

## Oral Presentation

### DNA-based circuits in well-mixed and spatially-organized systems

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To construct sophisticated biochemical circuits from scratch, one needs to understand how simple the building blocks can be and how robustly circuits can scale up. Using a simple DNA reaction mechanism based on a reversible strand displacement process, we developed a systematic approach to implement arbitrary feed-forward digital logic circuits. We experimentally demonstrated several logic circuits, culminating in a four-bit square root circuit that comprises over a hundred DNA strands. Expanding the architecture of DNA-based circuits from well-mixed systems to spatially-organized systems, we further developed a theoretical framework to implement chemical reaction networks on the surface of DNA nanostructures. We show that with spatial organization, DNA-based circuits would be more scalable than any well-mixed systems, and would allow the construction of sequential logic circuits.