



Office of Naval Research Synthetic Biology

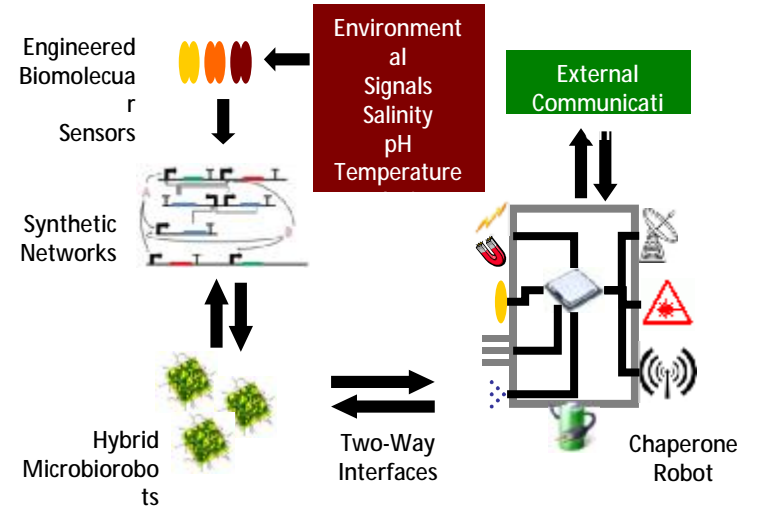
Objective: To develop engineered organisms to produce, deliver, detect and/or respond to target compounds or signals, and that can communicate with non-living devices, in support of future naval capabilities.

Possible applications:

- Secure, renewable, scalable production of high-value naval materials, e.g. electrobiosynthesis, ribosome engineering of polymers/fuels
- Stealthy, remotely-observable sentinel species for threat monitoring, e.g. TNT-detecting plants or diatoms.
- Autonomous, living-non-living integrated micro-devices:
 - bio-hybrid robotics (think “bacterial brain”);
 - electrical, optical, magnetic “Input/Output” signals for biological circuits
 - Cellular/biochemical logic for smart diagnostics or computation

Investment: ≈\$5M (reflects significant FY14 cuts to ONR programs)

Key Performers: MIT, Boston U., UC Berkeley, U. MN.



Challenges

	Short (1-3 yrs)	Near (3-5 yrs)	Long (5+years)
Science	<ul style="list-style-type: none"> •Elucidate and exploit molecular mechanisms of physical signal transduction in microbes (optical, EM...) •Determine how e- from current enter metabolism 	<ul style="list-style-type: none"> •Environmentally relevant chassis and circuit interoperability •Microbial containment while maintaining function in environmental system •2-way microbial communication across non-living interface 	<ul style="list-style-type: none"> •Engineering of multi-cellular microbial assemblies for multi-tasking. •Flexibility in metabolic pathway design for electro-bio-synthesis
Technical	<ul style="list-style-type: none"> •HTP methods for design/build/test functional circuits 	<ul style="list-style-type: none"> •Predictive design of circuit components with desired, (perhaps) non-natural functions •Scalability of electrobiosynthesis 	<ul style="list-style-type: none"> •Integration of living/non-living parts in autonomous systems •Deployable systems for remote electro-bio-synthesis
ELSI	None	Deployment of engineered organisms in environment	Deployment of engineered microbes in environment

Issues

- Potential adversarial uses of synthetic biology and how to detect them (novel BW pathogens and agents)
- Infrastructure to manage parts/circuit data/meta-data storage, analysis, interoperability