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Structural changes in single chromatin fibers induced by tension and torsion

Meng, H.

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Propositions

Accompanying the thesis
"Structural changes in single chromatin fibers induced by tension and torsion"
by He Meng

1. In negatively supercoiled DNA, plectonemes coexist with twisted DNA and melting bubbles.
   [*Chapter 2 of this thesis*]

2. The rupture of a chromatin fiber by force can be characterized by four nucleosome conformations: a folded, a singly wrapped, an extended and a fully unwrapped nucleosome.
   [*Chapter 3 of this thesis*]

3. The anisotropic response of a torsionally constrained chromatin fiber to changes in twist reflects its left-handed chirality.
   [*Chapter 4 of this thesis*]

4. Positive supercoiling controls chromatin fiber folding and unfolding at forces larger than 2.5 pN.
   [*Chapter 4 of this thesis*]

5. Surprisingly, the number of plectonemes in a topological domain depends not on the size of the domain, but only on the ionic strength and applied force.
   [Van Loenhout et al. ***Science*** **338**: 94 (2012)]
   [Emanuel *et al.* ***Phys. Rev. E*** **88**: 1539 (2013)]

6. Since torque can not facilitate nucleosome unwrapping below 1 pN, the chiral change of a left-handed nucleosome into a right-handed one below 1 pN as reported by Bancaud et al. should not happen.
   [Sheinin *et al.* ***Nature communications*** **4**: 2579 (2013)]
   [Bancaud *et al.* ***Molecular Cell*** 27: 135 (2007)]

7. In view of the fact that DNA in a nucleosome is only wrapped on histone cores, it is surprising that removal of the histone tails increases the DNA unwrapping rate.
   [Bintu *et al.* ***Cell*** **151**: 738 (2012)]

8. The fact that active genes are negatively supercoiled, whereas silent genomic regions appear positively supercoiled, provides a beautiful example of the role of topology in Nature.
   [Dixon *et al.* ***Nature*** **485**: 376 (2012)]
   [Naughton *et al.* ***Nat. Struct. Mol. Biol.*** **20**: 387 (2013)]

9. Unsuccessful scientific experiments should be published, rather than remain buried in lab journals.

10. "Big Data" cannot replace human judgement.
    [Inspired by the essay "*Eight Problems With Big Data*" on *The New York Times* (2014)]

Leiden, 9 October, 2014