

Defense Advanced Research Projects Agency (DARPA) Biological Technologies Office (BTO)

Director, BTO

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Briefing prepared for Defense Health Board

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What is DARPA?

**SATURN
F1 Rocket
Engine**



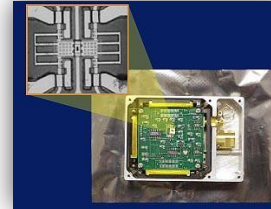
Stealth Fighter



Speech Recognition



**Microelectromechanical
Systems (MEMS)**



**Brain-controlled
Prosthetic Arm**



1960

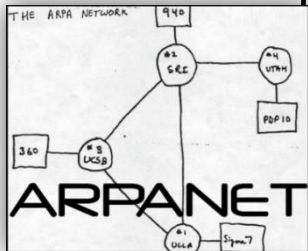
1970

1980

1990

2000

2010



ARPANET



**Global Positioning
System**



Global Hawk



Autonomous Vehicle



**Humanoid
Robot**



The Needs of Warfighter

- Control complex systems for complex missions
- Operate under extraordinary stress and physical requirements
- Quickly learn complex tasks and concepts

Some of the New Challenges and Opportunities in Biology

- Continued emergence of infectious diseases
- Unprecedented access to the brain and nervous system
- Cheap, accessible gene editing tools

BTO Mission Space

- Outpace Infectious Diseases
- Explore Neurotechnology
- Accelerate Synthetic Biology





Technologies for TBI and Neuropsychological Illness

Revolutionizing Prosthetics



Courtesy: Johns Hopkins APL and University of Pittsburgh

- Proof of concept for closed-loop control in brain research
- Demonstrated motor control and sensory feedback in neural prosthetic

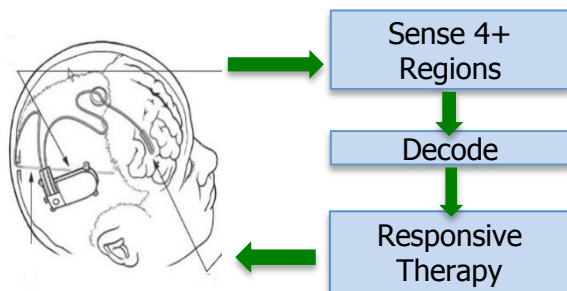
Restoring Active Memory (RAM)



Courtesy: University of Pennsylvania

- Computational model of neurobiological mechanisms underlying memory in humans
- Portable, secure wireless prototype implantable neural device for memory restoration in humans

Systems-Based Neurotechnology for Emerging Therapies (SUBNETS)



- Implanted, closed-loop diagnostic and therapeutic system for treating, and possibly even curing, neuropsychological illness
- Advance neuropsychiatry into the realm of therapy driven by quantifiable characteristics of neural state



Outpace Infectious Diseases

Prometheus



- Chikungunya Challenge lessons learned
- Prognostics for contagiousness

Mobile Analysis Platform (MAP)



Courtesy: Ibis Biosciences

- CLIA*-waived lab accuracy at the bedside
- Multi-functional: medical, biothreat
- Operational testing on-going

* Clinical Laboratory Improvement Amendments

ADEPT



- Gene-encoded vaccine, prophylaxis, and treatment
- Ebola, chikungunya, and Zika activities

Dialysis-Like Therapeutics (DLT)



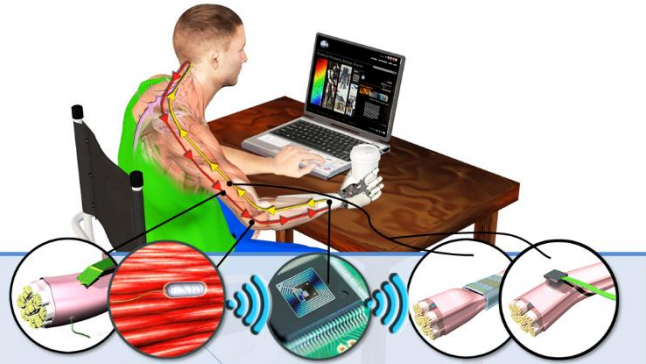
Courtesy: NxStage Medical, Inc. and Battelle

- Extracorporeal therapy in far-forward environments
- Prolonged field care is a DoD capability gap
- Multi-functional (dialysis, pathogen removal, immuno-modulation)



Restoring Health through Peripheral Interfaces

HAnd Proprioception and Touch Interfaces (HAPTIX)

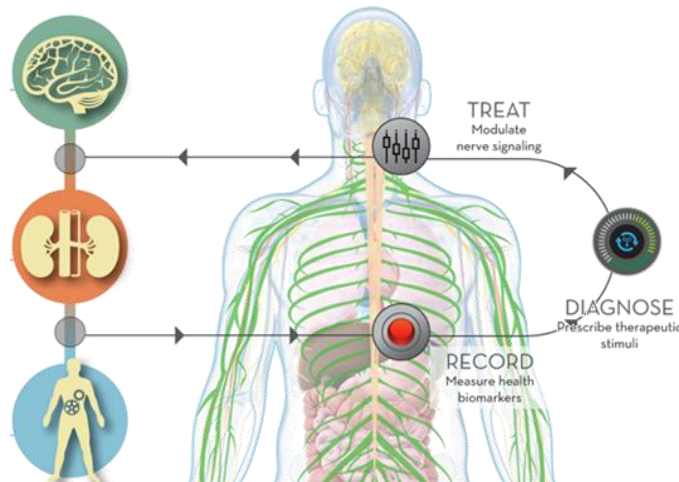


- Prosthetic hands with natural control and sensation
- Fully-implantable devices, approved for long-term human use
- Demonstrate benefits in 12-month take-home study

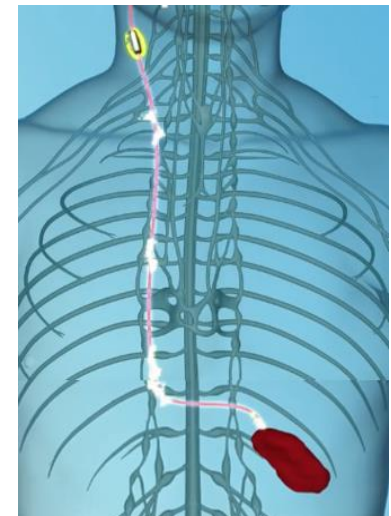


Courtesy: University of Utah

Electrical Prescriptions (ElectRx)



- Precise and intelligent modulation of nerve-organ end circuits to improve physical and mental health
- Paradigm shift for medicine: using nerves instead of drugs
- Develop minimally invasive strategies for monitoring and modulating nervous system and health status



Courtesy: Feinstein Institute



www.darpa.mil