• Biological systems often involve the self-assembly of basic components into complex and functioning structures. Artificial systems that mimic such processes can provide a well-controlled setting to explore the principles involved and also synthesize useful micro-machines.

• Our experiments show that immotile, but active, tripartite nanorods (Au-Pt-Au) can self-assemble into two types of structure that exhibit the fundamental forms of motility: translation and rotation.

• Metallic rods are designed to induce extensile surface flows by electrochemical reactions; these rods interact with each other and pair up to form either a swimmer or a rotor. Such pairs can transition reversibly between these two configurations, leading to kinetics reminiscent of bacterial run-and-tumble motion.

• Electrochemical reactions create both an hydrodynamic flow around a rod and an electric field. Both of these effects are crucial to the self-assembly.


Pairs of rods assemble into rotors and T-shaped swimmers. Electrochemical interactions break the symmetry of the hydrodynamic flow, resulting in directed motion. Pairs can transition between rotor and T-swimmer, resulting in run-and-tumble type motion. Rotors of various sizes are observed. Scale bars are 1µm.