Motor training

- CI therapy (Taub, Wolf)
- Bilateral arm training (Whitall, Luft, Macko, Hanley, Stinear, Byblow)
- Mirror training protocols (Ramachandran)
- Robot-assisted training (Krebs, Wittenberg, Volpe, Cramer)

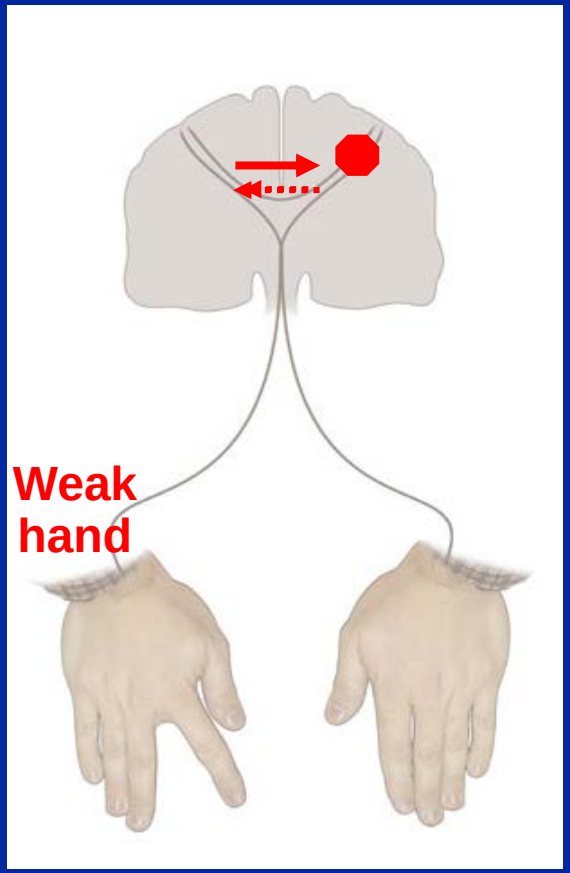
Interhemispheric interactions

Interregional interactions
Interhemispheric inhibition

Hypothesis: Interhemispheric inhibition from the contralesional to the ipsilesional motor cortex in patients with chronic stroke is more prominent than interhemispheric inhibition in age-matched healthy controls.

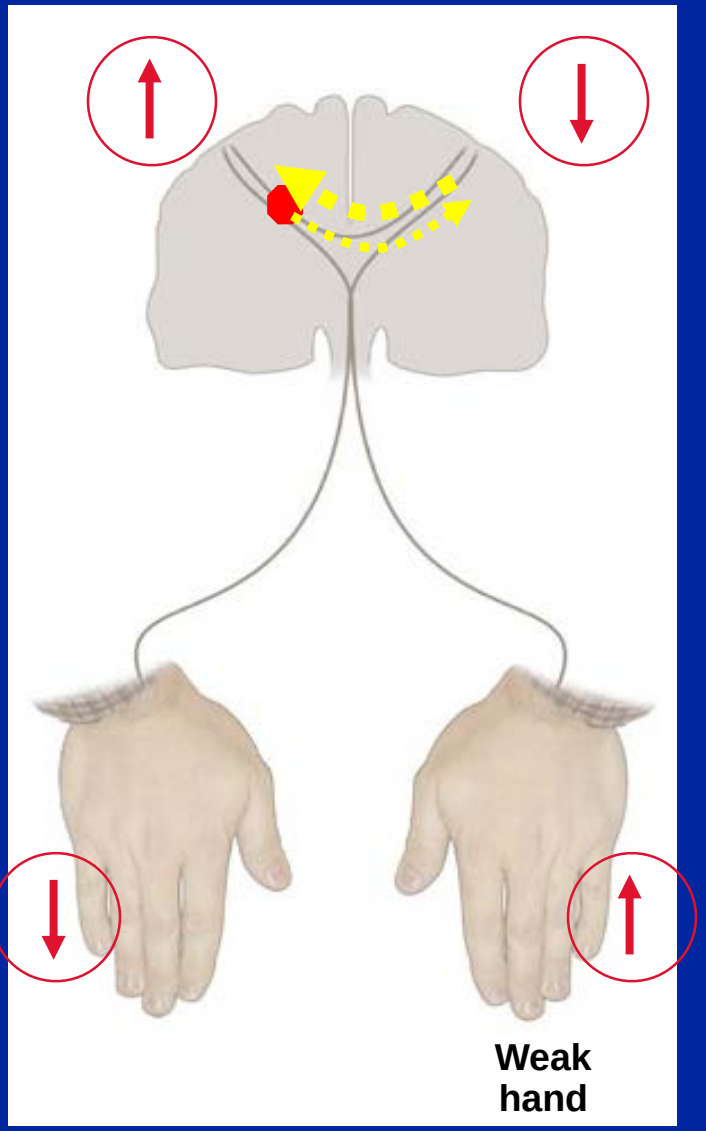
Murase et al. *Ann Neurol* 2004

Results



Murase et al. *Ann Neurol* 2004

Interhemispheric inhibition between primary motor cortices



Hummel and Cohen. ***Lancet Neurol*** 2006

Ward and Cohen. ***Arch Neurol*** 2004

Interhemispheric inhibition between M1s

Grefkes, *Ann Neurol* 2008

Changes in motor representations induced by repetitive electrical stimulation

Nudo, et al., 1990
(350Hz burst; 1 Hz burst freq.; 1 hr duration)
See also Graham Brown and Sherrington, 1912

Predictability of response to TMS of the ipsilesional M1

Ameli et al *Ann Neurol* 2009

Contralesional hemisphere

Contralesional hemisphere

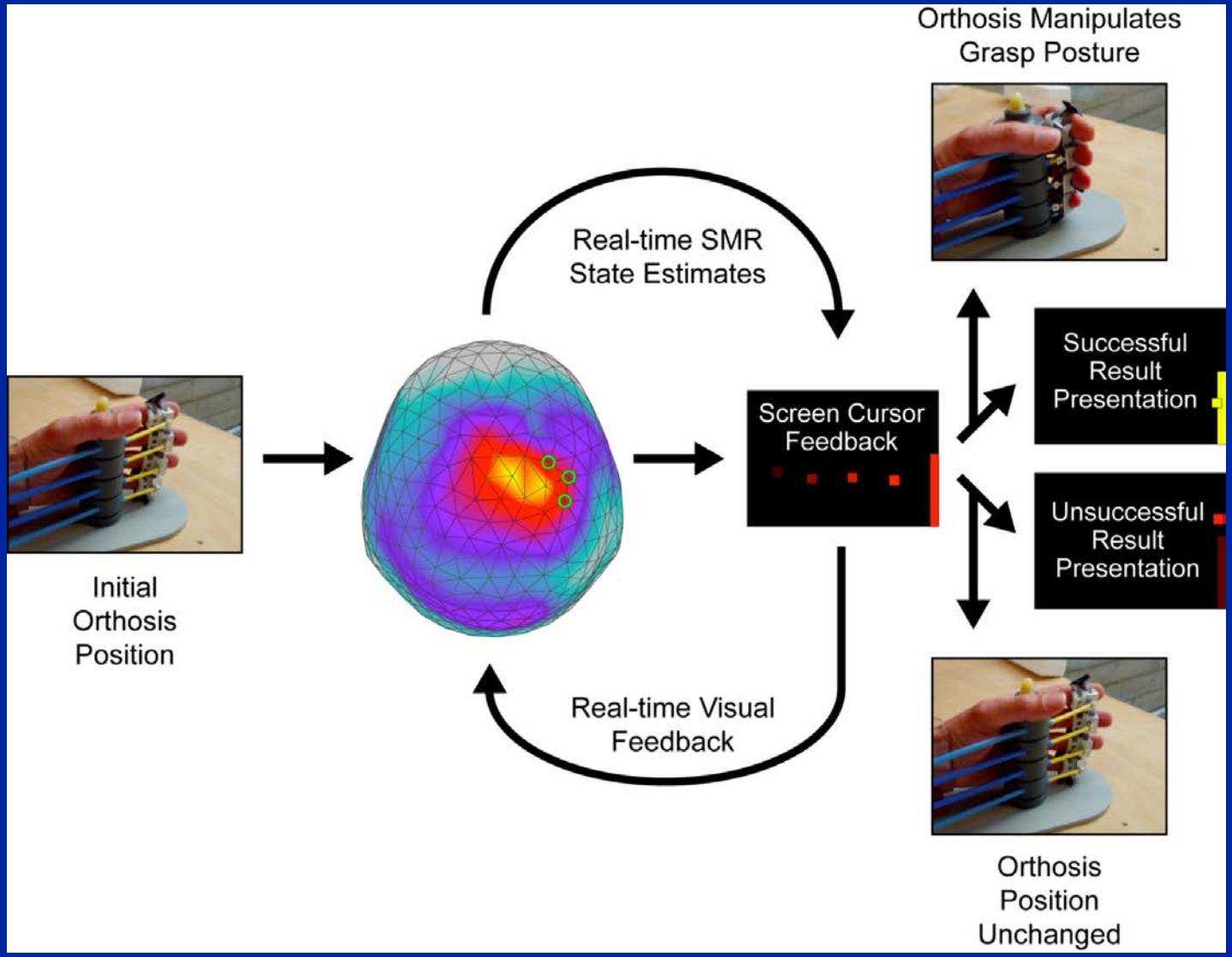
Lotze, *J Neurosci* 2006

Hand paralysis and more abstract learning

Brain lesions

Buch et al, *Brain* 2012

SMR modulation through Grasping Imagery Training



Buch et al, *Brain* 2012

Skill, Task-related SMR Power Contrast, and Global Functional Network Cost-efficiency

Buch et al, *Brain* 2012

Structural Network Nodal and Edge Betweenness Centrality and Skill

Contralesional nodes and edges
display a uniform relative increase
In their role in integrating
information between frontal
and parietal regions of the brain

Buch et al, *Brain* 2012

Extralesional White Matter FA Related to Skill.

Caudal contralesional SLF
(below intraparietal sulcus)

Central contralesional SLF
(below M1-PMv junction)

Buch et al, *Brain* 2012

Extralesional Gray-matter Volume Related to Skill (ROI)

Contralesional
intraparietal sulcus

Rostral precentral gyrus

Buch et al, *Brain* 2012

Conclusion

Contralesional parietofrontal integrity may underlie learning to control neural activity associated with grasping imagery after stroke with severe motor disability