Our research is focused on understanding and creating molecular devices and machines that can perform specific tasks as directed by users. We draw inspiration from natural macromolecular assemblies such as viruses and molecular motors and seek to implement similar principles in synthetic molecular machinery. We use both DNA origami and de-novo protein design in our research. Our efforts have lead to several interesting accomplishments:

(1) By studying viruses, we have successfully programmed DNA blocks to self-assemble into icosahedral shells, which have potential applications as programmable antiviral drugs and vaccine carriers.

(2) We have developed DNA origami structures capable of carrying genetic instructions that can be read by mammalian cells. This opens up possibilities for a wide range of applications, including gene therapy and targeted drug delivery.

(3) We have constructed nanoscale assemblies with controllable movements, such as autonomous, power-generating rotary DNA motors and turbines driven by ion flux across membranes. These machines offer potential for executing energy-consuming tasks in synthetic cells.

(4) We have built up and validated a novel computational protein design pipeline that enables building arbitrary shapes using protein backbones, which we intend to pair up with DNA scaffolds to create multifunctional objects, such as advanced therapeutic vehicles.

Thursday, June 27th, 2024 at 11:00 pm

Maria Goeppert room (0.79) and Zoom Meeting ID: 959 2774 3389
Passcode: 651129, direct link