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A deployable nanostructures from DNA

A programmable DNA-based nanotransformer offers reversible structural changes for controlled, directed delivery of payloads, enabling adaptable nanomaterials for synthetic viruses and stimuli-responsive nanodevices.

Deployable auxetic materials are defined as materials that can change their geometry upon external stimuli and have applications in aerospace engineering, soft robotics, and biomedical devices. These can also be found in nature as certain viruses can undergo reversible capsid contraction-expansion in response to environmental cues like pH or ionic strength. However, it has been very difficult to create similar length scale (nanoscale) synthetic 3D deployable auxetic materials. DNA origami can allow for nanometer-scale assembly with geometric programmability and molecular addressability, which makes the structures useful for constructing reconfigurable architecture like deployable auxetic materials. Researchers at Purdue University have designed a nanotransformer using DNA origami that can transform from one configuration to another, during which directed payload delivery at a target location can occur via reversible nanopores. Payloads can be conjugated with fluorescent dyes for tracking of payload movement through nanopores and potentially reactions that occur with enzymatic payloads.

Technology Validation:

-Tested system to regulate the permeability of lipid membranes and tracked payload movement with fluorescence

Advantages

-Reversible change in structure, meaning control over release of payload

-Control over direction of release of payload

Applications

-Creation of adaptable nanomaterials with potential in synthetic viruses and stimuli-responsive nanodevices

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Category

Pharmaceuticals/Pharmaceutical Packaging & Delivery Systems
Materials Science & Nanotechnology/Nanomaterials & Nanostructures
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