NanoSurface Biosciences
POSTECH

Nanoscale Mapping of Pax6 mRNA in a Tissue with Picoforce AFM

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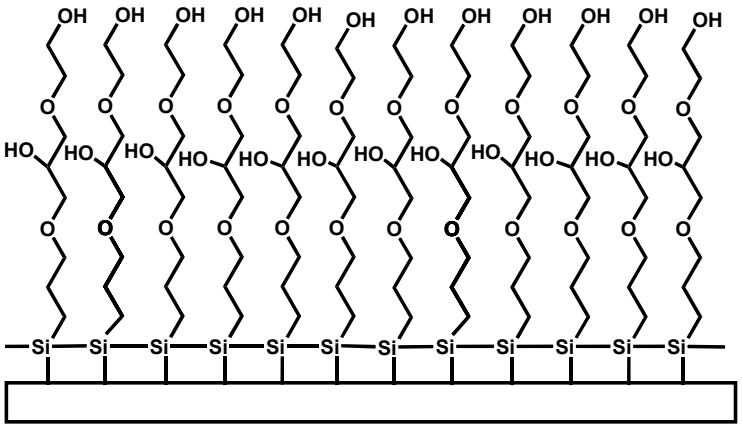
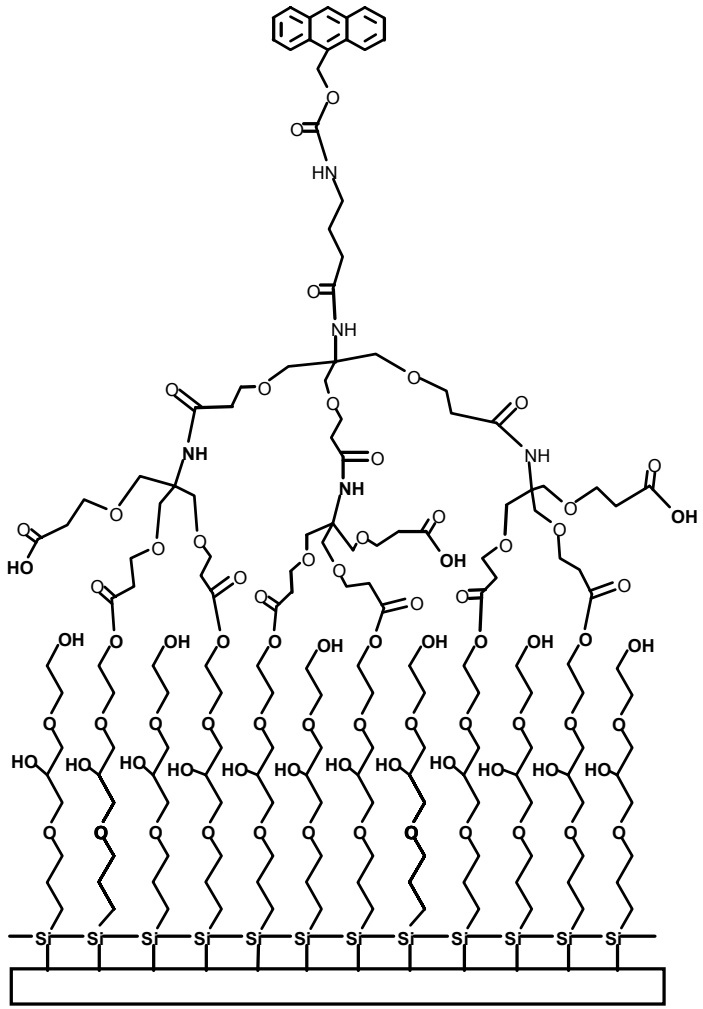
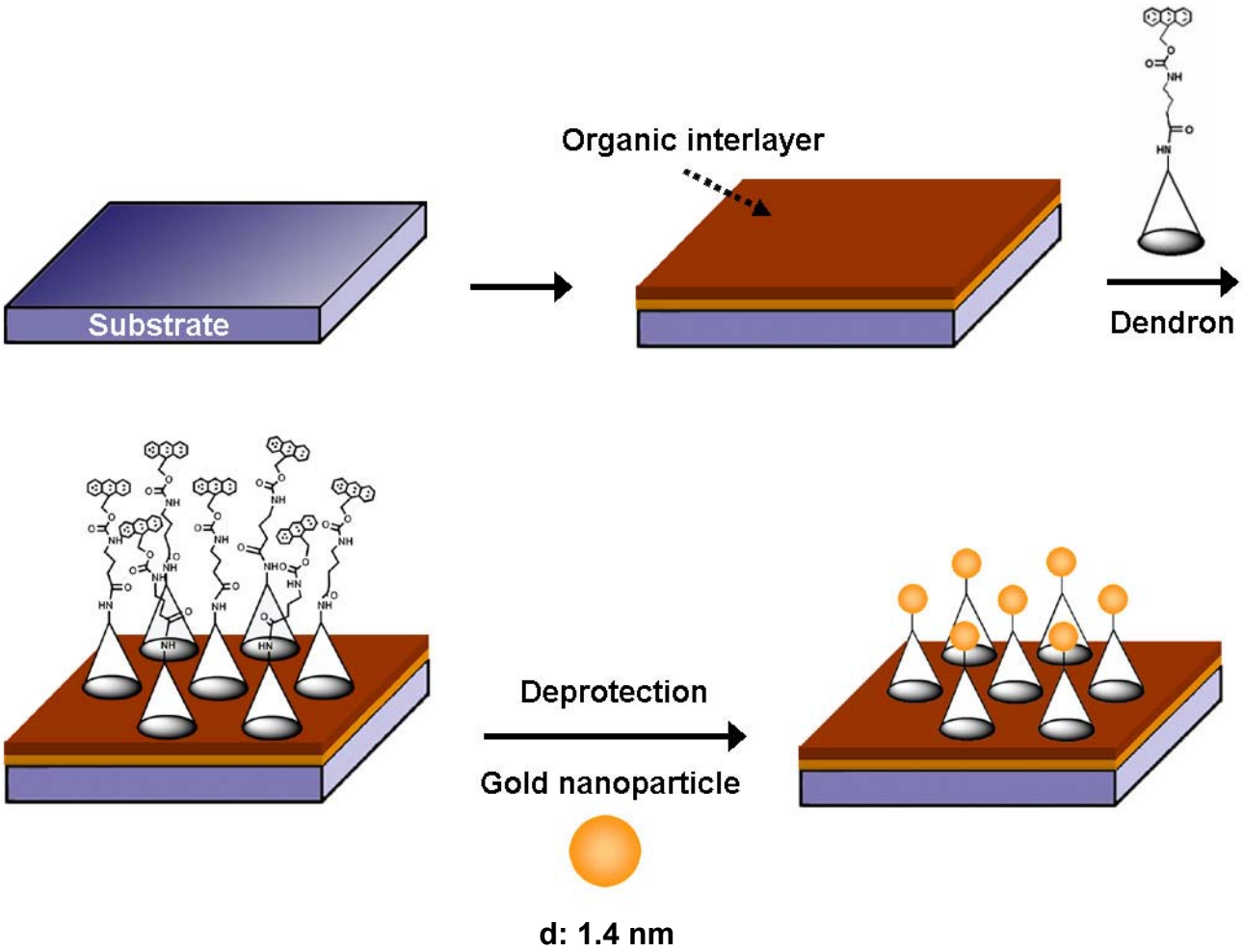
Joon Won Park
Dept of Chemistry, Center for Integrated Molecular Systems
Pohang University of Science and Technology

Self-Assmebly of Dendron on Surface





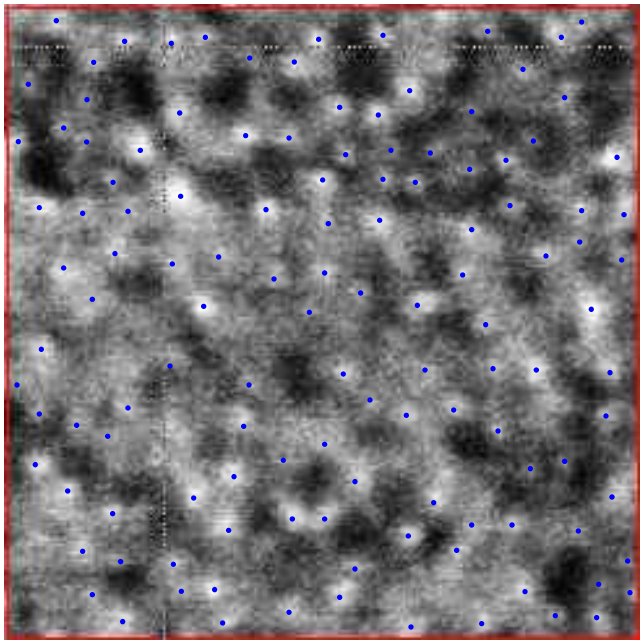
Immobilization of Gold Nanoparticles at the Dendron Surface



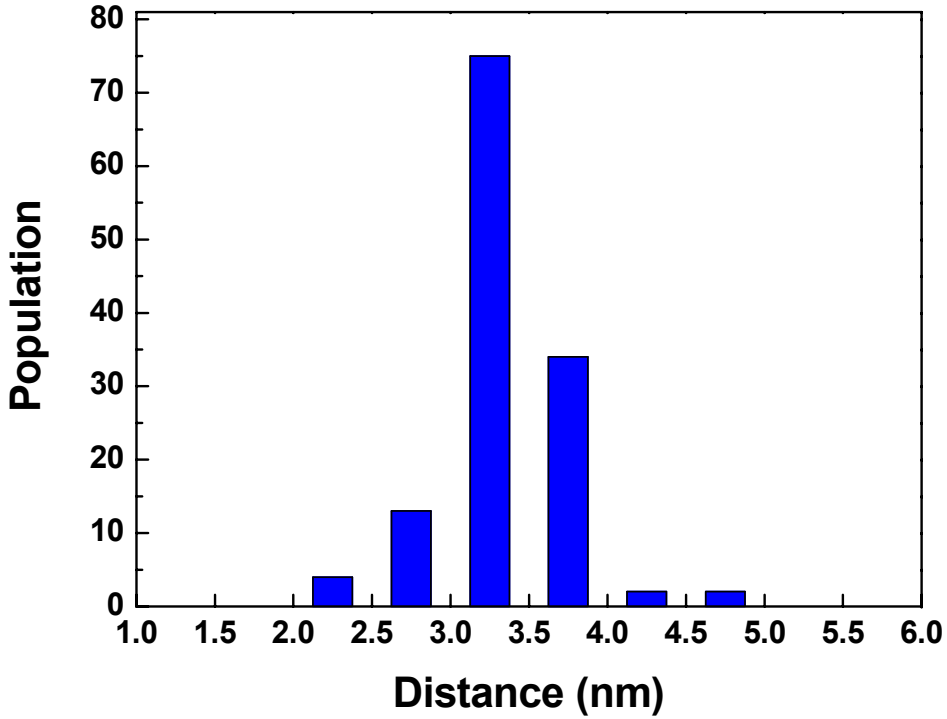
Park et al. *Langmuir* **2005**, 4257

Spacing between Dendron Molecules on Surface

➢ SEM Image



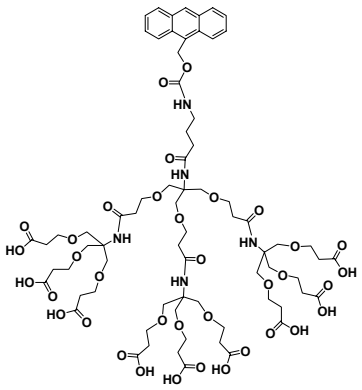
➢ Distance between Dendron Molecules

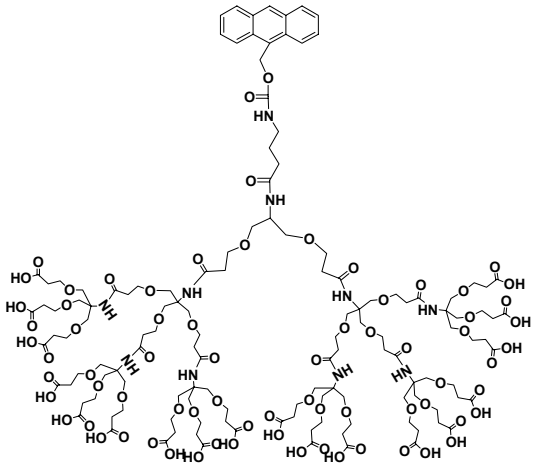


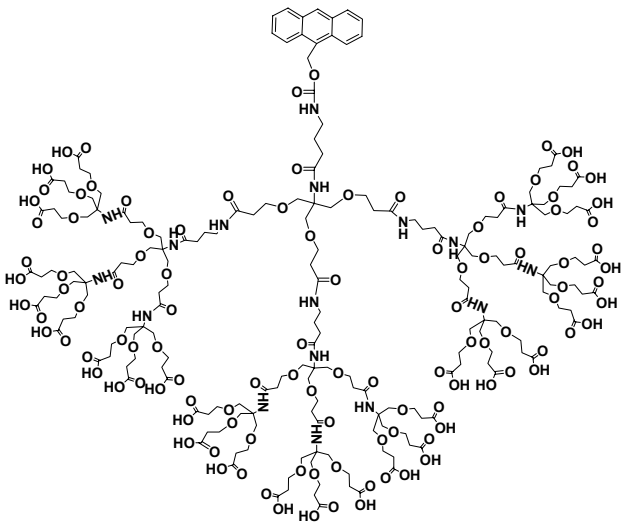
- Particle number / area : 130 ea / 50 x 50 nm^2
- Density: 0.05 – 0.06 ea/nm^2

- Average distance: 3.2 nm
- Standard deviation: 0.4 nm

Various Spacing up to 10 nm







[9]-acid

[18]-acid

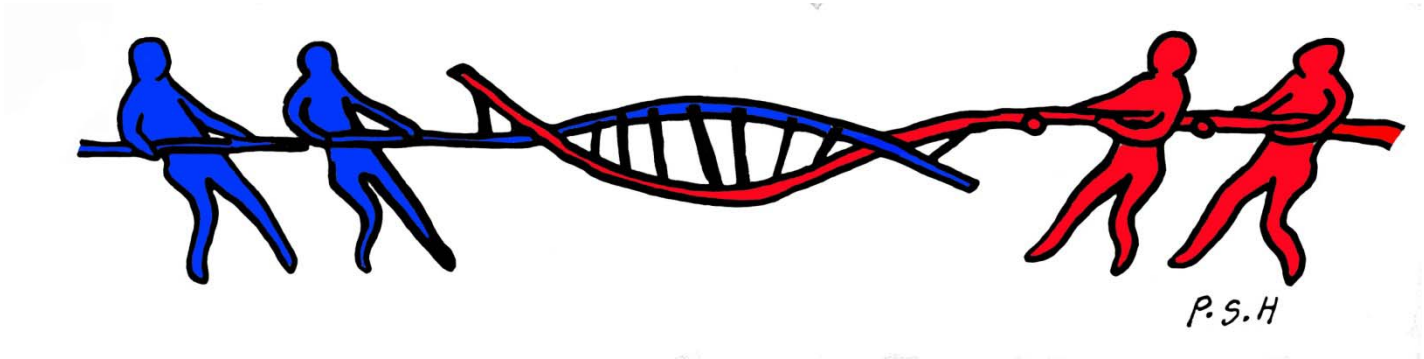
[27]-acid, [81]-acid

~ 3 nm

Spacing

~ 10 nm

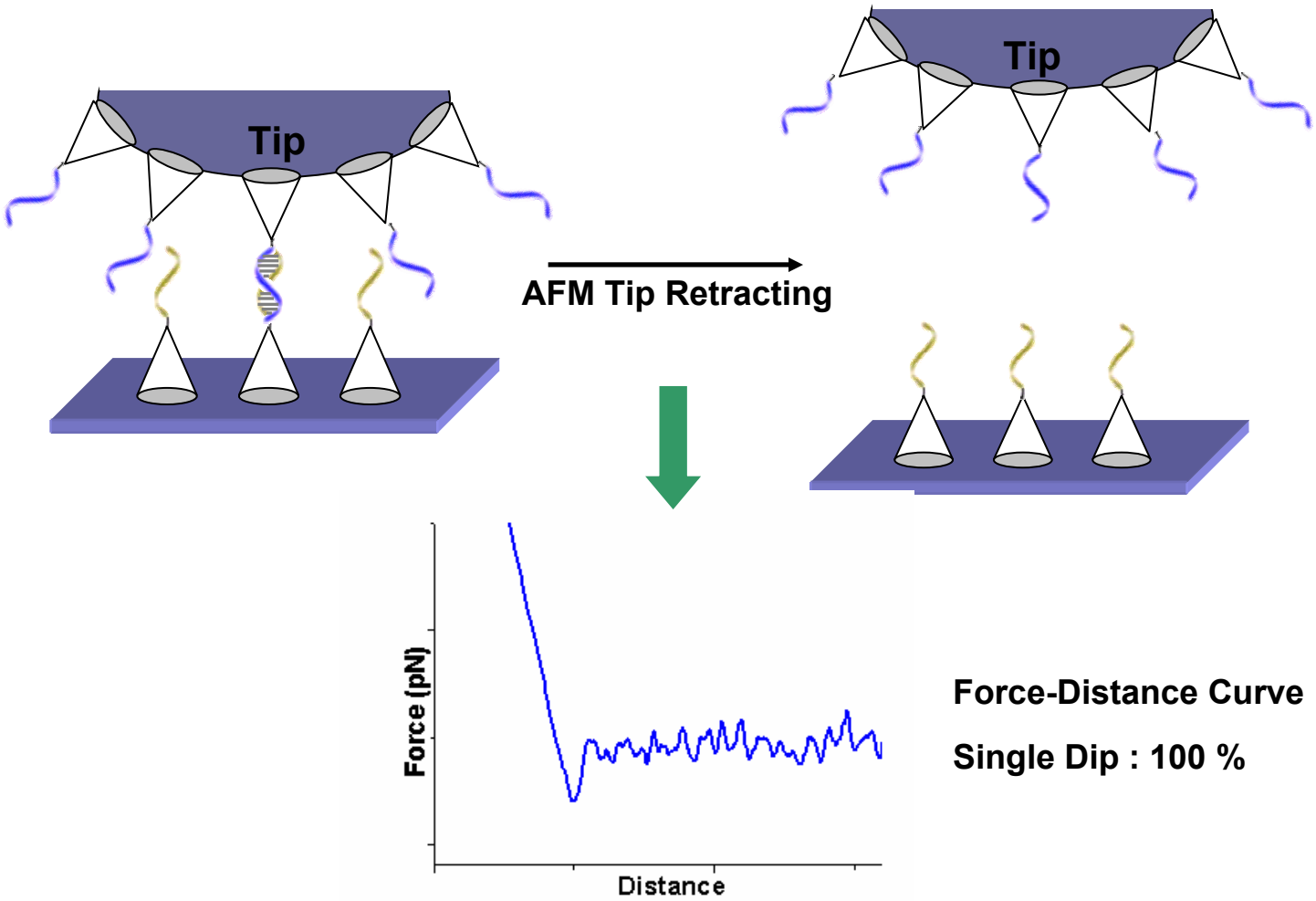
DNA-DNA Interaction with 9-acid Modified AFM tips



In collaboration with School of Pharmacy, Nottingham University

Yu Jin Jung and Joon Won Park

Proper Spacing Simplifies Force-Distance Curve

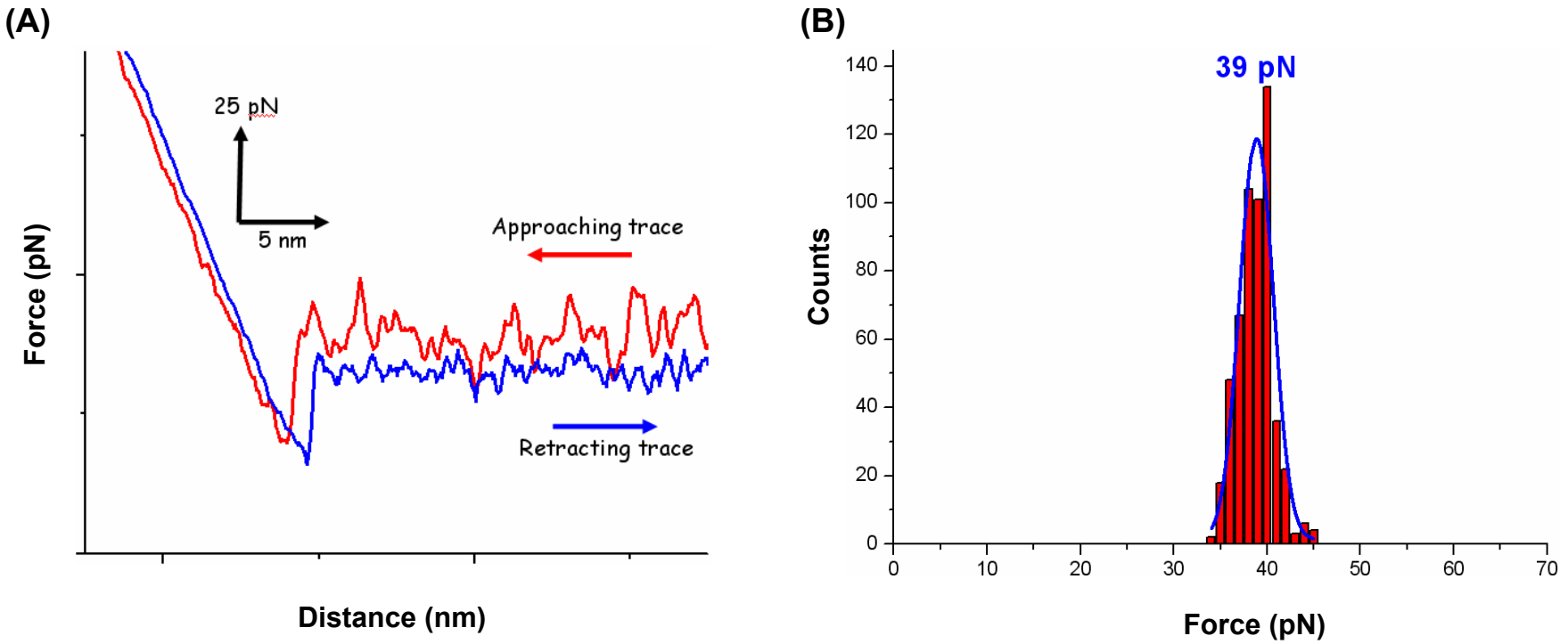


Force-Distance Curve

Single Dip : 100 %

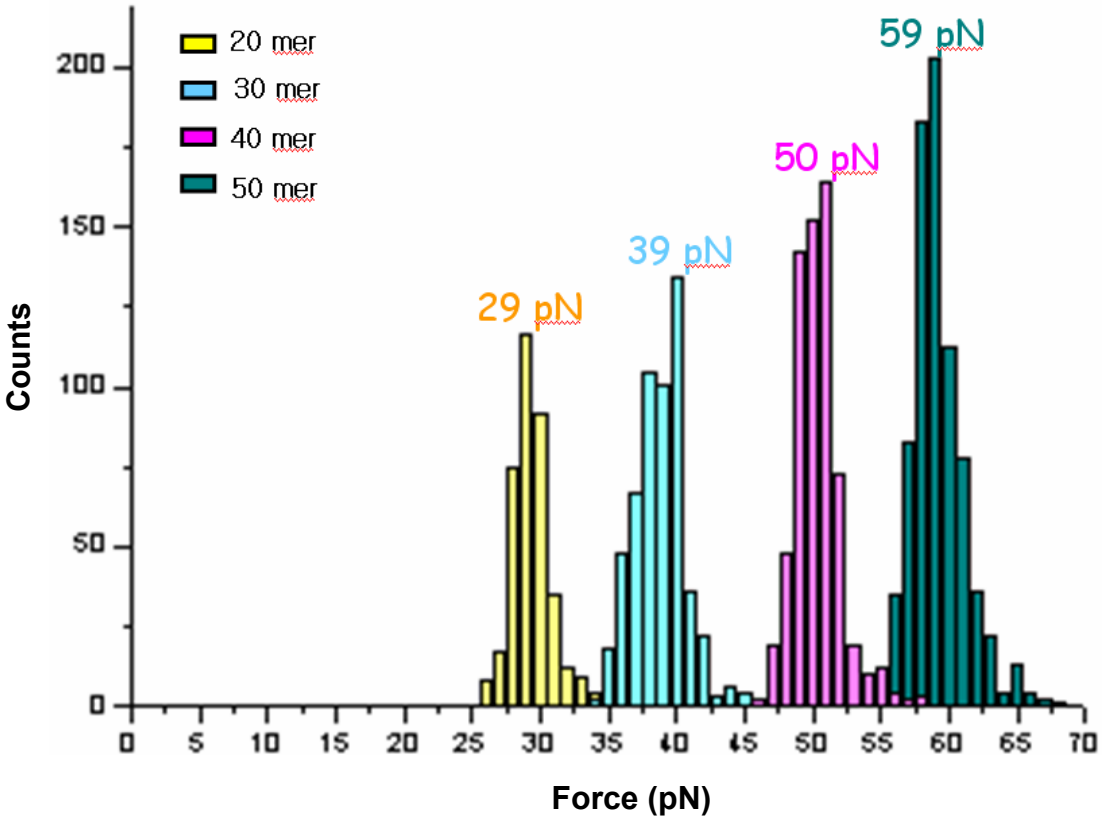
Joint US Patent Application (2005)

Unprecedented Binding Event



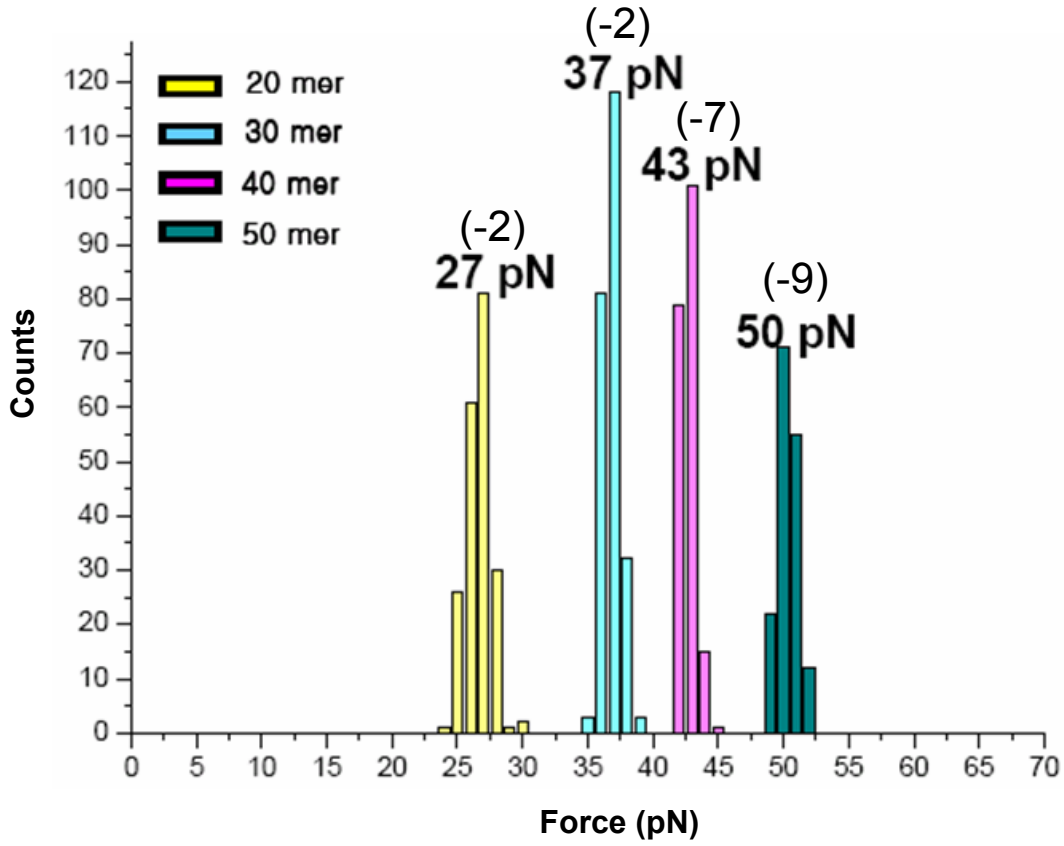
Park et al. *J. Am. Chem. Soc.*, **2007**, 9345

Resolved Binding Force Histogram



GC content = 60 %

Discrimination of Single Base Mismatched Pairs



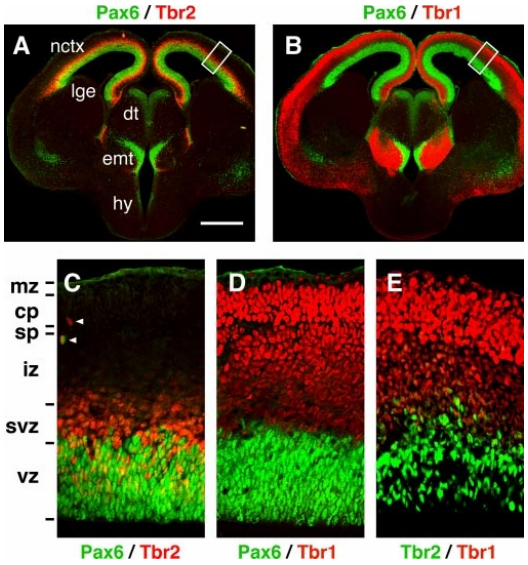
2-D Image of Pax6 mRNA Distribution with 27-acid modified AFM tips

In collaboration with Professor Hong Gil Nam and Dr. Yu Shin Park

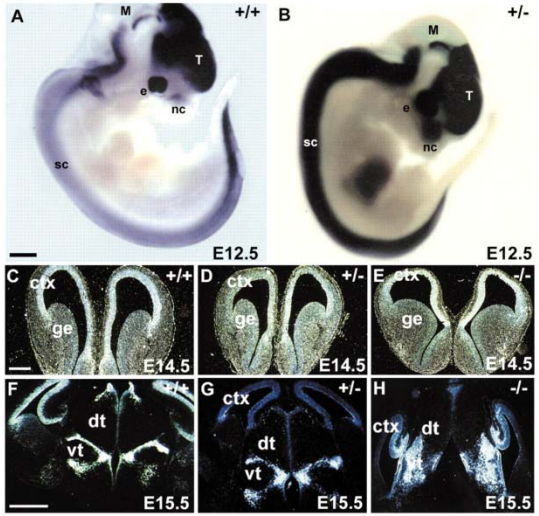
Yu Jin Jung and Joon Won Park
Pohang University of Science and Technology

Pax6 mRNA

- Pax6 mRNA plays a pivotal role in embryonic cell of mouse brain.
- Pax family consists of genes encoding transcription factors that regulate the development of the visual, olfactory, central nervous systems, pituitary, and pancreas.
- The essential role of Pax6 in early eye induction is conserved throughout the evolution of multicellular animals.



Expression of Pax6(green), Tbr2, and Tbr1 protein in E14.5 cortex (coronal sections).
J. Neuroscience, **2005,** *25*, 247.

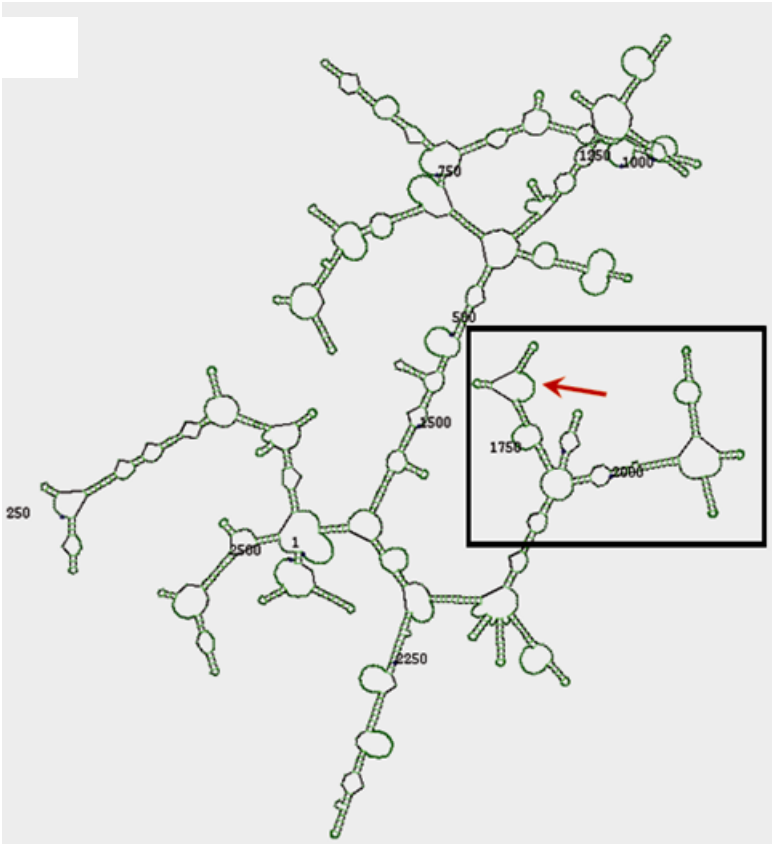


The in situ hybridization analysis with probes for *Pax6* (A and C)
Development, **2002**,*129*, 5041.

Secondary Structure of pax6 RNA

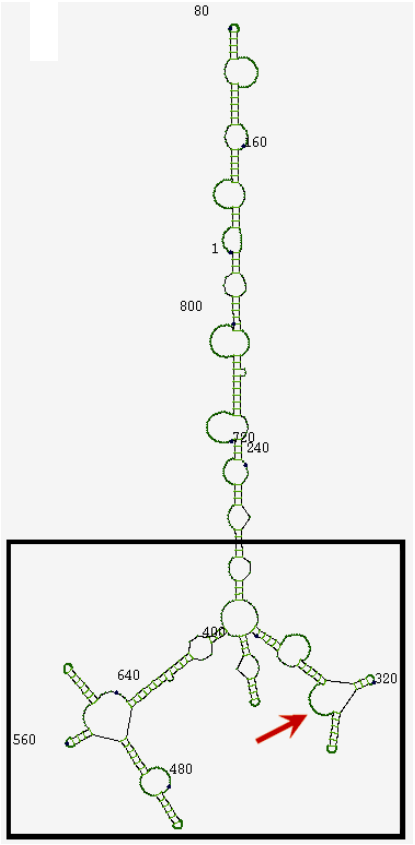
- **2,580 bases**

  Free Energy Structure= -515 kcal/mol

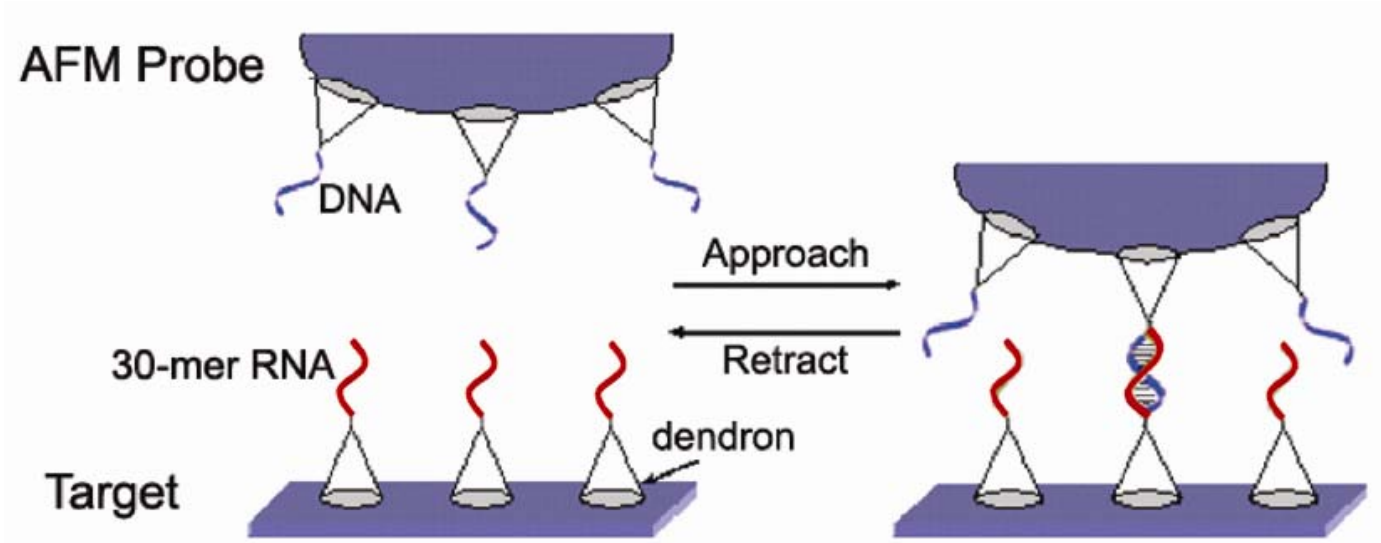


- ***in vitro* transcript (802 bases)**

  Free Energy Structure= -142.1 kcal/mol



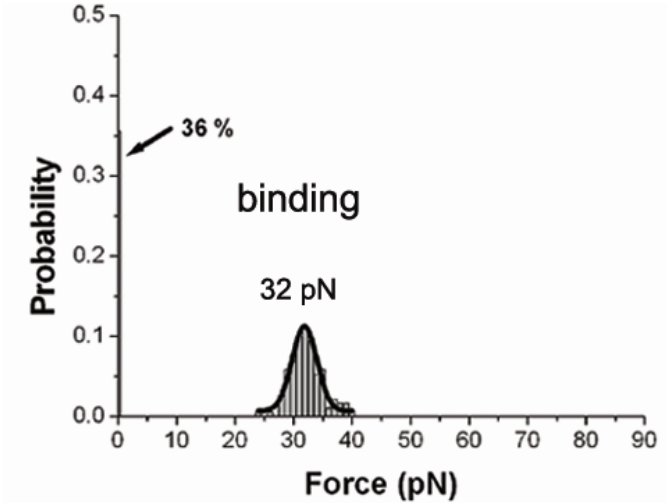
Force Curve and Histogram for a Model System I



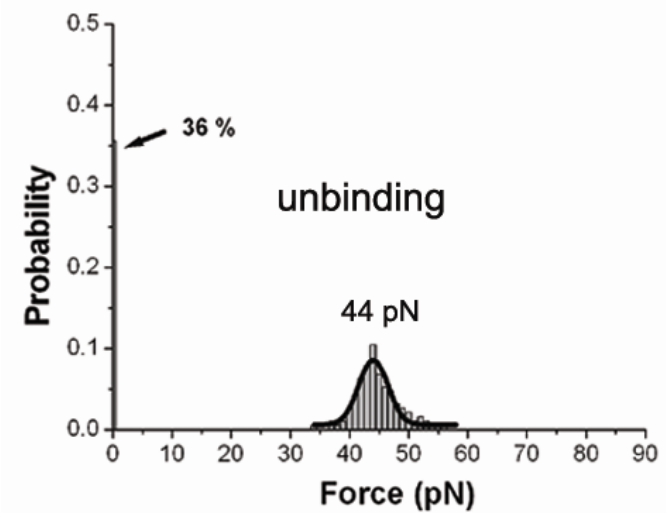
Size	DNA onto a tip	RNA on a substrate	GC %
30 bases	DNA30: 5'-$NH_2(CH_2)_6$-TGG GCT GAC TGT TCA TGT GTG TTT GCA TGT-3'	RNA30: 5'-$NH_2(CH_2)_6$-ACA UGC AAA CAC ACA UGA ACA GUC AGC CCA-3'	[14/30 (47 %)]

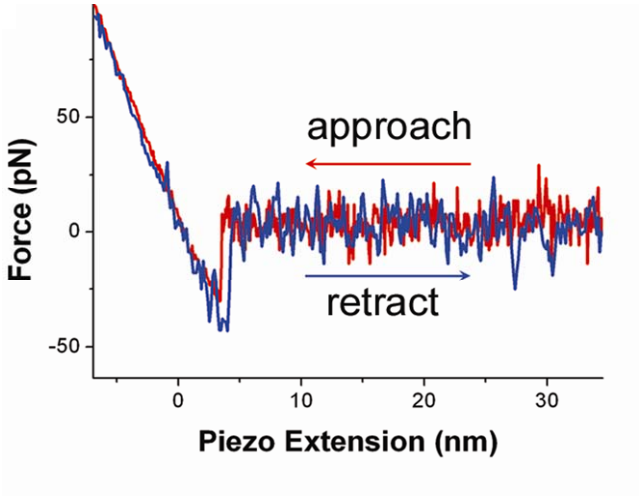
Force Curve and Histogram for a Model System I

- Binding Force Histogram

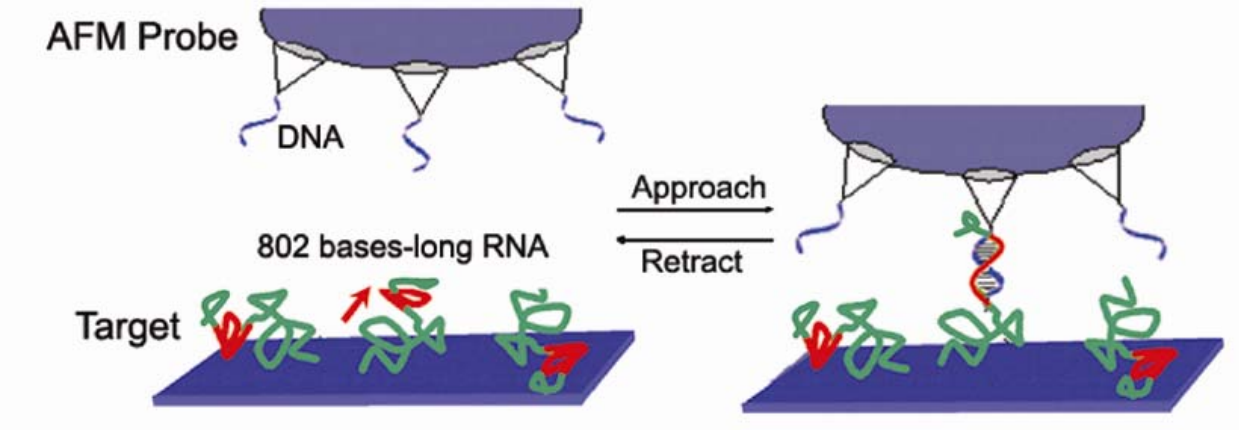


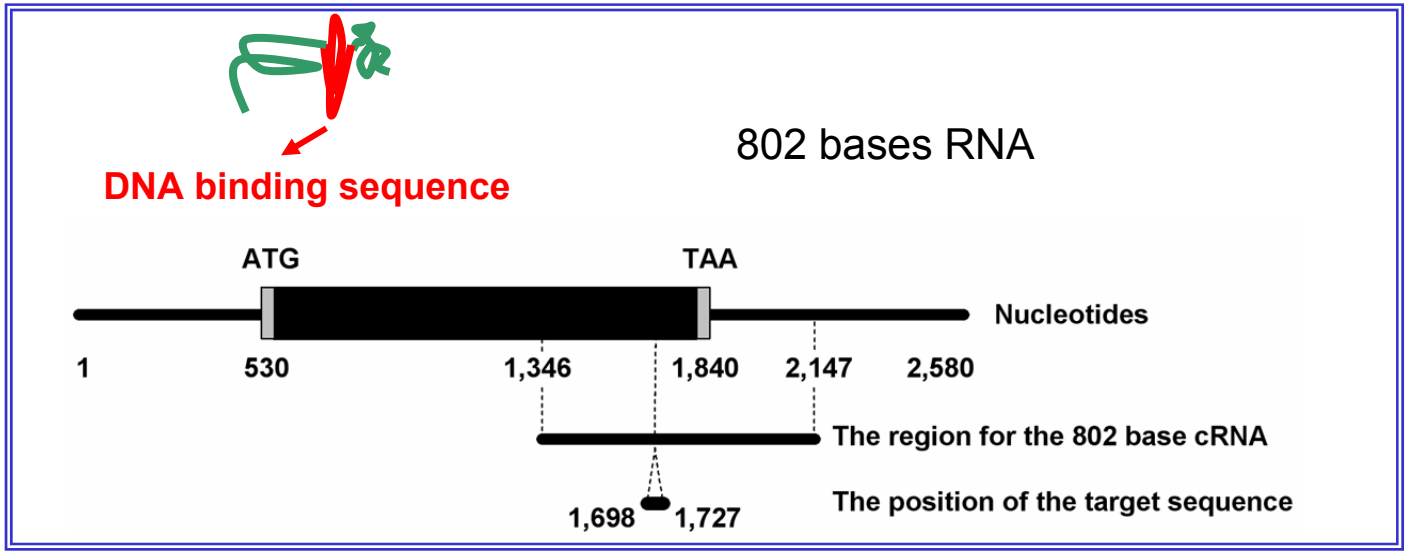
- Unbinding Force Histogram





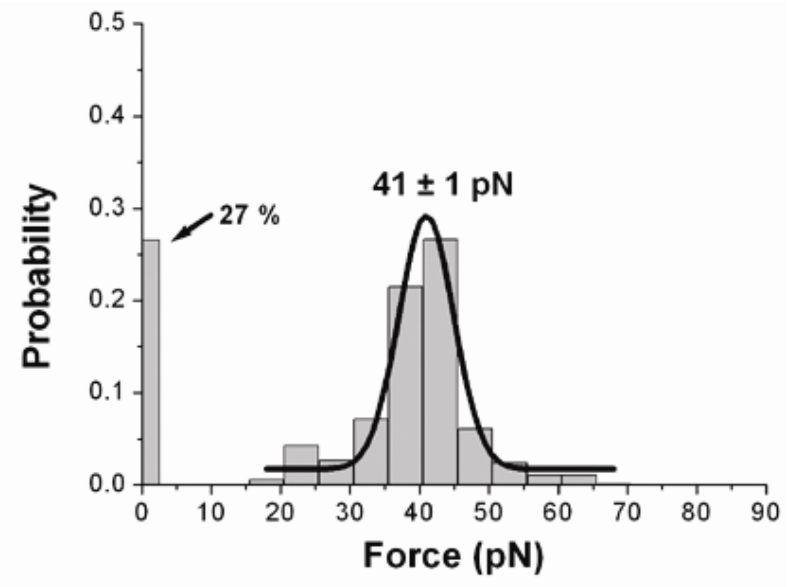
2D Image of mRNA with the Force Measurement



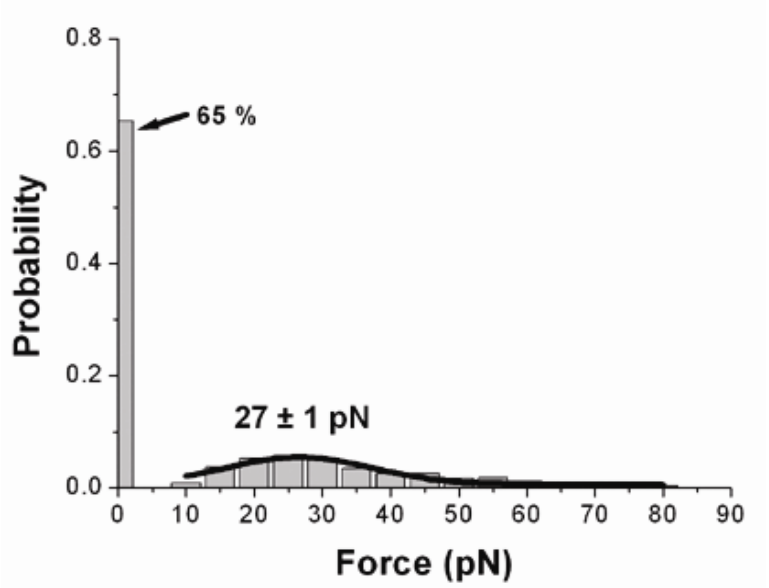


Interaction between Isolated 802 Bases and 30mer DNA

- with complementary oligonucleotide



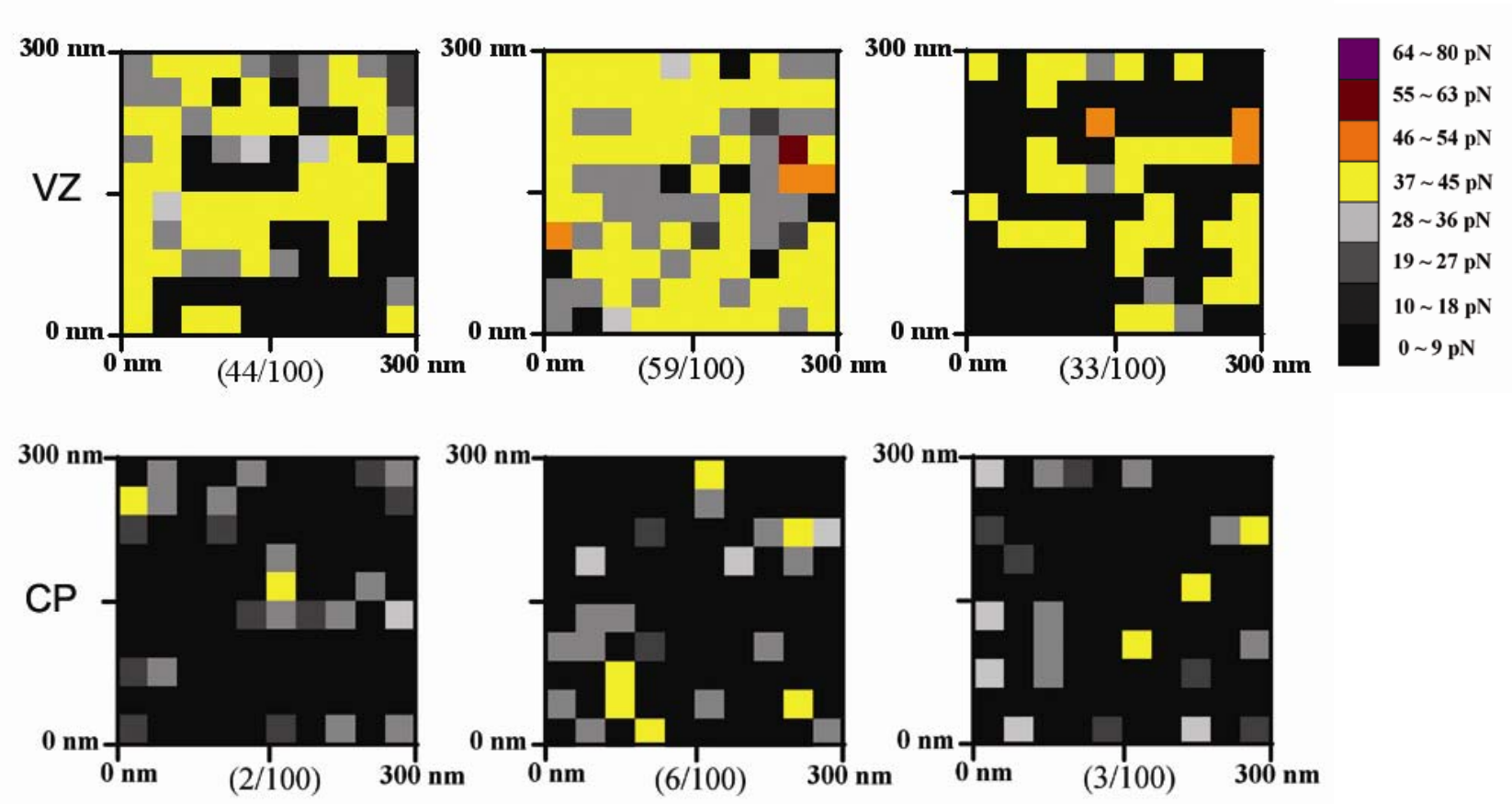
- with non-complementary oligonucleotide



Microscope Images of the Mouse Embryonic Tissue

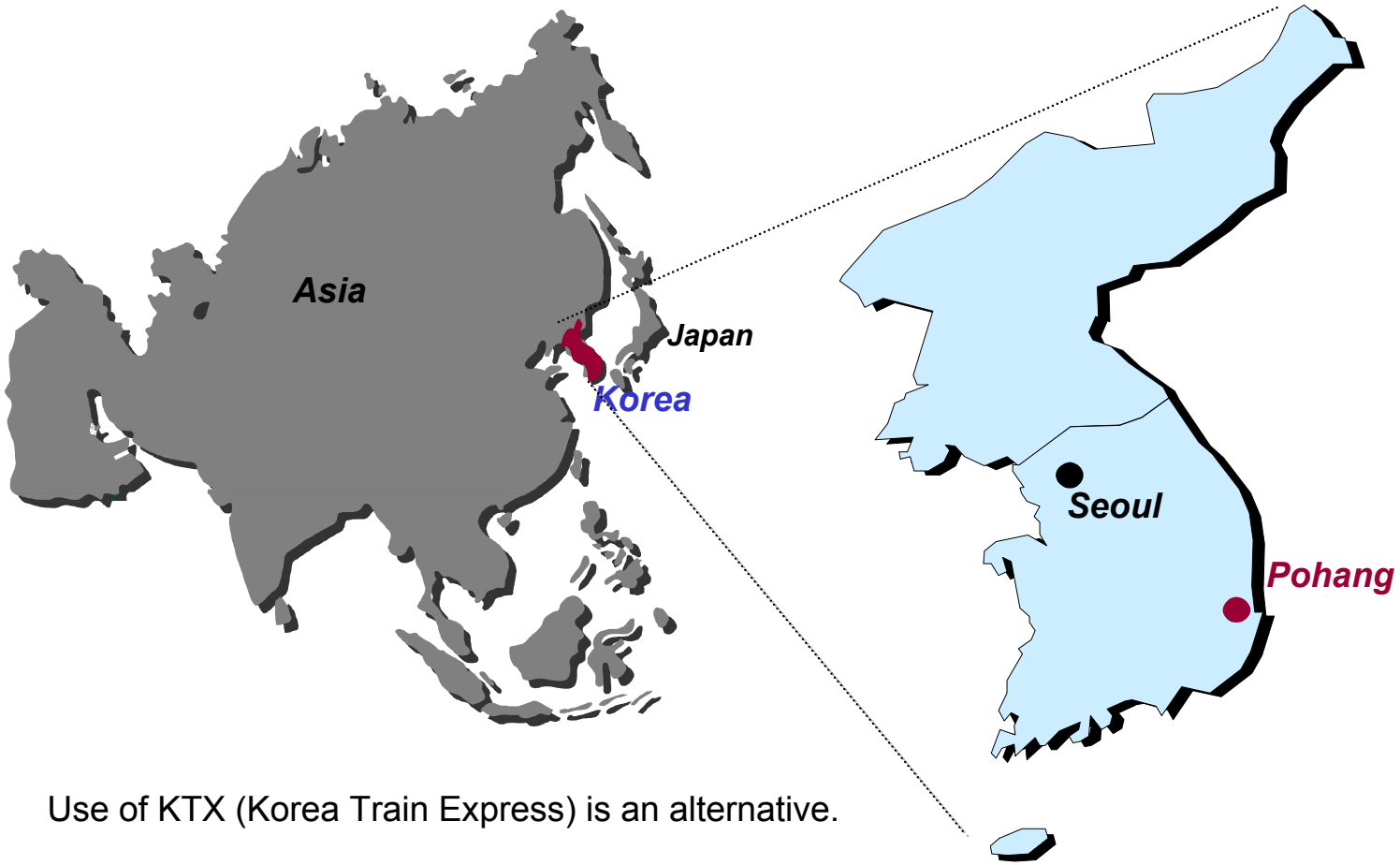
- *in situ* hybridization with the digoxigenin-labeled antisense Pax6 RNA probe

Low Resolution Force Maps of Pax6 mRNA in a Mouse Embryonic Tissue



Manuscript in preparation

Pohang is 50 min away from Seoul by Air



Use of KTX (Korea Train Express) is an alternative.

Campus Aerial View

- 1,638,135 m² Land area
- 325,362 m² Buildings area

Synchrotron Facility

Postech Biotech Center and a Newly Dedicated Library