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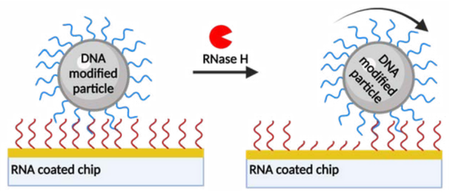
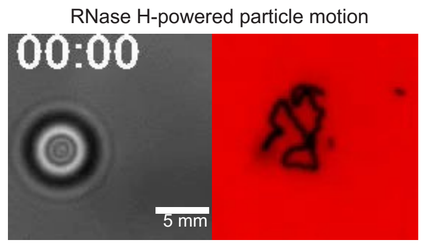
EMORY UNIVERSITY

DNA motors as sensors: toward a new platform for SARS-CoV-2 diagnostics

DNA motors that respond to chemical cues by rolling motion



RNase H-powered particle motion



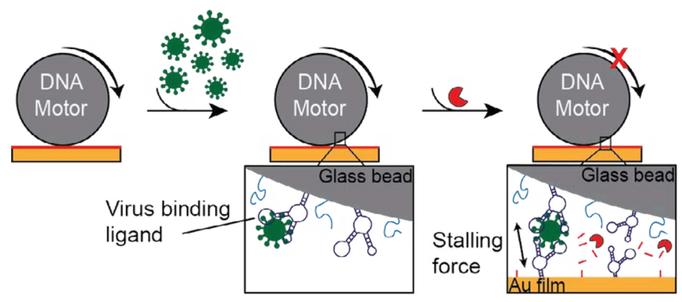
Brightfield (what you see in eyepiece)

RNA Fluorescence (RNA destroyed in thewake of particle motion)

- Fastest and most processive motors, can travel up to 5 µm/min across distances approaching mm length scale
Energy derived from RNA "fuel"
- Optical readouts

Yehl, K. et al. ***Nat. Nanotechnol.*** **2016**

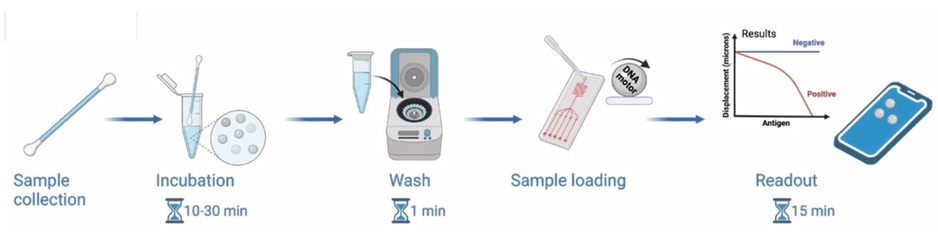
Presence of whole virus particles leads to stalling of DNA motors



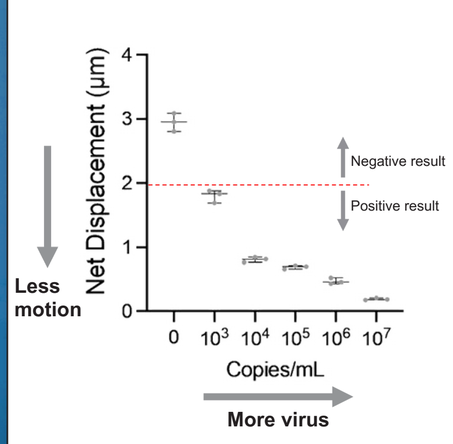
Only if $F_{rupture(virus-VBL)} > F_{motor}$

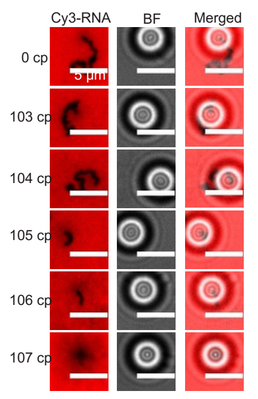
A single viral particle that crosslinks the motor and chip will cause stalling

Assay Workflow



DNA motors show sensitive detection of SARS-CoV-2





Contrived sample

Target: UV-inactivated Delta

Matrix: Artificial saliva

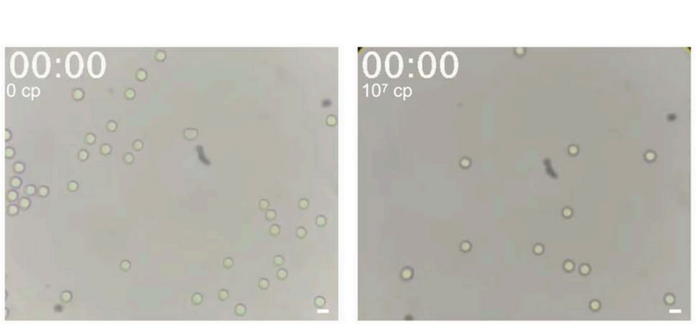
Incubation time: 30 min

Readout time: 15 min

LOD: ~10^3Cp/ml

A single swab from a fully infected person is 108cps

DNA motors show sensitive detection of SARS-CoV-2



Smartphone-scope set up

Scale bar= 5 µm

Summary

- DNA motors can be programmed to sense and respond with locomotion outputs to whole virus particles such as SARS-CoV-2 in a sensitive manner
  - No need for amplification, lysis, or nucleic acid extraction thus greatly reducing the overall cost and procedural complexity
  - The readout can be performedvia smartphone camera
- DNAmotors can be programmed formotor-to-motor communication which provides an important avenue towards mimicking emergent properties of life

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ARCS FOCUS ON THE FUTURE 2022

Scholar Awards Celebration
November 17, 2022