

NEUROTECHNOLOGY FUNDAMENTALS & EMERGING DEVICES FOR THE TREATMENT OF PARALYSIS

NEUROTECHNOLOGY Using Technology to Advance Outcomes for Persons with Brain Injury

Contemporary Forums
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Helping people regain life through neurotechnology



Objectives

- Identify four categories of neurotechnology devices and applications to conditions related to TBI population.
- Describe the implementation of FES applications in the rehabilitation environment and the impact to persons with brain injury.
- Assess the applications of and potential patient outcomes of vision feedback restoration therapy.
- Evaluate information resources available to rehabilitation professionals to enhance clinical practice for persons with TBI.

Agenda

- **Overview of Neurotechnology**
Jennifer French, MBA
- **Clinical Cases of Upper Extremity Rehabilitation with FES**
Suzanne Tinsley, PhD, DPT
- **Clinical Evidence of External FES for Drop Foot Stimulation**
Suzanne Tinsley, PhD, DPT
- Refreshment Break
- **Robotic Rehabilitation Using Visual Feedback Restoration Therapy**
Bambi Roberts Brewer, PhD
- Questions and Discussion

Sponsors

Potential Conflict of Interest

- NEC Foundation of America
- The Craig H. Neilsen Foundation
- Bioness
- Neurostream Technologies
- Restorative Therapies
- Christopher and Dana Reeve Foundation
- The Harold Grinspoon Charitable Foundation
- Neurotech Reports
- Neural Signals



Neurotech Network is a 501 (c)(3) non-profit organization dedicated to improve the education of and the advocacy to access neurotechnology devices, therapies and treatments for persons with neurological impairments, care givers and the medical professionals who care for them.

Neurotech Network, The Society to Increase Mobility, Inc. and its representatives do not rate, endorse, recommend, sell, distribute or prescribe any products, procedures or services. We provide resources to help make informed health decisions.

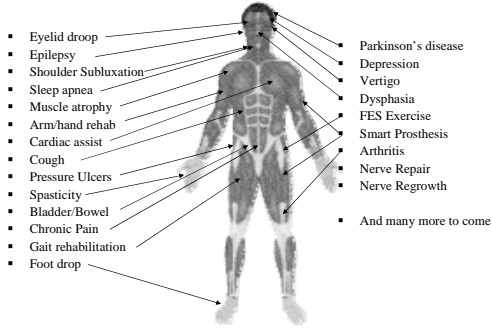
What is Neurotechnology?

Definition: The application of medical electronics and engineering to restore or improve the function of the human nervous system.

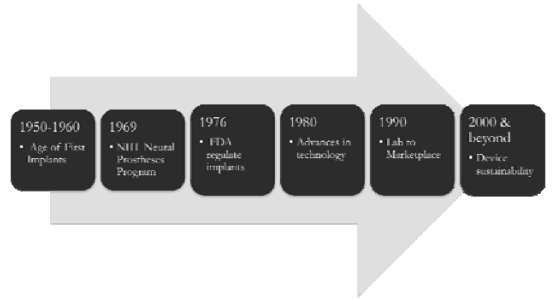


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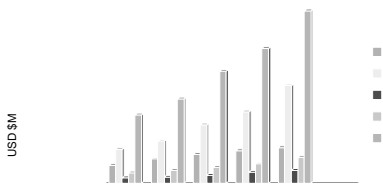
Variety of Applications



Evolution of Neurotechnology



Worldwide Neurotechnology Market (\$M)



Challenges

- **Reimbursement** – Physical Access vs Financial access
- **Market availability** – Formidable technology transfer
- **Awareness** – Standard of care vs. Last Resort Syndrome

Categories of Neurotechnology

- Neuromodulation
- Neural Prosthesis
- Neural Rehabilitation
- NeuroSensing & NeuroDiagnostics

*There are variation of these main categories

Neuromodulation

- Vagus Nerve Stimulation
- Spinal Cord Stimulation
- Surface Stimulation
- Implanted Drug Delivery Systems
- Transcranial Magnetic Stimulation



Spinal Cord Stimulation - Pain



Vagus Nerve Stimulator – Intractable Epilepsy



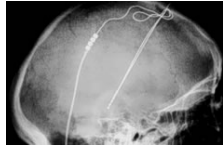
TENS for pain

Picture Sources: Medtronic, Cyberonics, Empti

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Deep Brain Stimulation

- Microelectrode arrays stimulating and sensing
- Customization of leads to interact with IPG
- Used to stimulate arousal, higher level functioning, i.e. movement and speech
- Target BI population:
 - Minimally Conscious State
 - Severe to moderate cognitive disability



Picture Sources: Intellect Medical

Neural Prostheses

- Lower extremity
- Upper extremity
- Dysphasia
- Breathing and Cough Assistance



Hand and wrist stimulation



Drop Foot Stimulation - Gait



Implanted breathing system



External stimulation - Dysphasia

Picture sources: Biomet, Chattanooga Group, Innovative Neurotechnics, Synapse Biomedical

Neural Rehabilitation

- Neuromuscular Electrical Stimulators
- Neural Reeducation Systems
- NeuroRobotics



FES Cycling



Robotic assisted interventions



EMG & NMES



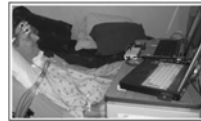
Picture Sources: Restorative Therapies, Robomedia, Zynex Medical, Columbia Scientific

NeuroSensing & Diagnostics

- EEG & EMG Sensing
- Brain Computer Interface
- Brain Analysis Systems
- Peripheral Nerve Sensing



Peripheral Nerve Sensing



Brain Computer Interface

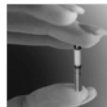


EMG Movement Sensing

Picture Source: Control Basics, Neurotechnics, ClearMed

Emerging Devices and Therapies

- New Electrode Designs:
 - BION
 - Spiral Cuff
 - Guided Nanowire
- High Intensity Infrared Therapy
- Cortical Stimulation
- Speech Prosthesis



Picture Source: APT Center/FES Center, AMF, PhotoThera



Available Resources

- Website – www.NeurotechNetwork.org
- Free Resources: Newsletters and User Experiences
- Central Database of Neurotechnology
- Advocacy for funding and reimbursement

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