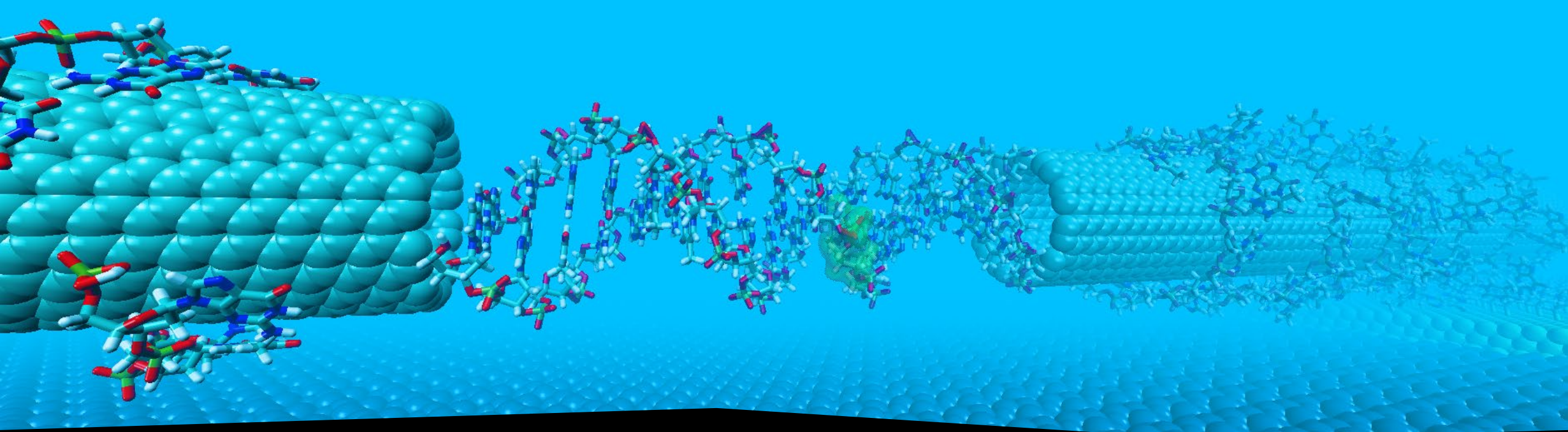




Integration of Biomolecular Electronic Devices and Sensors

Josh Hihath

18th US-Korea Forum on Nanotechnology

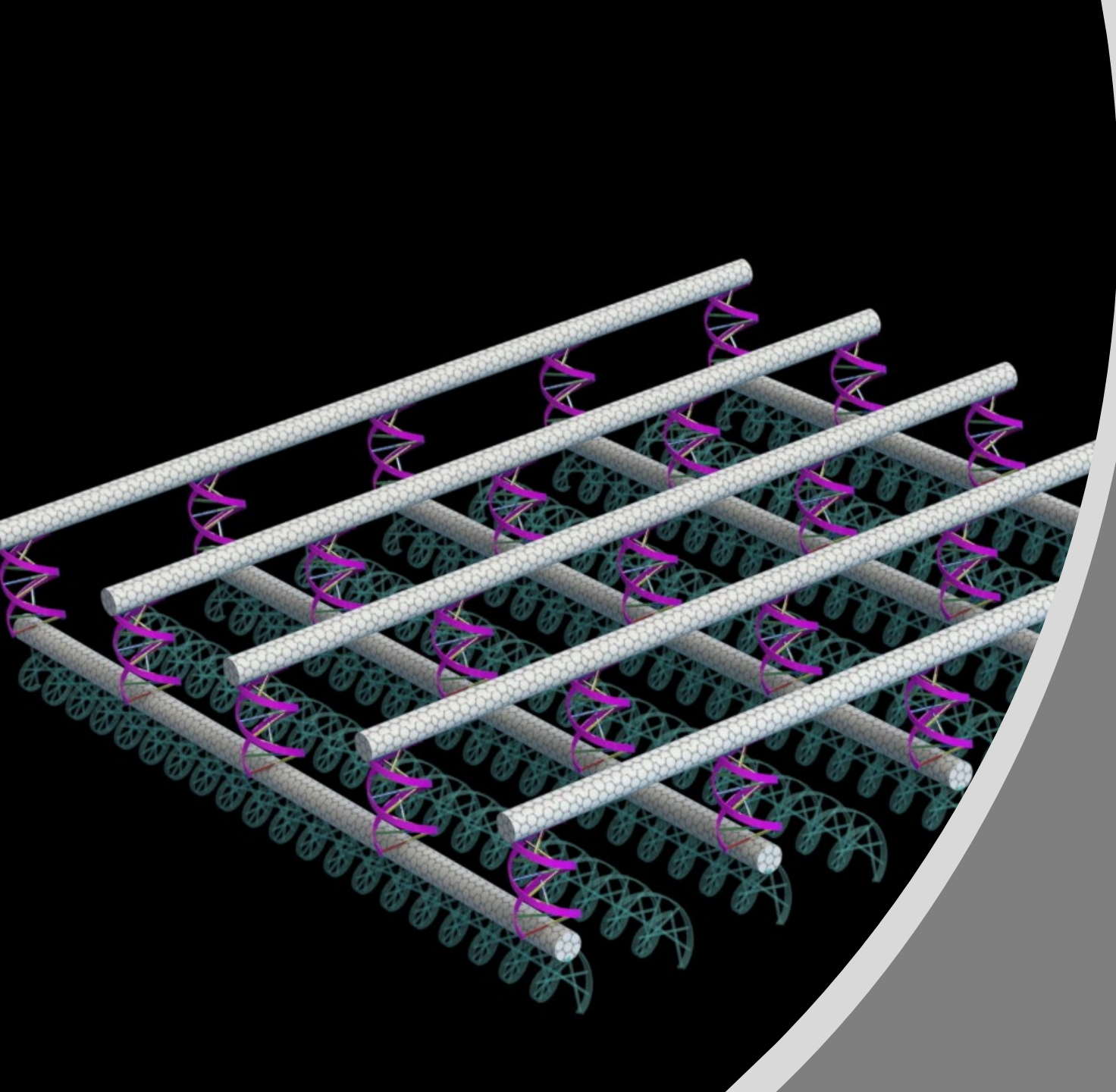
September 20, 2024



ARIZONA STATE UNIVERSITY

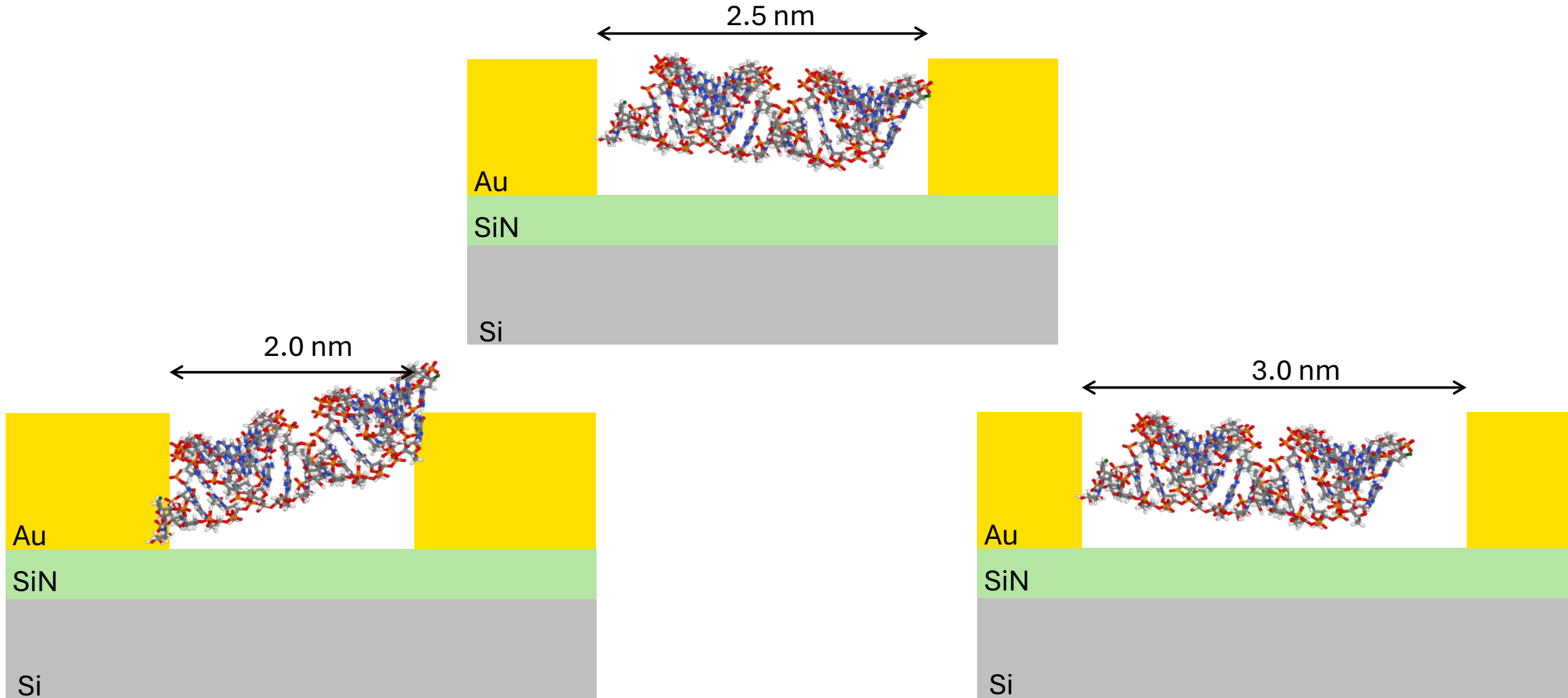


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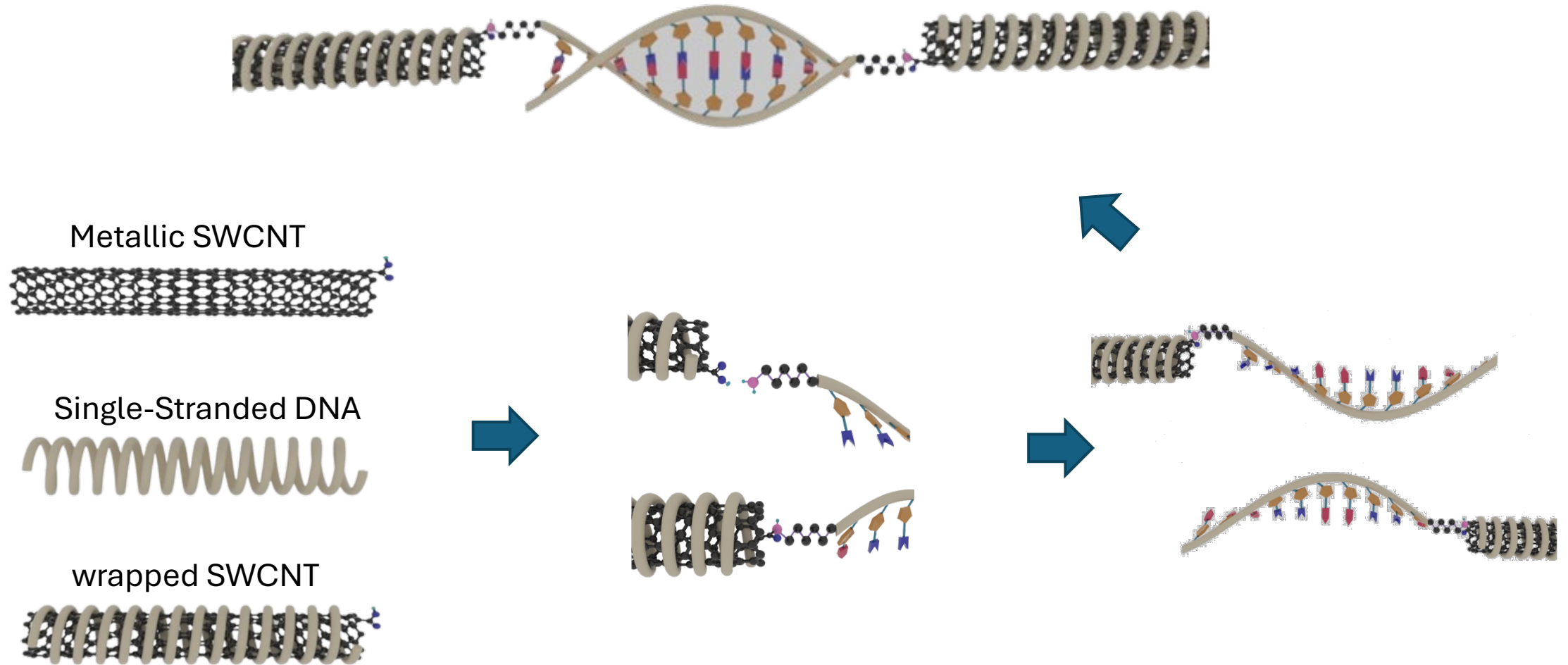


- Integrating Single Molecules with Electronics
- Creating Functional DNA-Based Electronic Devices

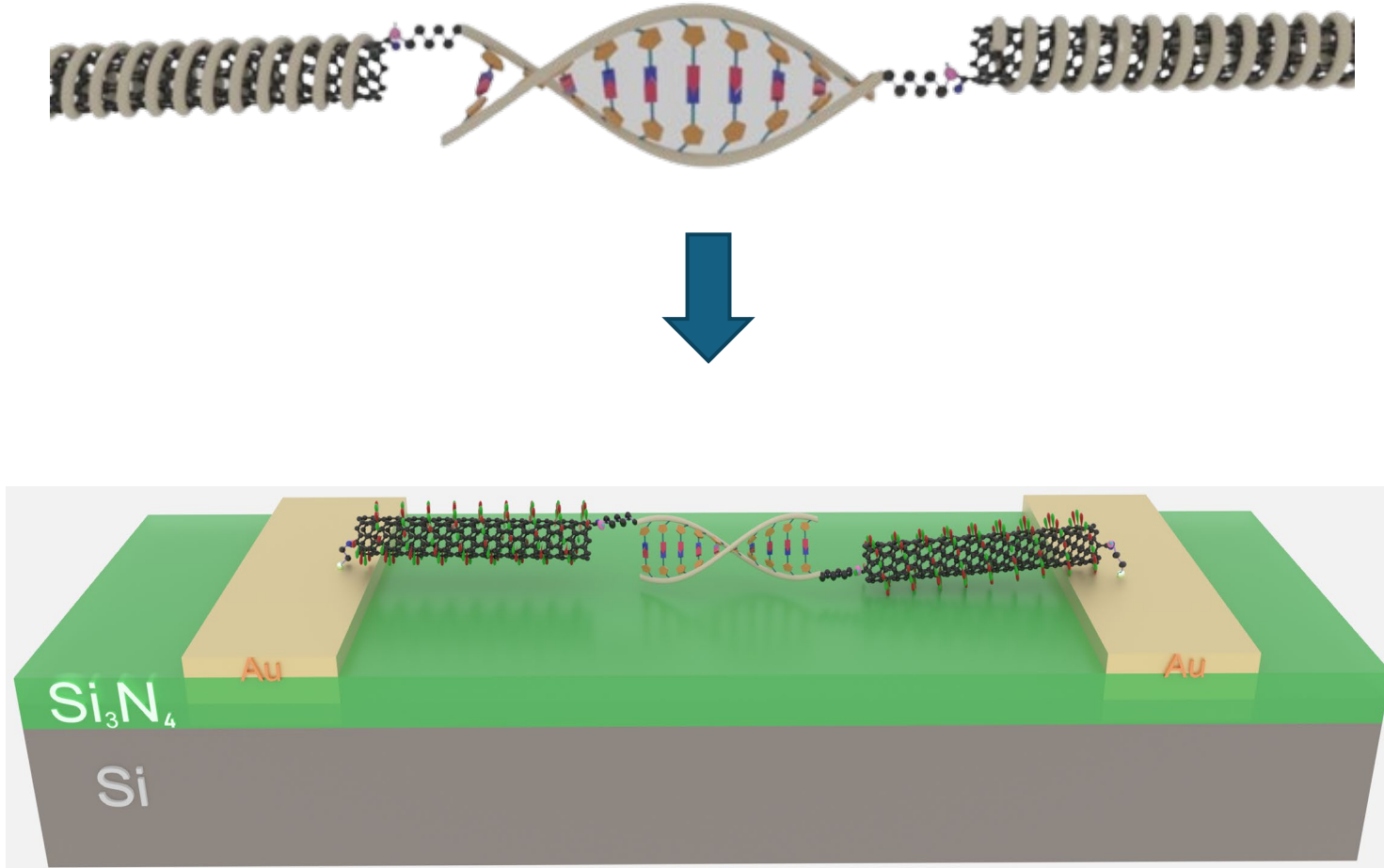
Single-Molecule Integration?



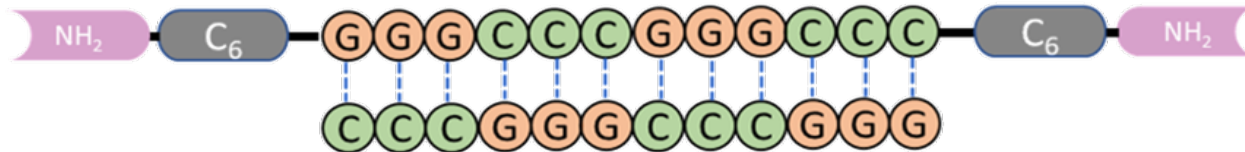
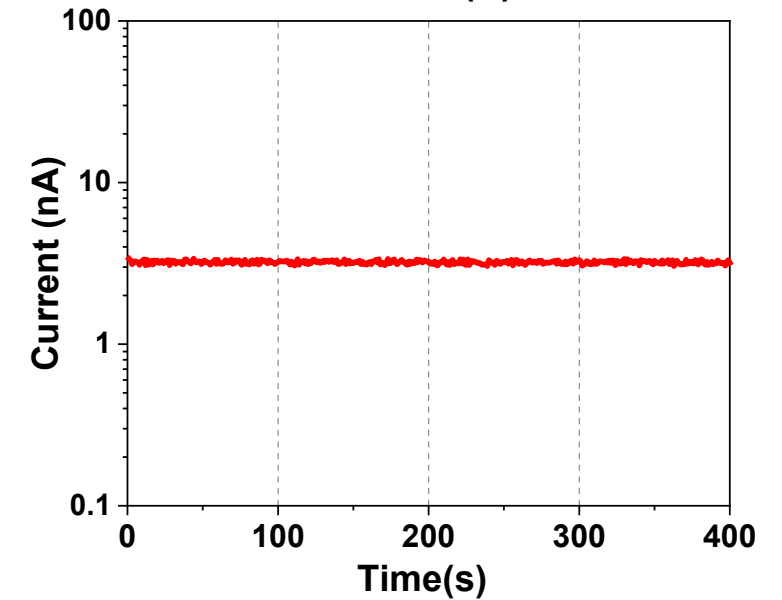
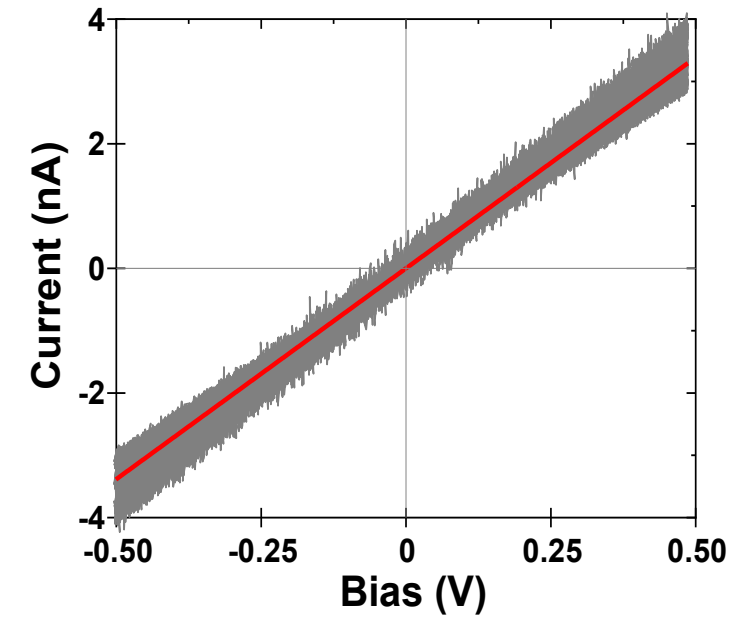
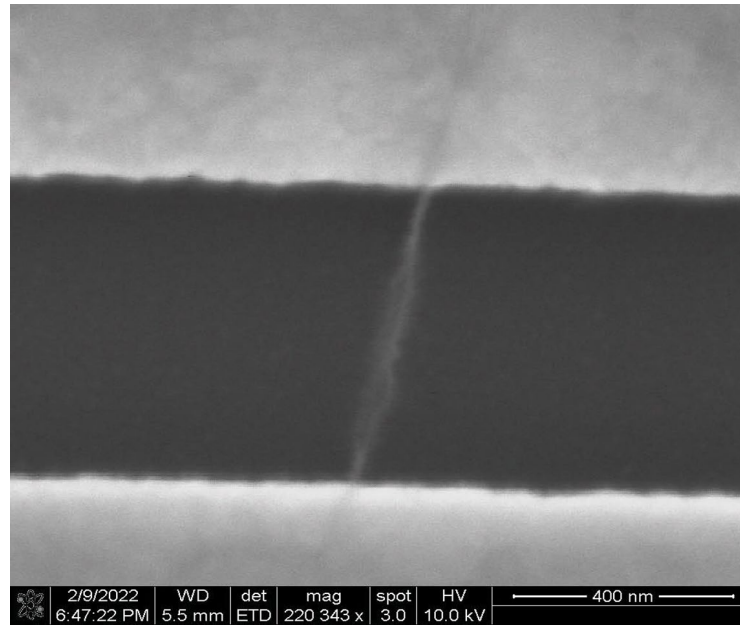
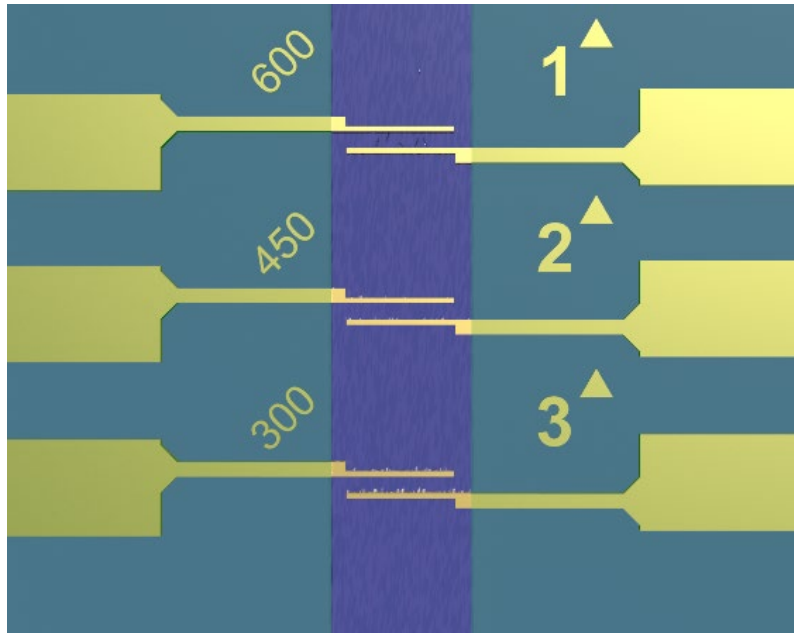
Self-Aligning Single-Molecule Junctions



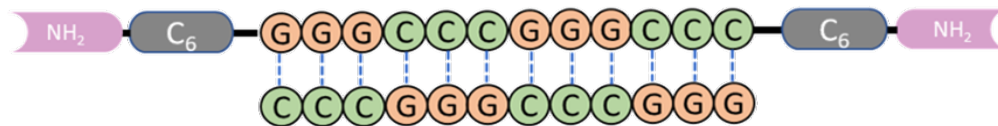
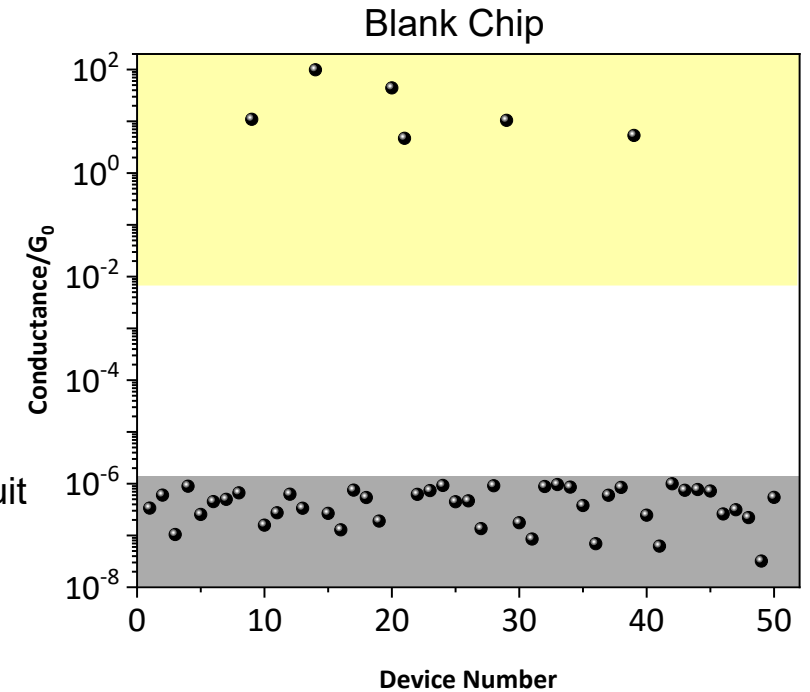
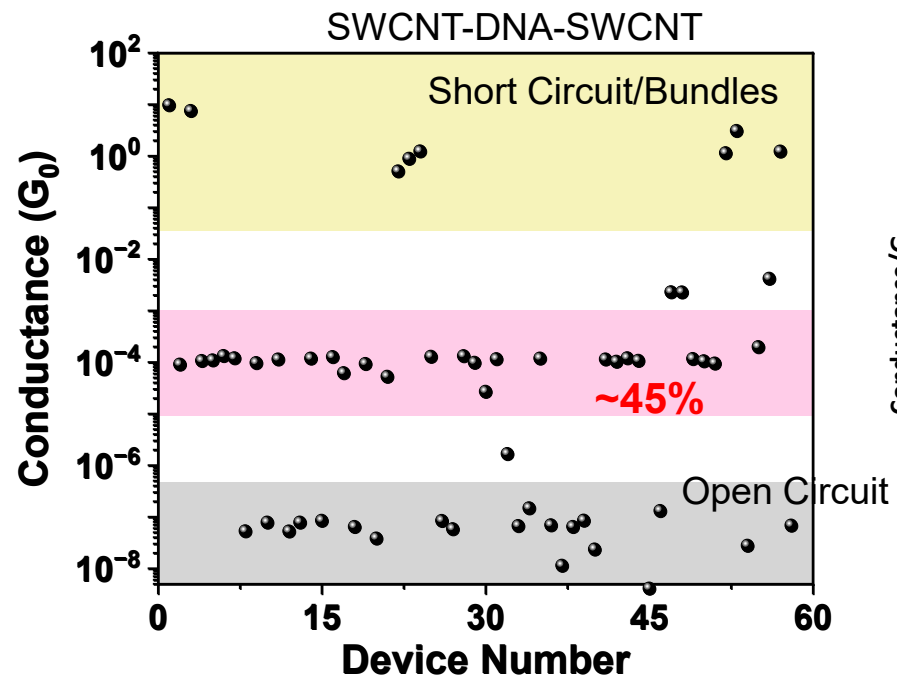
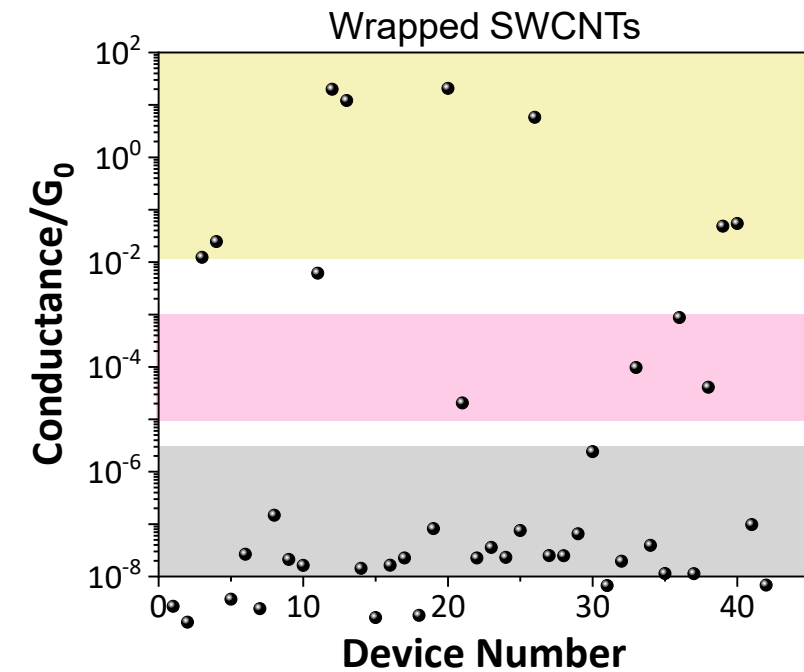
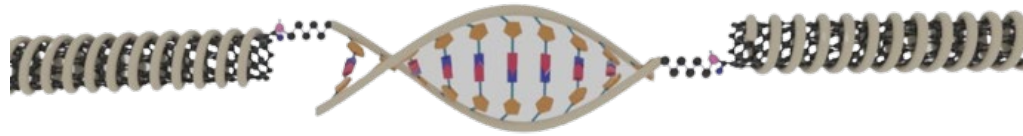
Self-Aligning Single-Molecule Junctions



Single-Molecule Devices?

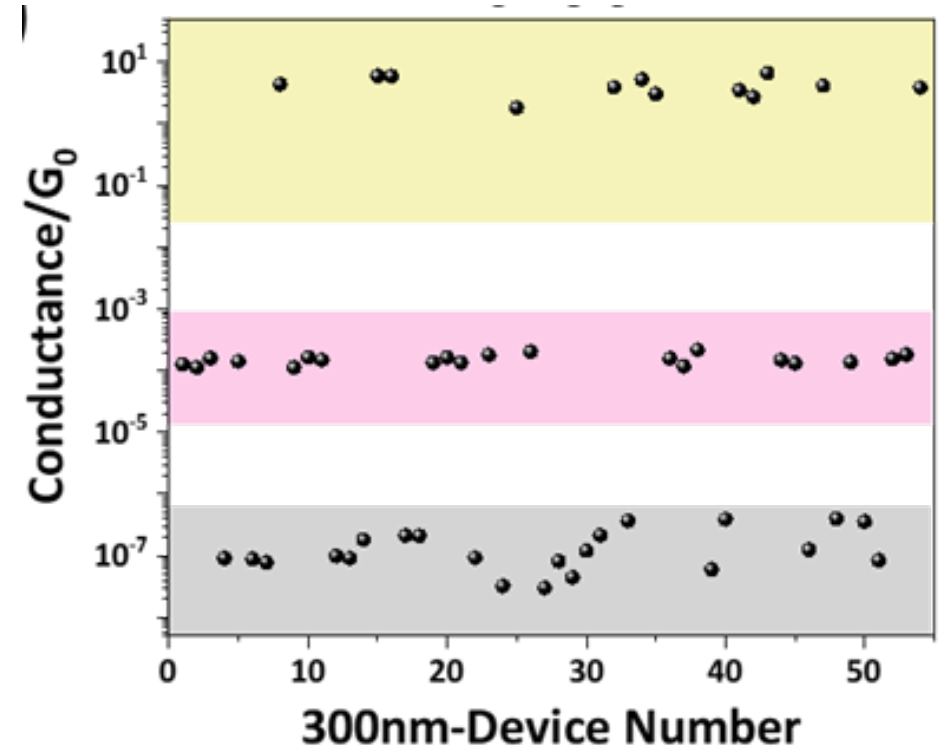
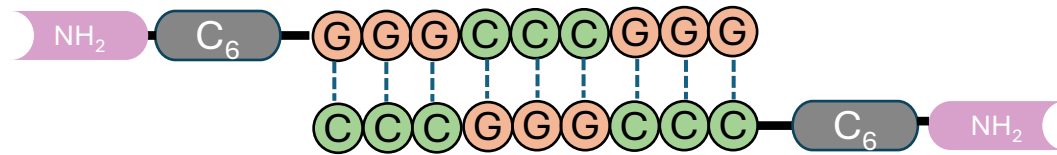
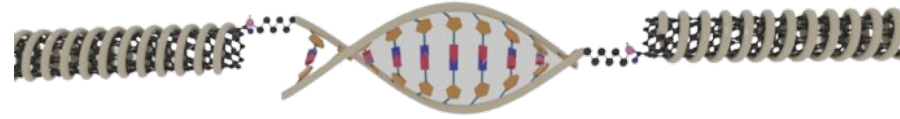


SWCNT-DNA-SWCNT Devices

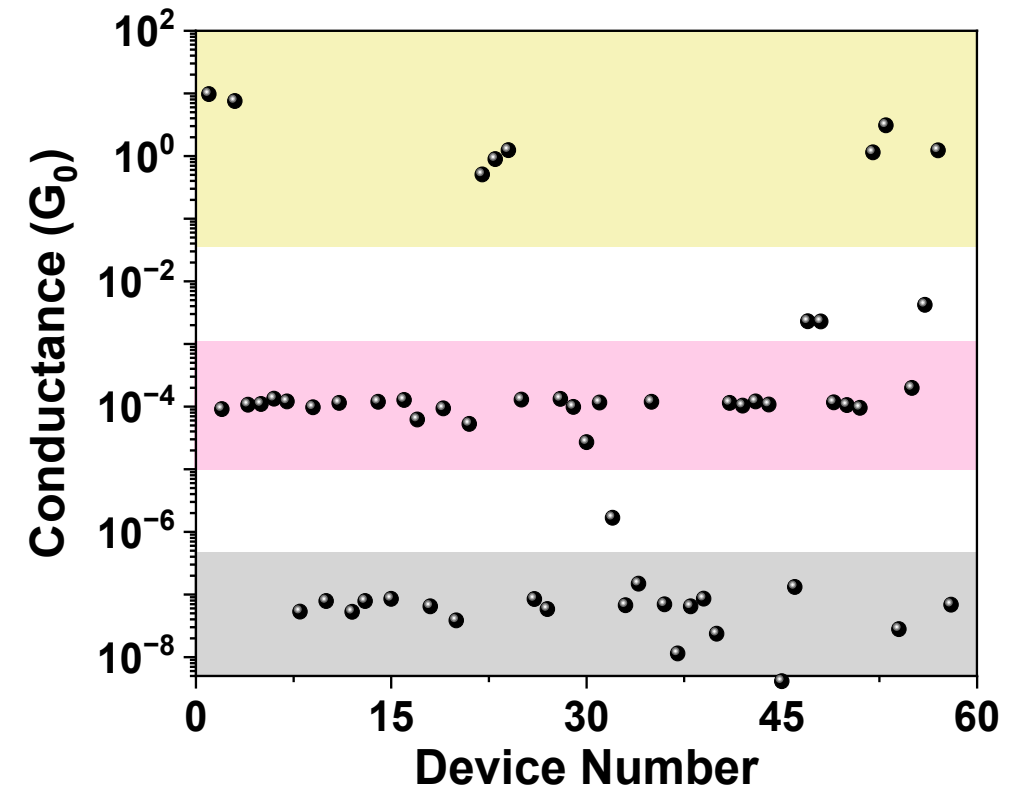
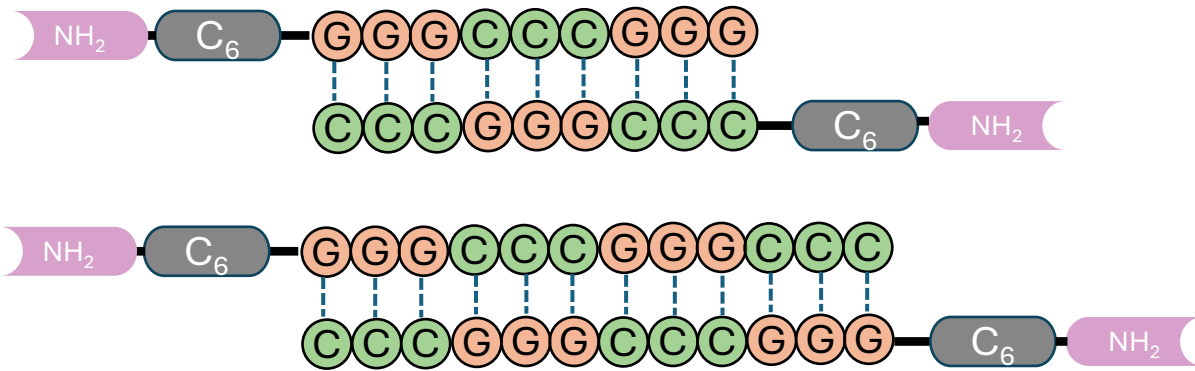
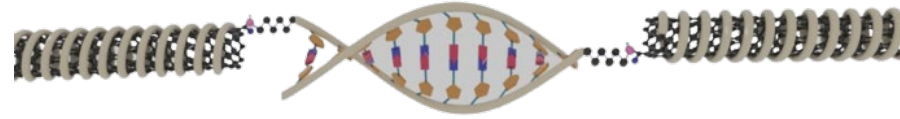


$$G_0 = 2e^2/h \approx 77.5 \mu S$$

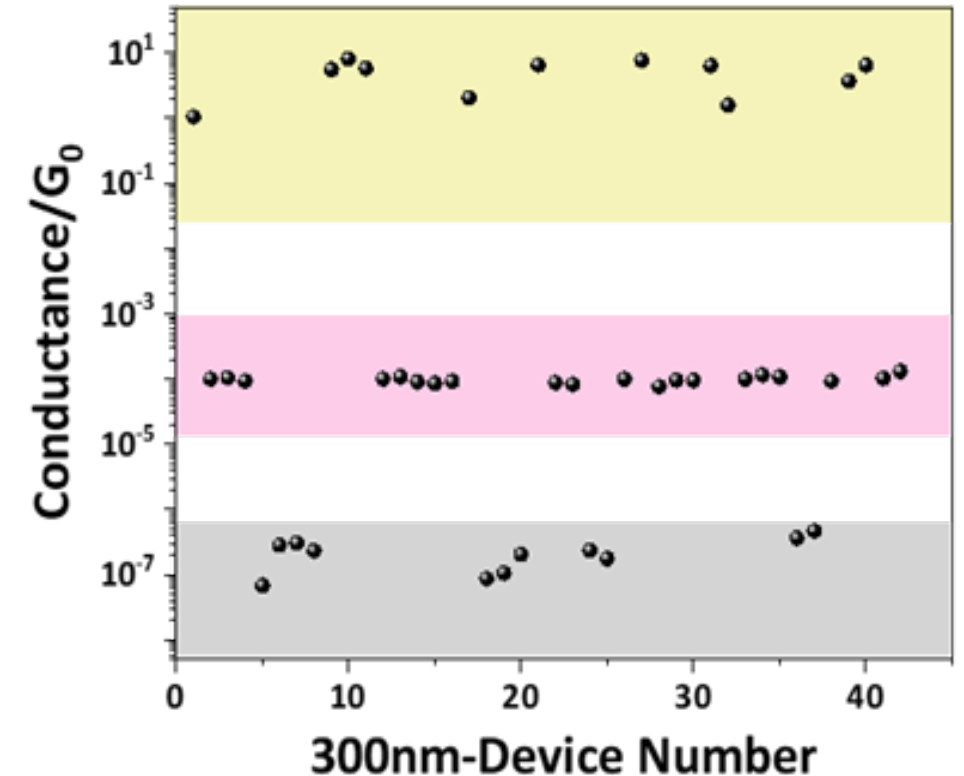
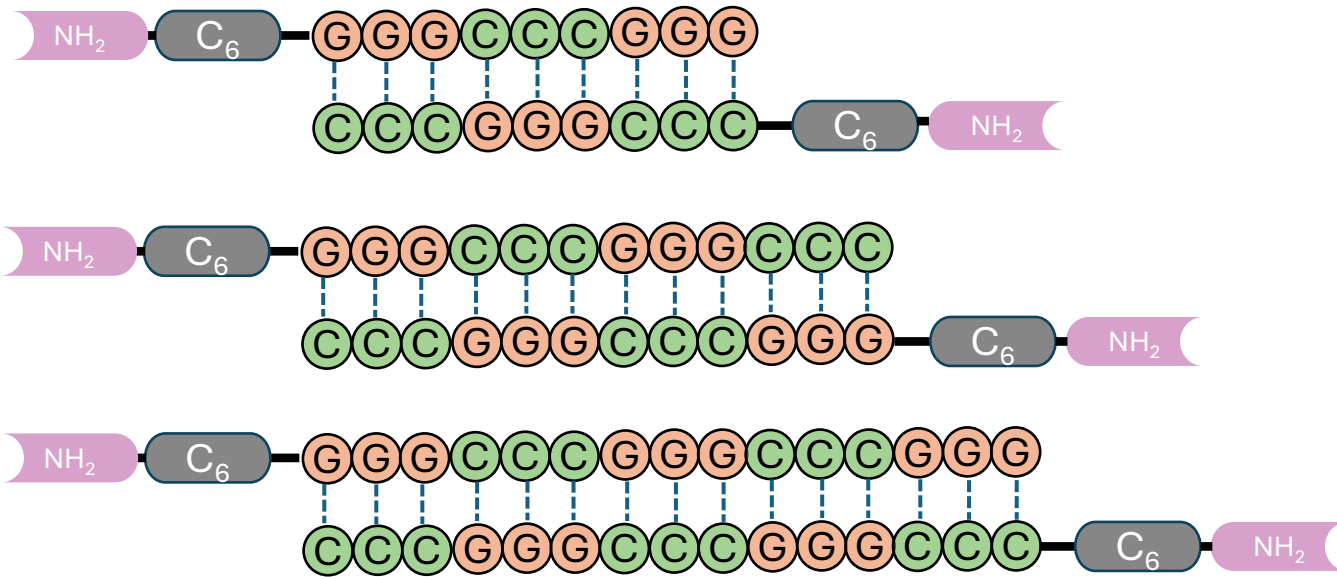
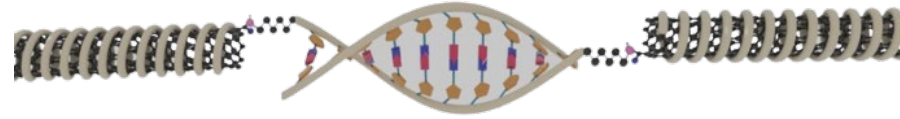
Length Dependence of DNA Conductance



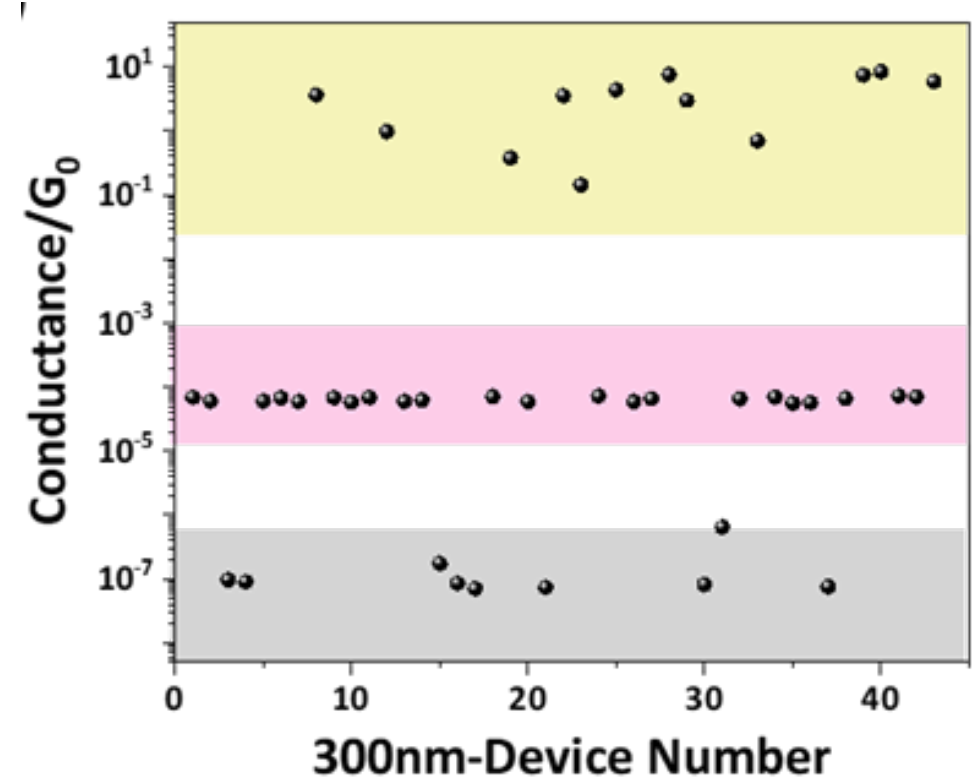
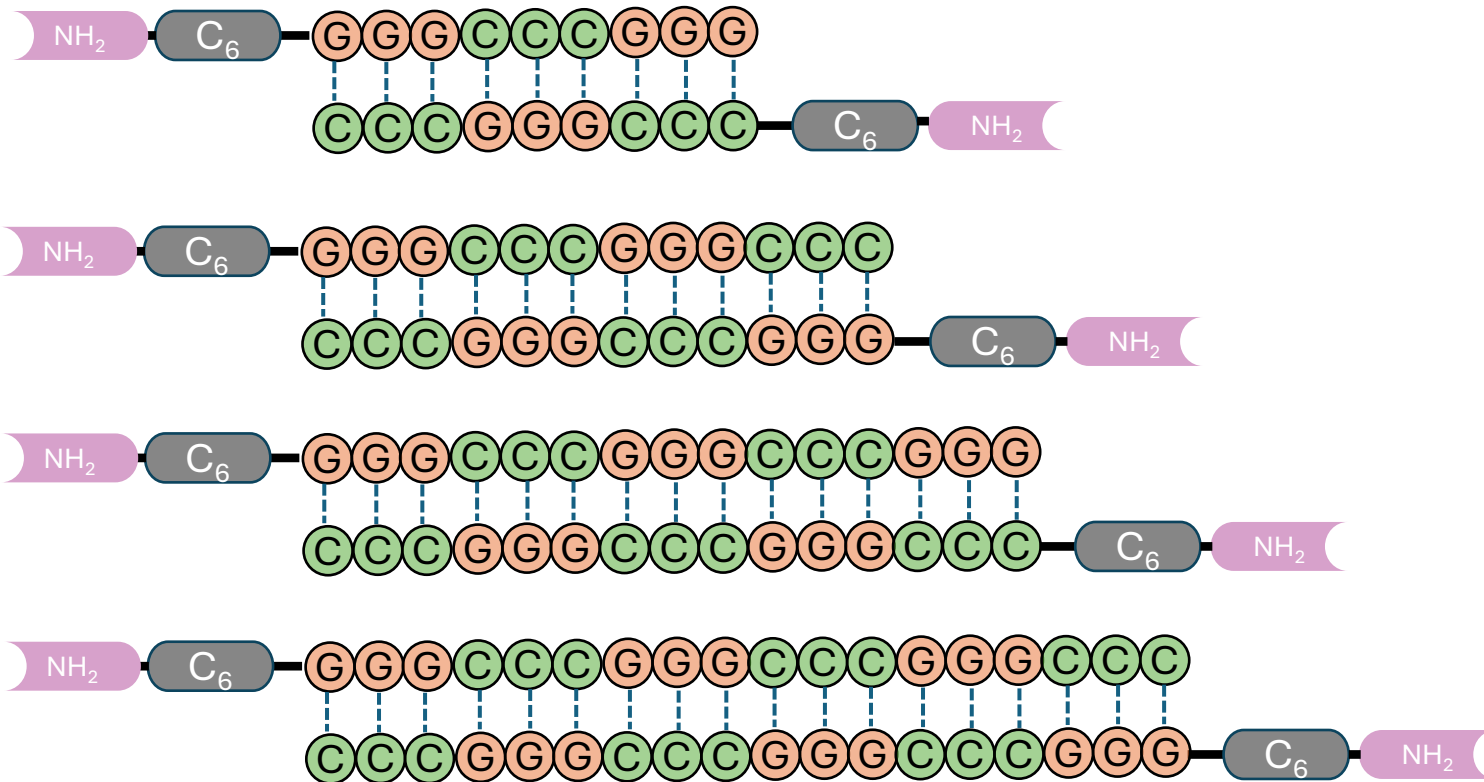
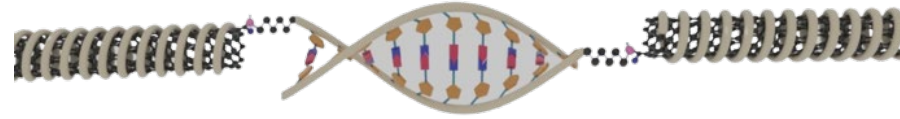
Length Dependence of DNA Conductance



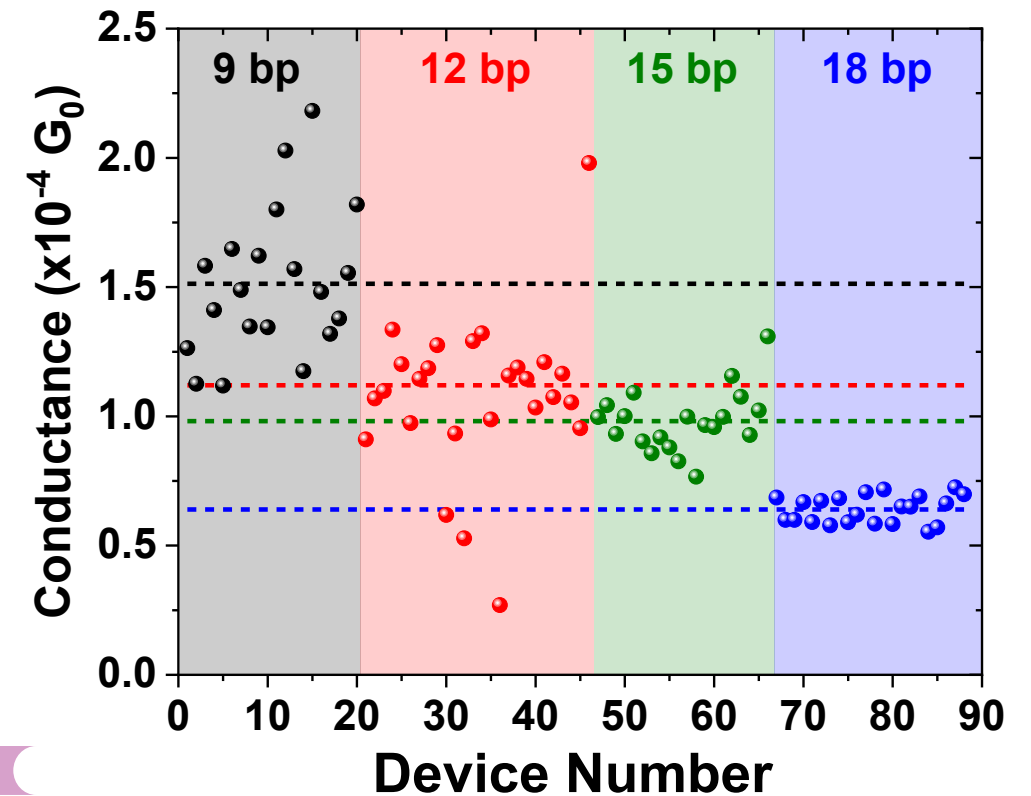
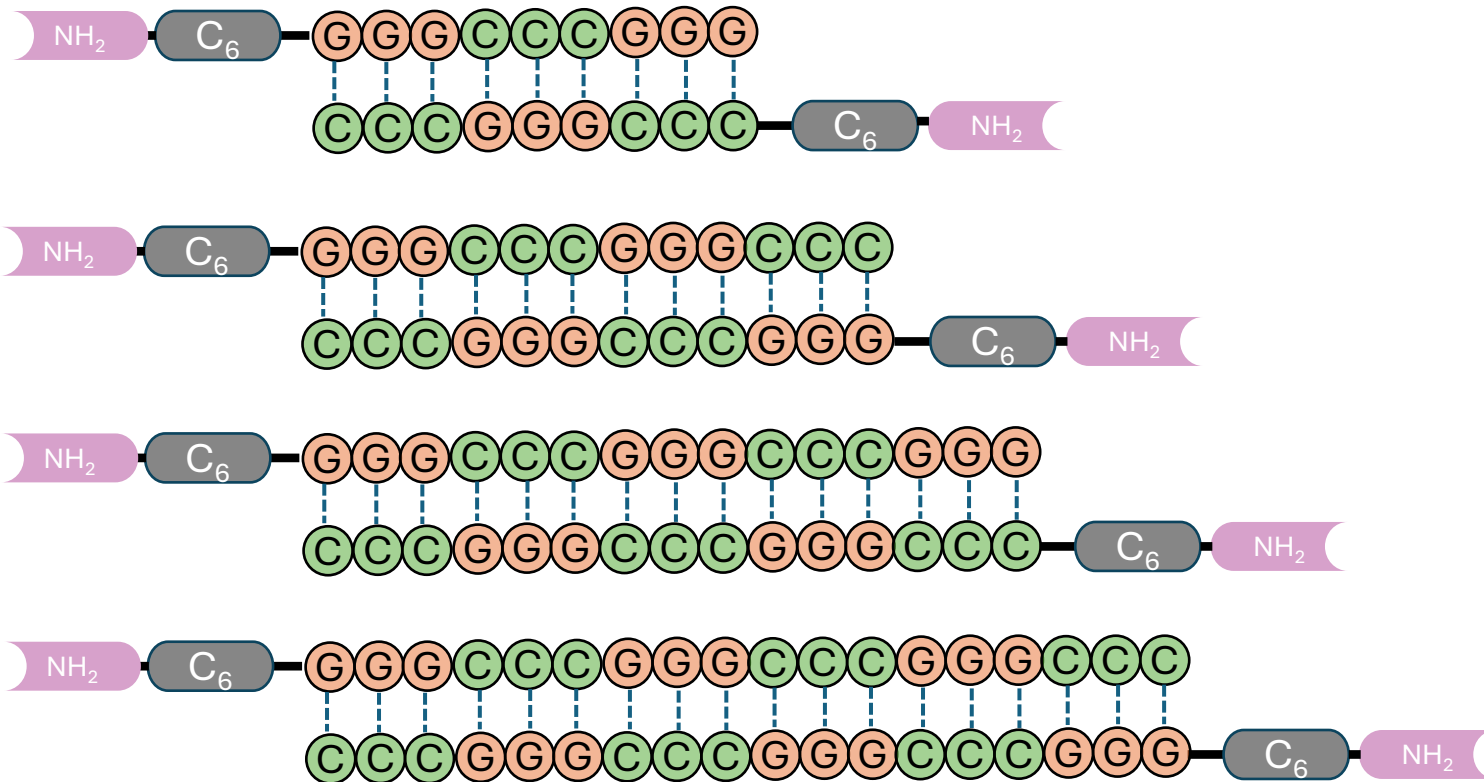
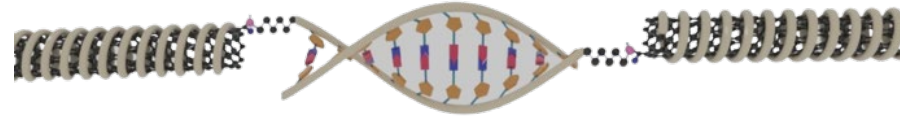
Length Dependence of DNA Conductance



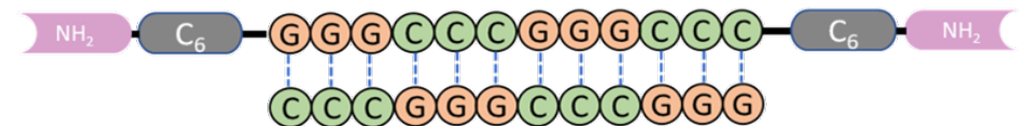
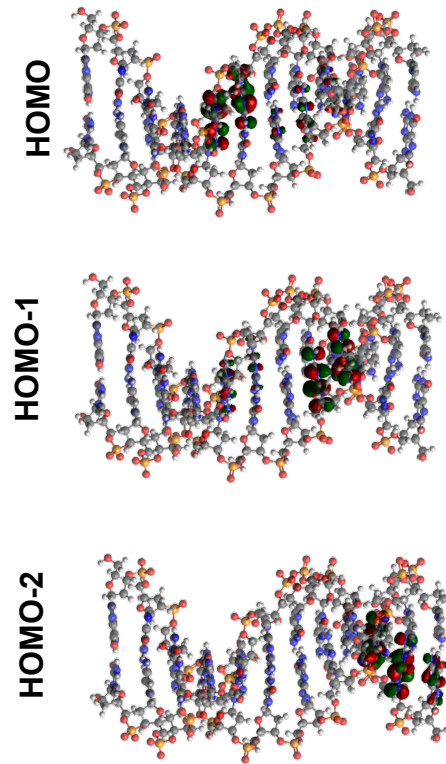
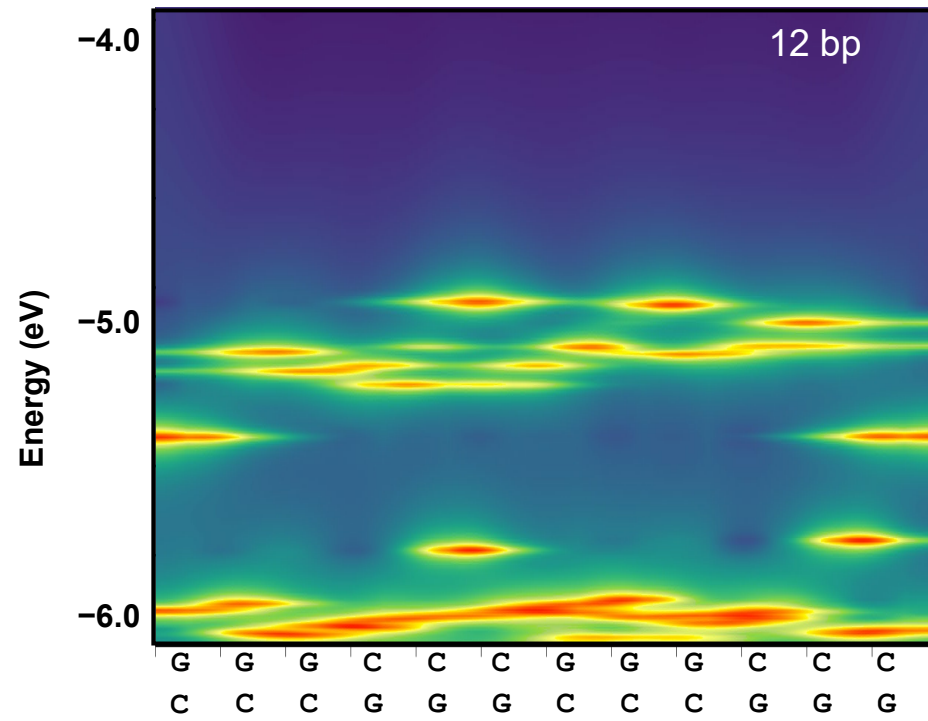
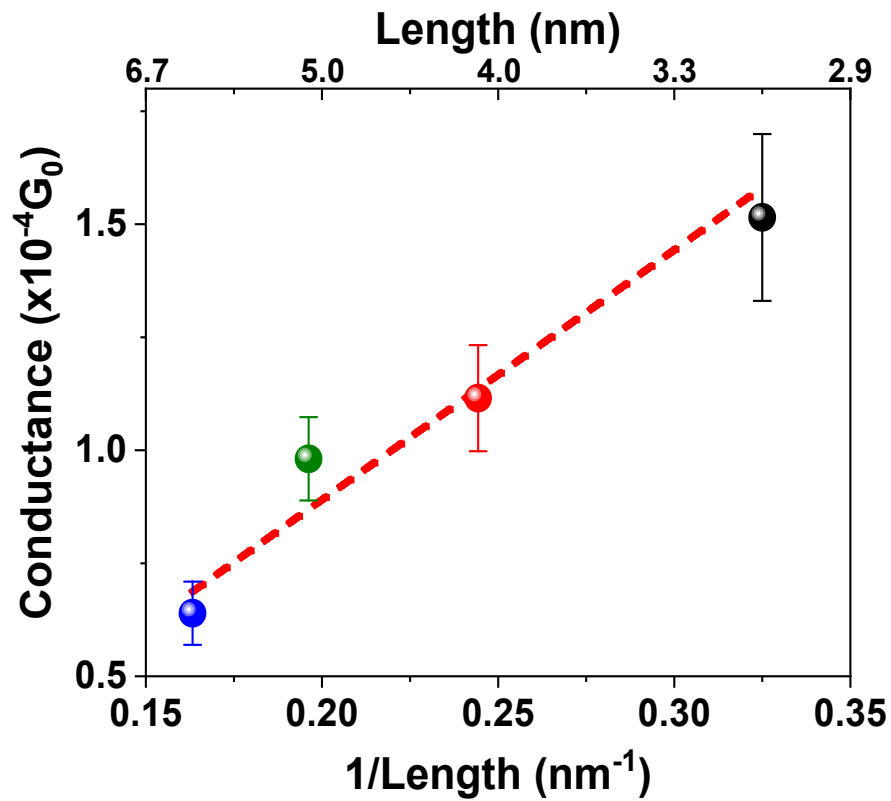
Length Dependence of DNA Conductance

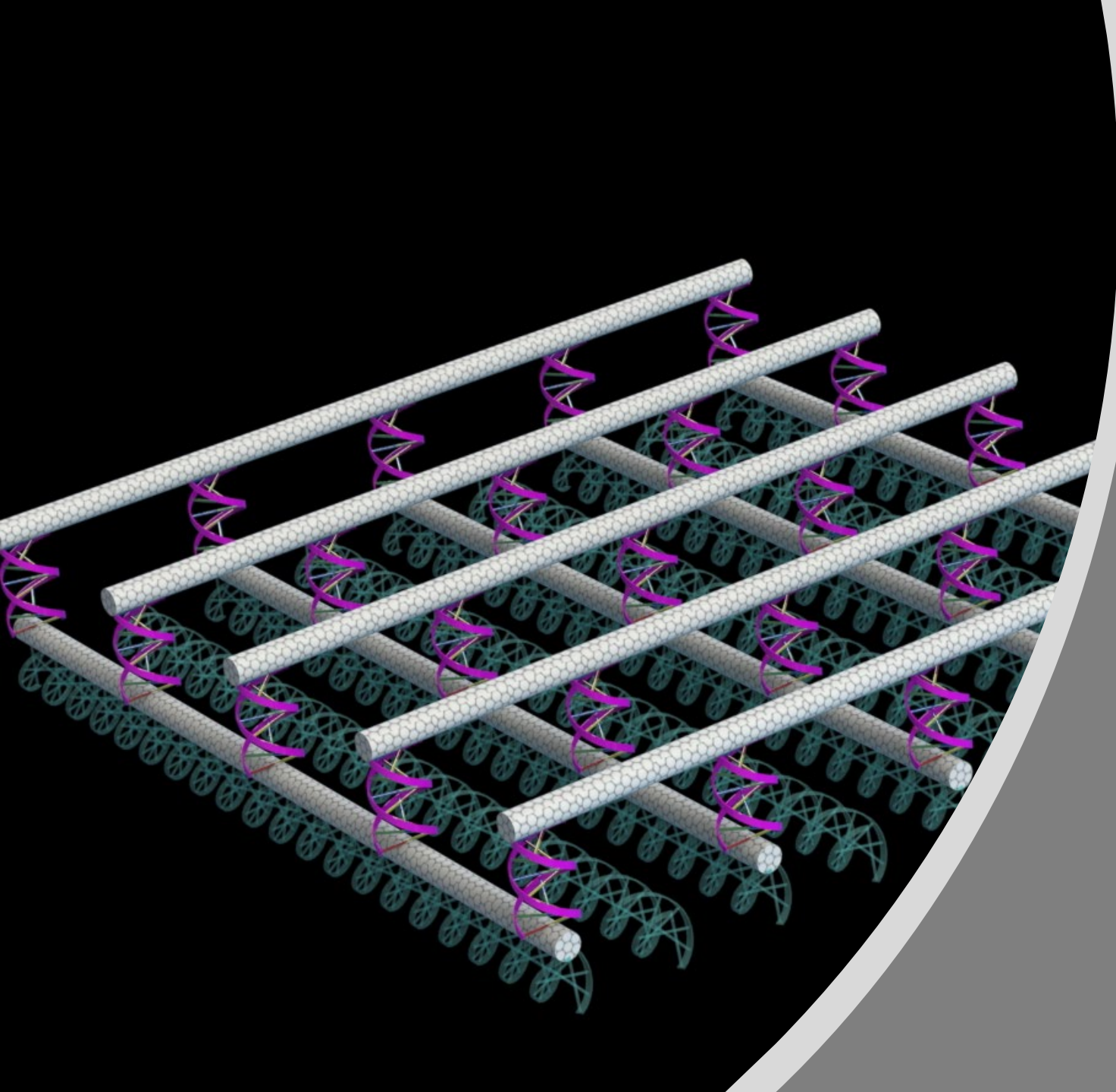


Length Dependence of DNA Conductance



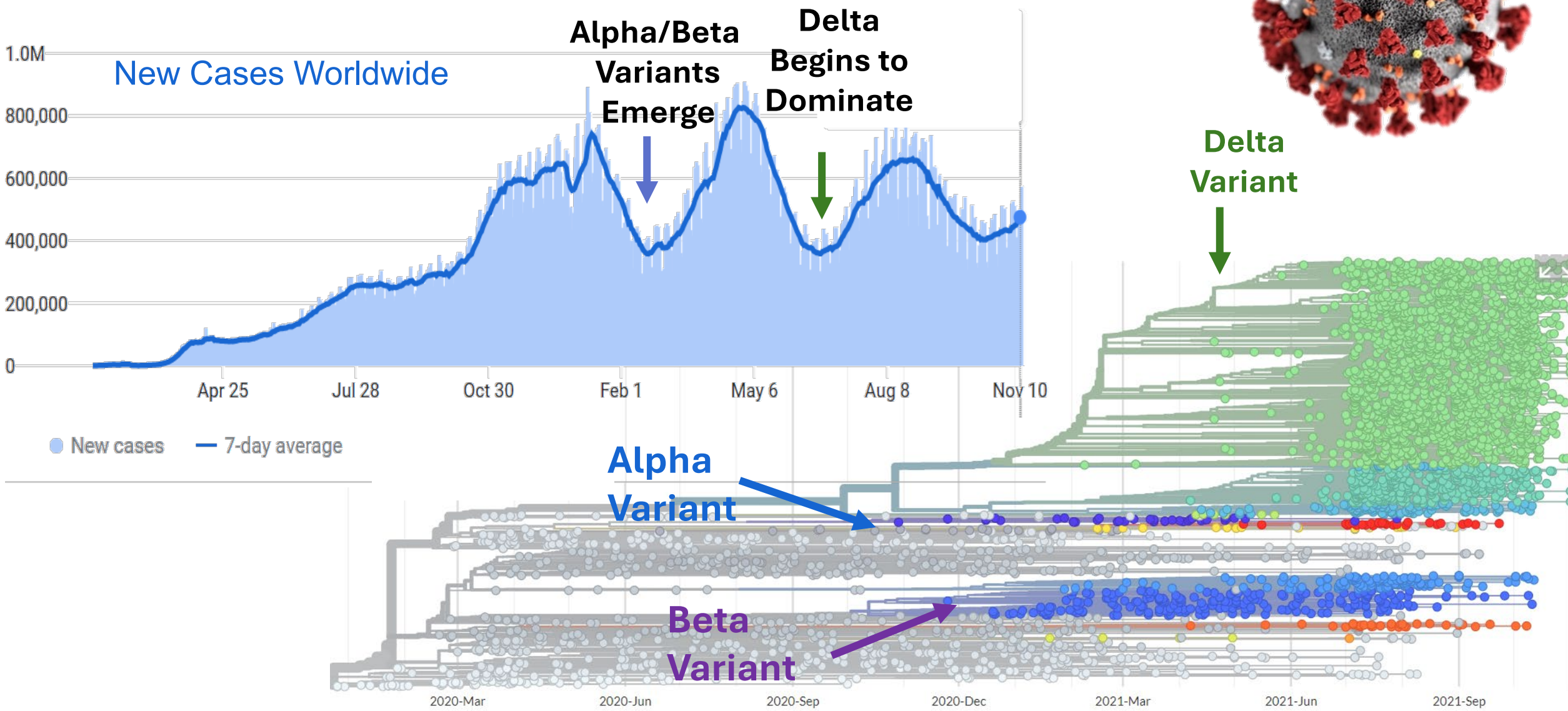
Hopping Dominated Transport Behavior?





- Integrating Single Molecules with Electronics
- Creating Functional DNA-Based Electronic Devices

COVID: Rise of the Variants



Can we electrically identify variants?

D614G

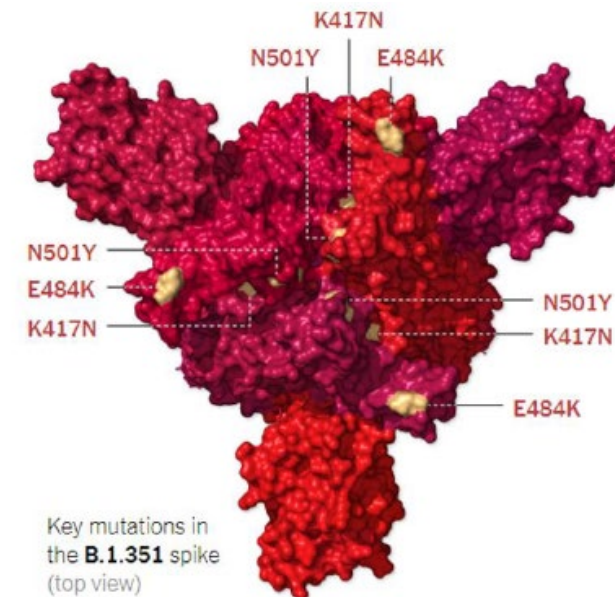
[illegible][illegible]

Sequence	T	G	I	A	V	E	Q	D	K	N	T	Q	E	V	F	A	Q	V	K	Q	I	Y	K	T	P	P	I	K	D	F	G	798
wuhan- hu-1																																
Delta variant-Iraq	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Omicron variant-Iraq	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Y	.	.	.

[illegible]

614D 5' -TATCAGG**A**TGTTAACTGC-3' *Wild Type*

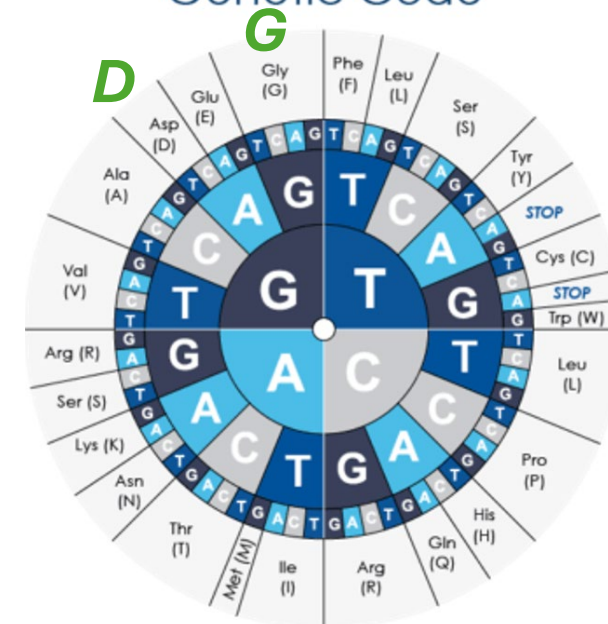
614G 5' -TATCAGG**G**TGTTAACTGC-3' *Variant*



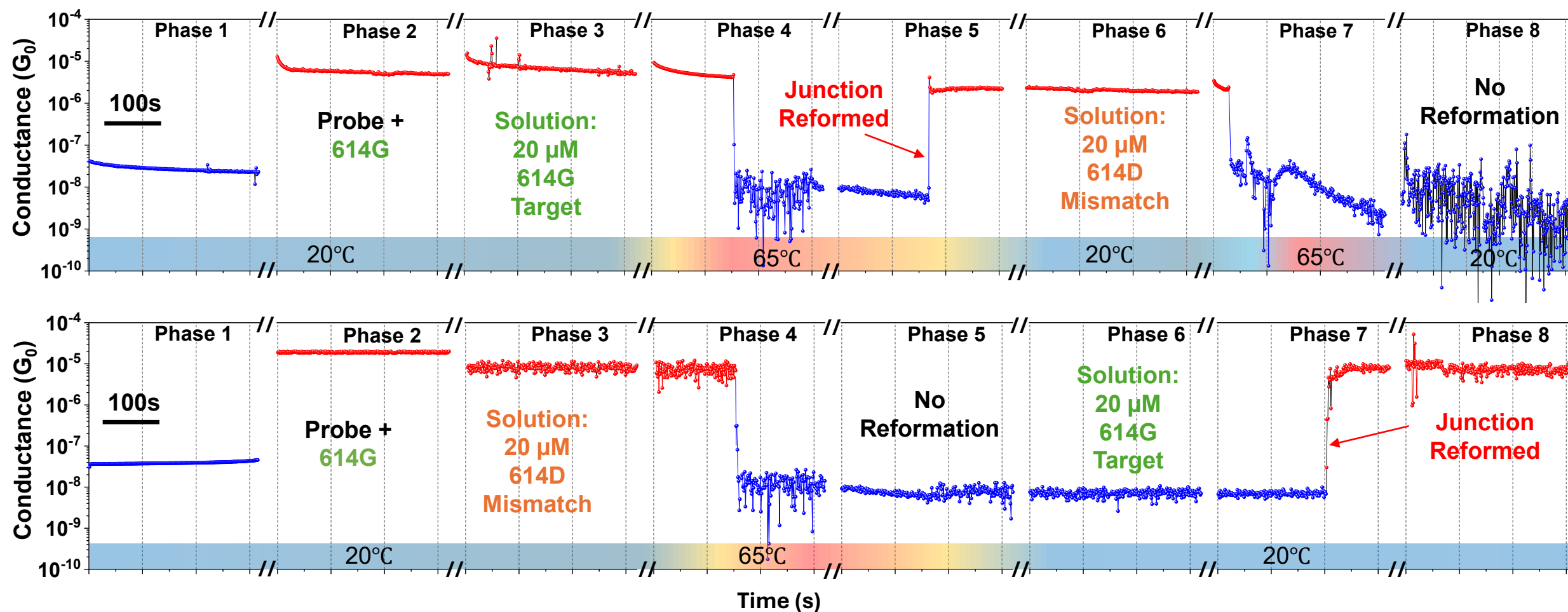
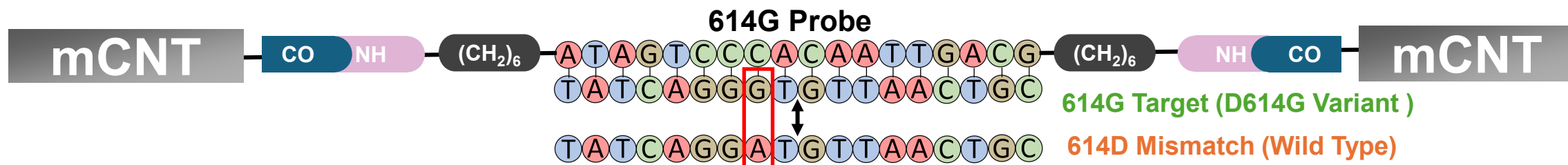
29903 bp

RNA-based Genome

Genetic Code

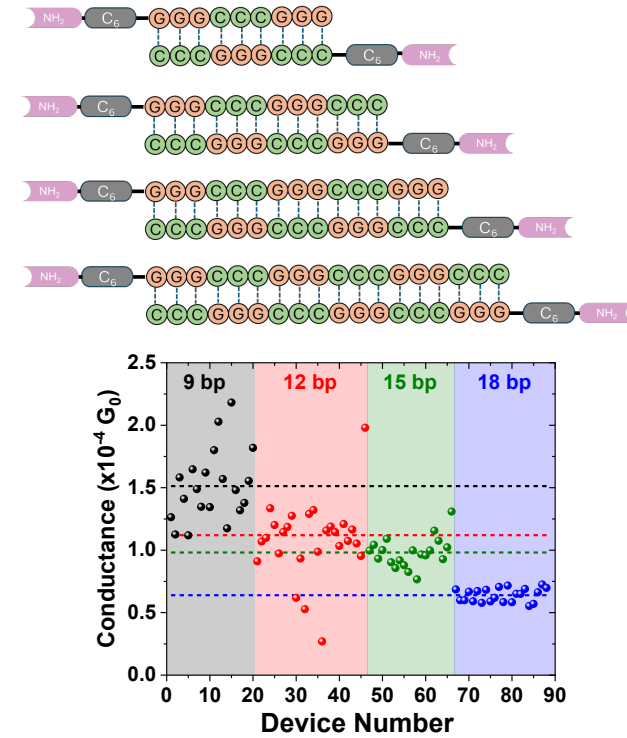
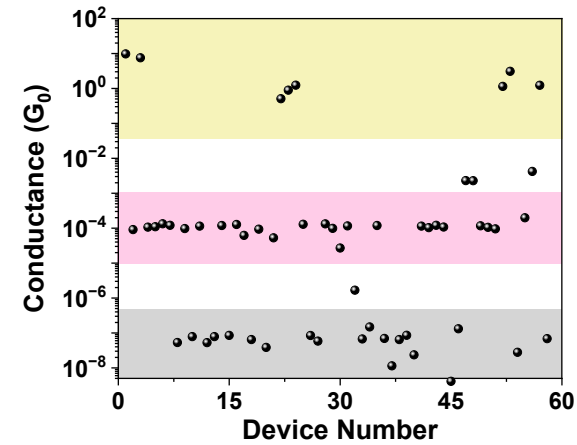
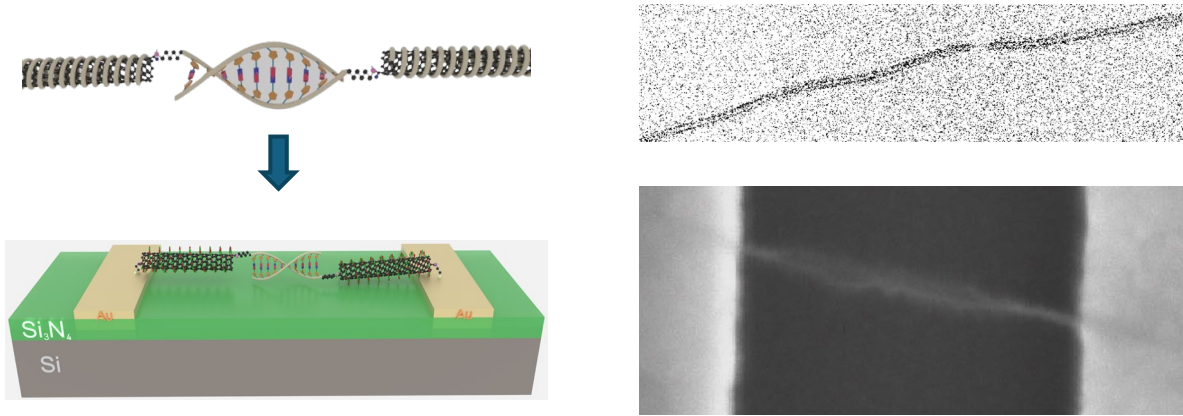


Active Single-Molecule Electronics: Biosensing

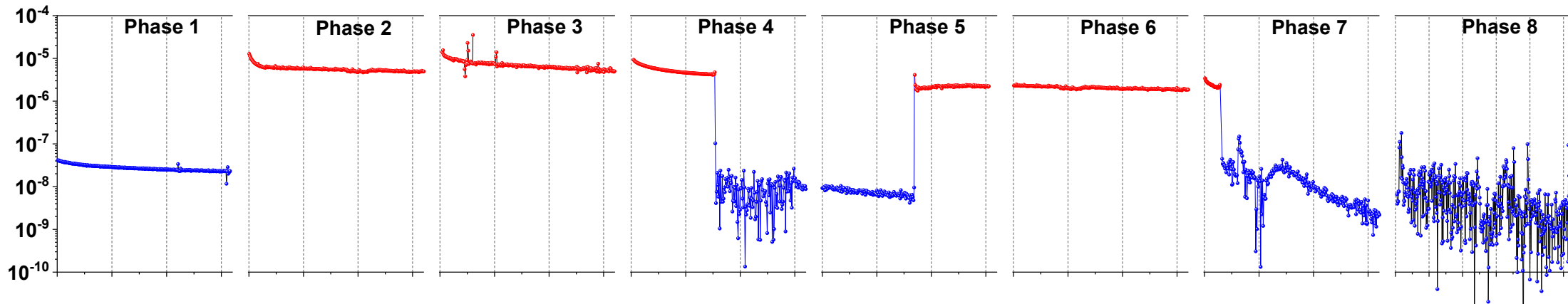


Summary and Conclusions

Self-Aligning Single-Molecule Junctions



Single-Molecule Biosensing



Electrically Controllable DNA-Based Electronics

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NIST:

- Ming Zheng

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- Victor Pan

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- Jim Canary
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