A sensing array of radically coupled genetic ‘biopixels’

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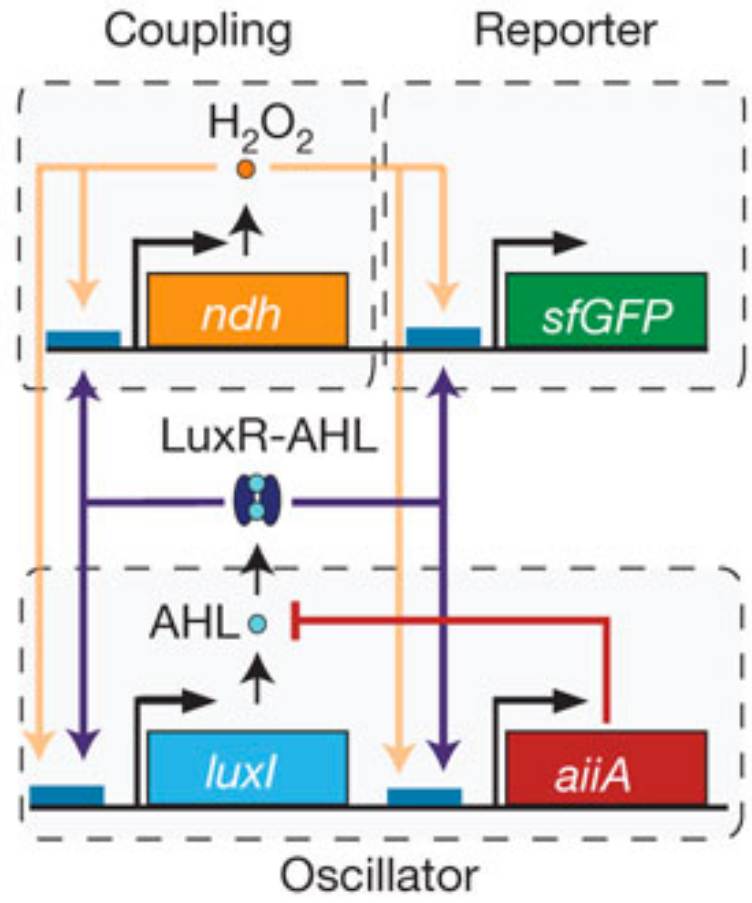
The Need

- Construction of robust circuits is hard in a noisy cellular environment
- In genetic circuits, toggle switches and oscillators have progressed into triggers, counters, and synchronized clocks.
- Oscillatory sensors have a number of advantages
  - Frequency is easily digitized
  - Quickly updated
  - Repeated measurements

The Solution

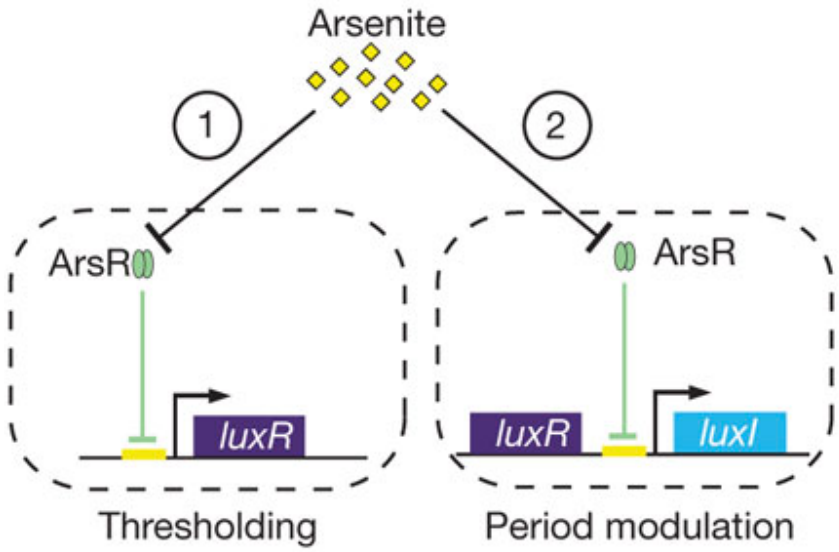
- Local Synchronization with quorum sensing
  - Strong Synchronization
  - Short Distance
- Global synchronization with hydrogen peroxide
  - Weak Synchronization
  - Far Distance



Synergistic Synchronization

Practical Use?

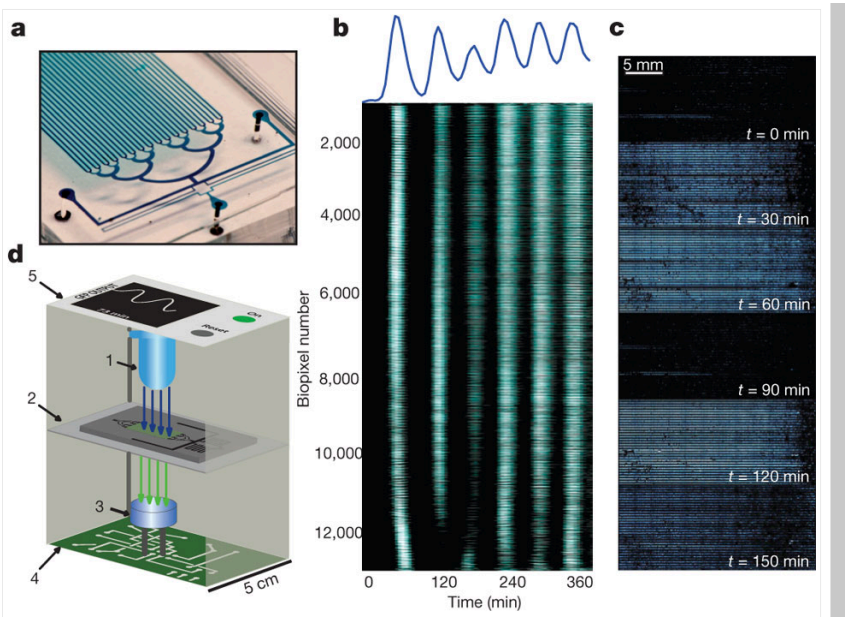
- Arsenite sensing array
- ON/OFF SYSTEM
  - Threshold modified by RBS and promoter strength
- Concentration of Arsenite (natural)
  - Calculate concentration of oscillation.
  - Able to generate a sensor calibration curve



Threshold Movie

Practical Use Part 2

- Microscope dependency cost a lot
  - Solution: increase signal
- Bigger Array, handheld device
  - 50 million cells



Significance

- Nesting two modes of communication
  - Expand Scale
  - Increase Complexity
- Allow us to scale up synthetic circuits
- Paves the way to next generation synthetic biology

Discussion Questions

- Neat idea
- Advantages of having fast synchronization? Any ideas to make it even faster?
- Relation to 380 or this class?

Movie 1 (ndh driven)

Set Up