Surprising Charge Transport in DNA

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Charge transport through molecular structures is interesting both scientifically and technologically. To date, DNA is the only type of polymer that transports significant current over distances of more than a few nanometers in individual molecules. Nevertheless, and in spite of large efforts to elucidate the charge transport mechanism through DNA a satisfying characterization and mechanistic description has not been provided yet. Measuring the charge transport in DNA was elusive due to great technical difficulties leading to various results. We recently devised an experiment in which double-stranded DNA is well positioned between metal electrodes. Electrical measurements give surprisingly high currents, up to tens of nA, over 100 base-pairs (~30 nm) elevated from the surface. We further found that homogeneous and non-homogeneous sequences transport charge similarly and that at least one continuous backbone is essential to enable transport. The theoretical calculations and the temperature dependence suggest resonant hopping through the backbone as the charge transport mechanism.

References

[1] "Backbone Charge Transport in Double Stranded DNA", Roman Zhuravel et. Al., Nature Nanotechnology 9, 836 (2020)

Figures