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### **Designing Self-powered Nanomotors and Pumps**

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Self-powered nano and microscale moving systems are currently the subject of intense interest due in part to their potential applications in nanomachinery, nanoscale assembly, robotics, fluidics, and chemical/biochemical sensing. We will demonstrate that one can build autonomous nanomotors over a wide range of length-scales “from scratch” that mimic biological motors by using catalytic reactions to create forces based on chemical gradients. These motors are autonomous in that they do not require external electric, magnetic, or optical fields as energy sources. Instead, the input energy is supplied locally and chemically. These “bots” can be directed by information in the form of chemical and light gradients. Furthermore, we have developed systems in which chemical secretions from the translating nano/micromotors initiate long-range, collective interactions among themselves. This behavior is reminiscent of quorum sensing organisms that swarm in response to a minimum threshold concentration of a signaling chemical. In addition, an object that moves by generating a continuous surface force in a fluid can, in principle, be used to pump the fluid by the same catalytic mechanism. Thus, by immobilizing the nano/micromotors, we have developed nano/microfluidic pumps that transduce energy catalytically. These non-mechanical pumps provide precise control over flow rate without the aid of an external power source and are capable of turning on in response to specific analytes in solution.