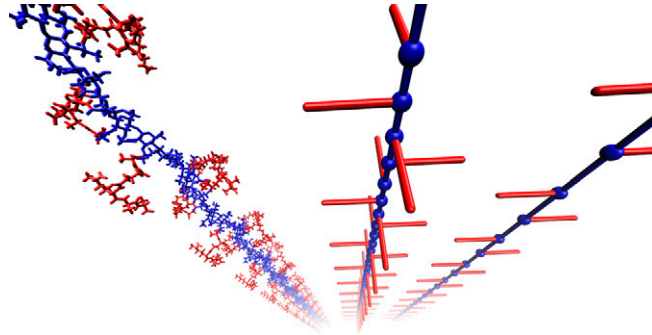


# Supporting Information

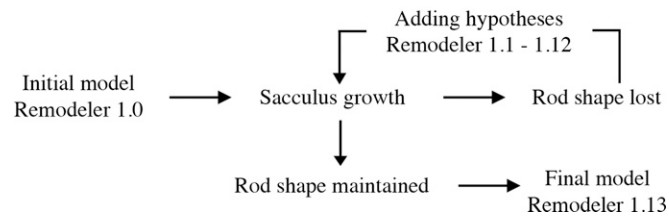
Nguyen et al. 10.1073/pnas.1504281112



**Movie S1.** Model building: how PG is coarse-grained, a start sacculus is created, and enzymes are implemented.

[Movie S1](#)

## EXPLORATION OF MODELS






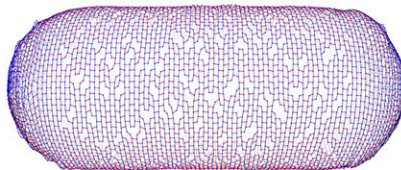
**Movie S2.** Exploration of models from the initial model (Remodeler 1.0) to the final model (Remodeler 1.13).

[Movie S2](#)

## CONCLUSION

Local spatial and temporal coordination of the enzymes could be sufficient to maintain rod shape.

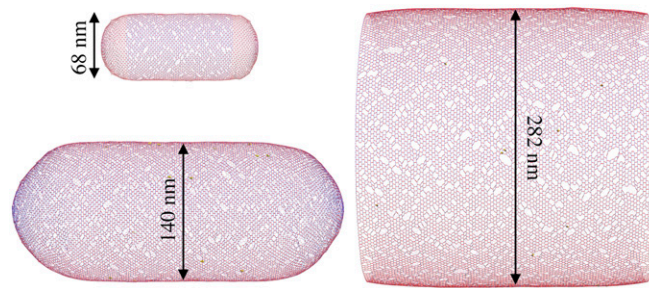
 Transglycosylase     Transpeptidase     Endopeptidase



**Movie S3.** Final model: local spatial and temporal coordination of enzymes could be sufficient to maintain rod shape.

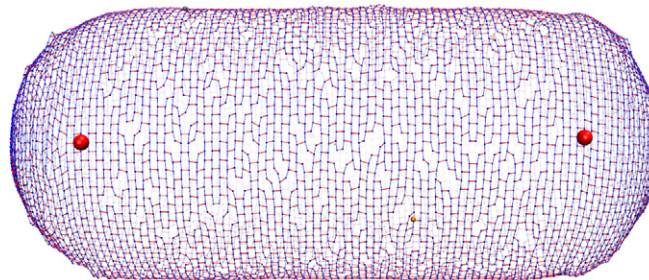
[Movie S3](#)

## Testing the effect of size



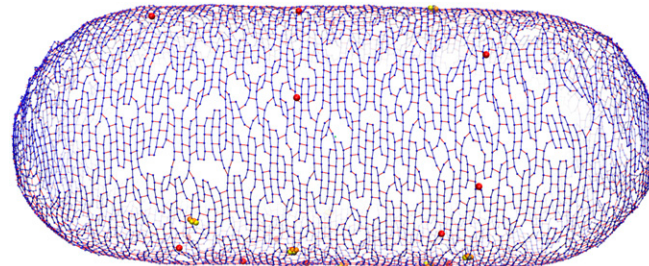
**Movie S4.** Simulations on bigger sacculi suggest that size does not fundamentally alter the basic challenges of maintaining integrity and rod shape during growth.

[Movie S4](#)



**Movie S5.** Effect of the first crosslink always on one side on twisting of the sacculus.

[Movie S5](#)



**Movie S6.** During the review process, we were asked by PNAS to address a recent finding that fluorescently-tagged PBP2 of *Escherichia coli* moves with a diffusive behavior (70). We then ran simulations where PBP2 is uncoupled from the complex and only functions when binding transiently to a complex. Within the parameter space tested, this model fails to maintain rod shape, as big holes form where PBP2 misses its turn.

[Movie S6](#)

## Other Supporting Information Files

[Dataset S1 \(TXT\)](#)

[Dataset S2 \(TXT\)](#)

[Dataset S3 \(TXT\)](#)

[Dataset S4 \(TXT\)](#)

[SI Appendix \(PDF\)](#)