NANO HIGHLIGHT
Manipulation of DNA-protein Interactions at the Nanoscale

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The goal of this project is to develop in vitro methods of studying protein-DNA interactions, which are crucial to DNA packaging, repair, and transcription. To do so, we are stretching single molecules of DNA by either electric fields or flow fields, as shown in Fig. 1.

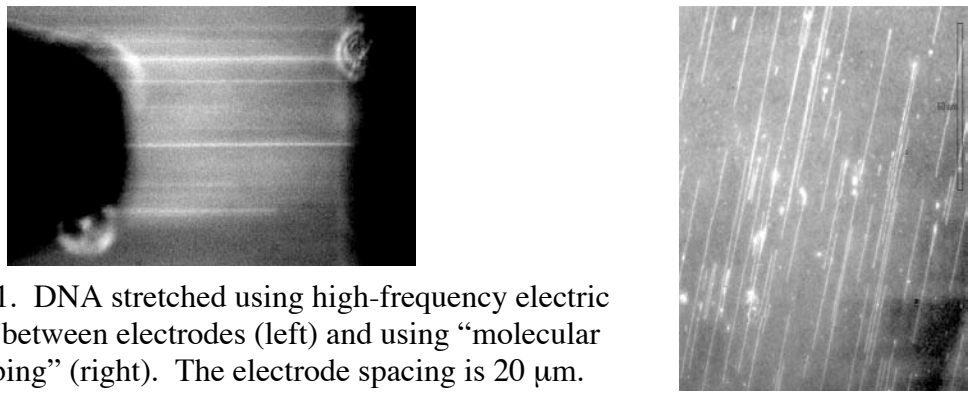
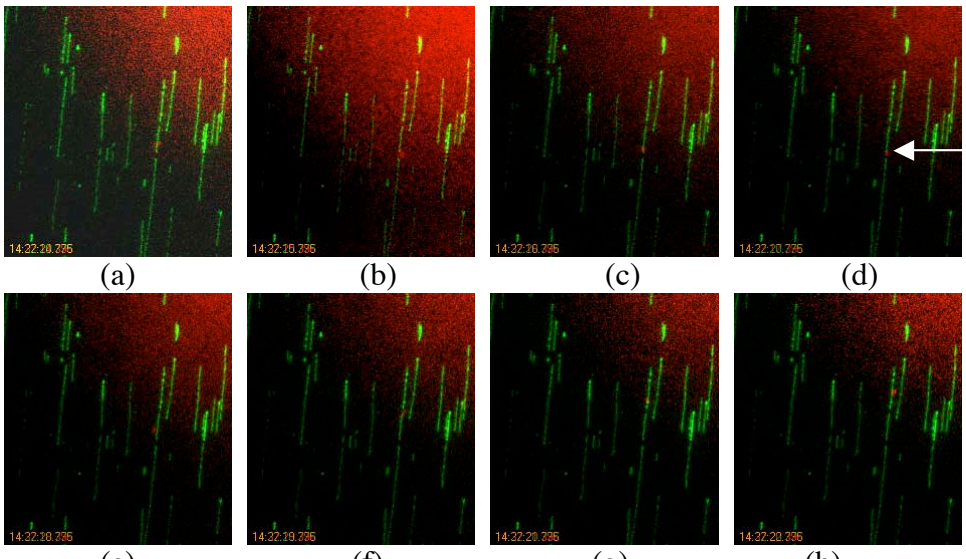


Fig. 1. DNA stretched using high-frequency electric field between electrodes (left) and using "molecular combing" (right). The electrode spacing is 20 μm.

Once stretched, we flow stained protein molecules past the DNA, to see if we can detect interactions, such as "sliding" of proteins along the DNA. "Sliding" is considered a possible way for the protein to efficiently find its target reaction site. In Fig. 2, type II restriction endonuclease EcoRI was fluorescently labeled using TRITC was injected into a customized flow cell where a cover glass with DNA stretched on its surface forms the bottom wall. Notice that the protein slides up the DNA molecule, whereas the flow is directed from left to right.



(a) (b) (c) (d)

(e) (f) (g) (h)

Fig. 3. (a) Photolabeled Eco RI (red TRITC stain) in contact with λ-DNA (green YOYO-1 stain) at times separated by one-second intervals. The red protein, indicated by an arrow in (d), slides along the DNA molecule.