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Quantifying the motility of *Vibrio alginolyticus* after simulated microgravity using digital holographic analysis

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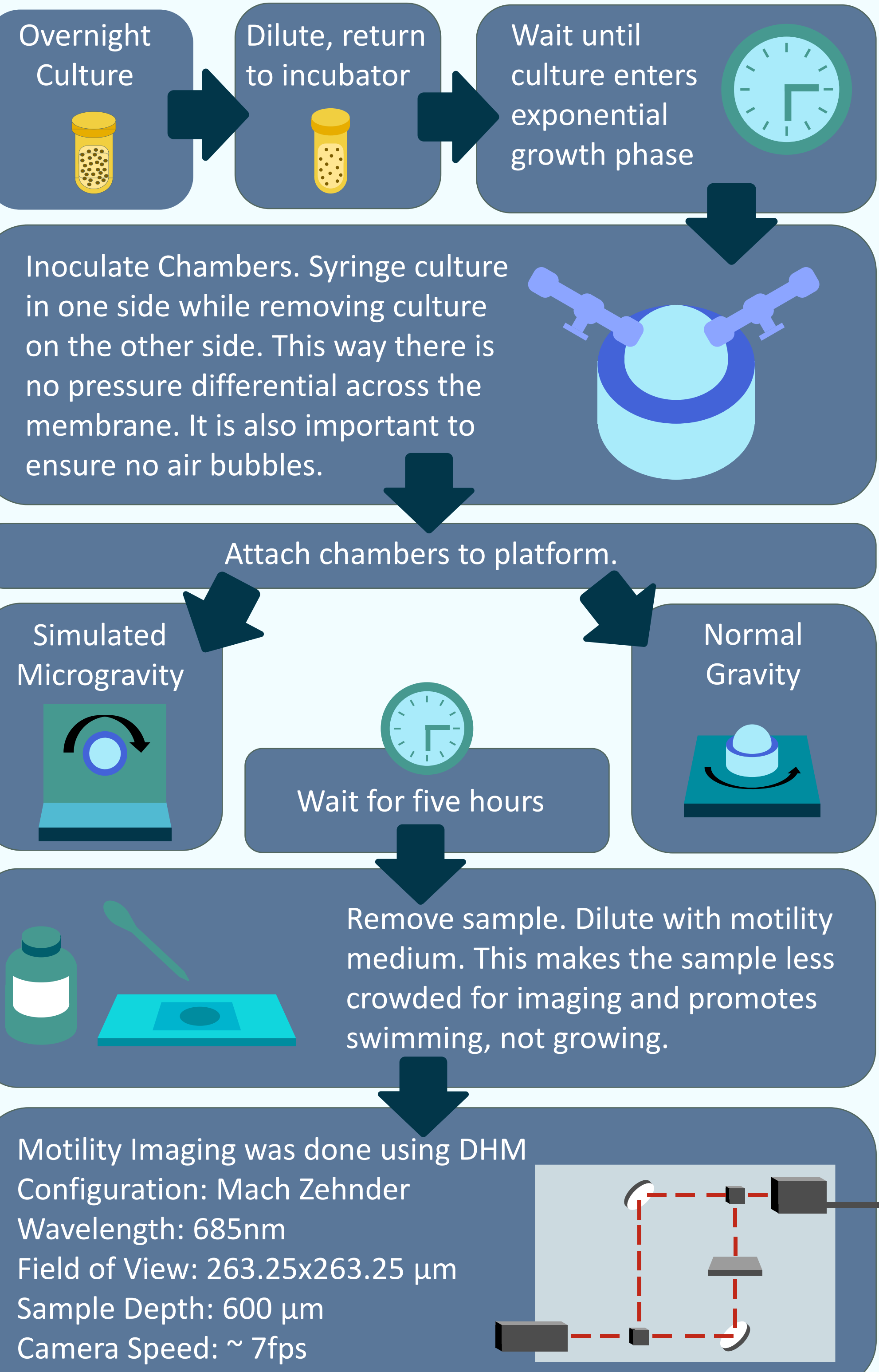
Quantifying motility of *Vibrio alginolyticus* after simulated microgravity using digital holographic microscopy

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Introduction

- Microgravity is the environment on the space station.
- It's very difficult to conduct experiments on the space station, so we simulate microgravity on Earth using special devices. The ones used in this study were high aspect ratio vessels, a type of rotating wall vessel.
- Simulated microgravity mimics specific conditions:
 - Low fluid shear
 - Lack of sedimentation
- Motility gene expression after microgravity and simulated microgravity isn't consistent between spaceflight and simulated microgravity devices. To better understand this, a good first step is to quantify motility phenotypes.
- Digital holographic microscopy (DHM) is a non-invasive technique that allows us to image microbes in a 3D environment over time.

Methods

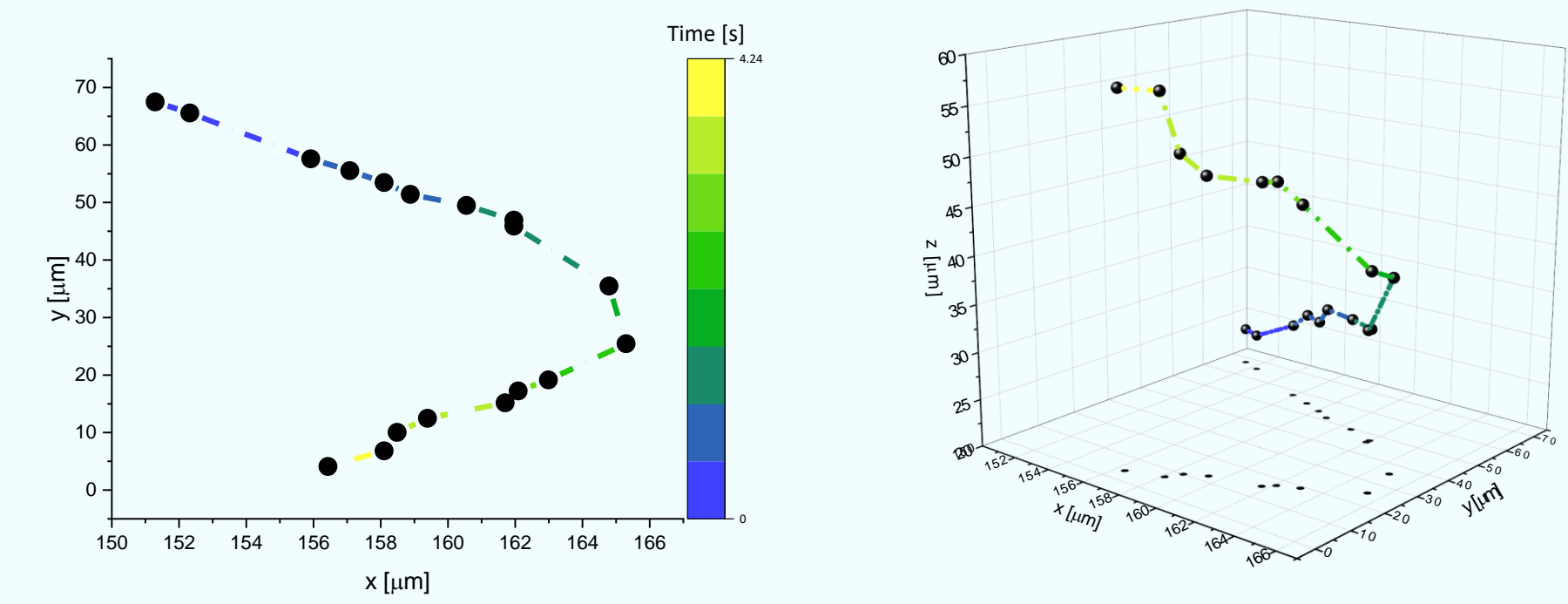


Reconstruct holograms. Concatenate z-planes into a hyperstack to scroll through time and z. Tracking was done manually. There is currently no high-throughput method to process DHM data.

How fast these bacteria move does NOT change after putting them in a weightless environment on Earth

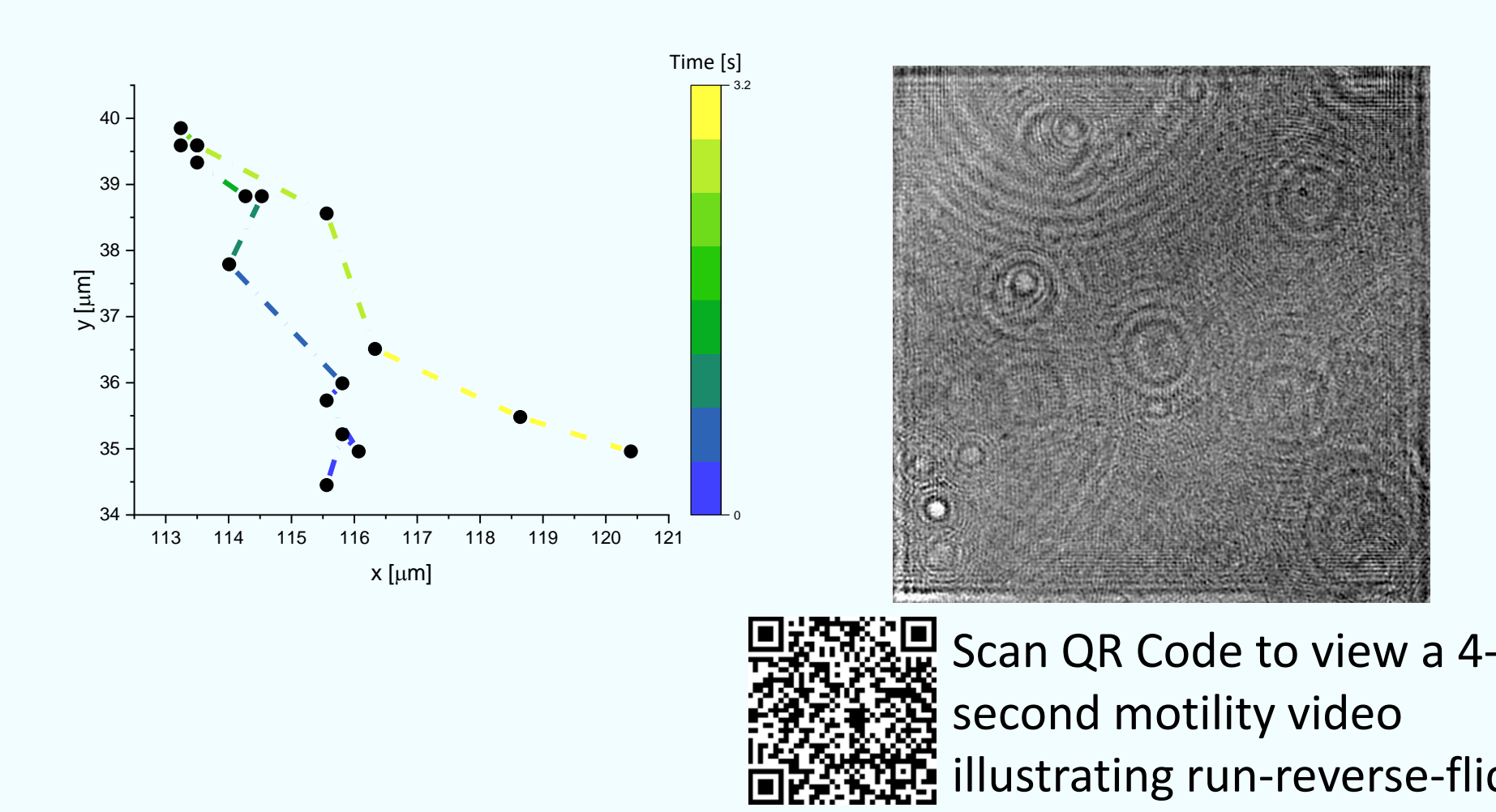
Results / Analysis

1. Comparison between 2D and 3D traces of a microbe after normal gravity:

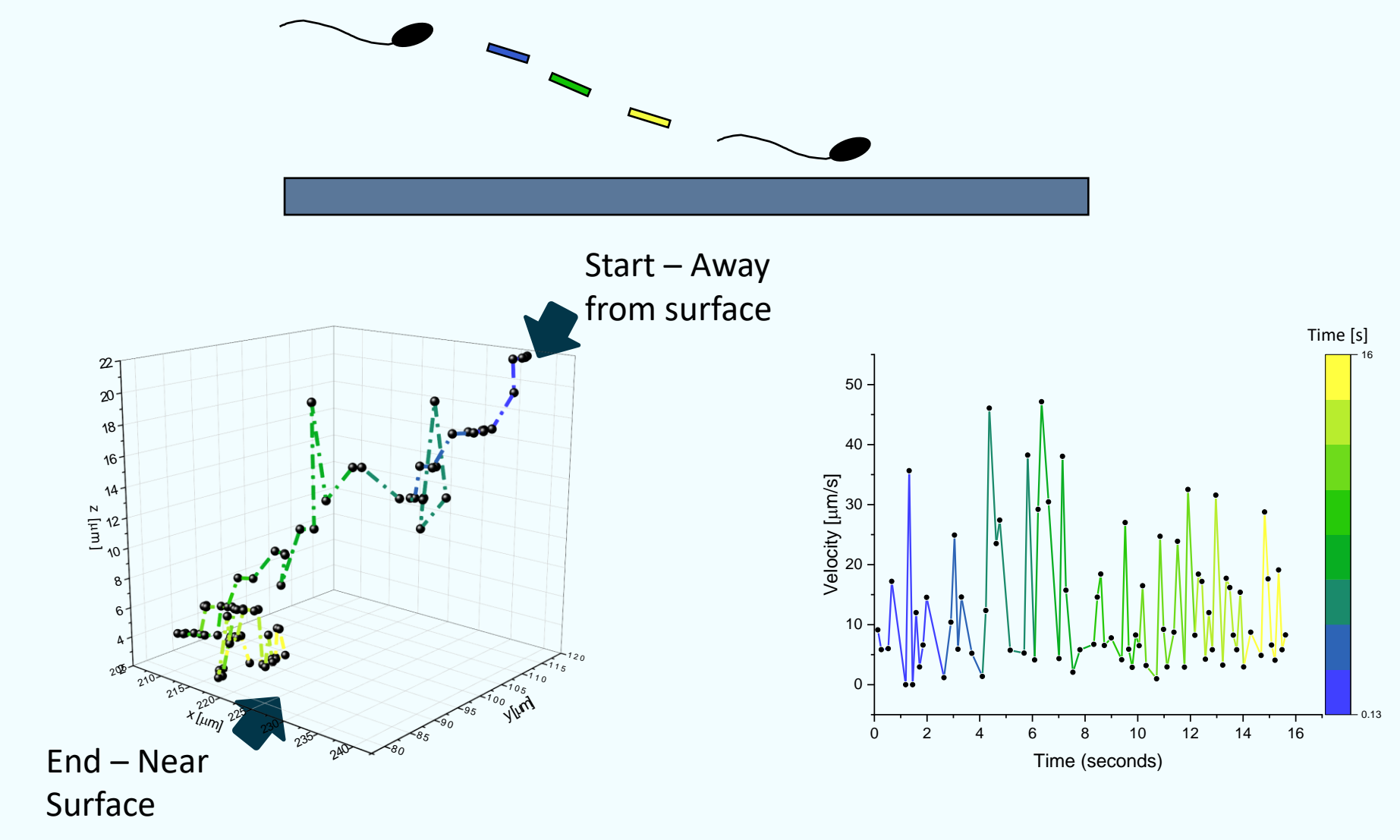


• 2D Traces can be misleading over organism movement. A 3D trace shows a clearer picture.

2. Run-reverse-flick motility of *Vibrio alginolyticus* observed via DHM

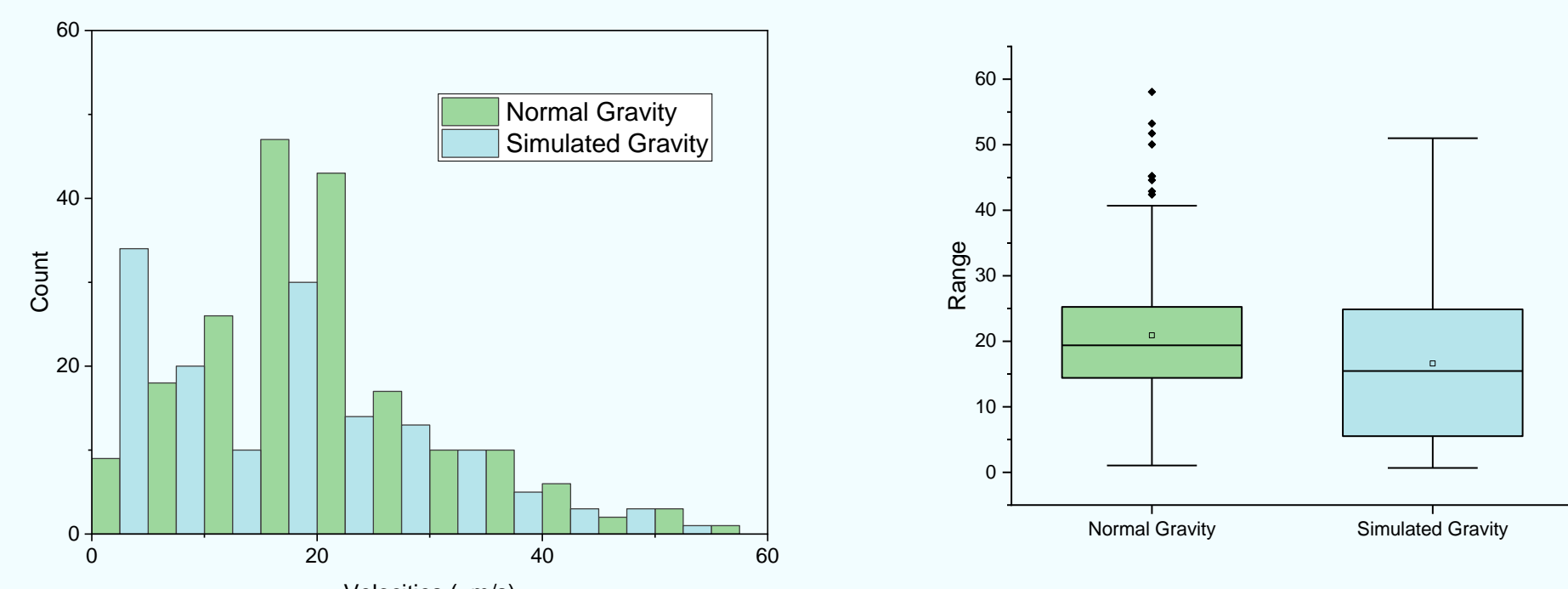


3. Impact of swimming speed a surface



• Swimming speed transitions to lower speeds when swimming next to the surface.

4. Comparison of swimming speeds between normal gravity with rotation and simulated microgravity



• Within error margins, these plots indicate little difference in swimming speeds between normal gravity and simulated microgravity

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