Motivation

- **Tools and algorithms**:
  - Other work exists, ***Plenum***[1]:
    - Mathematica, expressive, slow.
    - Only exact algorithm.
    - No native graph data structures.
  - The improvement: ***DGGML*** (C++17 library)
    - Uses faster approximate algorithm.
    - Native graph support.
    - Trades expressiveness for speed and future scalability.
    - Currently only for spatially local graphs.

- **Modeling**:
    - Two plant cell cortical microtubule array (CMA) models developed, but why?
        - Outstanding questions for CMA[2]
            - What general principles govern the organization of cortical microtubules into functional patterns?
- To demonstrate we use can use DGGML screen and compare hypotheses.
- Testing the approximate algorithm.
- Testing DGGML, and understanding points of improvement.

1. (Yosiphon, 2009); 2. (Elliot and Shaw, 2017)

Simulation and Modeling of Complex Systems

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Goals

What to take away from this presentation.

- What Dynamical Graph Grammars (**DGGs**) are.
- The language of DGGs.
- The exact and approximate algorithms.
- The Dynamical Graph Grammar Modeling Library (**DGGML**) and it's contribution.
- A better understanding of DGGs through the two plant cell cortical microtubule array (**CMA**) examples.
  - Interesting results we found.
- The future path forward!