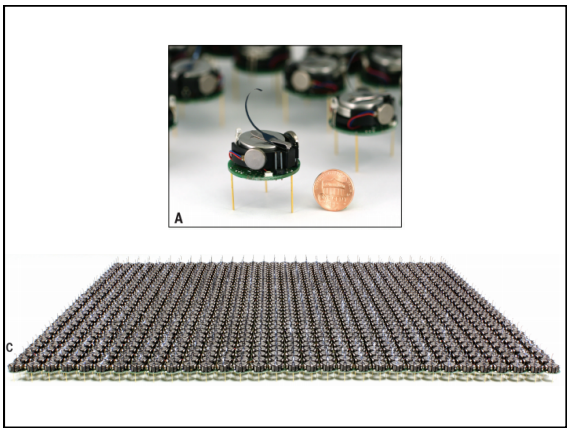


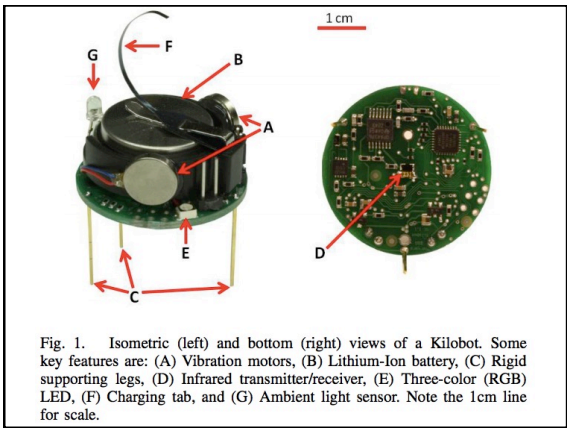
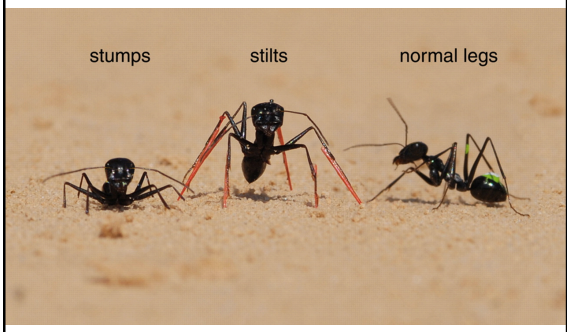
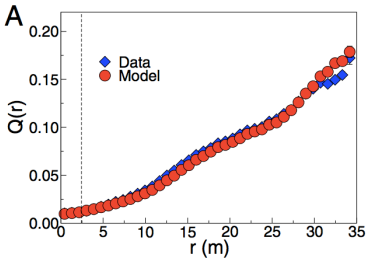


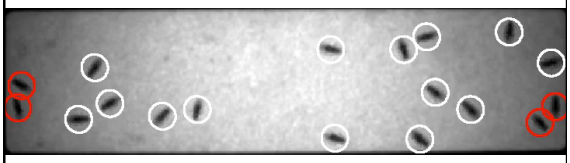
Fig. 1. Isometric (left) and bottom (right) views of a Kilobot. Some key features are: (A) Vibration motors, (B) Lithium-Ion battery, (C) Rigid supporting legs, (D) Infrared transmitter/receiver, (E) Three-color (RGB) LED, (F) Charging tab, and (G) Ambient light sensor. Note the 1cm line for scale.

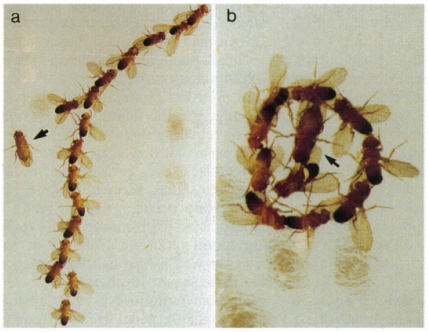


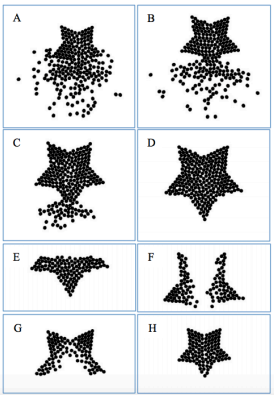
$$\mathcal{H}(\{\vec{\mathbf{v}}_i\}) = \frac{J}{4V^2}\sum_{ij=1}^{N} n_{ij}\left|\vec{\mathbf{v}}_i - \vec{\mathbf{v}}_j\right|^2 + \frac{g}{2V^2}\sum_{i=1}^{N}(v_i - V)^2$$

$$Q(r) = \frac{1}{V^2}\left\langle \left|\vec{\mathbf{v}}_i - \vec{\mathbf{v}}_j\right|^2 \right\rangle_{r_{ij}=r}$$









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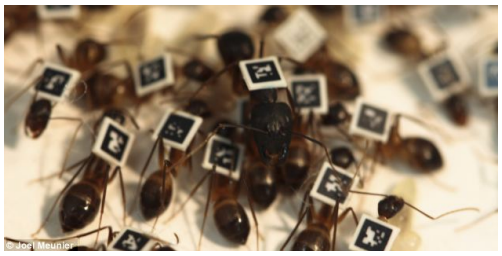
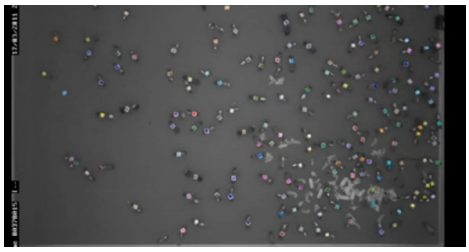
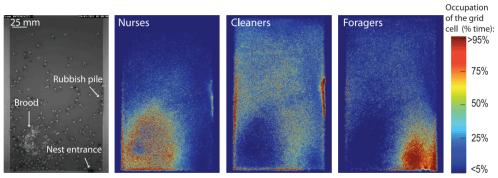
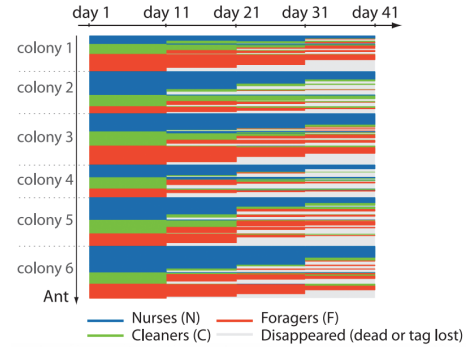








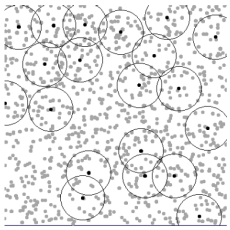
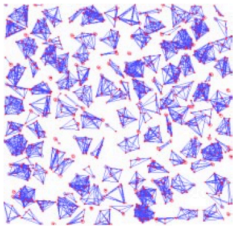


Figure 7: This figure shows leaders forming clubs. The circles circles indicate the area within "earshot" of the leader (at the center of the circle). All processors within this area are recruited as members of the leader's club.



A Biological Solution to a Fundamental Distributed Computing Problem

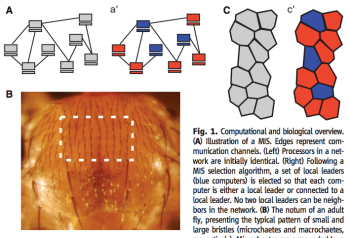
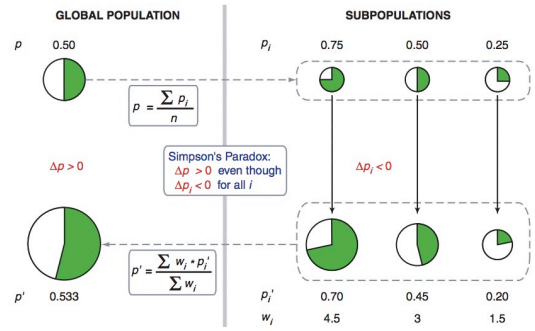


Fig. 1. Computational and biological overview. **(A)** Illustration of a MIS. Edges represent communication channels. (Left) Processors in a network are initially identical. (Right) Following a MIS selection algorithm, a set of local leaders (blue computers) is elected so that each computer is either a local leader or connected to a local leader. No two local leaders can be neighbors in the network. **(B)** The notum of an adult fly, presenting the typical pattern of small and large bristles (microchaetes and macrochaetes, respectively). Microchaetes are surrounded by a dashed line. **(C)** Illustration of SOPs in flies. (Left) Cells in a cluster are initially equivalent. (Right) Following a SOP selection process, selected SOPs (blue cells) inhibit their physical neighbors (red cells), and so for the cluster depicted in this figure, no more SOPs can be selected.



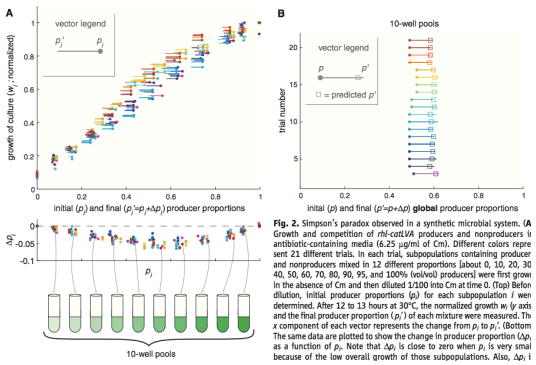
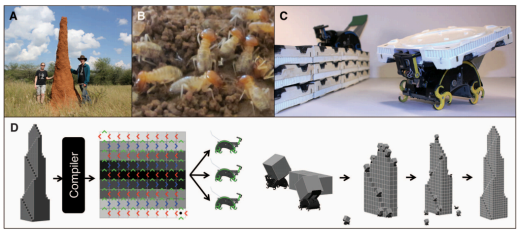


Fig. 2. Simpson's paradox observed in a synthetic microbial system. **(A** Growth and competition of *rhl-catLVA* producers and nonproducers i antibiotic-containing media (6.25 μg/ml of Cm). Different colors repre sent 21 different trials. In each trial, subpopulations containing producer and nonproducers mixed in 12 different proportions [about 0, 10, 20, 30 40, 50, 60, 70, 80, 90, 95, and 100% (vol/vol) producers] were first grown in the absence of Cm and then diluted 1/100 into Cm at time 0. (Top) Before dilution, initial producer proportions (p_i) for each subpopulation i wer determined. After 12 to 13 hours at 30°C, the normalized growth w_i (y axis and the final producer proportion (p_i') of each mixture were measured. Th x component of each vector represents the change from p_i to p_i'. (Bottom The same data are plotted to show the change in producer proportion (Δp_i as a function of p_i. Note that Δp_i is close to zero when p_i is very smal because of the low overall growth of those subpopulations. Also, Δp_i i



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