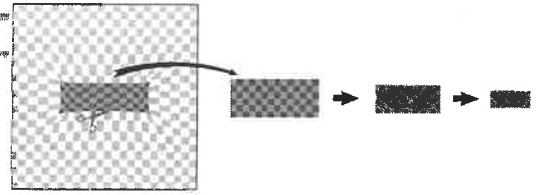


Implications for the dynamics

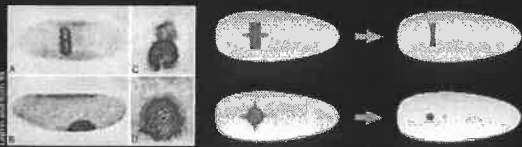


$$\eta \partial_t \mathbf{u} = \frac{Eh}{2(1+\sigma)} \nabla^2 \mathbf{u} + \frac{Eh}{2(1-\sigma)} \nabla \nabla \cdot \mathbf{u} + \nabla \cdot \boldsymbol{\mu}$$

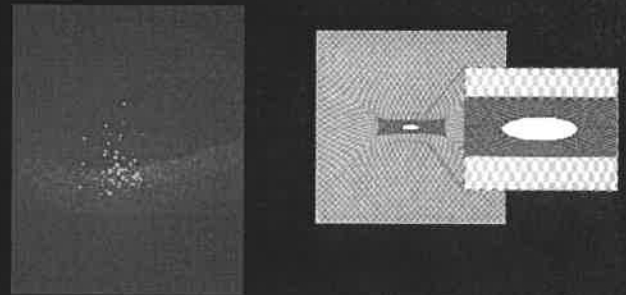
$$\boldsymbol{\mu} = \mathbf{I} \mu_0$$



Implications for the dynamics



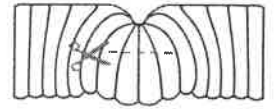
Implications for the dynamics



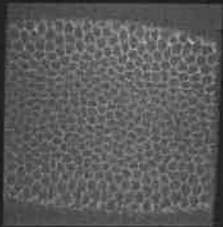
Why invagination?



Why invagination?



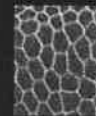
Stack



Gastrulation

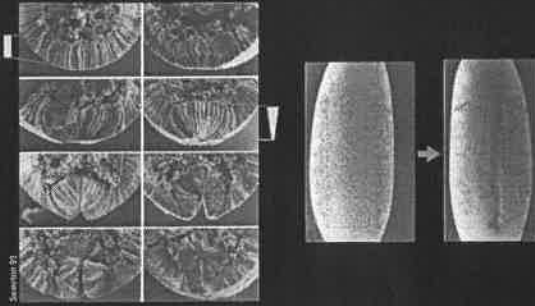


Ablation experiments: measuring tension in lateral membranes



Gastrulation

Gastrulation (Ventral Furrow)



Acknowledgements



Dan Needleman



Hai-Yin Wu



Eric Wieschaus



Amanda Goldner



Kelly Mapes



Reza Farhadifar

Needleman Lab



Bing He

Wieschaus Lab



Oleg Polyakov

Dobrovinski Lab