Regeneration is Not Synonymous with Recovery

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Central Research Forum
October 23rd 2007
Kinematics of treadmill walking

Joint angles change together as limb moves through space
Limb Kinematics After Nerve Regeneration
cut axons
sensory
motor
degeneration
disconnection
Regeneration is Not Synonymous with Recovery

Rudimentary movement recovers

Normal movement does NOT recover

**Ataxia**

discoordination/ decomposition of movement
Regeneration is Not Synonymous with Recovery

Additional Movement Disorders
• lost stretch reflex
• impaired proprioception
• impaired balance

Regeneration is Necessary but Not Sufficient to Restore Normal Movement
Why does regeneration fall short of restoring normal movement?

Problems with peripheral regeneration?

Sensory and Motor Reconnection can be very successful
- muscles are activated to contract
- sensory receptors generate appropriate signals
Regenerated sensory neurons encode muscle length similar to normal.
Why does regeneration fall short of restoring normal movement?

Abnormalities in the CNS?

central processes and synapses of regenerated sensory nerves
Why does regeneration fall short of restoring normal movement?

Abnormalities in the CNS?

new network influences on regenerated circuits
Why does regeneration fall short of restoring normal movement?

Abnormalities in the CNS?

new network influences on uninjured circuits

stretch reflex is suppressed in injury-spared circuits
Program Project Grant
“Synaptic Function: Effects of Nerve Injury, Repair, and Altered Activity”
Broad Objectives are to improve understanding of:
• basic cellular/circuit mechanisms, normally and after injury
• limits on recovery from peripheral nerve injury or disease
• limits on recovery after regeneration of central axons
Acknowledgements

Wright State University
• Paul Nardelli
• Katie Bullinger
• Jeannine Crum
• Lori Goss
• Gabrielle Horstman
• Nkoli Ukpabi

Program Project Laboratories
• Dr. Francisco Alvarez
• Dr. Timothy Cope
• Dr. Kathrin Engisch
• Dr. Robert Fyffe
• Dr. Mark Rich

Emory University
• Dr. Edyta Bichler
• Dr. Valerie Haftel
• Dr. Stan Nakanishi
• Dr. Richard Nichols
• Dr. Marty Pinter
• Dr. Jon Prather

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- facilitate Access to Specialized Expertise
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