Neuroplasticity:
The brain's ability to adapt and change with experience

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Schedule

- What is neuroplasticity?
- Neuroplasticity and stroke
- Timeline of neuroplasticity following stroke
- Neuroplasticity principles
- Learning stages
- Promoting brain health
- Review

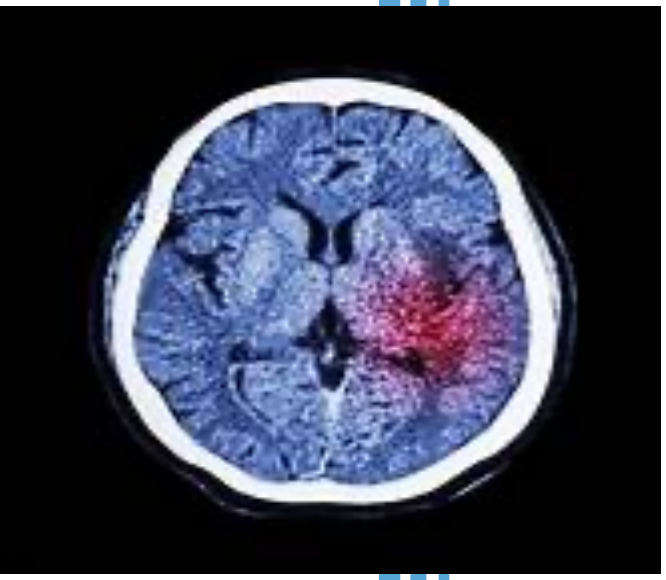
What is neuroplasticity?

- Neuroplasticity refers to how the brain **changes** with **experience**.

- Following injury or rehabilitation, changes to brain structure and function may occur.

(Takahashi et al., 2008)

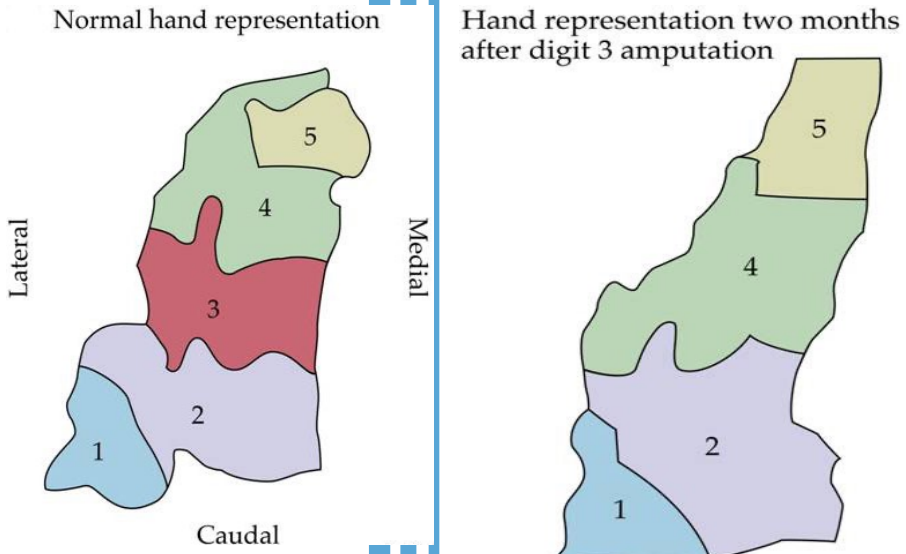
Neuroplasticity & stroke



- Strokes occur when areas of the brain are deprived of oxygen leading to death of cells
- The death of brain cells results in inflammation, nerve connection loss, and interrupted homeostasis causing impairments.
- The **brain can adapt and change!**

Neuroplasticity & stroke

- How does the brain adapt and change?



Kaas et al., 1983

- The brain can **remap and reorganize** areas
- Rehab can help drive recovery by making you use areas in the brain that were injured/affected by the stroke.

Timeline of neuroplasticity following stroke

<u>After a stroke there are two general ways the brain recovers</u>:

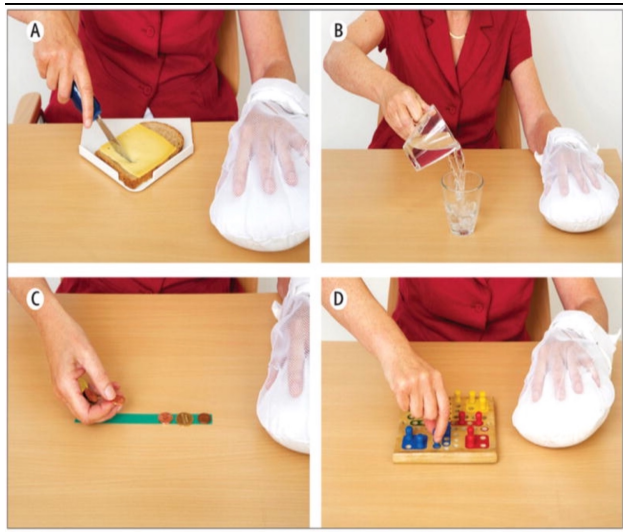
1) **Spontaneous recovery:** first 3 months

2) **Therapeutic-induced recovery:** days-years

Neuroplasticity principles

- **Use it or lose it**
  - Failure to use the weak extremity results in an inability to use it in the future

- **Use it and improve it**
  - Doing a certain task helps train the brain and leads to enhancement of that function



Kwakkel et al., 2015

Neuroplasticity principles

- **Specificity**
  - Training/rehabilitation needs to be specific
- **Repetition and intensity matter**
  - Number of reps and intensity during rehabilitation are important for lasting brain change
- **Experience matters**
  - Optimal training in a helpful environment

Learning stages

- 3 stages
  1) Cognitive. 2) Associative 3) Autonomous

Early Learning	Later Learning
Lots of repetitions	Practicing a task in a sequence or random order
More frequent practice	More spread-out practice

Promoting brain health

- <u>Exercise</u>
  - **Aerobic exercise:** walk, jog, dance, circuits, stairs, swim, bike, etc.
  - **Resistance training**: bands, weights, bodyweight, etc.

Review

- Neuroplasticity describes how the brain changes from experience
- Neuroplasticity is involved in learning
- The brain can remap and reorganize
- There is spontaneous recovery and therapeutic-induced recovery.
- There are multiple principles of brain change
- Exercise promotes brain health

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