Title: Spatial organization of a ring copolymer confined in a cylindrical space

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Abstract: Confinement can influence qualitatively the spatial organization of polymer chains. Cylindrical confinement is of particular interest since it not only stiffens individual chains but also enhances their segregation. Here we discuss a ring copolymer confined in a closed cylindrical space as a model nucleoid (an intracellular space where the bacterial chromosome is confined). When the cylinder and polymer parameters are chosen properly our model explains quantitatively recent experimental results for the spatial organization of the E. coli chromosome.

Spatial Organization of a ring copolymer co nfined in a cylindrical space

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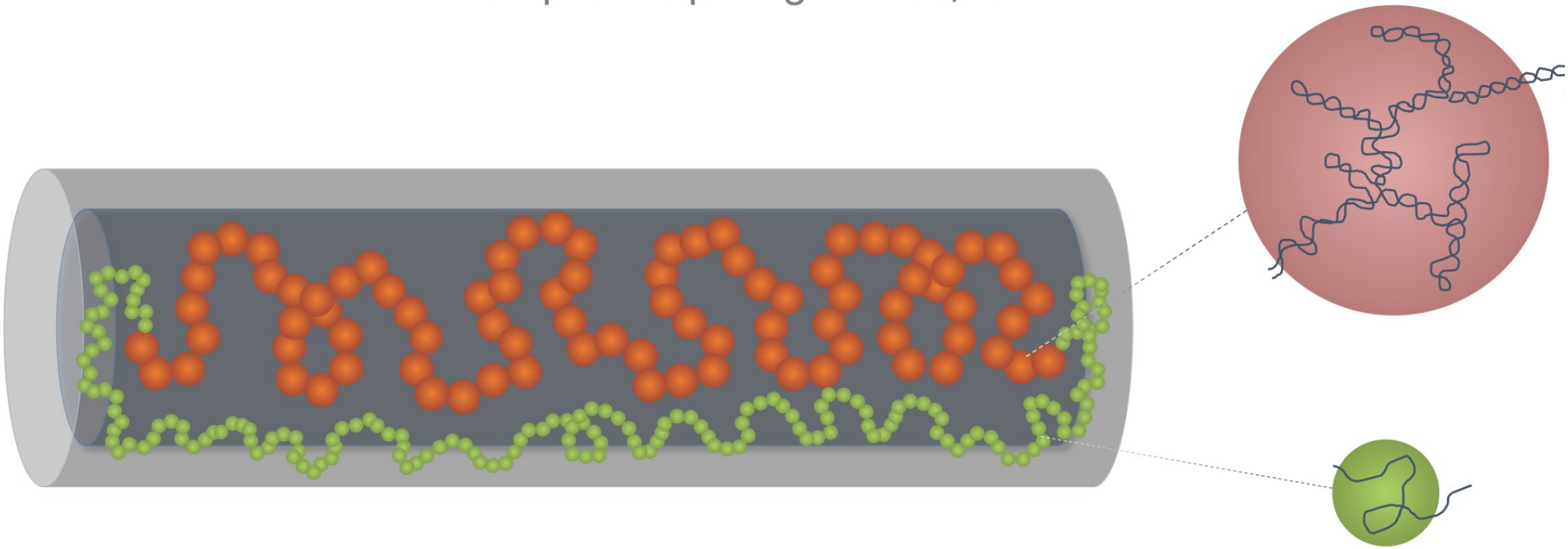
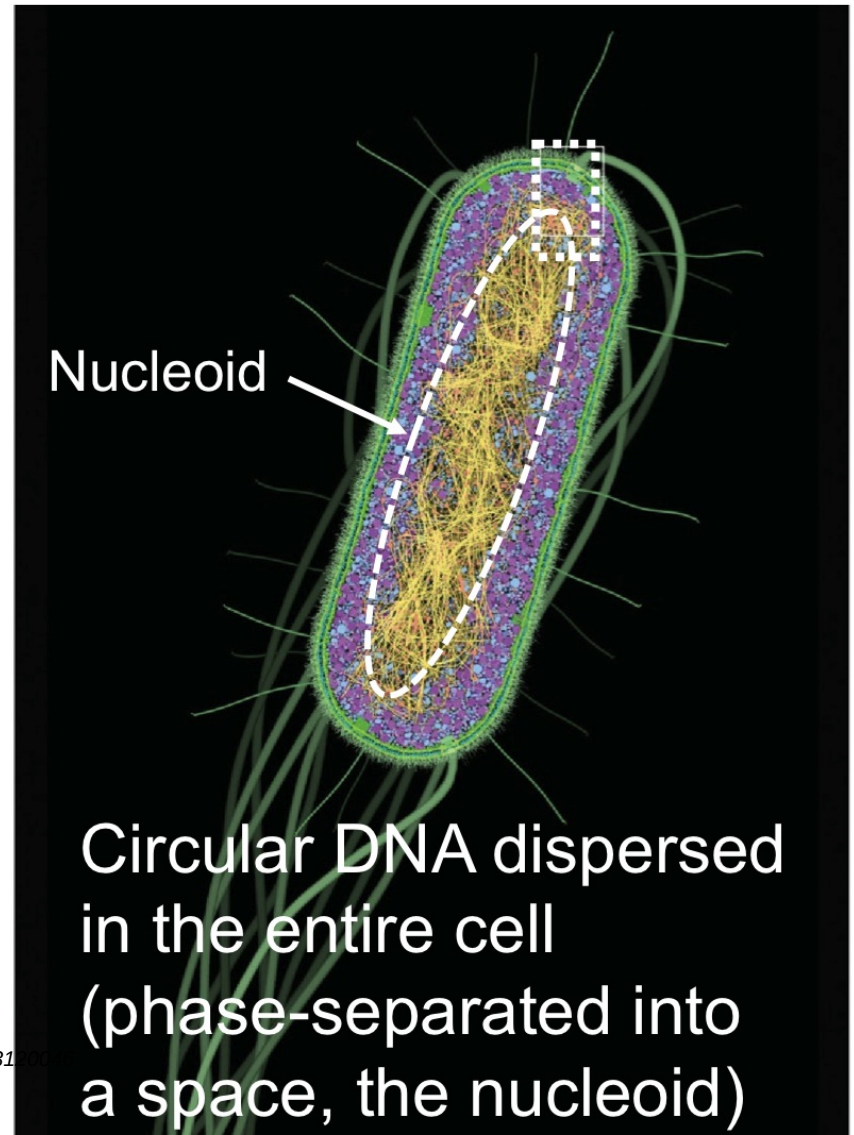
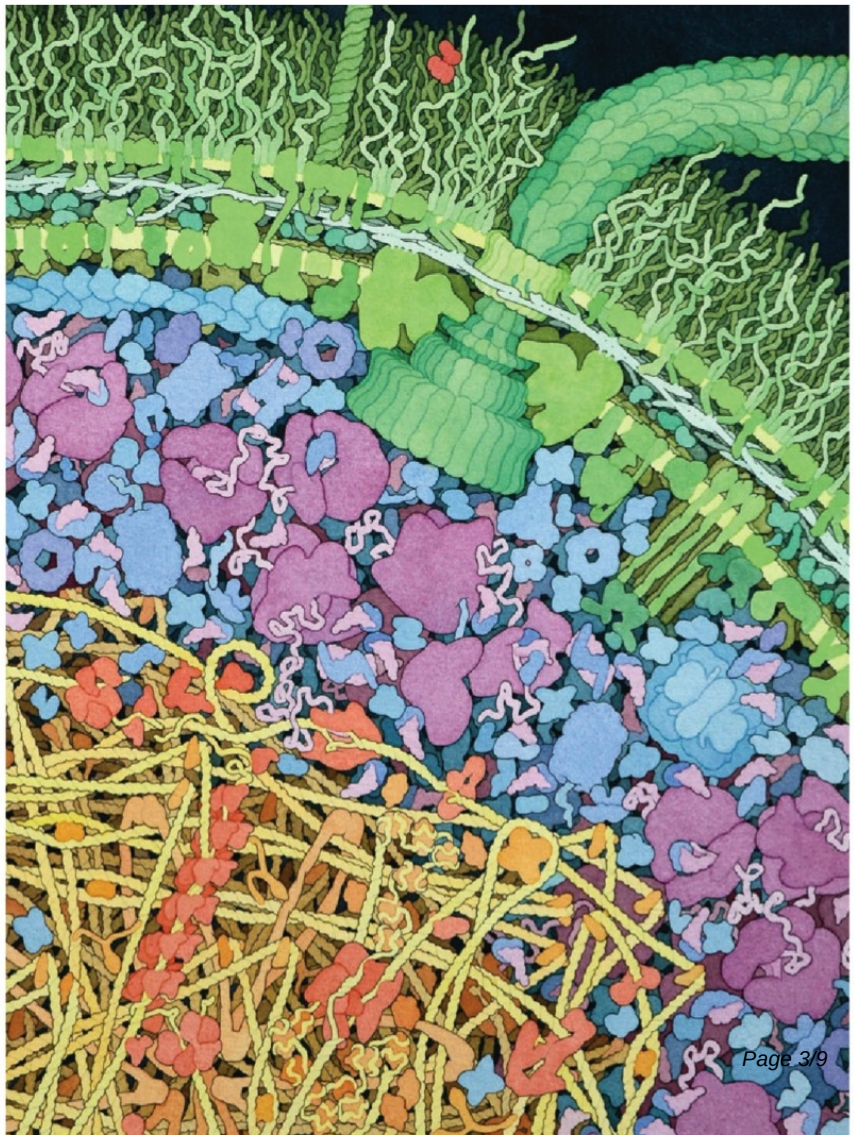


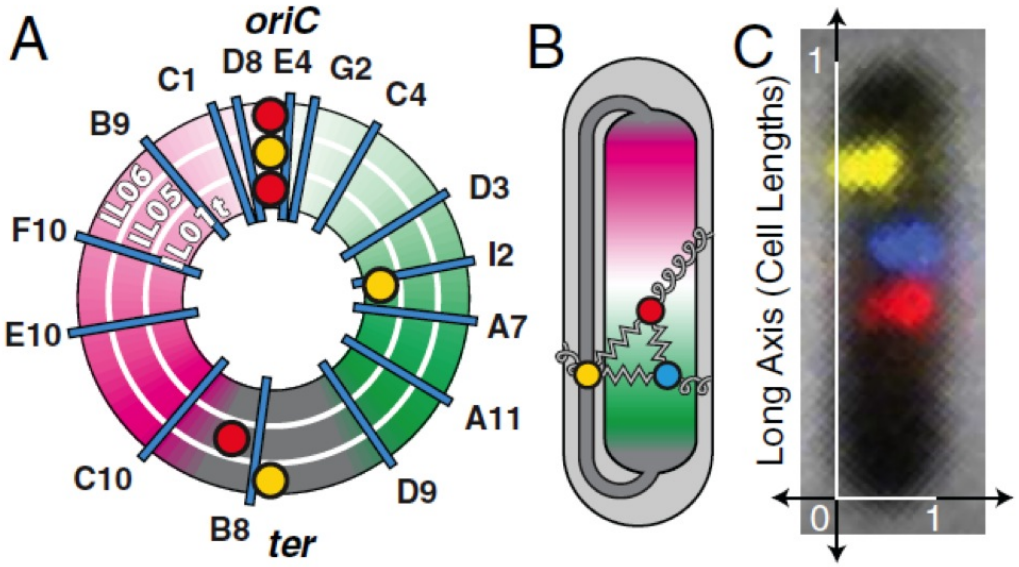
D. Goodsell, Biochem. Mol. Biol. Education (2009); The Machinery of Life (2009)

E. Coli – sack of molecules?



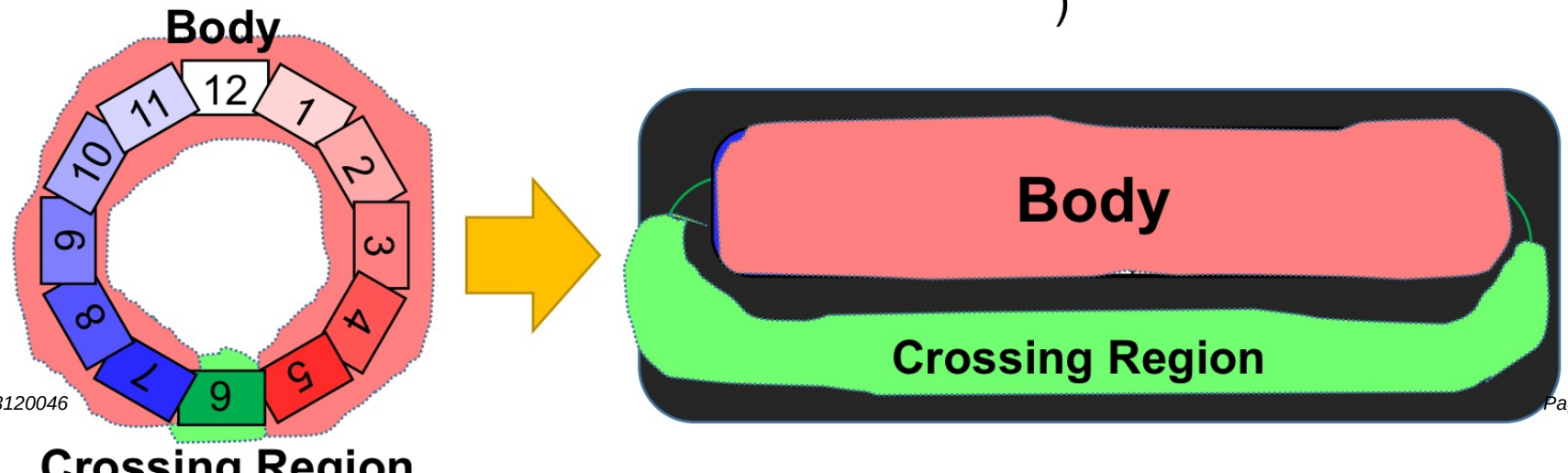


Spatial Organization of Bacterial Chromosome (*E. coli*)

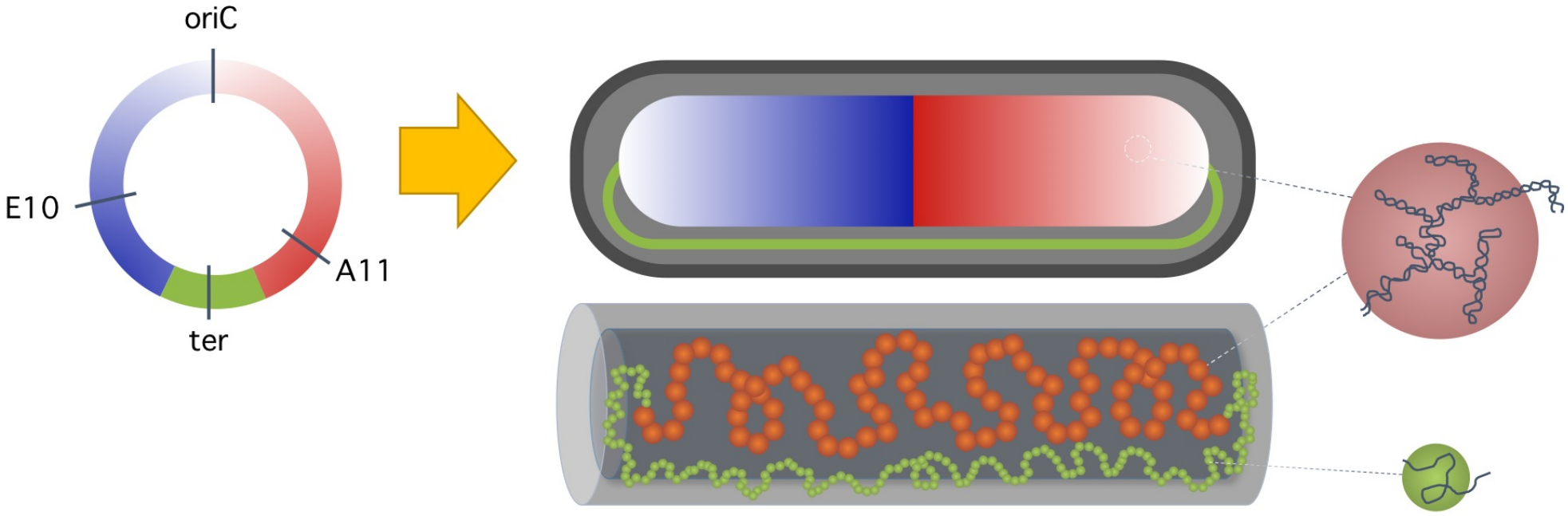


- Linearly ordered
- Partitioning into b ody and crossing r egion

slowly growing cell
PA Wiggins et al., PNAS (2010)

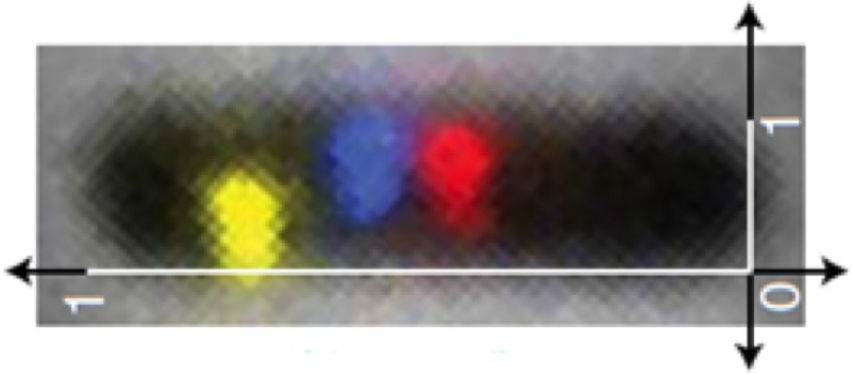


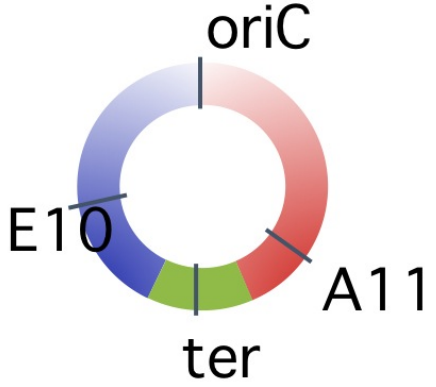
Modeling the nucleoid

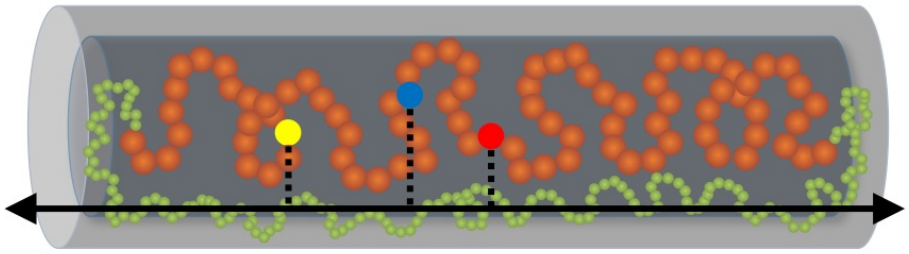


Nucleoid~ cylindrical confinement
Chromosome ~ diblock ring copolymer

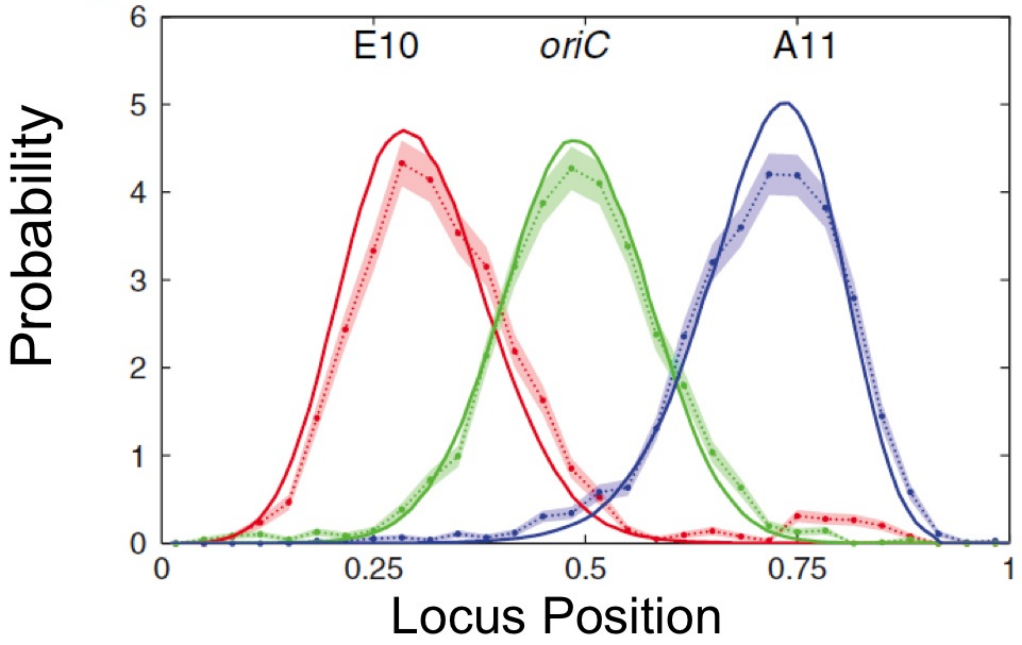
How successful will this effort be?



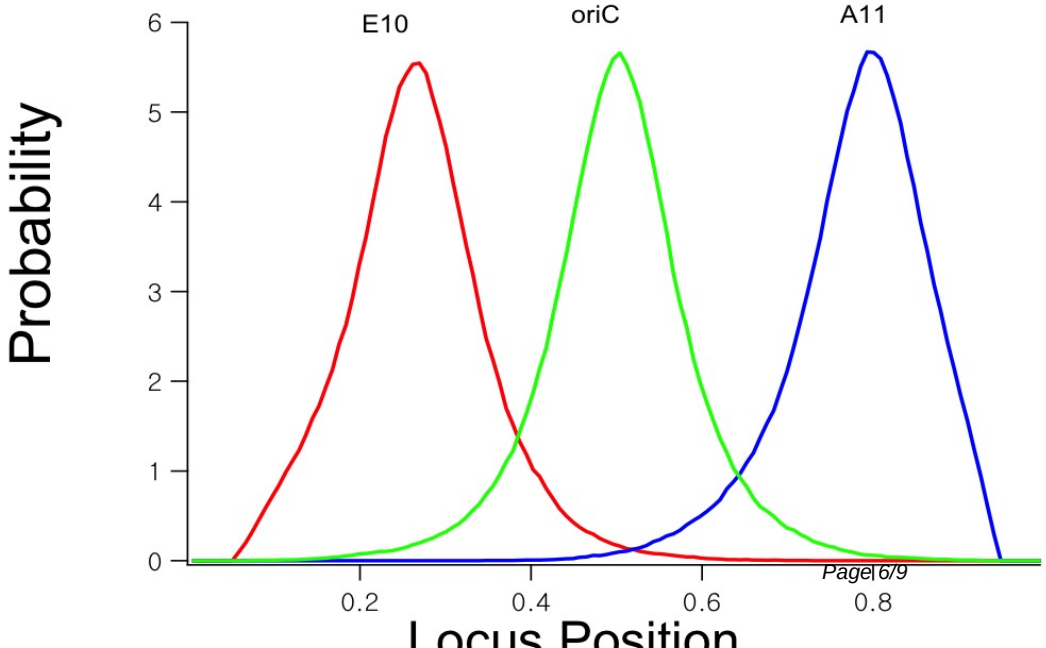




Experiments

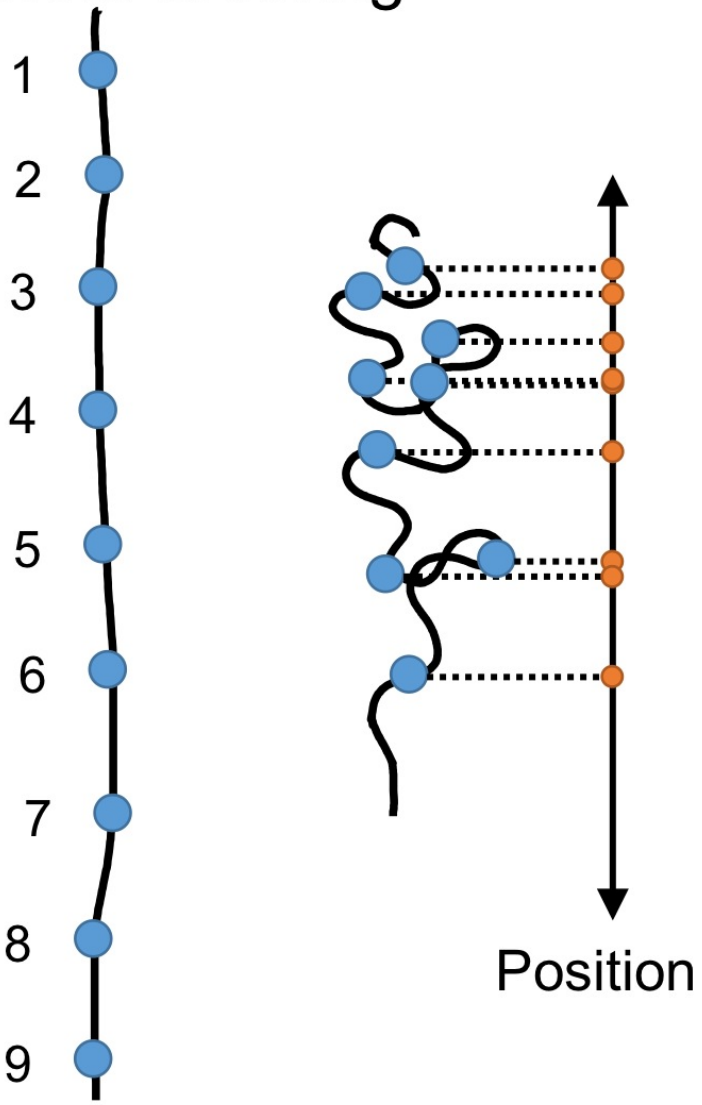


Our simulations

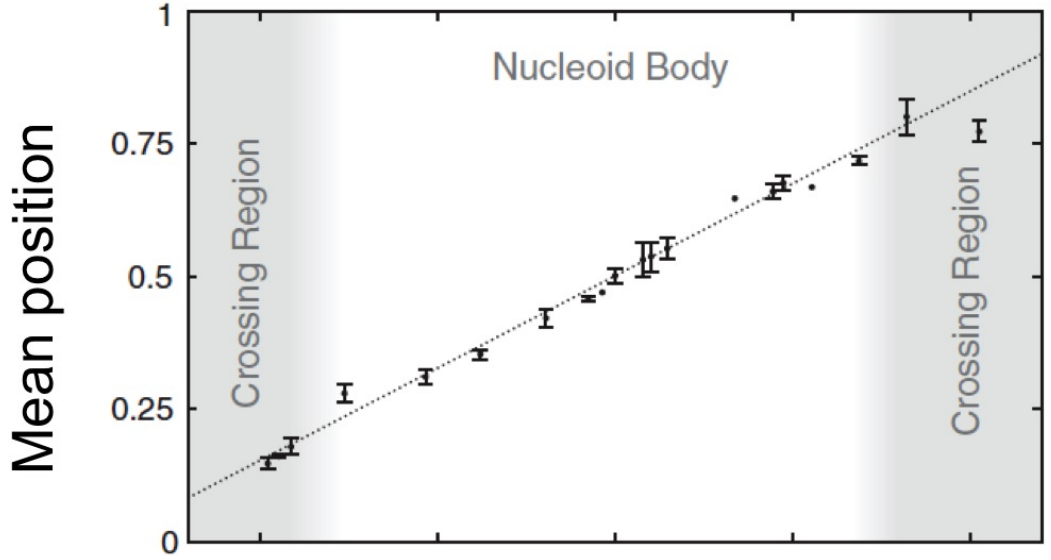


Almost perfect agreement

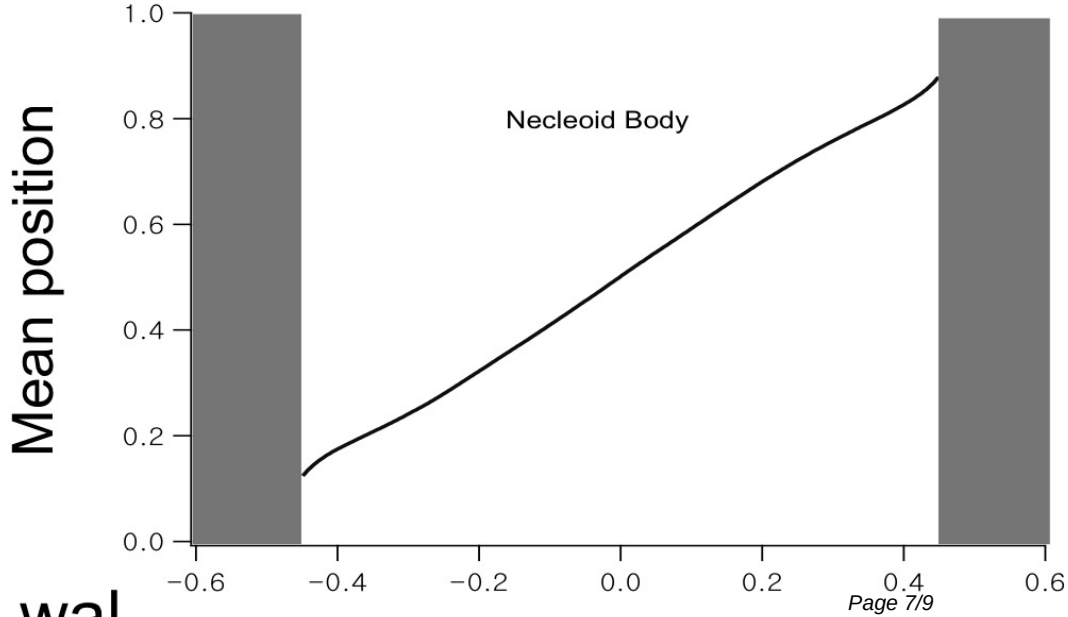
From randomness
to linear ordering



Experiments

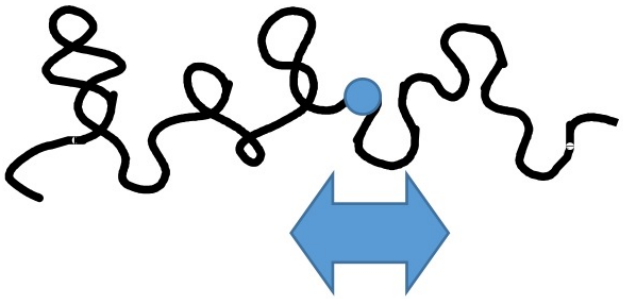


Our simulations

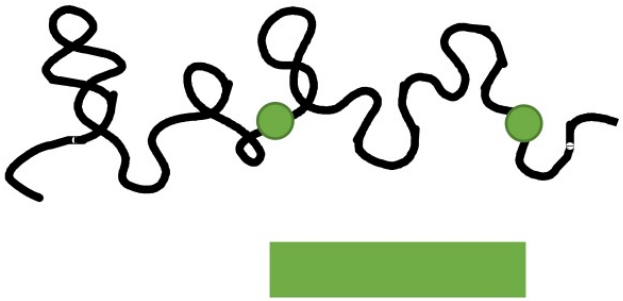


Analogous to a drifted random wal

About springiness

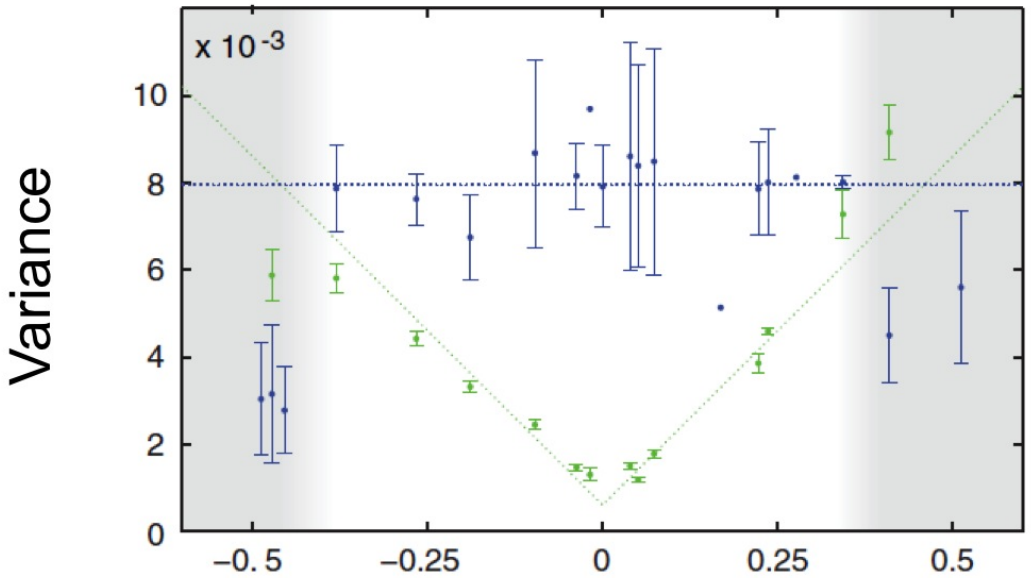


Single locus variance

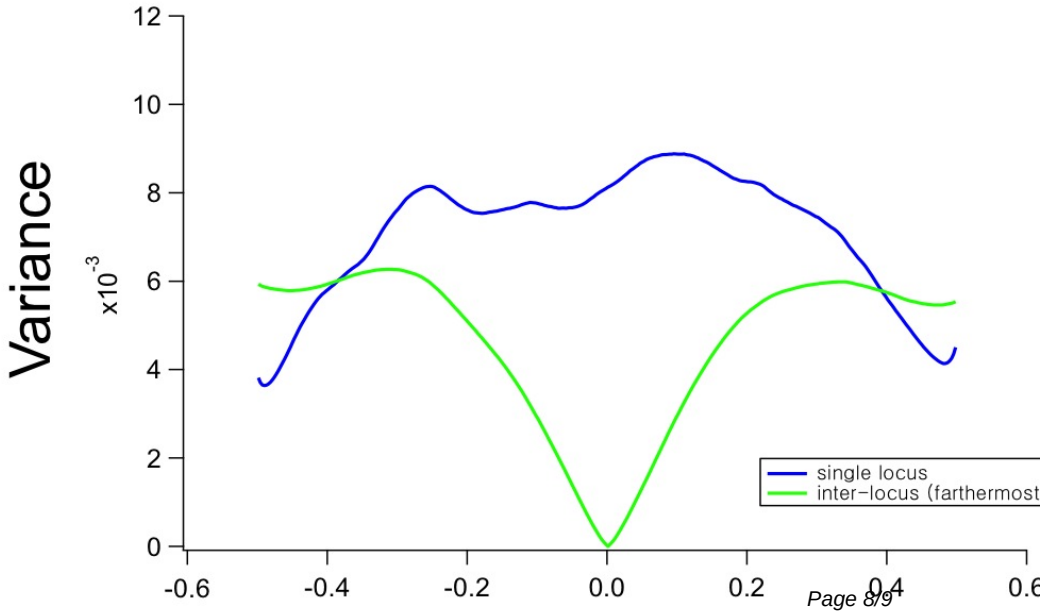


Inter-locus variance

Experiments

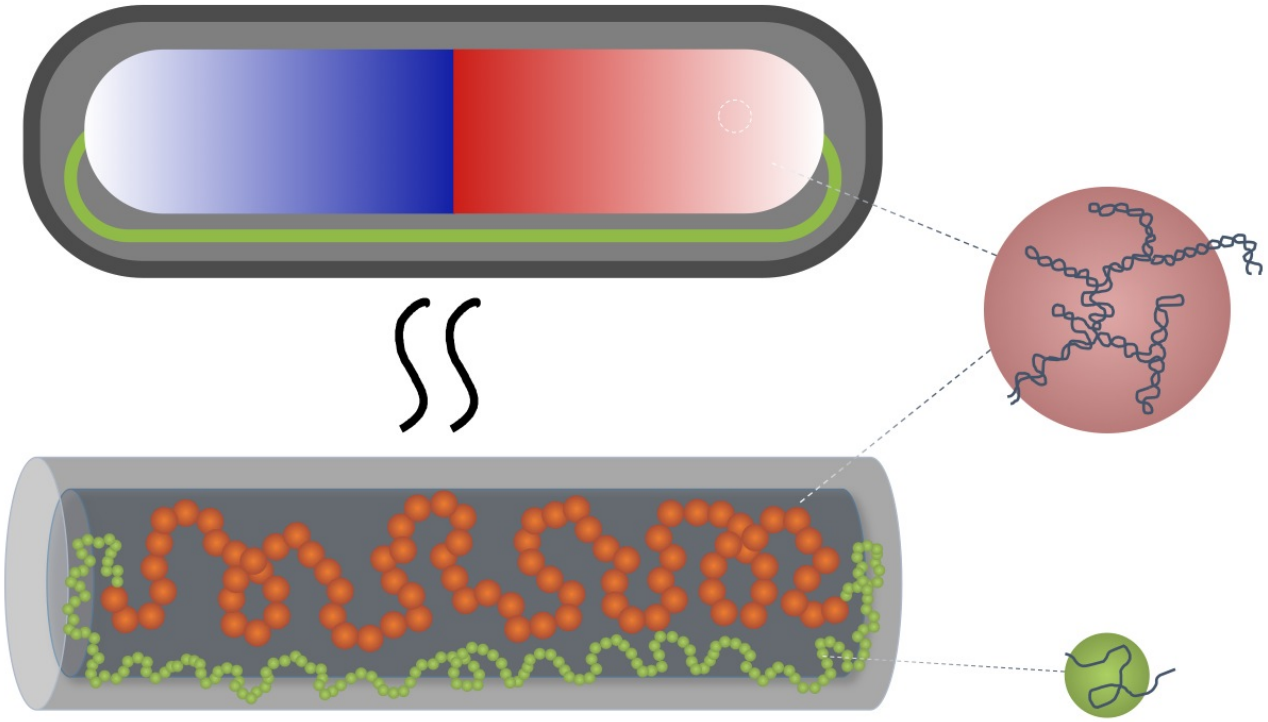


Our simulations



Almost perfect agreement

Conclusion



Beyond E. coli chromosomes