

Peeling DNA from a Rigid Substrate

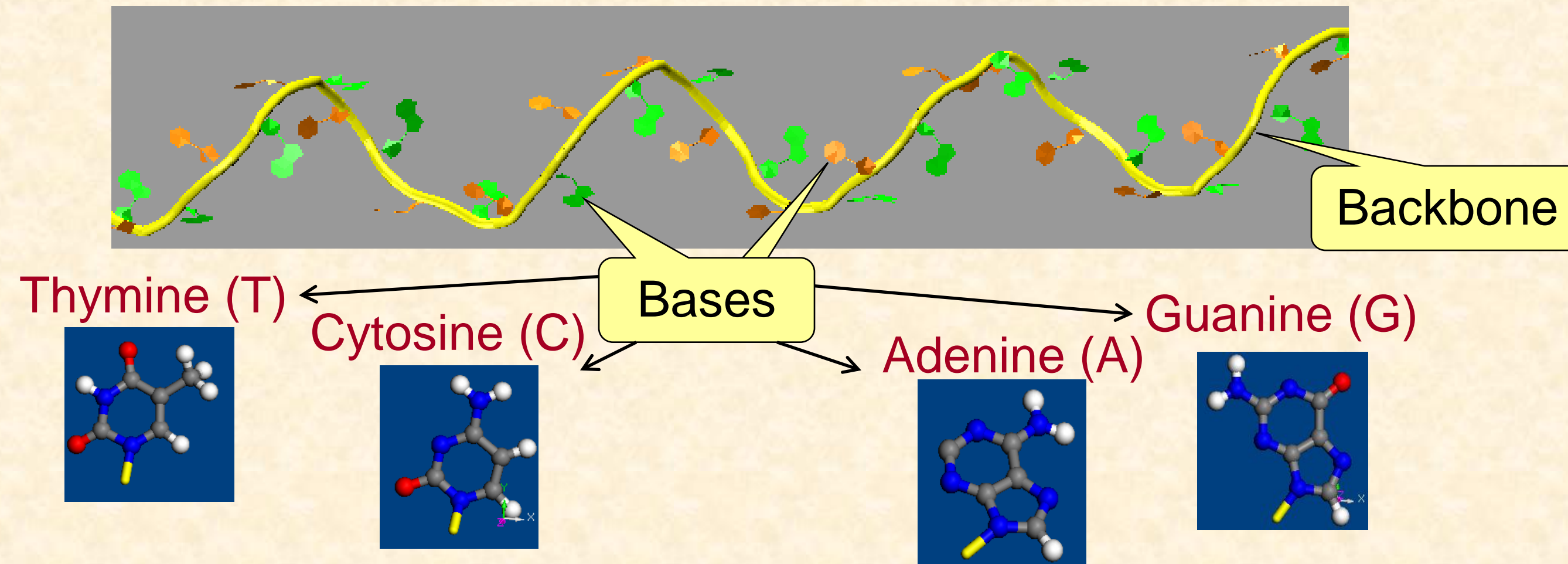
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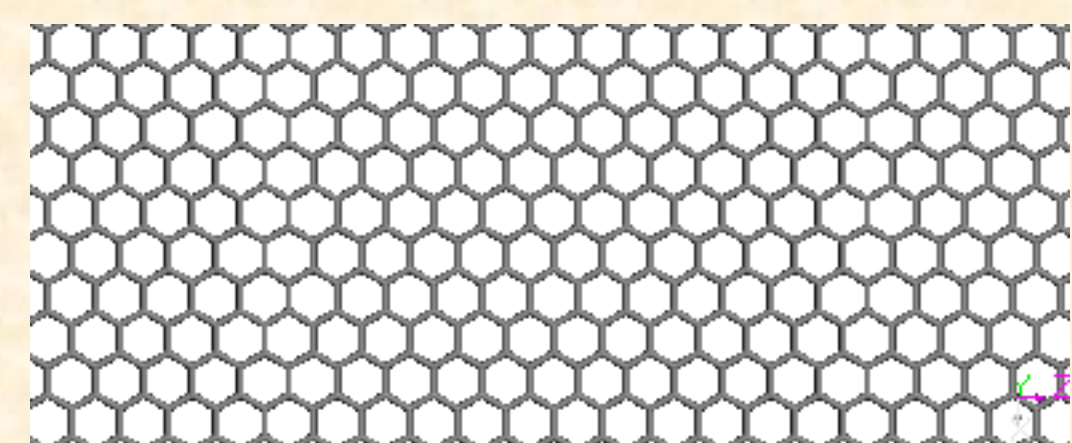
MOTIVATION

- Study *DNA/nanomaterial hybrids* – potential use in medicine (eg. drug delivery) and materials technology (eg. transistor).
- Develop a tool for DNA base *sequencing*.
- Understand the structure of *DNA–CNT* hybrids (potential use as DNA sensor, transistor and nanocomposites).
- Probe novel secondary and ordered-DNA structures (*DNA β-sheets* and *β-barrels*).
- All the above depend on the *sequence specific adhesion strength of DNA bases* which we seek to determine.

DNA – DEOXYRIBOSE NUCLEIC ACID

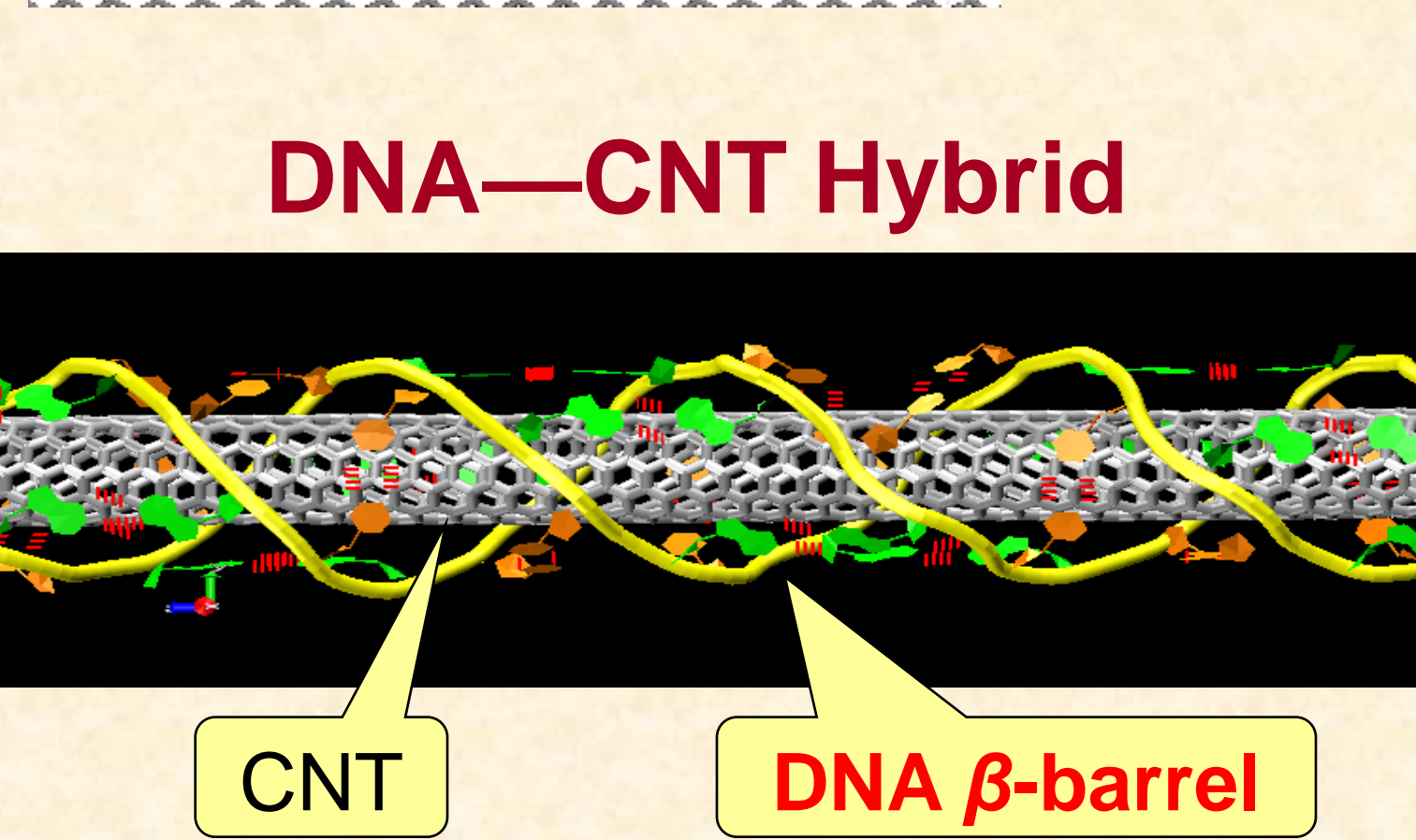


GRAPHITE

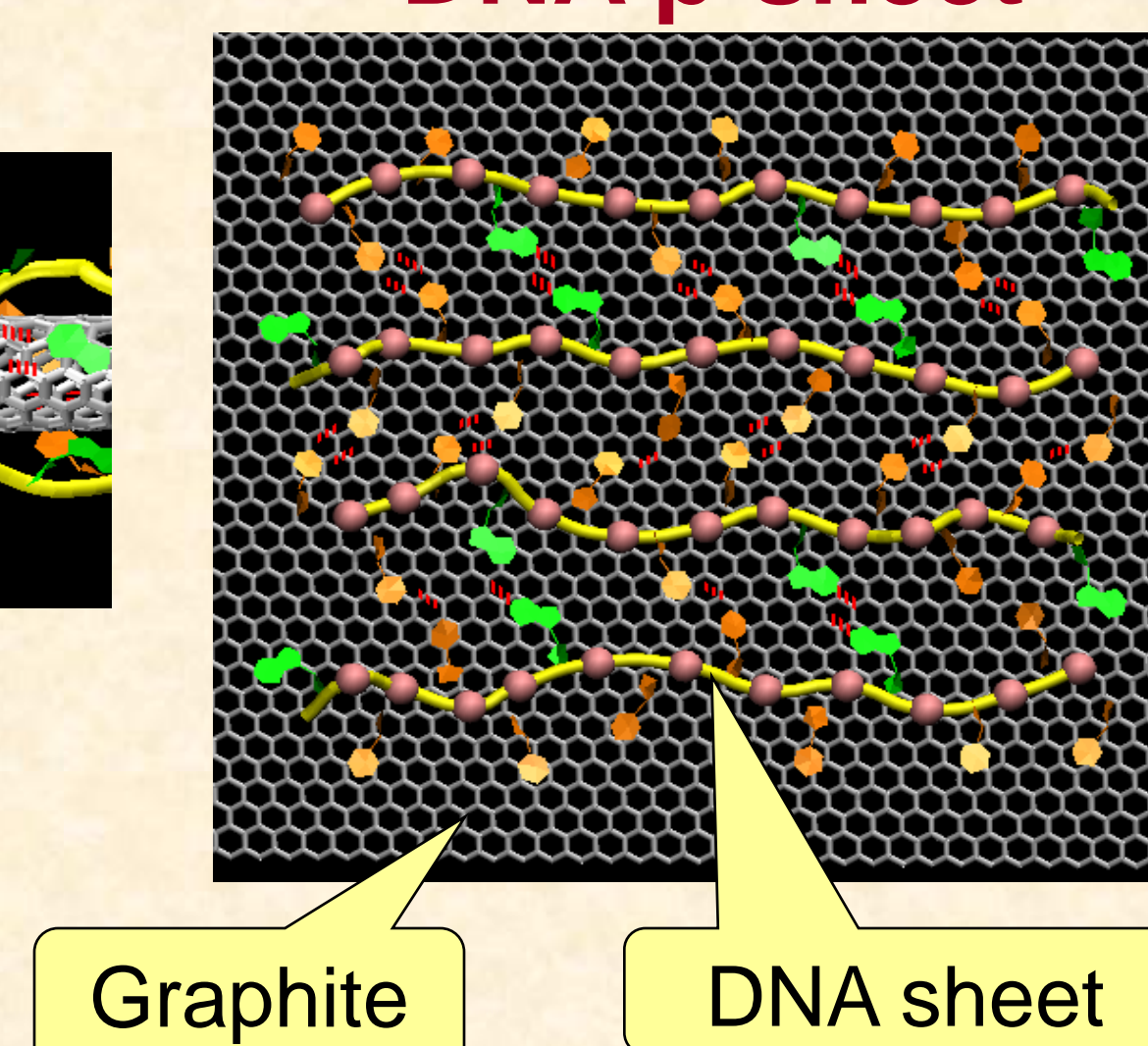


CARBON-NANOTUBE (CNT)

fold



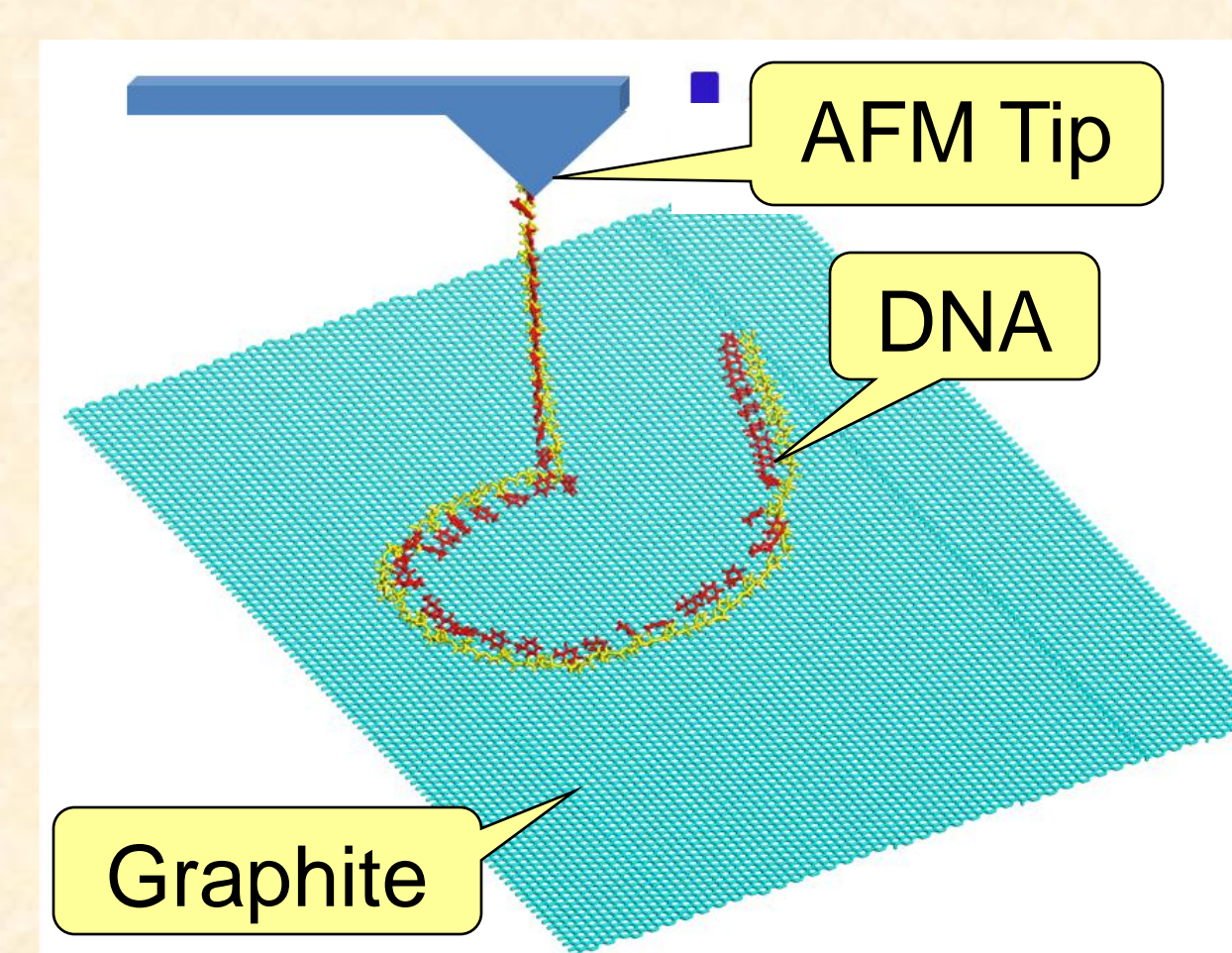
DNA β-sheet



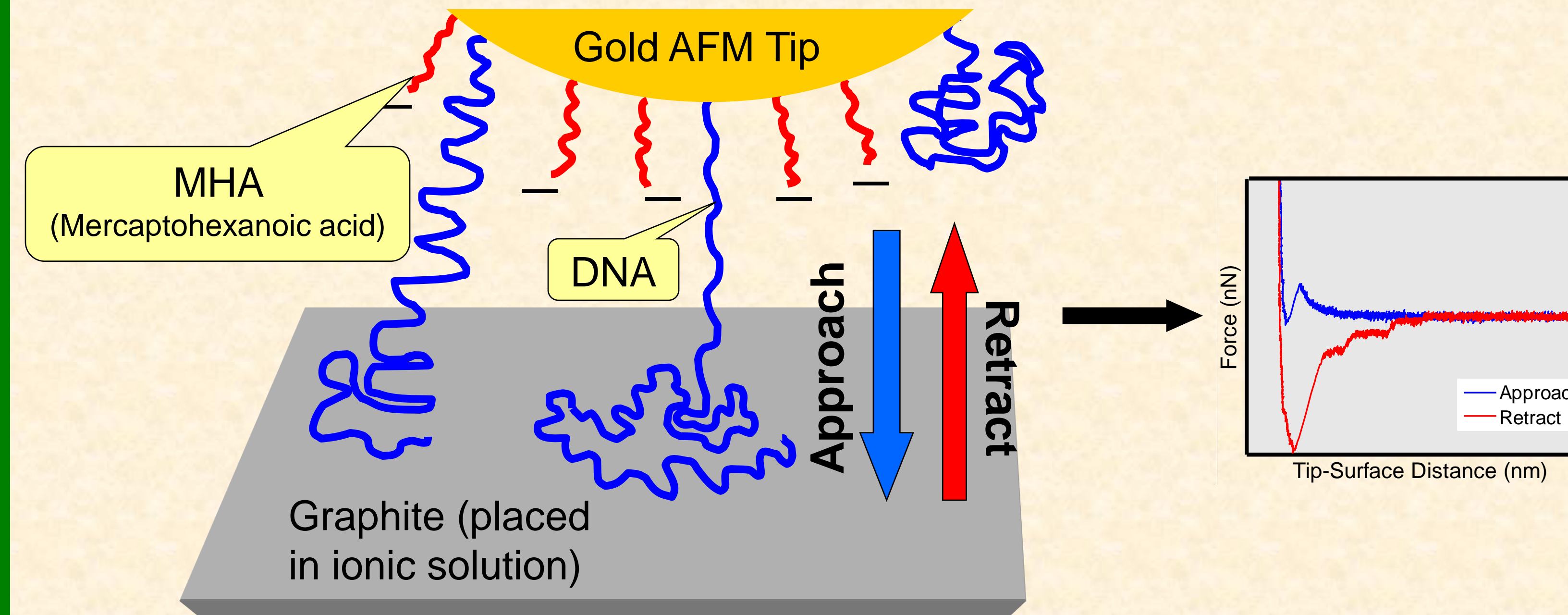
(Suresh Manohar)

OBJECTIVES

- Measure force required to peel DNA from a rigid surface (graphite) using Atomic Force Microscopy (AFM).
- Develop a model to relate peel force to adhesion energy between the two.

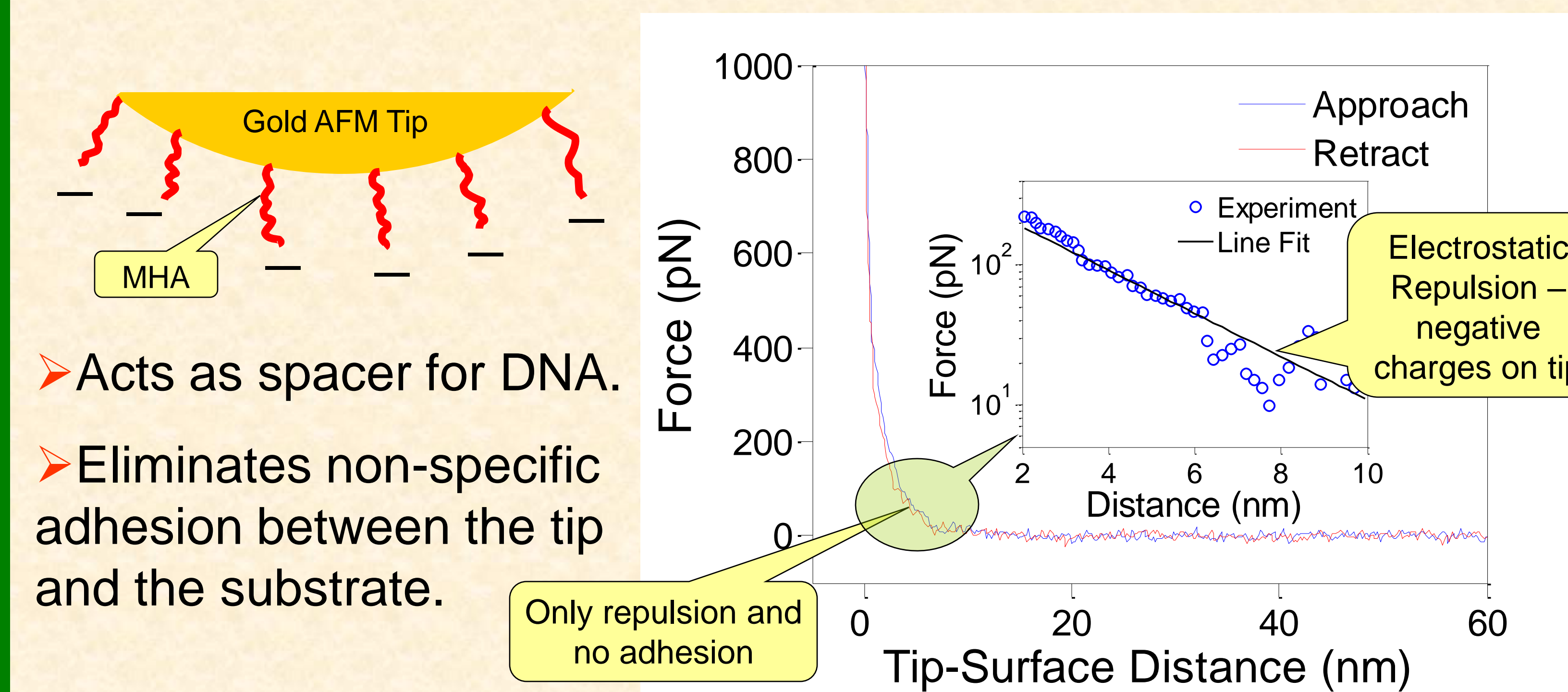


ATOMIC FORCE MICROSCOPY (AFM)



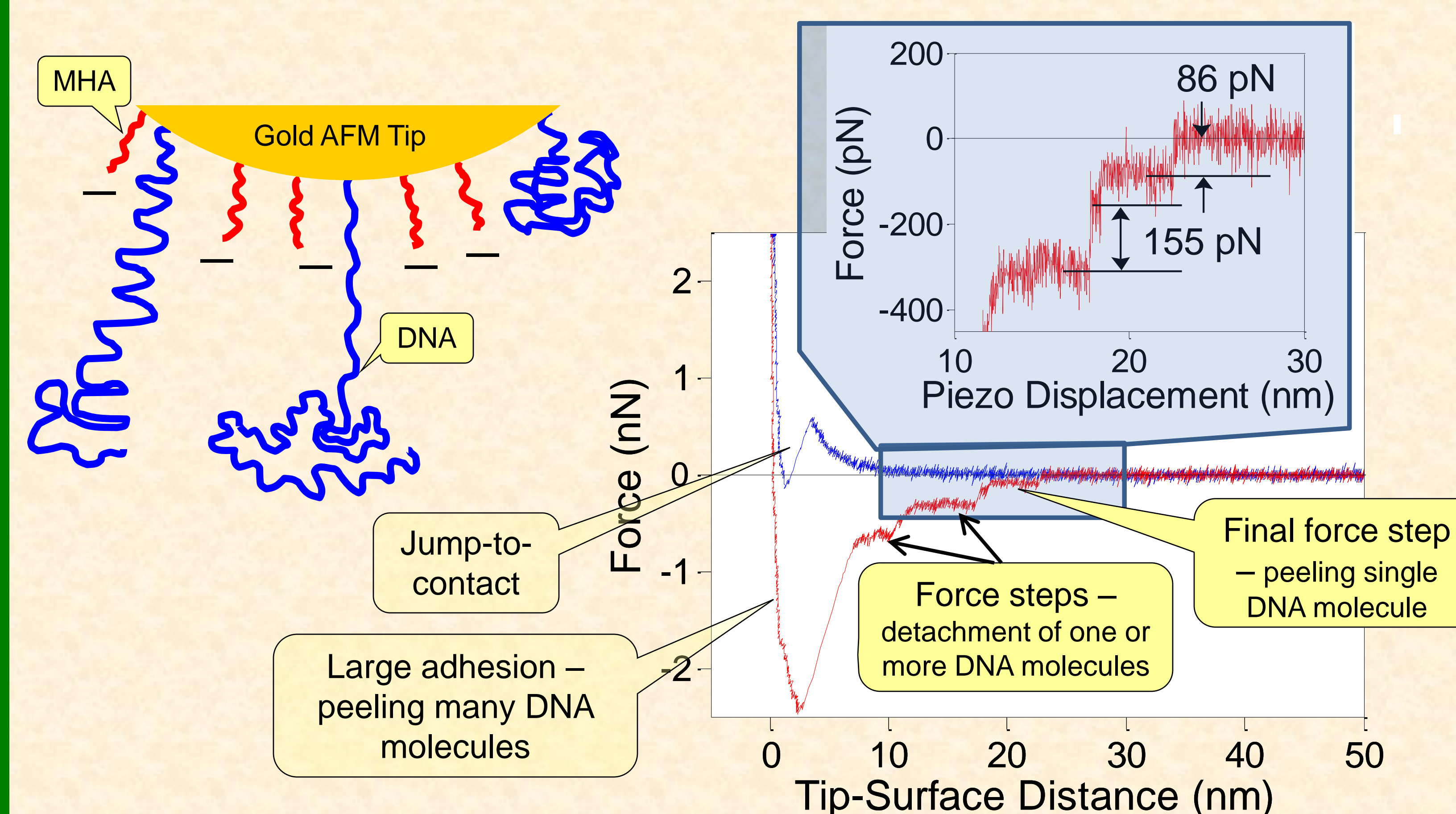
RESULTS

Purpose of Mercaptohexanoic Acid (MHA)

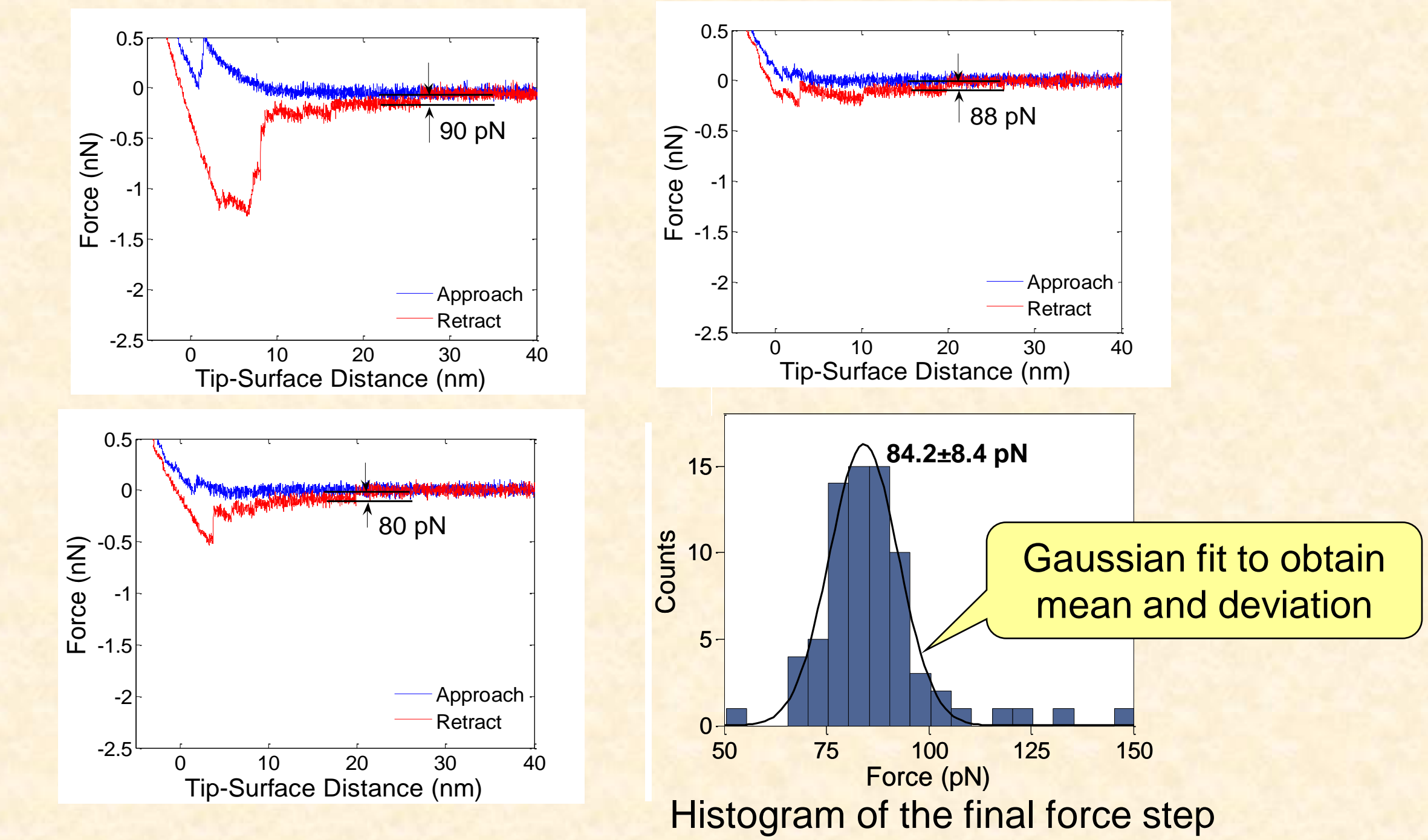


- Acts as spacer for DNA.
- Eliminates non-specific adhesion between the tip and the substrate.

Peeling DNA from Graphite



Typical Force Curves for Peeling DNA from Graphite

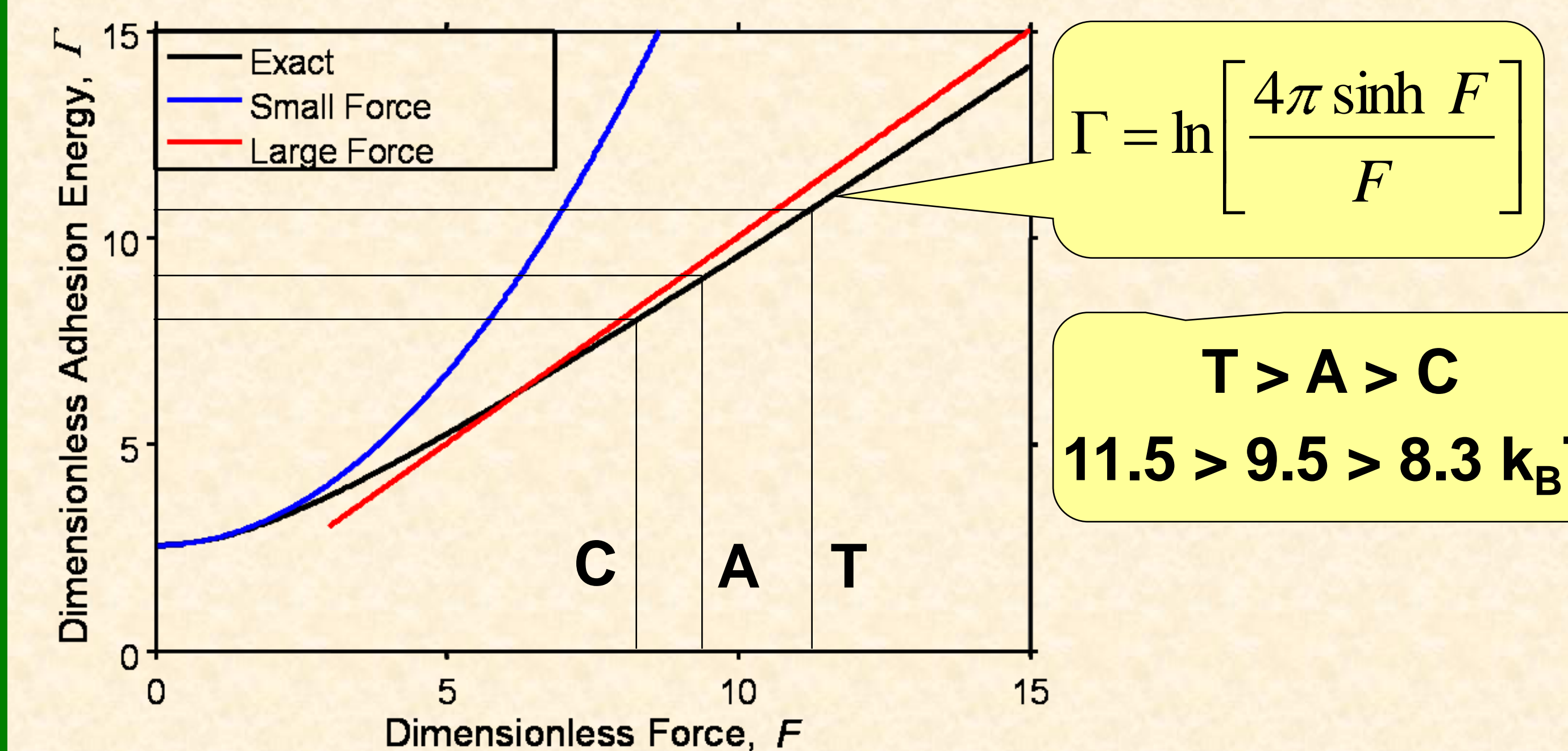


- Variable initial adhesion peak.
- Final force step is a characteristic feature in all force curves – interpreted as peeling single DNA molecule.
- Force step is independent of salt concentration and rate (velocity of approach/retract).

MODEL

- To relate measured force to adhesion energy of DNA with graphite.

Relation:



CONCLUSIONS

- Tool for direct measurement of peel force between a single molecule and substrate.
- Potential tool for DNA base sequencing.
- Polymer binding ($T > A > C$) is different from single base binding ($A > T > C$).
- Plausible technique to study secondary DNA structures.

ACKNOWLEDGEMENTS

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