

# Overview and Motivation

## The Plant Cell Cortical Microtubule Array (CMA) DGG

- We had three scenarios:
  - In scenario 1 we found long-time network like behavior.
  - In scenario 2 we found long-time behavior of local alignment.
  - In scenario 3 we found evidence indicating the approximate algorithm is faster than the exact, even in serial.

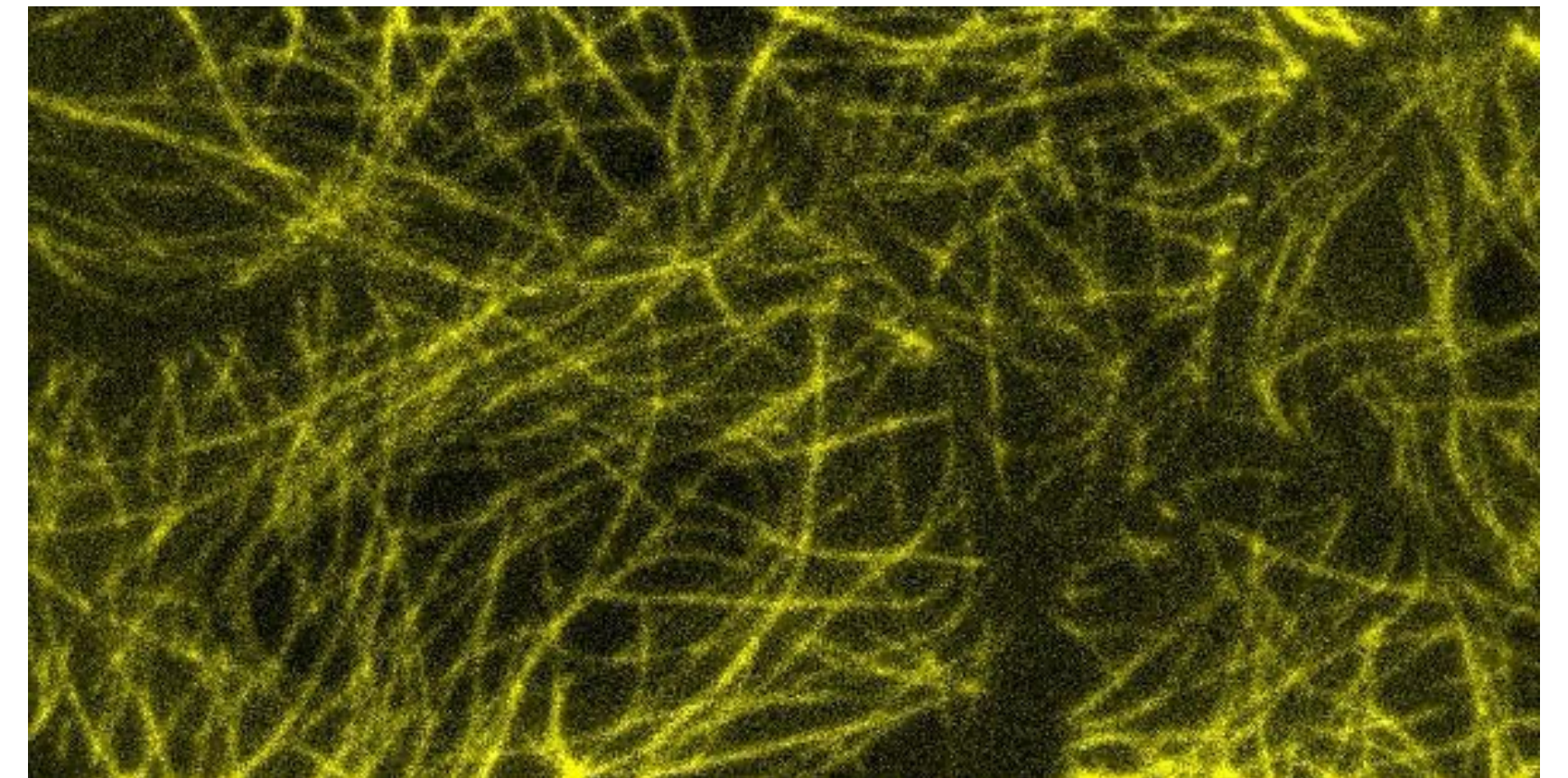


Figure 30: Cortical microtubules in Arabidopsis petiole cells<sup>1</sup>.

1. (Mjolsness and Wightman) unpublished image data

2. (Medwedeff and Mjolsness, 2023); 3. (Tindemans et al., 2010)



# Dynamical Graph Grammar for the Cortical Microtubule Array (CMA)

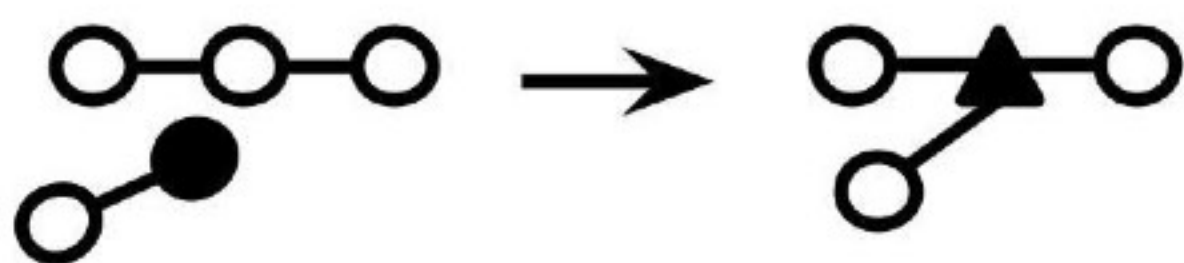
R1: Elongation by polymerization ODE



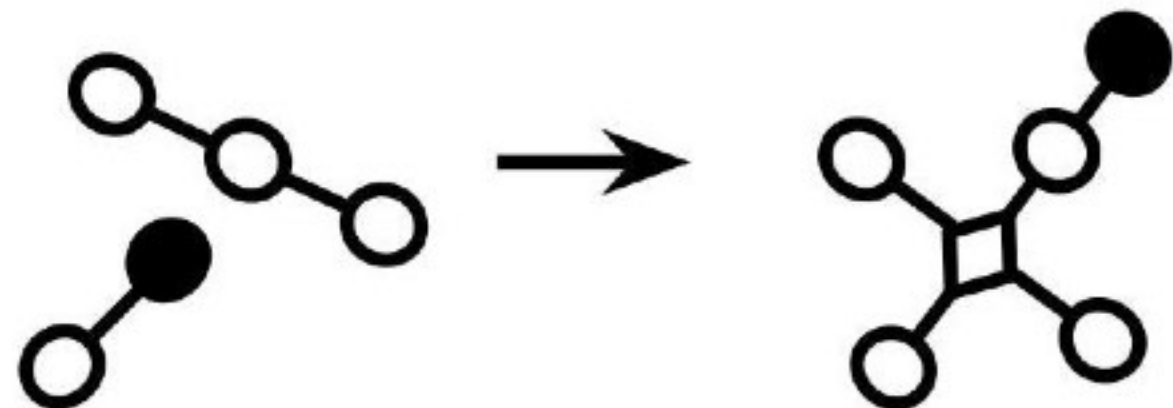
R2: MT elongation event



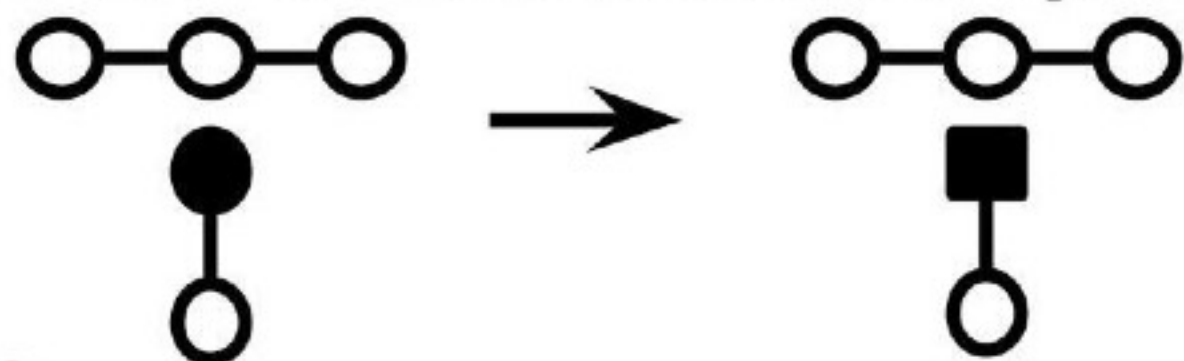
R3: MT zippering event



R4: MT crossover event



R5: MT collision catastrophe



R6: Retraction by depolymerization ODE



R7: MT retraction event



R8: State change, destabilization/rescue events



● : polymerizing (growing) end

○ : intermediate tubulin segment

■ : depolymerizing (retracting) end

▲ : zippering location

◊ : crossover location (junction)