



Diggin' on the rhythms of life

Balint



Image sonification of cell autophagy

Joanna



Machine learning tools for cardiac motion analysis

Joachim



Cell flow in embryo models

Dongho



Music for cells



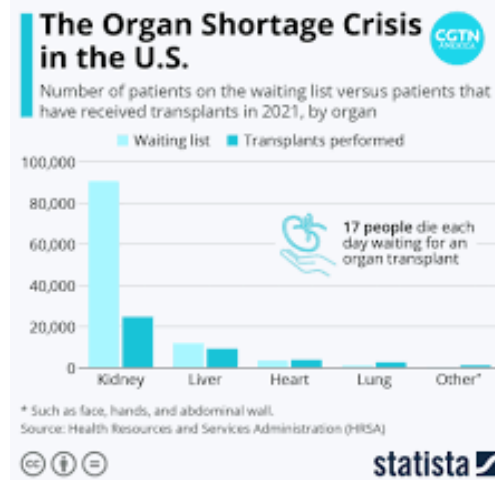
Music
for cells

Motion capture of cells in 3D

Joachim Mossige, RITMO SFF, joachim.mossige@imv.uio.no
Food and Paper, 5 April 2024

3D Printed 'Body-on-Chip' Could Mean the End of Animal Testing

Published on January 9, 2024 by Madeleine P.

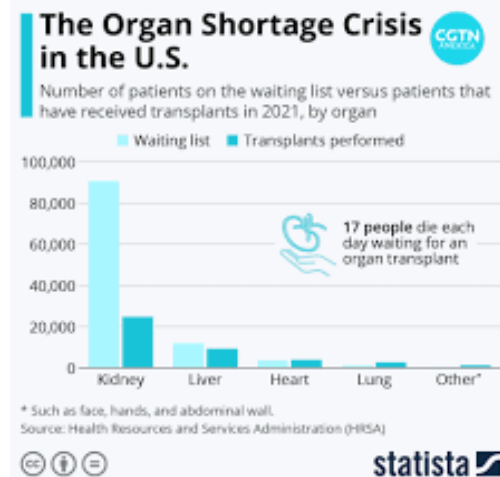




Music
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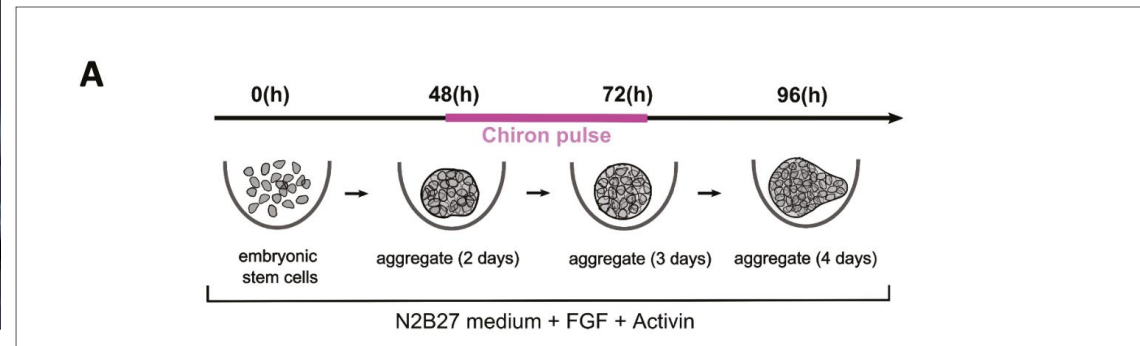
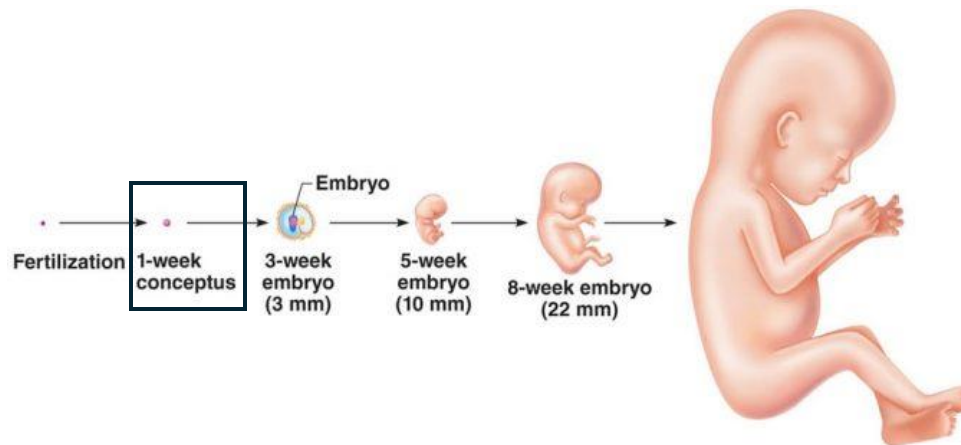
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ITOM: a multi-disciplinary project funded by UiO:LifeScience



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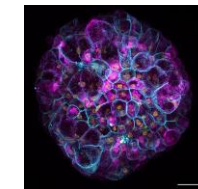
Alexander R. Jensenius
Centre director at RITMO SFF



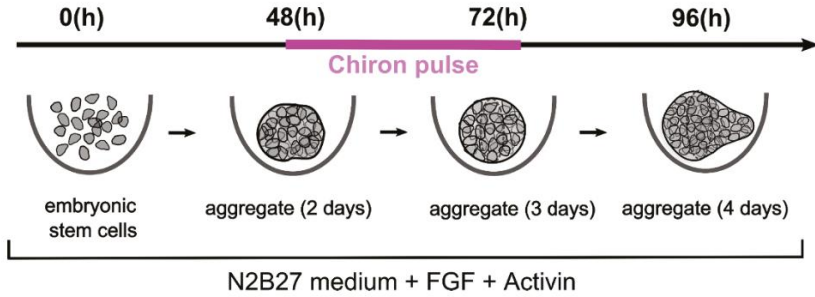
Dr. Sergei Ponomartcev
HTH SFF



Dr. Richard Ho
Dept. Phys.

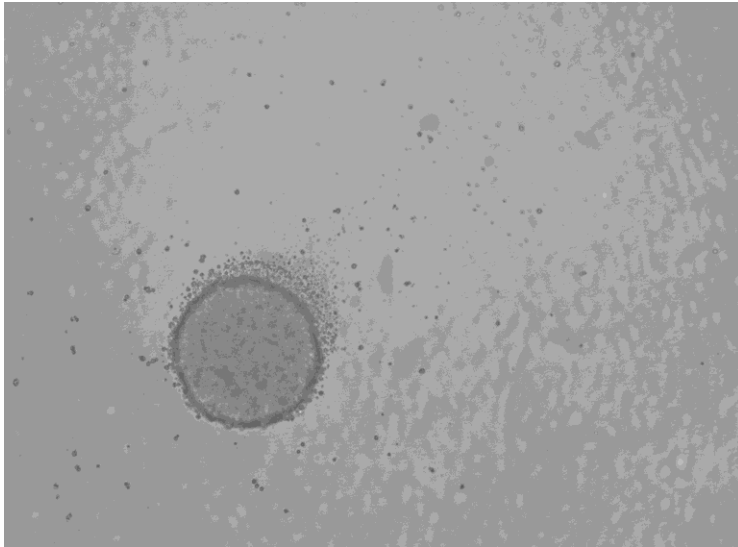


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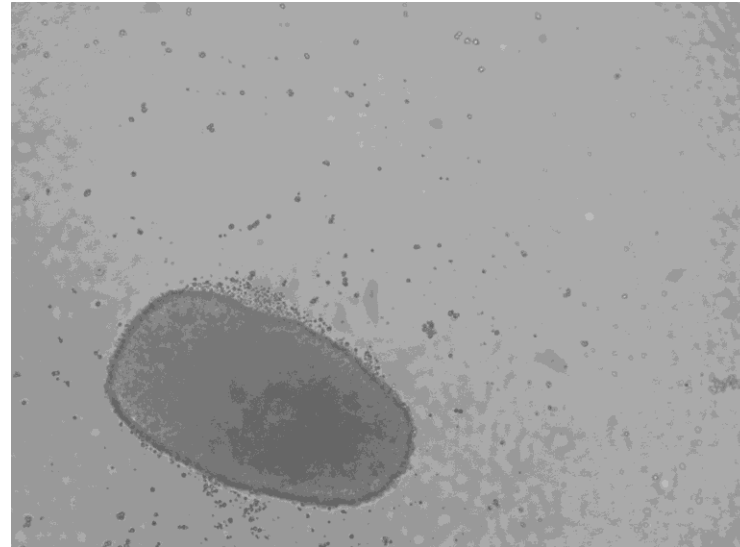


How do these gastruloids elongate?

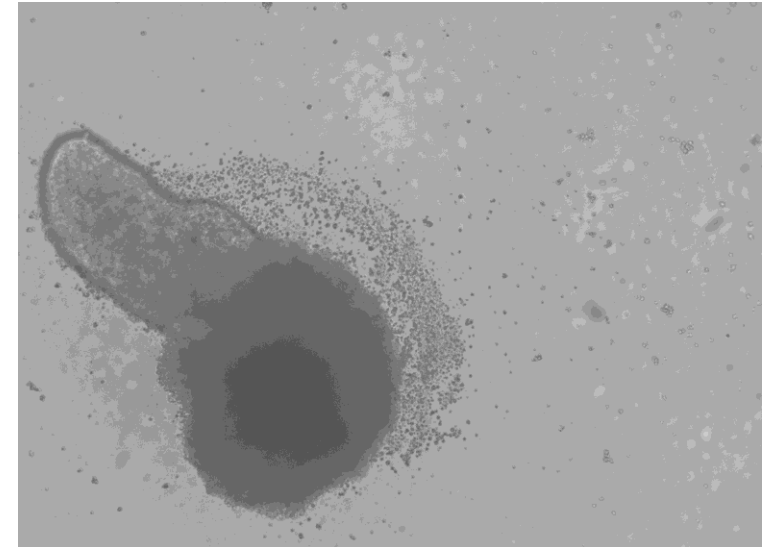
Gastruloids: Embryo models without a brain made from stem cells



72 h (3 days)

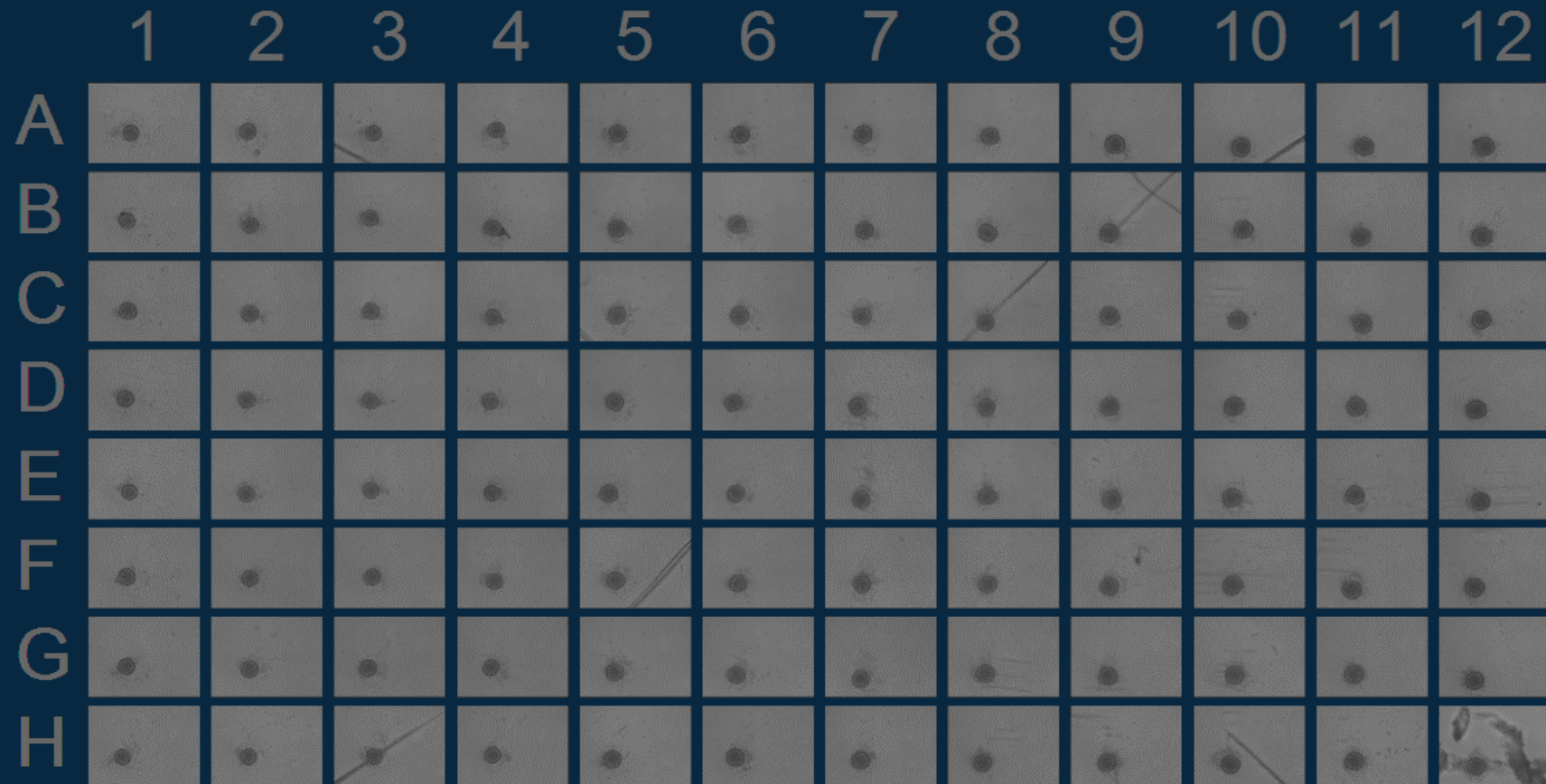


96 h (4 days)



120 h (5 days)

2i/N2B27 48h (2dpa)



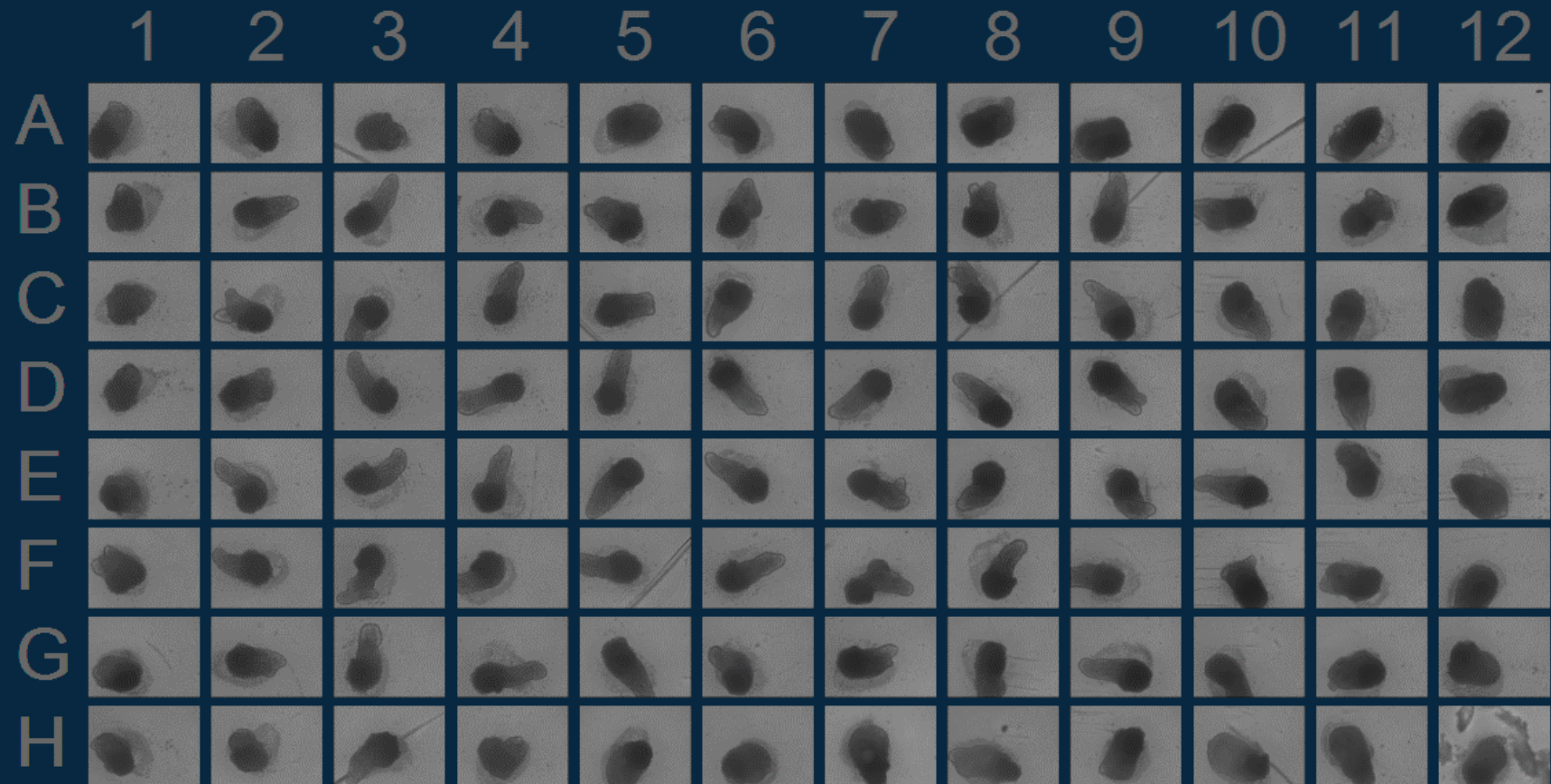
2i/N2B27 72h (3dpa)



2i/N2B27 96h (4dpa)

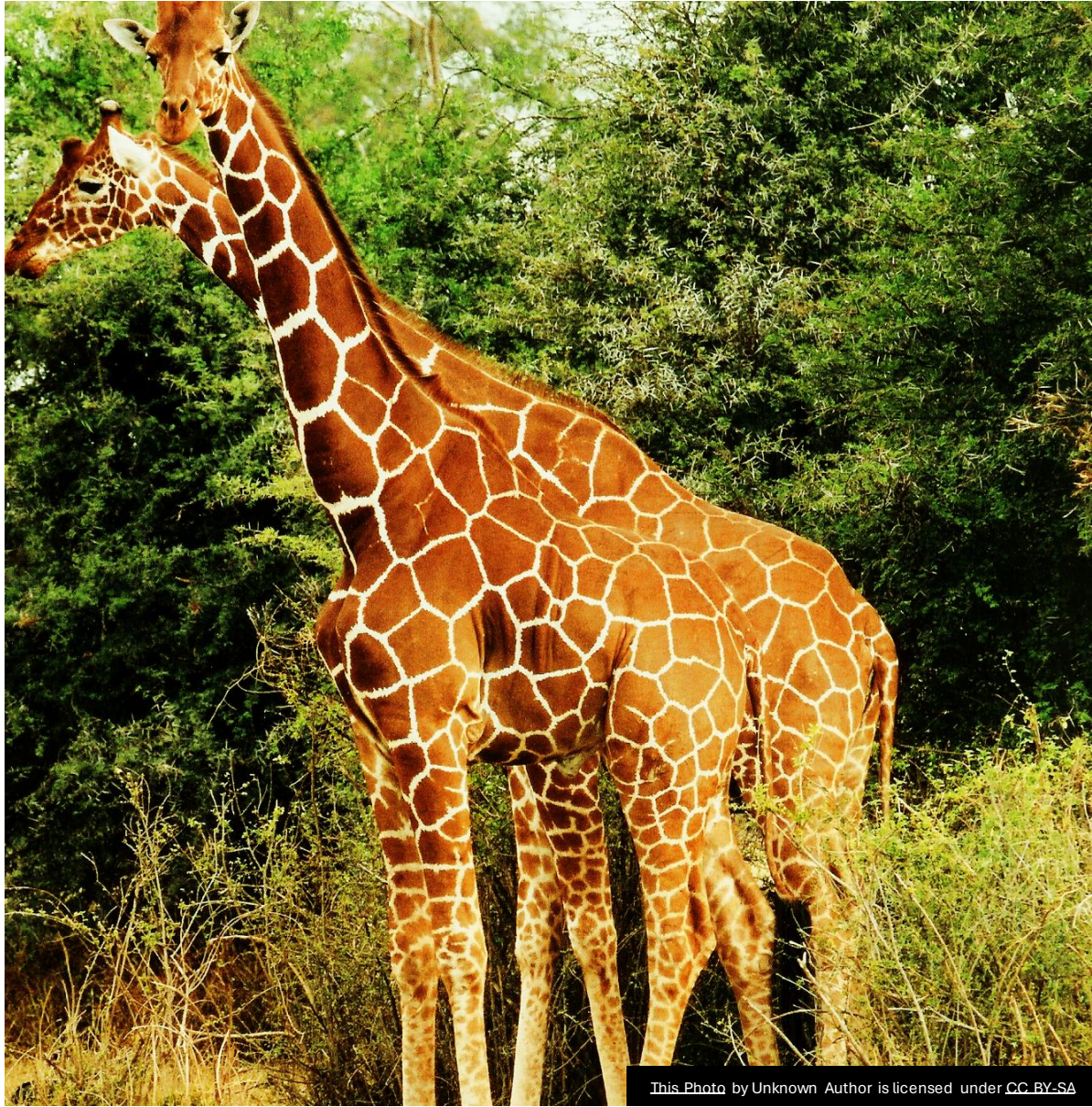


2i/N2B27 120h (5dpa)





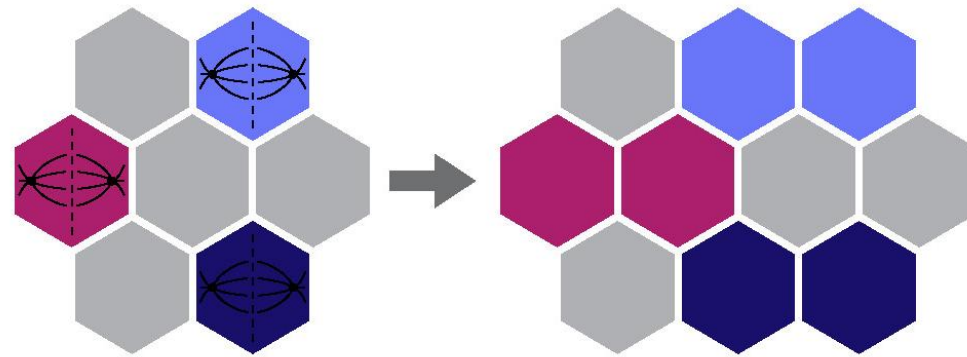
How do things in nature
develop their shape?



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A common strategy to change shape: Oriented cell division



Oriented cell division

Collective/cooperative motion: Bacteria spreading as fluids



Bacillus subtilis

environmental strains 100, 102, 108
&
strain NCIB3610

Biofilm growth comparison during seven days

Flows without fluids: Collective motion

Examples of entrainment 'flows' in nature



Herds of sheep



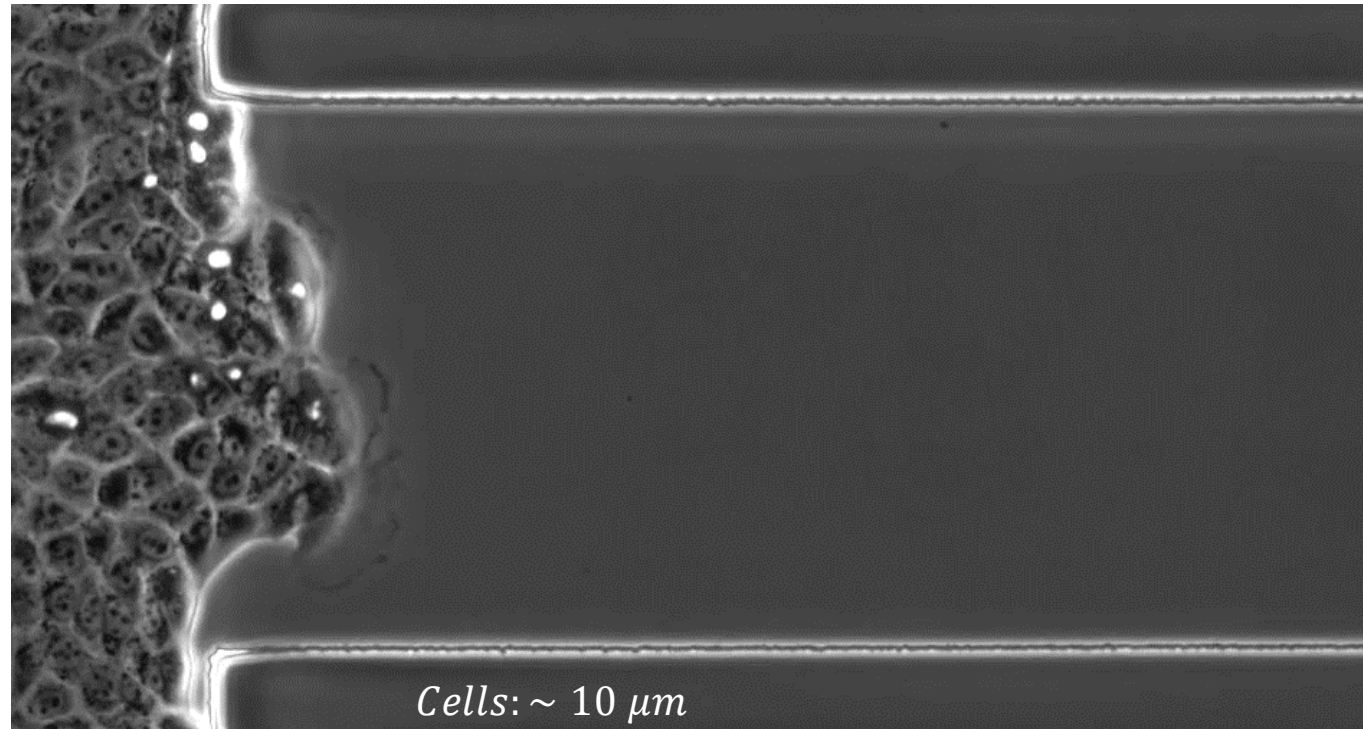
Schools of fish

Collective motion: Black Friday

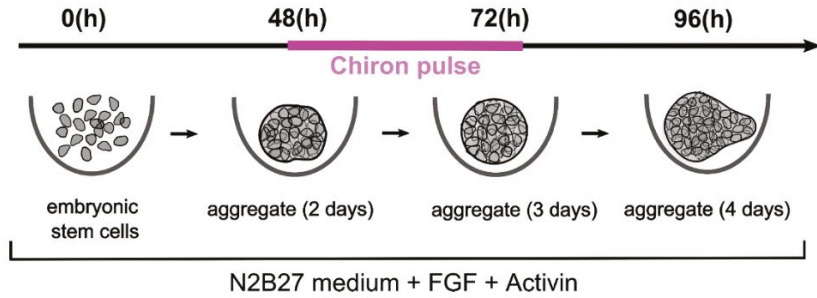


MakeAGIF.com

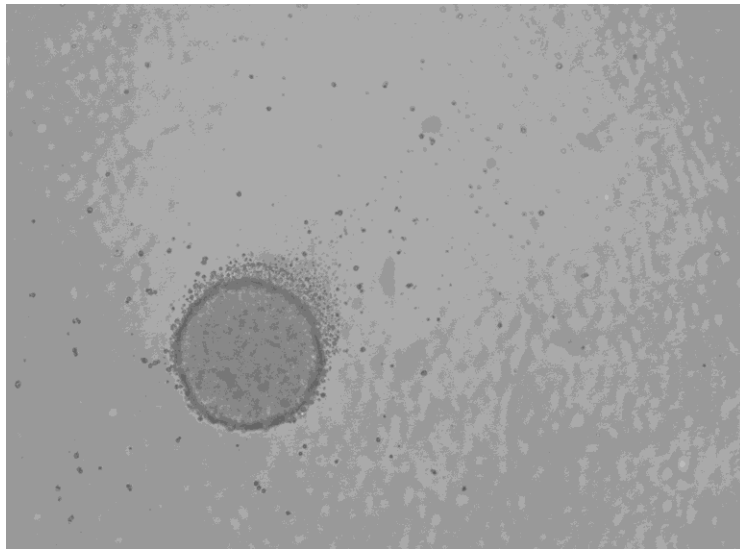
Collective motion across all scales



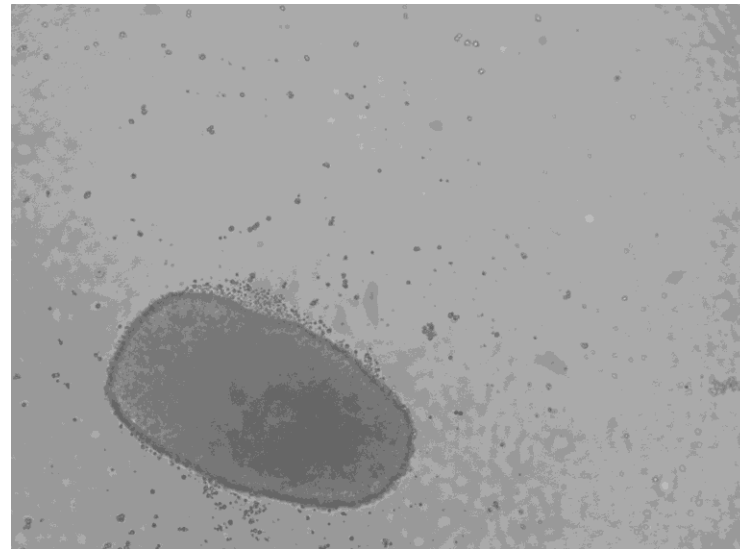
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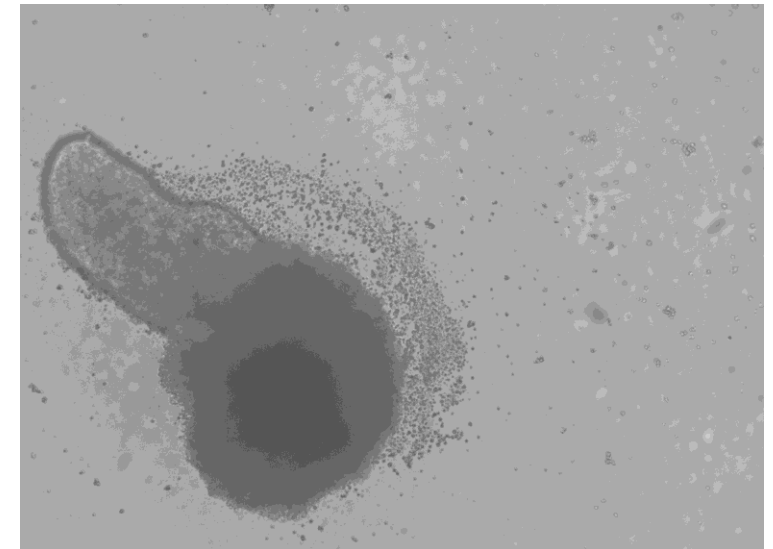
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72 h (3 days)

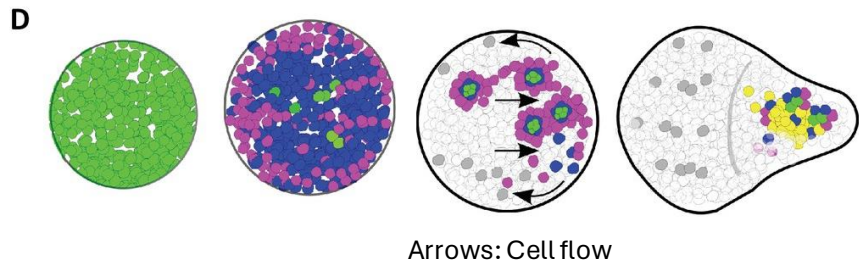
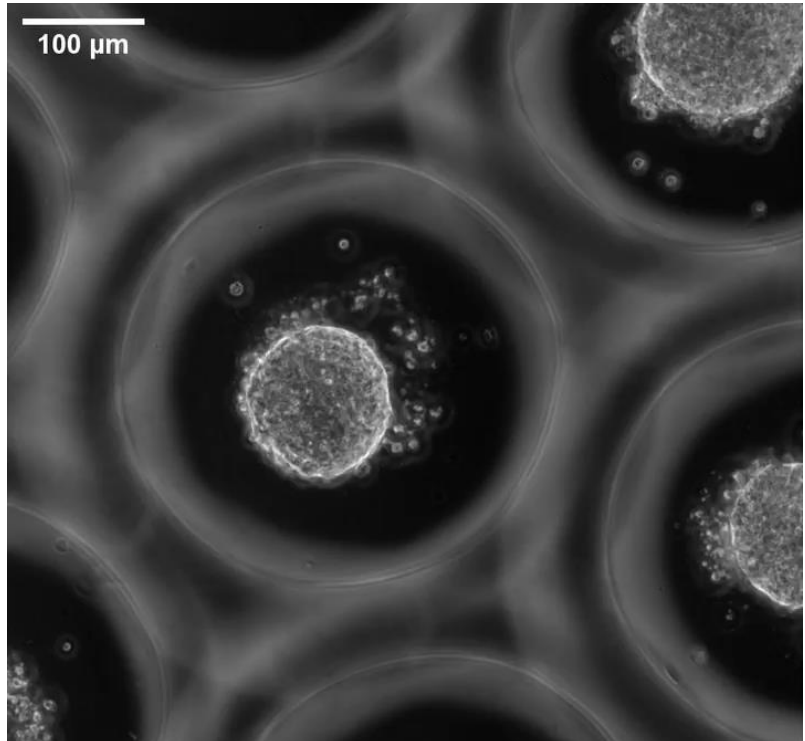


96 h (4 days)



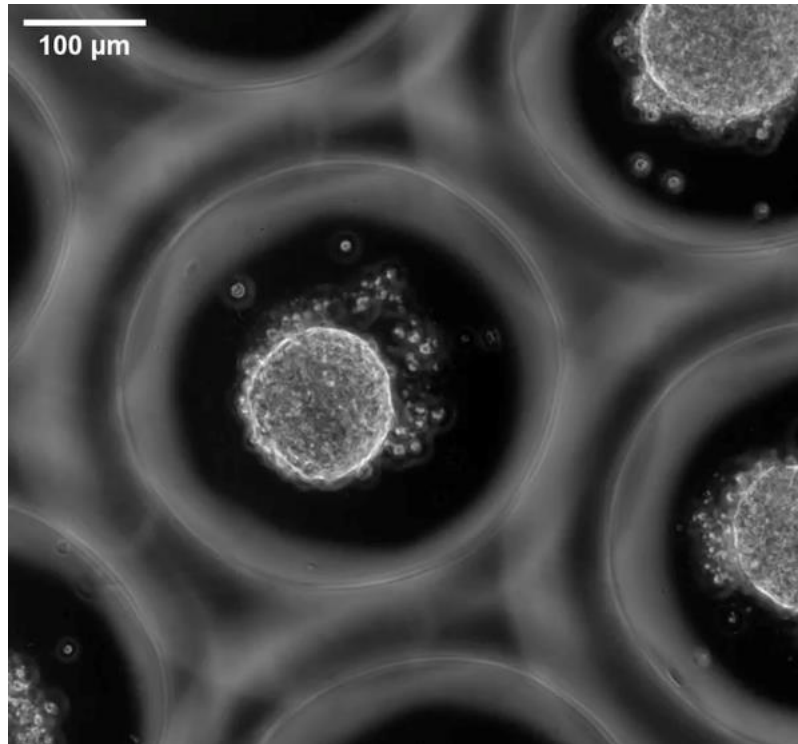
120 h (5 days)

Cells migrate collectively to shape developing gastruloids

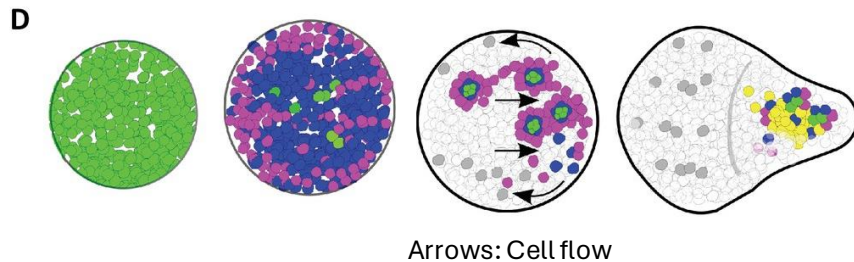
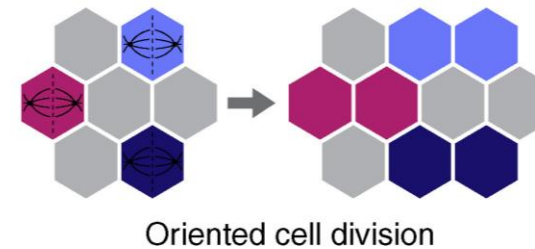


Arrows: Cell flow

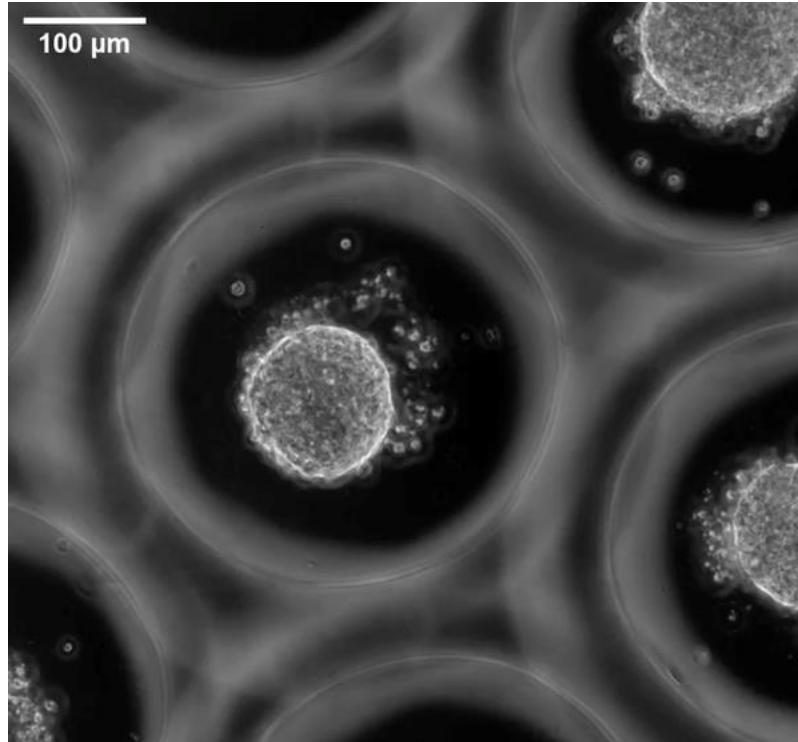
Cells migrate collectively to shape developing gastruloids



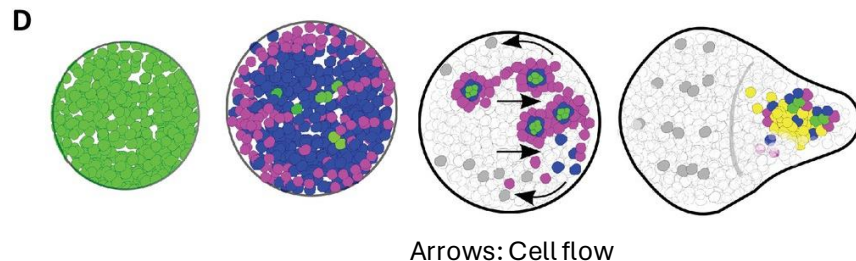
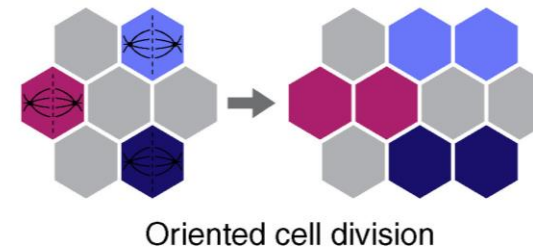
We aim to quantify the relative importance of cell flows vs. oriented cell division in shaping a developing gastruloid



Cell migrate collectively to shape developing gastruloids

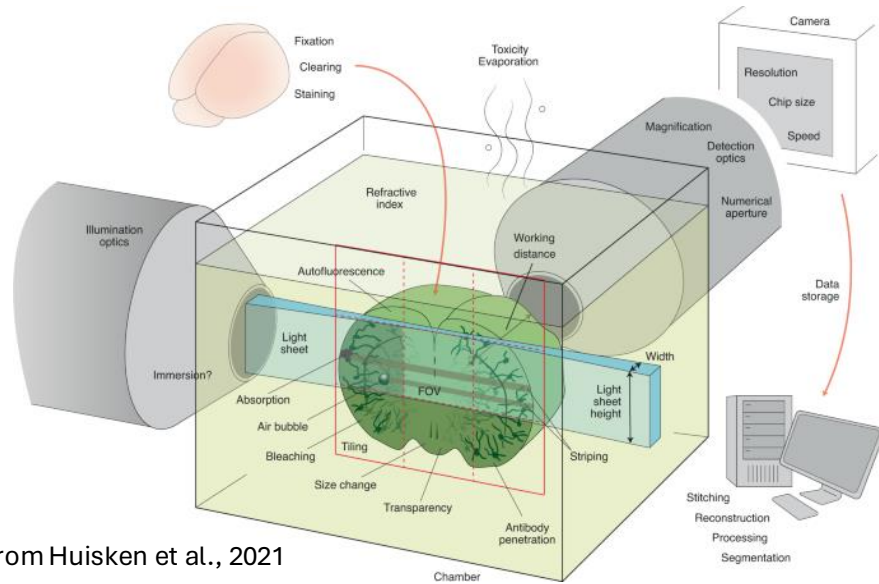


We aim to quantify the relative importance of cell flows vs. oriented cell division in shaping a developing gastruloid

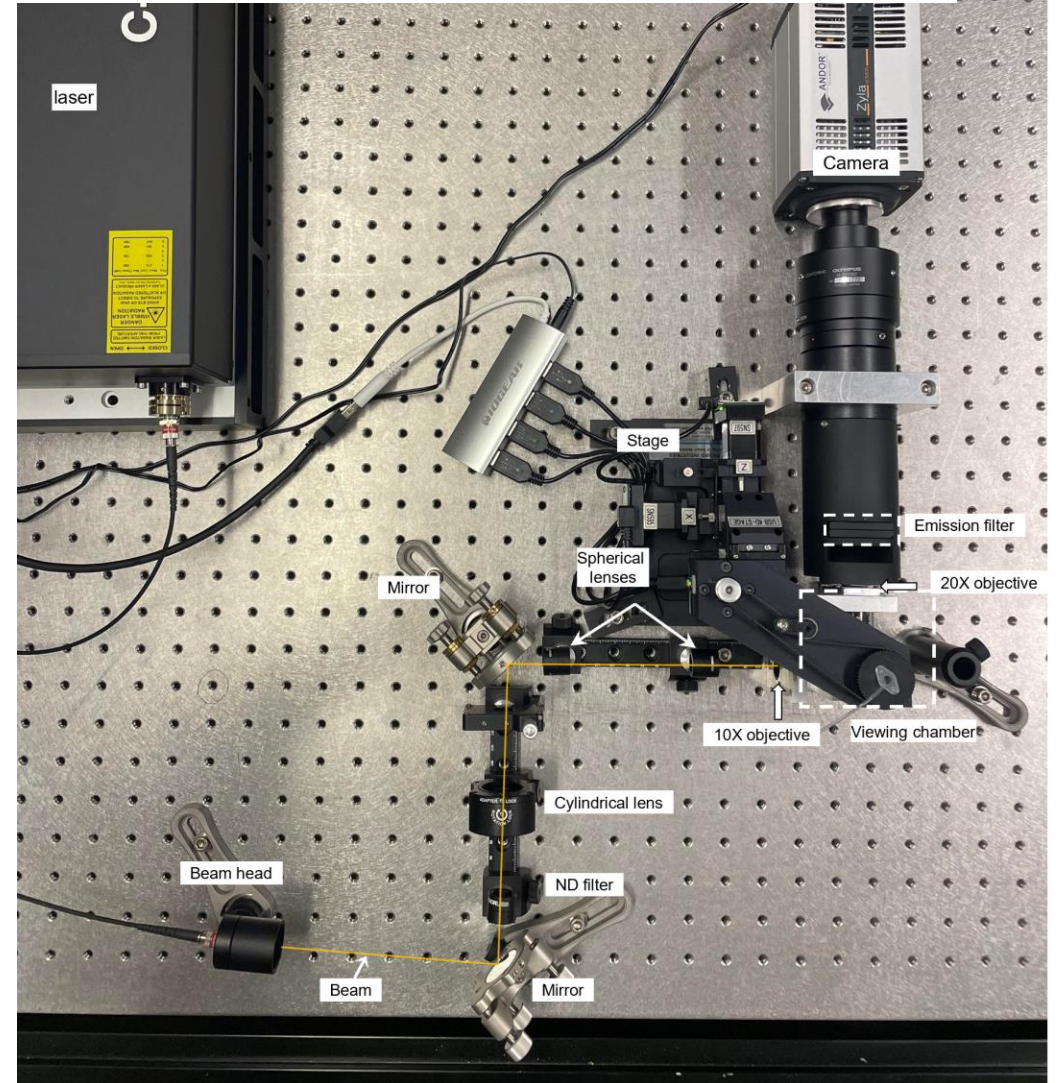
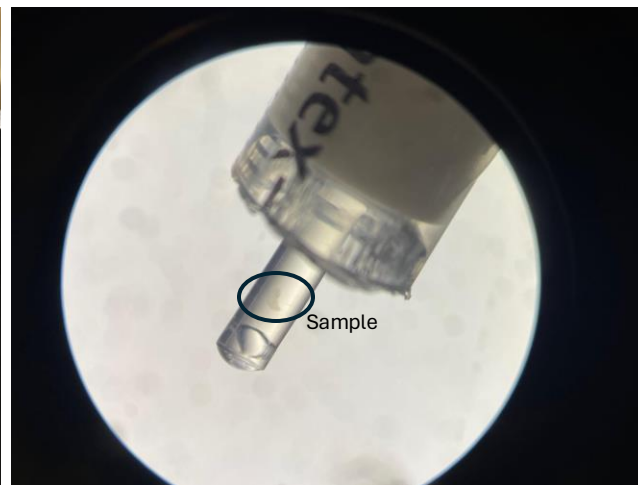
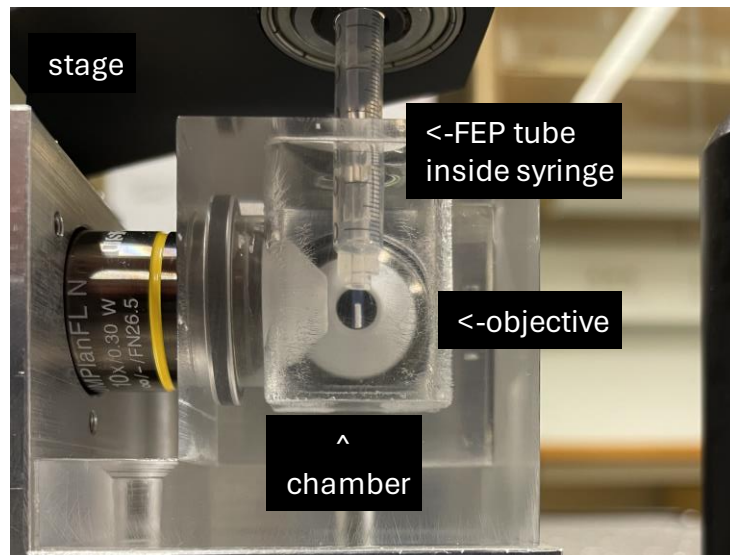


Gastruloids are highly 3D, and so our measurements must be as well!

We built a light-sheet microscope to characterize the 3D shape evolution of developing gastruloids



From Huisken et al., 2021

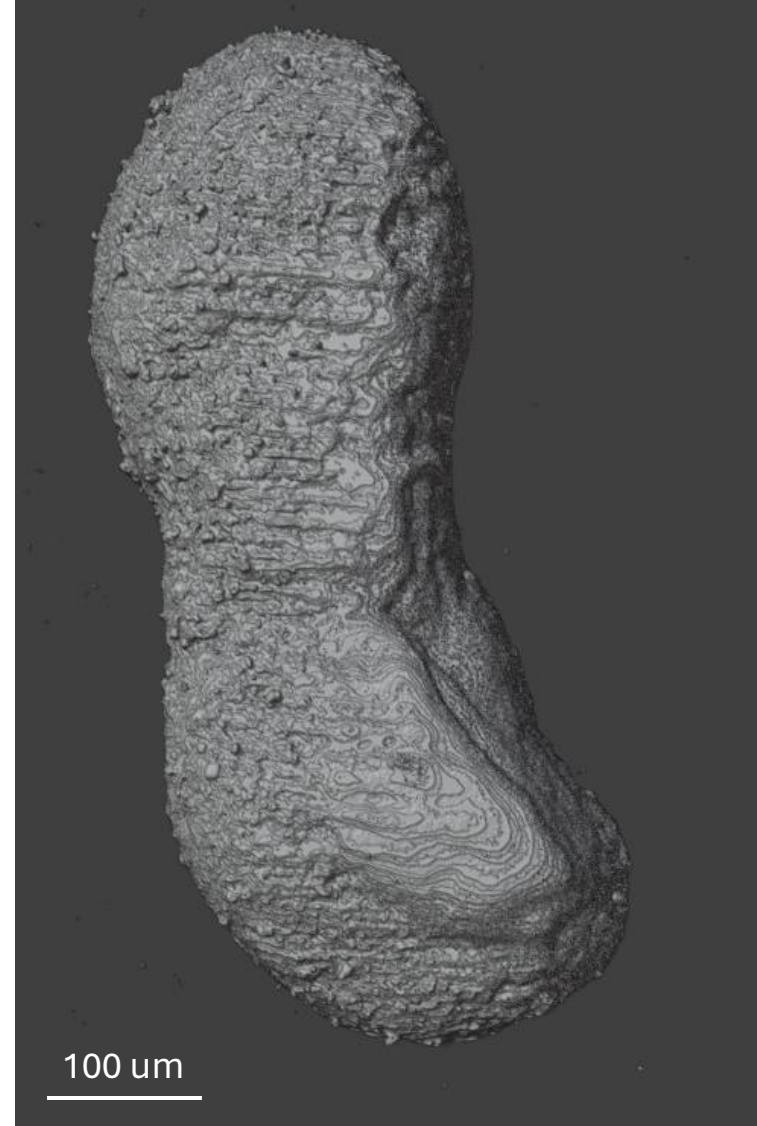
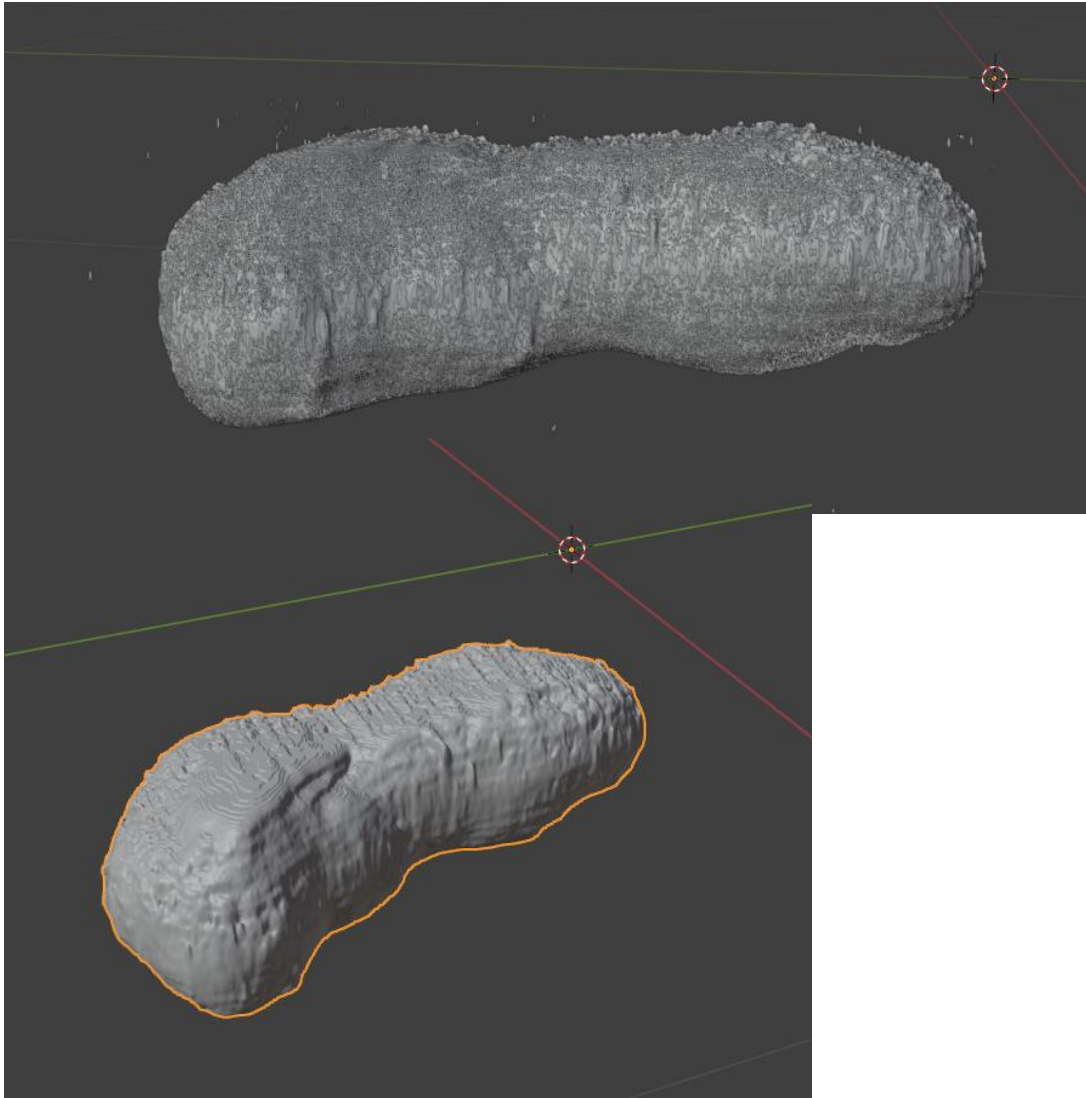


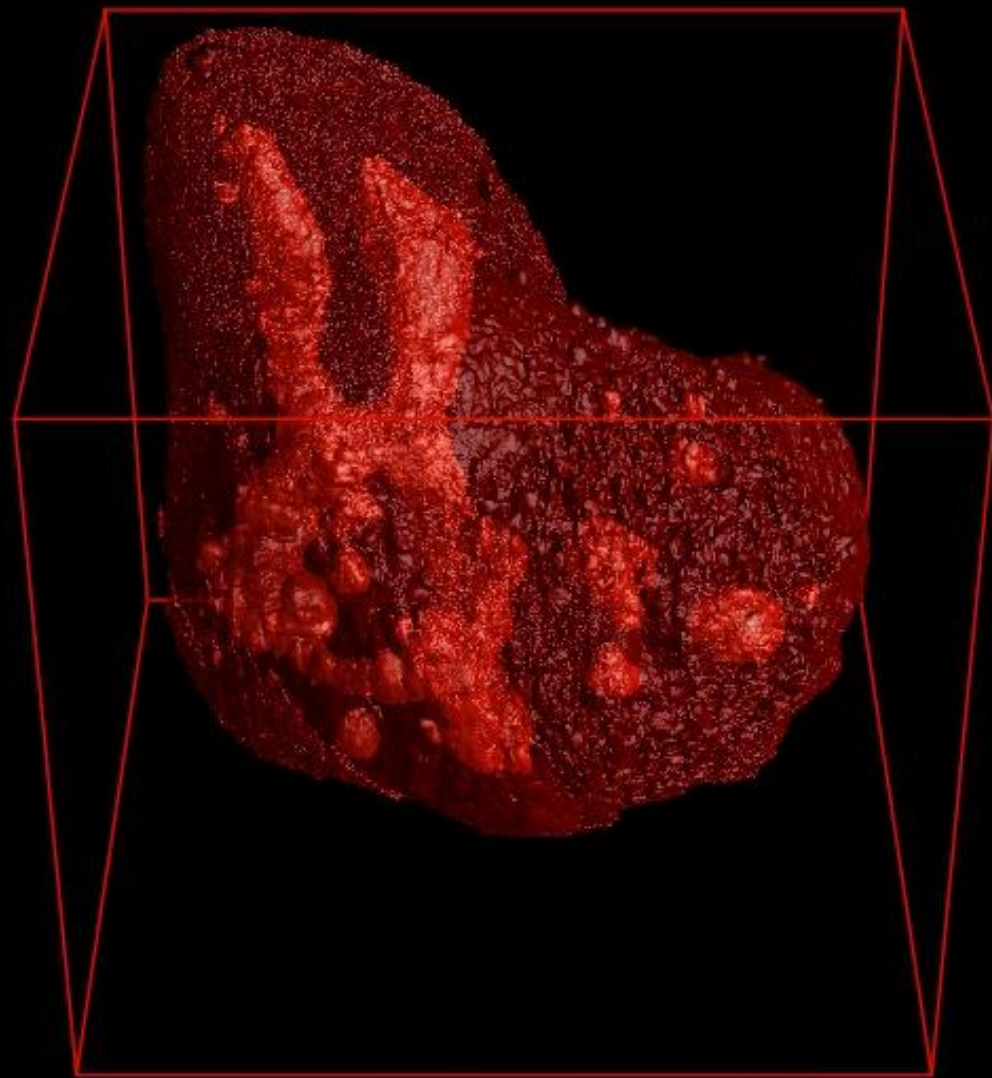


3d reconstruction
of gastruloid from
a stack of images

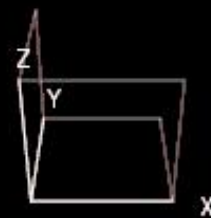


Binarize (segment) images to quantify gastruloid shape



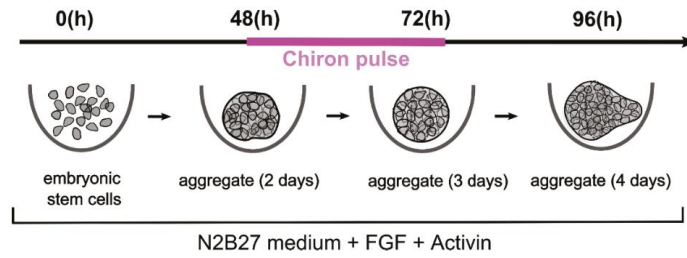


500.00 μm

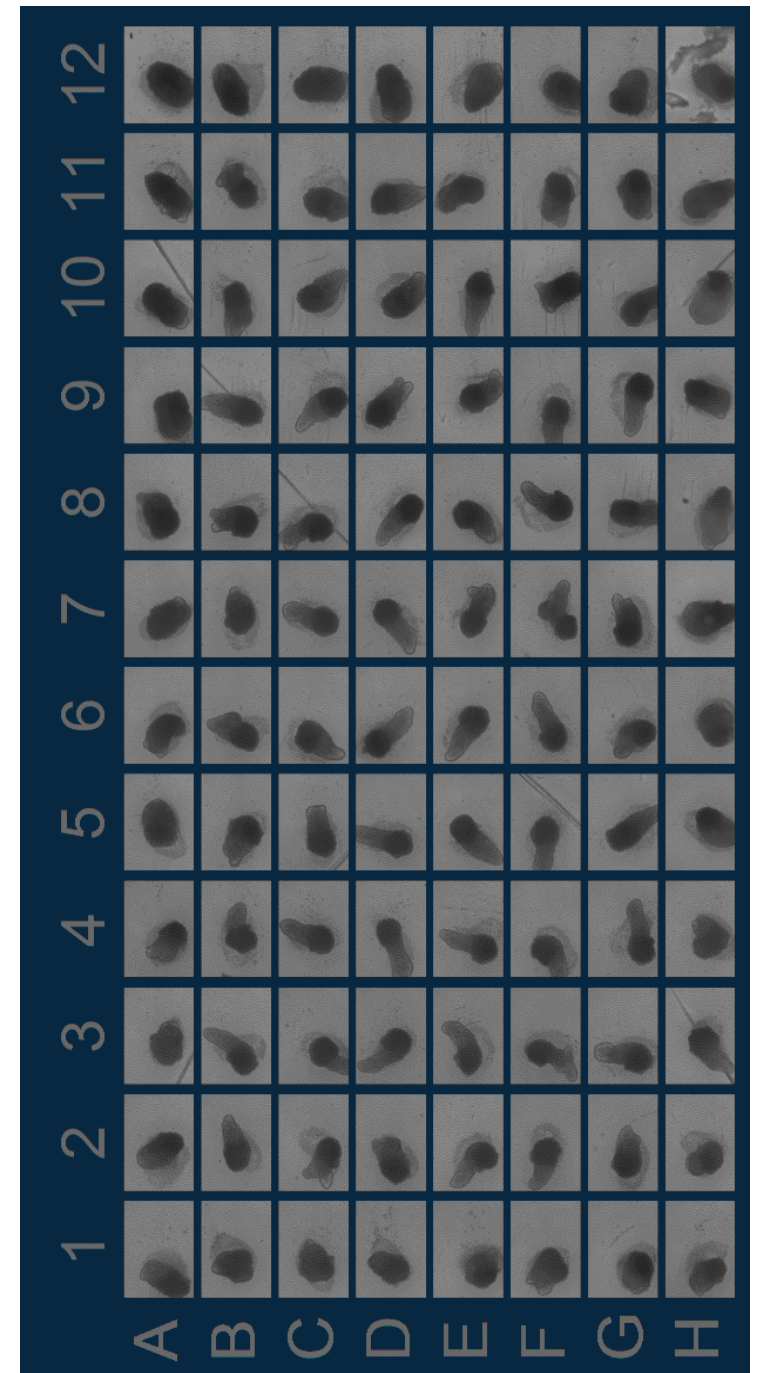


Tasks

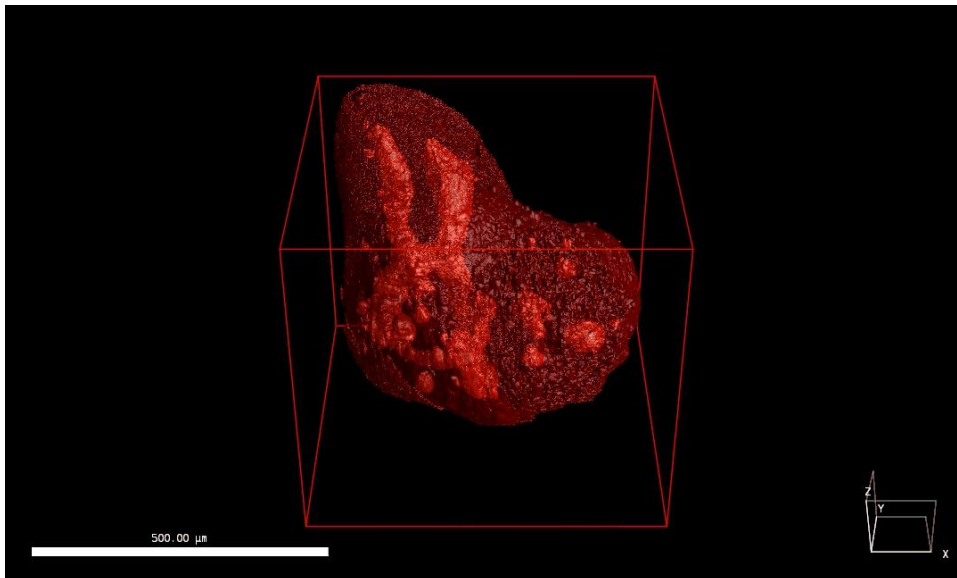
- Task 0: Quantify the 3D shape of gastruloids. Compare with 2D.



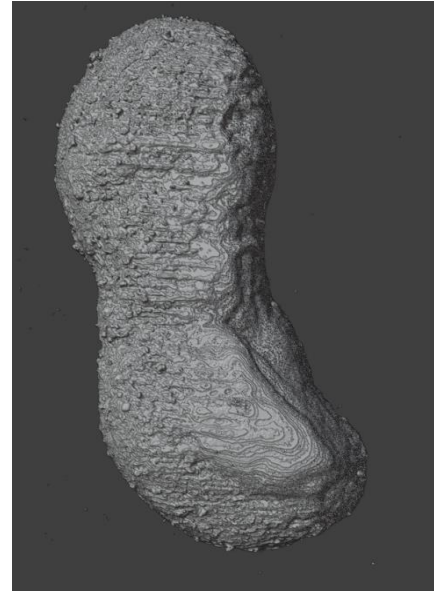
2D



3D

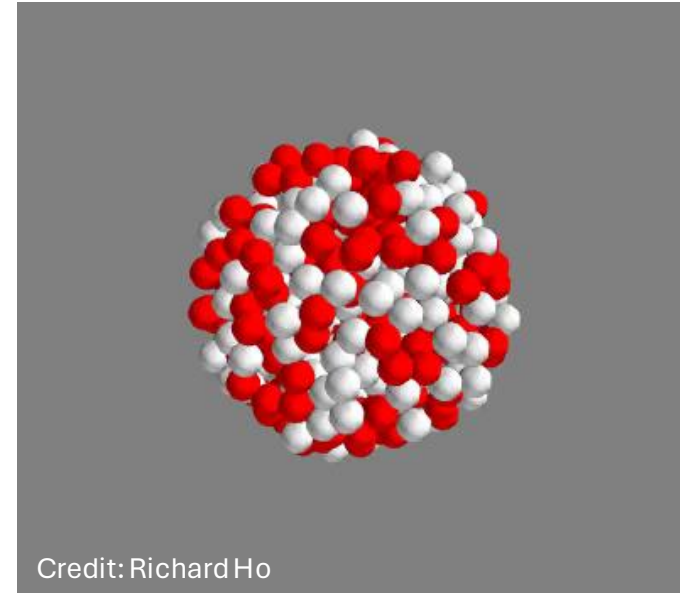


3D



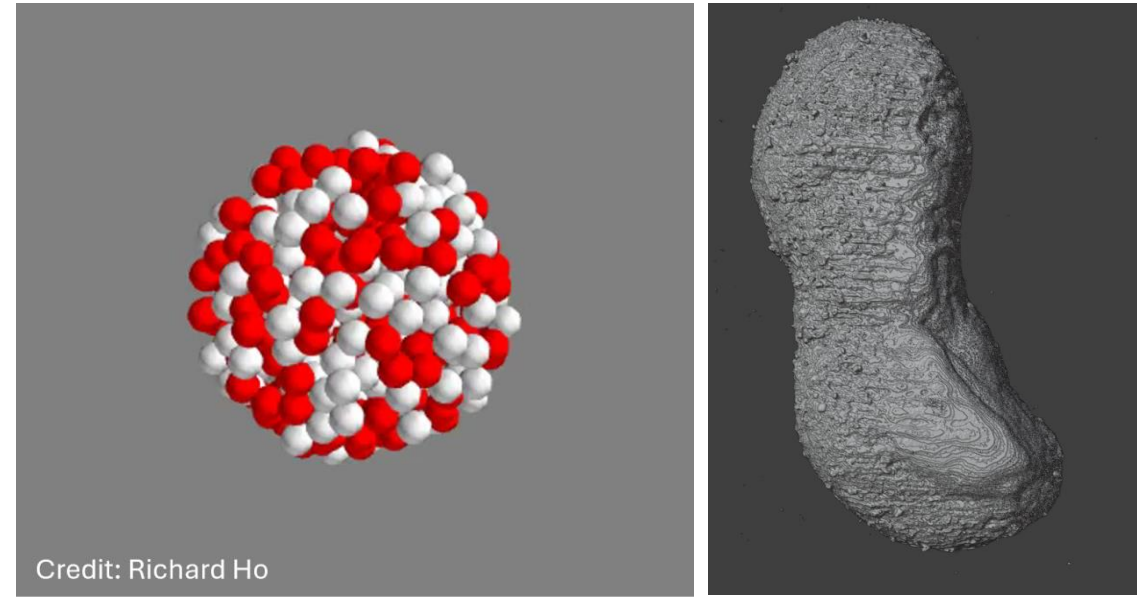
Tasks

- Task 1: Benchmark simulations of developing gastruloids (fixed).



Tasks

- Task 1: Benchmark simulations of developing gastruloids (fixed).
- **Task 2: Measure morphogenesis experimentally (live)**
 - How does cell flow shape the gastruloid?
 - What's the relative importance of directed cell division?



Acknowledgements



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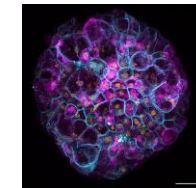
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Still curious? Joachim Mossige: joachim.mossige@imv.uio.no