DARPA and the Brain Initiative

The White House announced the BRAIN initiative in April 2013. Today, the initiative is supported by several federal agencies as well as dozens of technology firms, academic institutions, scientists and other key contributors to the field of neuroscience. DARPA is supporting the BRAIN initiative through a number of programs, continuing a legacy of DARPA investment in neurotechnology that extends back to the 1970s. An article in our 60th anniversary magazine provides an overview of the agency's recent research aimed at expanding the frontiers of the field and enabling powerful, new capabilities.

Electrical Prescriptions (ElectRx)

The ElectRx program aims to help the human body heal itself through neuromodulation of organ functions using ultraminiaturized devices, approximately the size of individual nerve fibers, which could be delivered through minimally invasive injection.

- Work Begins to Support Self-Healing of Body and Mind
- ElectRx Has the Nerve to Envision Revolutionary Therapies for Self-Healing
- President Obama Highlights New DARPA Program Aimed at Developing Novel Therapies Customized to Individual Patients

Hand Proprioception and Touch Interfaces (HAPTIX)

The HAPTIX program aims to create fully implantable, modular and reconfigurable neural-interface microsystems that communicate wirelessly with external modules, such as a prosthesis interface link, to deliver naturalistic sensations to amputees.

- Neuroscience of Touch Supports Improved Robotic and Prosthetic Interfaces
- HAPTIX Starts Work to Provide Prosthetic Hands with Sense of Touch
- By Restoring Sense of Touch to Amputees, HAPTIX Seeks to Overcome Physical and Psychological Effects of Upper Limb Loss

Neural Engineering System Design (NESD)

The NESD program aims to develop an implantable neural interface able to provide unprecedented signal resolution and data-transfer bandwidth between the brain and the digital world.

- Towards a High-Resolution, Implantable Neural Interface

Bridging the Bio-Electronic Divide

Neuro Function, Activity, Structure and Technology (Neuro-FAST)

The Neuro-FAST program seeks to enable unprecedented visualization and decoding of brain activity to better characterize and mitigate threats to the human brain, as well as facilitate development of brain-in-the loop systems to accelerate and improve functional behaviors. The program has developed CLARITY, a revolutionary tissue-preservation method, and builds off recent discoveries in genetics, optical recordings and brain-computer interfaces.

Researchers Identify Conductor of Brain's Neural Orchestra & Begin to Decode the Score

Advanced CLARITY Method Offers Faster, Better Views of Entire Brain

Next-Generation Nonsurgical Neurotechnology (N^3)

The N^3 program aims to develop a safe, portable neural interface system capable of reading from and writing to multiple points in the brain at once. Whereas the most advanced existing neurotechnology requires surgical implantation of electrodes, N^3 is pursuing high-resolution technology that works without the requirement for surgery so that it can be used by able-bodied people.

Six Paths to the Nonsurgical Future of Brain-Machine Interfaces

Nonsurgical Neural Interfaces Could Significantly Expand Use of Neurotechnology

Reliable Neural-Interface Technology (RE-NET) (Archived)

The RE-NET program seeks to develop the technologies needed to reliably extract information from the nervous system, and to do so at a scale and rate necessary to control complex machines, such as high-performance prosthetic limbs.

Minimally Invasive "Stentrode" Shows Potential as Neural Interface for Brain

Atom-width Graphene Sensors Could Provide Unprecedented Insights into Brain Structure and Function

New Nerve and Muscle Interfaces Aid Wounded Warrior Amputees

Restoring Active Memory (RAM)

The RAM program aims to develop and test a wireless, fully implantable neural-interface medical device for human clinical use. The device would facilitate the formation of new memories and retrieval of existing ones in individuals who have lost these capacities as a result of traumatic brain injury or neurological disease.

Progress in Quest to Develop a Human Memory Prosthesis

Targeted Electrical Stimulation of the Brain Shows Promise as a Memory Aid

Restoring Active Memory Program Poised to Launch

Restoring Active Memory – Replay (RAM Replay)

The RAM Replay program will investigate the role of neural "replay" in the formation and recall of memory, with the goal of helping individuals better remember specific episodic events and learned skills. The program aims to develop novel and rigorous computational methods to help investigators determine not only which

brain components matter in memory formation and recall, but also how much they matter.

DARPA Aims to Accelerate Memory Function for Skill Learning

Revolutionizing Prosthetics

The Revolutionizing Prosthetics program aims to continue increasing functionality of DARPA-developed arm systems to benefit Service members and others who have lost upper limbs. The dexterous hand capabilities developed under the program have already been applied to small robotic systems used to manipulate unexploded ordnance, reducing the risk of limb loss among Soldiers.

DARPA Helps Paralyzed Man Feel Again Using a Brain-Controlled Robotic Arm

Neurotechnology Provides Near-Natural Sense of Touch

From Idea to Market in Eight Years, DARPA-Funded DEKA Arm System Earns FDA Approval

Systems-Based Neurotechnology for Emerging Therapies (SUBNETS)

The SUBNETS program seeks to create implanted, closed-loop diagnostic and therapeutic systems for treating neuropsychological illnesses.

Breakthroughs Inspire Hope for Treating Intractable Mood Disorders

Journey of Discovery Starts toward Understanding and Treating Networks of the Brain

SUBNETS Aims for Systems-Based Neurotechnology and Understanding for the Treatment of Neuropsychological Illnesses

Targeted Neuroplasticity Training (TNT)

The TNT program seeks to advance the pace and effectiveness of cognitive skills training through the precise activation of peripheral nerves that can in turn promote and strengthen neuronal connections in the brain. TNT will pursue development of a platform technology to enhance learning of a wide range of cognitive skills, with a goal of reducing the cost and duration of the Defense Department's extensive training regimen, while improving outcomes.

TNT Researchers Set Out to Advance Pace and Effectiveness of Cognitive Skills Training

Boosting Synaptic Plasticity to Accelerate Learning

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