

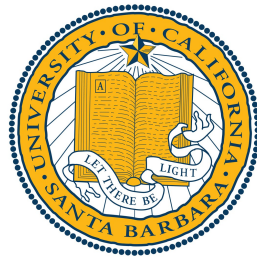
Understanding how active fluid flow shapes embryos

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Mentor: Dillon Cislo

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Morphogenesis: A challenging problem

Fecundation (Point A)



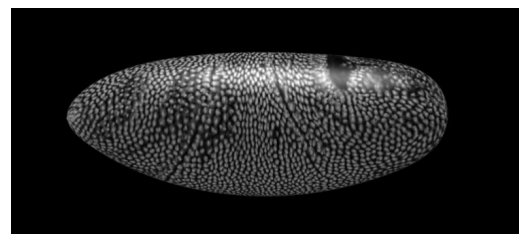
How ?



Human body (Point B)

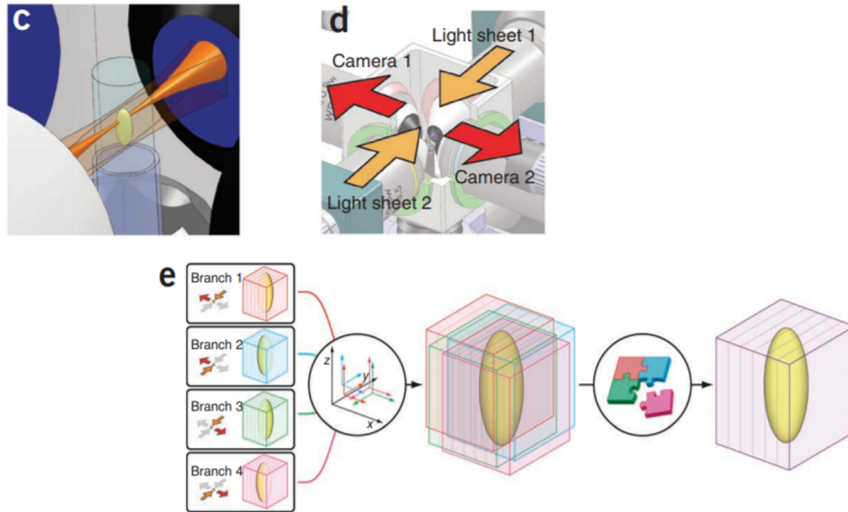


buzzfeed.com



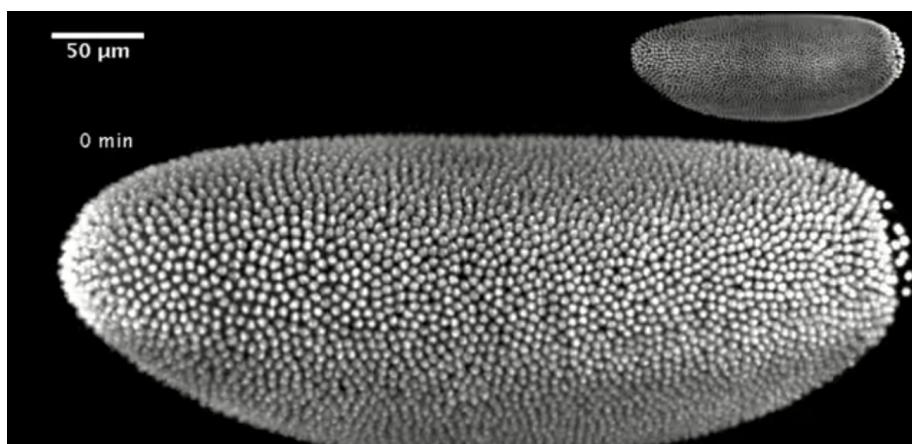
From Streichan Lab

Advancement: Light Sheet Microscopy



Krzic, Gunther, Saunders, Streichan and Hufnagel (2012). Multiview light-sheet microscope for rapid in toto imaging. *Nature Methods*, Vol. 9, p. 730-733.

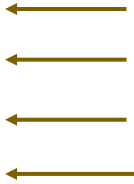
High optical resolution and non intrusive



Streichan Lab at UCSB

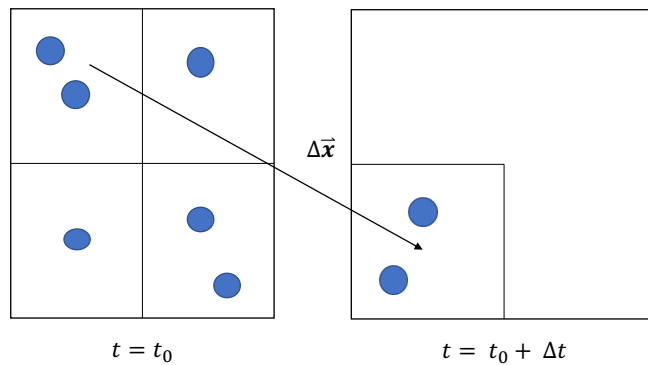
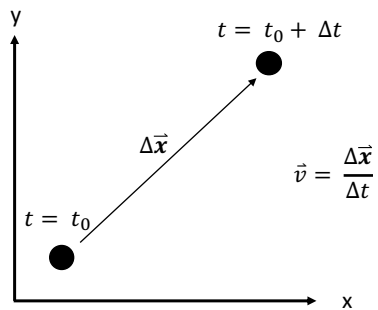
Fluid approximation behaves like Stokes flow

$$Re = \frac{\text{inertial forces}}{\text{viscous forces}} \ll 1$$

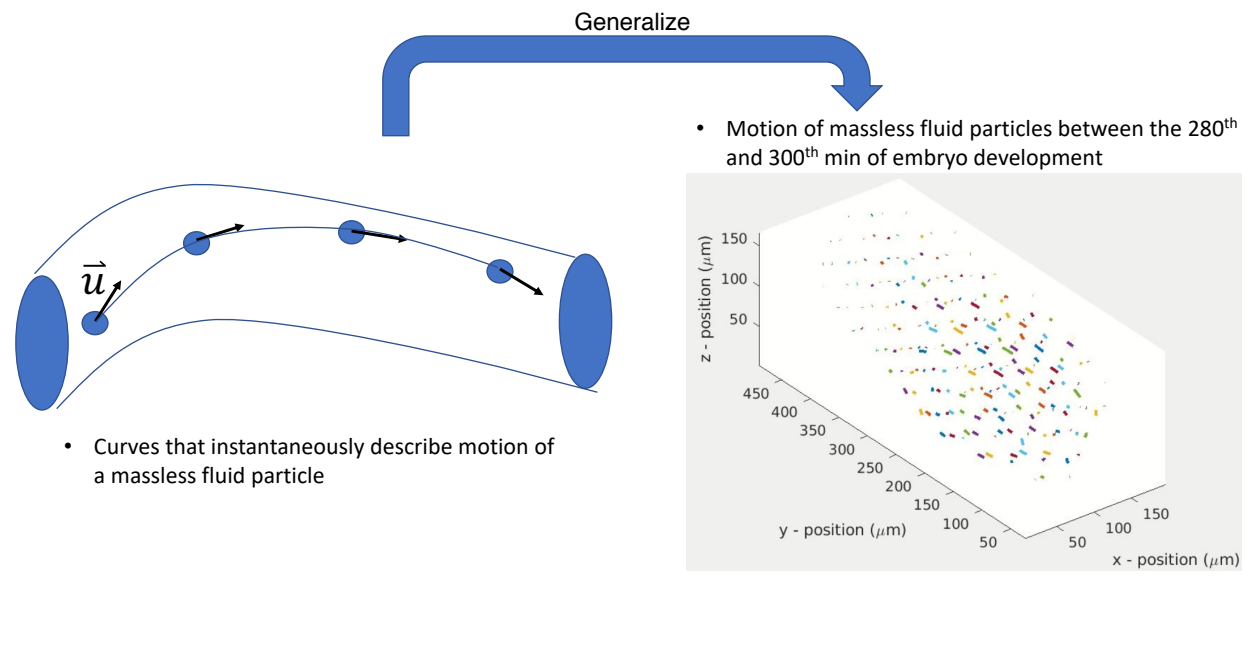


Extracting the velocity field of fluid

Particle Image Velocimetry



Integrating the velocity field yields streamlines

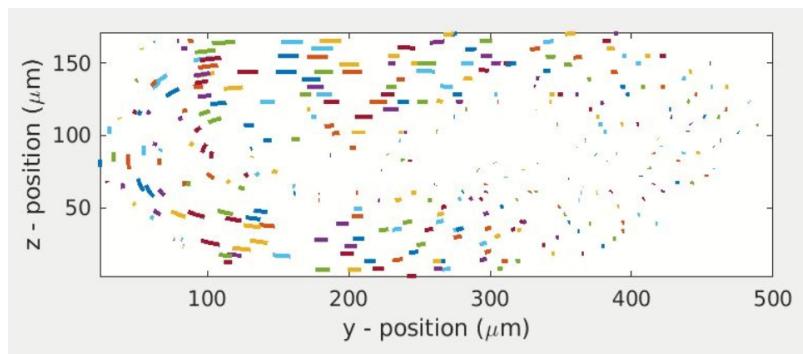


Curl of the velocity field

- Vorticity measures how fast the ball is spinning



- How vorticity looks like in an embryo?

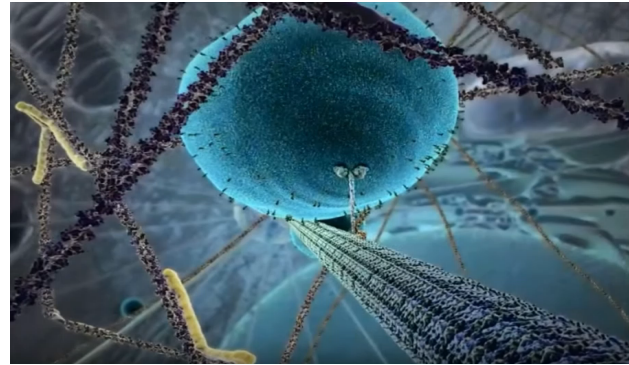


Let's talk about active matter

- What if your coffee could spin itself?

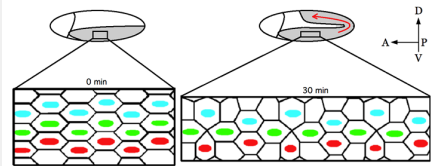
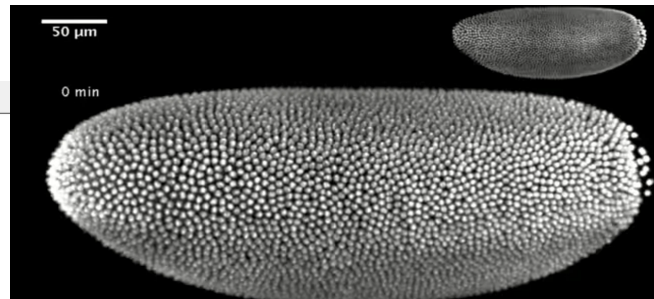
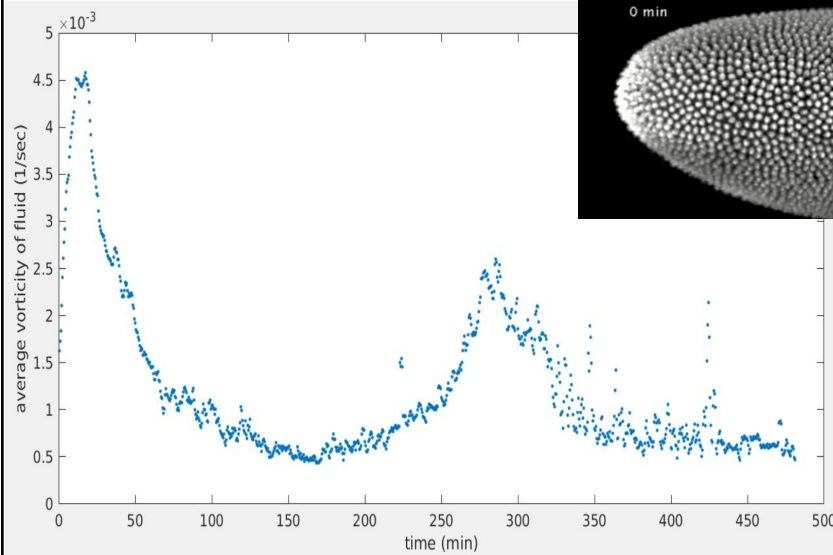


Active matter found in nature: Myosin motor



<https://www.youtube.com/watch?v=y-uuk4Pr2i8>

Average vorticity of fluid signals germ-band extension and contraction



- Process in which layer of cells doubles in size

Future steps

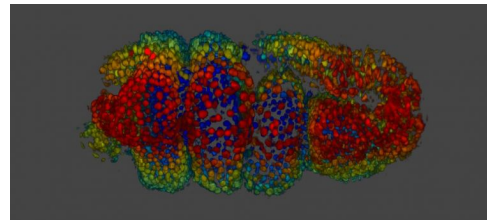
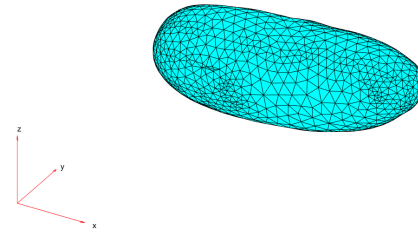
Implement Finite Element Method



Interpret calculations



Are surface and bulk dynamics coupled?



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What should we take away?

1. We believe that this “fluid” behavior has answer in active matter
2. Properties of the “fluid” may signal biological milestones

Acknowledgements

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Dr. Sebastian Streichan



Dillon Ciso