Artificial Life, Self-replication, Exponential growth, Mutations, Evolution, Colloidal Architecture, and DNA Activated Colloidal Machines.

Paul Chaikin
NYU
chaikin@nyu.edu

Self-replication and evolution under selective pressure are inherent phenomena in life, but few artificial systems exhibit these phenomena. We have designed a process and a system of DNA origami tiles that exponentially replicate a seed pattern, doubling (or more) the copies in each diurnal-like cycle of temperature and UV illumination, producing more than 7 million copies in 24 cycles, with fewer cycles when we produce litters. We demonstrate environmental selection in growing populations by incorporating pH sensitive binding in two sub-populations. We use slightly mismatched DNA sticky ends to induce mutations and follow the relative populations. We also use DNA origami to self-assemble complex arrangements of colloids and emulsion droplets with highly specific geometry showing control over valence, position, dihedral angles, and chirality and we make DNA-colloid hybrid micro-machines.