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Computational Simulations of Cell Diffusion in Matrix Environments

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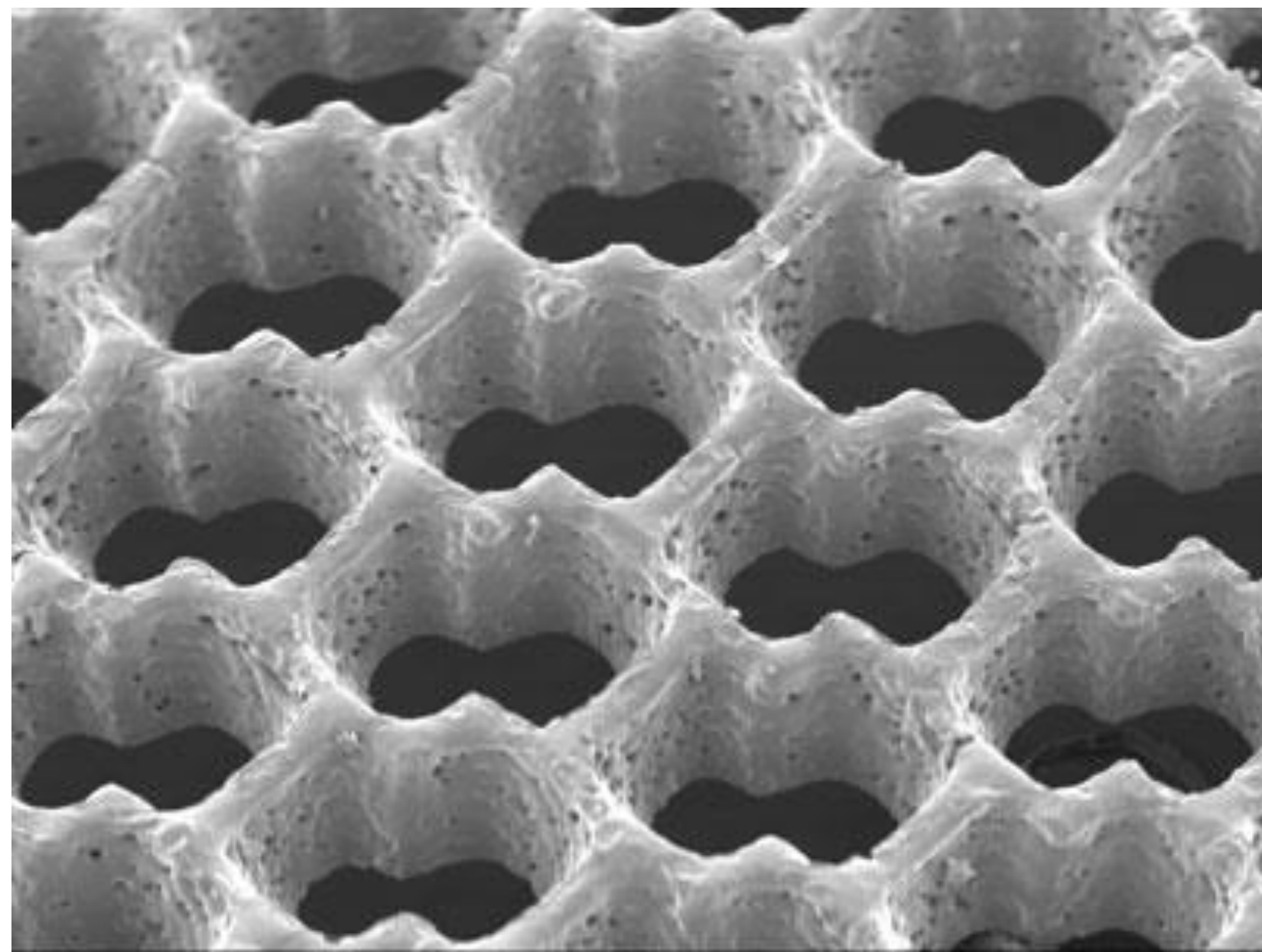
Recommended Citation

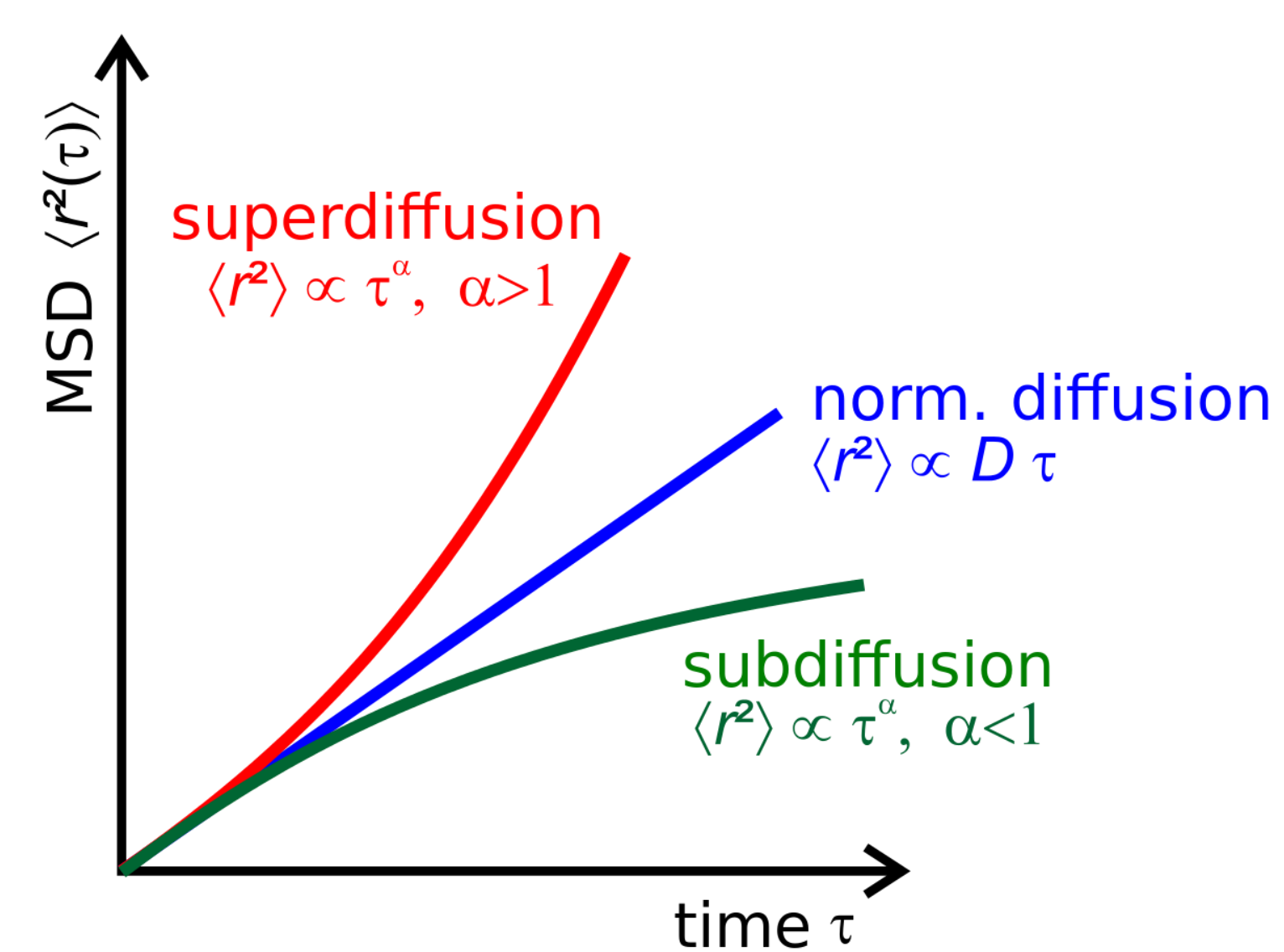# Computational Simulations of Cell Diffusion in Matrix Environments

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BACKGROUND

Tissue Scaffolds

Mean-squared displacement (MSD): an average measurement of the distance a cell travels throughout the scaffold.

$$\text{MSD } \langle r^2(\tau)\rangle$$

superdiffusion
$\langle r^2 \rangle \propto \tau^{\alpha}, \ \alpha > 1$

norm. diffusion
$\langle r^2 \rangle \propto D\tau$

subdiffusion
$\langle r^2 \rangle \propto \tau^{\alpha}, \ \alpha < 1$

time τ

HYPOTHESIS

We hypothesize that cell diffusion will be confined when in a high local fiber fraction.

RESULTS
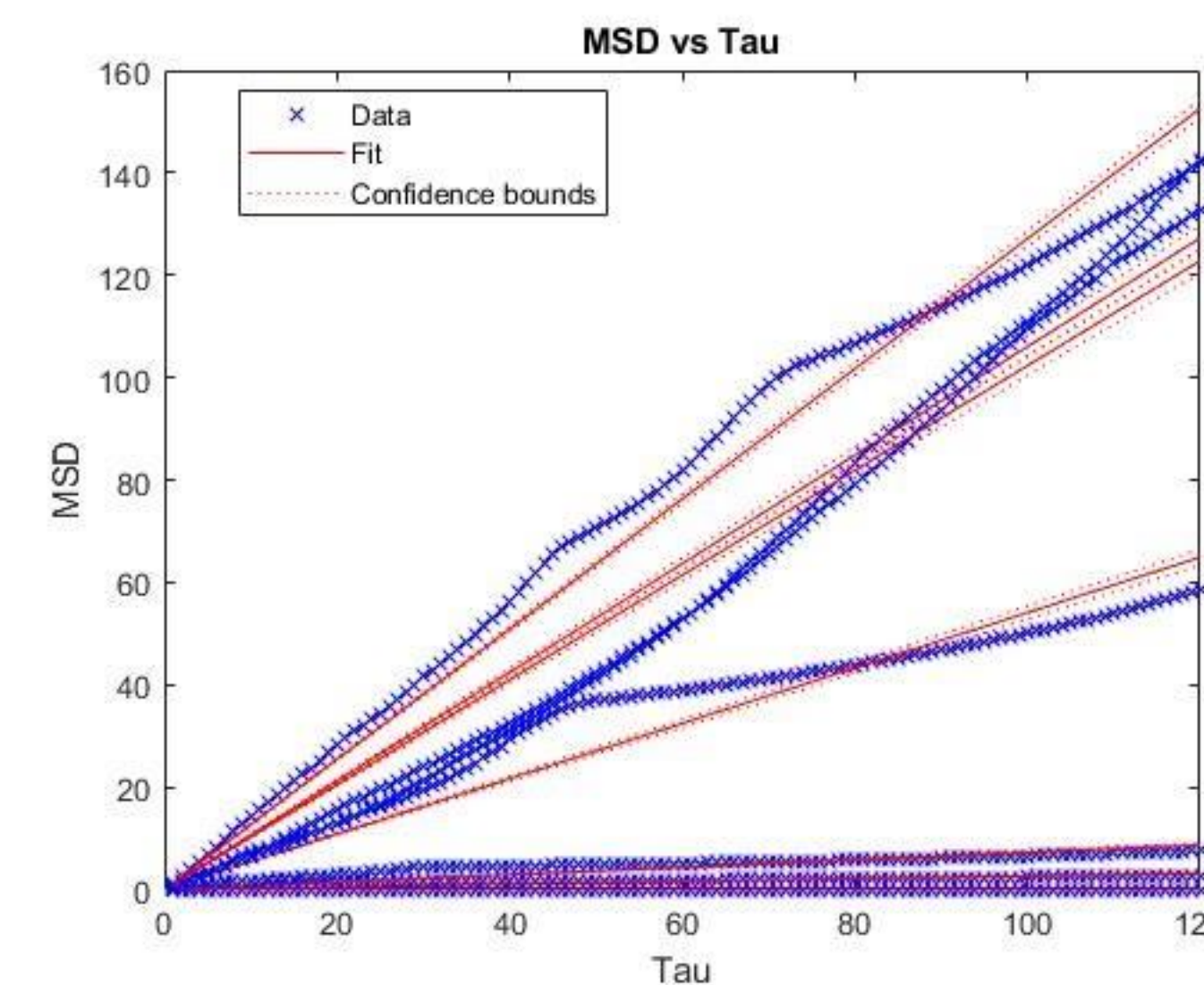
Figure 1: simulation of 15 cells diffusing throughout a 3D matrix environment for five days.

Figure 2: Comparing MSD and fiber fraction versus time for a cell that did not diffuse.

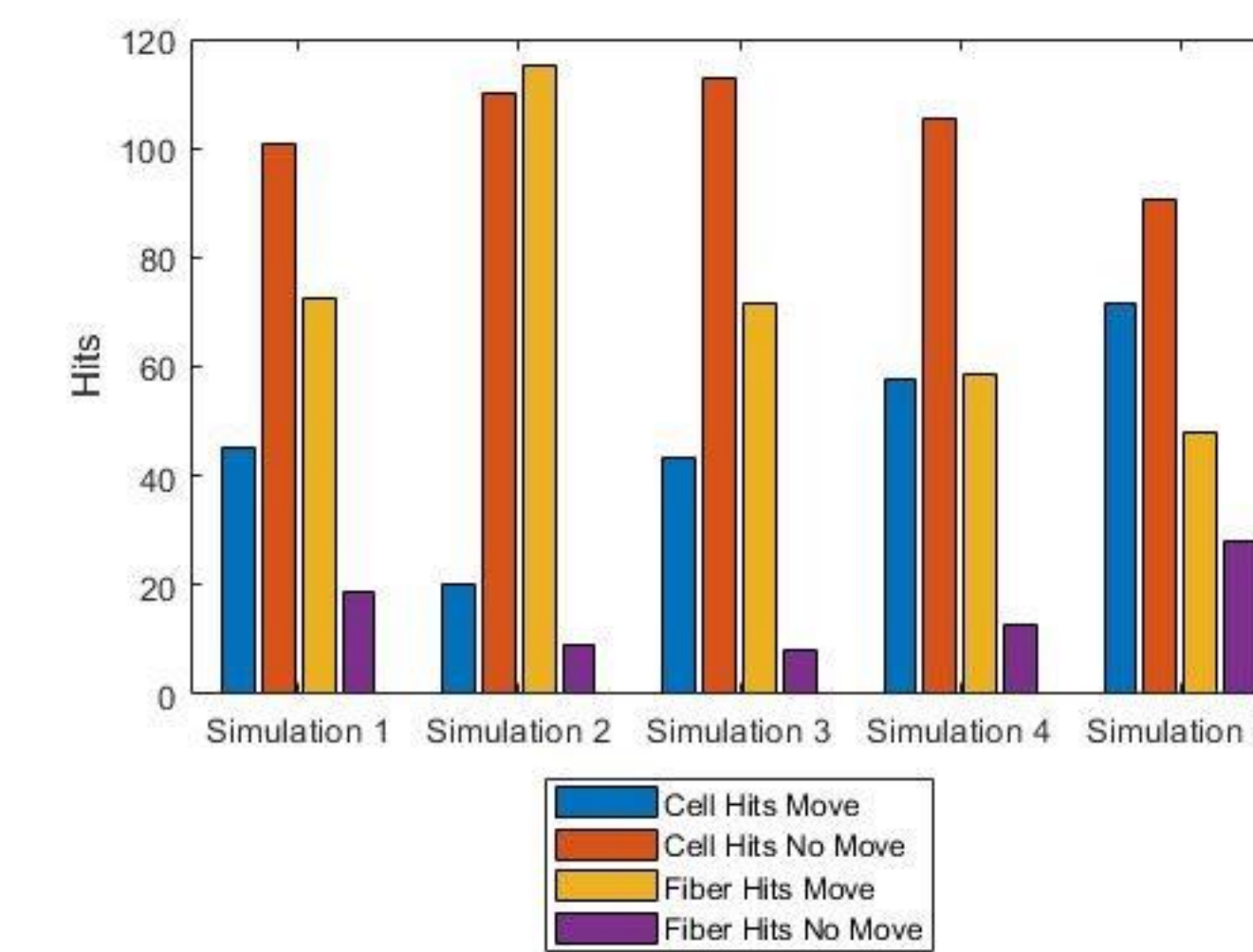Figure 3: Comparing MSD and fiber fraction versus time for cell that experienced confinement.

Figure 4: histogram showing five simulations that count the number of cell and fiber hits for cells that move and do not move.
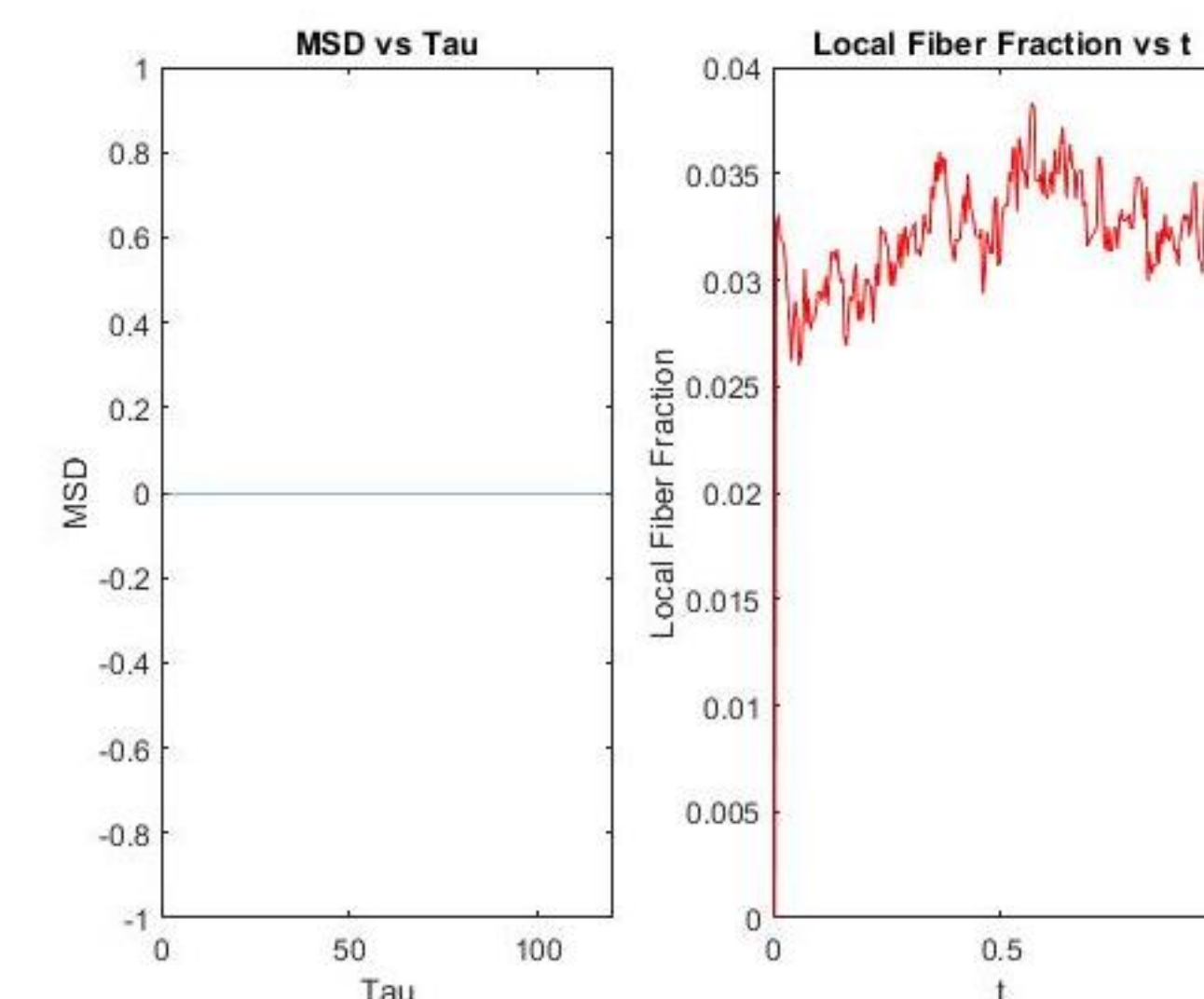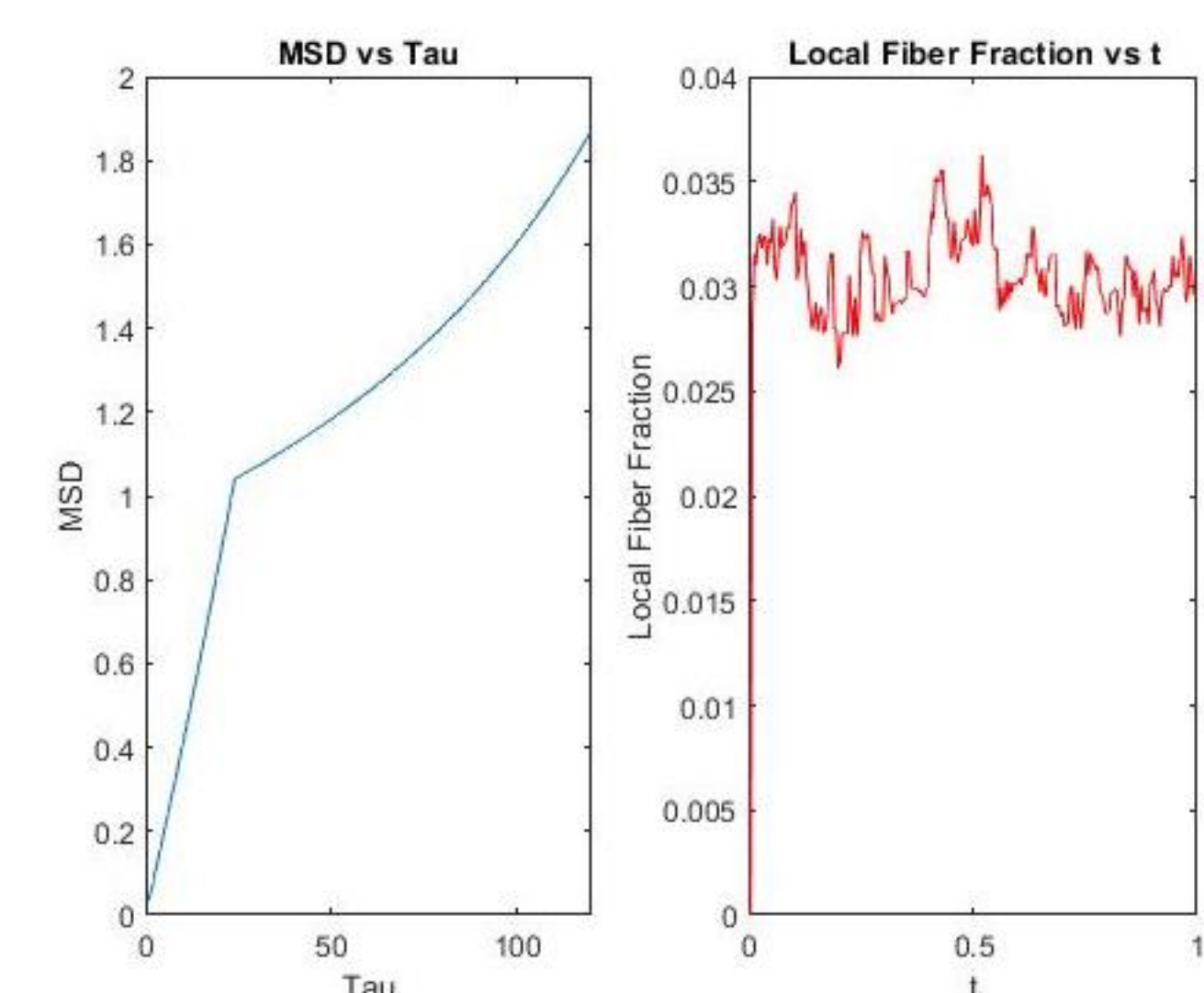
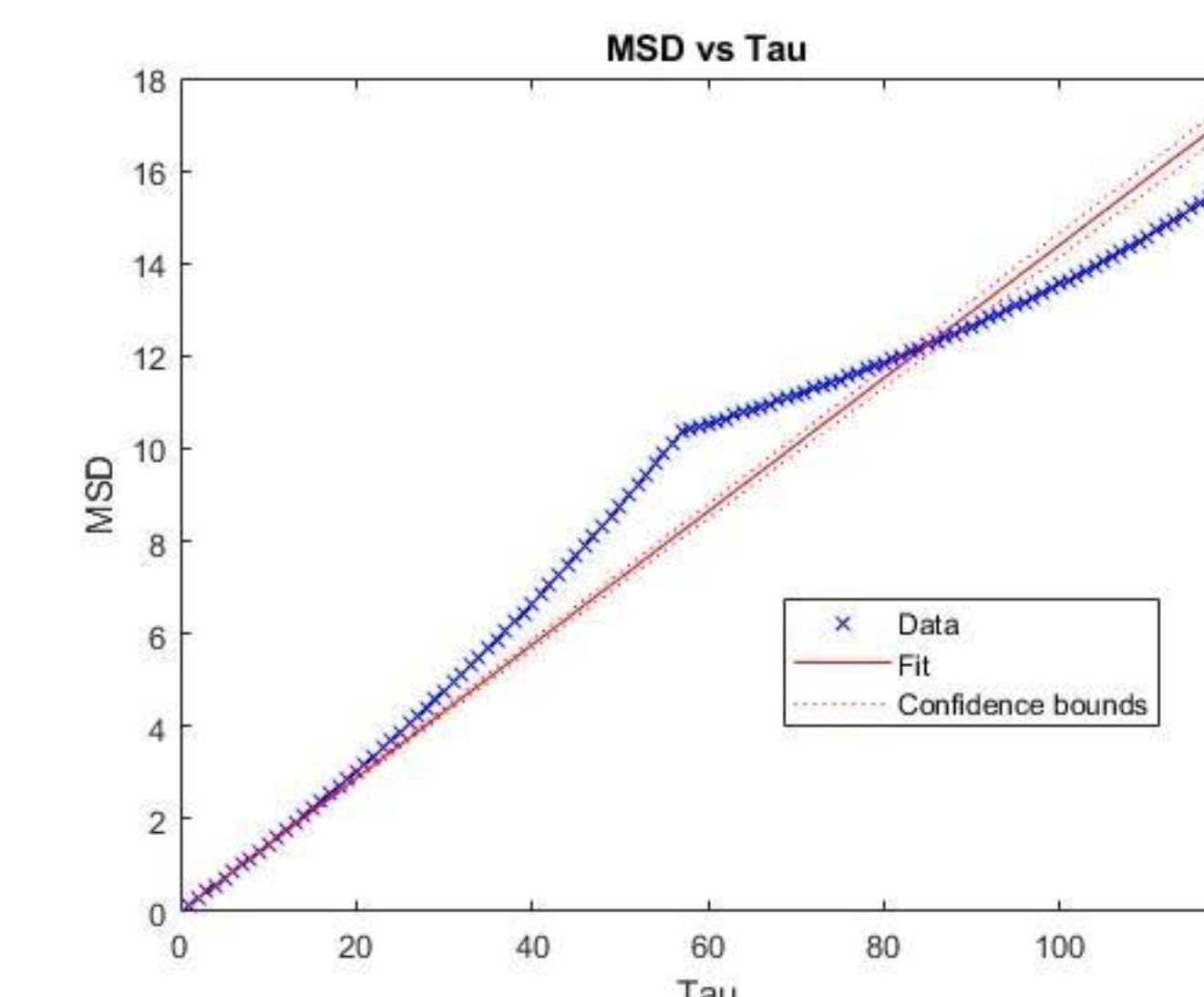Figure 5: Comparing MSD versus time for a single cell.

Figure 6: Comparing MSD versus time for a single cell using the updated code.

FUTURE WORK

Literature review

Adjust parameters

Rerun simulations based off new parameters

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