Class 14
Skill memories

Monday

10/10/2022

Cognitive skill vs perceptual motor skill

- Typing
- Furniture assembly
- Playing chess
- Driving
- Dancing
- Handloom Weaving
- Tabla player
- Cooking
- Cycling
- All terrain cycling marathon

Skill: an ability that can improve over time through practice

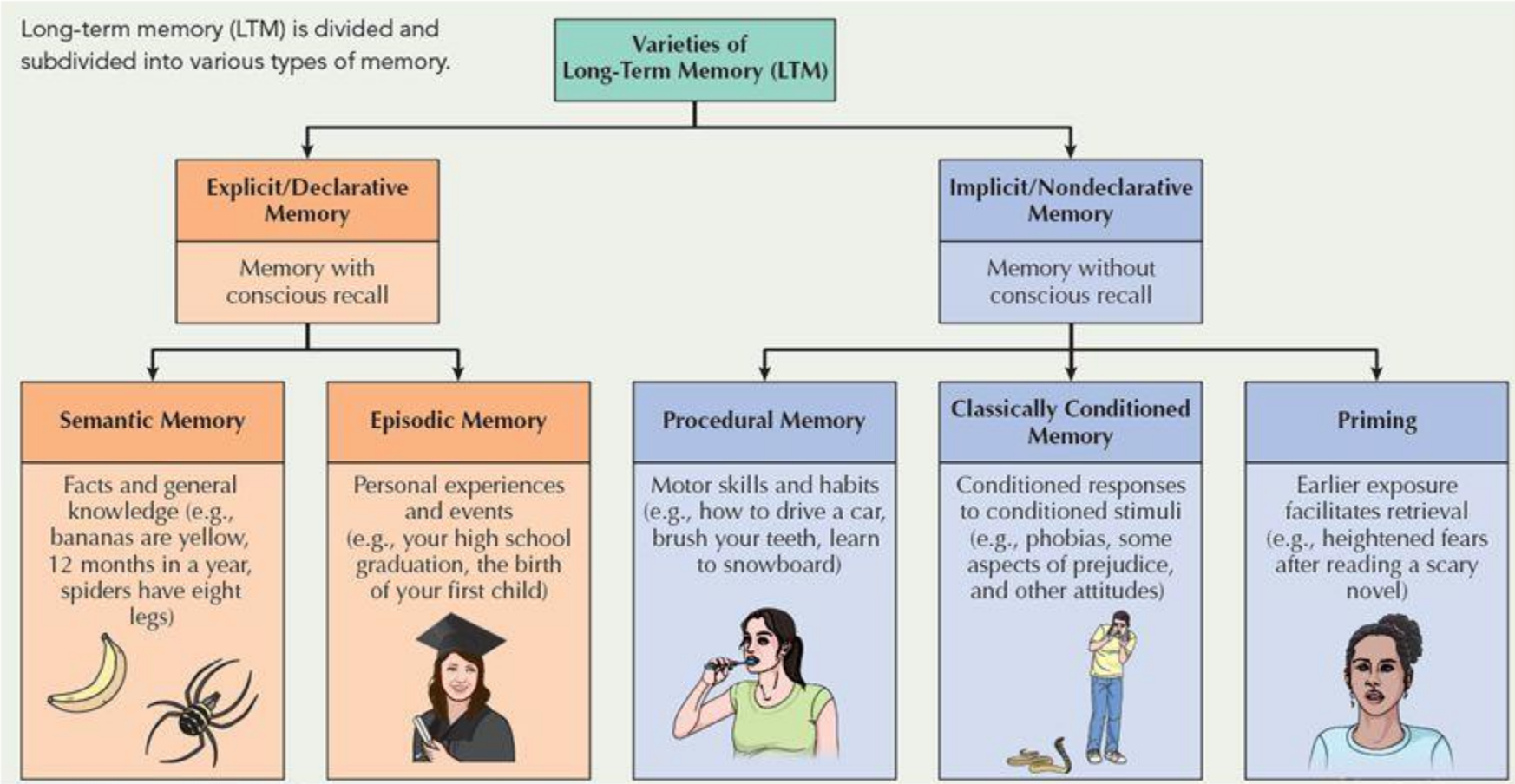
Perceptual-motor skill: learned movement patterns guided by sensory inputs (physical dexterity)

Cognitive skill: a skill that requires thinking, reasoning, problem solving or the application of strategies (mental dexterity)

Closed skill: perfecting a predefined sequence of movements (perceptual-motor skill)

Open skill – perceptual- motor skill + cognitive skill

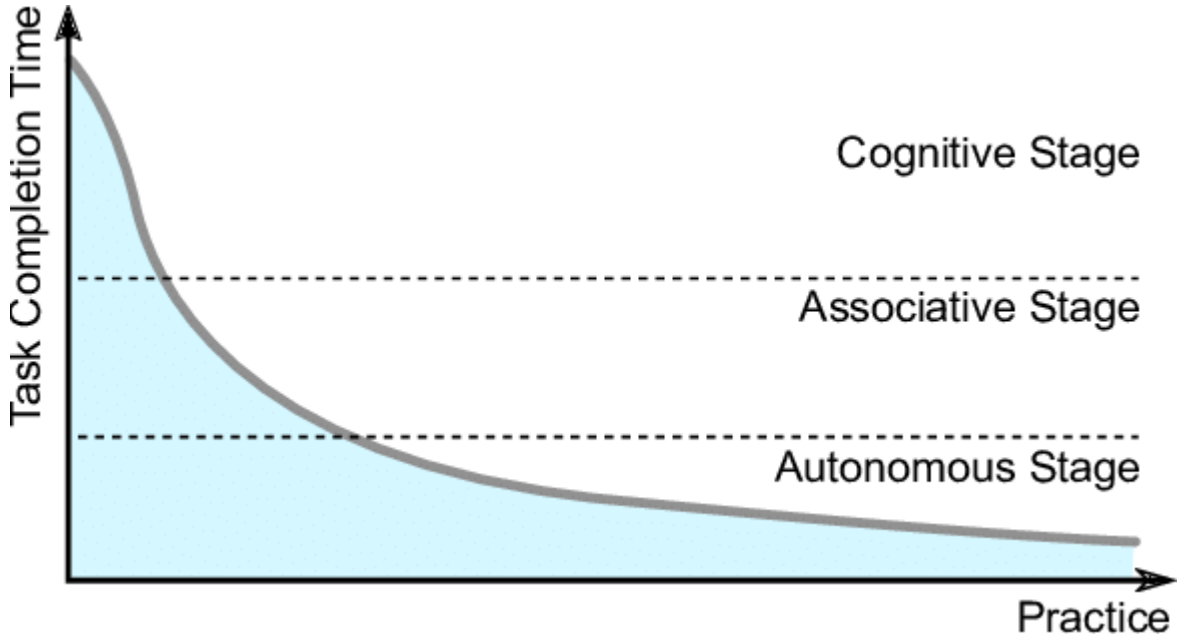
Types of Long-Term Memories



How do we learn a motor skill?

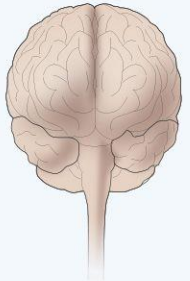
- E.g. driving

- Can learning a motor skill include a cognitive component?



Stage	Characteristics	Example
1. Cognitive stage	Performance is based on rules that can be verbalized.	Using written instructions to set up a tent
2. Associative stage	Actions become stereotyped.	Setting up a tent in a fixed sequence, without instructions
3. Autonomous stage	Movements seem automatic.	Setting up a tent while carrying on a discussion about politics

Fitts and Posner's Model of Motor Learning



Cognitive Stage

Learners expend cognitive energy to understand how they are supposed to move

Associative Stage

Learners have mastered the basic forms of movement and begin to refine their skills with practice

Autonomous Stage

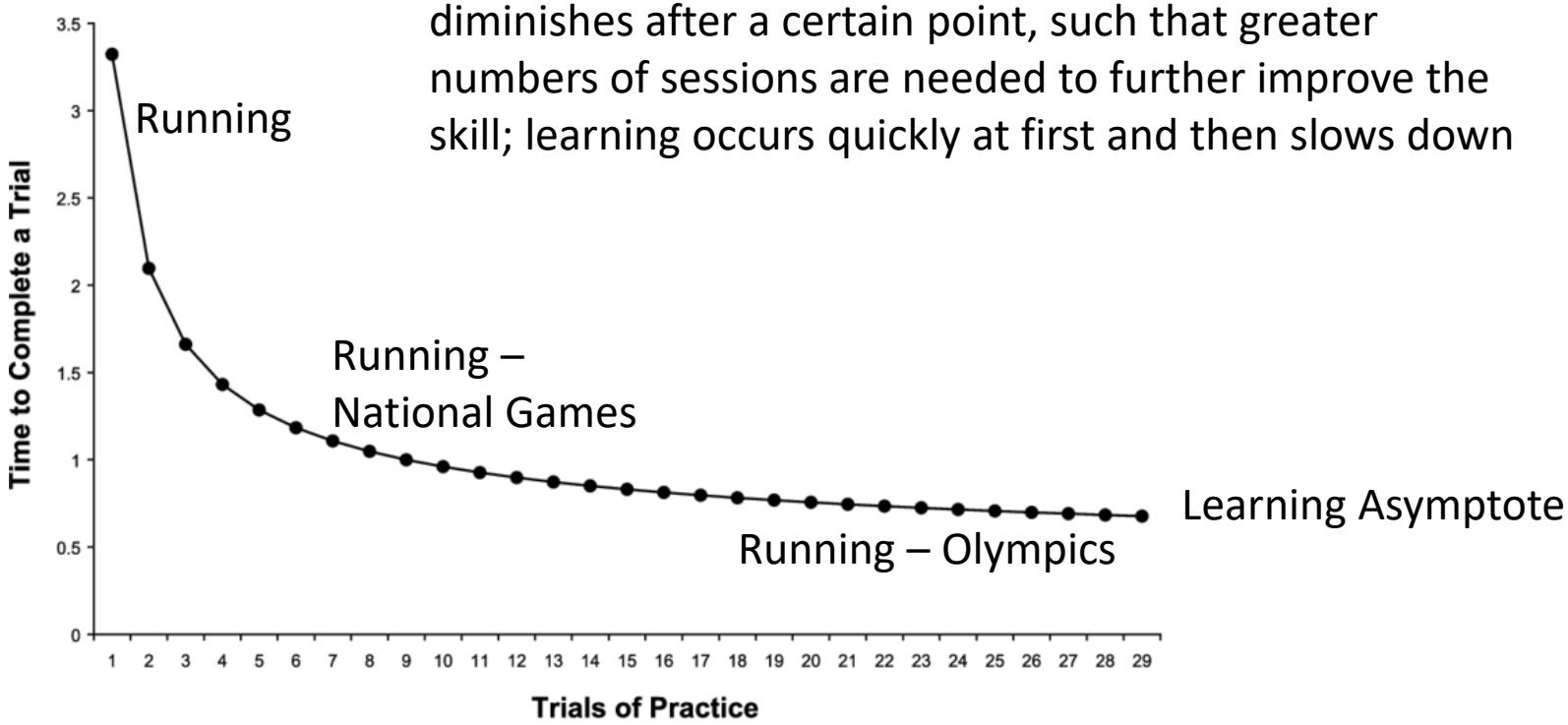
Learners perform movements automatically without significant cognitive energy, and can focus on strategy

what allows some individuals to excel at a particular skill?

- Which factors matter?

Practice

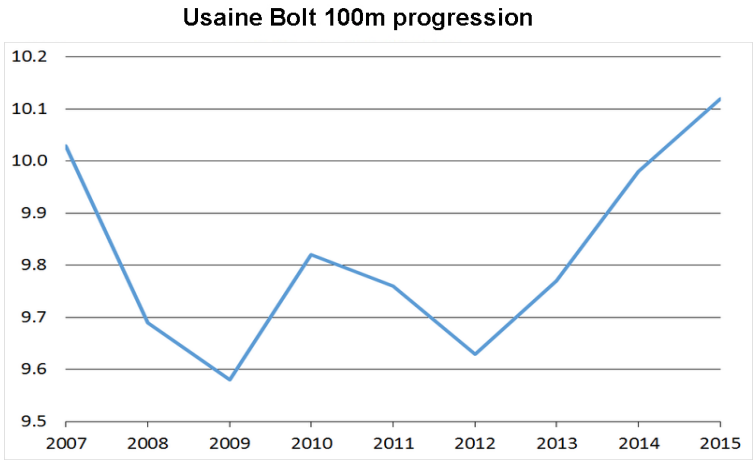
Power law of practice: a law stating that the degree to which each new practice session improves performance diminishes after a certain point, such that greater numbers of sessions are needed to further improve the skill; learning occurs quickly at first and then slows down



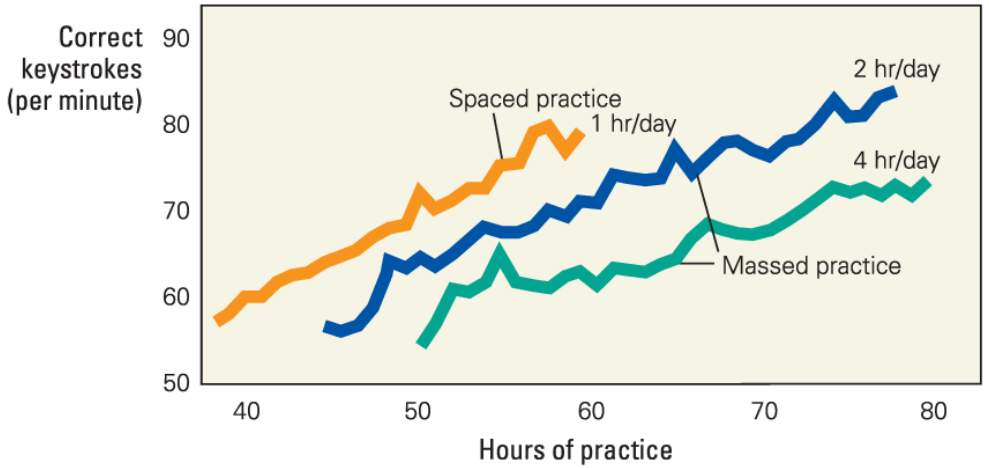
Feedback is important to improve any skill (observe the learning)

- Dancing in front of mirror
- Players watching their recorded game
- Singers listening to their recorded sessions
- Regular math exams in school children

Perfecting a stride technique with flawlessly raised knees and straight ankles takes years of training



Timing and Sequencing of Practice

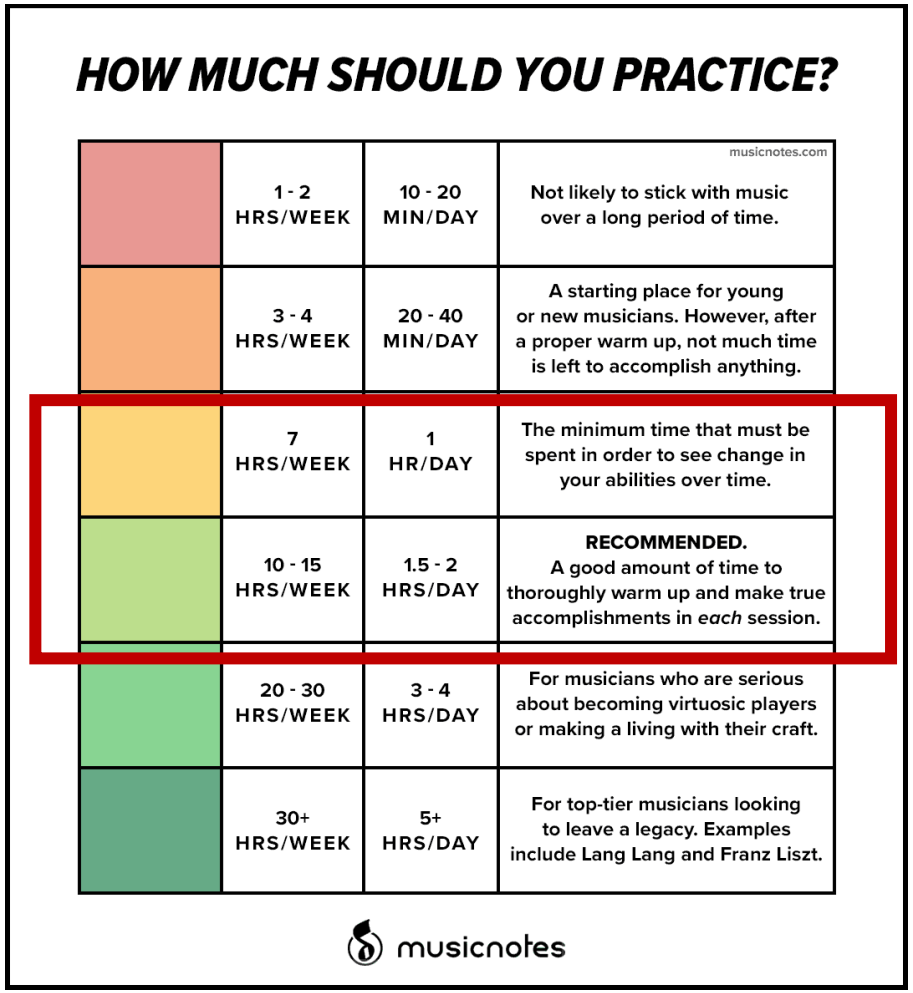


Gluck et al., *Learning and Memory*, 4e, © 2020 Worth Publishers

The performance of post office workers using a keyboard to control a letter-sorting machine improved at different rates, depending on their training schedules.

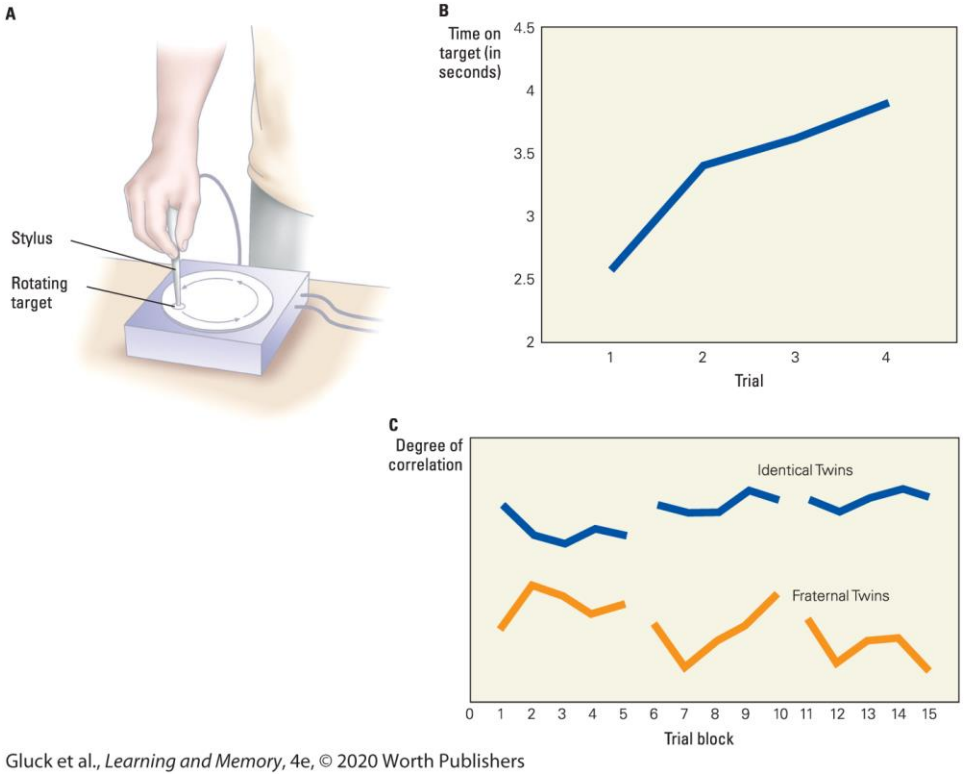
[Sleep & motor learning](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC202318/)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC202318/

Music Practice



Talent?

Twin studies



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- Child prodigies also need training – but they learn faster
- Do genes play a role?

Practice can overcome the effects of talent – requires additional hours of training

Fast-twitch muscle fibers are used to generate huge amounts of force but they cannot be active for too long. Good for short distance sprinting. Usain has more of these.

https://qz.com/1043997/usain-bolt-is-the-fastest-human-in-the-world-heres-the-science-that-shows-how-he-does-it/

Skill memories are often formed unconsciously

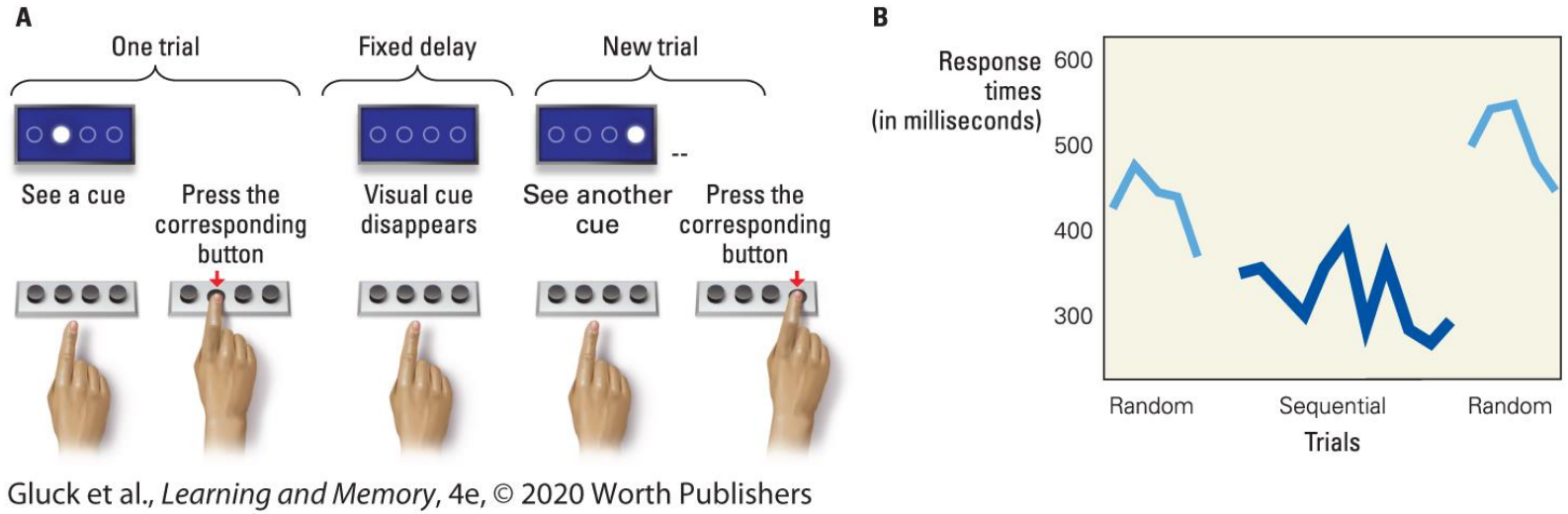
- HM’s mirror-tracing ability

- Process of learning is often unconscious – procedural (difficult to verbalize)
- Learning event may be remembered – episodic

- Difficult to study or prove the unconscious nature of learning – we study indirectly – ideas?

Serial Reaction Time Task

ABADBCDACBDCABADBCDACBDCABADBCDACBDC



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Implicit learning → faster reaction time

Transfer of training

- Right to left hand writing
- Using legs to perform actions of hands

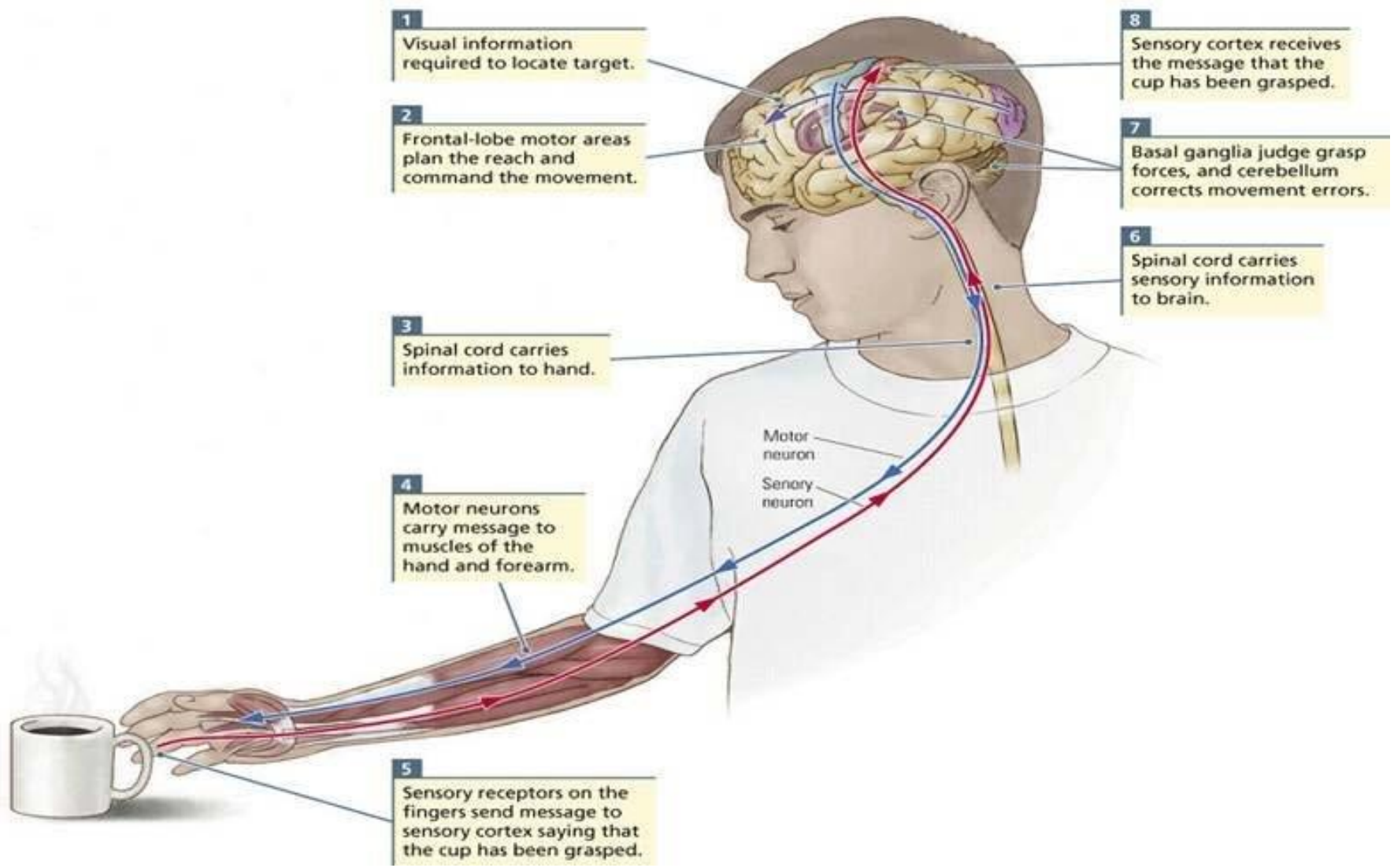
Transfer specificity

- Playing different racquet sports
- Playing different string instruments/ percussion instruments

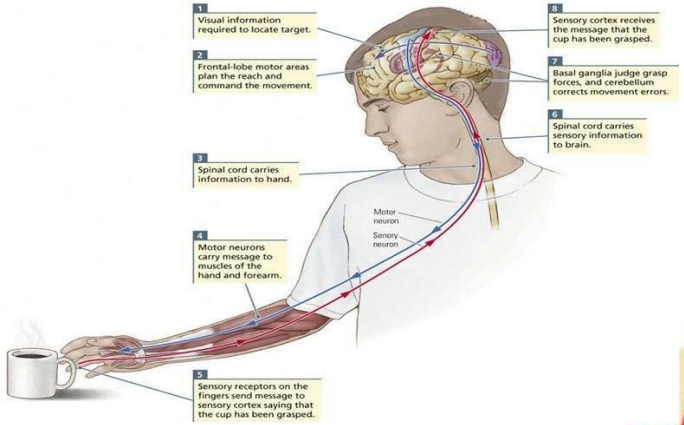
Loss of skill

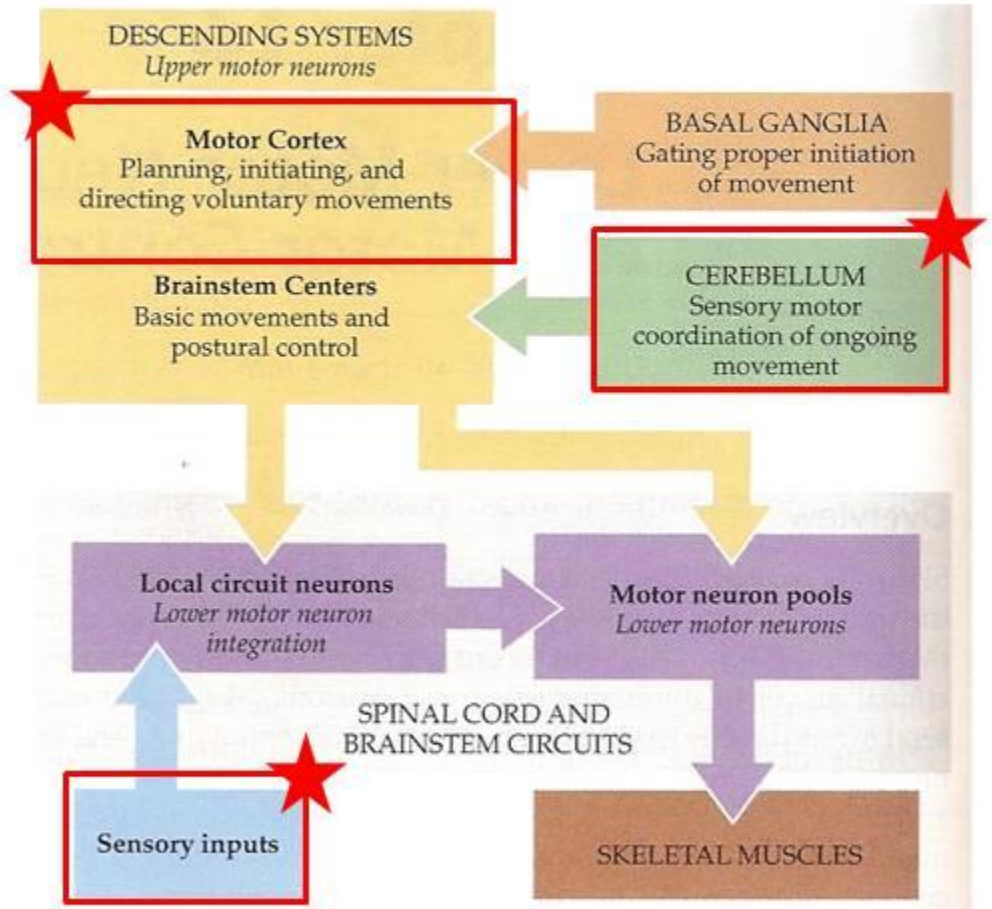
- Skill memories are like any other memories
- But they last longer, decay slower
- forgetting curves are similar to learning curves - forgetting occurs quickly at first and then gets slower

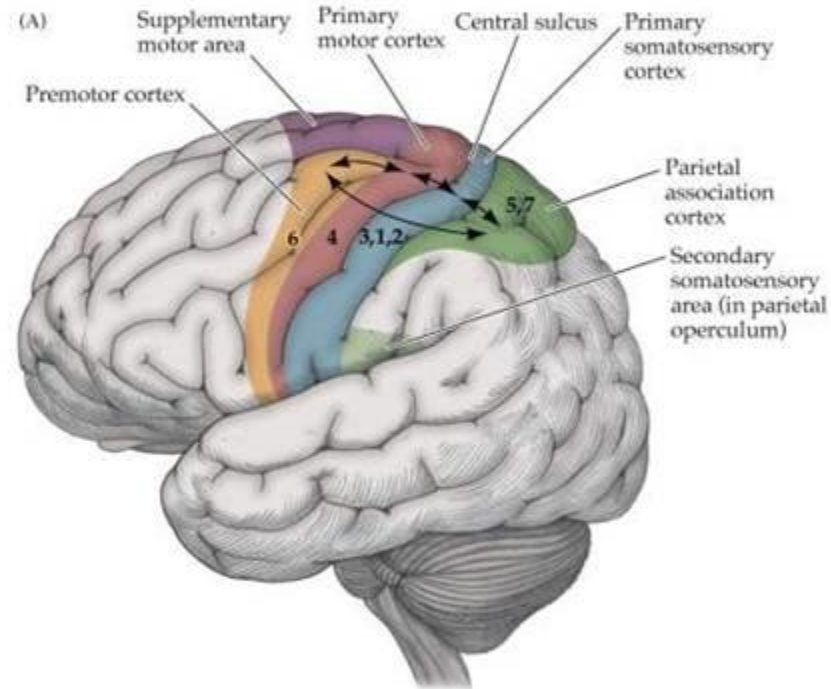
- Once acquired, persistence of a skill depends
  - complexity of the skill,
  - how well the skill memory was encoded in the first place,
  - how often the skill has subsequently been performed,
  - Passage of time
  - Interference from new skills (new dance sequence interferes with an old one, learning interval between similar skills)


1
Visual information required to locate target.
2
Frontal-lobe motor areas plan the reach and command the movement.
3
Spinal cord carries information to hand.
4
Motor neurons carry message to muscles of the hand and forearm.
5
Sensory receptors on the fingers send message to sensory cortex saying that the cup has been grasped.
6
Spinal cord carries sensory information to brain.
7
Basal ganglia judge grasp forces, and cerebellum corrects movement errors.
8
Sensory cortex receives the message that the cup has been grasped.
Motor neuron
Sensory neuron

The Motor System(1-6)



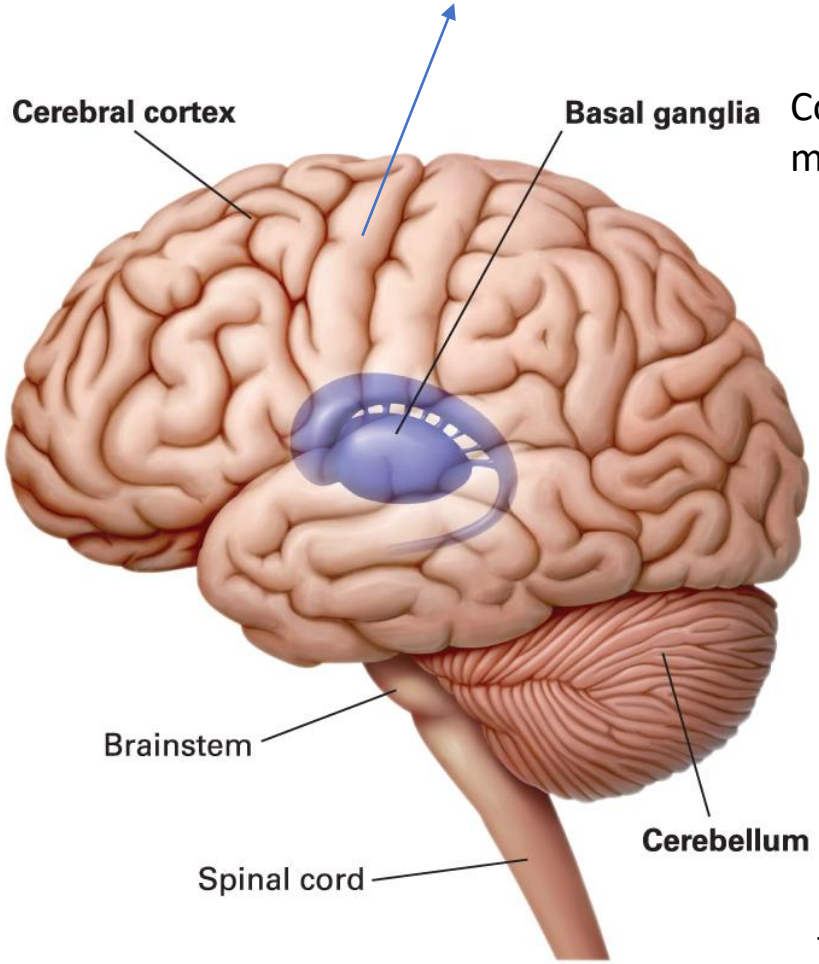




From: Neuroscience, 4th Edition, Purves et. al.

Motor Cortex
Executes motor movements

Stores different sets of movements. E.g. picking up coffee mug and bring it to your mouth



Coordinates the sequence of movements with the motor cortex

Monitors ongoing movements and fine tunes them

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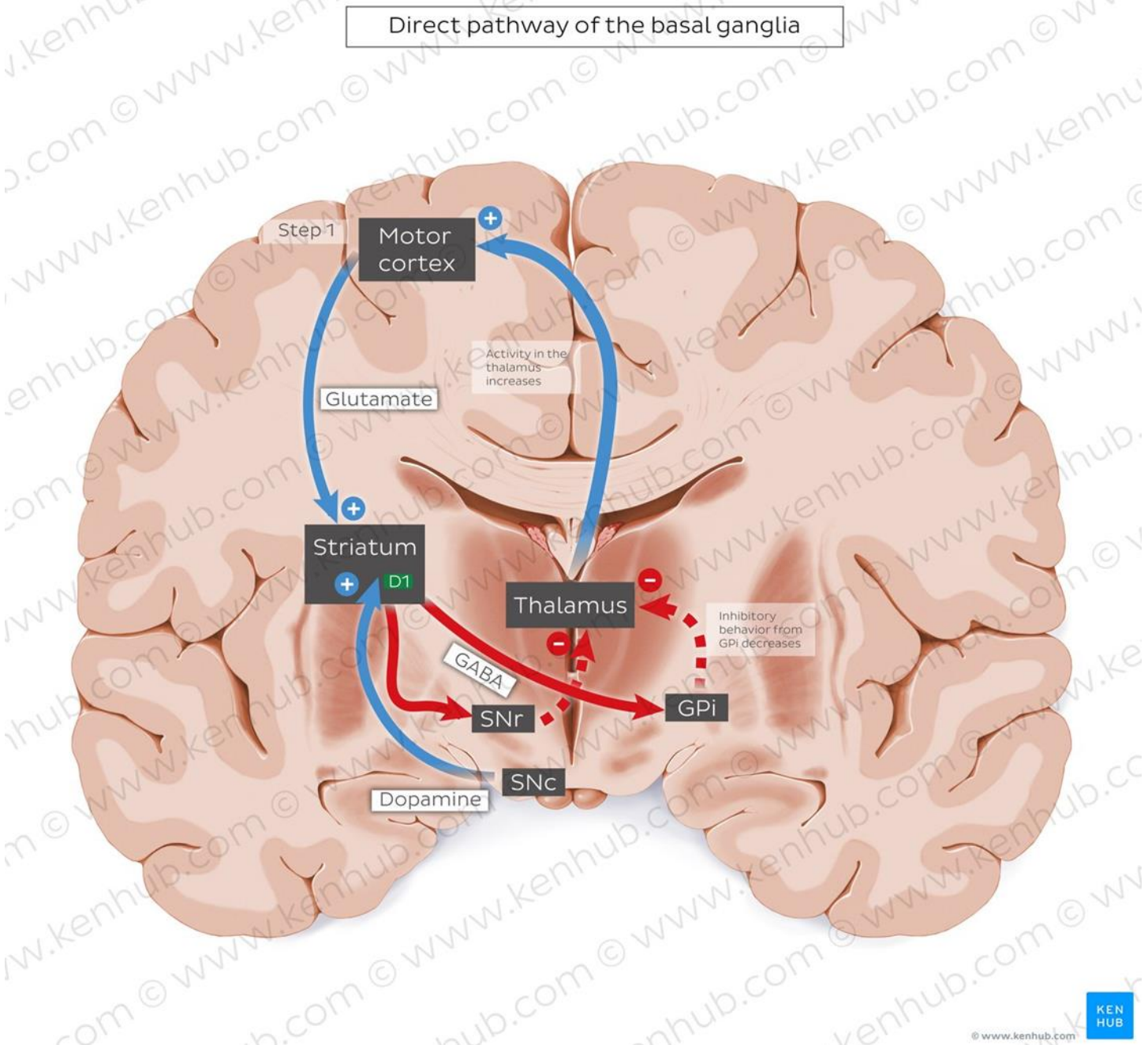
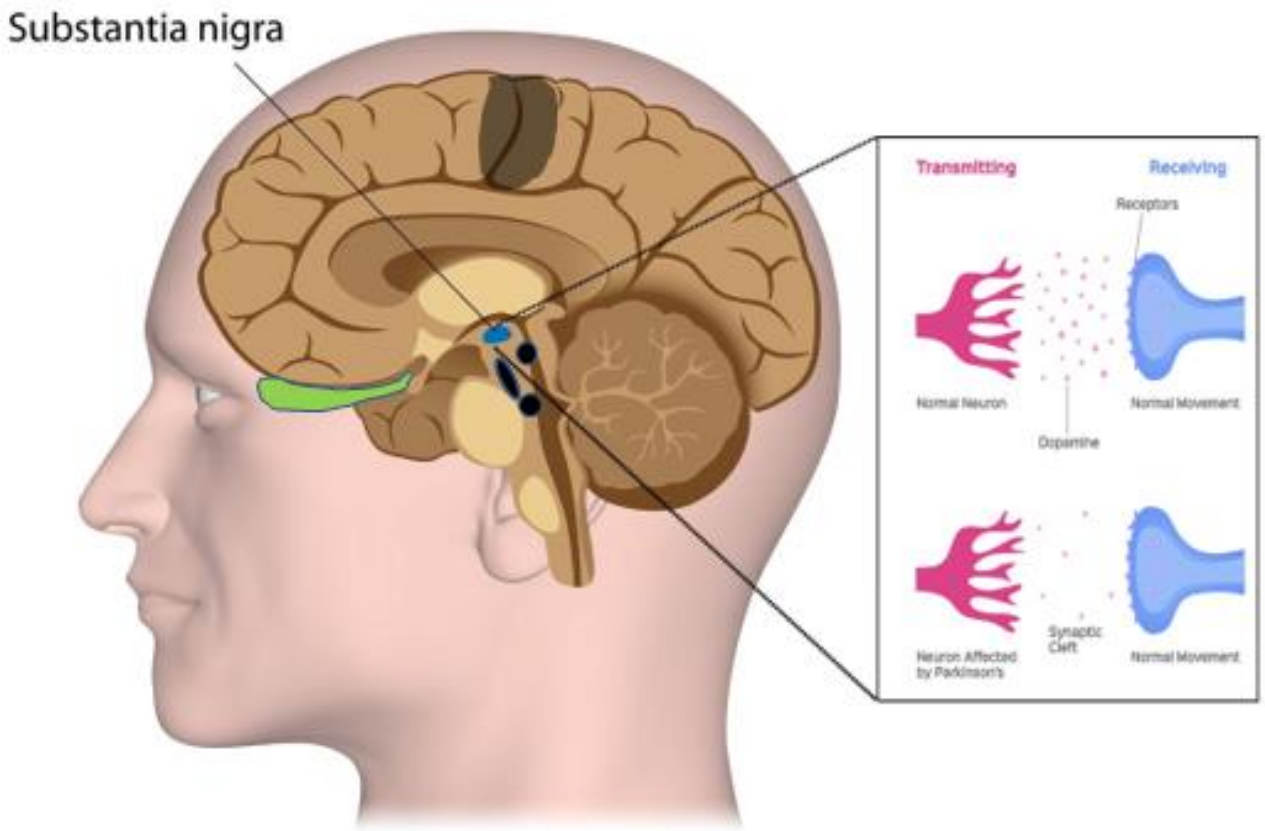
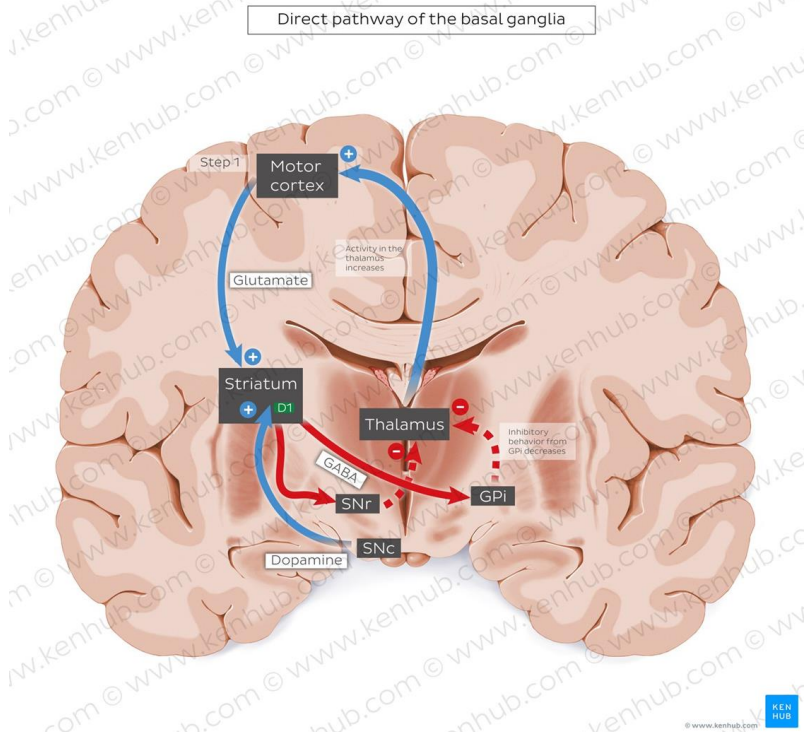
- Skill-memory systems in the brain include the basal ganglia, motor cortex, and cerebellum
- These three regions modulate the control of movements by circuits in the brainstem and spinal cord

- Basal Ganglia motor control circuit



Parkinson’s disease



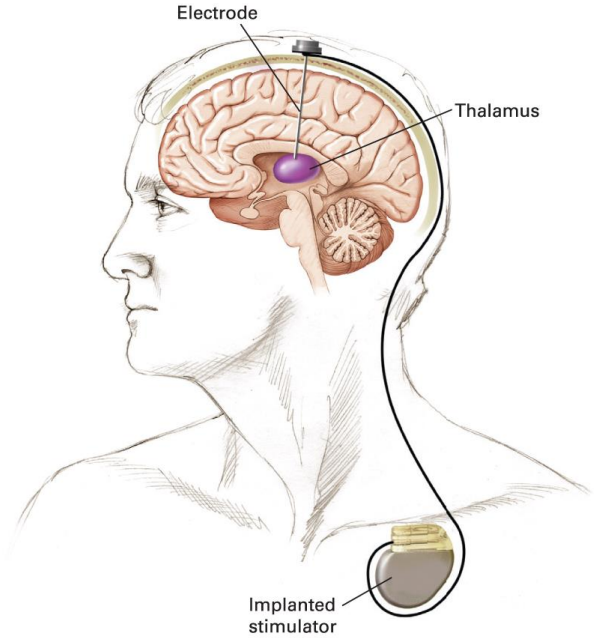


Inhibition of motor activity is reduced → excessive movement

Parkinson's Disease

- [Symptom's video]

Deep Brain Stimulation for the Treatment of Parkinson's Disease



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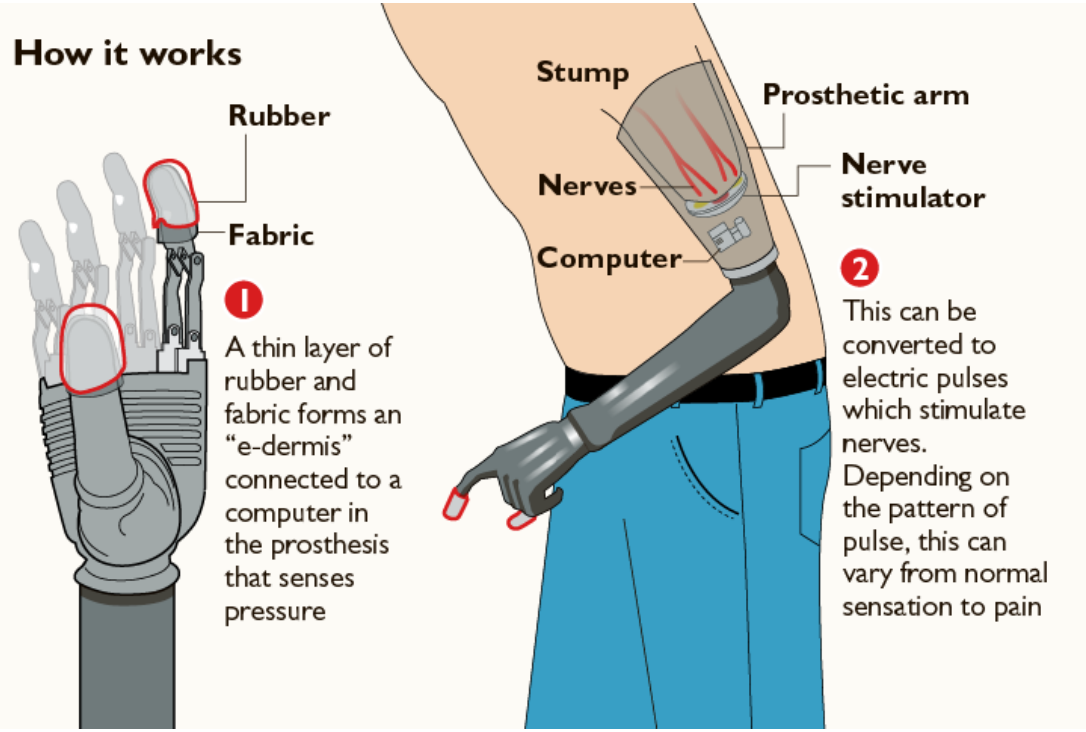
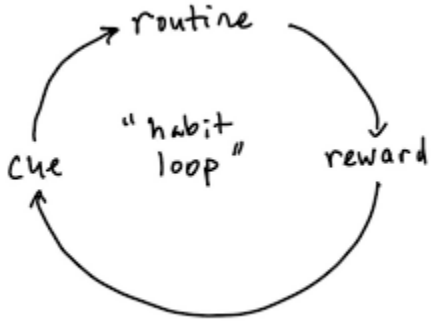
Controlling artificial limbs



Habit vs skill



- A person can possess a skill (being proficient at playing the sitar) without being in the habit of exercising it or routinely playing it.

- Habit is voluntary behaviour – involves executing a set of skills.

- Also involves the Basal Ganglia.