

# PHYSICAL MATHEMATICS SEMINAR

## Mechanistic Basis of Spindle Size Control and Scaling

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### ABSTRACT:

The size and morphology of intracellular structures such as the nucleus, Golgi apparatus, and mitotic spindle dramatically vary between different cell types, yet the mechanisms that regulate the size of these structures are not understood. Interestingly, the size of most intracellular structures scales with cell size, i.e., larger cells tend to have a larger nucleus and spindle. So far, many models have been proposed to explain such scaling behavior, but rigorous testing of these models inside the cells is challenging, and often not feasible. To overcome this challenge, we combined the statistical framework of quantitative genetics, with cell biology and biophysics to develop a general methodology to quantitatively examine different models of spindle size control and scaling for the first mitotic spindle in *C. elegans*. We developed a high-throughput microscopy platform to measure the size and dynamics of the spindle for ~200 genotyped recombinant inbred lines, which are created by the random crossing of two genetically distinct *C. elegans* wild isolates. We observed quantitative variations for all attributes of spindle size and dynamics, as well as cell size, across these lines. We used these variations to discriminate between different models of spindle size regulation and scaling, and we proposed a new model based on the effect of cortical forces on spindle elongation. To further examine our model, we used laser ablation technique to selectively cut different populations of microtubules and compared the results with predictions of the model. The combination of quantitative genetics with cell biology and biophysics provides a systematic and unbiased method to study mechanisms that contribute to size regulation of intracellular structure and also will give us a deeper understanding of the evolution of these structures.

**TUESDAY, OCTOBER 16, 2018**

**2:30 pm**

**Building 2, Room 136**

*Reception following in Building 2, Room 290  
(Math Dept. Common Room)*

<http://math.mit.edu/seminars/pms/>