

Therapy after Stroke

-Physical Therapy

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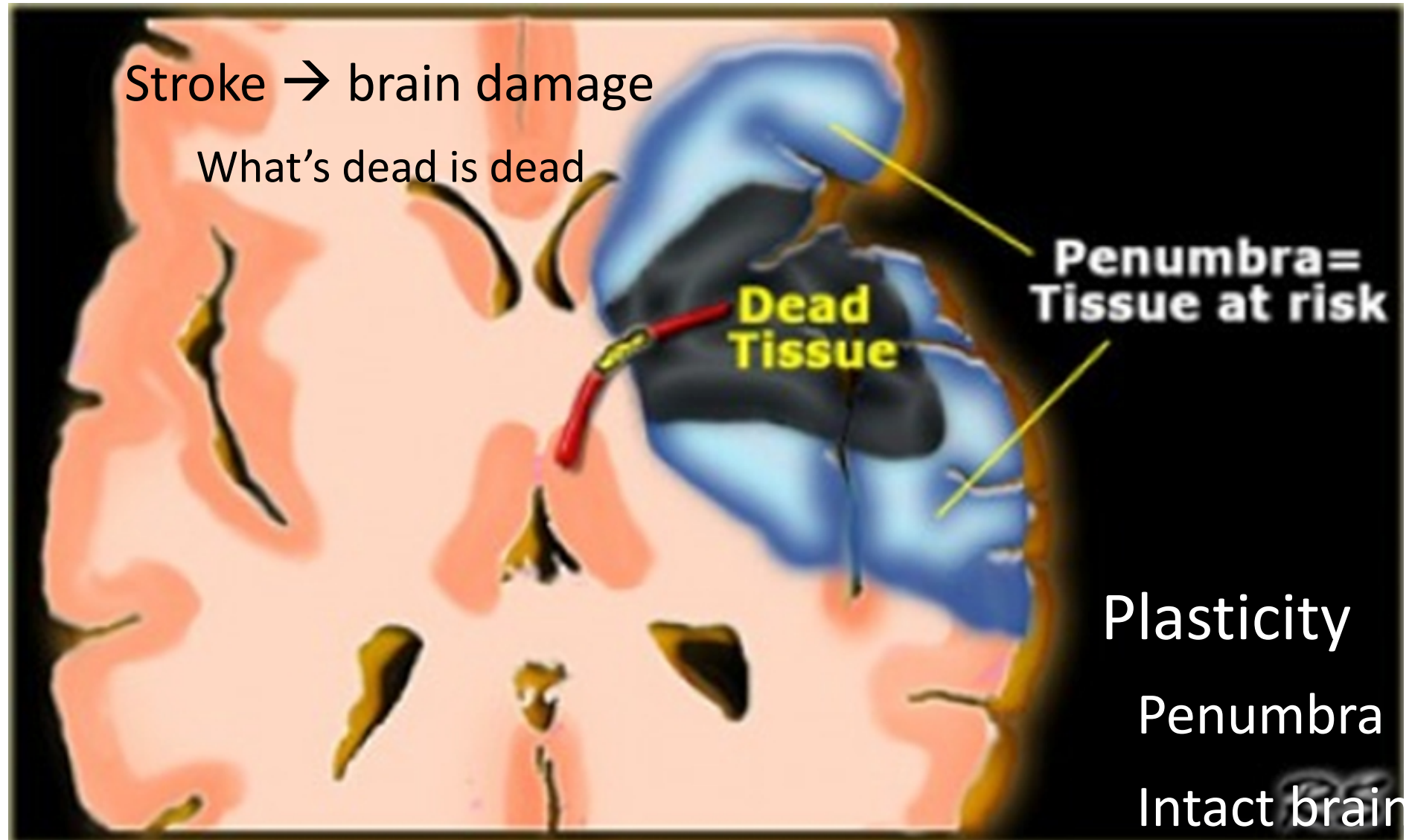


Therapy after Stroke



- Plasticity of the brain
- Therapy
 - Motor learning
- Physical Therapy

Plasticity of the brain



Plasticity of the brain

- Different levels

- Cell
 - Neurogenesis
- Synaptic
- Pathways
- Areas

- Negative plasticity

- Cell death
- Wrong connections (spasticity)

- Positive plasticity

- Everything that will give increased movement and function

Use it or loose it!



Plasticity of the brain

Influences on plasticity:

- Stroke
 - First six months
- Exercise
 - Physical
 - Mental
- Medication
 - Anti depressives, EPO, anti epileptics, ...
 - Artorvastatin
- Illness

Plasticity of the brain

Recovery is a complex process that probably occurs through a combination of **spontaneous** and **learning-dependent** processes,

including **restitution** (restoring the functionality of damaged neural tissue),
substitution (reorganisation of partly-spared neural pathways to relearn lost functions),

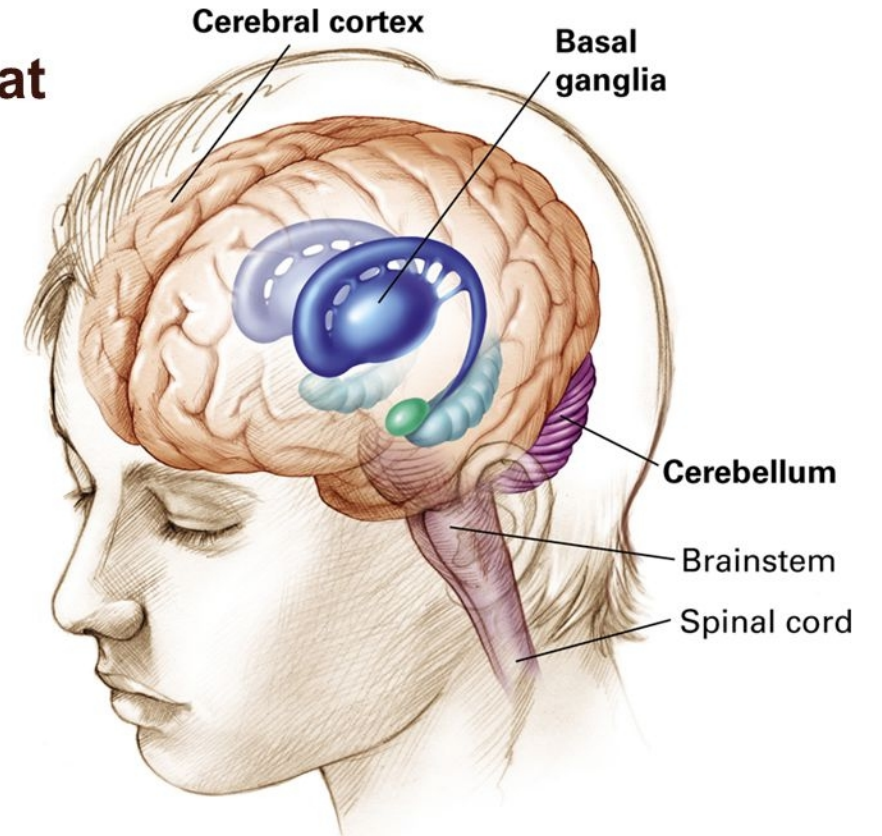
and **compensation** (improvement of the disparity between the impaired skills of a patient and the demands of their environment).

Kwakkel et al 2004

Therapy – motor learning

Motor learning is
the process through practice
and/or experience,
which will lead to a relative
permanent change in the motor
skills of a person

Brain Regions that Contribute to Skill Learning



Therapy – motor learning

Fysionet-evidencebased.nl

- Make the exercise not too easy but also not too difficult
→ **success experience**
- Enough **repetitions** ('repetition-without-repetition-principle').
- **Rest** between repeats and sessions are important.
- **Feedback** (verbal and non-verbal) should be given about the performance of the learned movement ('knowledge of performance'), in decreasing frequencies.
- **Increase motivation to learn** by giving information on the goal, the way you coach and to give (positive) feedback.

Therapy – motor learning

- The exercise should take place in a **meaningful environment**.
- Complex movements, like getting dressed, it is advised to **breakup the movement into partial movements**.
- Automatic movements (like walking), should not be fragmented.

To the degree that all rehabilitation is a form of motor learning, it can occur to promote both true recovery and compensation.

Krakauer John, Current Opinion in Neurology 2006, 19:84–90

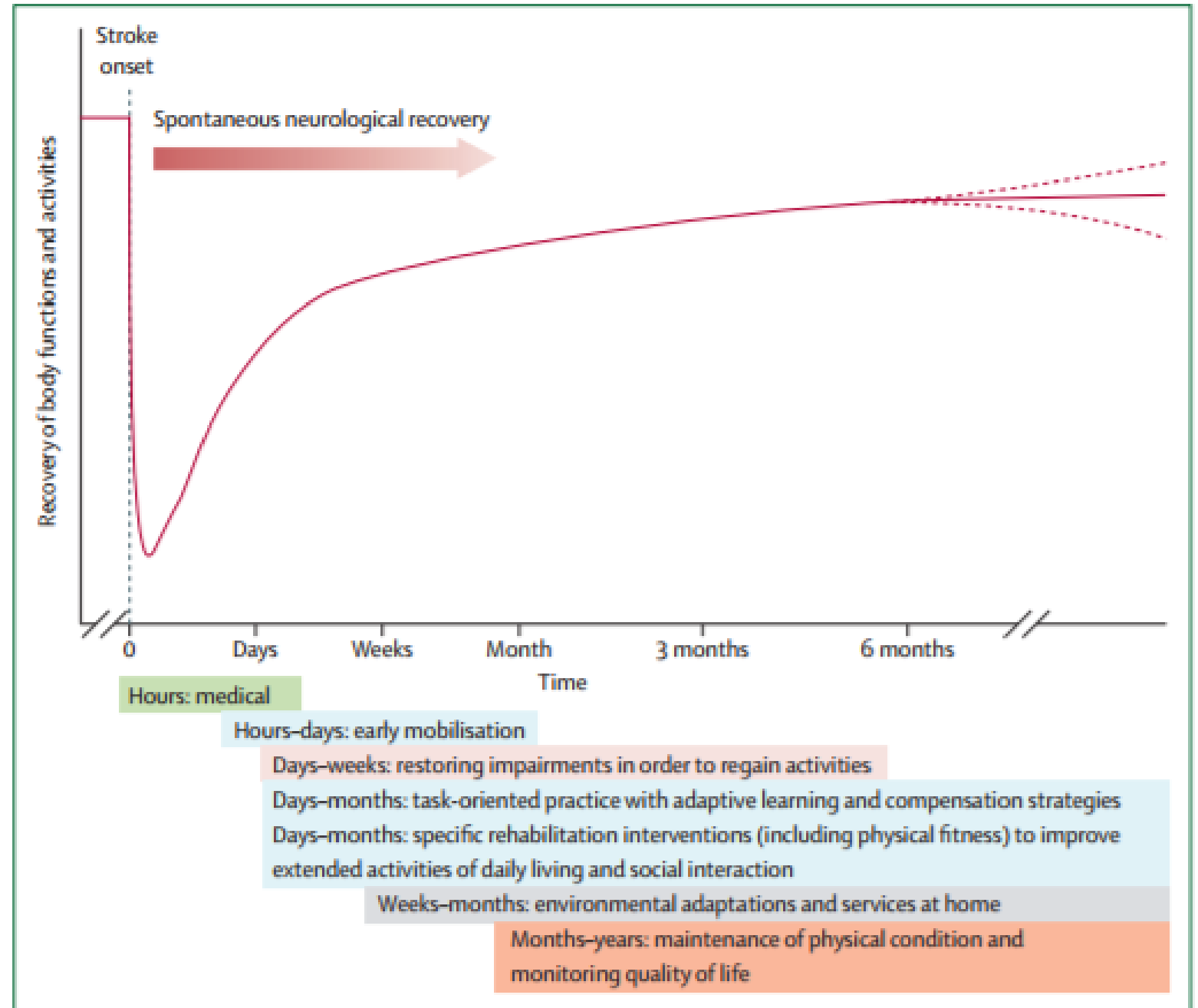
Hypothetical pattern of recovery after stroke with timing of intervention strategies

Series

Stroke Care
Stroke Rehabilitation 2

Langhorne P, Bernhardt J, Kwakkel G

The Lancet Vol 377 May 14 2011



Motor recovery beginning 23 years after stroke

Case study, Sörös et al 2017, journal of neurophysiology

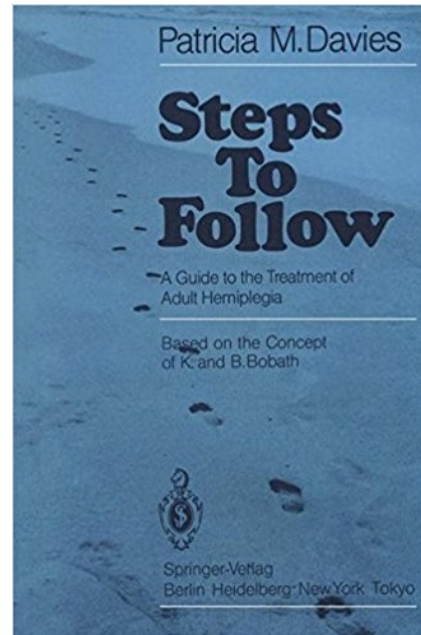
- Totally non-functional spastic left hand
- 22 years after stroke: started swimming
- 1 year later: ability to move his fingers
- 2 years of physical therapy: picking up small objects (coins)
- Functional MRI: widespread bilateral activation of both sides of the cerebrum and cerebellum are demonstrated

→ The generally accepted window of recovery, beyond which further therapy is not indicated, should be entirely reconsidered.

Therapy is everything that is given in **interaction** with a patient with the intention to improve or maintain function and health

Physical therapy

- Bobath
- Neuro Development Treatment NDT



Evidence based therapy EBT

FES

Use of treadmills

Virtual reality

Use of robotica

Exercise programs

(UL, LL, standing

balance, trunk

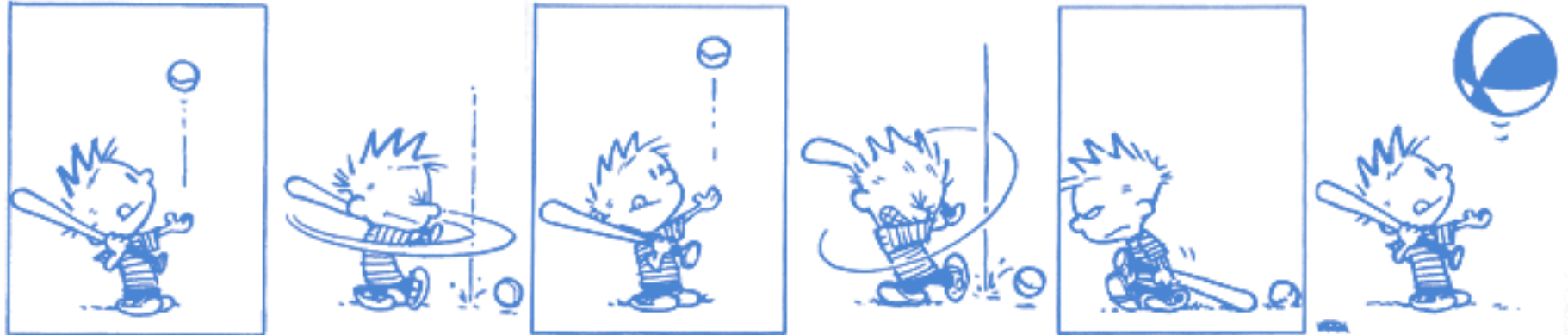
control, ...)

...

Physical therapy

Bobath, NDT concept and EBT are all based on the motor learning principle!

- Repeat without repeat, but how much do you need?
 - CE Lang says 400-600 for an upper limb movement
 - 1000 steps for walking
- Facilitate: making it easier, not taking over
 - Hands-on, functional electrical stimulation, robotics
 - Adapt the environment



Physical therapy

Physical therapy



Physical therapy



Physical therapy



Physical therapy



Physical therapy



Physical therapy



