

1. *Labyrinthula* Infects Seagrass

- Seagrass is a highly important for the health of coastlines
- *Labyrinthula zosterae* kills seagrass and was responsible for decline in the 1930s [1]
- *Labyrinthula*'s network structure is variable and responds to the environment [2]



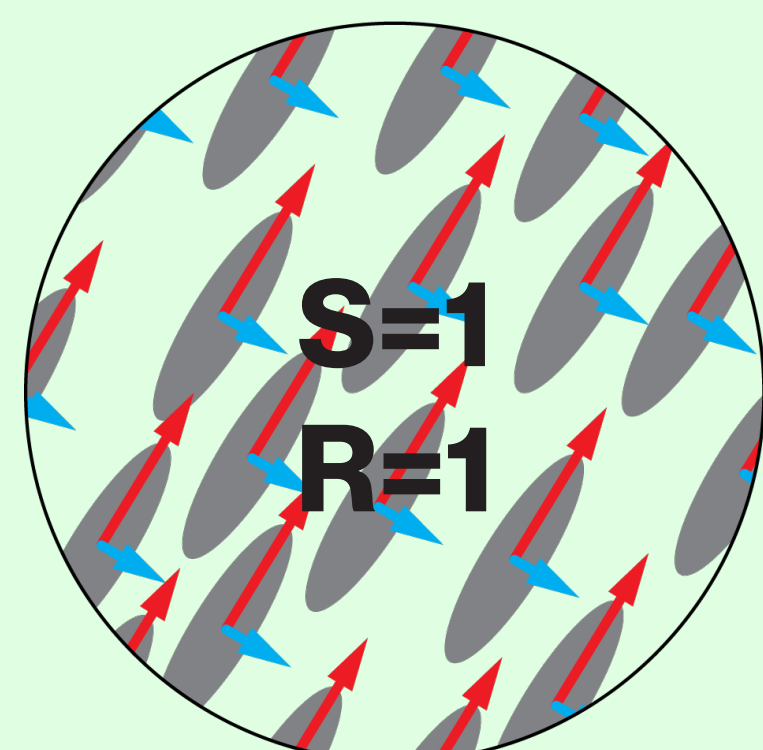
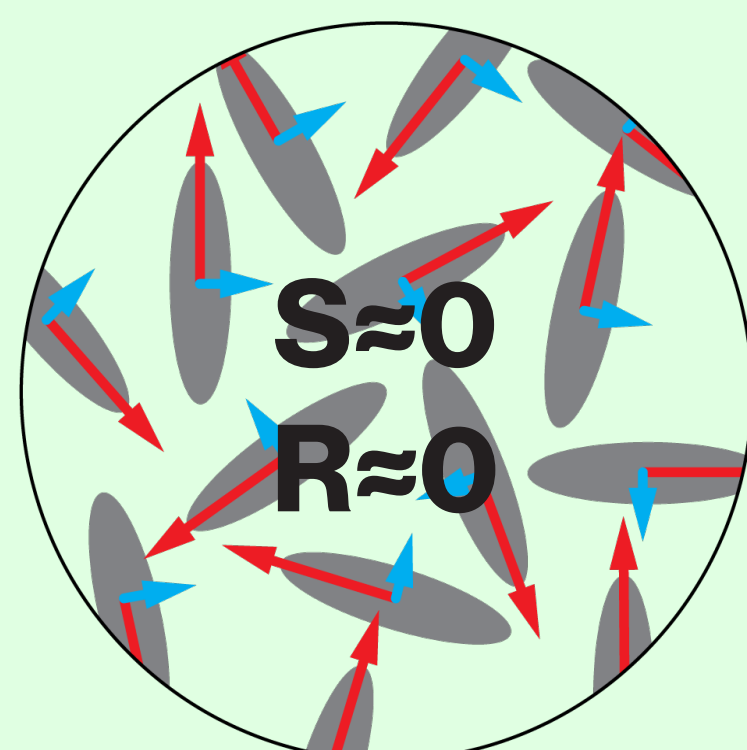
2. Nematic Order to Reveal Structure

- Nematic ordering from soft matter physics quantifies alignment in a system using vectors to form the Q-tensor

$$Q = S \left(\mathbf{n} \otimes \mathbf{n} - \frac{1}{3} \mathbf{I} \right) + R \left(\mathbf{m} \otimes \mathbf{m} - \frac{1}{3} \mathbf{I} \right)$$

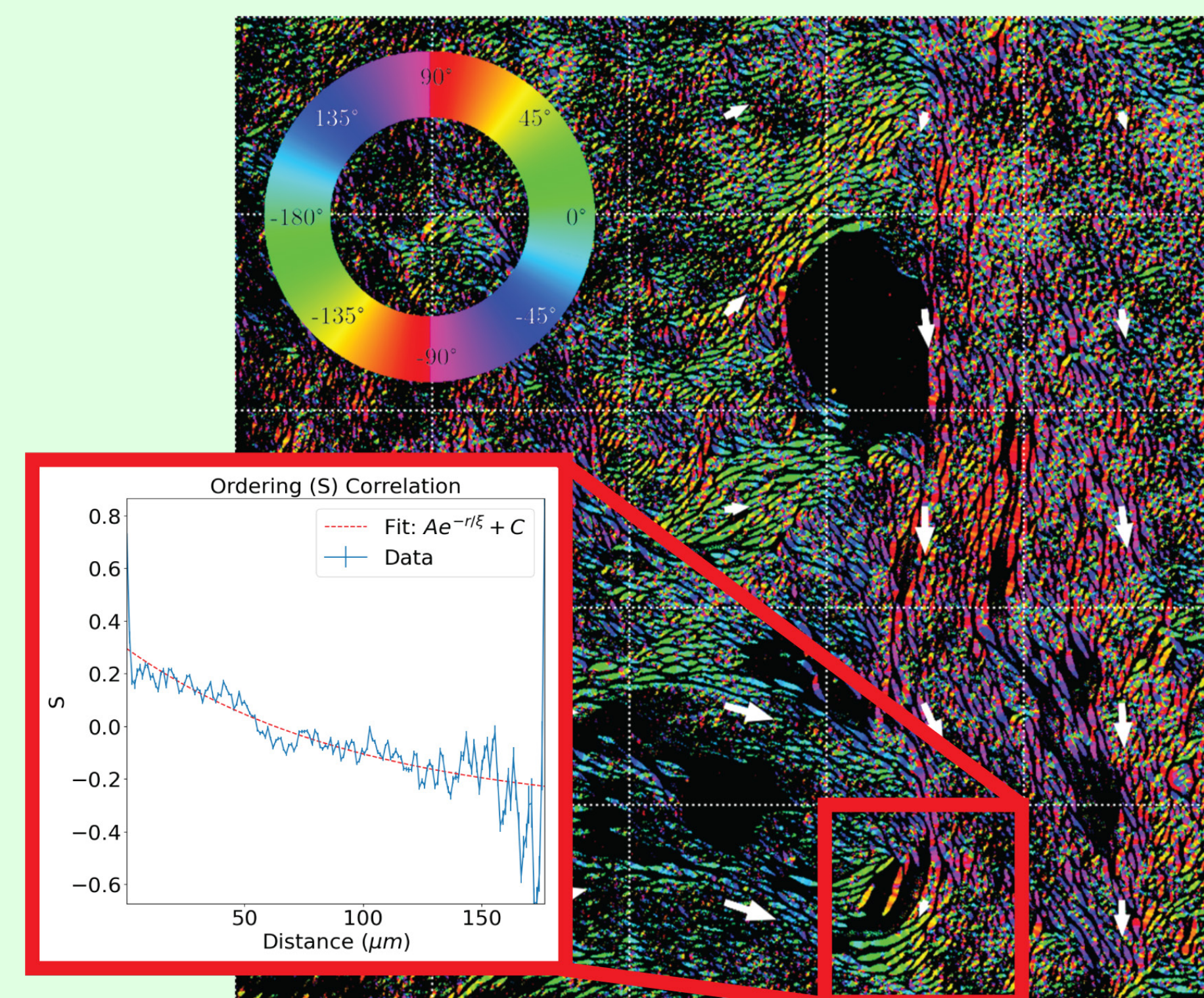
- \mathbf{n} : Long axis vector

- \mathbf{m} : Short axis vector



3. A Tool To Analyse Colony Structure

- Extracting cell alignment is non-trivial, therefore software has been developed to apply:
- **Image moments** to extract angular information from microscope images
- **Q-Tensor calculations** to describe the orientation and alignment of specified regions



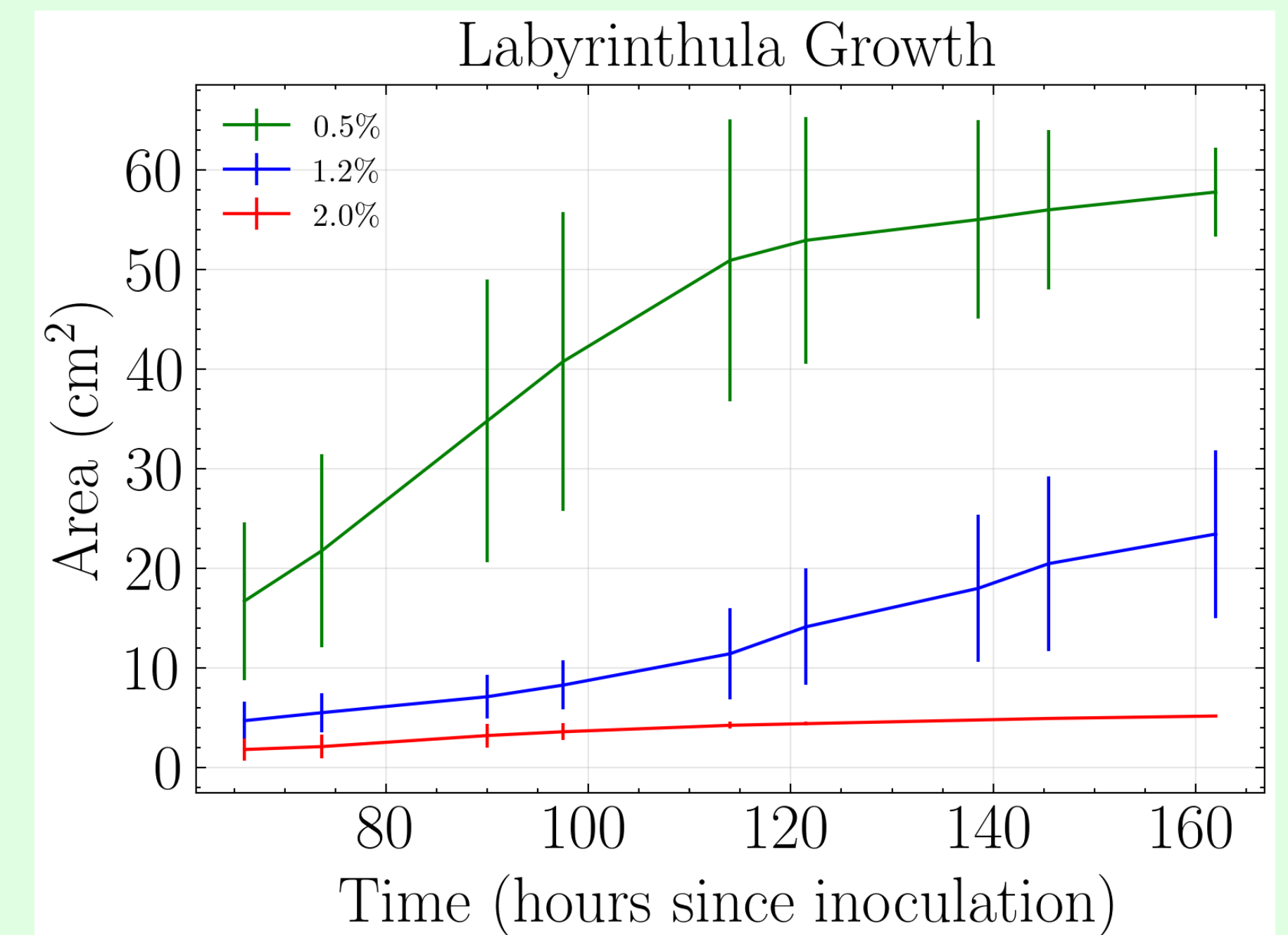
4. Empowering The User

A user can:

- Load an image in
- Process angles, get a colour map to display local cell alignment (white arrows)
- **Click on any region** to get a correlation-distance function, revealing an exponentially fitted ordering decay

5. Understanding Changing Conditions

- Agar concentration impacts growth



- Agar stiffness impacts moisture of growth conditions
- The new tool can be used to systematically characterise spatial alignment of *Labyrinthula* in different agar concentrations across large length-scales
- **We hypothesise that *Labyrinthula* exhibits nematic order that varies with agar stiffness**
- **The tool also allows for on-the-fly analysis of other biological systems**

References

- [1] C den Hartog et al. (1994) The dieback of *Zostera marina* in the 1930's in the Wadden Sea; an eye-witness account by A. van der Werff. *Netherlands Journal of Aquatic Ecology* **28**, 51-54
- [2] J Knight et al. (2025). Environmental dependence of colony morphologies in *Labyrinthula* species. University of Edinburgh. [Preprint]