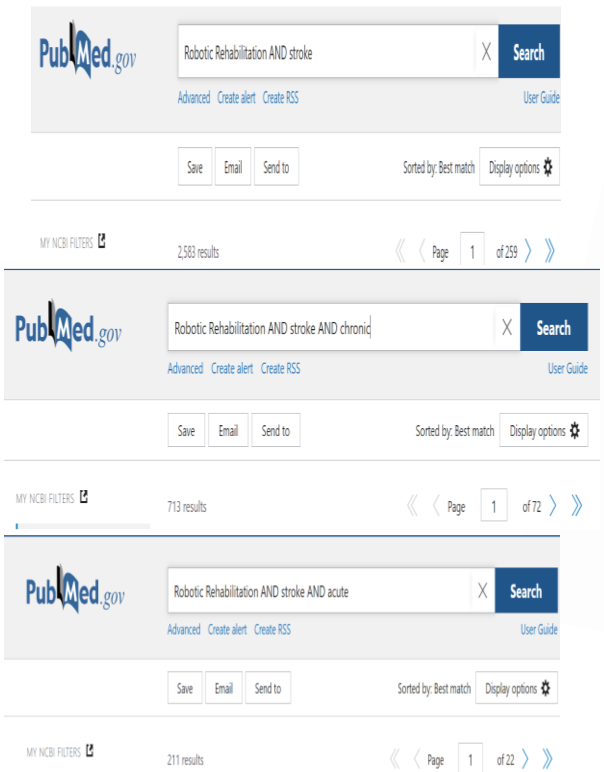
Rééducation robotique

Prof Karin Diserens
Unité de Neurorééducation Aiguë (NRA)
Service de neurologie, DNC, CHUV, Lausanne

UNIL | Université de Lausanne
Faculté de biologie et de médecine



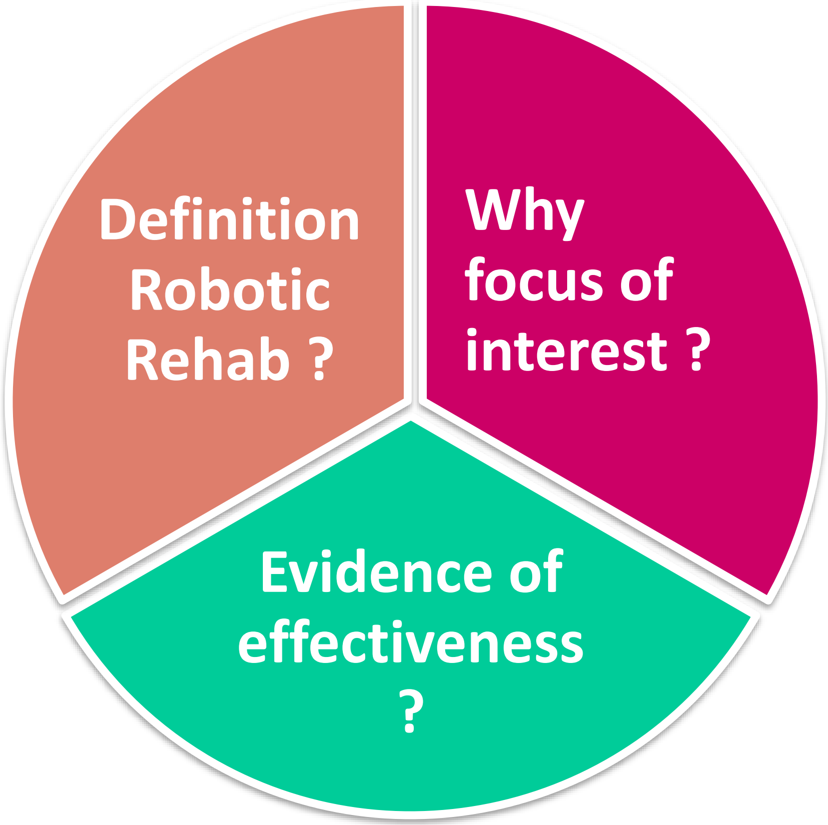
Rehabilitation AND stroke
2583

Rehabilitation AND stroke
AND chronic
713

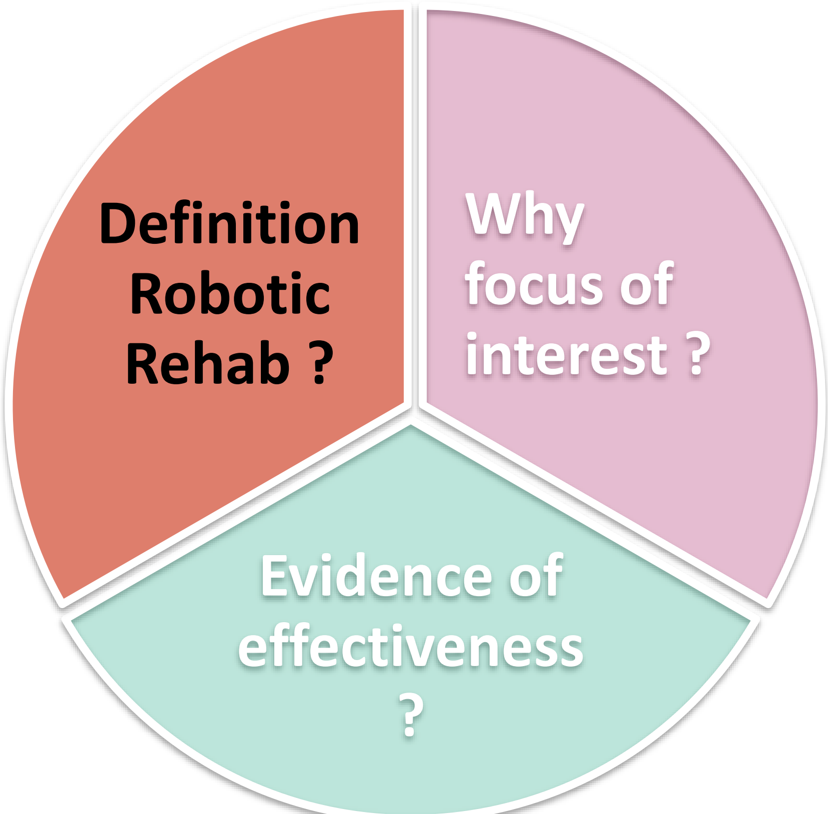
Rehabilitation AND stroke
AND acute
211

Big controversy !!!

Robotic Rehabilitation



Robotic Rehabilitation



Types of robot

History

Definition
Robotic
Rehabilitation

„ *robot*“= old slawian, tschech: „*robota*“=*hard work*

1921

Karel Čapek

Rossum's Universal Robots theater play

Definition Robotic Rehabilitation

,, *robot*"= old slawian, tschech: ,,*robota*"=*hard work*

Karel Čapek

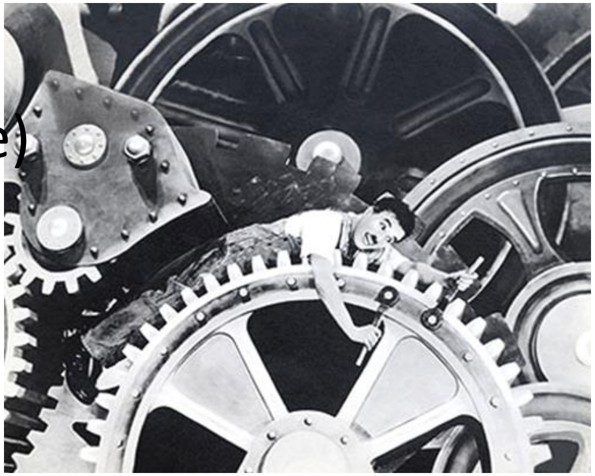
Rossum's Universal Robots theater play

1921

1936

Definition Robotic Rehabilitation

A Robot ist a (manlike) technical system helping man to do heavy work



Charles Spencer Chaplin in ,,Modern Times"1936

LAROUSSE

robot

Automatic machine able to manipulate objects, execute operations according to a **fixed program, modifiable and adaptable**

2022

>2022

Definition Robotic Rehabilitation

Robotic in Neurorehabilitation

Intelligent Mechanical Training Devices (IMTD)

Types of robot

History

2 types of robots

Definition Robotic Rehabilitation

Types of robots

Active robot:
moves plegic part

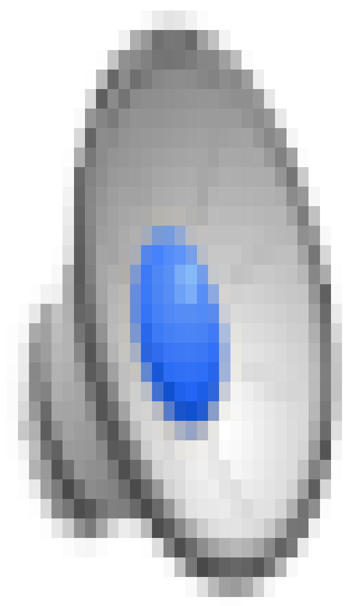
Semi- active robot:
assists paretic part with
reduced movement

EX: Armeo Spring : different modulation

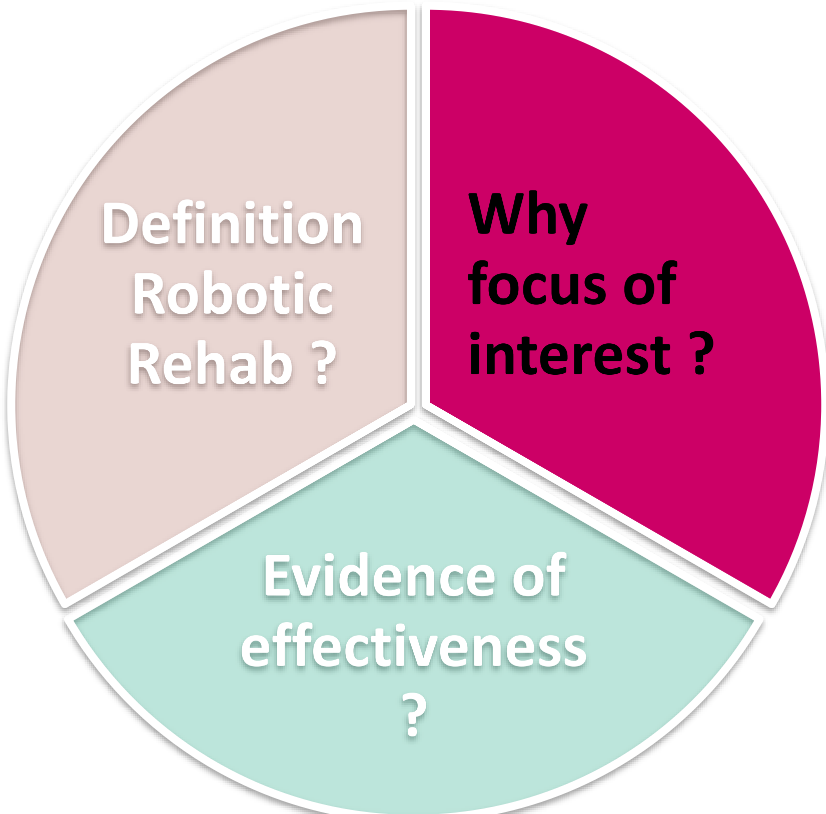
The ReWalk Device

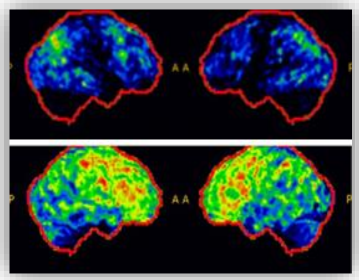
Interface
with different parts of
body: Exoskeleton

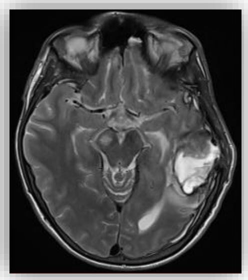
REWALK



Robotic Rehabilitation







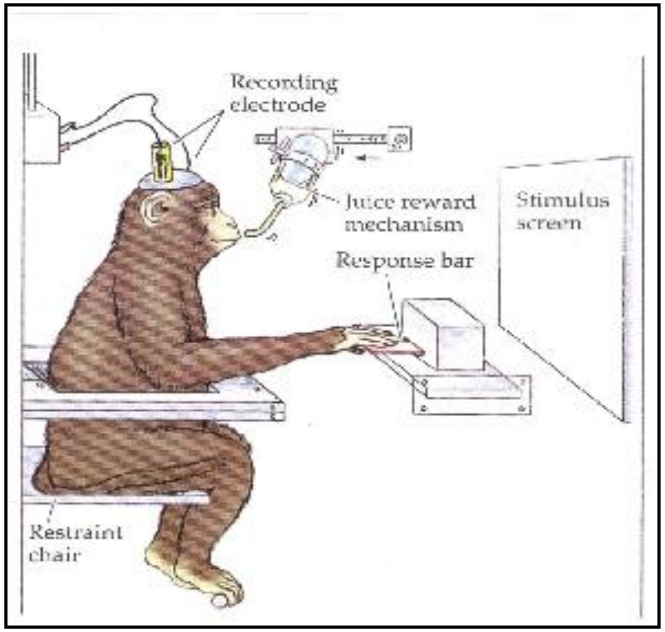
Decade of the brain:

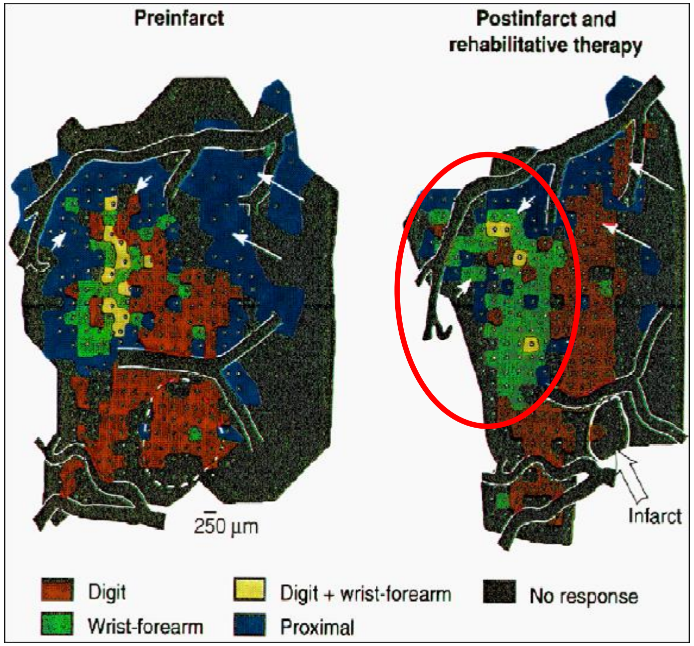
Neuroimaging and EEG

Decade of the brain

Why focus of interest ?

Decade of the brain



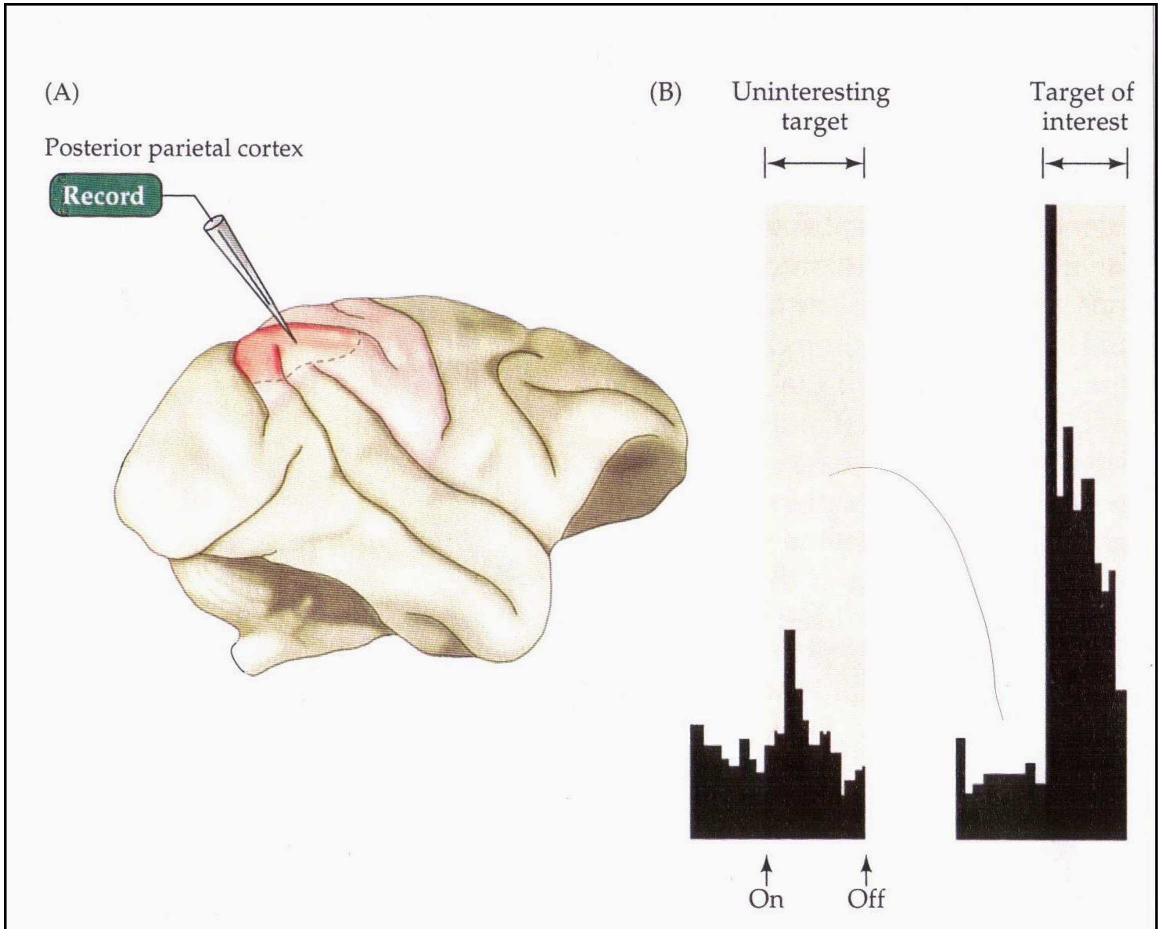


Merzenich M et al.1988

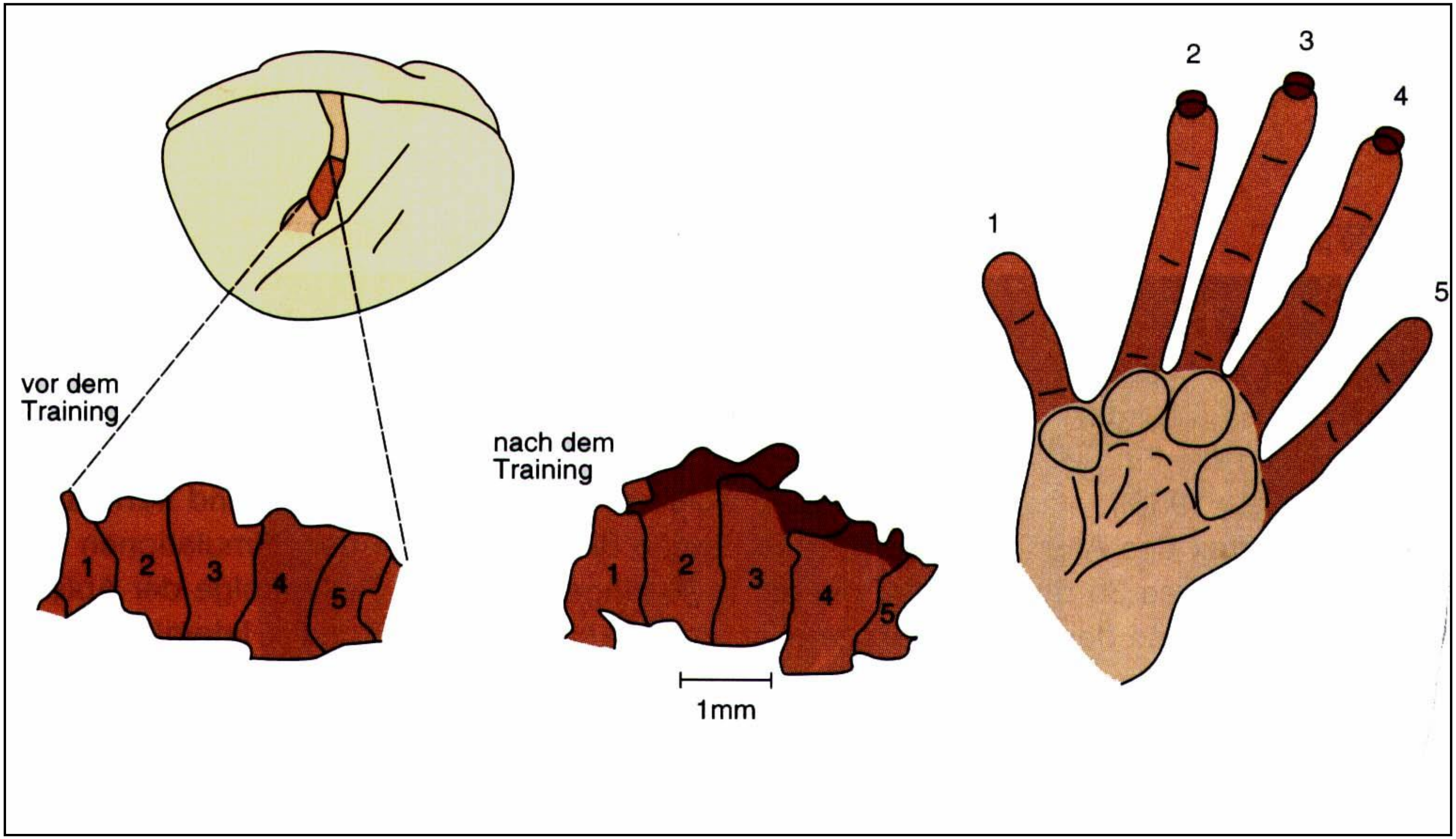
Jenkins WM,1990

Taub E, 1993

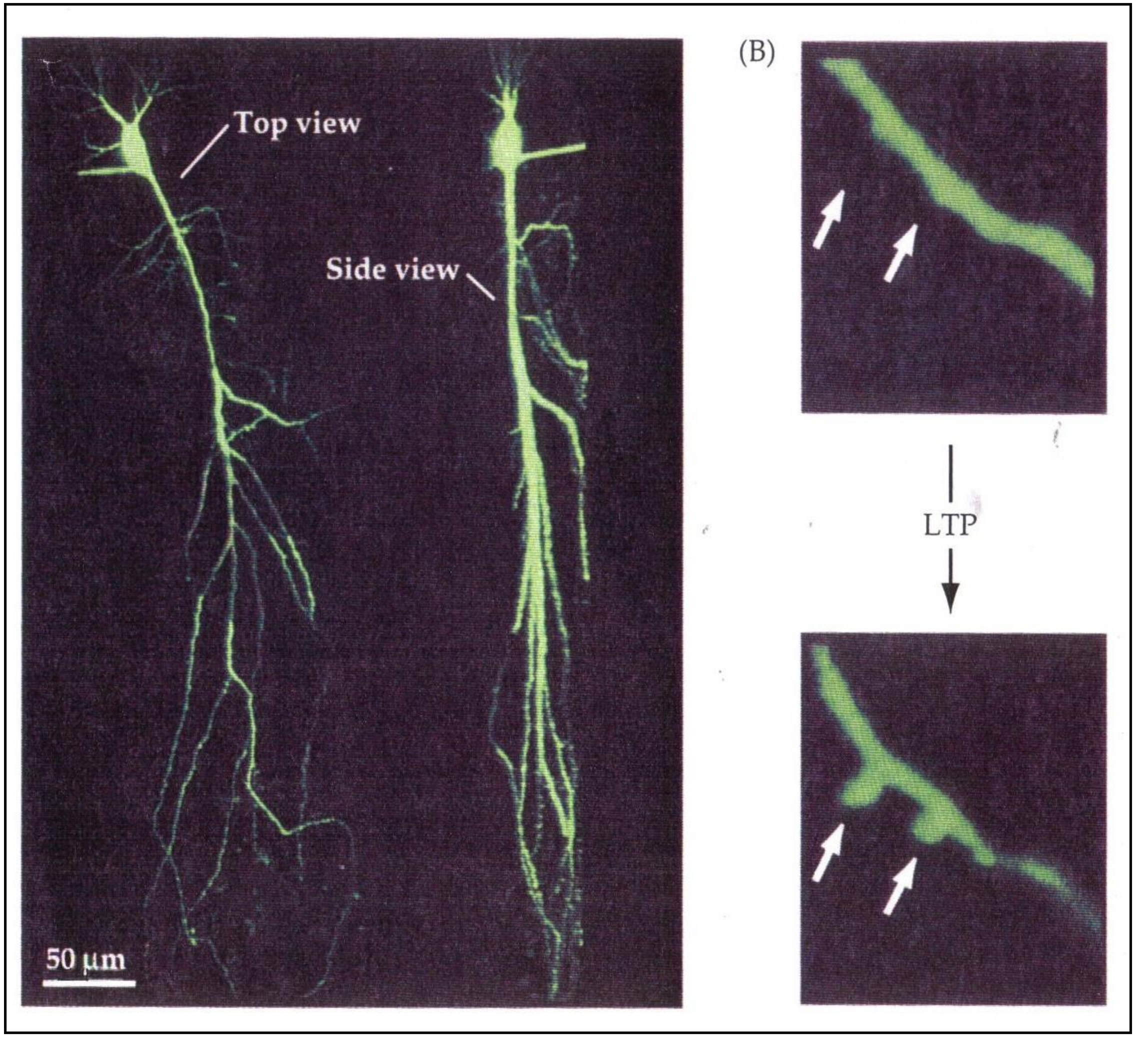
Selective activation



Reorganization of the brain mapping



Synaptic regrowth

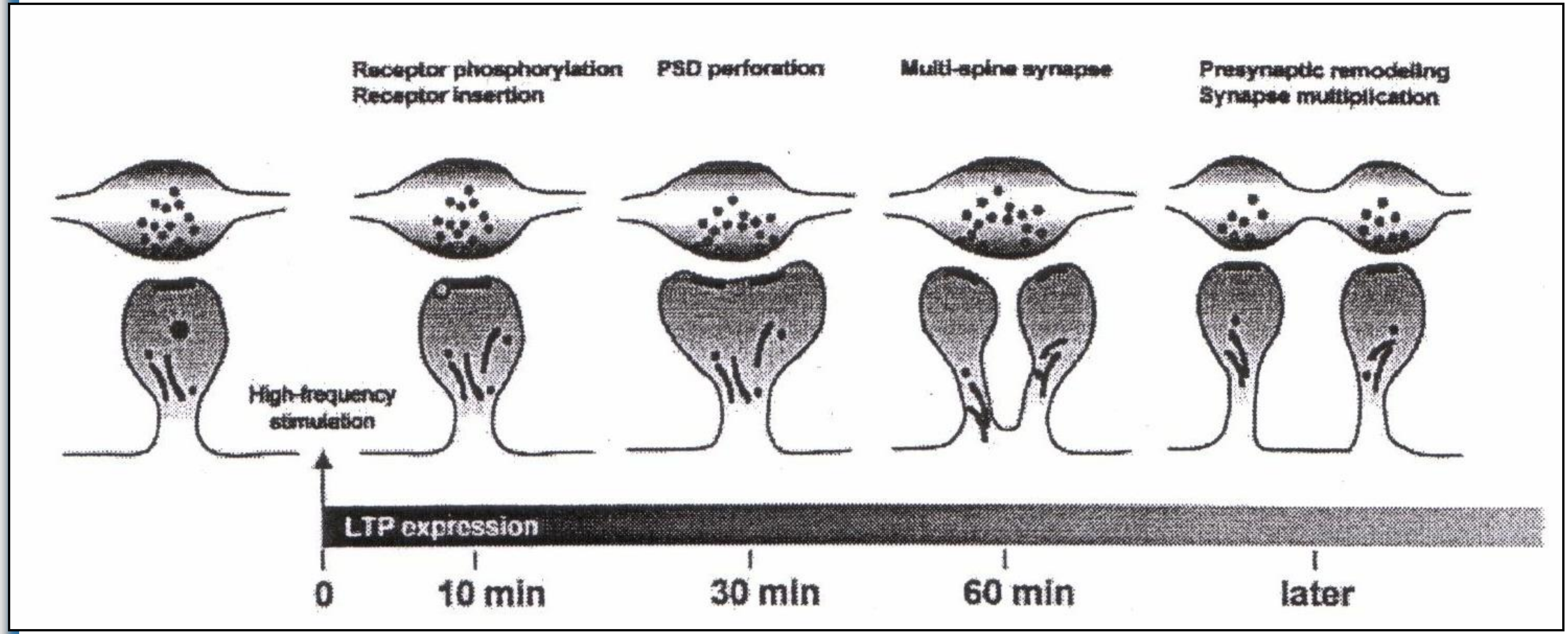


Muller D.

2000

Intensive stimulation and synaptic regrowth

- Synaptic regrowth depends on the intensity of the stimulus



Repetitive movement - functional imaging

Table 2 Functional brain activation studies of effects of specific motor upper limb training post-stroke

Study	Sample: size N treat group	Design	Motor paradigm	Intervention	Comparison group	Outcomes	Findings* (functional neuroima
Levy *et al.* (175)	$N = 2$, chronic	Case studies	fMRI finger tap	CIMT 6 h/day, 2 weeks	Nil	Grip, MAL, WMFT fMRI: voxel count; LI	Variable: perilesional and bilate vation in M1
Nelles *et al.* (94)	$N = 5$, severe paresis	RCT	PET Passive elbow move,	Task-oriented motor training. 4 × 45min/ day, 3 weeks	Stroke, $n = 5$: nonspecific rehabilitation, Healthy, $n = 5$	FM, NIHSS PET: site, extent	Greater activation bilaterally in parietal cortex, PMC and ipsile S1M1 over time compared to c
Carey *et al.* (93)	$N = 10$, chronic	RCT-crossover design	fMRI finger tracking	Motor learning. Intensive finger tracking; 18–20 sessions	Stroke control phase, $n = 5$; Healthy train, $n = 9$	Box and block, finger tracking fMRI: LI; ROI	LI – contralesional to ipsilesiona S1M1, M1, S1, PMC activation
Johansen-Berg *et al.* (95)	$N = 7$, chronic mild–mod paresis	Case–control before × 2 after × 2	fMRI, hand flex–ext	Progressive exercises, 2 × 30 min/day 90% restraint; 2 weeks	Nil	Motoricity index, grip strength, JHFT fMRI: site; recovery-weighted correlation image	Increased ipsilesional SII, PMC, cerebellum. Laterality shift to c sional M1. Correlated decrease unaffected hand
Schaechter *et al.* (176)	$N = 4$, chronic,	Case series	fMRI 4 fingers flex–ext	CIMT 4 h/day; 2 weeks	Healthy, $n = 5$	Surface EMG, WMFT; MAL, grip strength, FM-UE fMRI: LI (M1)	Trend to reduced LI with shift t contralesional hemisphere
Wittenberg *et al.* (96)	$N = 9$, chronic	RCT	PET finger ext (TMS)	CIMT task-oriented 6 h/day, 10 days	Stroke, $n = 7$ 3 h/day Healthy, $n = 10$	WMFT, MAL, AMPS fMRI: mean voxel in ROIs (S1M1)	Decreased overactivation in les hemisphere
Kim *et al.* (177)	$N = 4$	Case series	fMRI repeated fist; finger opposition	CIMT 7 h/day, 2 weeks	Nil	FM; 9-HPT; JHFT fMRI: voxel count	New activation in ipsilesional M SMA ($n = 3$); increase in contra M1 ($n = 1$); increase SMA ($n =$
Liepert *et al.* (98)	$N = 3$, chronic	Case series	fMRI passive hand move (TMS)	CIMT 6 h/day; 2 weeks	Nil	MAL fMRI: site, pre–post subtraction	Decreased activation in ipsilesi S1M1. Decreased inhibition of hand
Lindberg *et al.* (178)	$N = 2$, chronic	Case studies	fMRI passive wrist move	Repetitive active–passive arm move; 4 weeks	Nil	MCP ext, ROM, MAS–UE; 9-HPT fMRI: voxel count, intensity	Increased activation in prefron sensorimotor areas
Luft *et al.* (97)	$N = 9$, chronic	RCT Blinded	fMRI elbow movement	Repetitive BATRAC 3 days/week, 6 weeks	Stroke, $n = 12$ Standardized DMTE	FM-UE; WMFT, arm questionnaire, strength fMRI: site	Increased contralesional S1, M ipsilesional cerebellum for BAT not DMTE. Trend for lateraliza
Butler and Page (179)	$N = 4$, moderate paresis	Case series	fMRI move or imagery	CIMT and mental practice ($n = 2$); CIMT ($n = 1$); mental practice ($n = 1$); 2 weeks	Nil	WMFT, MAL, Sirigu break test; movement imagery questionnaires fMRI: site	Variable across individuals: cer activation; increased bilateral P PMC with CIMT
Dong *et al.* (99)	$N = 8$ >3 months	Exploratory, before, during, after	fMRI repetitive pinch	CIMT 2 weeks	Nil	WMFT fMRI: site, correlation	Linear reduction in contralesio voxel counts over time. Interin variability

Effect of Repetitive Arm Cycling Following Botulinum Toxin Injection for Poststroke Spasticity: Evidence From fMRI

Neurorehabilitation and Neural Repair
24(8) 753–762

DOI: 10.1177/1545968310372138
http://nnr.sagepub.com
SAGE

Karin Diserens, MD[1], Dieter Ruegg, PhD[2], Raimund Kleiser, PhD[3,4], Sandrine Hyde, MD[2], Nicolas Perret[5], Philippe Vuadens, MD[6], Eleonora Fornari, PhD[1], Francois Vingerhoets, MD[1], and Rüdiger J. Seitz, MD[3,4]

Double crossed over randomized study
N=9
3x/ week during 3 months

Research Articles

Effect of Repetitive Arm Cycling Following Botulinum Toxin Injection for Poststroke Spasticity: Evidence From fMRI

Neurorehabilitation and Neural Repair
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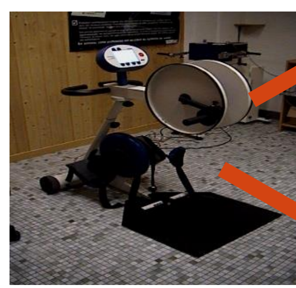
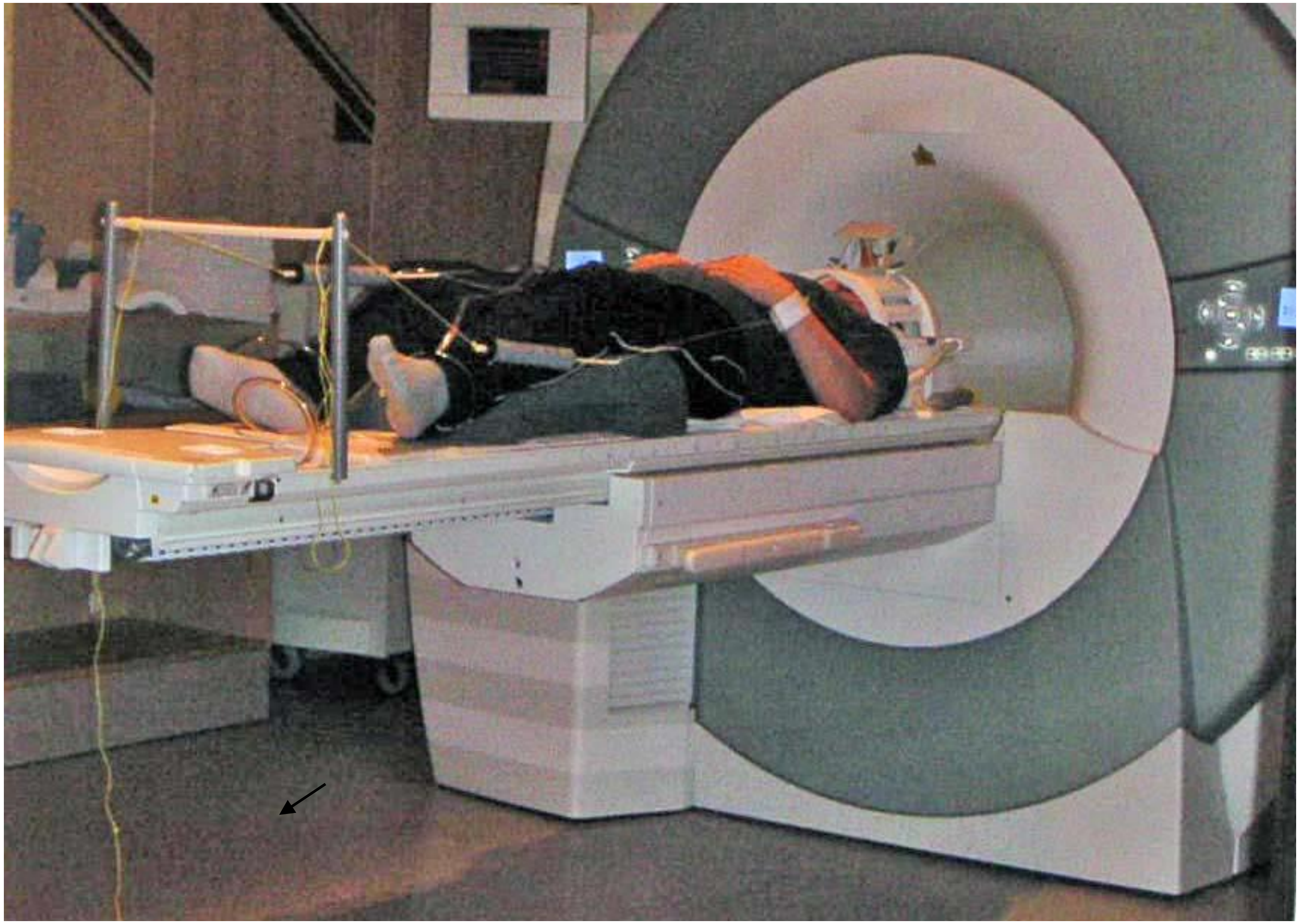
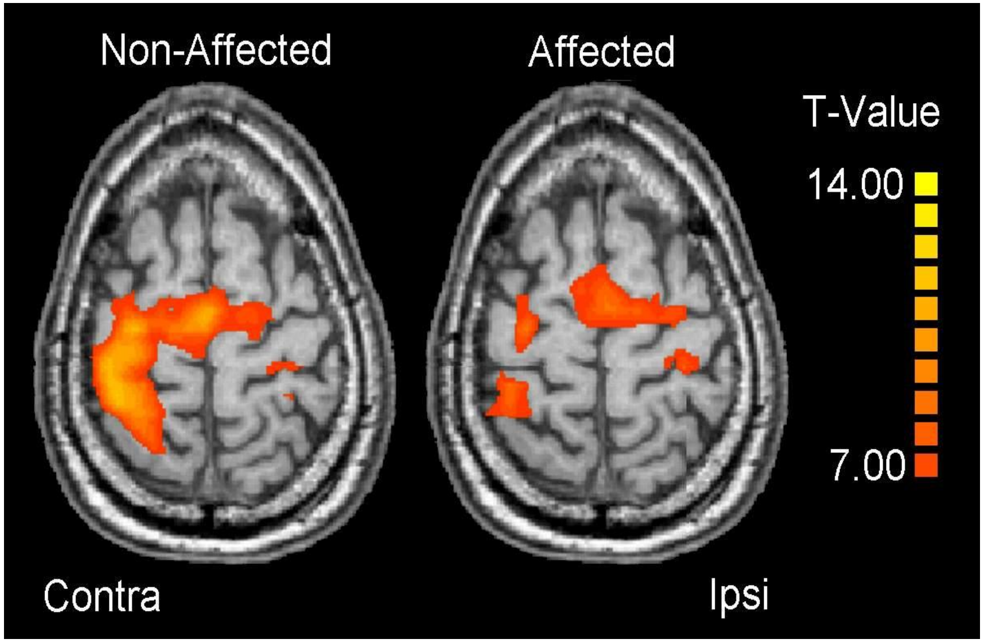
Double crossed over study
N=9
3x/ week during 3 months
Changement of group
3x/week during 3 months



control group:
Motomed
+ playing card

treatment group
Motomed
+ Botox

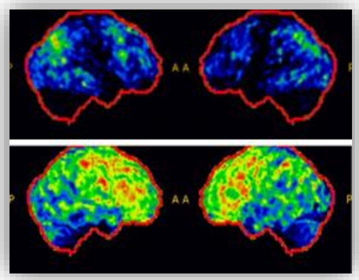


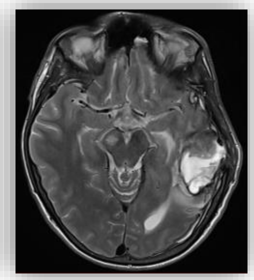


Repetitive movement increases the effect of Botox

→ Affected Hemisphere: **MISI**
→ Non- affected Hemisphere:**SII**

→ **Improvement of motricity + spasticity by sensorial input**

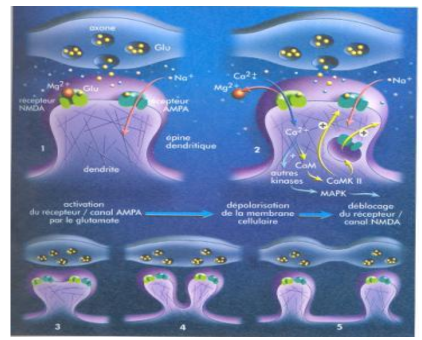




Decade of brain: Understanding of neuronal plasticity: Neuroimaging and EEG

Decade of the brain

Principles of learning



- **Repetive movement**
- **Shaping**
- **Neurosensorial stimulation and biofeedback**
- **Motivation**

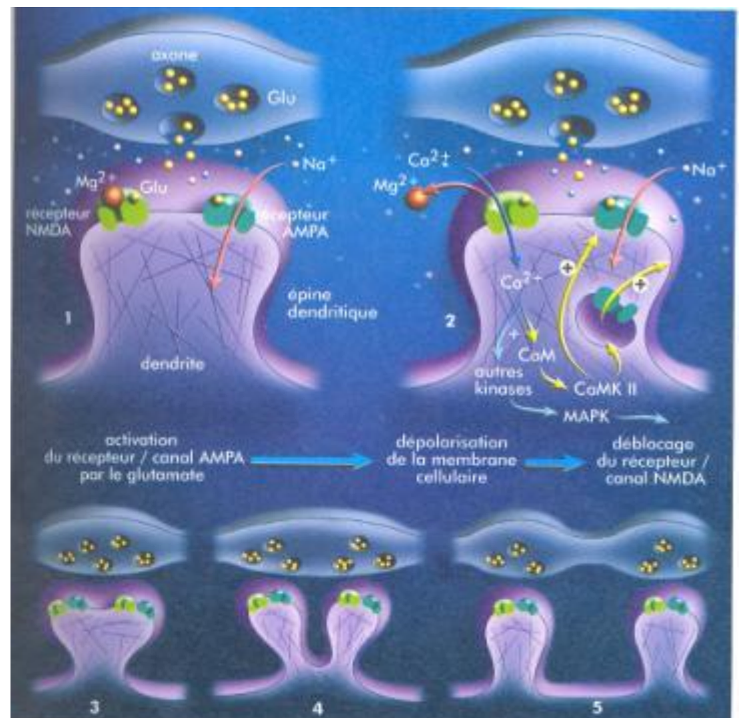
Why focus of interest ?

Condition of (Motor) Learning: Synaptic regrowth

→ **Intensive stimulation**

→ **LTP (Long terme potential)**

→ **Increased connectivity**



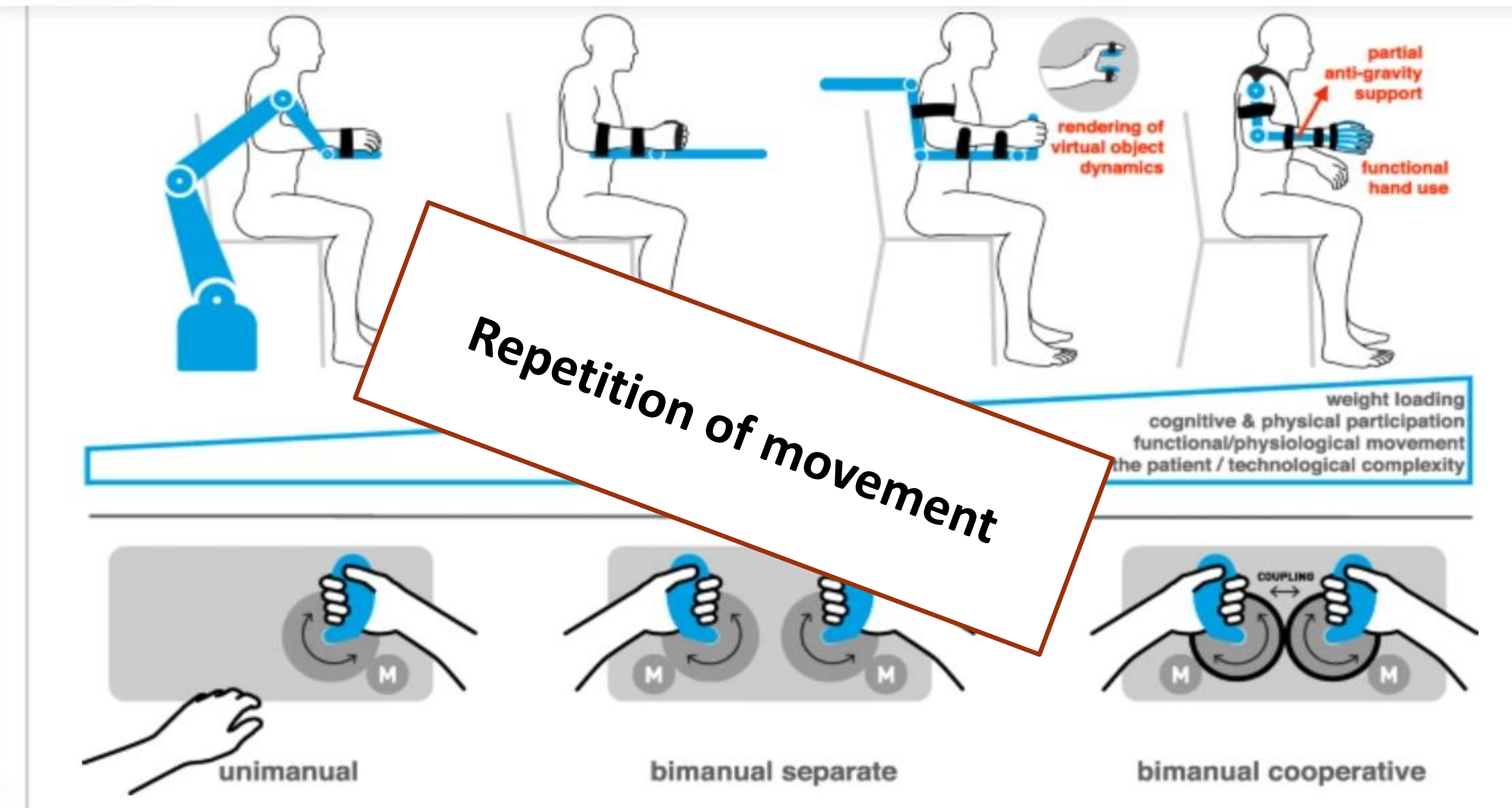
Facilitated principles by robotic

passive

Modulation

active

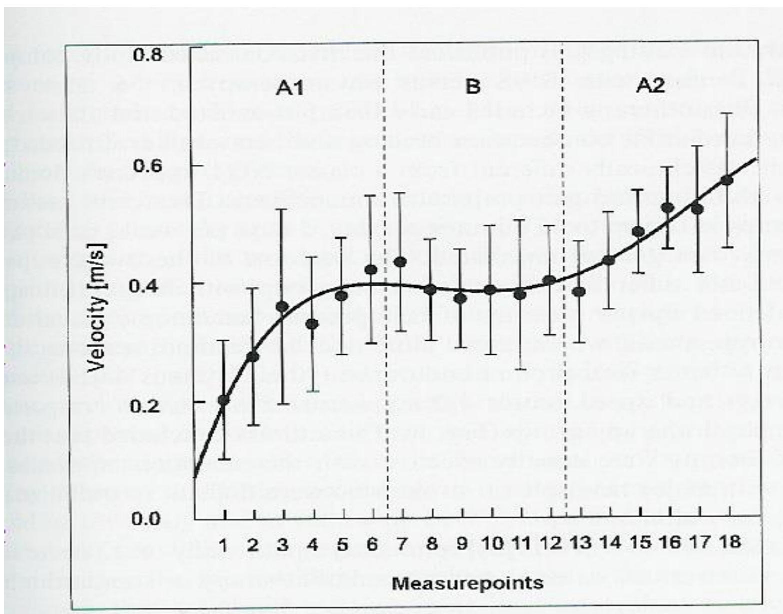
Shaping

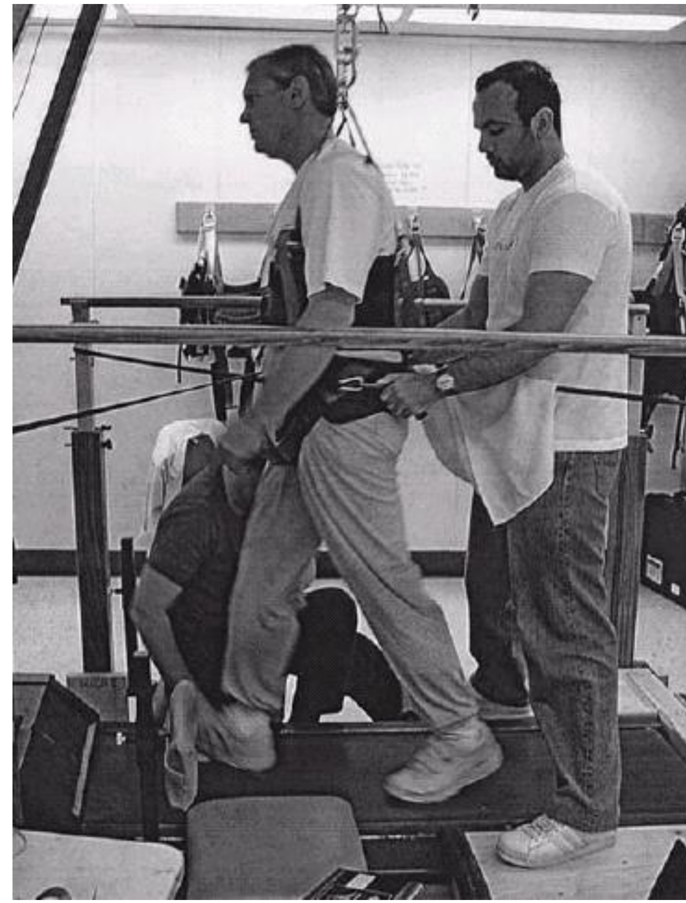


Repetition of movement

Repetitive movement

- 60% of the body weight is taken off
- 45 min. 5 times a week
- Stop when walking independently





Taub E, Uswatte G, Elbert T. New treatments in neurorehabilitation founded on basic research. Nature Reviews Neuroscience 2002; 3: 228-236

Crit Care Med. 2009 Sep;37(9):2499-505.

Early exercise in critically ill patients enhances short-term functional recovery.

Burtin C, Clerckx B, Robbeets C, Ferdinande P, Langer D, Troosters T, Hermans G, Decramer M, Gosselink R.

Faculty of Kinesiology and Rehabilitation Sciences (CB, BC, CR, DL, TT, RG), Katholieke Universiteit Leuven, Leuven, Belgium.

Treatment group n= 26
Control :n=32
20 min, 5th day, 5/7
Median cycling sessions: 7 (4-11)

143m	196m	15/23	21/23

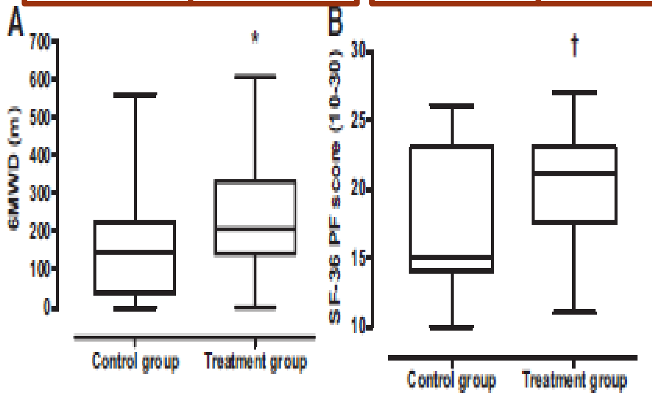


Figure 3. *A*, *Boxplot* of 6MWD at hospital discharge. *6MWD*, 6-min walking distance. *$p < .05$ compared with control group. *B*, *Boxplot* of SF-36 PF score at hospital discharge. *SF-36 PF*, "Physical Function" item of Short Form 36 Health Survey Questionnaire. †$p < .01$ compared with control group.

Improvement of walking speed

Improvement of the isometric strength of the quadriceps

1.83 kg	**2.37 kg**

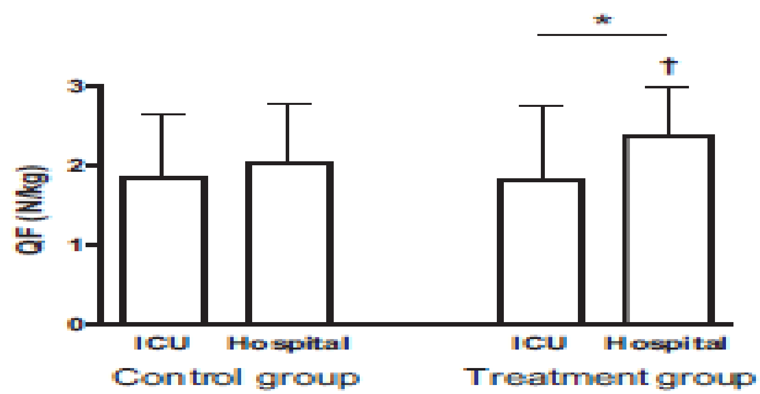
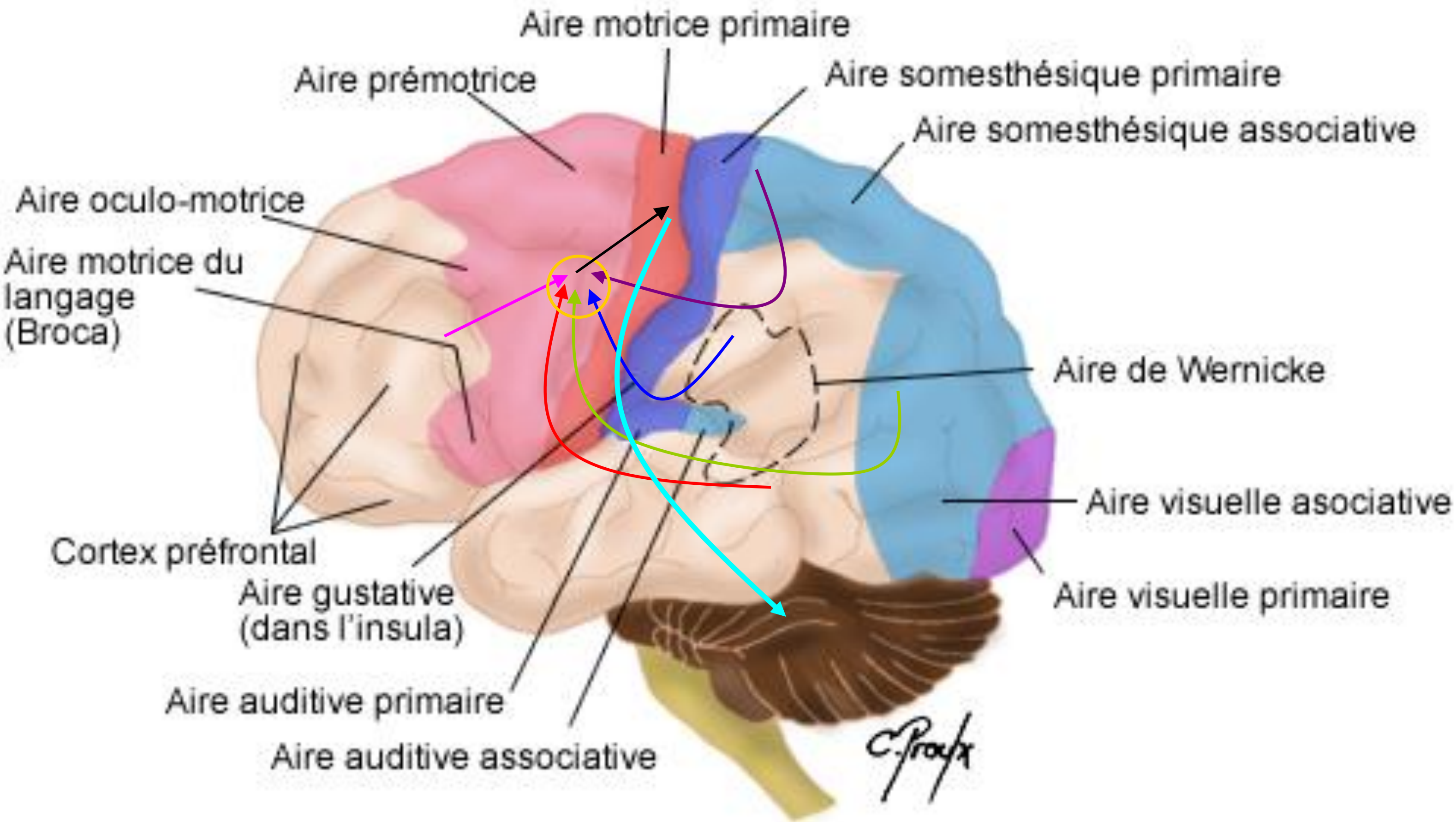
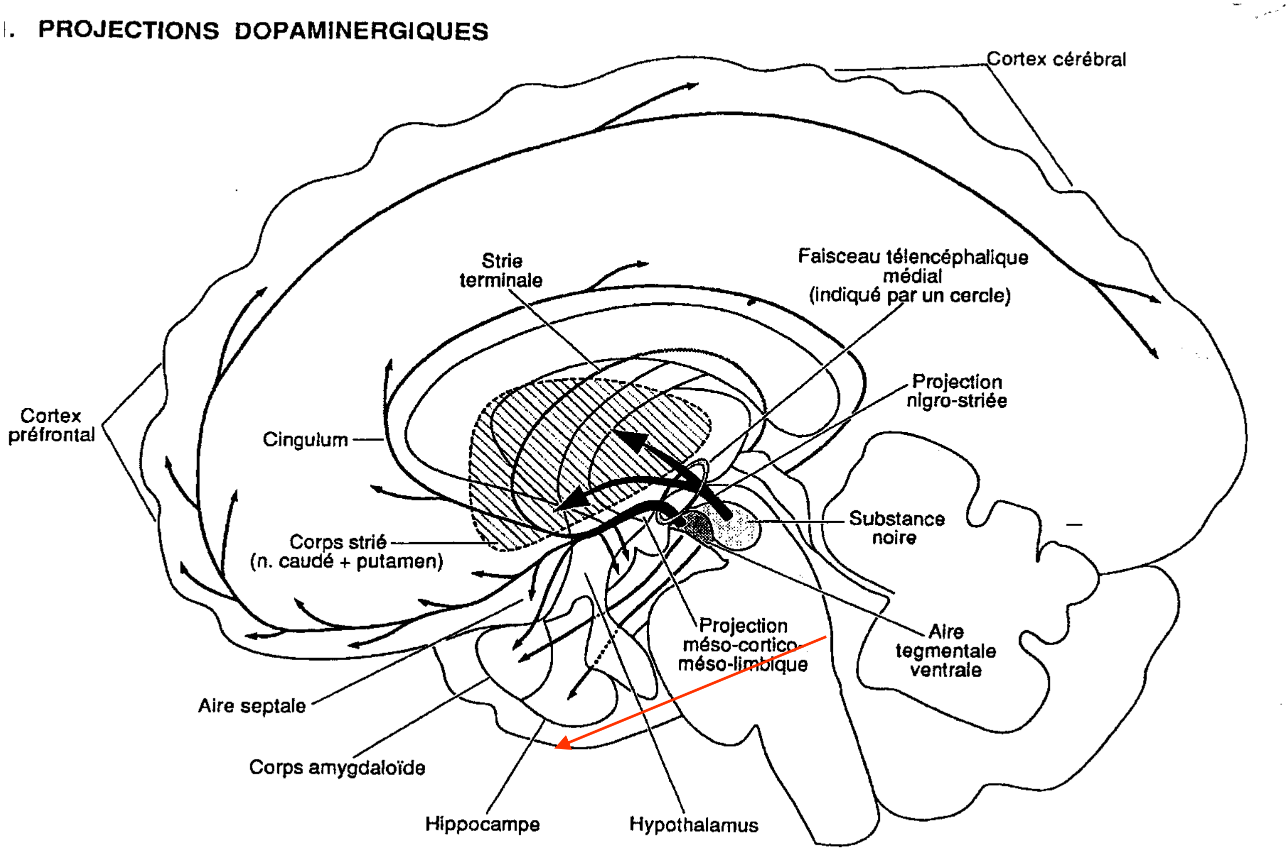


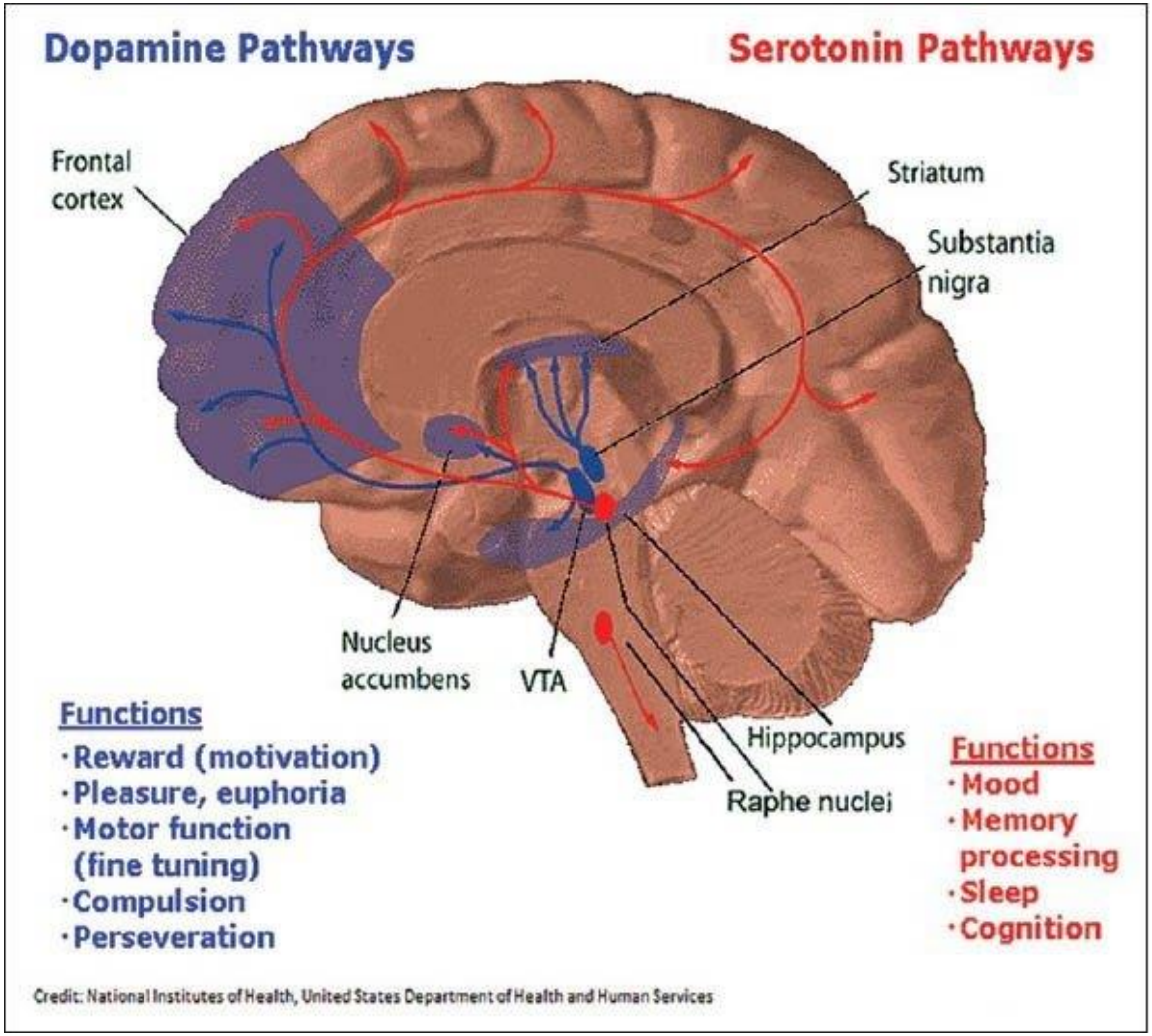
Figure 4. Isometric quadriceps force at intensive care unit (*ICU*) discharge and at hospital discharge. Data are presented as mean and standard deviation. *QF*, quadriceps force; *hospital*, day of hospital discharge. *$p < .01$ between ICU and hospital discharge; †$p < .05$ compared with control group.

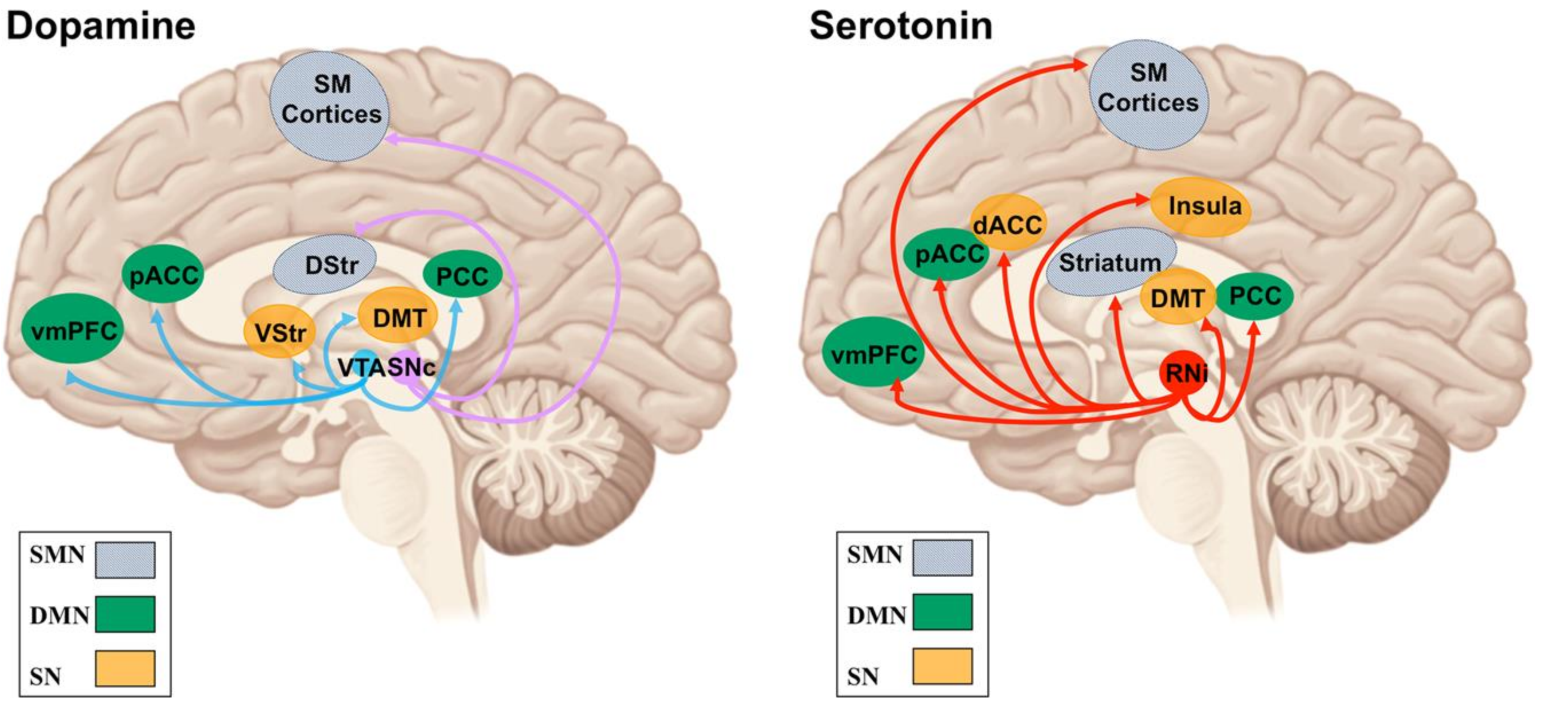
Increased connectivity by neurosensorial stimulation



Increased connectivity by: Motivation



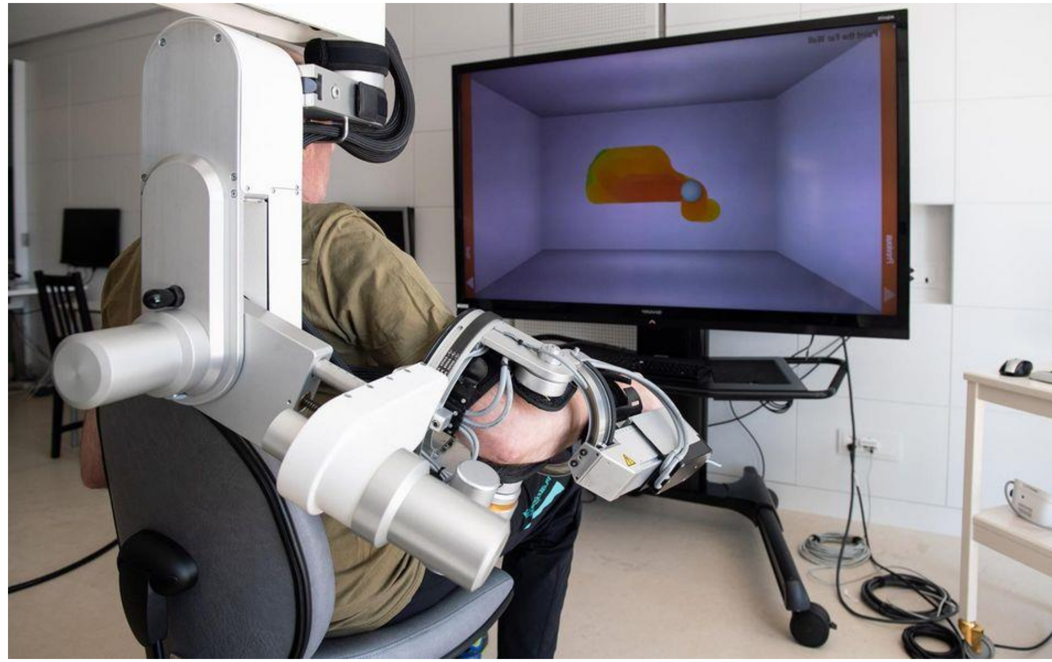

Dopamine Pathways
Serotonin Pathways
Frontal cortex
Striatum
Substantia nigra
Nucleus accumbens
VTA
Hippocampus
Raphe nuclei
Functions
·Reward (motivation)
·Pleasure, euphoria
·Motor function (fine tuning)
·Compulsion
·Perseveration
Functions
·Mood
·Memory processing
·Sleep
·Cognition
Credit: National Institutes of Health, United States Department of Health and Human Services



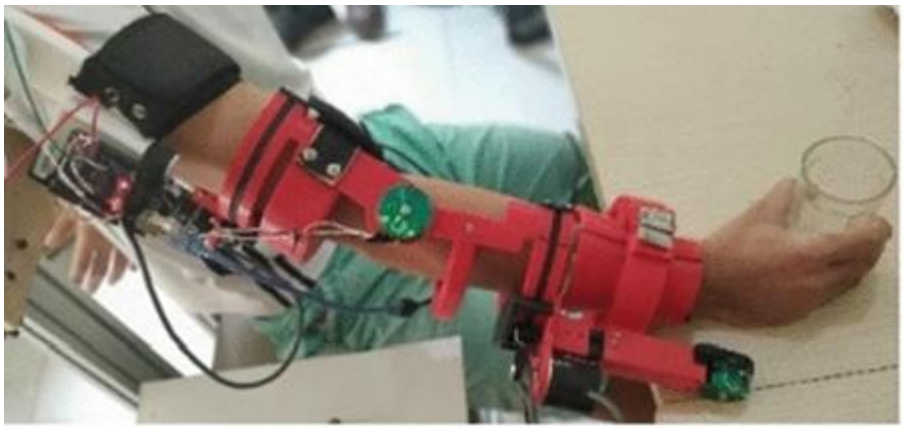
Neurotransmitters nuclei projections and RSNs. Dopamine: dopaminergic pathways and RSNs: the nigrostriatal pathway projects mainly to core regions of the SMN, whereas the mesocorticolimbic pathway to the SN. Serotonin: serotonergic pathways and RSNs: the main projections of the RNi involve regions of the SMN and DMN. SNc substantia nigra pars compacta, VTA ventral tegmental area, DStr dorsal striatum, VStr ventral striatum, DMT dorsomedial thalamus, pACC perigenual anterior cingulate cortex, PCC posterior cingulate cortex, vmPFC ventromedial prefrontal cortex, SM sensorimotor, RNi raphe nuclei, dACC dorsal anterior cingulate cortex, RSNs resting-state networks, SMN sensorimotor network, DMN default-mode network, SN salience network

Conio et al. Opposite effects of dopamine and serotonin on resting-state networks: review and implications for psychiatric disorders. Mol Psychiatry, 2020


78
18.1
0.577
JOG-RUNNER



Task specific:
Neuromotorsensorial + cognitive + motivation



(a) *Stage 1 of drinking water task (reaching stage)*

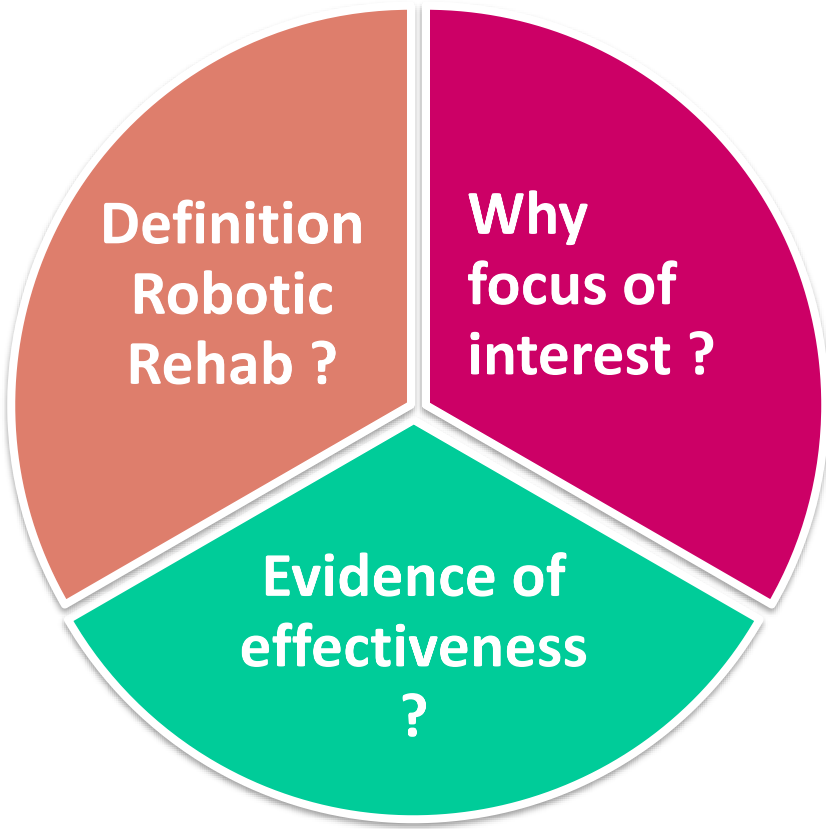
(b) *Stage 2 of drinking water task (lifting stage)*

No motivation without a therapist

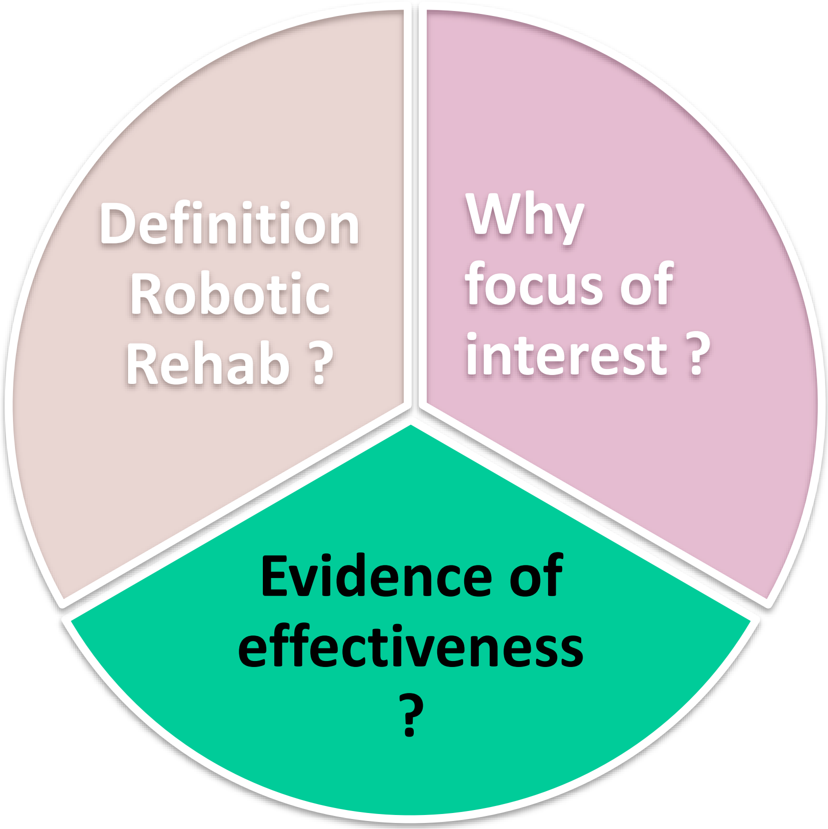
canton de vaud

CHUV

Robotic Rehabilitation



Robotic Rehabilitation



canton de vaud

CHUV

Arch Phys Med Rehabil Vol 88, February 2007

ORIGINAL ARTICLE

Robotic-Assisted Rehabilitation of the Upper Limb After Acute Stroke

Stefano Masiero, MD, Andrea Celia, MD, Giulio Rosati, PhD, Mario Armani, MD

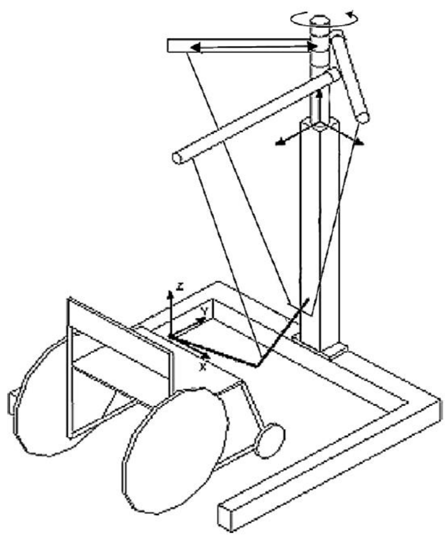
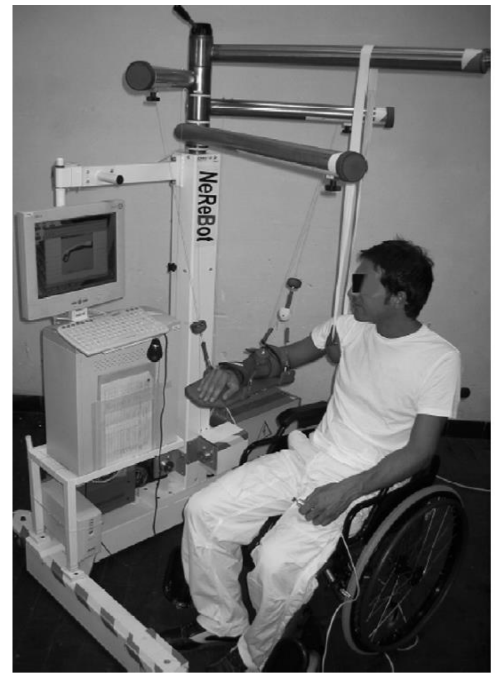


Fig 2. Diagram of the NeReBot. The angular position of each arm can be manually adjusted within a range of ±90° and the distance between each wire entry point and the main column axis can be independently set within a range of 200 to 700mm.



Training by
robot consisted of peripheral manipulation of the shoulder and elbow of the impaired limb, correlated with visual stimuli

Interventions: ACUTE stroke!

Patients of both groups :

same dose and length per day of standard post stroke multidisciplinary rehabilitation

+ individual adaptation of robotic fixation by therapist.

Experimental group (n=17):

early sensorimotor robotic training, 4 hours a week for 5 weeks; + Robotic: 4 hours/ week for 5 weeks;

Control group (n18) idem but:

- Robotic 30 minutes, twice a week (1h/w) !!
- Robotic device unimpaired upper limb.

Training by robot :

With individual adaptation by therapist

Conclusions:

Robotic therapy + to conventional therapy

→ greater reductions in

- motor impairment
- improvements in functional abilities.

"Robotic therapy may therefore effectively complement standard rehabilitation from the start"

Received: 12 April 2020 | Revised: 9 June 2020 | Accepted: 12 June 2020
DOI: 10.1002/brb3.1742

Brain and Behavior Open Access
WILEY

REVIEW ARTICLE

Robot-assisted therapy for upper-limb rehabilitation in subacute stroke patients: A systematic review and meta-analysis

Wai-tong Chien[1] | Yuen-yu Chong[1] | Man-kei Tse[1] | Cheuk-woon Chien[2] | Ho-yu Cheng[1]

Methods: Randomized controlled trials (RCTs) published between January 1, 2000 - December 31, 2019

Results:

- Eleven RCTs **involving 493** participants - were included for review.

-**were nonsignificant** (all *p*s ranged .16 to .86). The quality of this evidence was generally rated as low-to-moderate.

Conclusion:

Robot-assisted therapy produced benefits similar, **but not significantly**

→ **using head-to-head comparison**

→ **Future studies** may integrate the fact:

the less labor-intensive RT may offer important advantages over currently available standard care, in terms of improved convenience, better adherence, and lower manpower

Conditions to meet

WHEN

Evidence of effectiveness of robotic rehabilitation ?

Acute phase of stroke: Intermediate care

Article

CLINICAL REHABILITATION

Clinical Rehabilitation
26(5) 451–459

DOI: 10.1177/0269215511425541
cre.sagepub.com
SAGE

Early mobilization out of bed after ischaemic stroke reduces severe complications but not cerebral blood flow: a randomized controlled pilot trial

Karin Diserens[1], Tiago Moreira[1], Lorenz Hirt[1], Mohamed Faouzi[2], Jelena Grujic[1], Gilles Bieler[3], Philippe Vuadens[4] and Patrik Michel[1]

Very Acute phase of stroke: intensive care

Therapeutic approach by the NRA

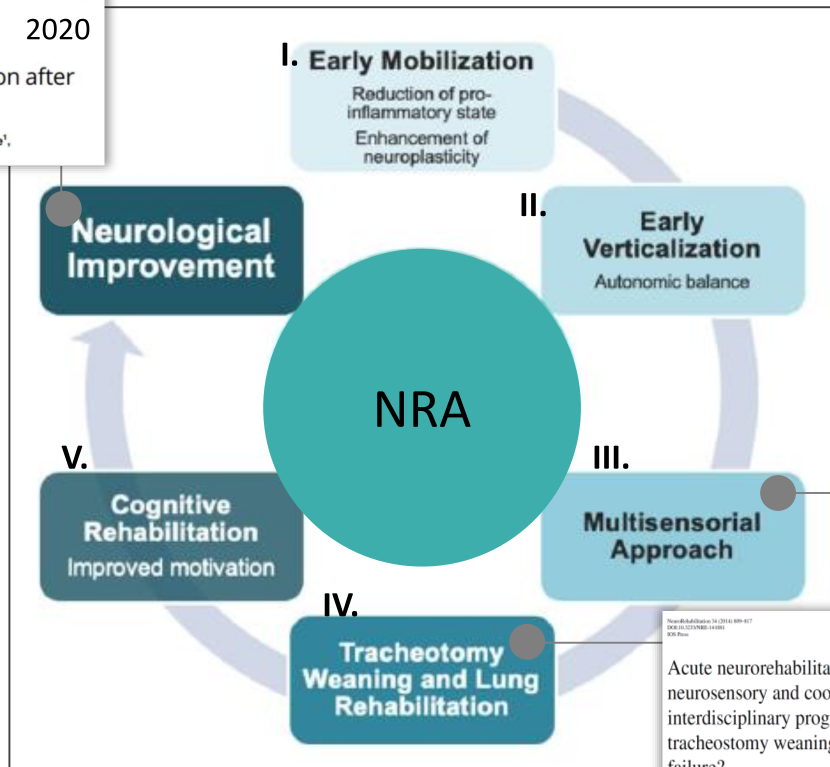
PLOS ONE

2020

RESEARCH ARTICLE

Recovery in cognitive motor dissociation after severe brain injury: A cohort study

Jane Jöhr[1*], Floriana Halimi[1], Jérôme Pasquier[2], Alessandro Pincherle[1], Nicholas Schiff[3], Karin Diserens[1]



NeuroRehabilitation 44 (2019) 545–554
DOI:10.3233/NRE-192692
IOS Press

2019

Neurosensory stimulation outdoors enhances cognition recovery in cognitive motor dissociation: A prospective crossover study

Caroline Attwell[1,*], Jane Jöhr[1], Alessandro Pincherle, Jean-Michel Pignat, Nina Kaufmann, Jean-François Knebel, Loric Berney, Philippe Ryvlin and Karin Diserens
Department of Clinical Neurosciences, Neurology, Acute Neurorehabilitation Unit, University Hospital CHUV, Lausanne, Vaud, Switzerland

NeuroRehabilitation 34 (2014) 809–817
DOI:10.3233/NRE-141081
IOS Press

2014

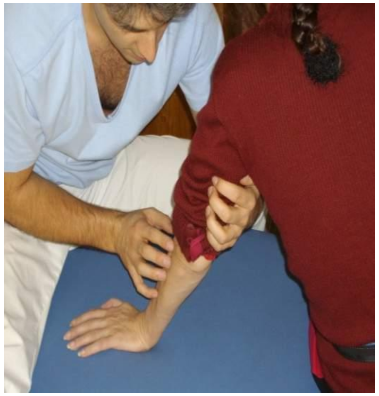
Acute neurorehabilitation: Does a neurosensory and coordinated interdisciplinary programme reduce tracheostomy weaning time and weaning failure?

Loric Berney[a,*], Jean-Blaise Wasserfallen[a], Kathleen Grant[b], Marc Levivier[c], Christian Simon[d], Mohamed Faouzi[e], Roland Paillex[f], Valérie Schweizer[g] and Karin Diserens[a]

A. Pincherle, J. Jöhr, L. Pancini, L. Leocani, L. Dalla Vecchia, P. Ryvlin3, N. Schiff, K.Diserens Frontiers 2020

Therapeutic approach by the NRA
(I) Early Mobilization

In bed

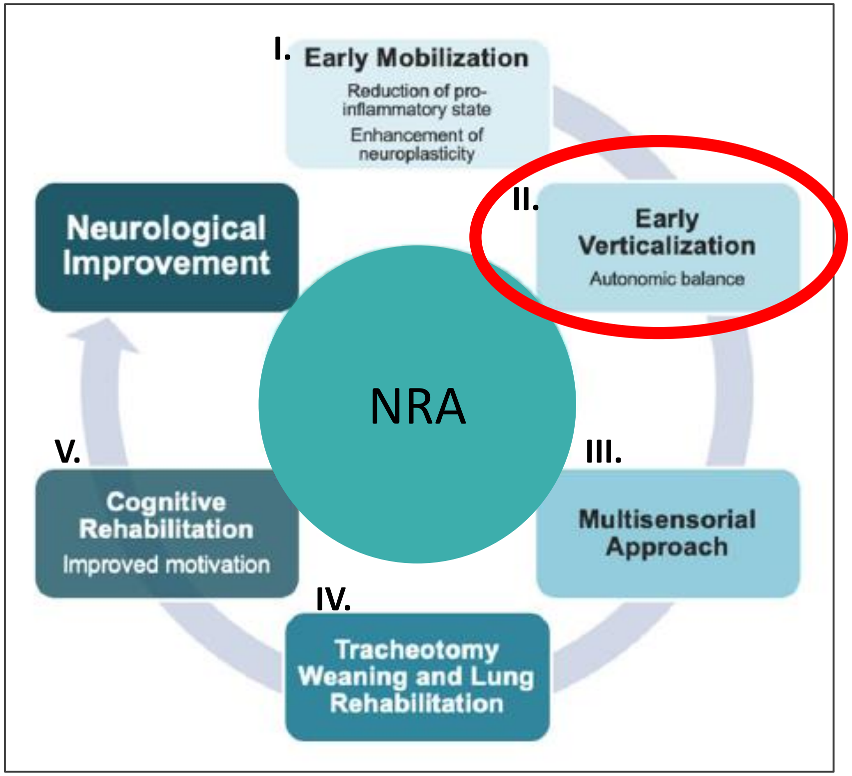


Out of bed

✚

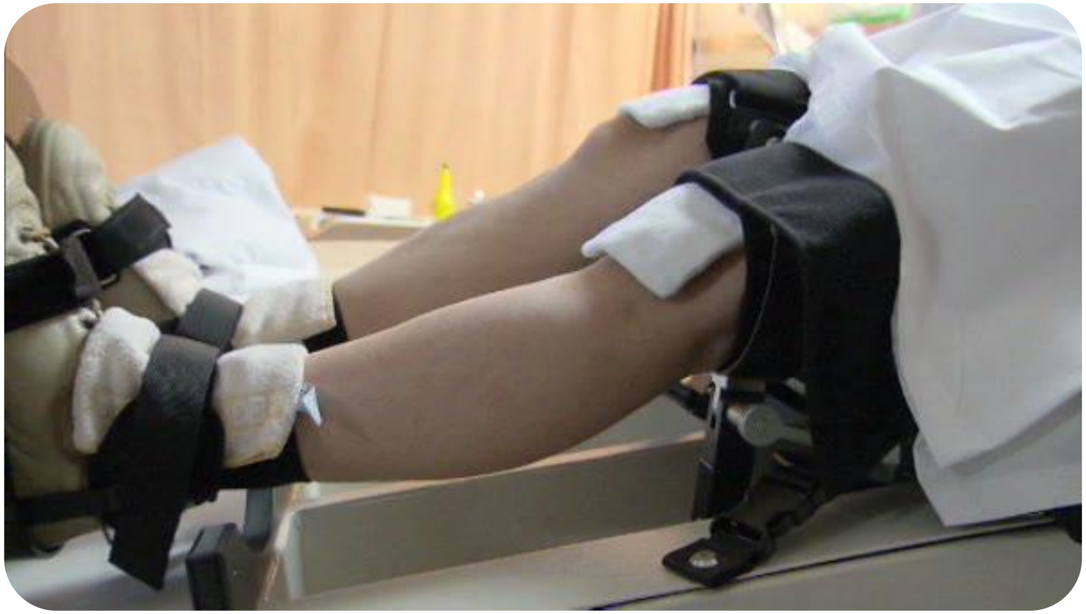
Robotic: Motomed®

Therapeutic approach by the NRA



Therapeutic approach by the NRA
(II) Early Verticalization

Robotic:
Erigo®



Direction of gravity (standing upright) → increases perception → better awareness better sensitivomotor rehabilitation

Conditions to meet

WHEN

FOR WHO

Evidence of effectiveness of robotic rehabilitation ?

FOR WHO ?

Conditions to meet

WHEN

FOR WHO

HOW MUCH

Evidence of effectiveness of robotic rehabilitation ?

How much: Intensity?

Randomized Controlled Trial > Eur J Phys Rehabil Med. 2018 Jun;54(3):408-418.
doi: 10.23736/S1973-9087.16.04224-6. Epub 2016 Aug 30.

High-intensity treadmill training improves gait ability, VO2peak and cost of walking in stroke survivors: preliminary results of a pilot randomized controlled trial

Daniele Munari [1], Anna Pedrinolla [2], Nicola Smania [3], Alessandro Picelli [3], Marialuisa Gandolfi [3], Leopold Saltuari [4] [5], Federico Schena [2]

Background: Previous studies documented beneficial effects of **aerobic exercises on cardiovascular fitness and gait ability.**

Aim: to compare the effects of a high-intensity treadmill training (HITT)

against low-intensity treadmill training (LITT)

- on gait ability
- quality of life
- cardiorespiratory fitness VO2peak
- and cost of walking in chronic stroke subjects.

Design: Randomized, controlled pilot study.

Population: n=16 ; HITT (N.=8) or in the LITT (N.=8).

Conclusions:

HITT :- feasible training

- improvement in gait ability
- enhanced VO2peak
- reduction in cost of walking compared to LITT.

Conditions to meet

WHEN

FOR WHO

HOW MUCH

GOAL

Evidence of effectiveness of robotic rehabilitation ?

Archives of Physical Medicine and Rehabilitation
journal homepage: www.archives-pmr.org
Archives of Physical Medicine and Rehabilitation 2015;96:981-90

ORIGINAL RESEARCH

Comparison of Robotics, Functional Electrical Stimulation, and Motor Learning Methods for Treatment of Persistent Upper Extremity Dysfunction After Stroke: A Randomized Controlled Trial

Jessica McCabe, MPT,[a] Michelle Monkiewicz, DPT,[a] John Holcomb, PhD,[b] Svetlana Pundik, MD, MS,[a] Janis J. Daly, PhD, MS[a]

Methodology

Design: Single-blind, randomized trial

Participants: (N=39)
>1 year post-single stroke
35 completed the study

Interventions: 12 weeks
All groups received treatment **5d/wk for 5h/d** (60 sessions), with unique treatment as follows:
ML (Motor learning) alone (n=11) **(5h/d** partial- and whole-task practice of complex functional tasks),
Robotics plus ML (n=12) (3.5h/d of ML and 1.5h/d of shoulder/elbow robotics flexion-extension -horizontal)
FES plus ML (n=12) (**3.5h/d of ML** and **1.5h**/d of FES wrist/hand coordination training)

J McCabe et al. Archives of Physical Medicine and Rehabiliation 2015.

Results

Table 5 Within-group gains in impaired coordination (FM) for each of the 3 treatment groups

Treatment Group	Coordination Measure	Pretreatment (points)	Posttreatment (points)	Median Gain Score (95% CI) (points)	P	Mean Gain Score
ML	FM	23.6±5.8	33.5±8.3	9 (7.5–12.5)	.003*	11
	FM scale for shoulders/elbows	12.7±2.9	16.4±3.9	3.5 (2.5–4.5)	.003*	4
	FM scale for wrists/hands	9.1±2.6	14.7±4.7	5 (4.0–7.5)	.003*	6
FES+ML	FM	23.5±6.5	32.3±7.9	8 (5.5–12)	.002*	10
	FM scale for shoulders/elbows	12.7±3.5	16.5±3.9	4 (2.0–6.0)	.005*	4
	FM scale for wrists/hands	8.8±3.5	13.4±4.2	5 (2.0–7.0)	.003*	5
ROB+ML	FM	23.6±5.9	31.3±6.2	7.8 (4.5–11)	.003*	8
	FM scale for shoulders/elbows	12.9±1.9	16.6±2.5	3.5 (2.5–5.0)	.002*	3
	FM scale for wrists/hands	8.3±4.3	12.0±4.1	4.0 (1.5–5.0)	.007*	4

Conclusion

Severely impaired stroke survivors with persistent (>1y) upper-extremity dysfunction → clinically and statistically significant gains in coordination and functional task performance with

- robotics plus ML, FES plus ML, and ML alone
- in an intensive and long-duration intervention;
- **no group differences were found**.

J McCabe et al. Archives of Physical Medicine and Rehabiliation 2015.

Conclusion perspective

Additional studies are warranted to determine the effectiveness of these methods in the clinical setting

J McCabe et al. Archives of Physical Medicine and Rehabilitation 2015.
Mehrholz, Platz et al.,Chochrane Database of Systematic Reviews, 2018.

Good outcome condition of standard therapy + Robotic

Angl nom	Angl adj	Français nom	Français adjectif	Signification
✓ Efficacy	Efficient, methodical	Efficacité	Efficace	Given intervention in an ideal controlled condition Scientific good study methodology
Effectiveness	Effective	Efficacité, efficience	Efficace, effectif	Meaningful effect Working well, on patients in a NORMAL condition
Efficiency	Efficient	Efficacité, efficience, rendement	Efficace, efficient	Most economical way with good input and output

Conclusion perspective

Additional studies are warranted to determine the effectiveness of these methods in the clinical setting

1. **As early as possible**

2. **Enriched environment → motivation ⬆**

3. **Individual goalassessment**

J McCabe et al. Archives of Physical Medicine and Rehabilitation 2015.

Therapeutic approach by the NRA
Acute Neurorehab Unit

1. As early as possible

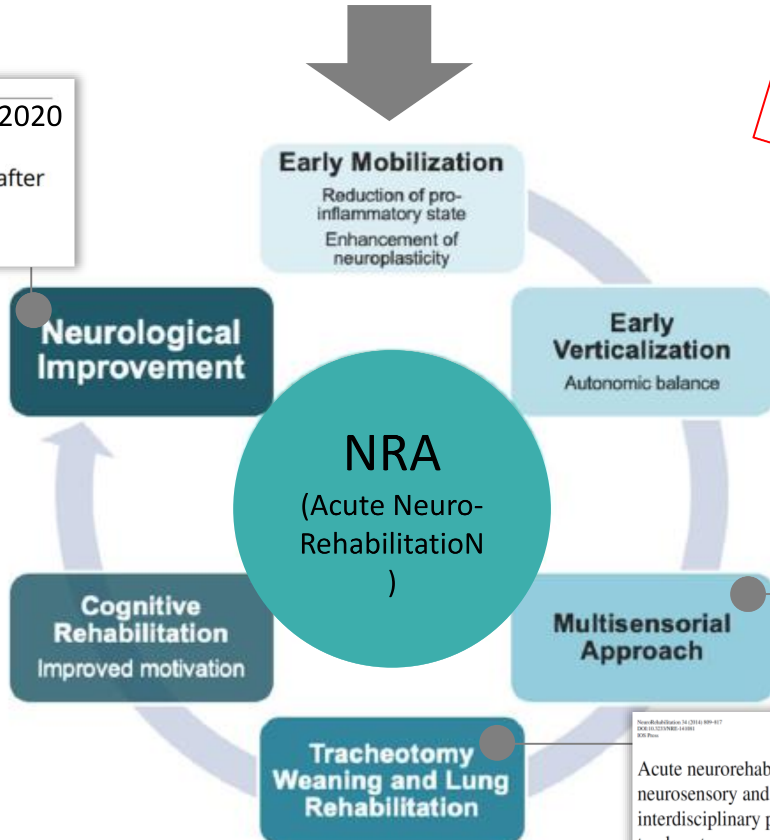
PLOS ONE

2020

RESEARCH ARTICLE

Recovery in cognitive motor dissociation after severe brain injury: A cohort study

Jane Jöhr[1*], Floriana Halimi[1], Jérôme Pasquier[2], Alessandro Pincherle[1], Nicholas Schiff[3], Karin Diserens[1]



NeuroRehabilitation 44 (2019) 545–554
DOI:10.3233/NRE-192692
IOS Press

2019

Neurosensory stimulation outdoors enhances cognition recovery in cognitive motor dissociation: A prospective crossover study

Caroline Attwell[1,*], Jane Jöhr[1], Alessandro Pincherle, Jean-Michel Pignat, Nina Kaufmann, Jean-François Knebel, Loric Berney, Philippe Ryvlin and Karin Diserens
Department of Clinical Neurosciences, Neurology, Acute Neurorehabilitation Unit, University Hospital CHUV, Lausanne, Vaud, Switzerland

NeuroRehabilitation 34 (2014) 809–817
DOI:10.3233/NRE-141081
IOS Press

2014

Acute neurorehabilitation: Does a neurosensory and coordinated interdisciplinary programme reduce tracheostomy weaning time and weaning failure?

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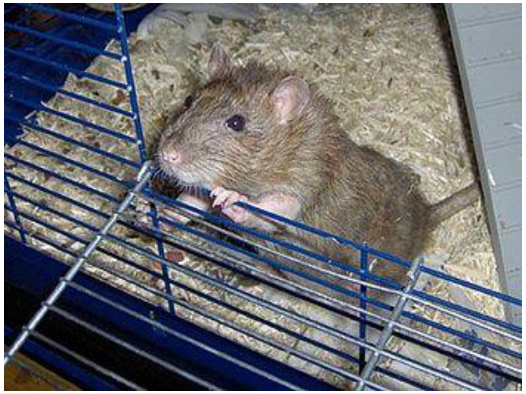
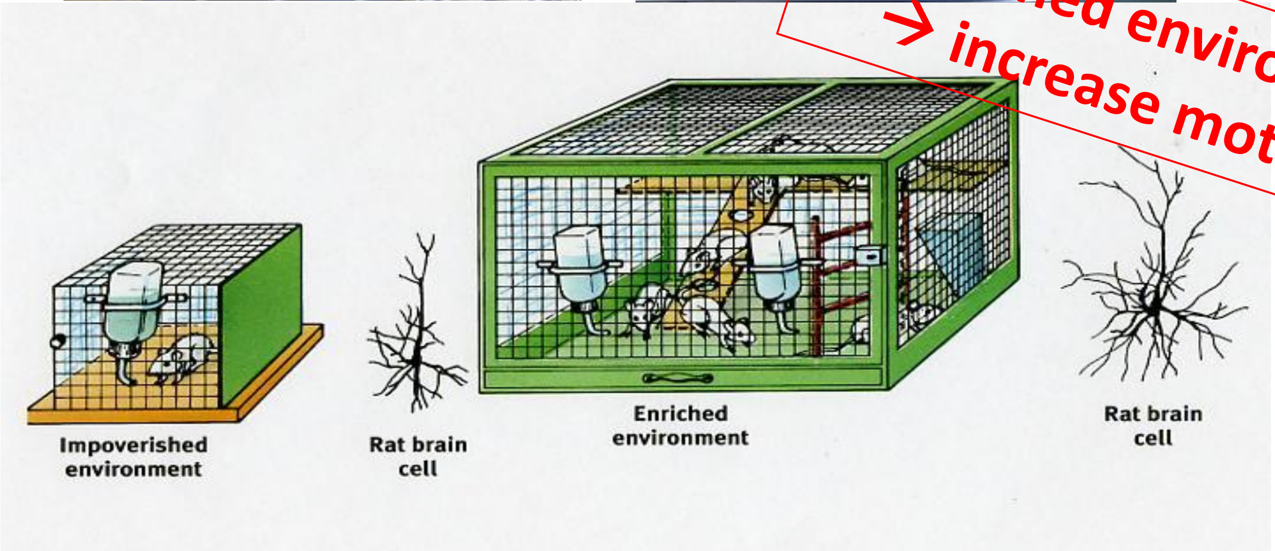
Brain Repair
Enriched Environment : animal concept





2. Enriched environment
→ increase motivation

Neurobiology of Learning and Memory, VoL147, 2018: 54-6

Therapeutic approach by the NRA
(III) Neurosensorial Approach

Definition:

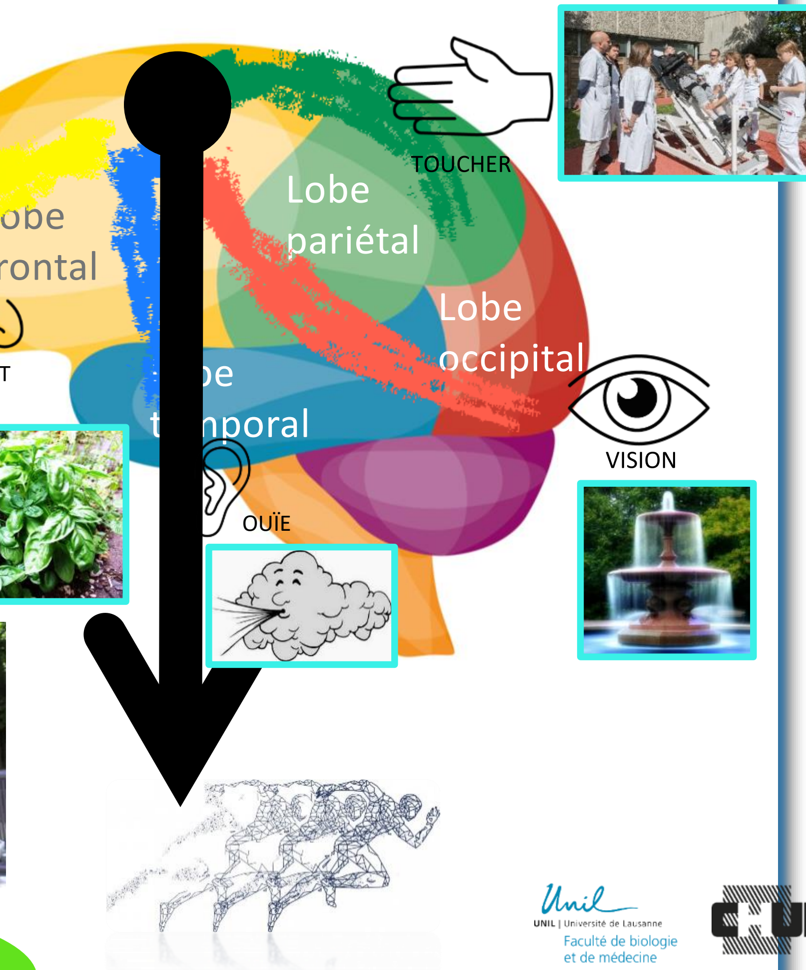
1) Coordinated stimulation of 5 senses

+

2) Cognitive motivation

+

3) Enriched environnement



INDOOR:
BÂTIMENT HOSPITALIER

+

OUTDOOR:
JARDIN
THÉRAPEUTIQUE

NeuroRehabilitation 44 (2019) 545–554
DOI:10.3233/NRE-192692
IOS Press

2019

Neurosensory stimulation outdoors enhances cognition recovery in cognitive motor dissociation: A prospective crossover study

Caroline Attwell[1,*], Jane Jöhr[1], Alessandro Pincherle, Jean-Michel Pignat, Nina Kaufmann, Jean-François Knebel, Loric Berney, Philippe Ryvlin and Karin Diserens
Department of Clinical Neurosciences, Neurology, Acute Neurorehabilitation Unit, University Hospital CHUV, Lausanne, Vaud, Switzerland

Influence of passive leg movements on blood circulation on the tilt table in healthy adults

David Czell*[1], Reinhard Schreier[1], Rüdiger Rupp[2], Stephen Eberhard[1], Gery Colombo[1,3] and Volker Dietz[1]

Address: [1]Spinal Cord Injury Center, Balgrist University Hospital, Zurich, Switzerland, [2]Orthopaedic Hospital of Heidelberg University, Department II, Heidelberg, Germany and [3]Hocoma AG, Medical engineering, Volketswil, Switzerland

Email: David Czell* - dczell@balgrist.unizh.ch; Reinhard Schreier - schreier@hocoma.ch; Rüdiger Rupp - ruediger.rupp@ok.uni-heidelberg.de; Stephen Eberhard - stephan.eberhard@balgrist.ch; Gery Colombo - colombo@hocoma.ch; Volker Dietz - dietz@balgrist.unizh.ch

* Corresponding author

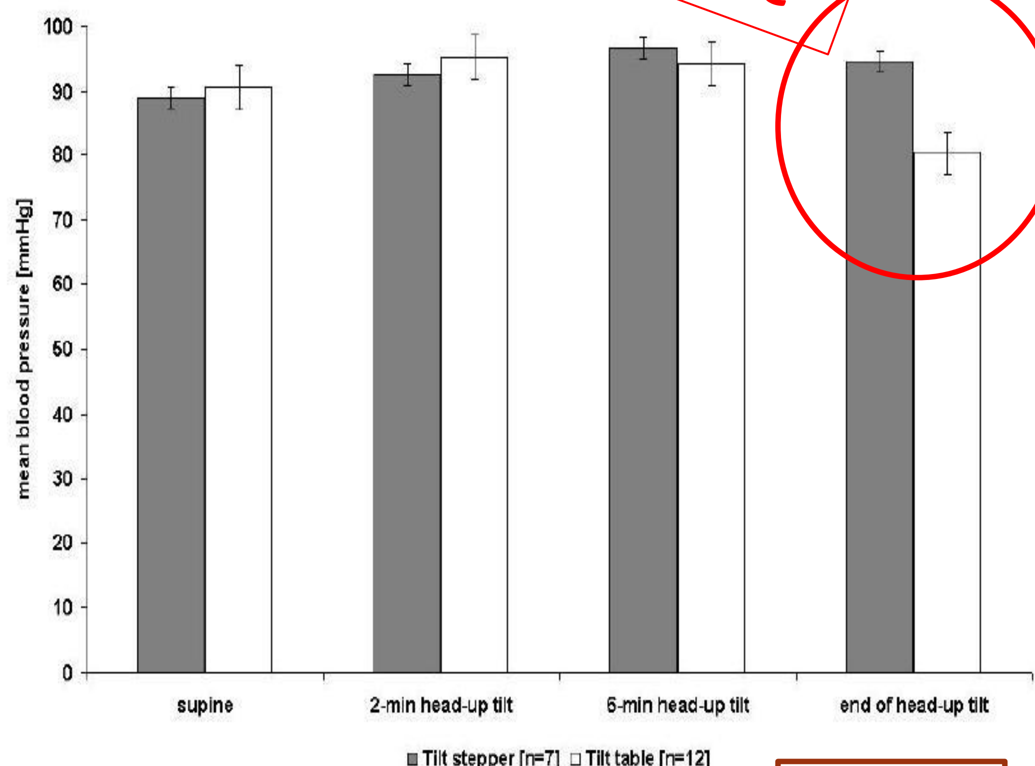
Published: 25 October 2004

Journal of NeuroEngineering and Rehabilitation 2004, 1:4 doi:10.1186/1743-0003-1-4

Received: 30 August 2004

Accepted: 25 October 2004

3. Individual goalassessment: Maintain blood pressure



30 min

Figure 4
Blood pressure +/- SE during 75° the tilt table and tilt stepper test

Rocca *et al. BMC Neurology* (2016) 16:169
DOI 10.1186/s12883-016-0684-2

BMC Neurology

2016

RESEARCH ARTICLE Open Access

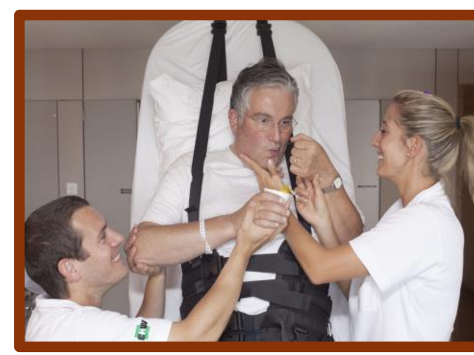
Sympathetic activity and early mobilization in patients in intensive and intermediate care with severe brain injuries: a preliminary prospective randomized study

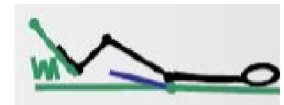
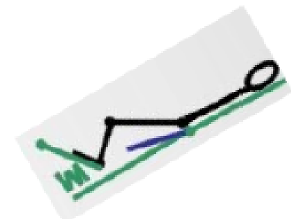
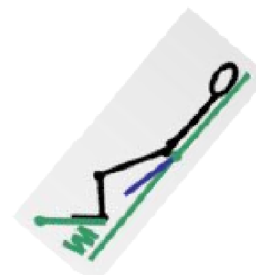
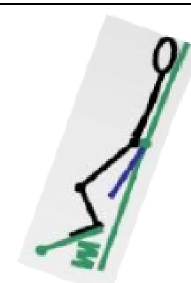
A. Rocca[1*], J.-M. Pignat[2], L. Berney[2], J. Jöhr[2], D. Van de Ville[3], R. T. Daniel[1], M. Levivier[1], L. Hirt[4], A. R. Luft[5], E. Grouzmann[6] and K. Diserens[2]

Groupe I
(n=10)

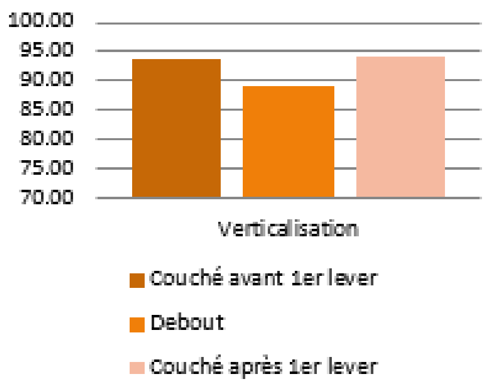
Groupe II
(n=10)

Groupe III
(n=10)

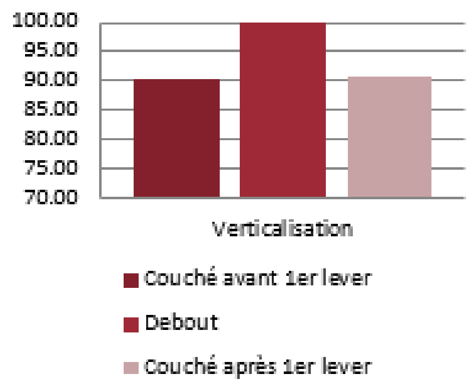


1. Mouvements passifs, 0°, 5 min Monitoring du patient et prendre la tension artérielle avant la verticalisation. S'assurer que les câbles soient suffisamment longs pour le bon déroulement de la verticalisation.	
2. Mouvements passifs, 30°, 10 min Incliner à 30° la table et prendre la tension artérielle. Serrer à nouveau la sangle abdominale pour assurer un maintien optimal.	
3. Mouvements passifs, 50°, 10 min Incliner à 50° la table et prendre la tension artérielle. Serrer à nouveau la sangle abdominale pour assurer un maintien optimal.	
4. Mouvements passifs, 70°, 10 min Incliner à 70° la table et prendre la tension artérielle. Serrer à nouveau la sangle abdominale pour assurer un maintien optimal.	

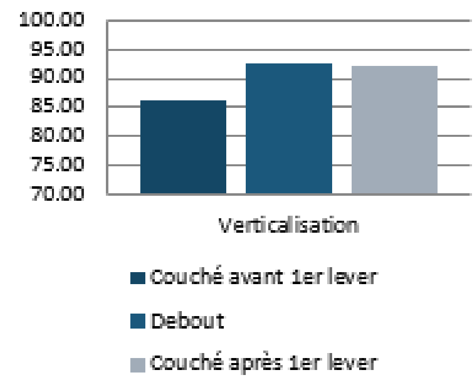
Group I
(n=10)



Group II
(n=10)



Group III
(n=10)



Absence of orthostatic effect By increased endogenous catecholamin production

Perspectives

WHEN

FOR WHO

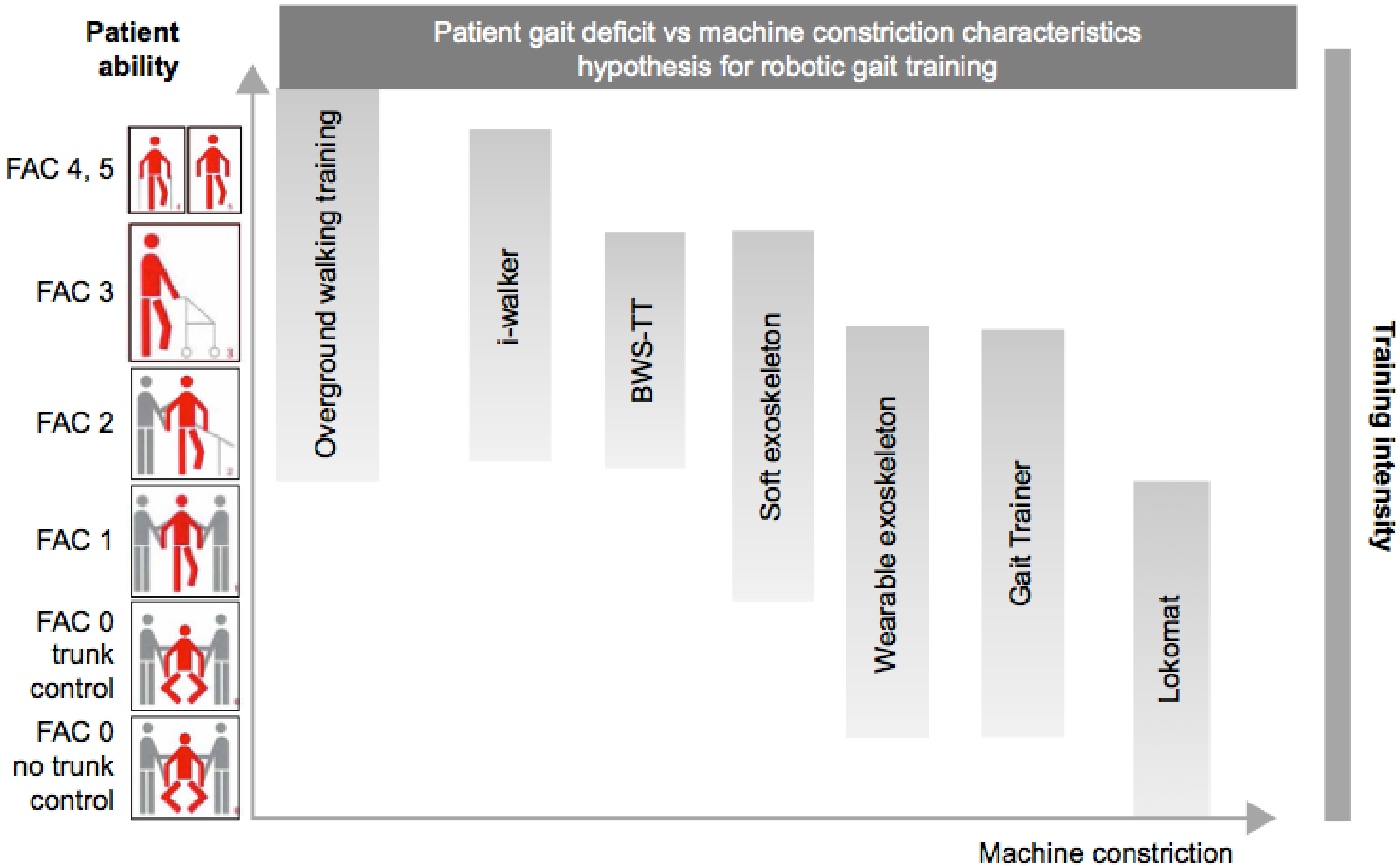
HOW MUCH

GOAL

Evidence of effectiveness of robotic rehabilitation ?

Perspectives

Robot-assisted gait training for stroke patients: current state of the art and perspectives of robotics



Perspectives to maintain efficacy to improve: effectiveness and efficiency

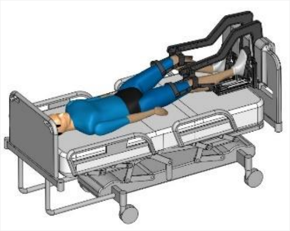
Perspectives in acute care

Currently

Robotic : Erigo®

Perspective

Robot of verticalization comes to bed

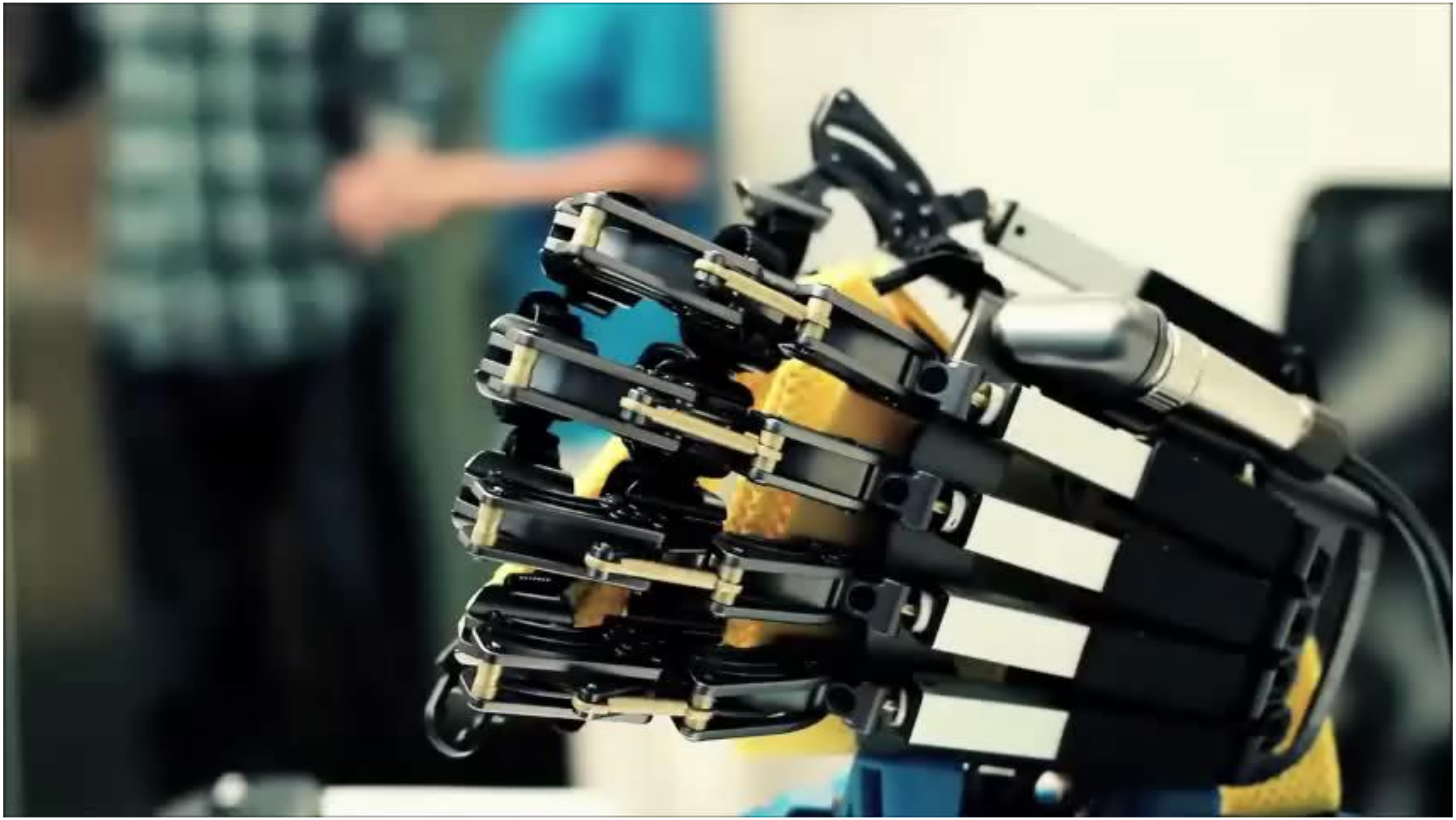


Robotic : VEMO®

Actual reality in post-acute /ambulatory care

- During a therapy day patients spent **50%** of their time in bed
- **28%** are sitting in their rooms
- only **13%** with activities aimed to avoid complications or improve their abilities
- **60%** of the time the patients were alone

Standard Hand Exoskeleton



Perspectives in post-acute /ambulatory care

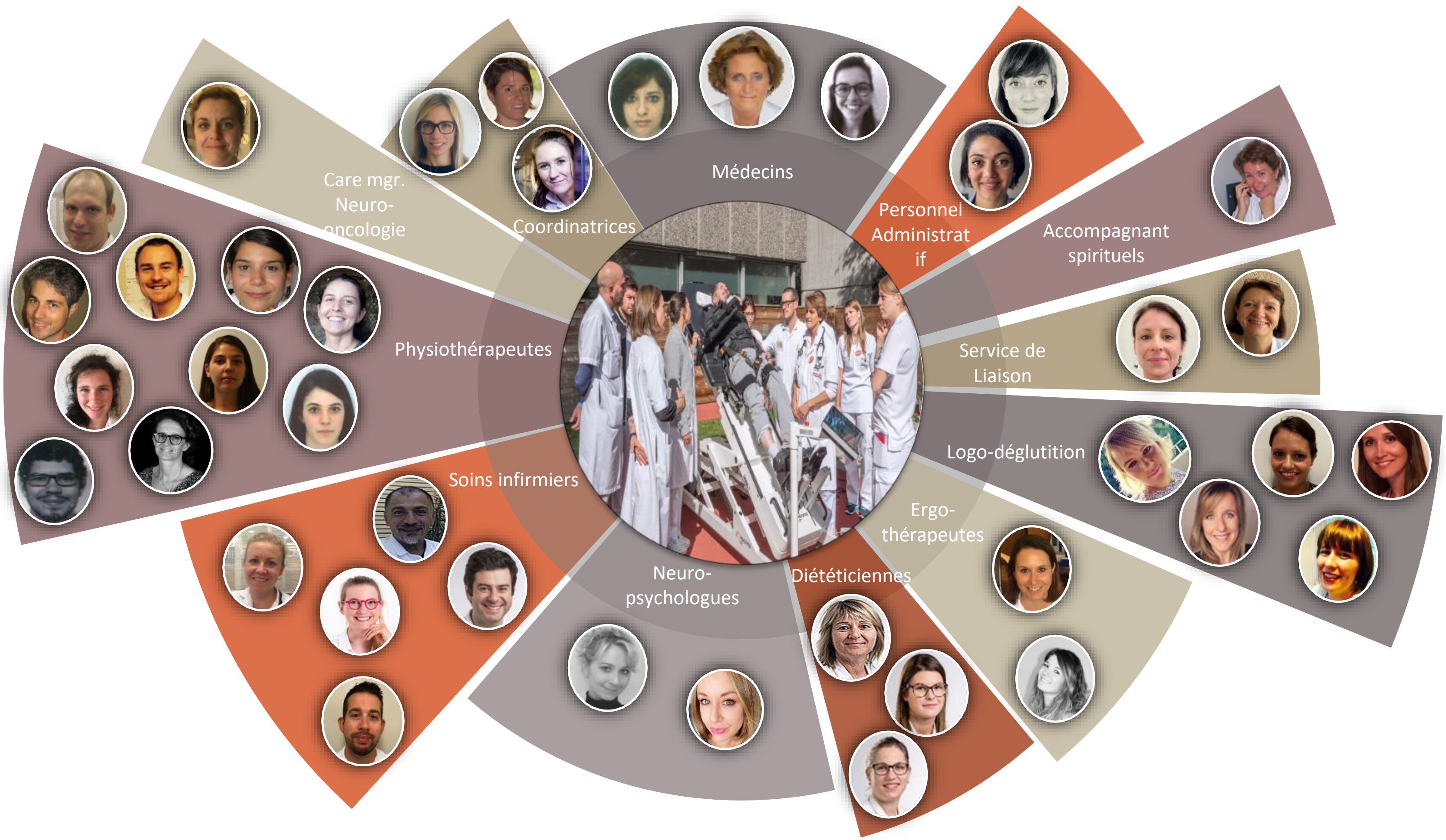
✓ **efficacy, improve effectiveness + efficiency**

Exoskeleton Emovo wants to enabl these users to move their hands at home without help

- High dose of treatment
- Functional and repetitive movement
- Complementary to standard of care

Emovo Care, EPFL

No Robotic rehabilitation without an interdisciplinary team



Perspective : robotic + rehabilitation by virtual reality

Rééducation par la réalité virtuelle **S. Crottaz-Herbette**, Laboratoire des sciences cognitives, CHUV, Lausanne