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# Learning How to Learn for Engineering Professionals

Thursday, 9 December 2021 | Technical Topic Webinar

**Presented By**

**Barbara Oakley** | PhD, PE, Distinguished Professor of Engineering at Oakland University in Rochester, Michigan

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*Barbara Oakley*  
Professor of Engineering

Barbara Oakley, PhD, PE is a Distinguished Professor of Engineering at Oakland University in Rochester, Michigan; Michigan's Distinguished Professor of the Year; and Coursera's inaugural "Innovation Instructor." Her work focuses on the complex relationship between neuroscience and social behavior. Dr. Oakley's research has been described as "revolutionary" in the Wall Street Journal. She is a New York Times best-selling author who has published in outlets as varied as the Proceedings of the National Academy of Sciences, the Wall Street Journal, and The New York Times. She has won numerous teaching awards, including the American Society of Engineering Education's Chester F. Carlson Award for technical innovation in engineering education and the Institute of Electrical and Electronic Engineers William E. Sayle II Award for Achievement in Education. Together with Terrence Sejnowski, the Francis Crick Professor at the Salk Institute, she co-teaches Coursera's "Learning How to Learn," one of the world's most popular massive open online courses with over three million registered students, along with a number of other leading MOOCs.

# Agenda

- 1 Welcome & Introduction
- 2 Learning How to Learn
- 3 Techniques
- 4 Procedural and Declarative Learning Systems
- 5 Conclusion and Q&A



A photograph of Julius Yego, a Kenyan athlete, celebrating a victory. He is wearing a red athletic singlet with a white Nike logo and the word "KENYA" in white letters. He is holding the Kenyan flag (black, red, and white) above his head with both arms. He has a joyful expression, smiling broadly. The background is a plain, light-colored wall.

# Learning How to Learn for Engineering Professionals

**Barbara Oakley, PhD, PE**  
Distinguished Professor of  
Engineering  
Oakland University  
Rochester, Michigan

**Julius Yego**

Photo by Erik van Leeuwen

# Learning How to Learn for Engineering Professionals

This fascinating, brief talk will tie together the latest insights from neuroscience about how to help engineers learn most effectively. Distinguished Professor of Engineering Barbara Oakley, creator of one of the world's most popular online courses, *Learning How to Learn*, will use vibrant illustrations and animations to show you what is happening physically as you are learning effectively. Creating sets of links in long-term memory—the heart of good learning—isn't easy. But you'll discover the best tricks known from neuroscience to help make learning stick. And yet a final insight involves how to teach to both the procedural and declarative learning systems, which allow you to be both fast and flexible in your learning. Don't miss this rapid-fire compendium of the most useful, practical insights from latest research in learning!

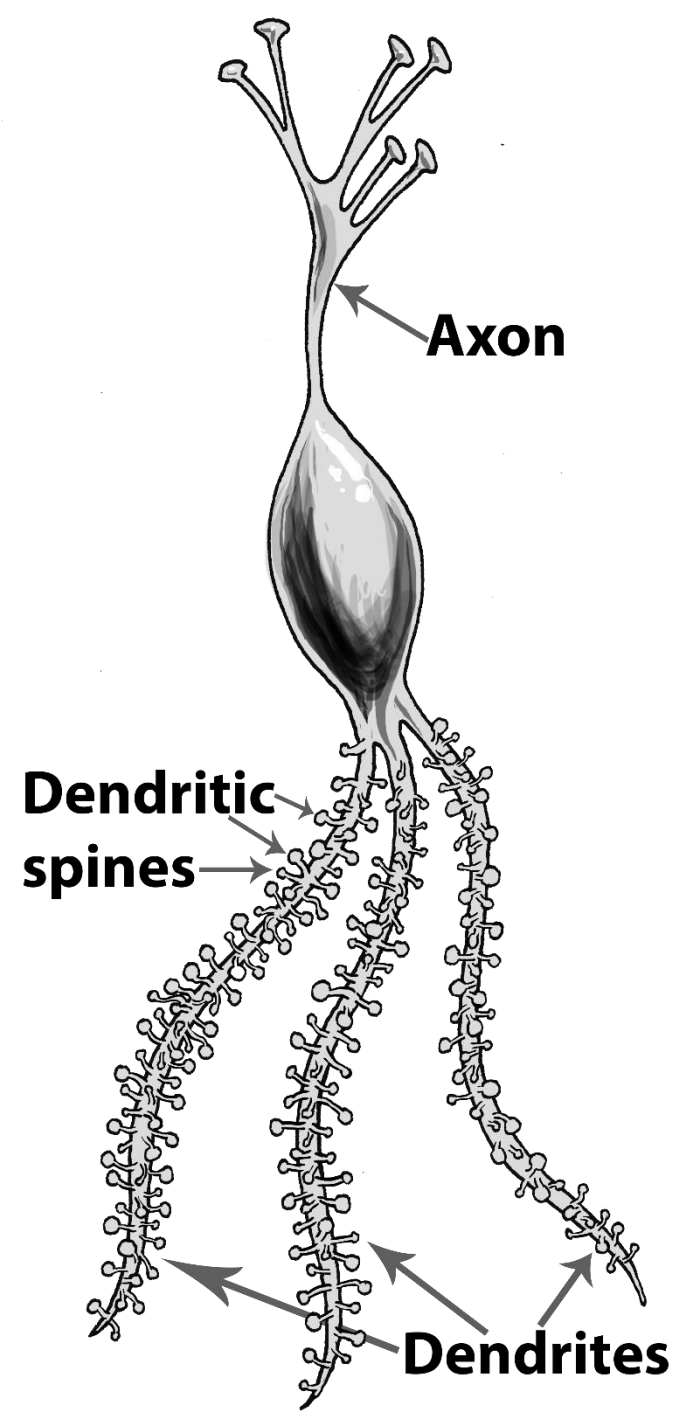
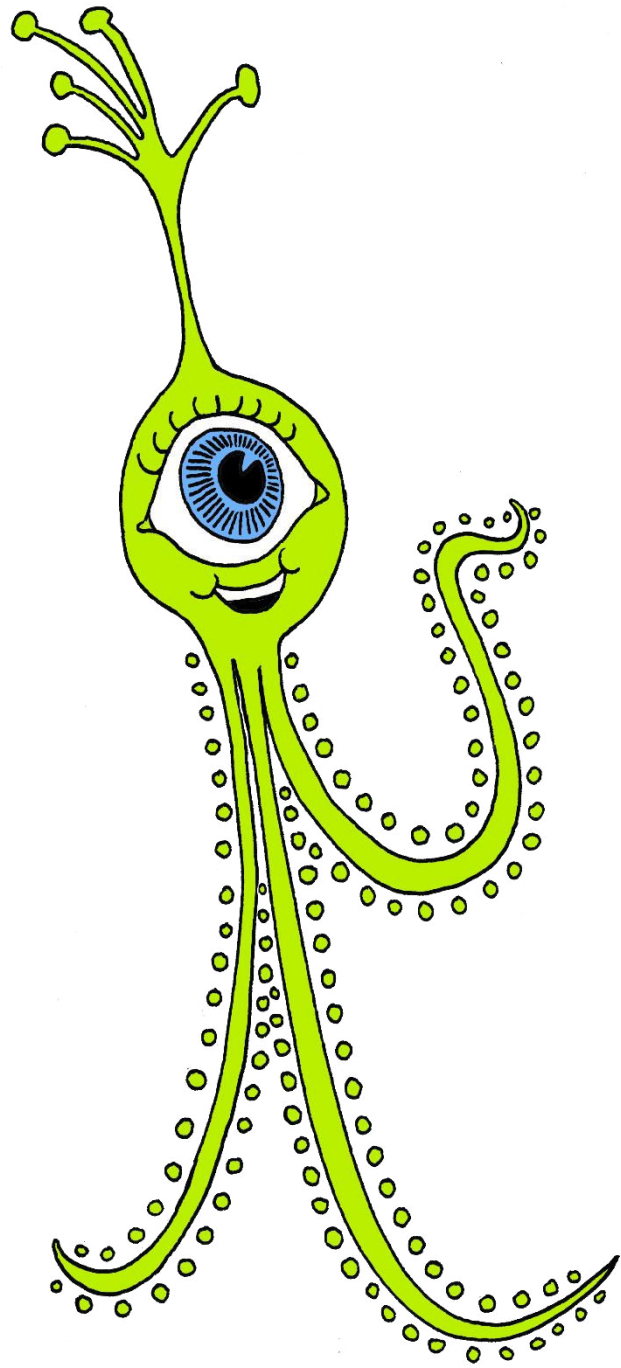


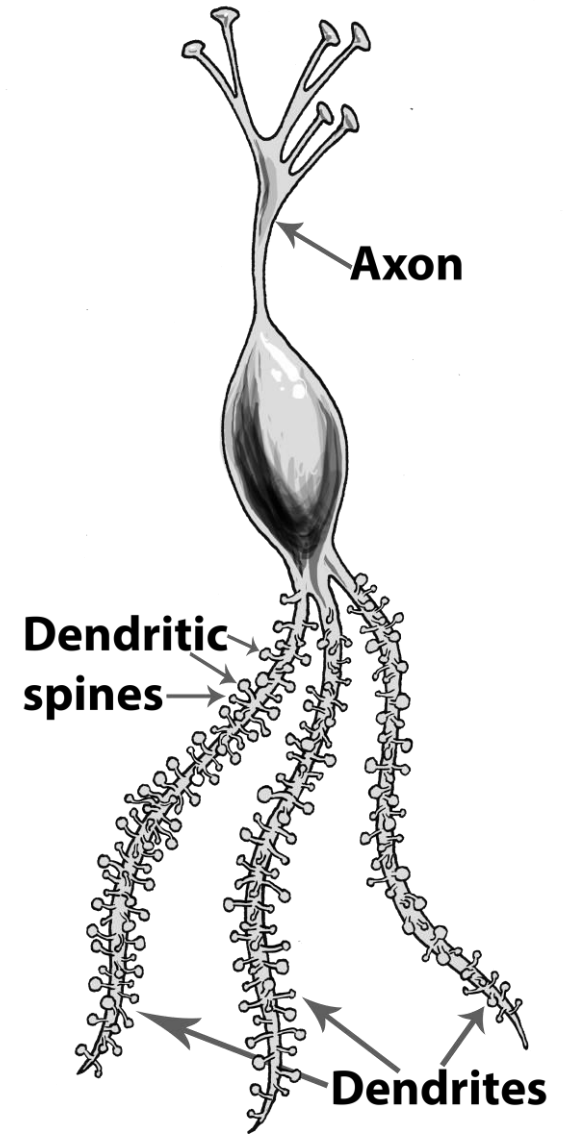
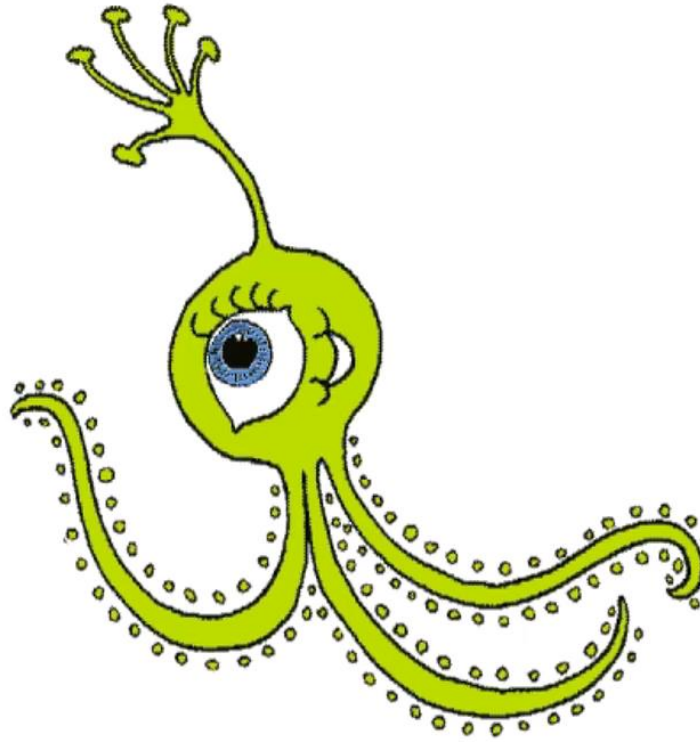
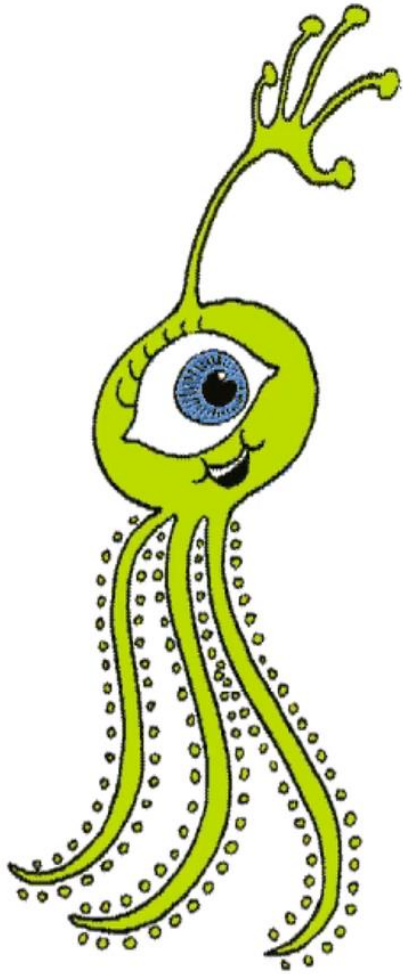


**Philip Oakley**





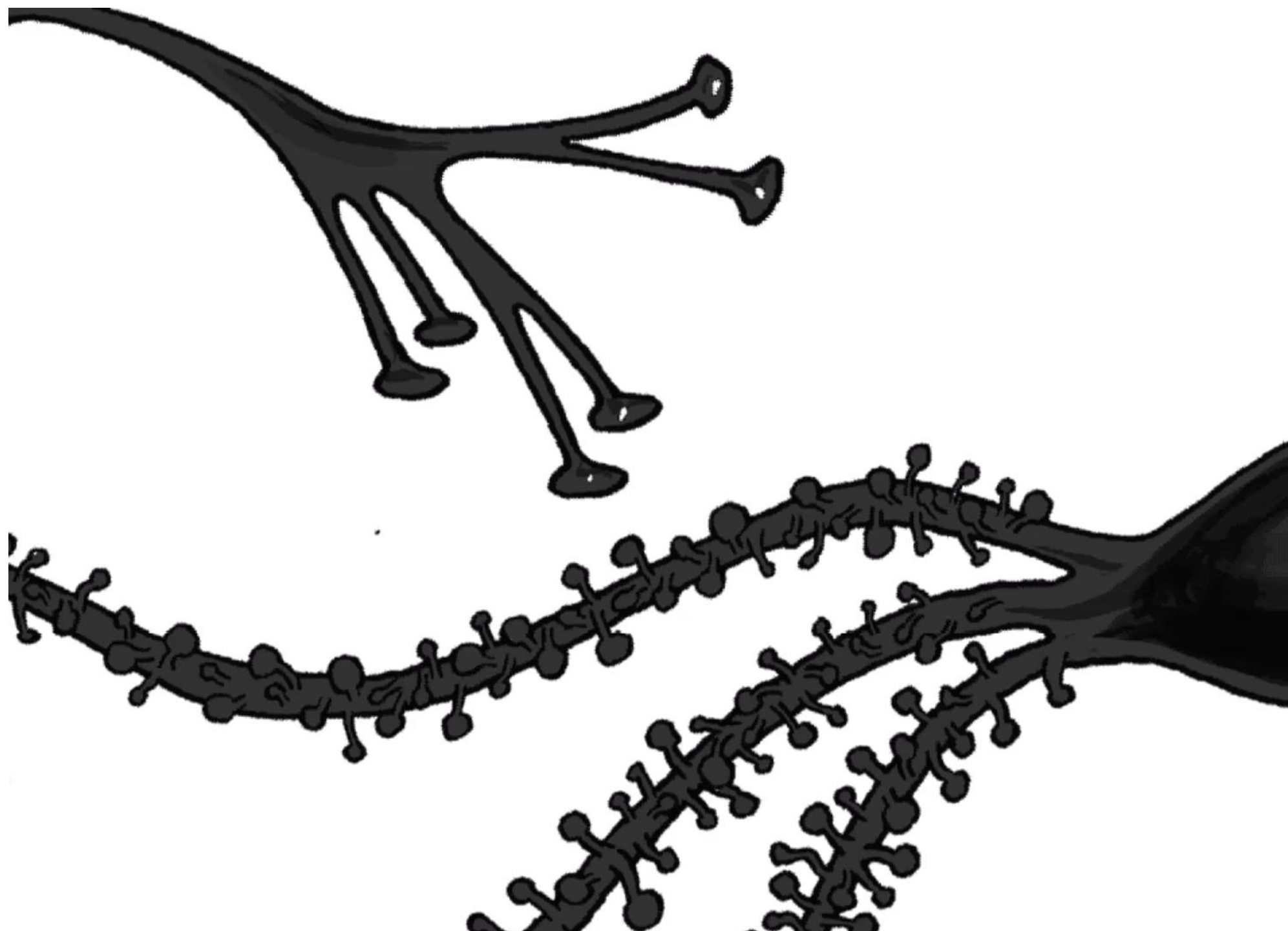




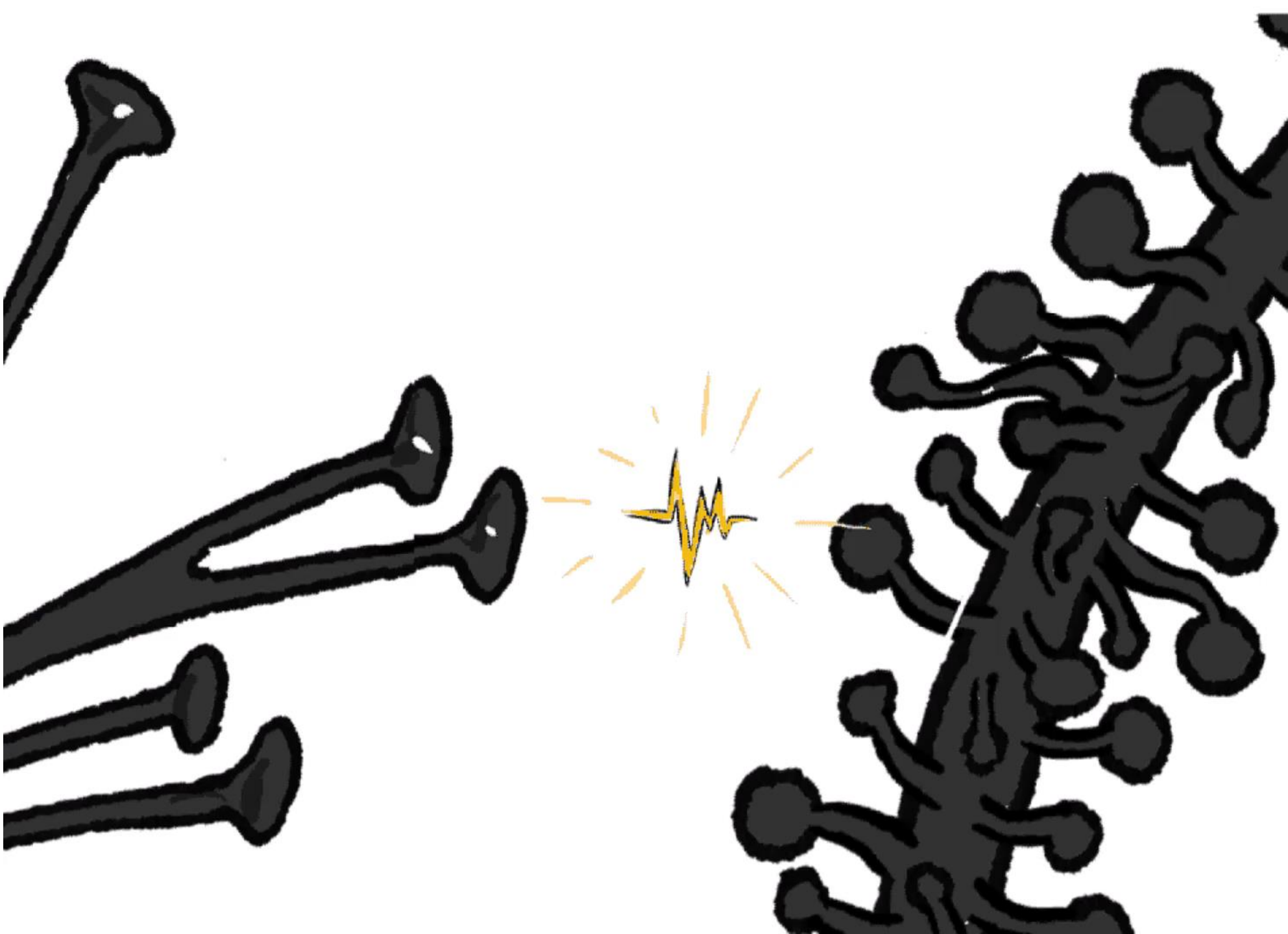


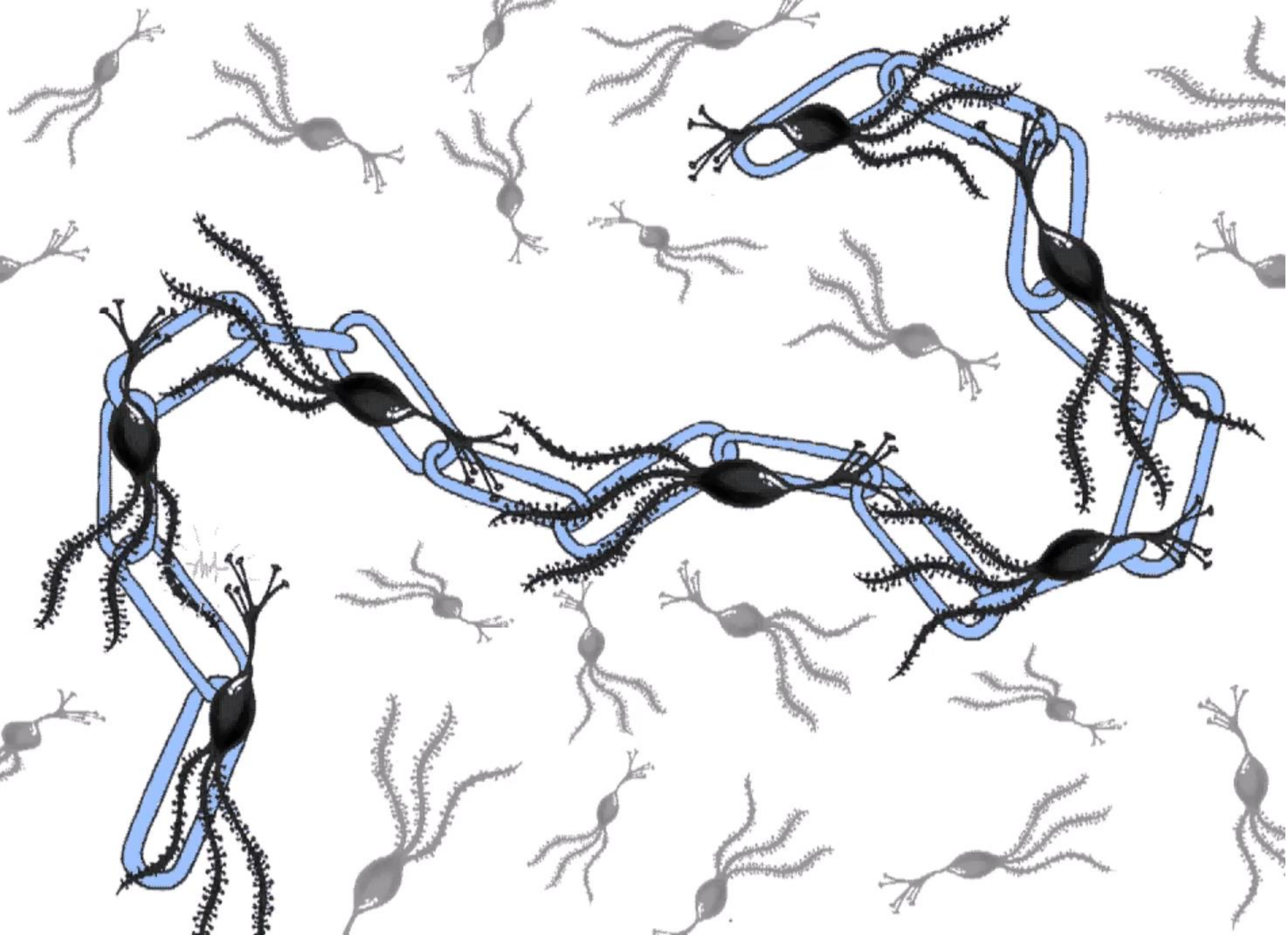
Neurons  
send  
signals

Neurons create sets of links when you learn something.



Connections  
strengthen  
with practice



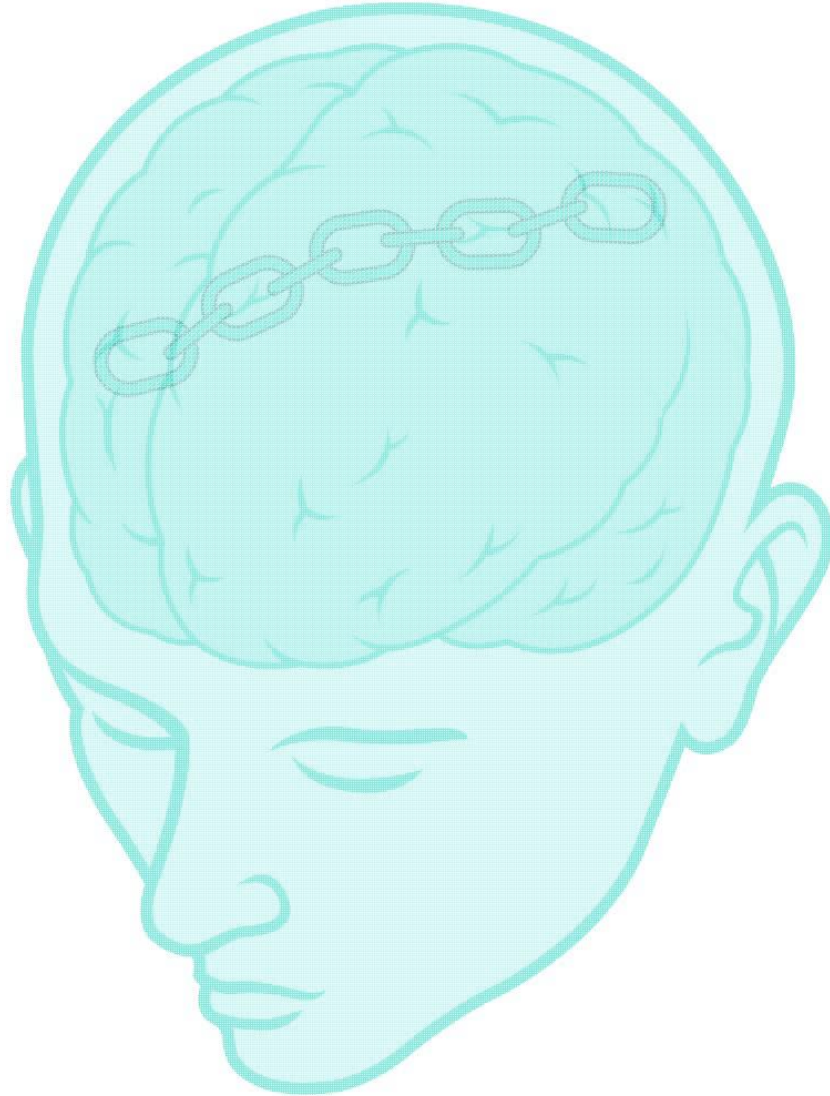


These are like sets of links in a chain.

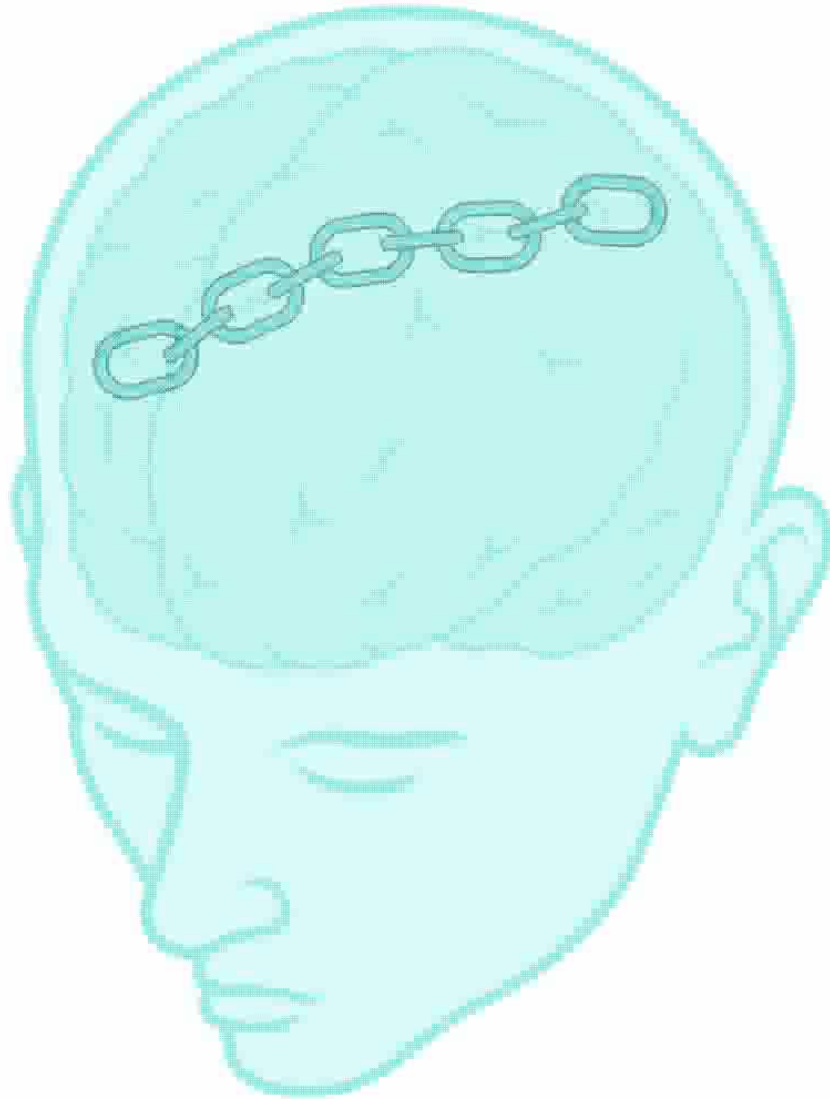




# Retrieval Practice



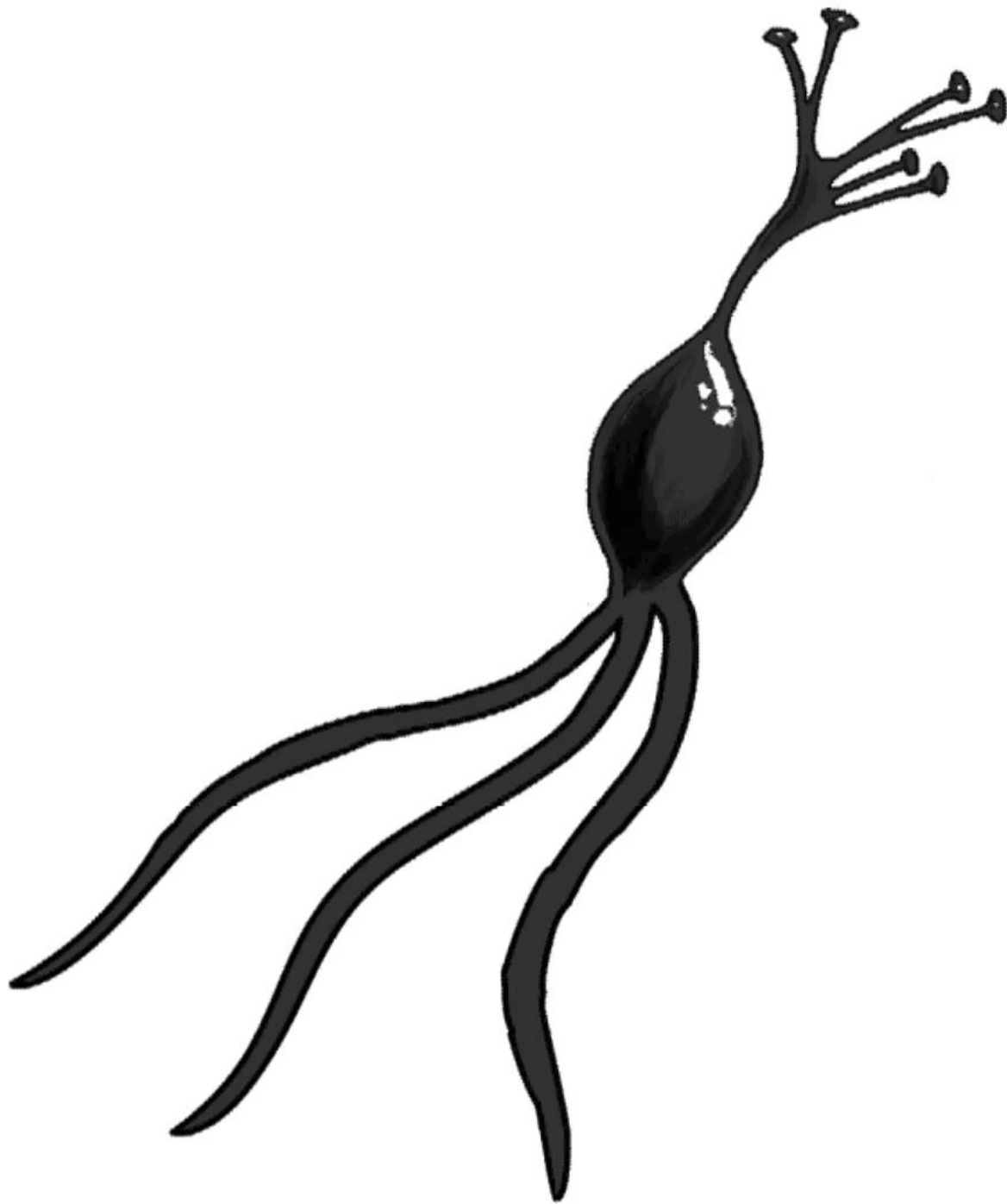
# Retrieval Practice



← **Initial learning**

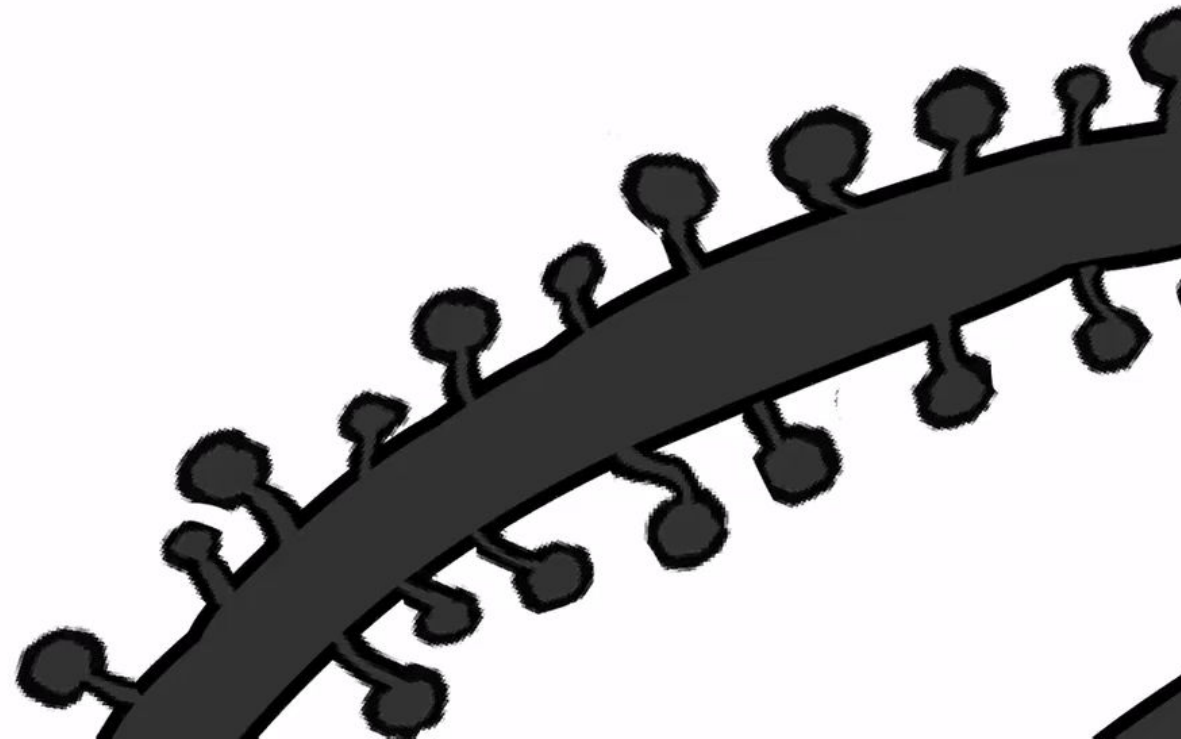






Active learning  
(with sleep in  
between!)

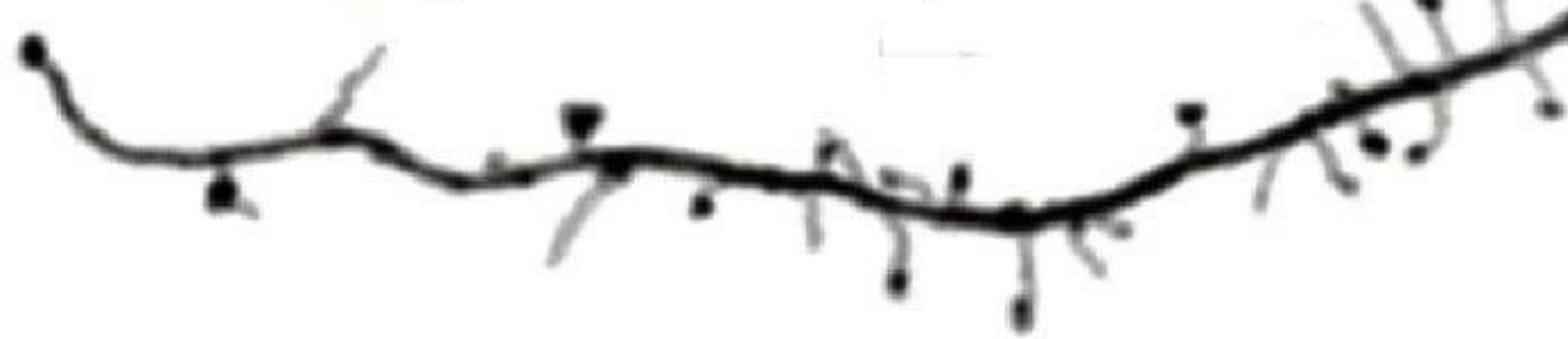
Active learning  
(with sleep in  
between!)



Before learning and before sleep



Before learning and before sleep



After learning and after sleep

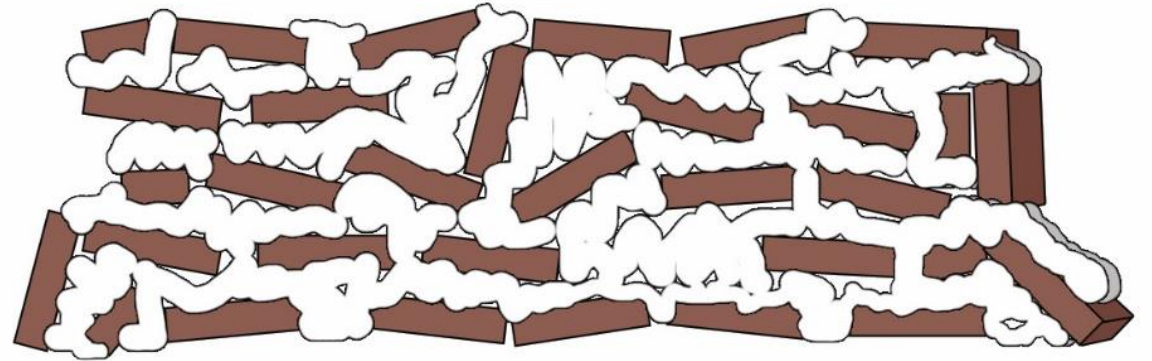
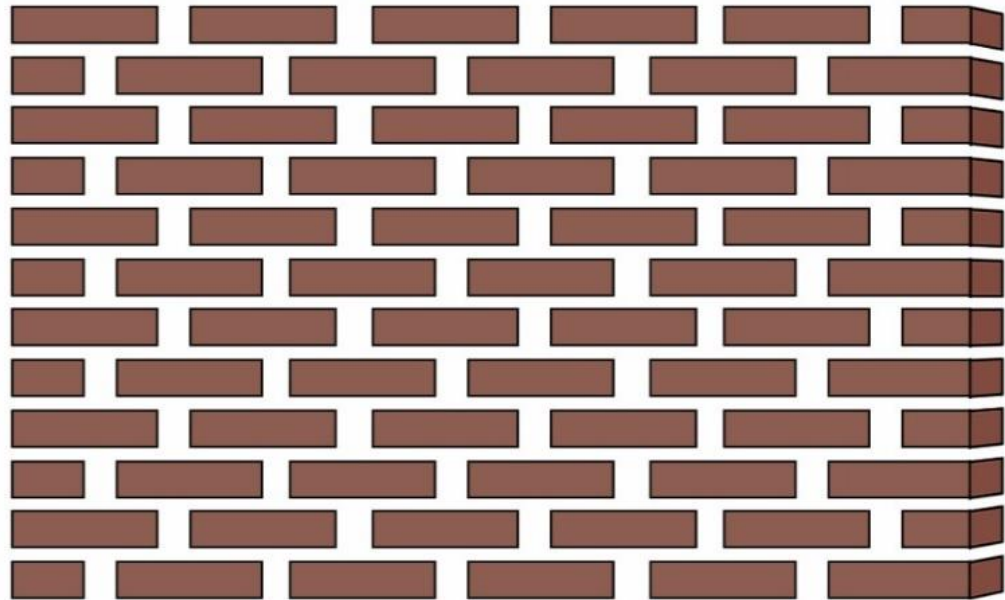


2 μm

Images courtesy Guang Yang, NYU Langone

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
						

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
						



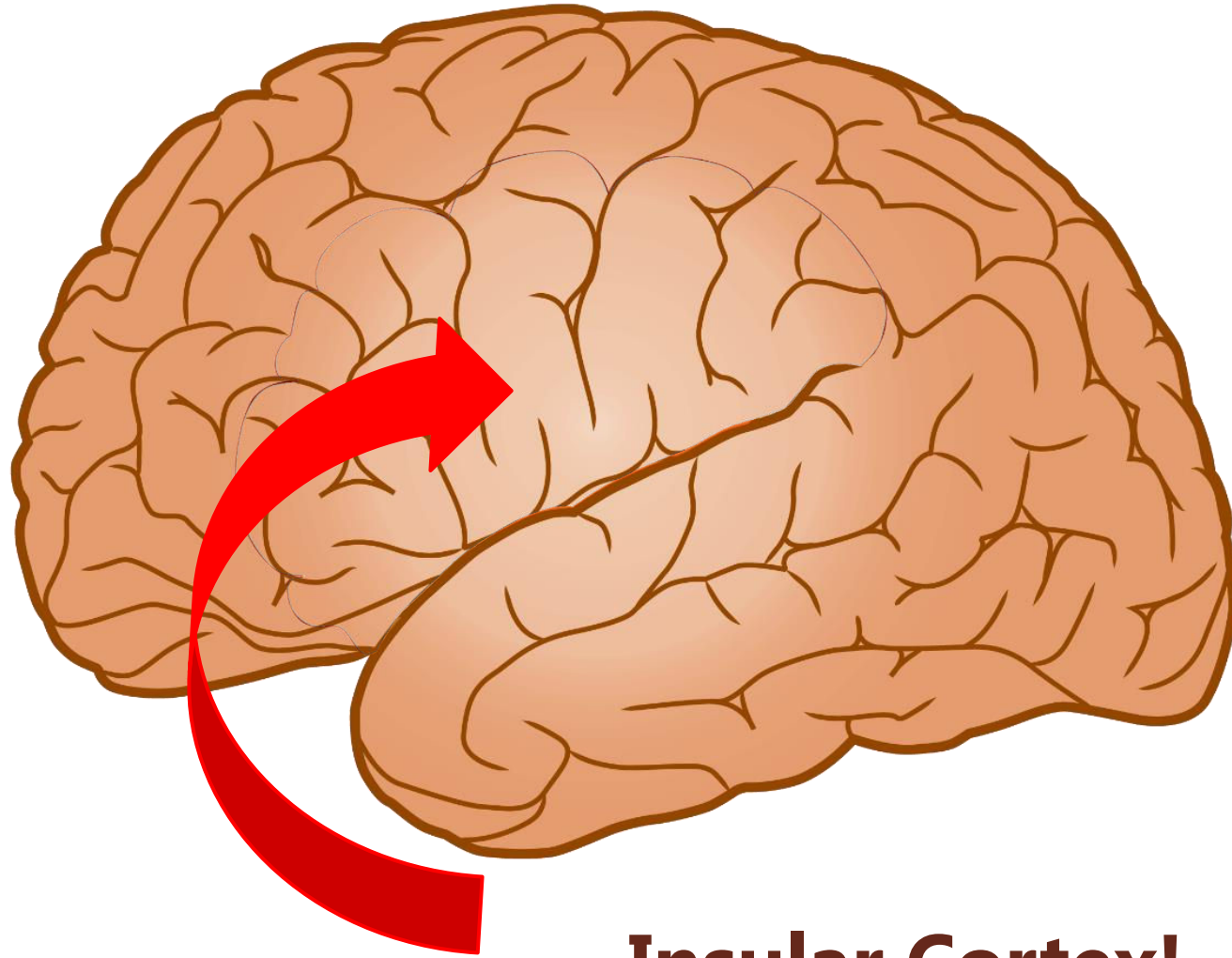


It takes time



Weight lifter Sultan Rakhmanov, RIA Novosti

# Procrastination



**Insular Cortex!**

3

Feel happy  
(temporarily)

2

Turn your attention to  
something more pleasant

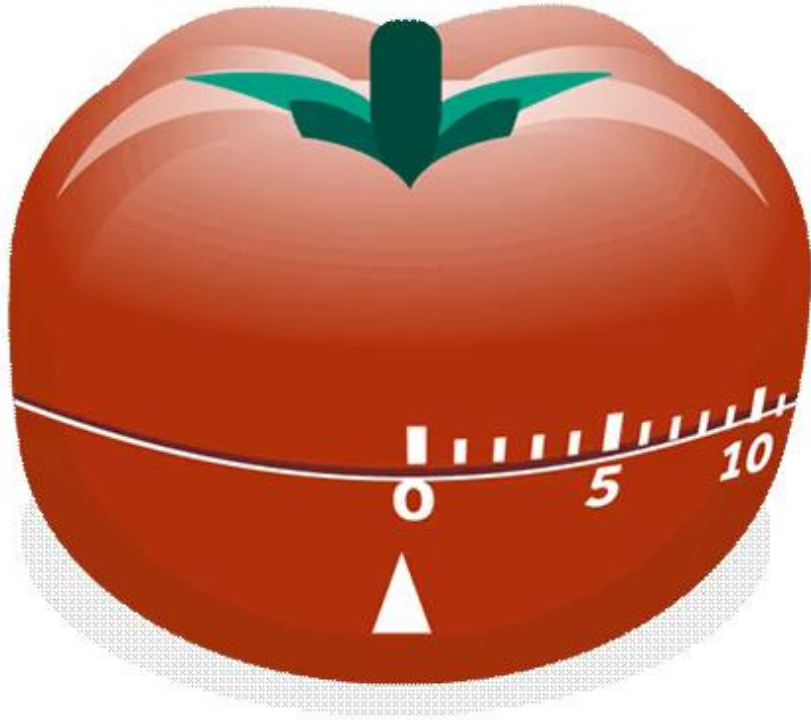
1

Unhappy  
feeling



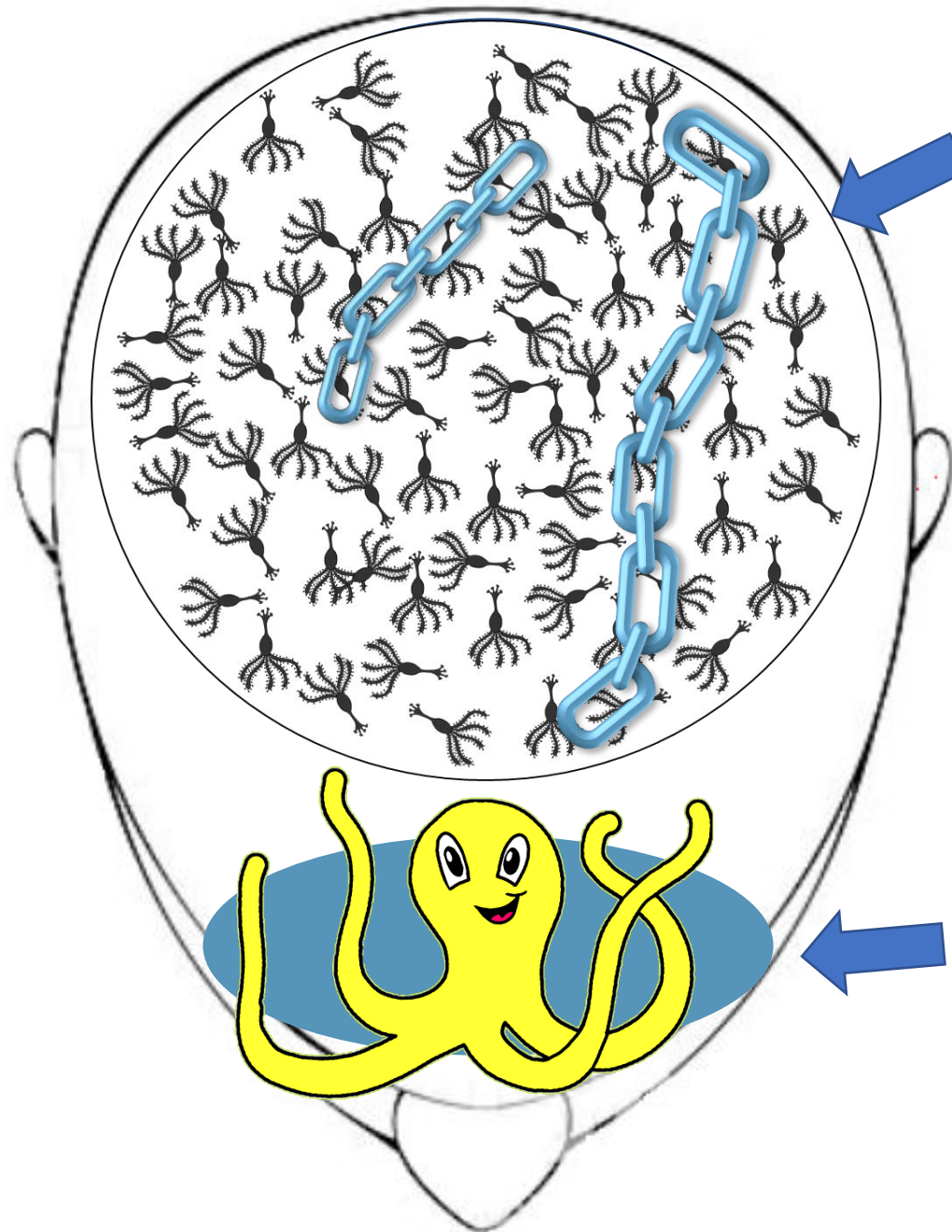
Zombie Tube





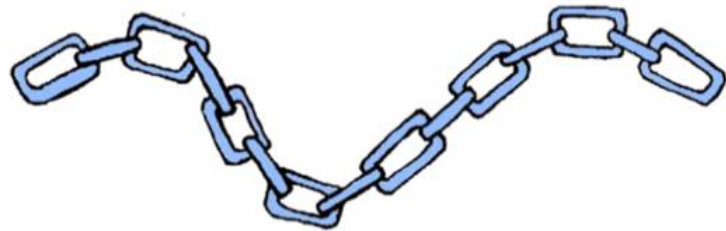
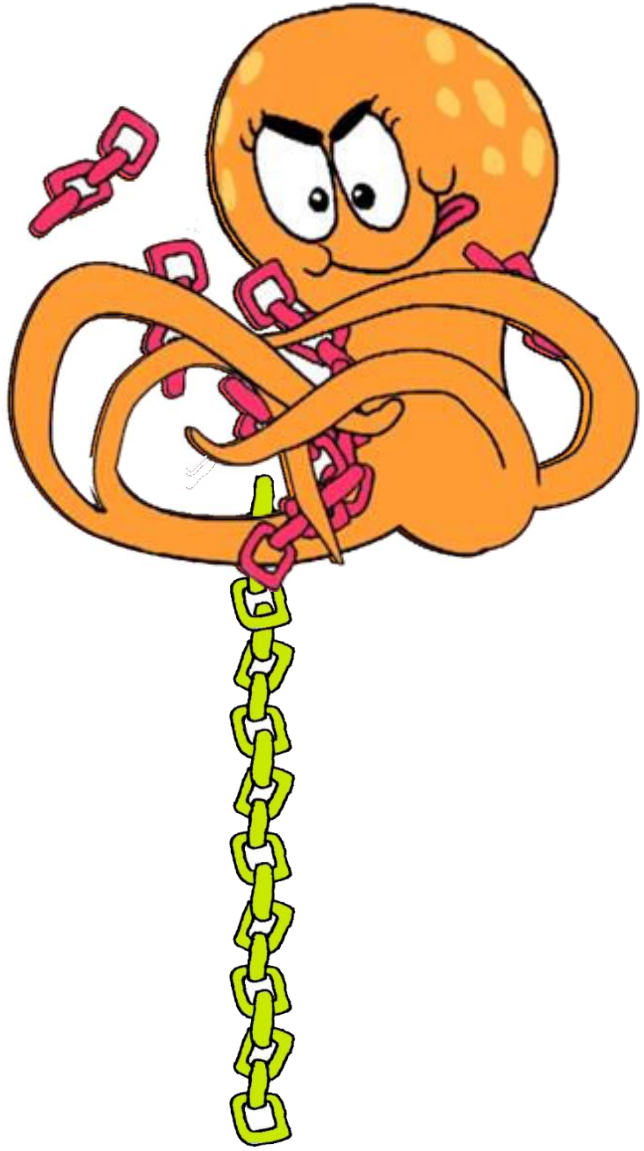
- **Turn off all distractions**
- **Set timer for 25 minutes**
- **Focus**
- ***Reward!***

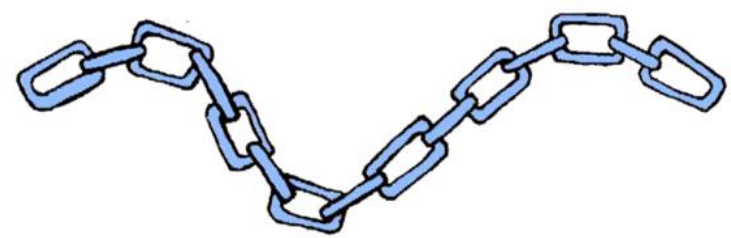
## **Pomodoro Technique**



LONG-TERM  
MEMORY

WORKING  
MEMORY





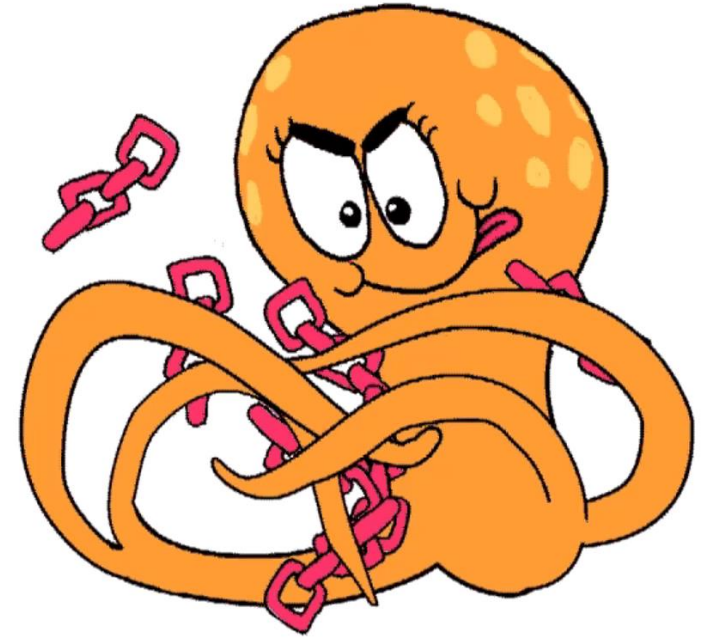




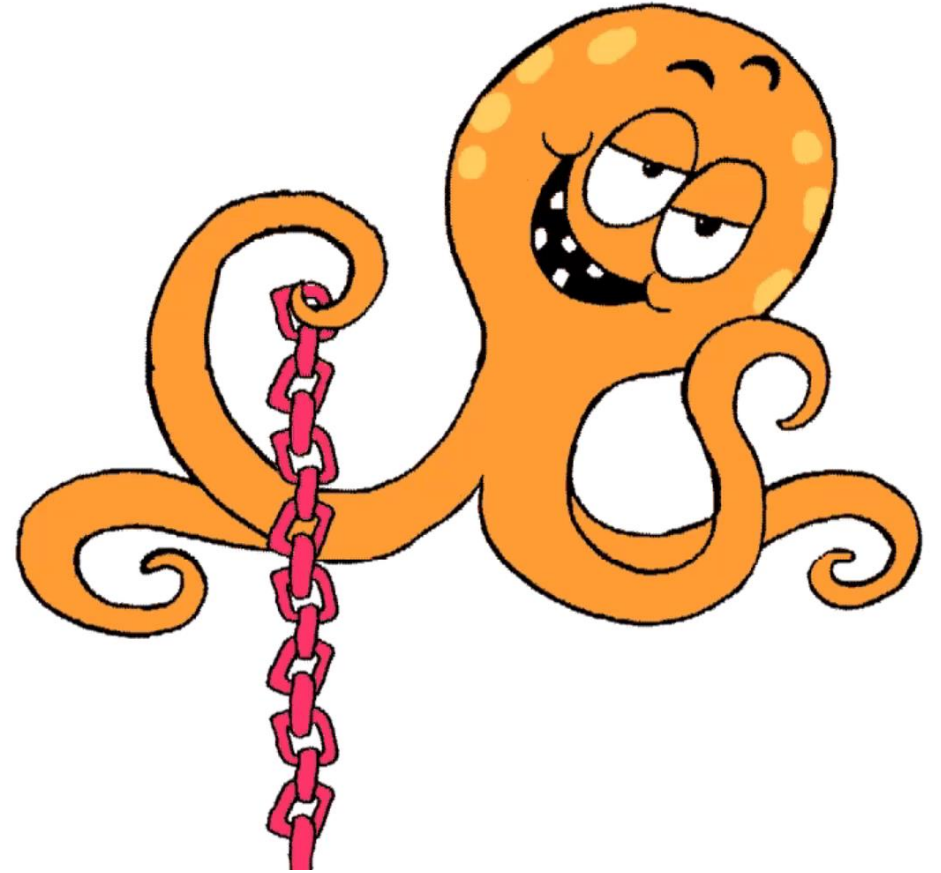


25 focused tangled octopus-20180922T134857Z-001.zip

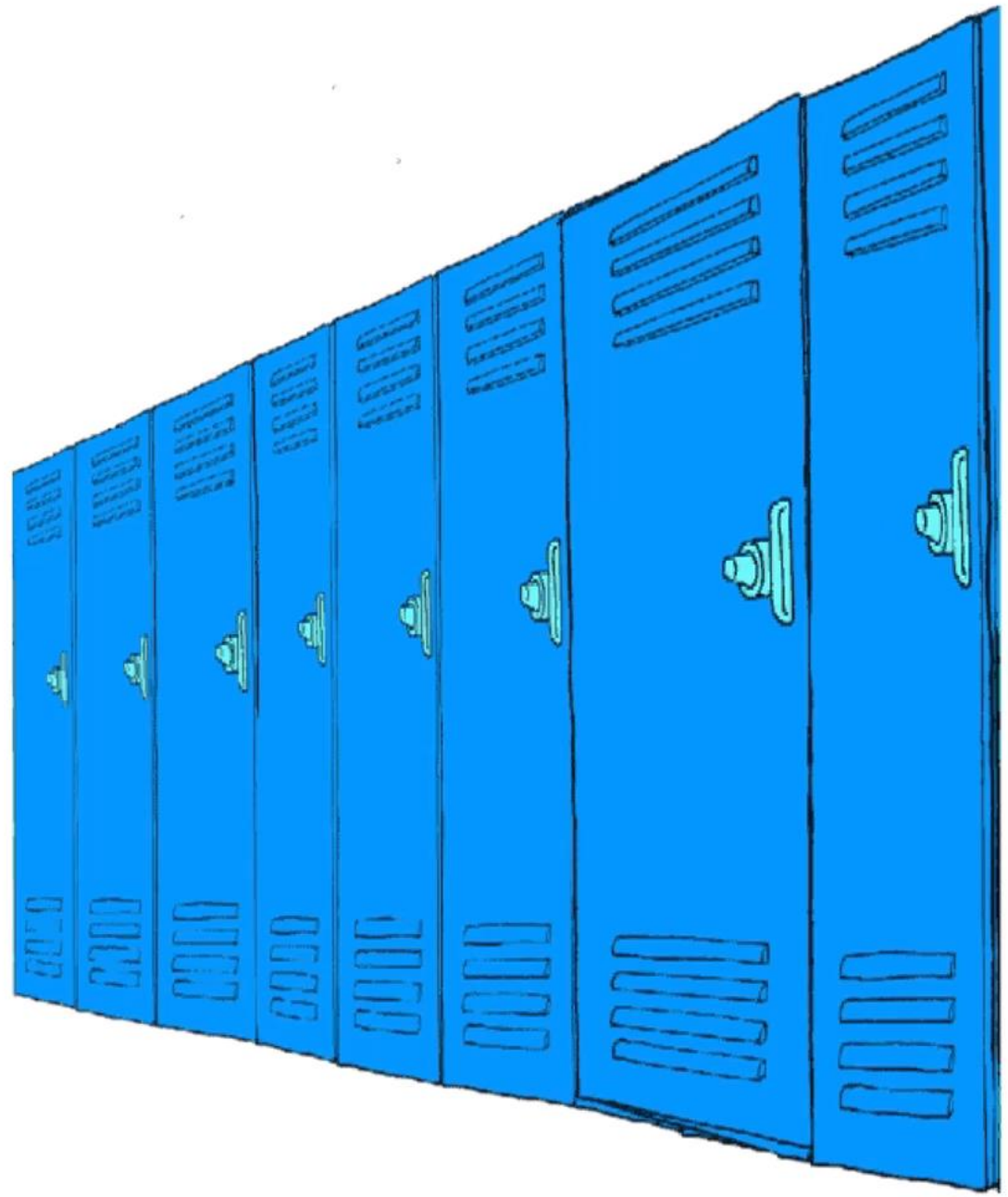
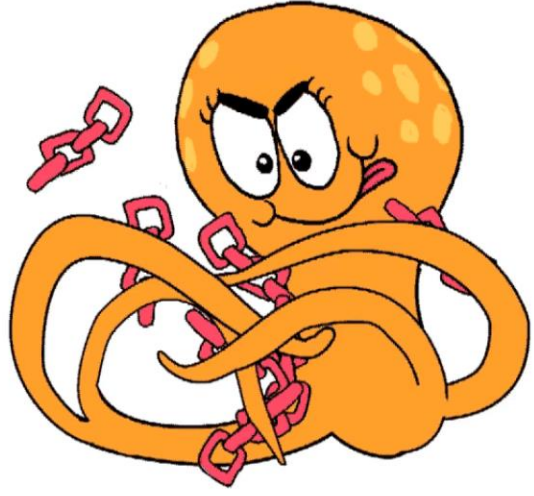




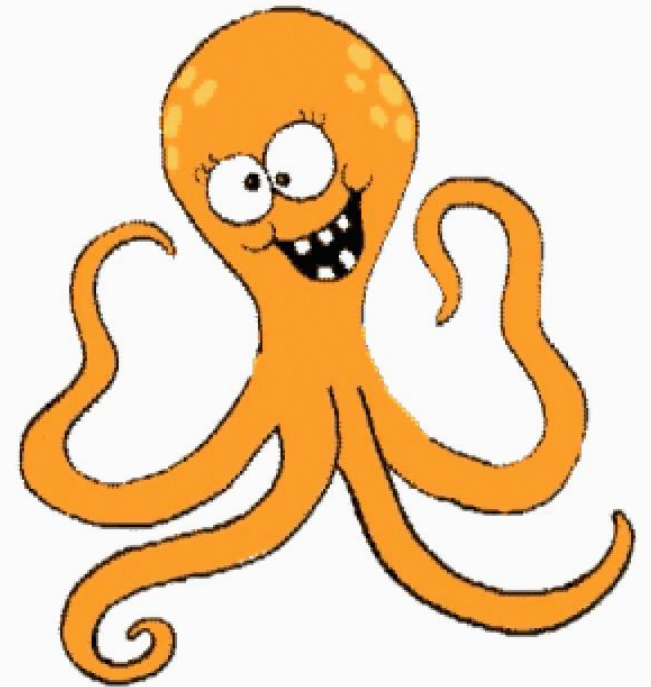
- Heavy cognitive load
- No working memory is available for anything else



- Light cognitive load!
- Working memory is available for more complex thinking



Working memory capacities vary



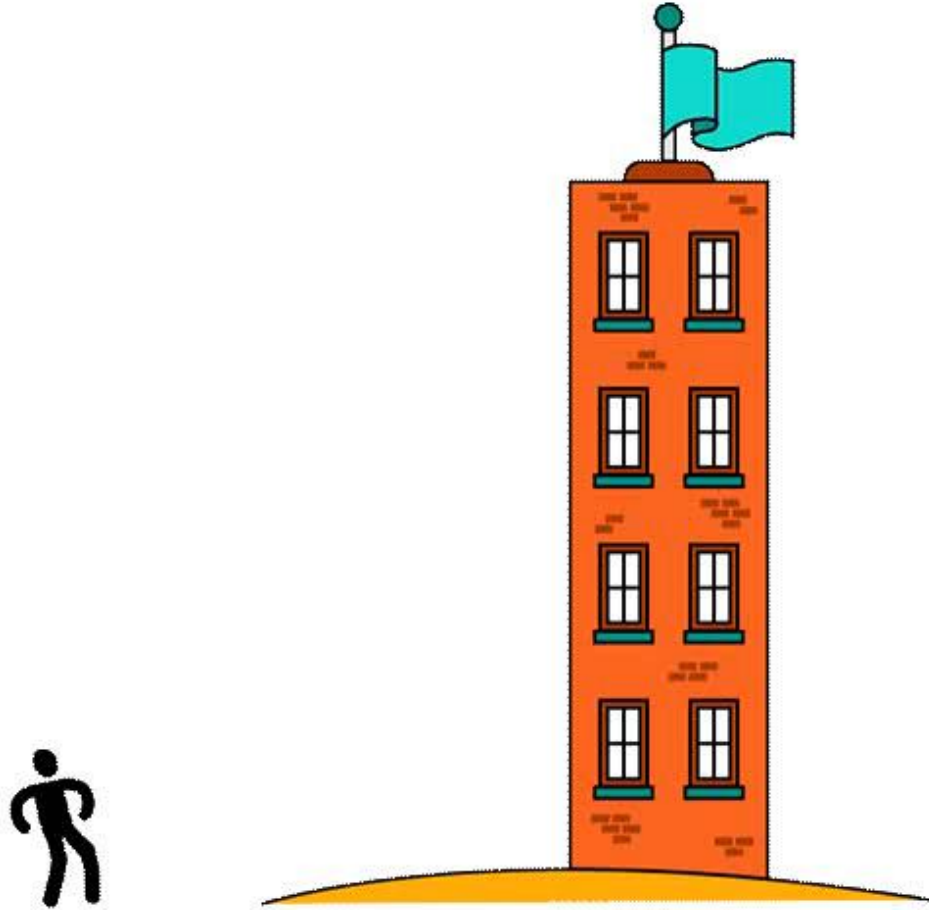


**Race car learners**

**Hiker learners**



# The value of scaffolding



- Small chunks
- Practice



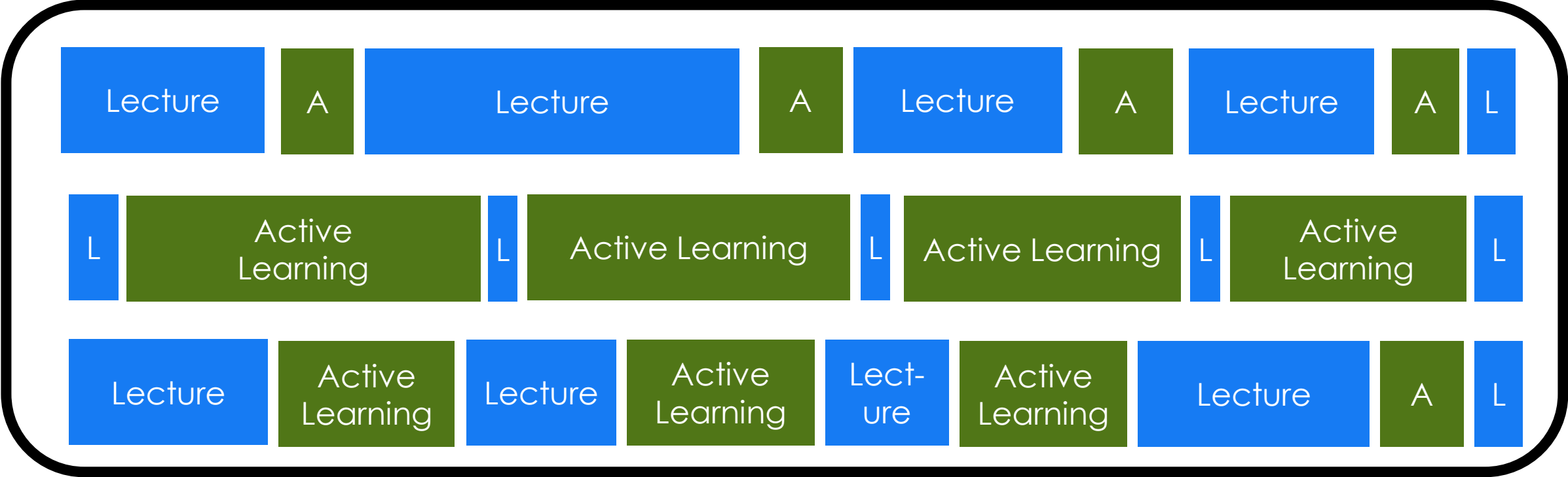
Photo by Erik van Leeuwen

Julius Yego

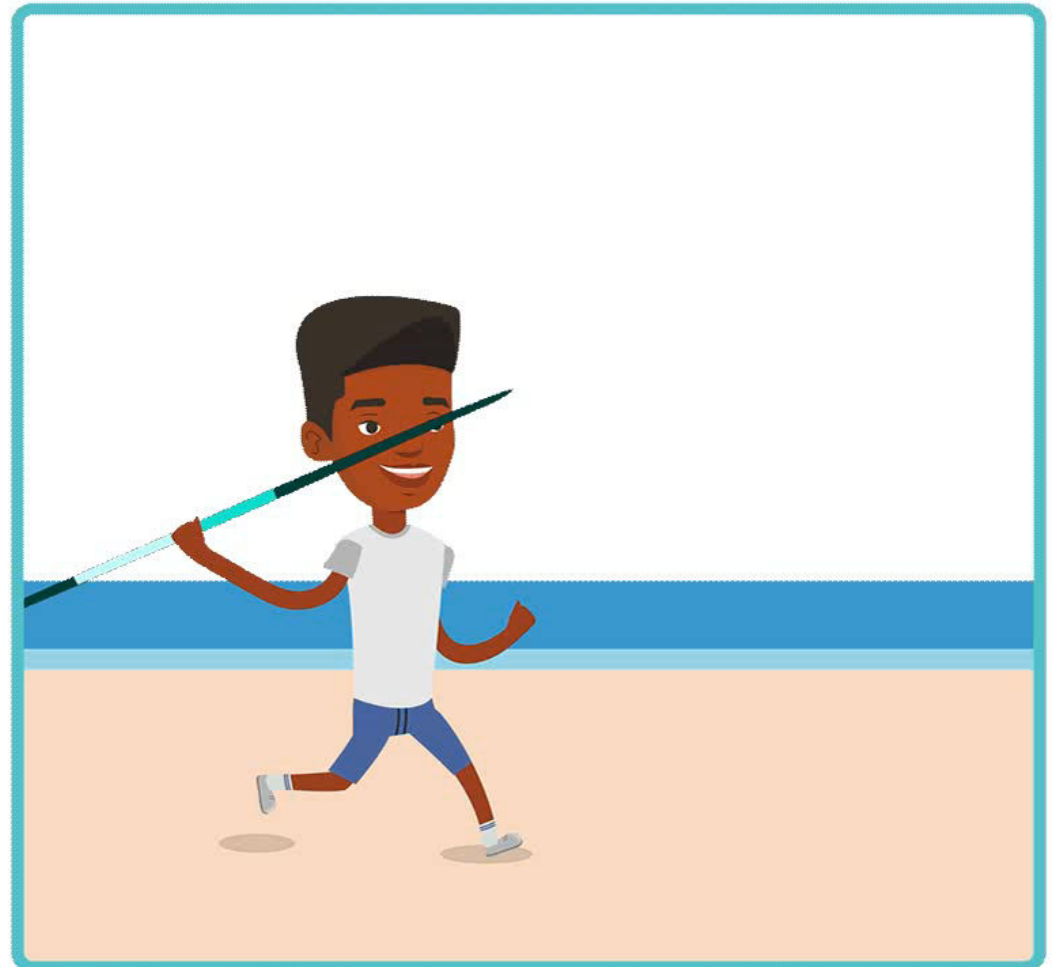
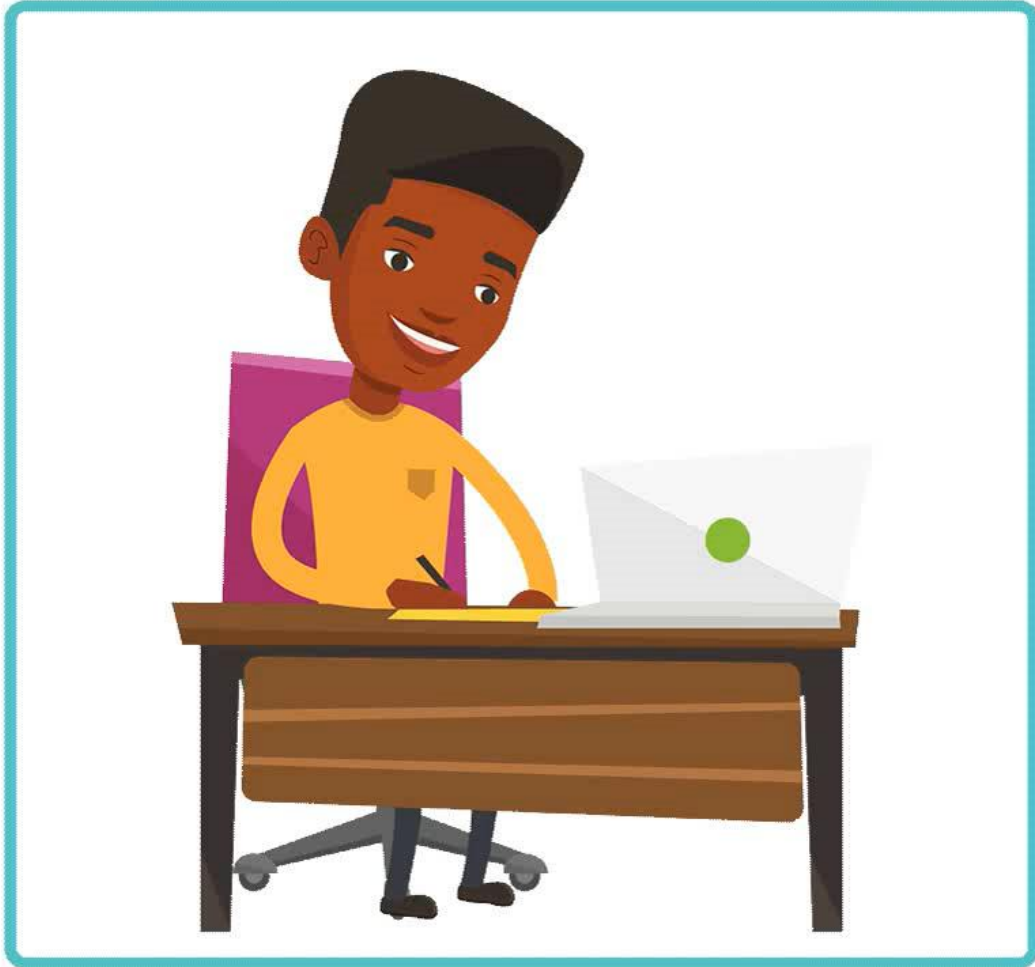


Lecture

Active Learning



**Direct instruction**



Lecture

Active Learning

Lecture

Active Learning

Lecture

Active Learning

Lecture

Active Learning

Lecture

Active Learning

Lecture

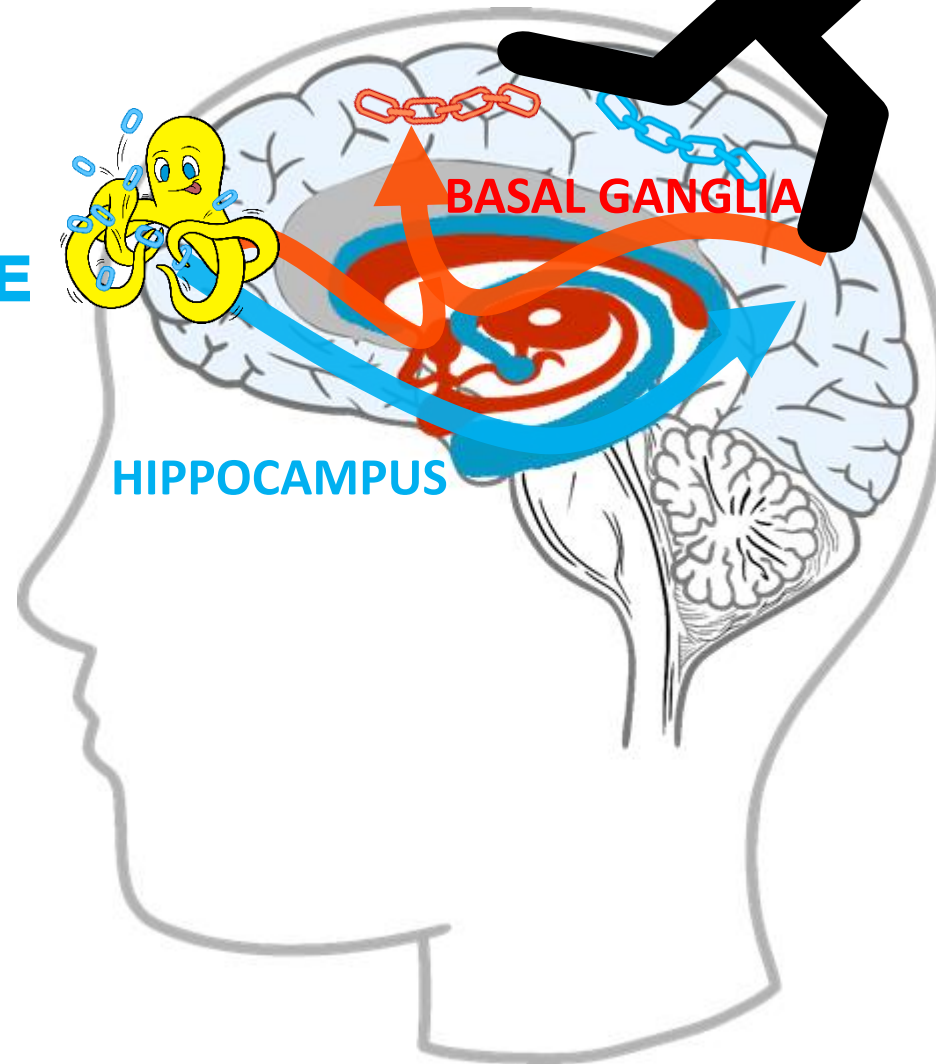
Active Learning

Lecture

Active Learning

Lecture

**DECLARATIVE**



HIPPOCAMPUS

BASAL GANGLIA

**PROCEDURAL**



# DECLARATIVE



# PROCEDURAL

RETRIEVAL PRACTICE

SPACED REPETITION

EXPLANATION

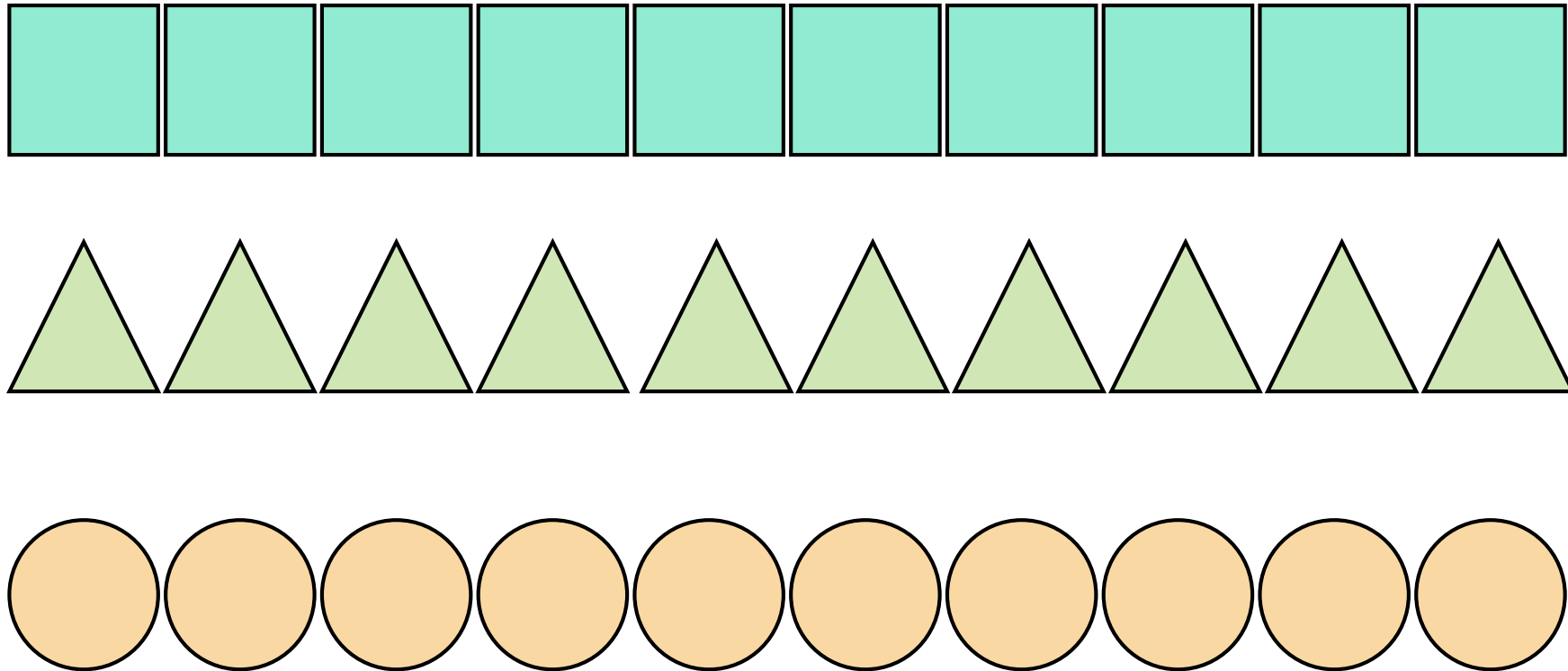
DELAYED FEEDBACK

VARIED PRACTICE

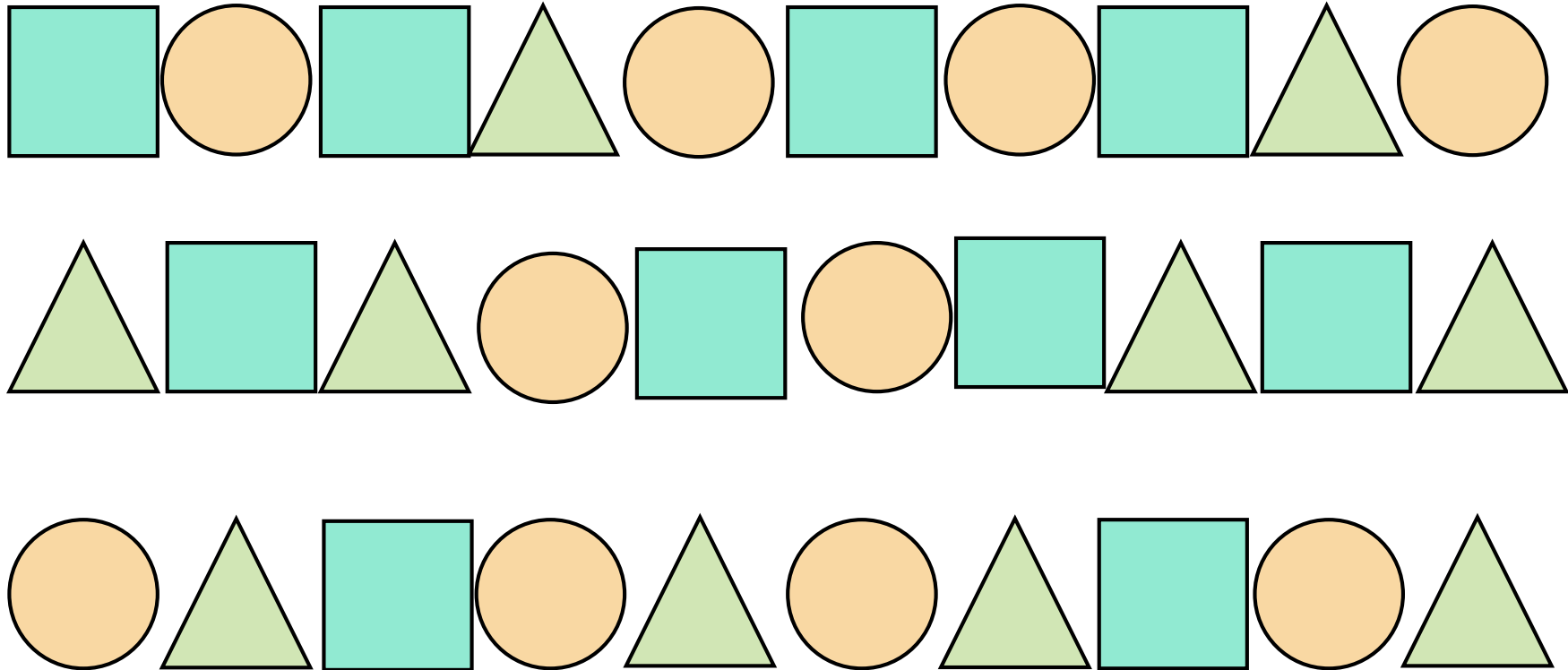
RAPID FEEDBACK

INTERLEAVING

# Blocking



# INTERLEAVING



# Interleaving

## Plain Assignment

Topic 7 problem 4

Topic 7 problem 9

Topic 7 problem 15

Topic 7 problem 17

Topic 7 problem 22

## Interleaved Assignment

Topic 7 problem 4

*Topic 4 problem 8*

Topic 7 problem 9

*Topic 6 problem 26*

Topic 7 problem 15

*Topic 5 problem 18*

Topic 7 problem 17





**DRILL**



**KILL**

**But you didn't give  
us time to practice  
all you taught!**



Photo by Erik van Leeuwen

Julius Yego

That was our **last webinar of the year!**

More webinars to come starting late January.

Please check our events page regularly:

<https://www.eit.edu.au/news-events/events/>

# Upcoming EIT Courses

Course	Start Date
52882WA Advanced Diploma of Electrical and Instrumentation (E&I) Engineering for Oil and Gas Facilities	17/01/2022
Professional Certificate of Competency in Substation Design (Main Equipment)	17/01/2022
Professional Certificate of Competency in Mechanical Engineering	24/01/2022
Professional Certificate of Competency in Programmable Logic Controllers (PLCs) & SCADA Systems	24/01/2022
Online Doctor of Engineering	31/01/2022
Advanced Diplomas in Biomedical, Civil and Mechanical	08/02/2022
Online Bachelor of Science degrees in Civil, Electrical, Mechanical, and Industrial Automation Engineering	14/02/2022
Professional Certificate of Competency in Safety Instrumentation Systems for Process Industries	14/02/2022
On Campus: Bachelor of Science, Master of Engineering, and Doctor of Engineering courses	21/02/2022
Professional Certificate of Competency in Electrical Power System Protection	21/02/2022

See our full course schedule here: <https://www.eit.edu.au/schedule/>

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<https://qrco.de/bcbWsh>

Please note that Certificate of Attendances will be sent out in the next 1-2 business days.



# Q&A





Engineering Institute of Technology.

# Thank you for attending.

## Contact Us



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