Self-replication of information-bearing nanoscale patterns

自复制信息载体纳米模式

汇报人：袁慧

2011.12.02

1. What is the highlight?

- Using DNA tile motifs that can recognize and bind complementary tiles in a pre-programmed fashion!

2. What did the author do?

- 1.design tile motifs to form a seven-tile seed sequence
- 2.use the seeds to instruct the formation of a first generation of complementary seven-tile daughter sequences
- 3.daughter ⟶ granddaughter=initial seed

3.Methods

- We know ⟶ We do not know

  DNA replication → materials fabrication

  DNA bases → BTX —paired→ P6HB

  DNA backbone → 7 tile BTX sequences

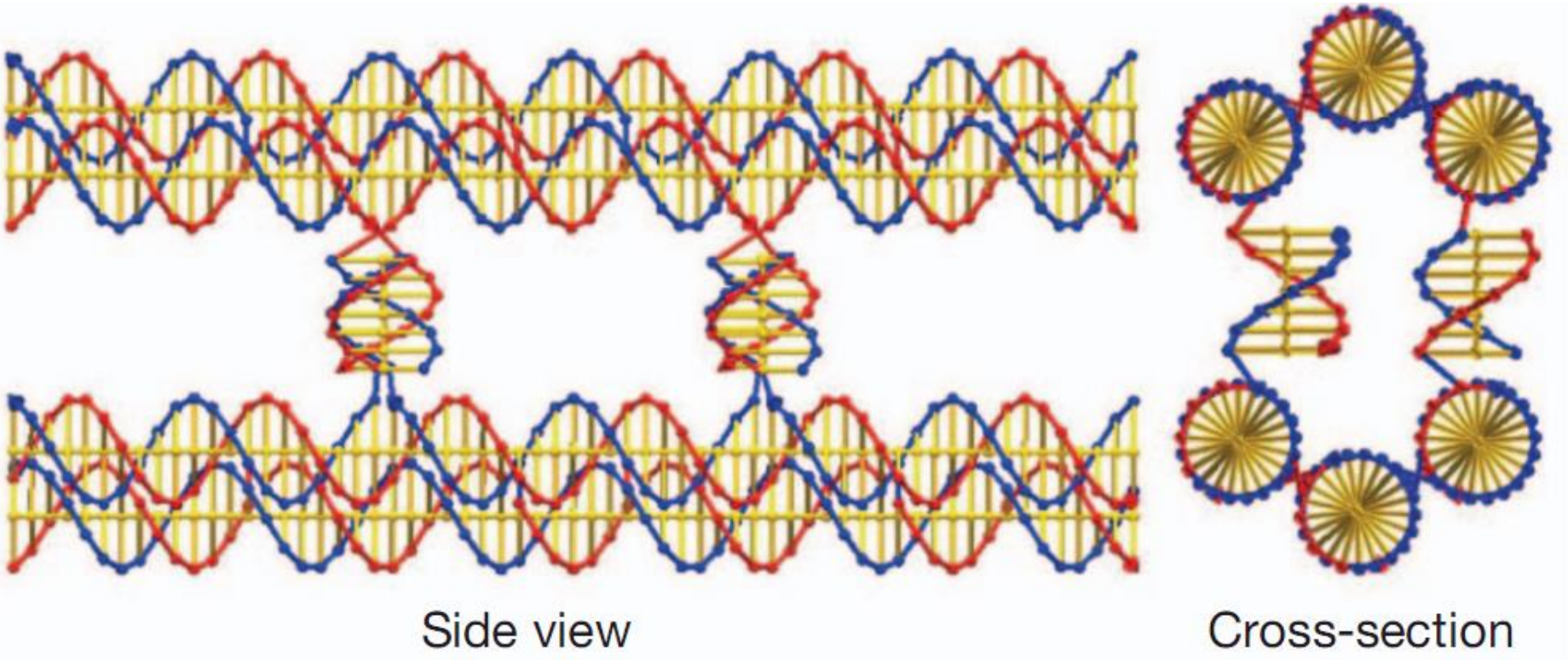
3.1 BTX and P6HB

- BTX---bent triple crossover motif

  four single strands (of seven nucleotide each)
- P6HB---paired 6-helix bundle motif

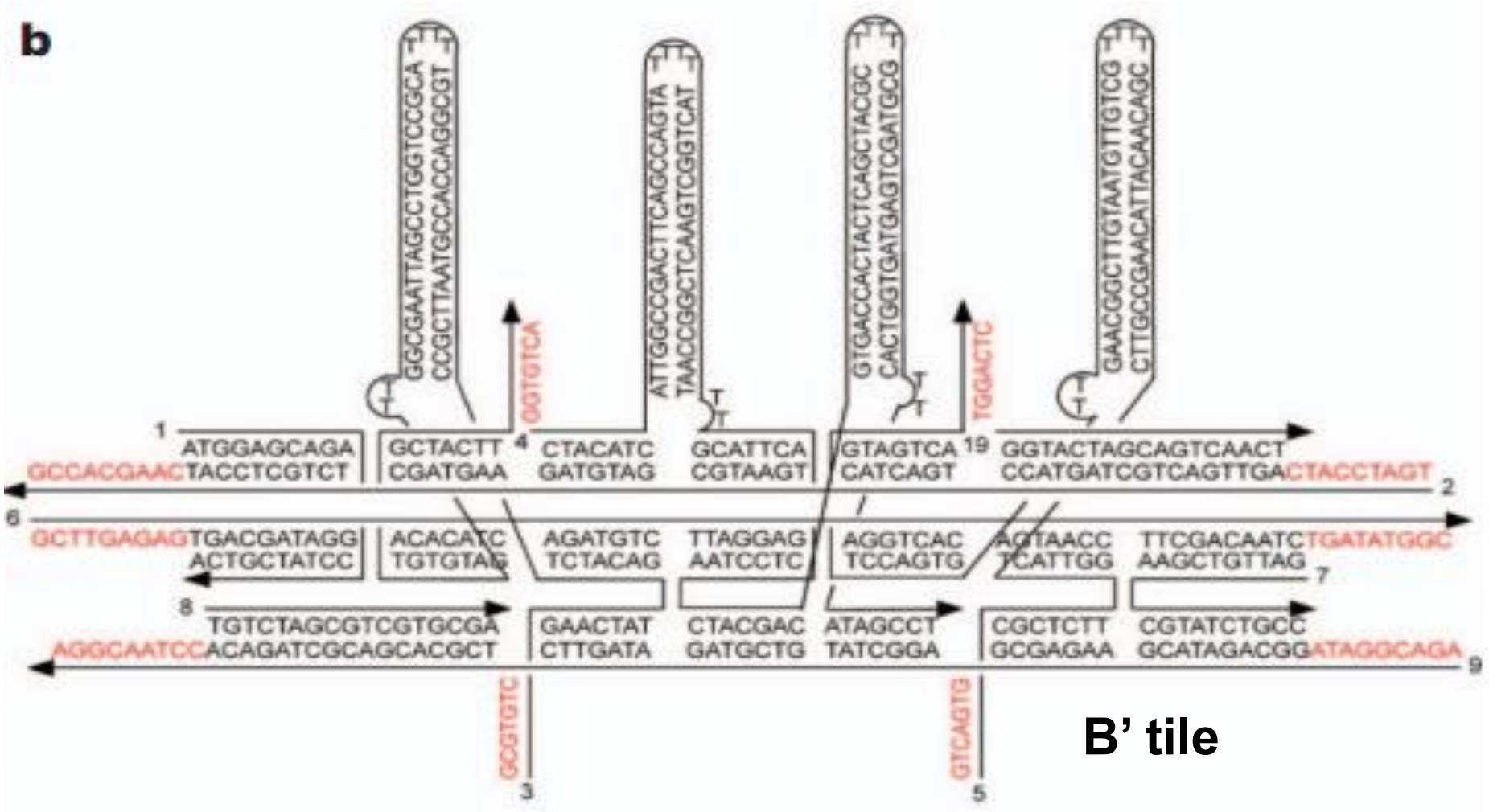
  two paired BTX letters which contains six helices connected to each other by four small double helices

3.1 BTX and P6HB



3.2 Simple case

- A----A’ B----B’



3.3 Two labels

- 1. biotinylated nucleotides that bind streptavidin
- 2. large hairpin features

WHY?

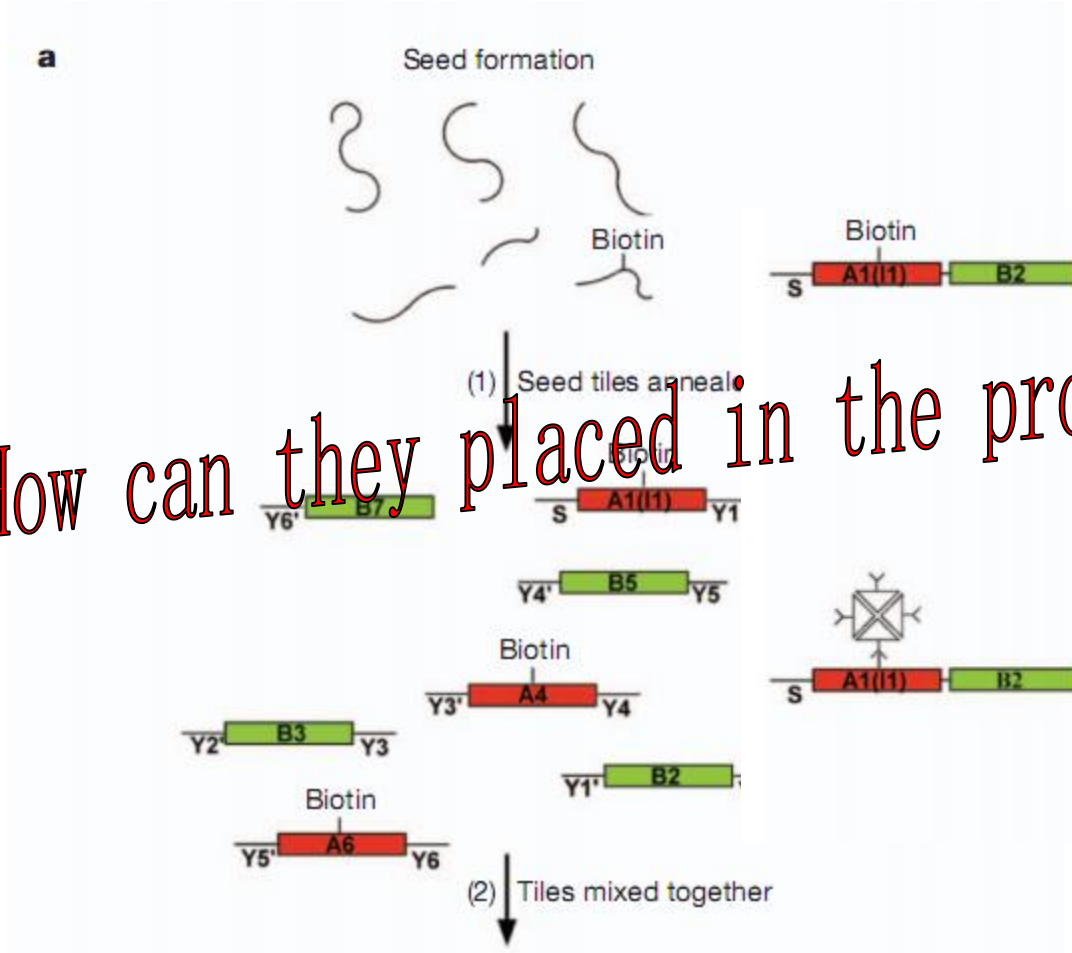
1. Read with AFM
2. Judge the correctness of initial pattern
3. Check fidelity

3.4 Seed sequence

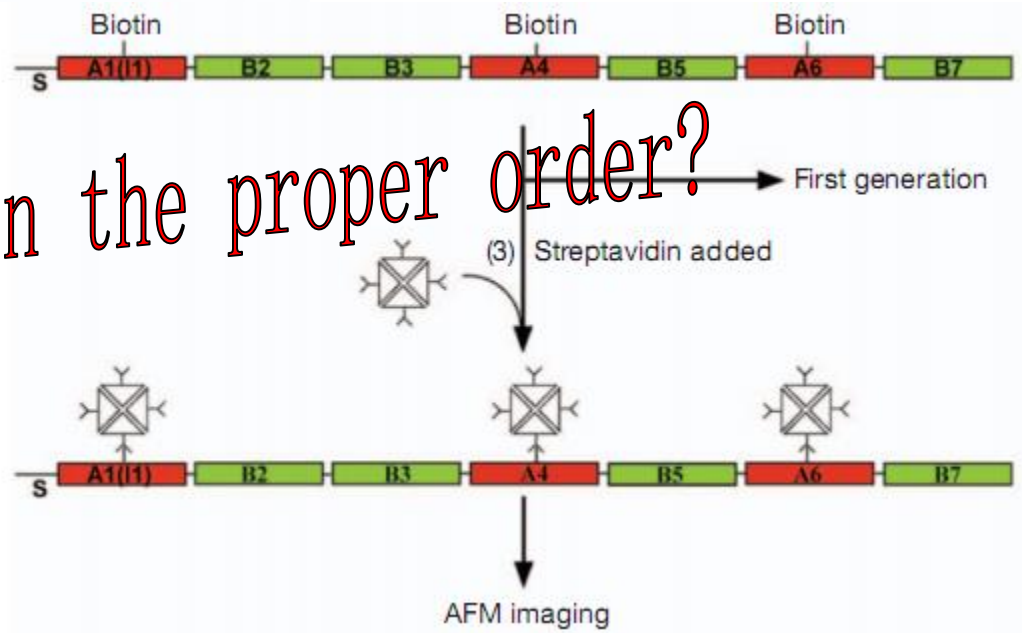
- Seed I B B A B A B
- Complementary I’B’B’A’B’A’B’

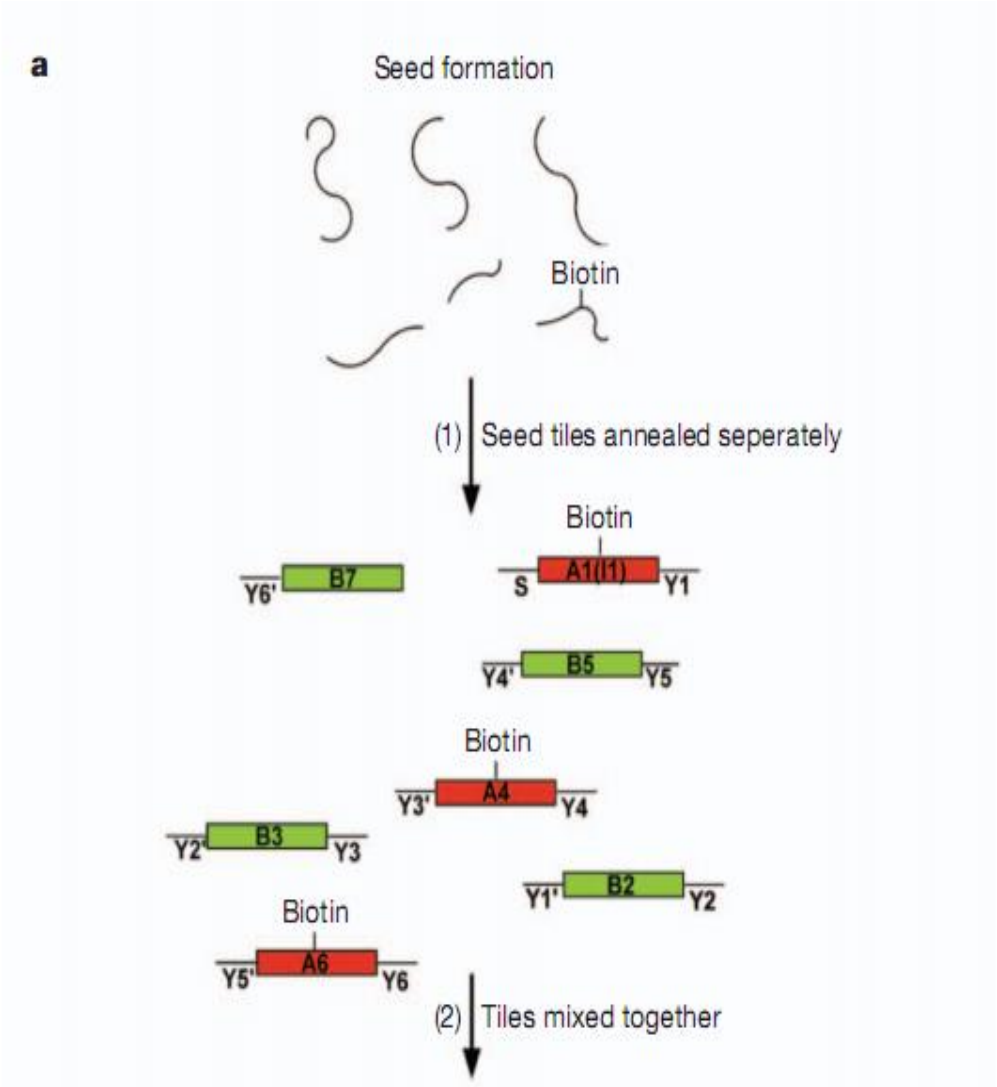
initiator I:an A-like tile labelled S that can be attached to a magnetic bead

3.5 Self-assembly of BTX tiles



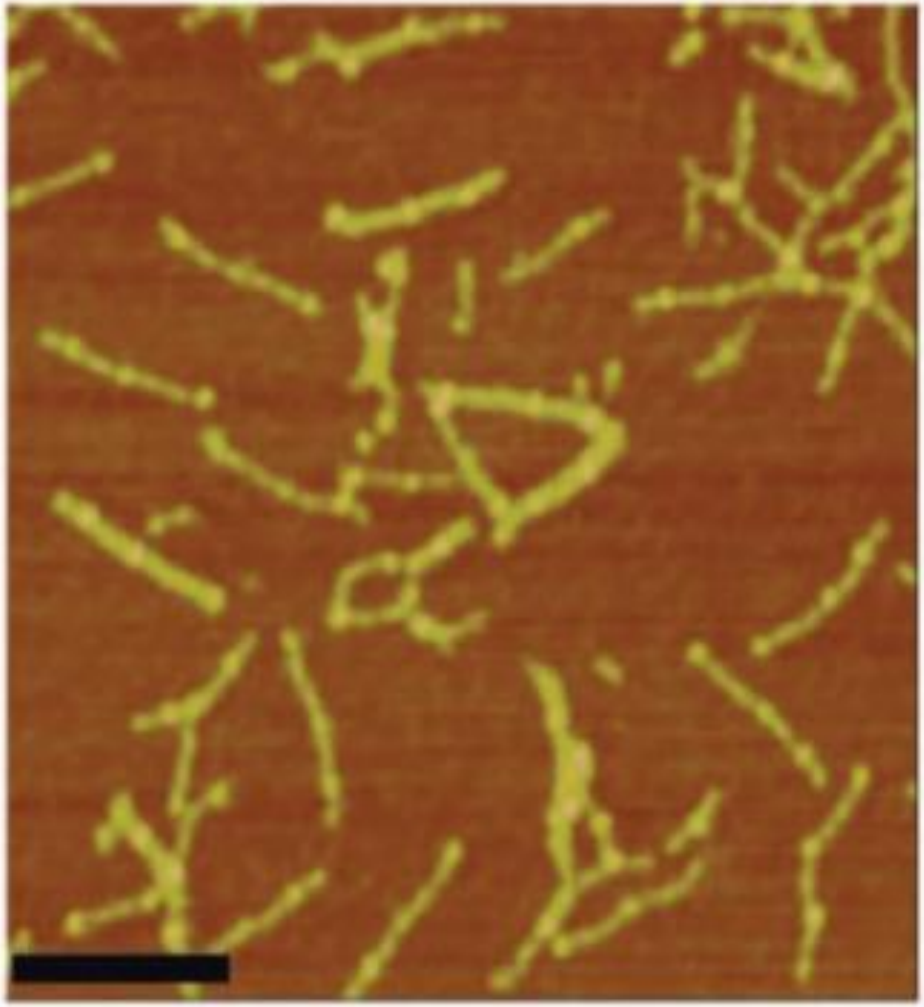
How can they placed in the proper order?

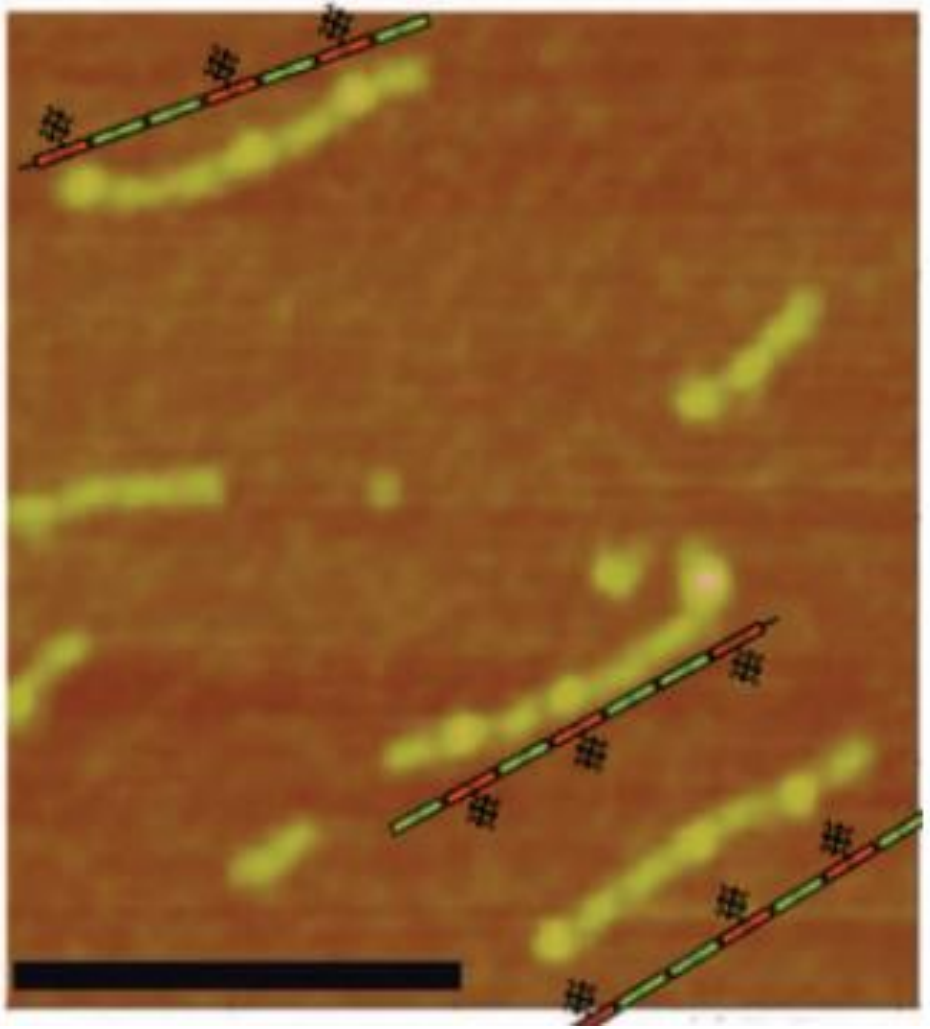




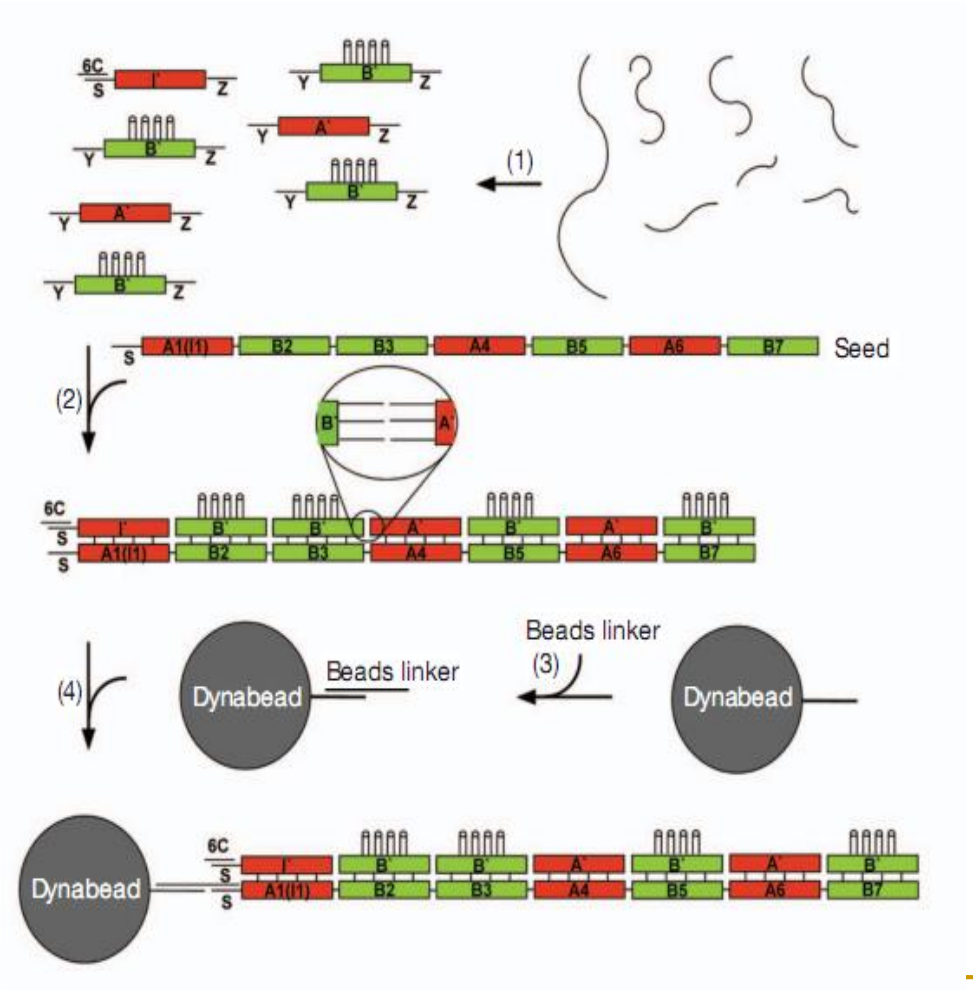
unique16-mer sticky ends

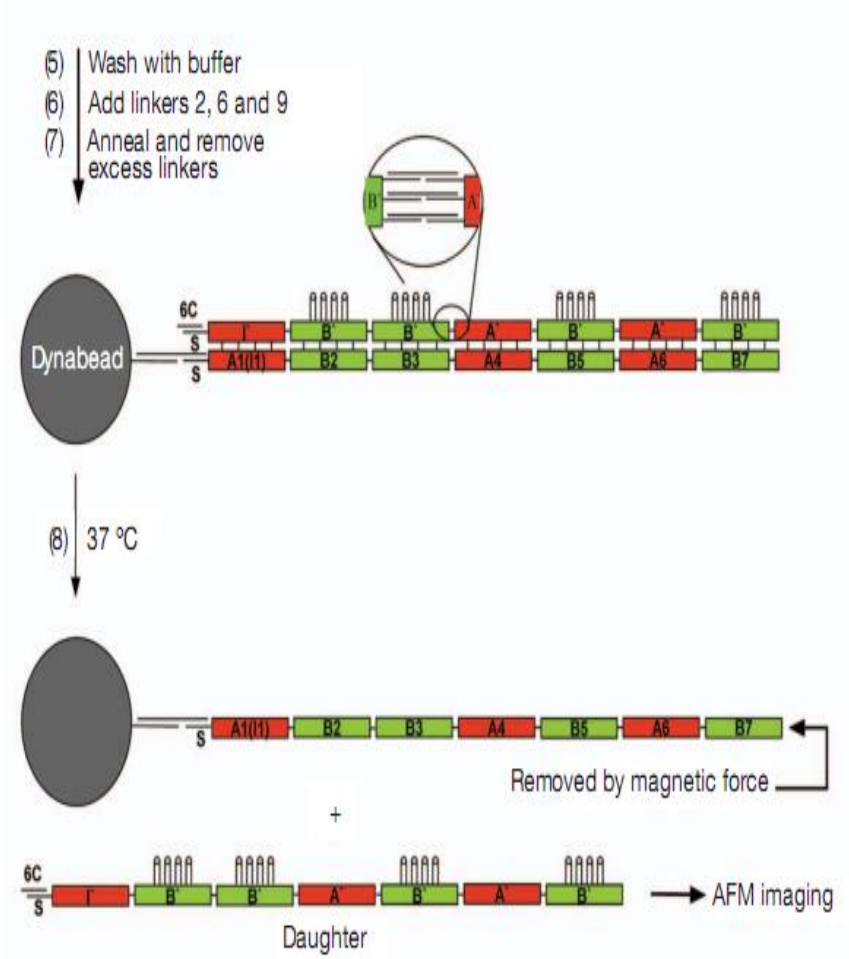
The successful formation of the seeds

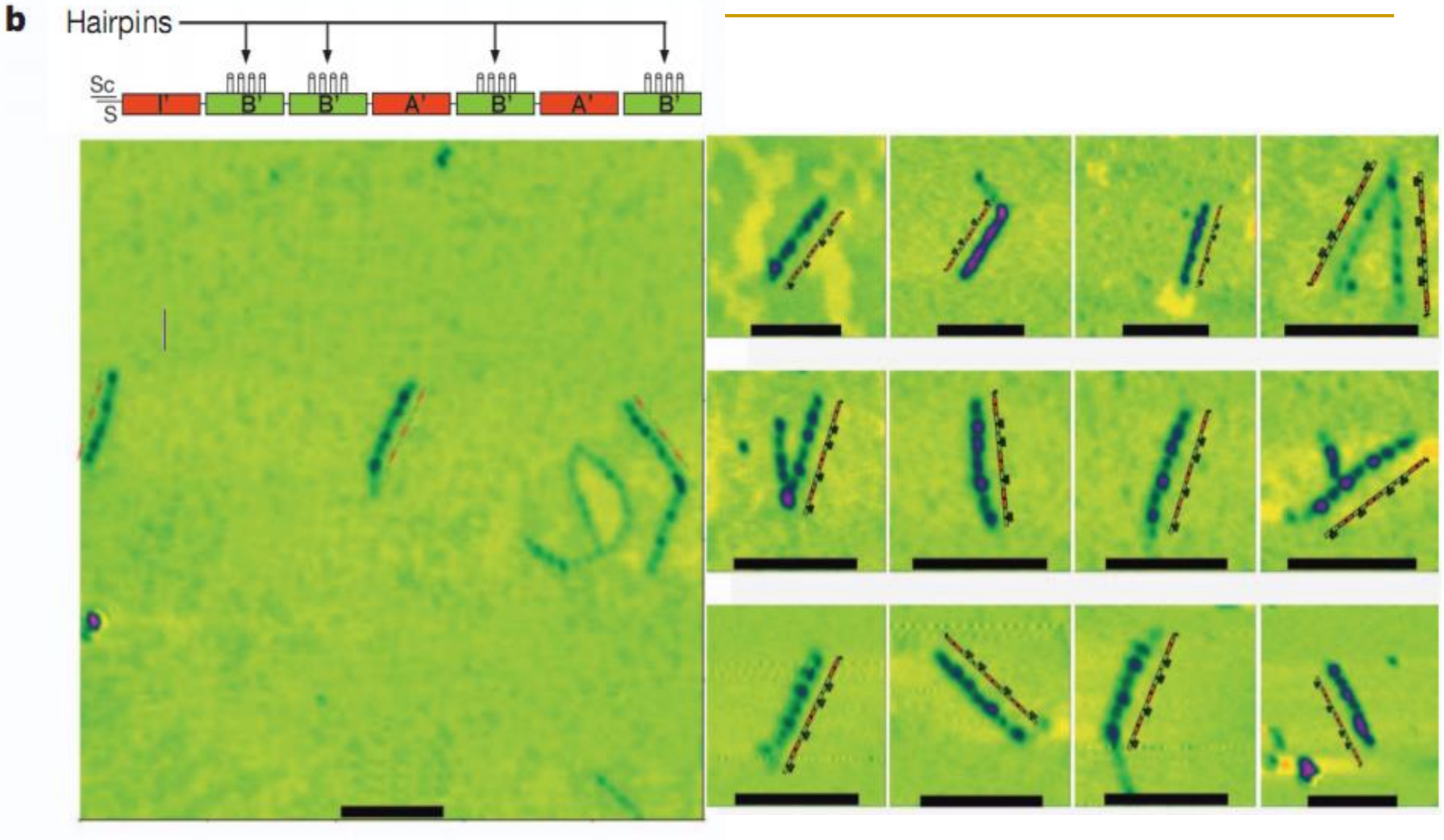




3.6 Formation of daughter and P6HB

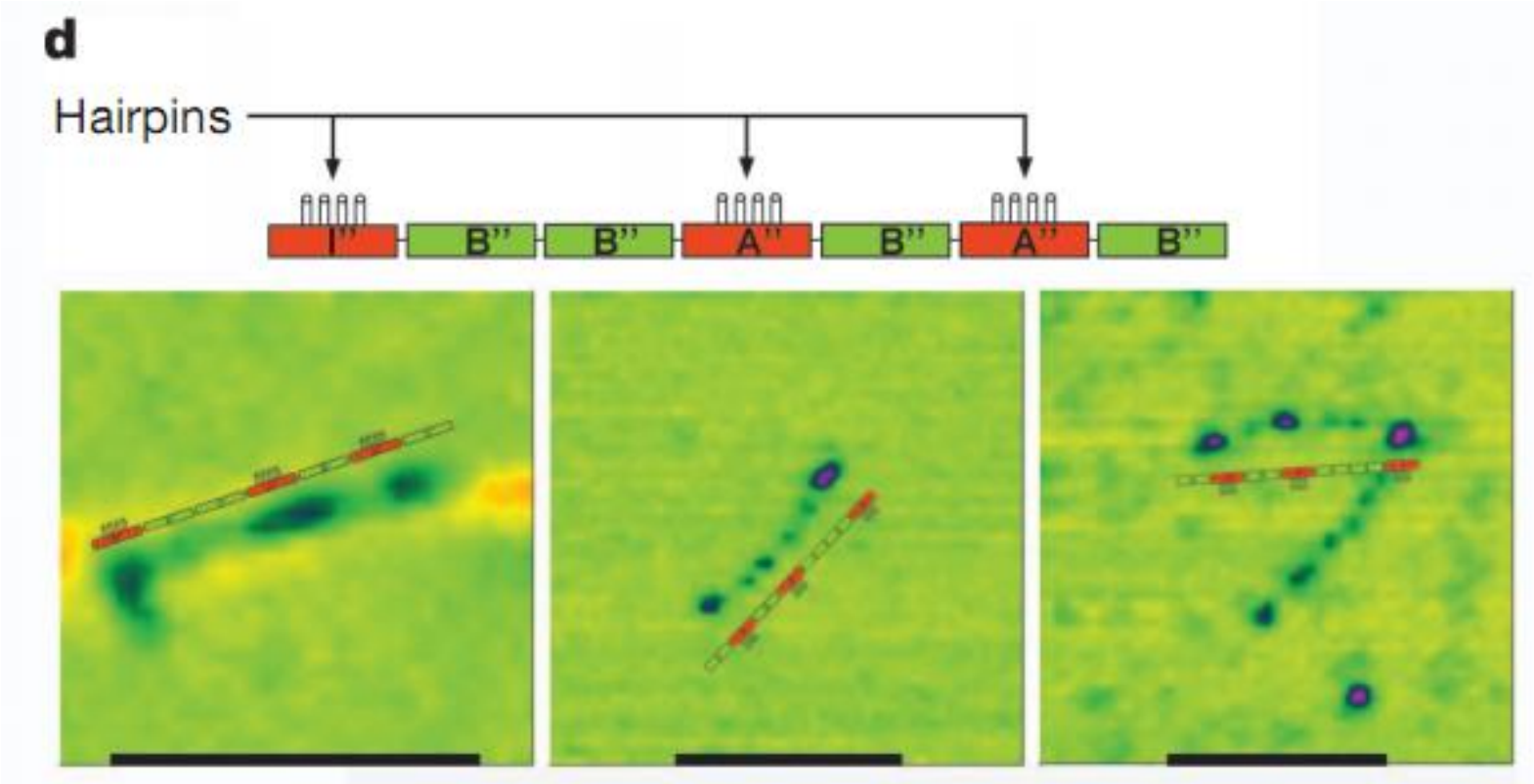






Daughters are significantly sparser than the seeds

3.7 Granddaughters



4. Conclusion

- Cumbersome
- Can’t achieve exponential amplification

- Question:

  yield is obviously affected by the removal of seed molecules to produce the daughters
- Solutions:

  elimination of bead removal steps, by using self-protected hairpins or photoactive molecules for the longitudinal interactions

Contibutions

- It is possible to replicate not just molecules such as DNA or RNA, but discrete tertiary structures

Rosy expectations:

robust replication

Thank you !