

Self-assembly of functional DNA nanostructures:

- **DNA catenanes**
- **Supramolecular protein/DNA or aptamer nanowires**
- **DNA nanotubes**

Supramolecular DNA nanostructures in solution and on surfaces for:

- **Programmed biocatalysis, bioelectrocatalysis and photocatalysis**
- **Design of DNA machines**

Supramolecular nucleic acid structures for biocomputing

- **DNAzyme-based logic gates and possible applications for nanomedicine**

Encoded Information in DNA Sequences

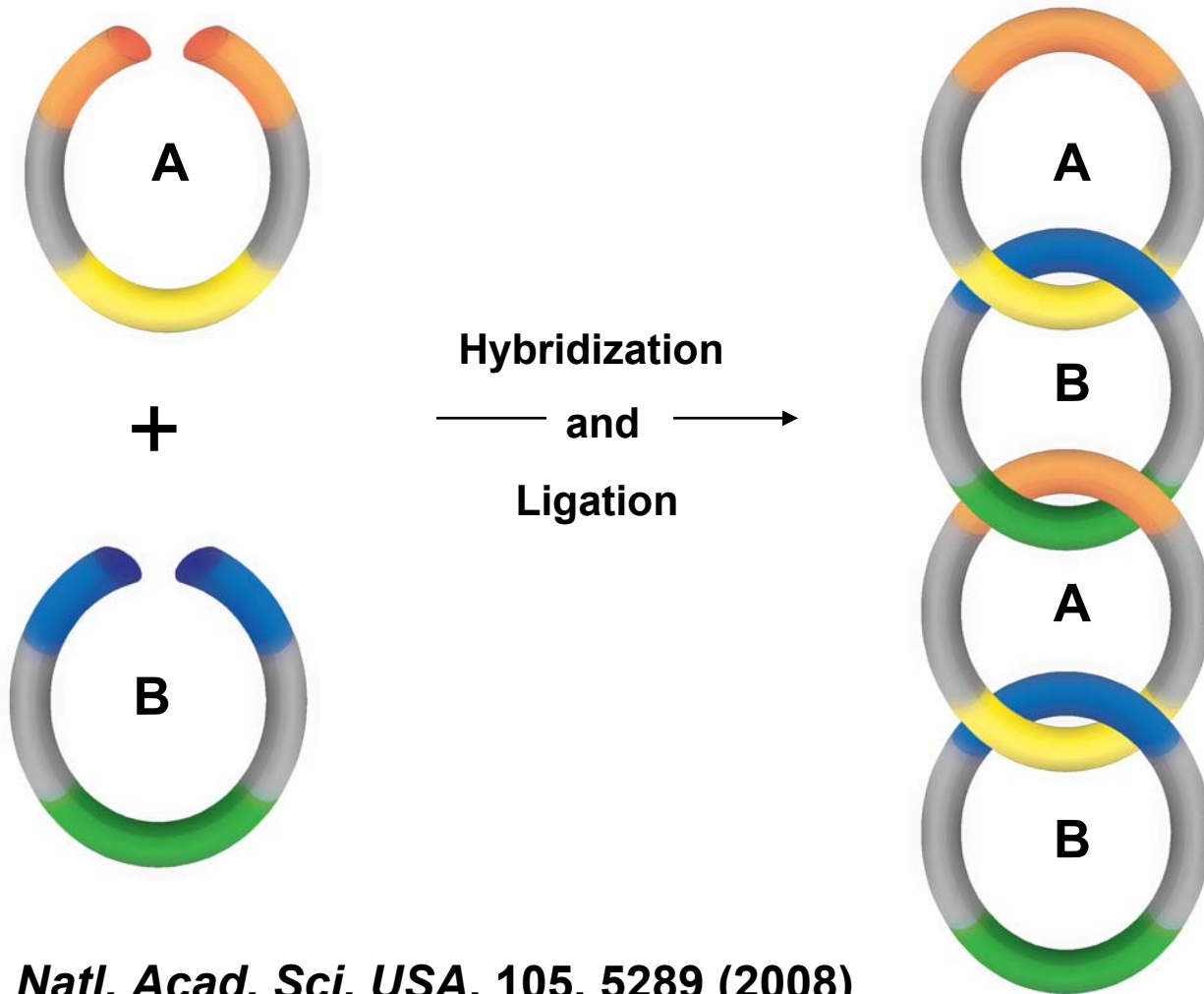
Structural information

- Geometrically shaped
- 2D and 3D structures
- G-quadruplexes
-
-
-

Functional information

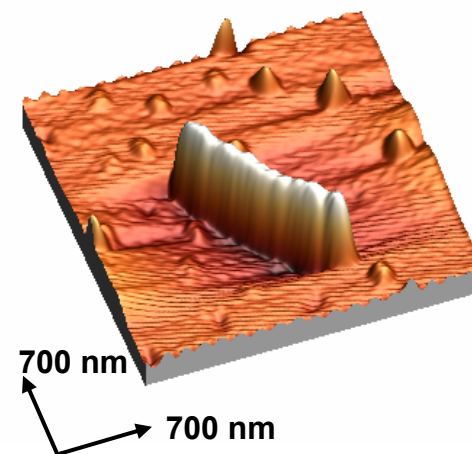
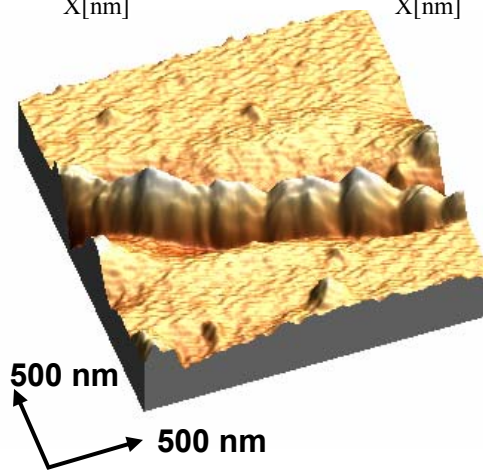
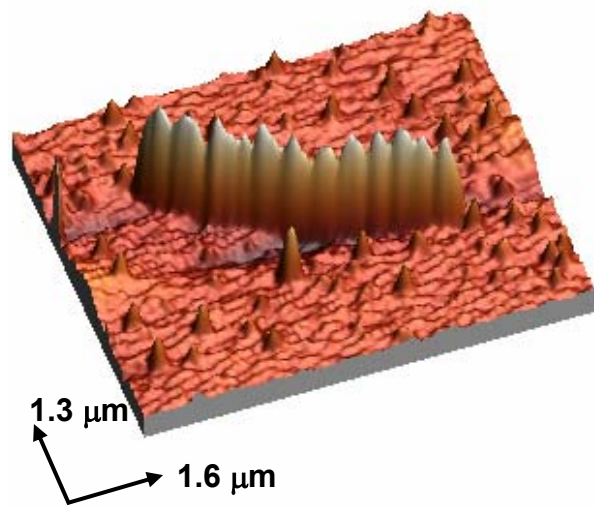
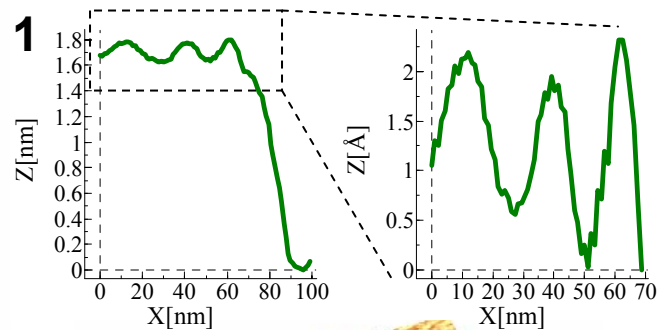
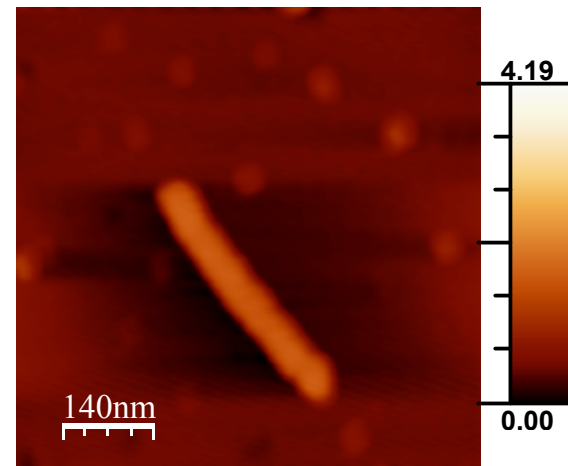
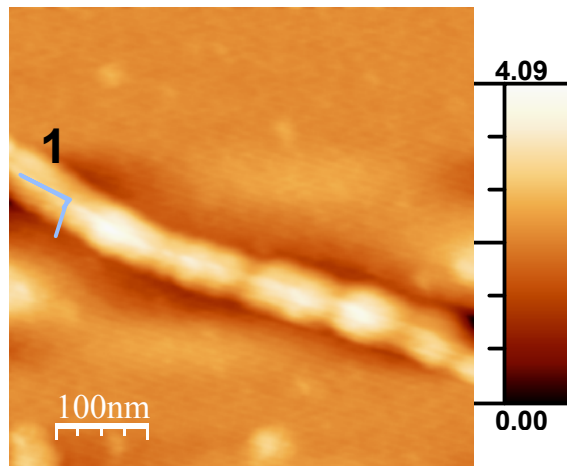
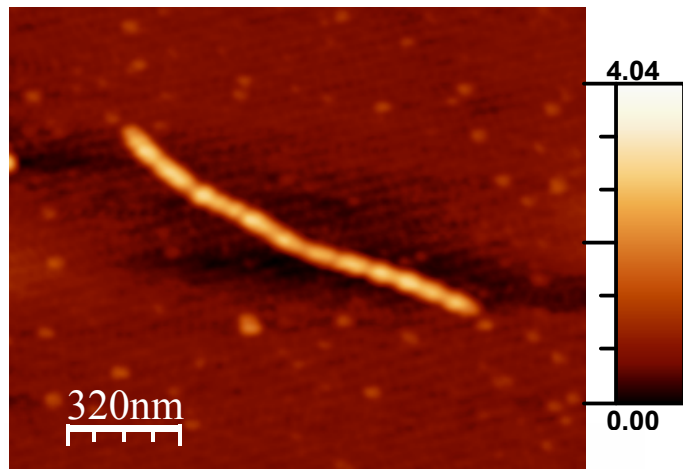
- Sequence-specific hybridization
- Sequence-specific binding of proteins
- Sequence instructive replication, scission, nicking
- Sequence-controlled binding: aptamers
- Sequence-regulated catalysis (DNAzymes, Ribozymes)

Polycatenated DNA

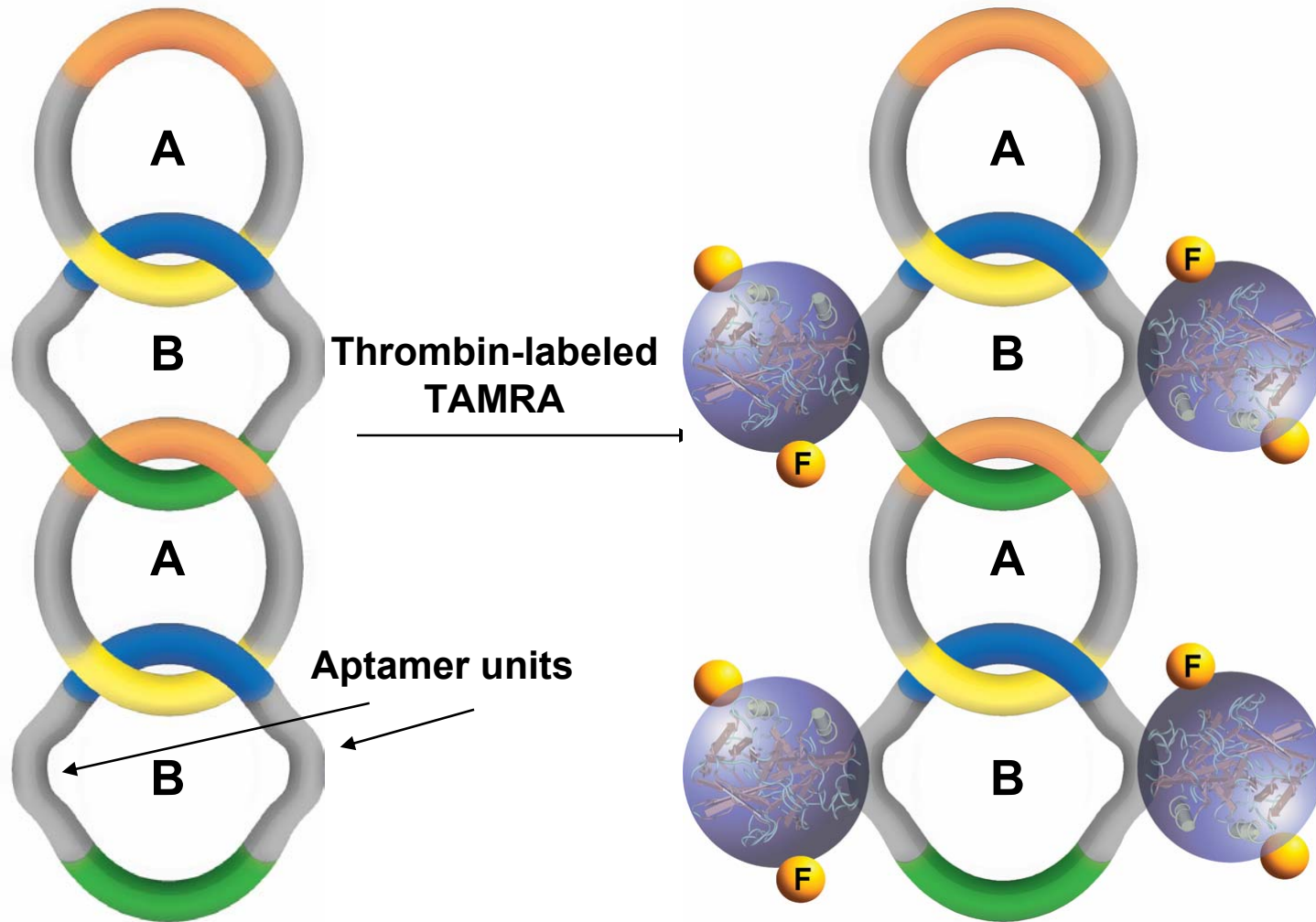


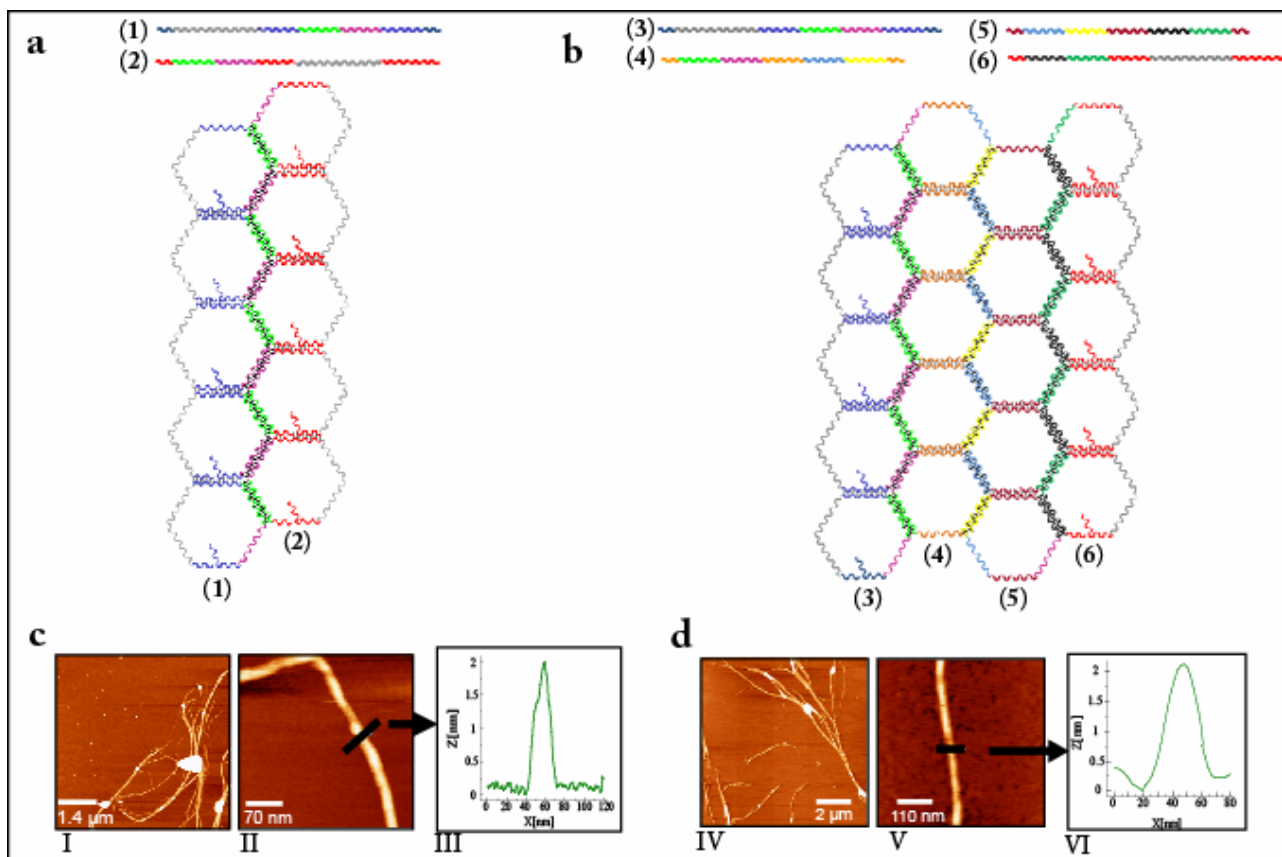
Proc. Natl. Acad. Sci. USA, 105, 5289 (2008)

AFM Images

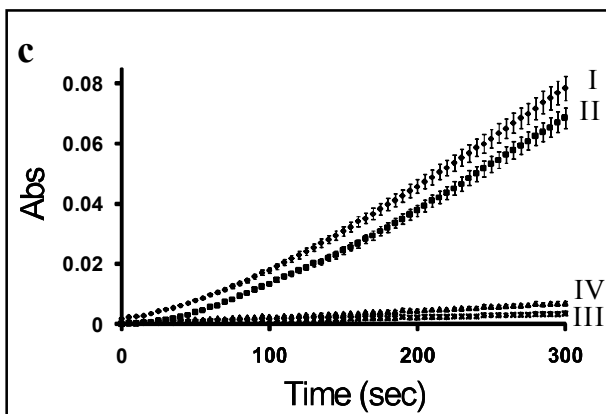
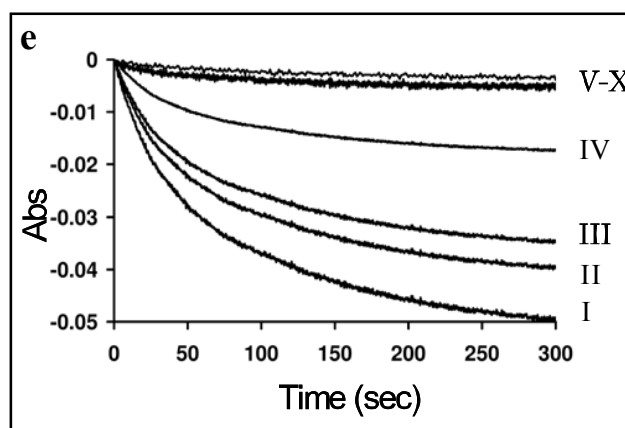
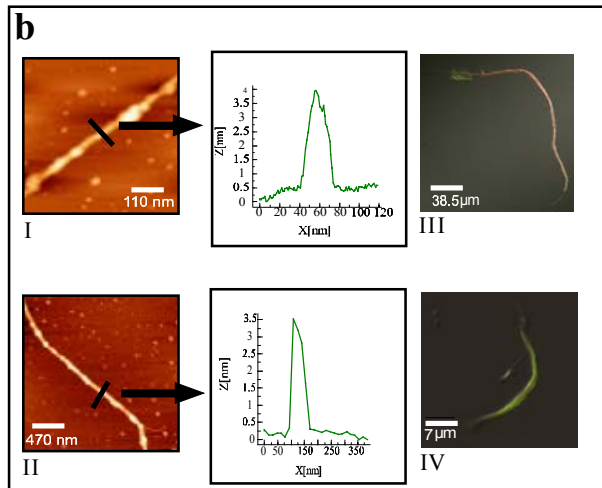
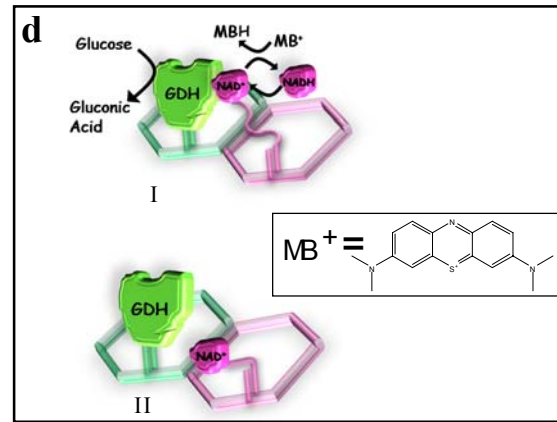
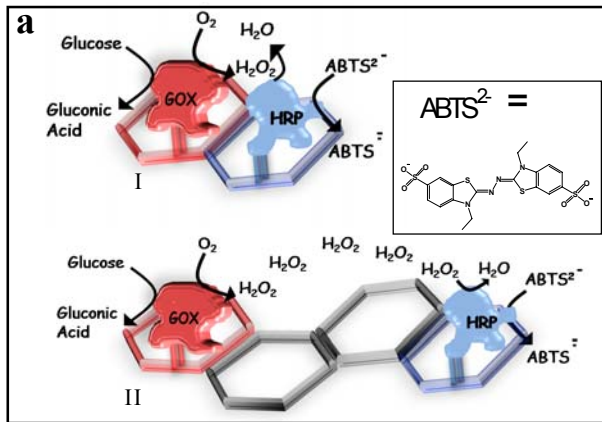


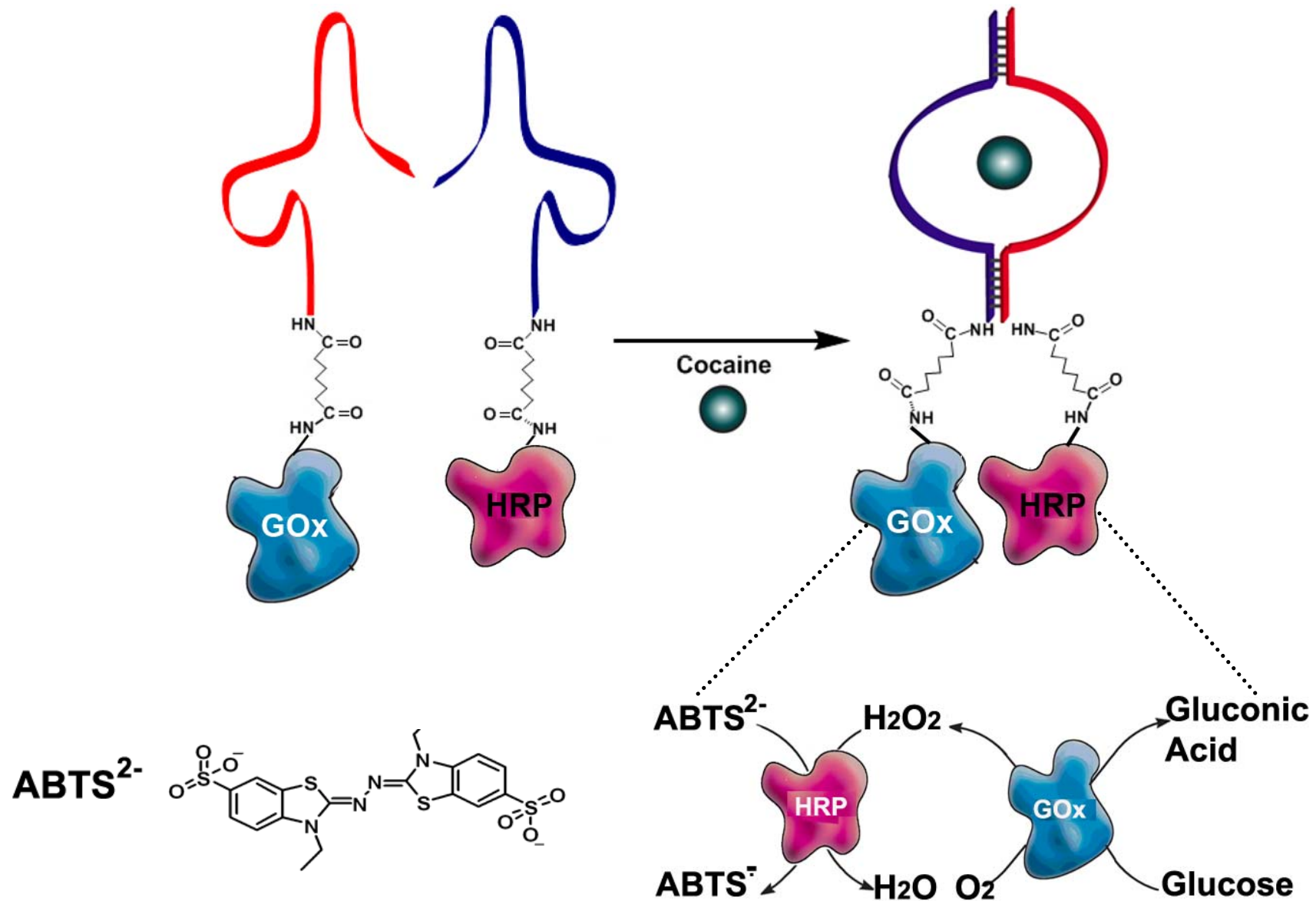
Polycatenated DNA-Thrombin Fluorescent Wire



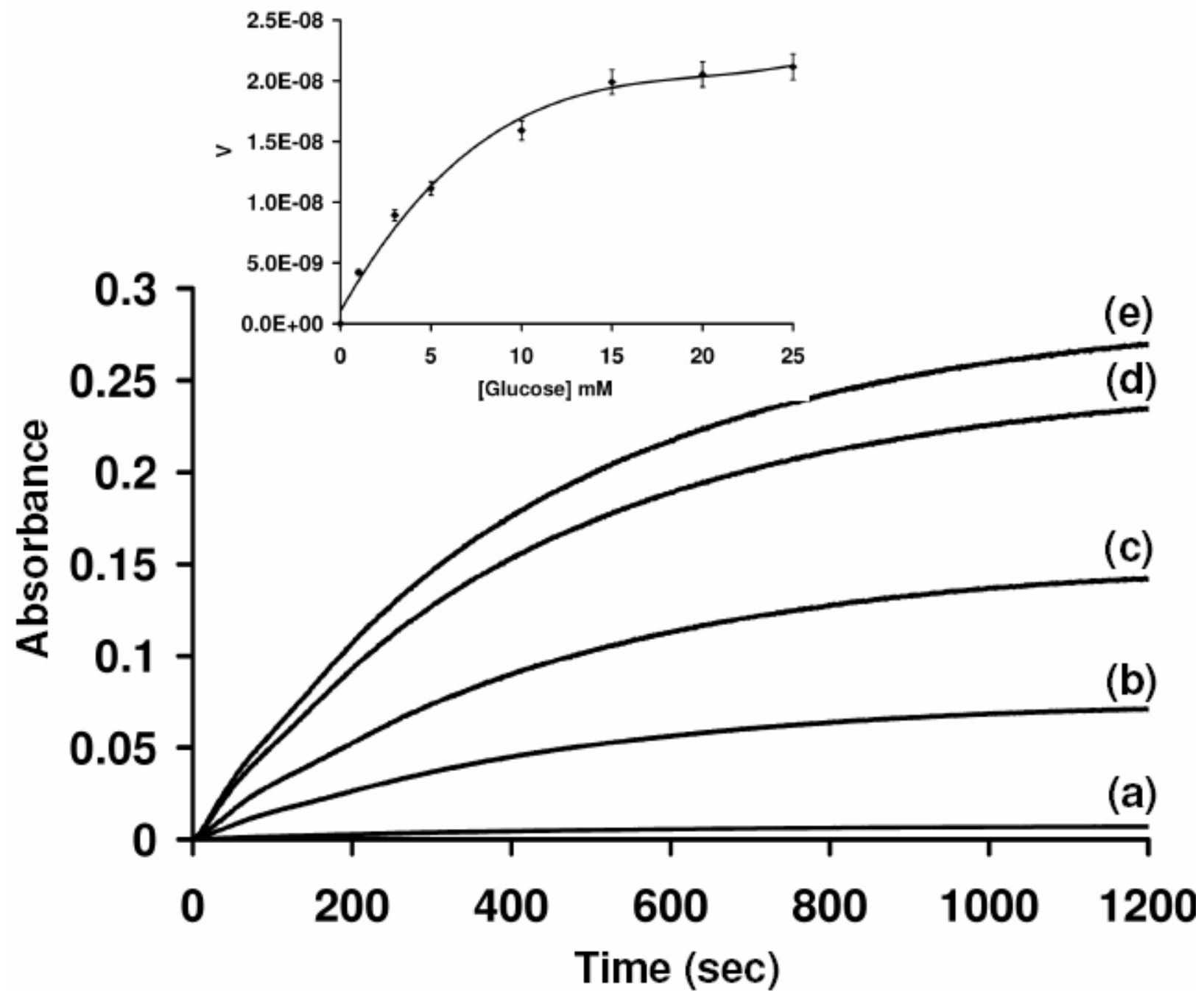


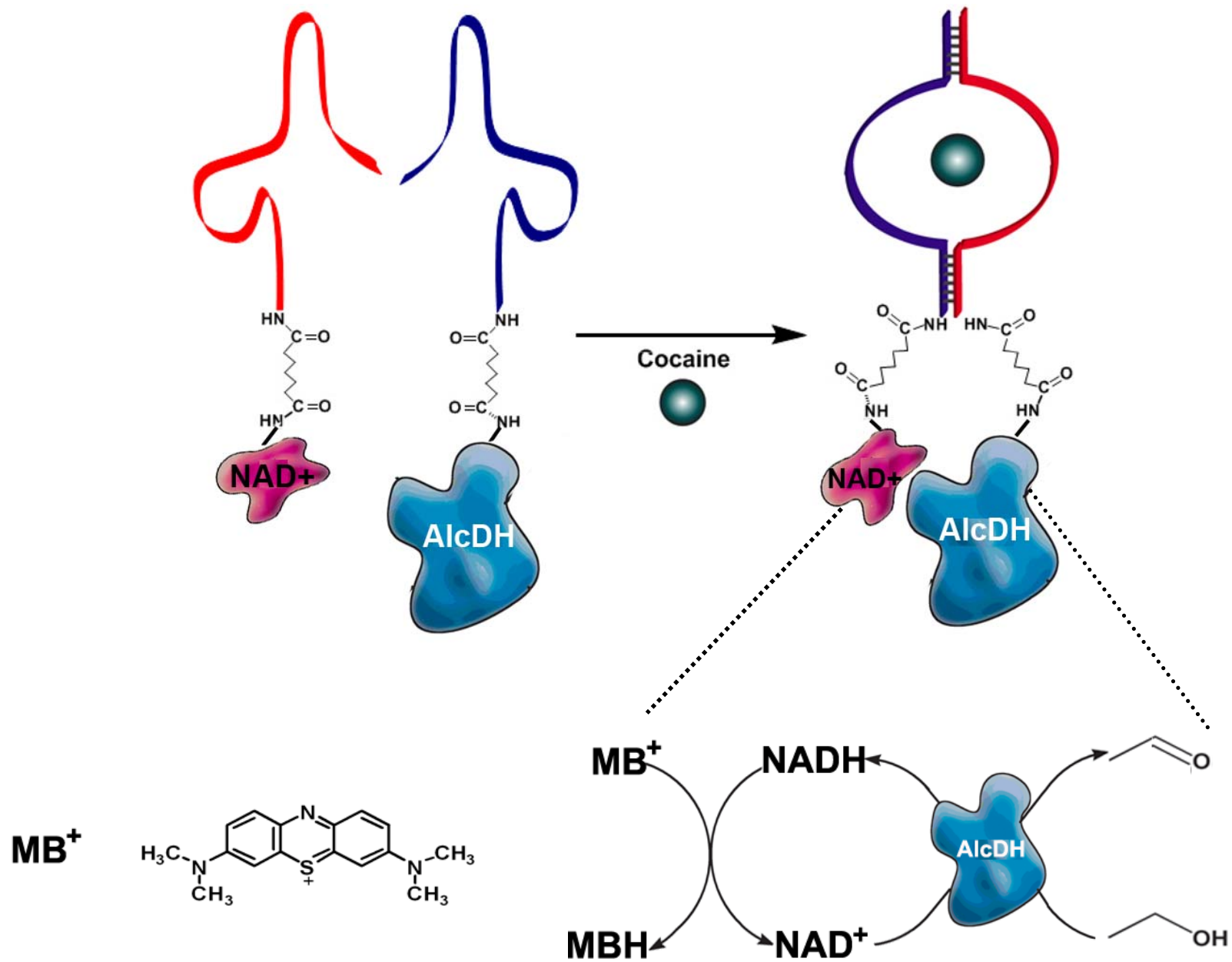
Nature Nanotechnol., 4, 249-254 (2009)

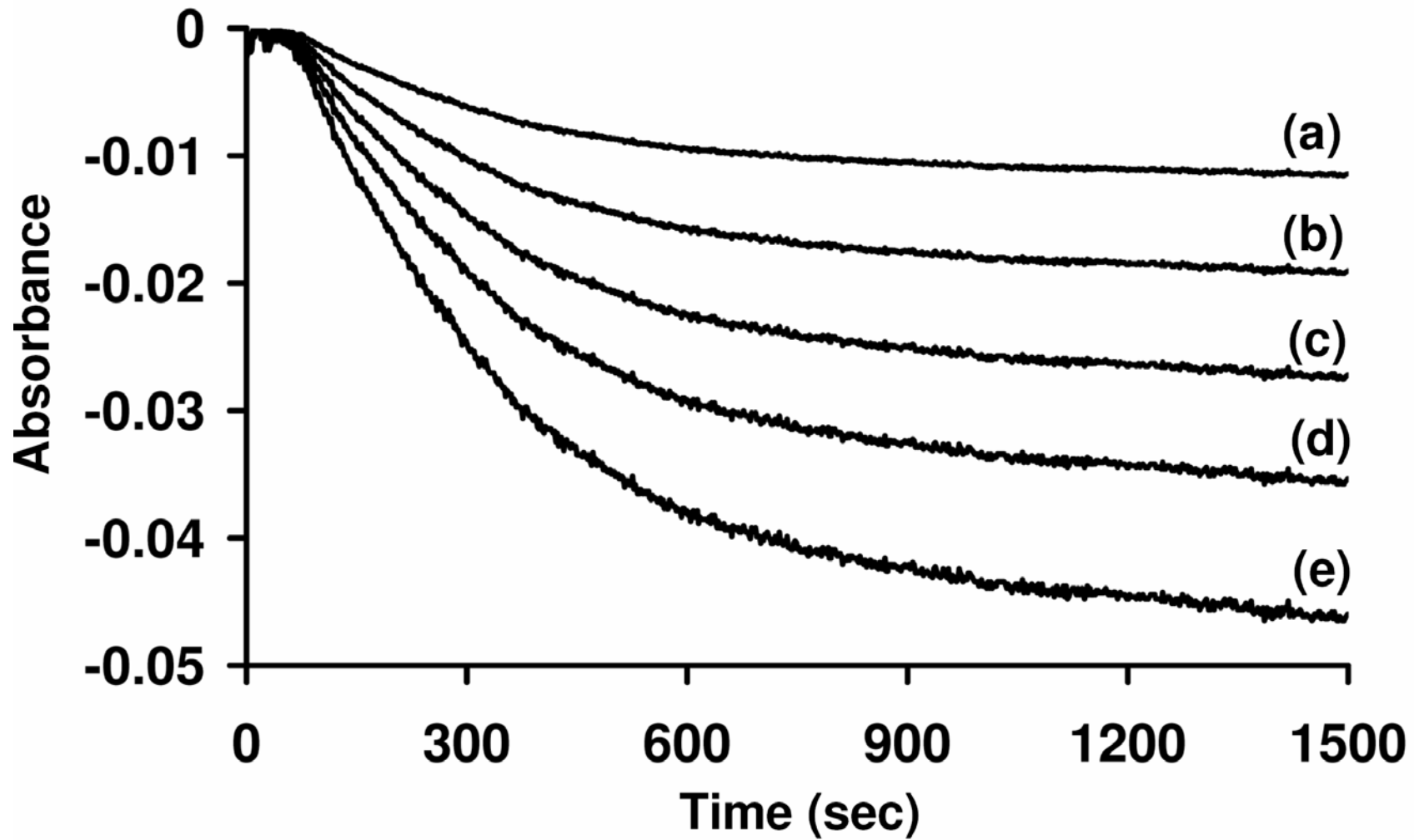


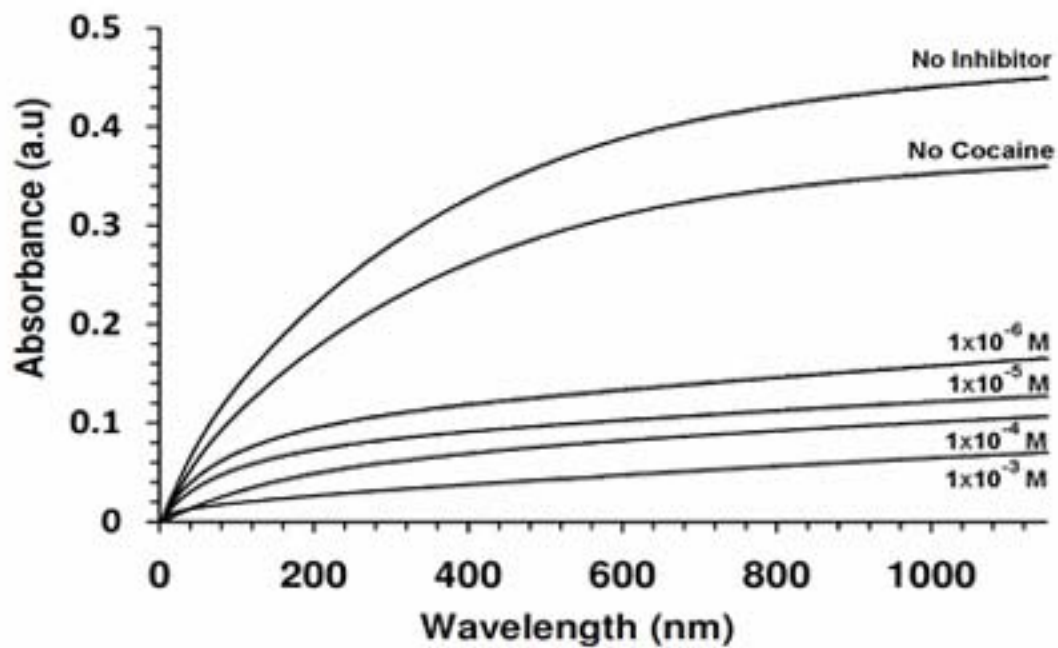
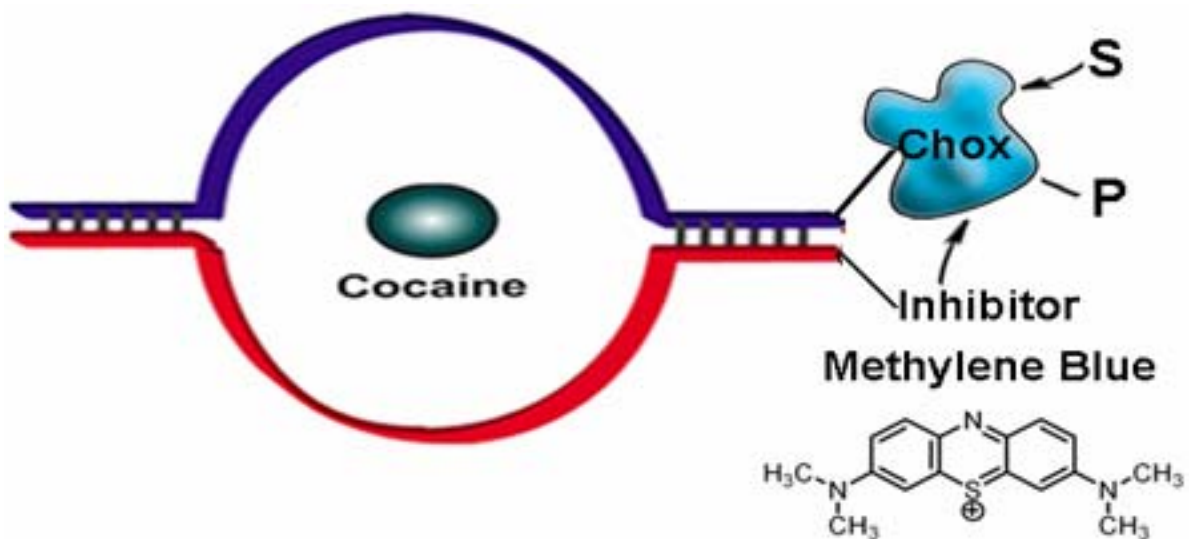


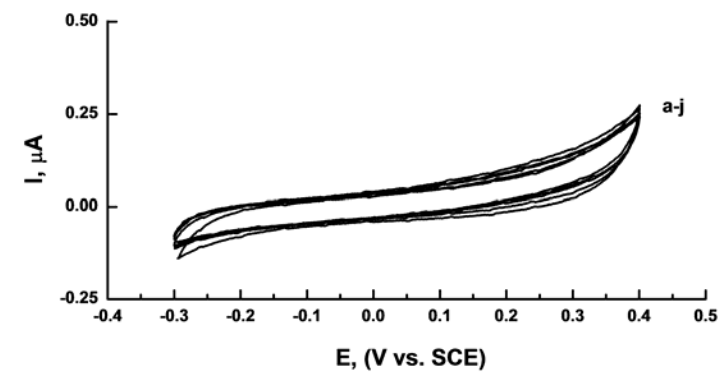
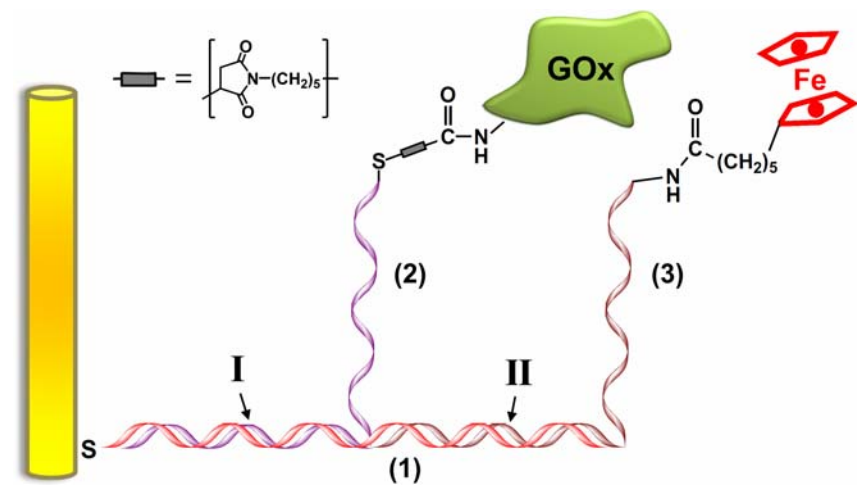
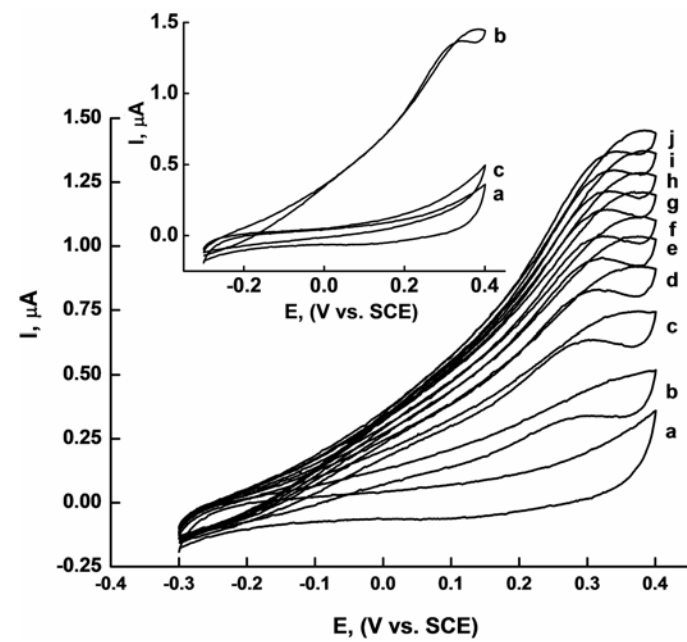
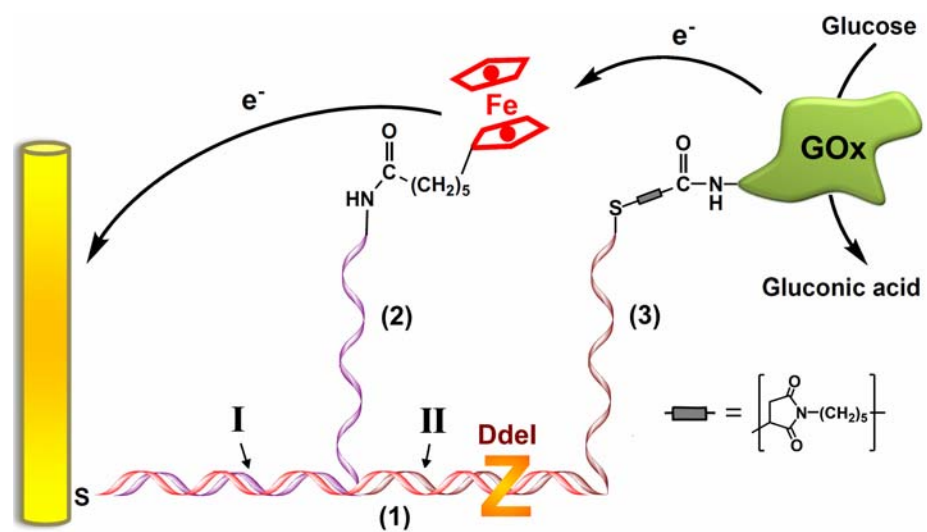
J. Am. Chem. Soc., 131, 5028 (2009)

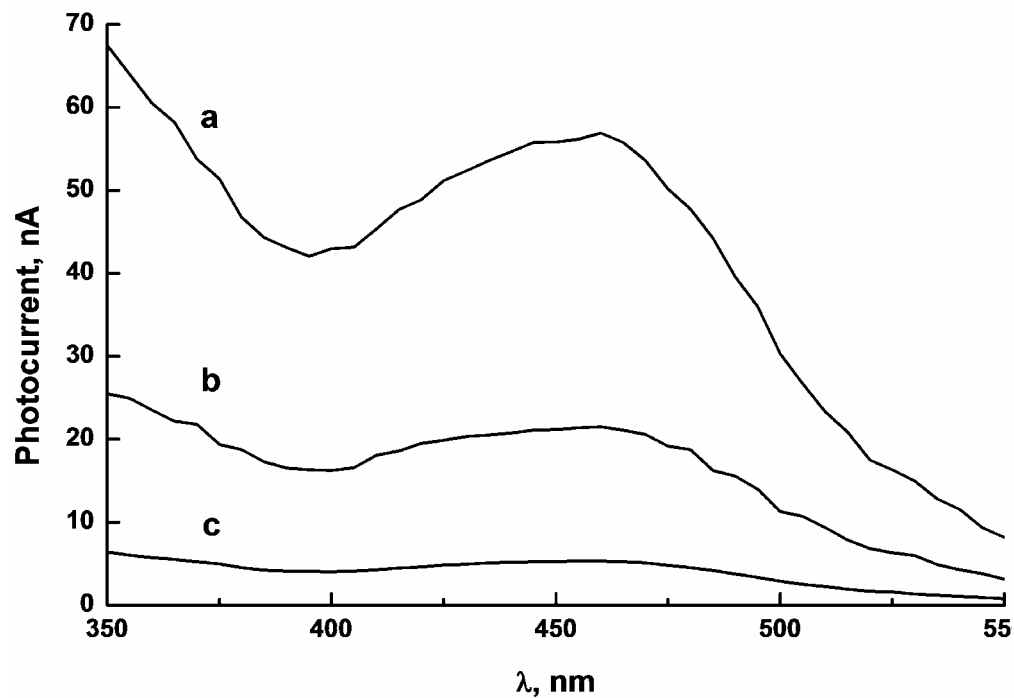
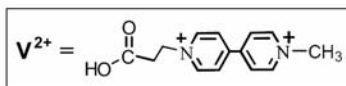
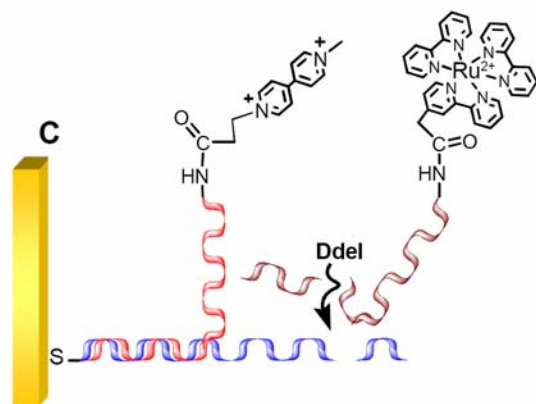
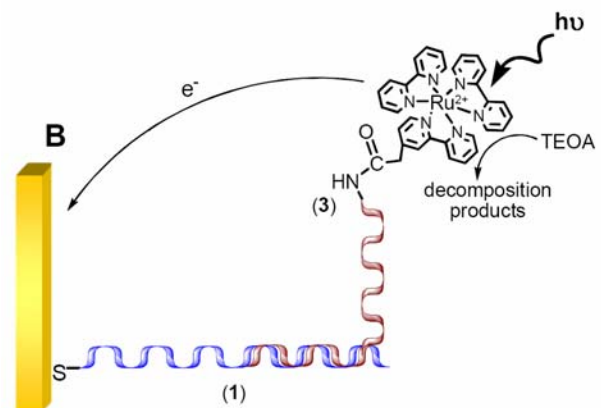
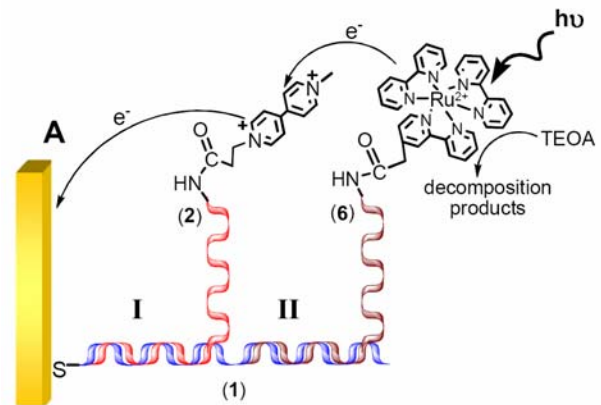






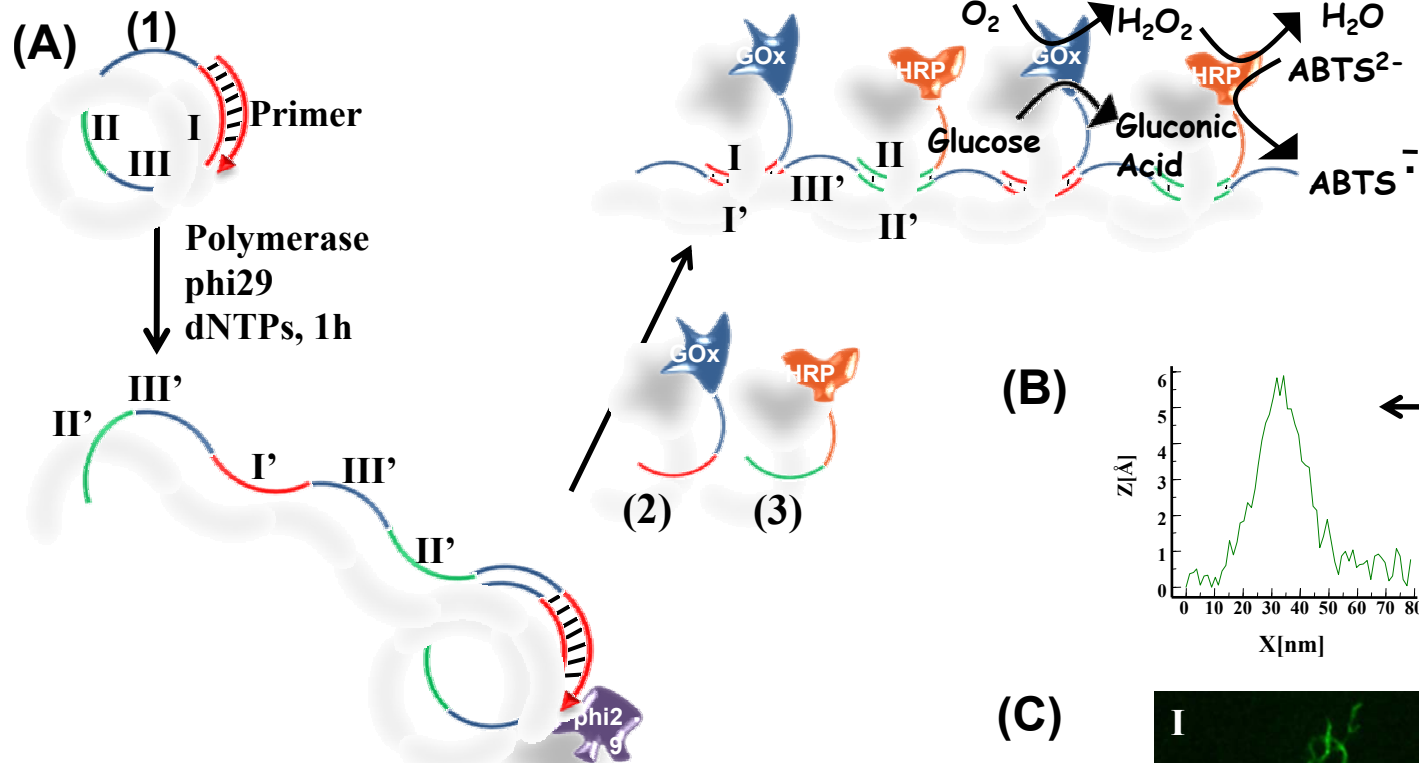




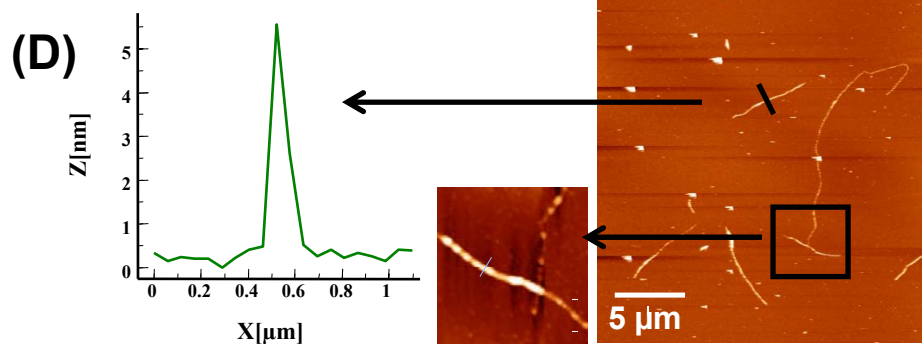
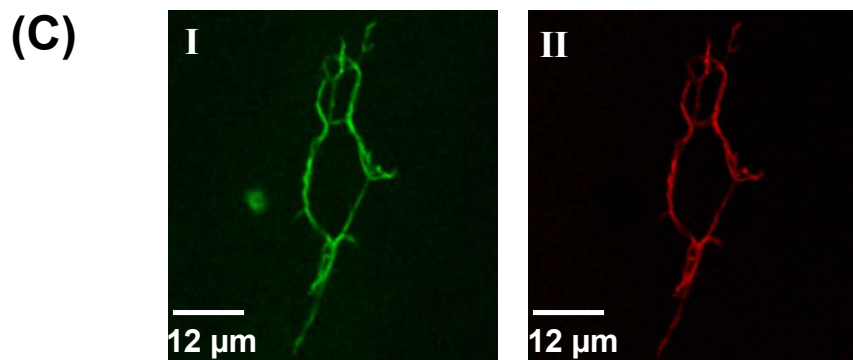
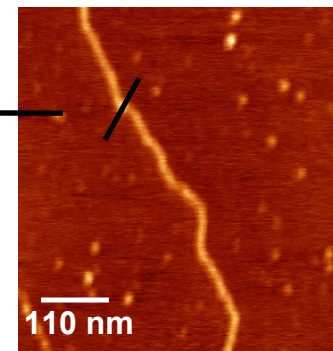
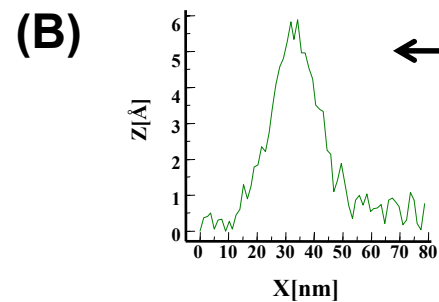
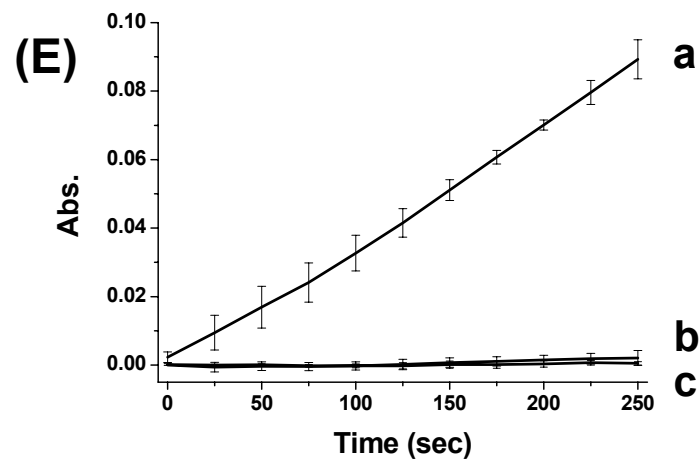


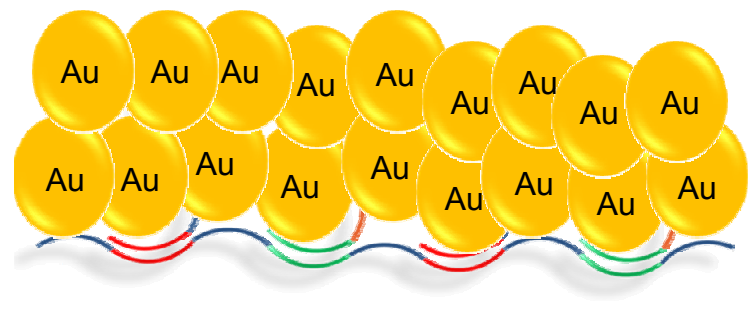
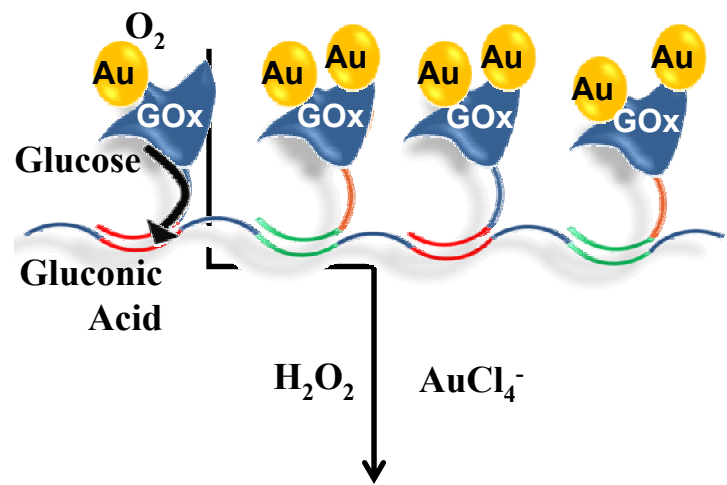
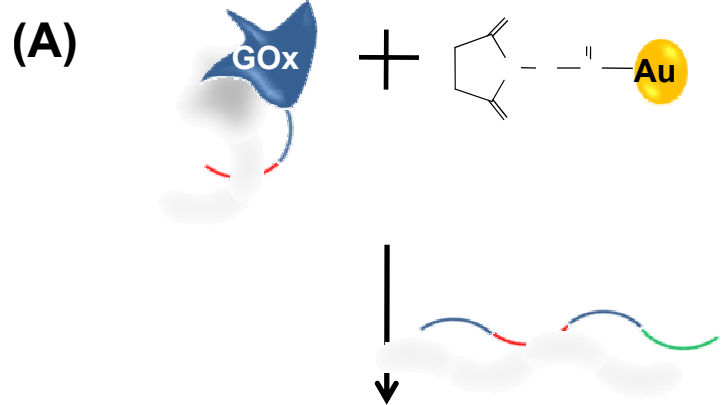
Angew. Chem. Int. Ed., 47, 8272 (2008)

Figure 1



(1)=5GACTGAAAAAAAAAAAAATGGATG
GATGGAAAAAAAAAAAAACTGACT3'
5'AAAACTGACTGACTGA3'
5'AAAAATGGATGGATGGA3'





(B)

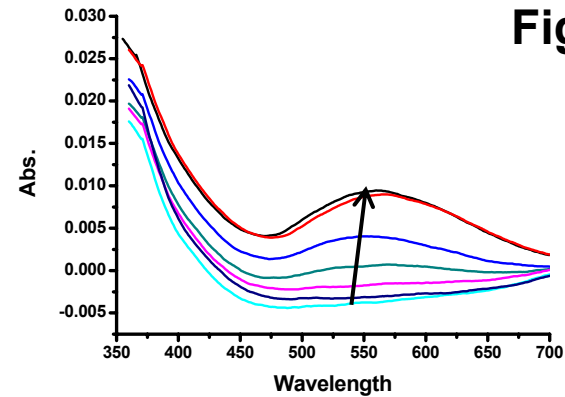
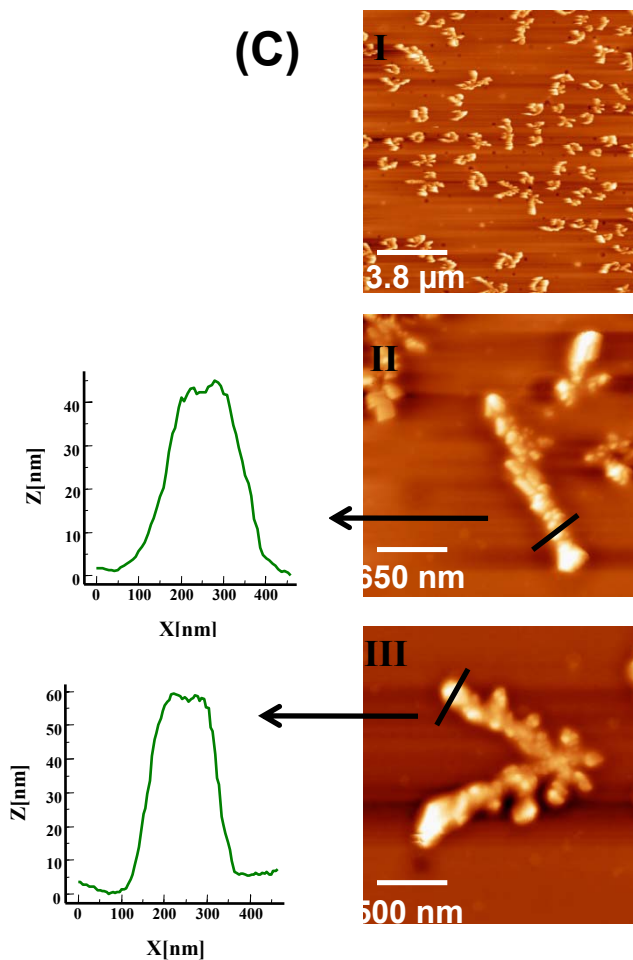


Figure 2

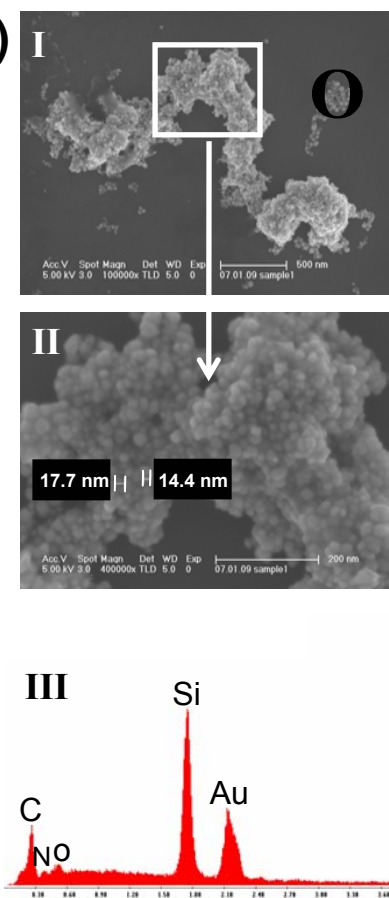
O

N O

(C)



(D)



Self-assembly of functional DNA nanostructures:

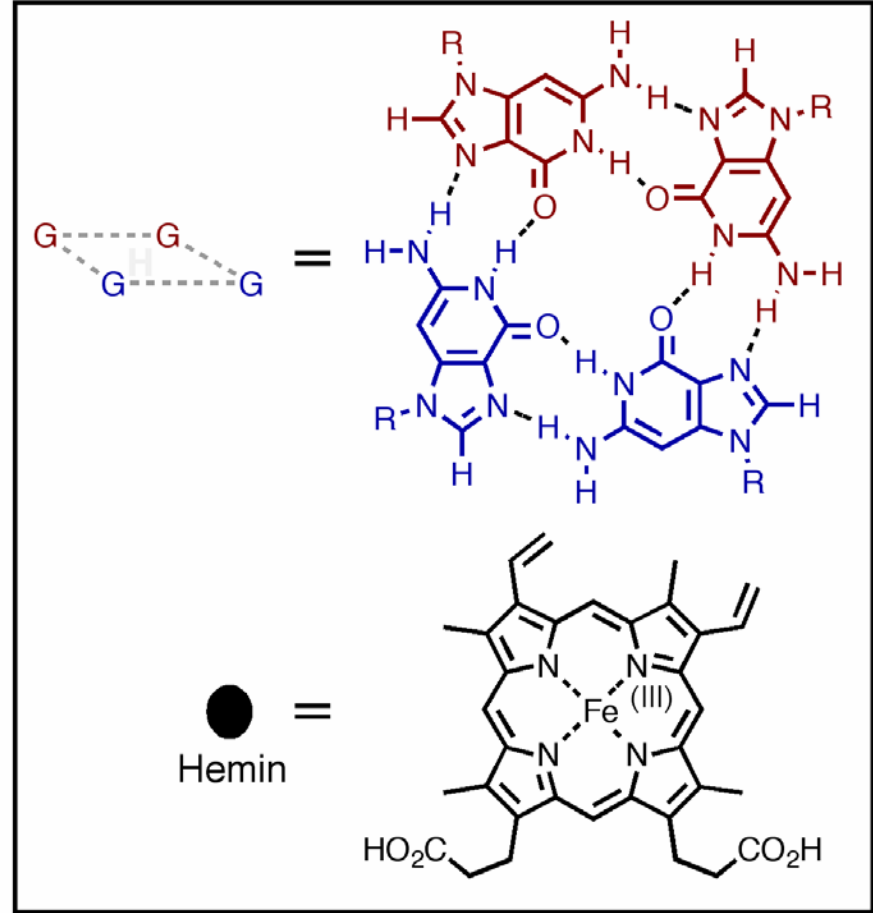
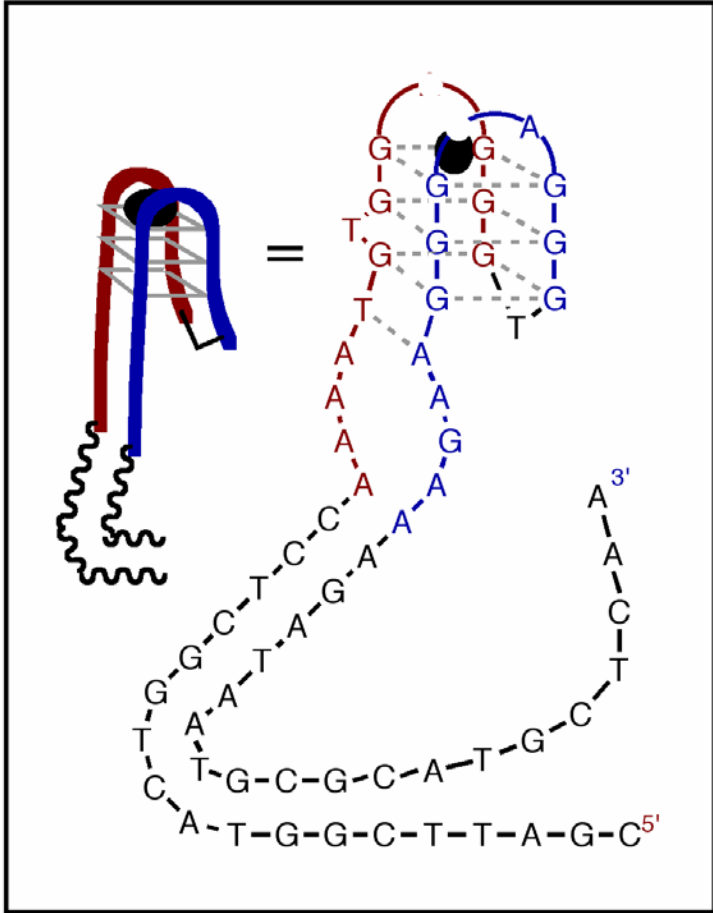
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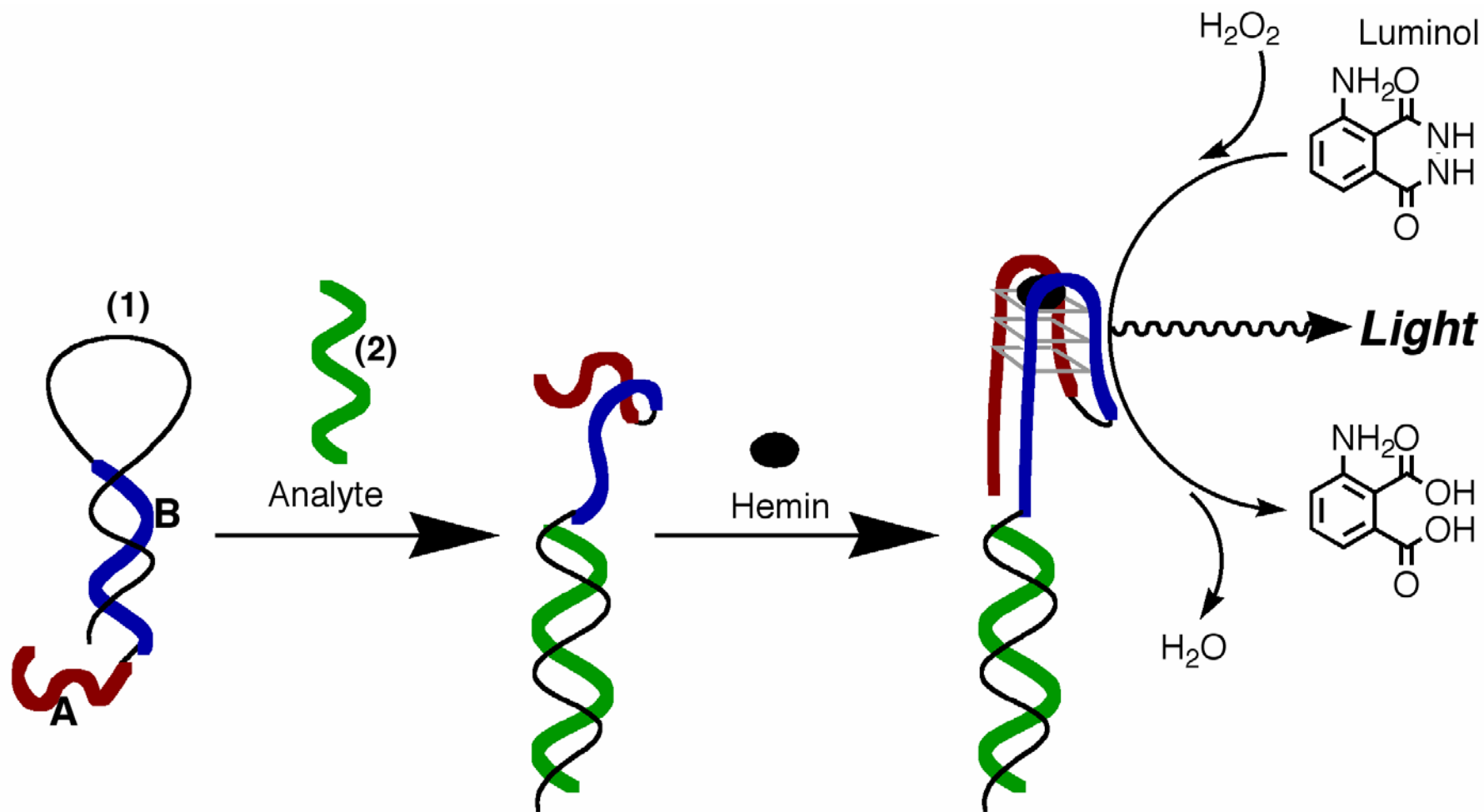
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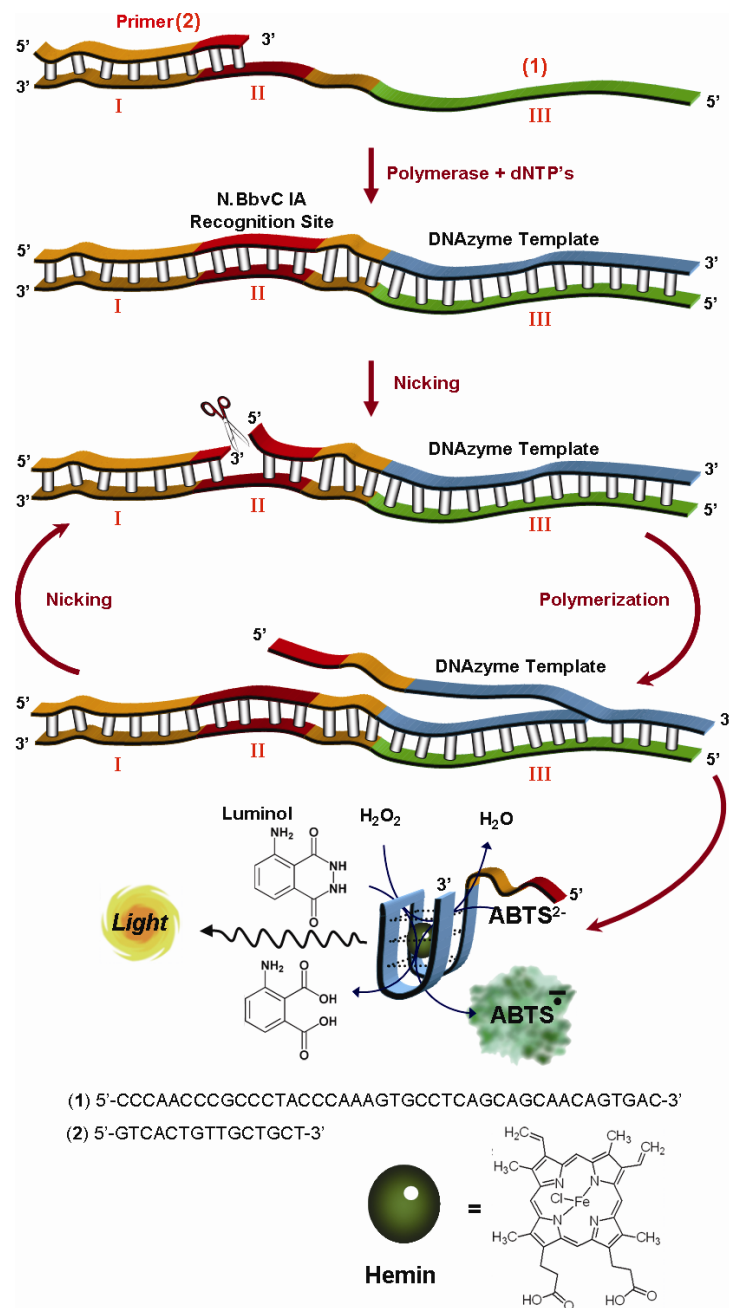
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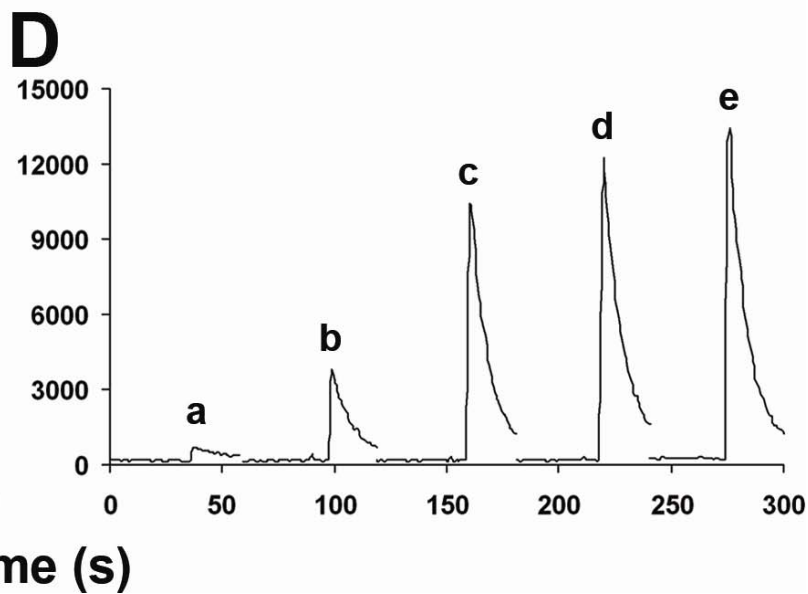
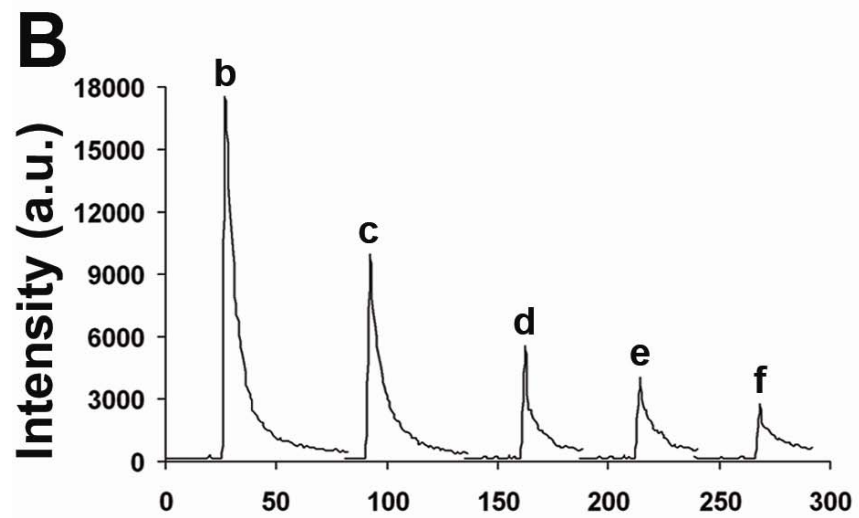
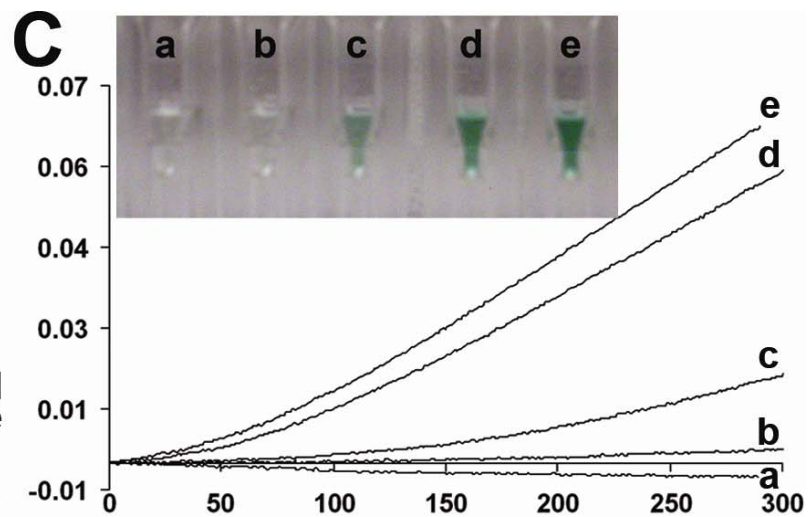
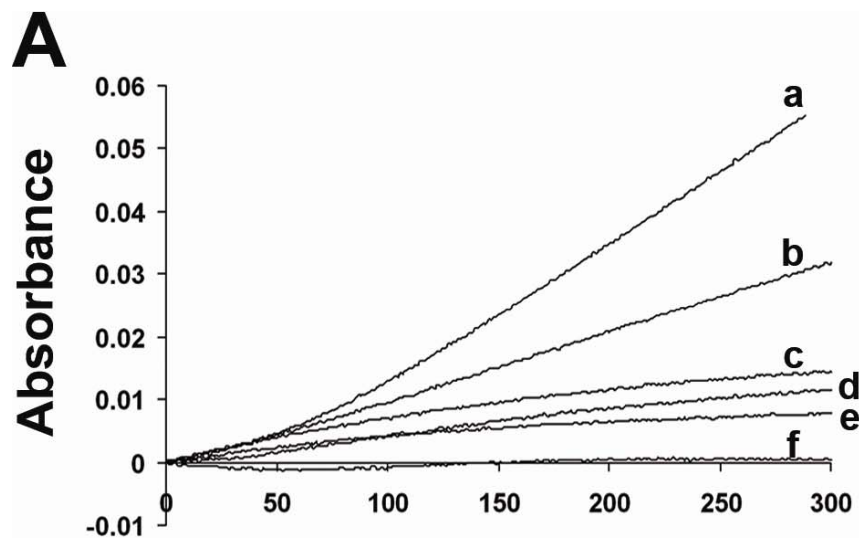


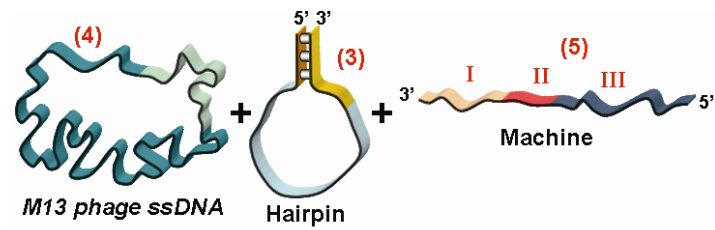


J. Am. Chem. Soc., 126, 7430 (2004)

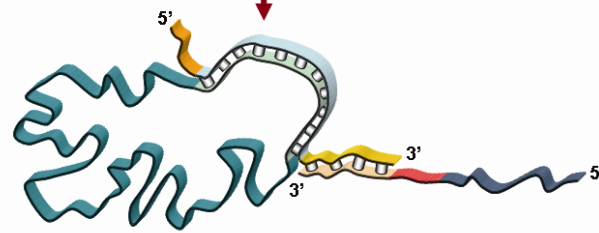


**Angew. Chem. Int. Ed.,
45, 7384 (2006)**

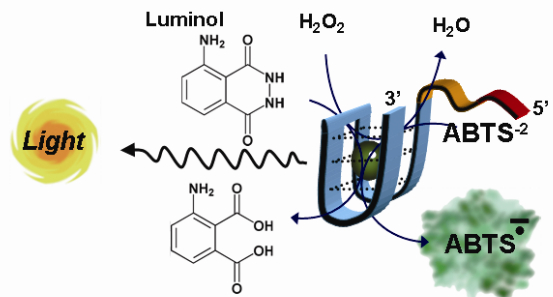
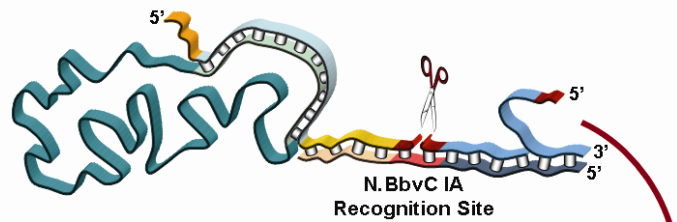




Hybridization

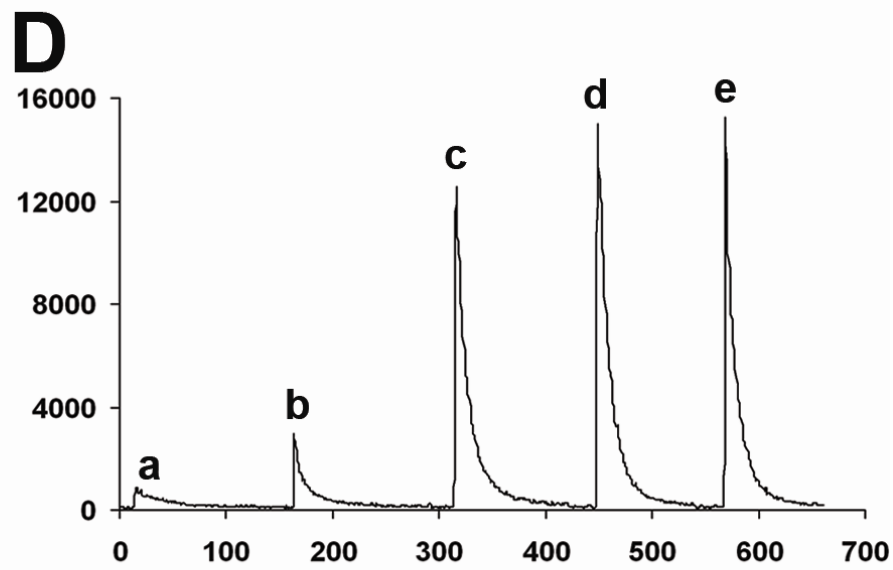
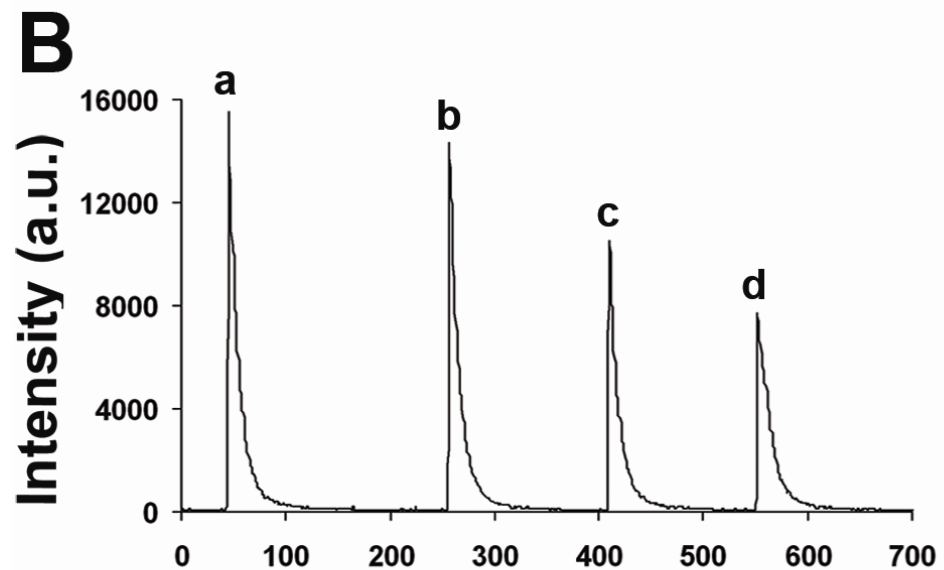
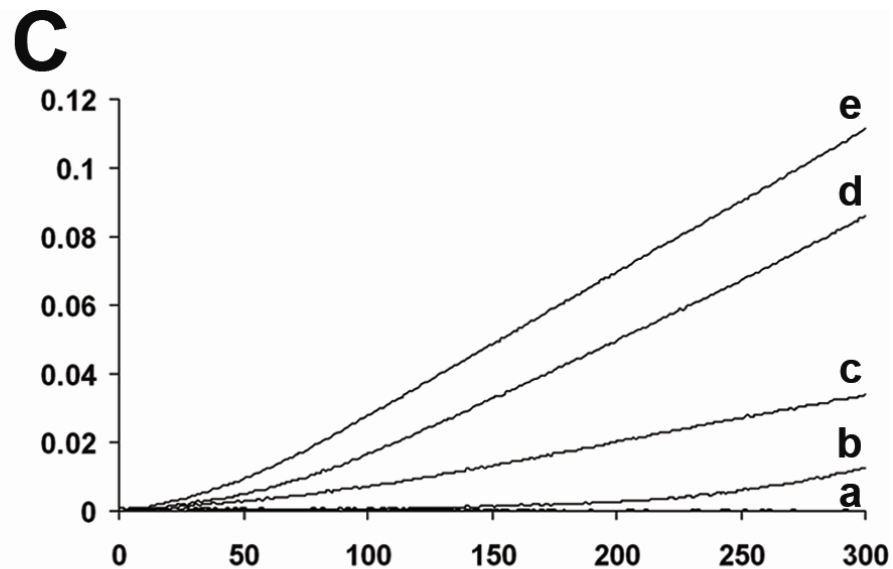
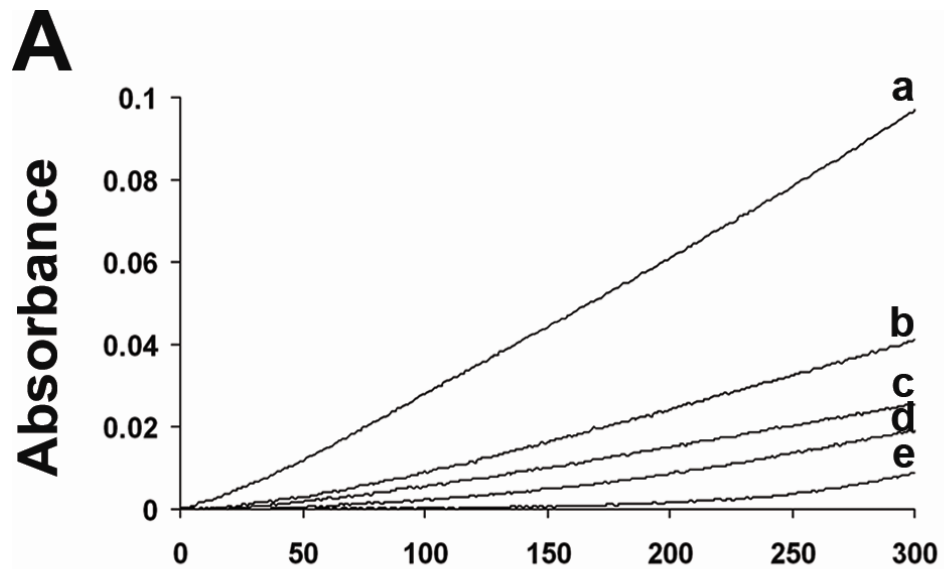


Polymerization & Nicking

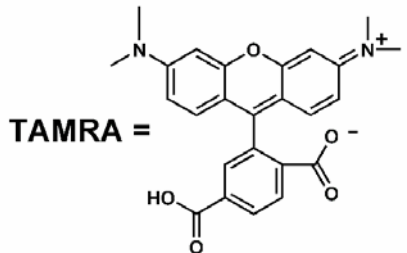
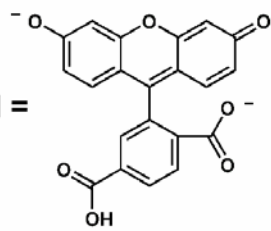
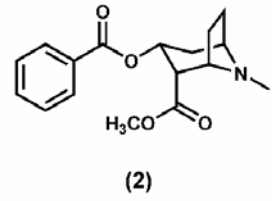
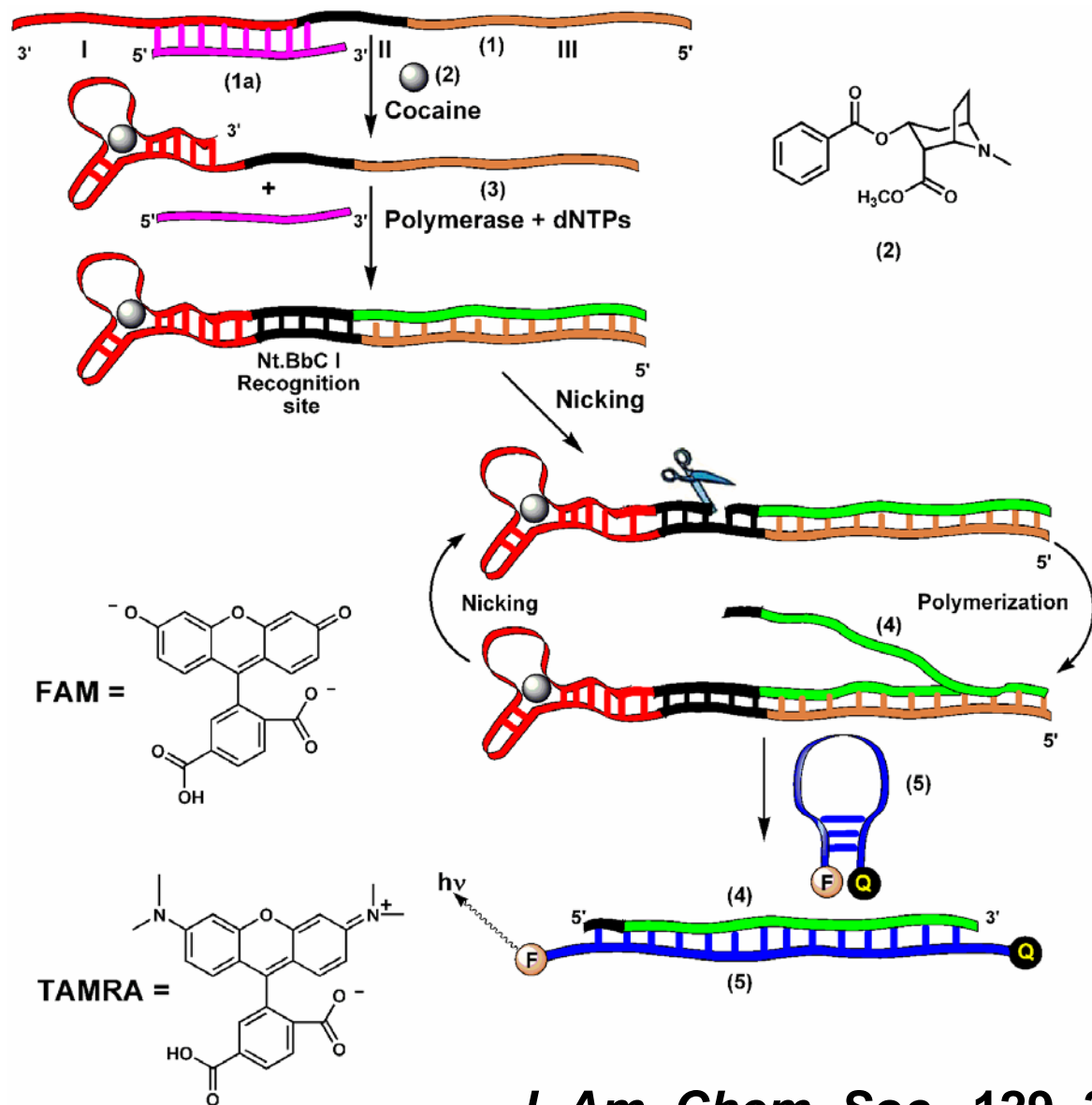


(5) 5'-CCCAACCCGCCCTACCCAACCTCAGCCCACACGATCCT-3'

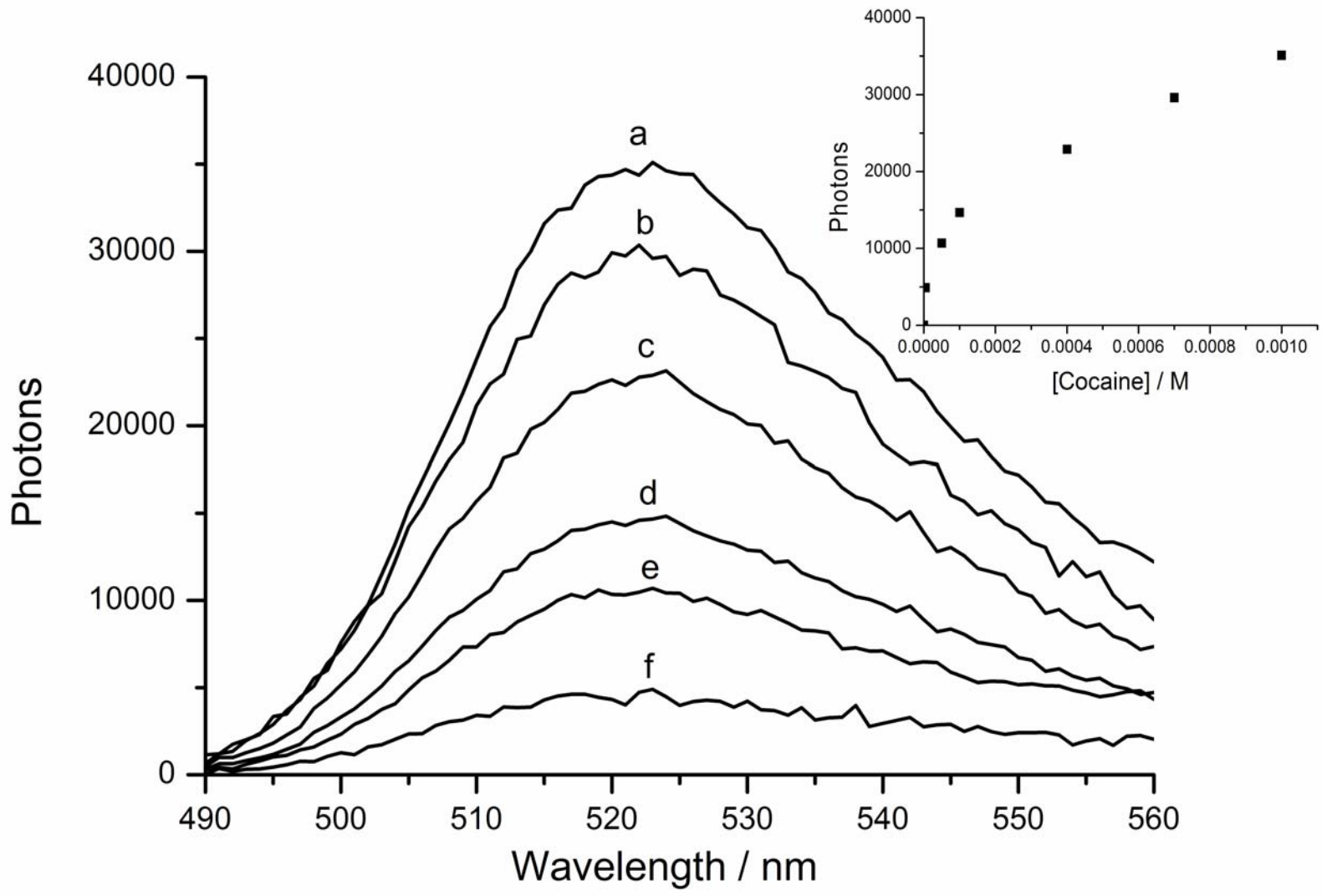
(3) 5'-CCACACGCAAAAAGATTAAGAGAGGATCGTGTGG-3'



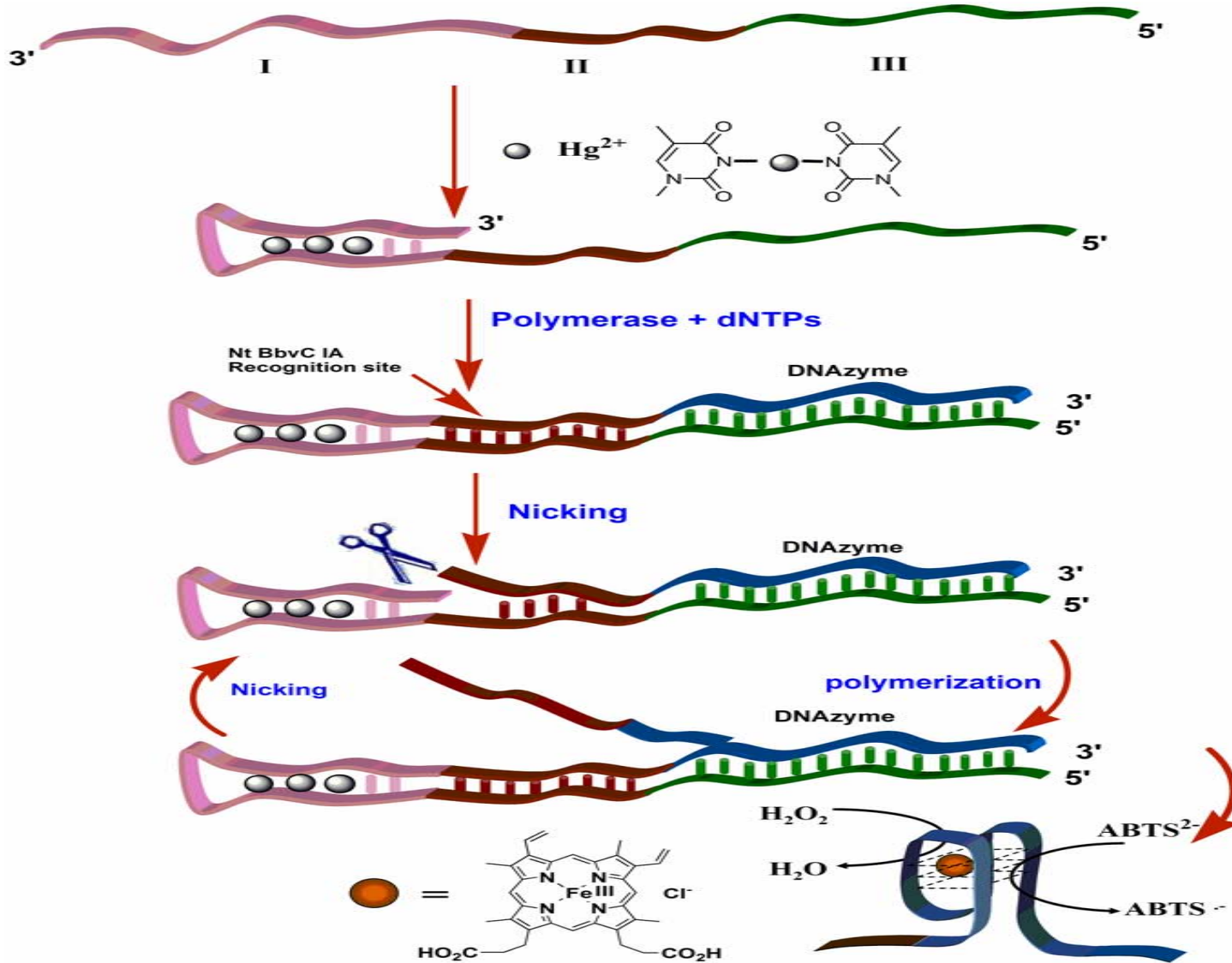
Time (s)



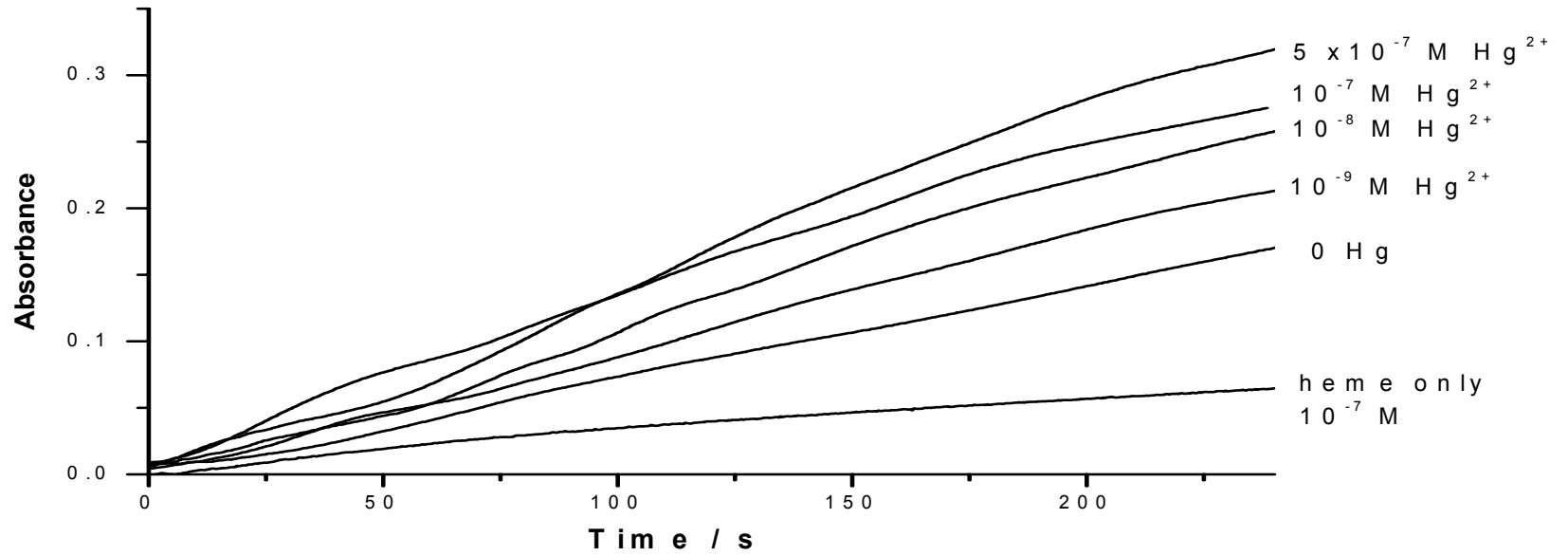
J. Am. Chem. Soc., 129, 3814 (2007)



Hg²⁺ Detection by a DNA Machine



Sensitivity



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