Seminar
Brain Modeling

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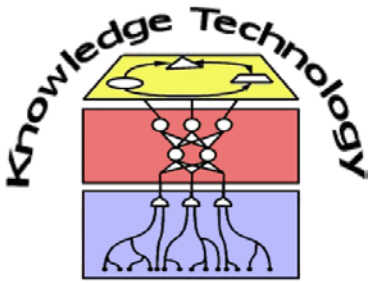
University of Hamburg
Dept. of Informatics, Knowledge Technology



http://www.informatik.uni-hamburg.de/WTM/

Who is Who

- Group: Knowledge Technology
  - Research into foundations, representations and applications of intelligent systems
  - Interested in nature-inspired hybrid neural & symbolic representations and learning methods
- Lecturers
  - Prof. Stefan Wermter
    - wermter@informatik.uni-hamburg.de
    - Office: F-230; Office hours: on request via Secretariate
  - Dr. Cornelius Weber
    - weber@informatik.uni-hamburg.de
    - Office: F-233; Office hours: mostly there Mon-Fri 10am-7pm

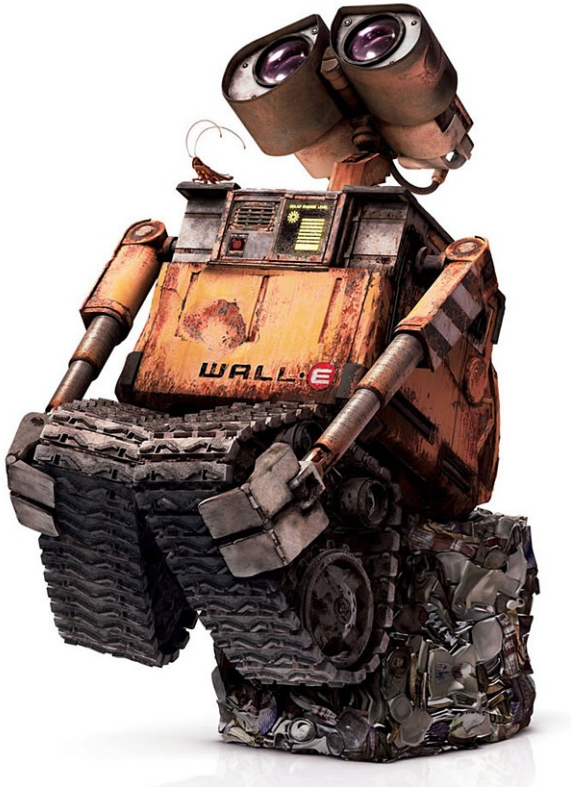
What is a Seminar?

- Seminar in general:
  - Not a lecture
  - For the audience: overview about methods and approaches
  - For the speaker: deep knowledge in a specific area
  - No own research / implementation

- Side effects:
  - Practice reading, writing and presenting
  - Preparation towards seminars in research and economy

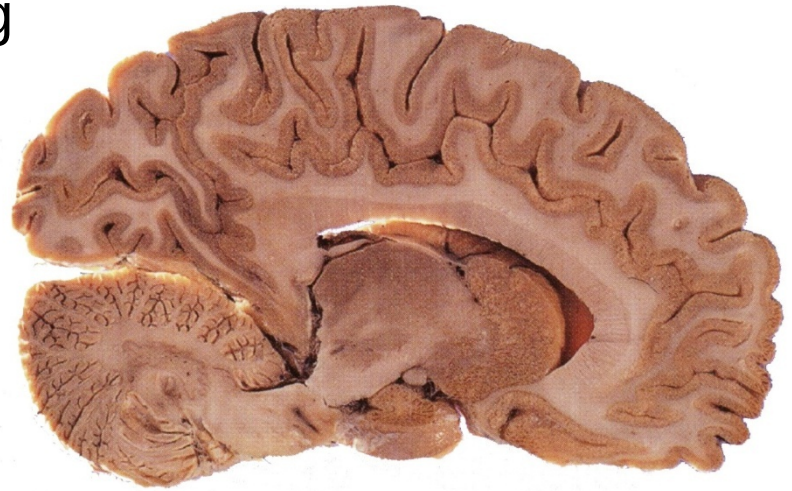
Artificial Intelligence

- Intelligent behaviour of an artificial agent (computer/robot)
  - Make decisions and do reasoning
  - Plan actions
  - Learn and use knowledge
  - Detect and interpret images and scenes
  - Communicate and cooperate
  - Use natural language
  - React to something unexpected
  - ...
- Central requirement
  - Represent knowledge
  - Process knowledge



Brain Research (Neuroscience)

- Intelligent behaviour of animals and humans
  - Make decisions and do reasoning
  - Plan actions
  - ...
- Neurophysiologic data
  - Reaction of neurons to stimuli
  - Anatomical substrate
  - ...
- Central requirement
  - Formulate models of information processing
  - Models on different levels
  - Interdisciplinary view: physics, chemistry, statistics, ...



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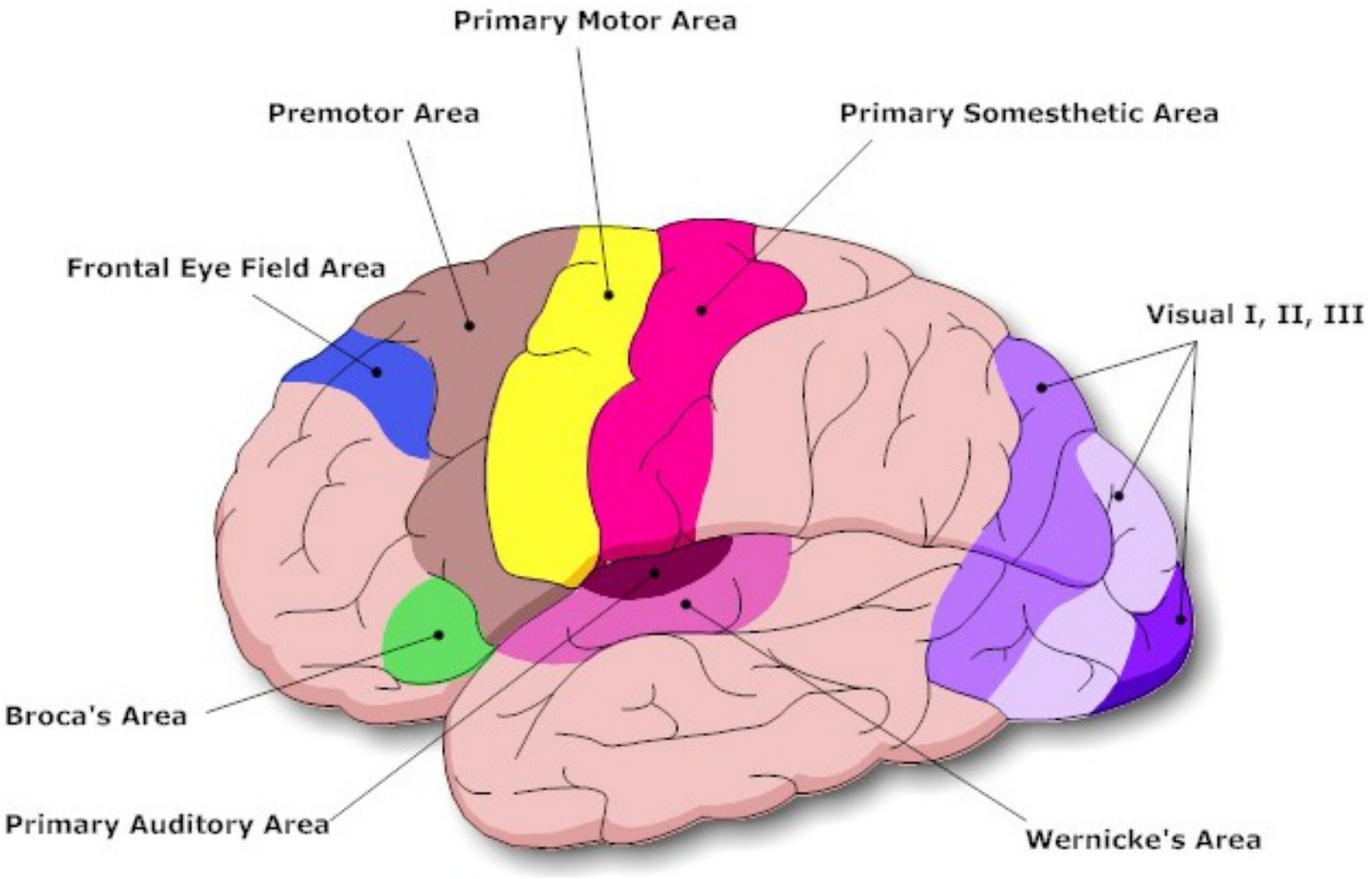

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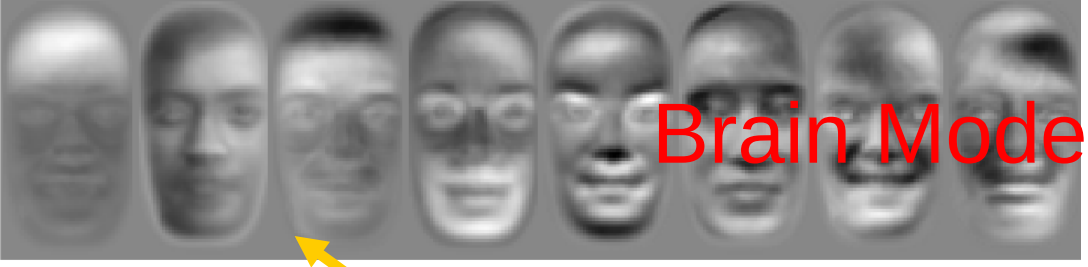

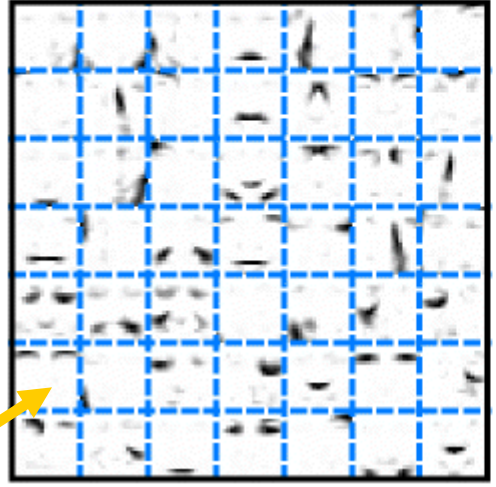

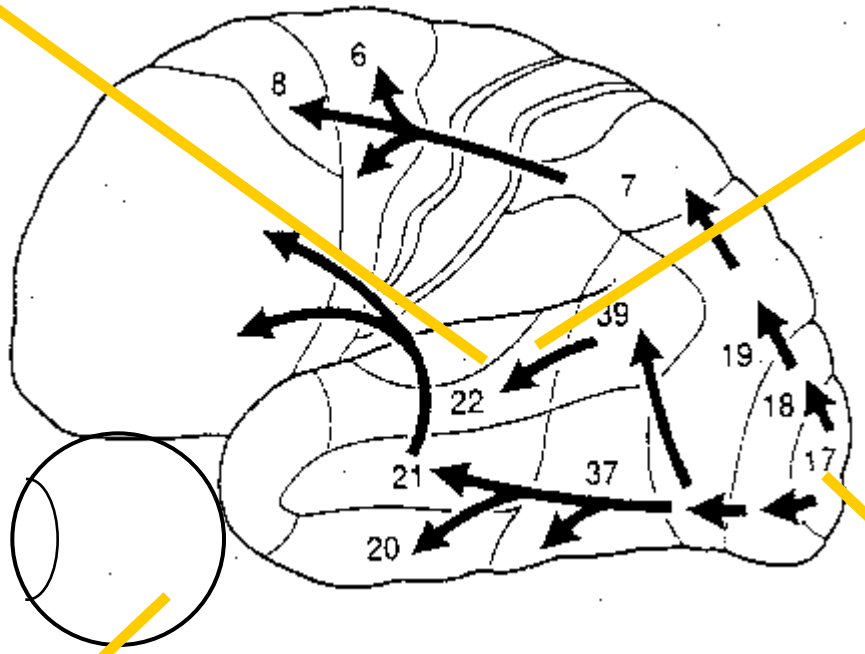

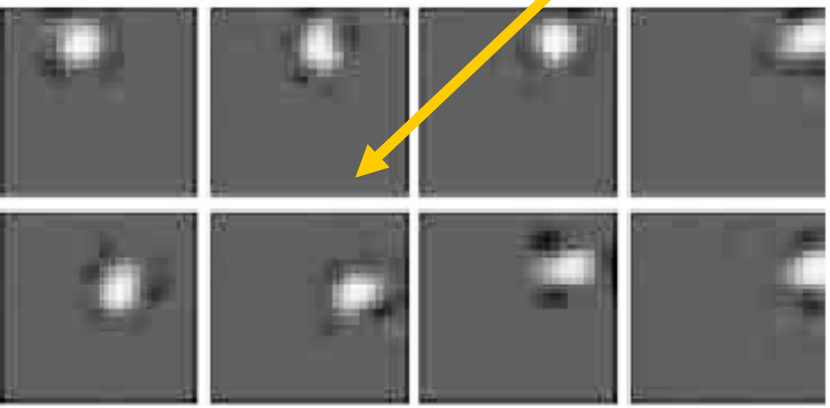

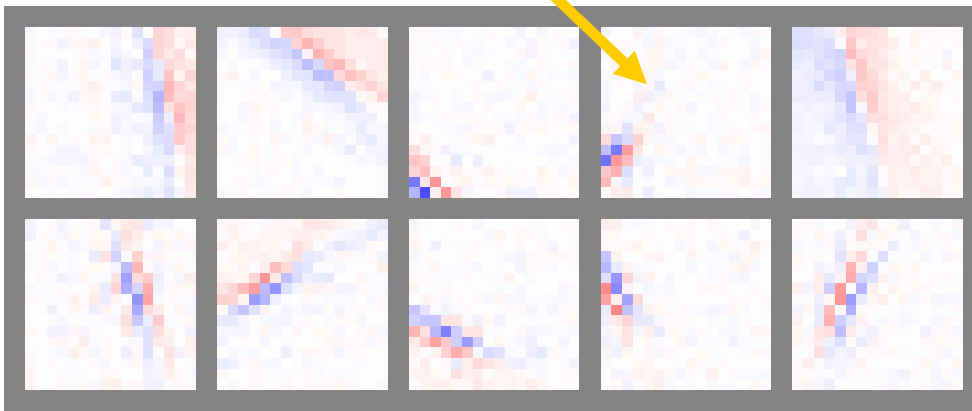

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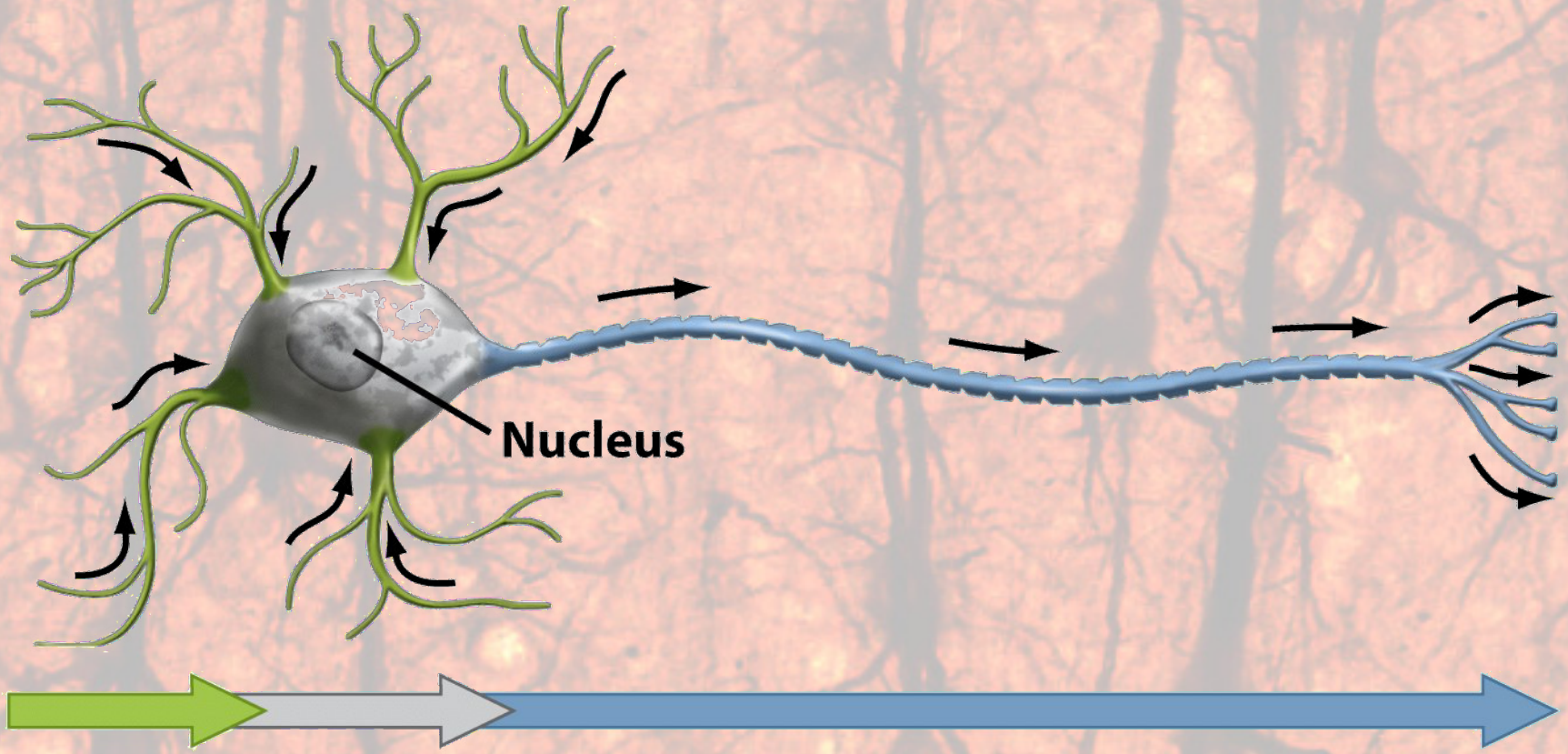

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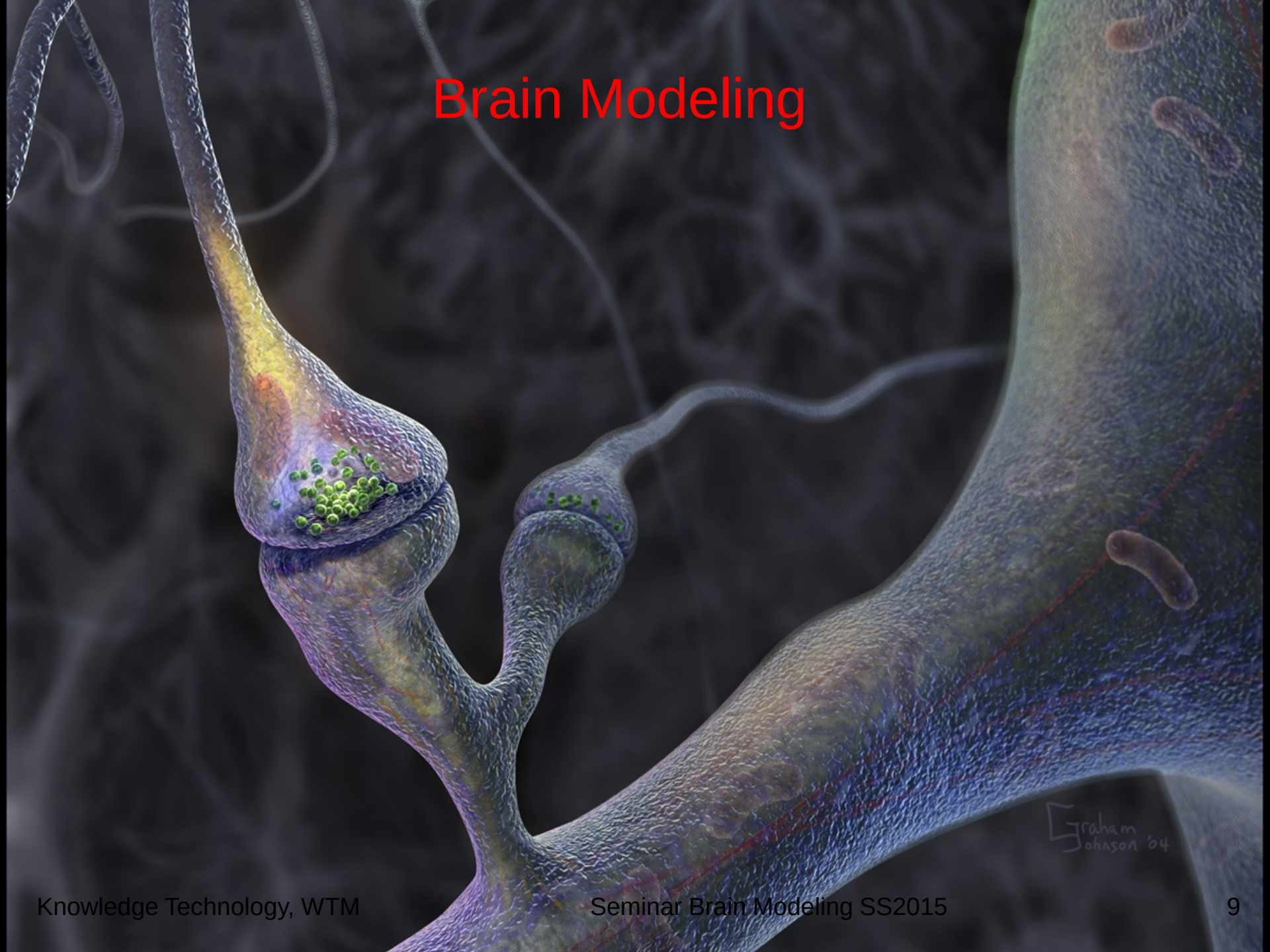

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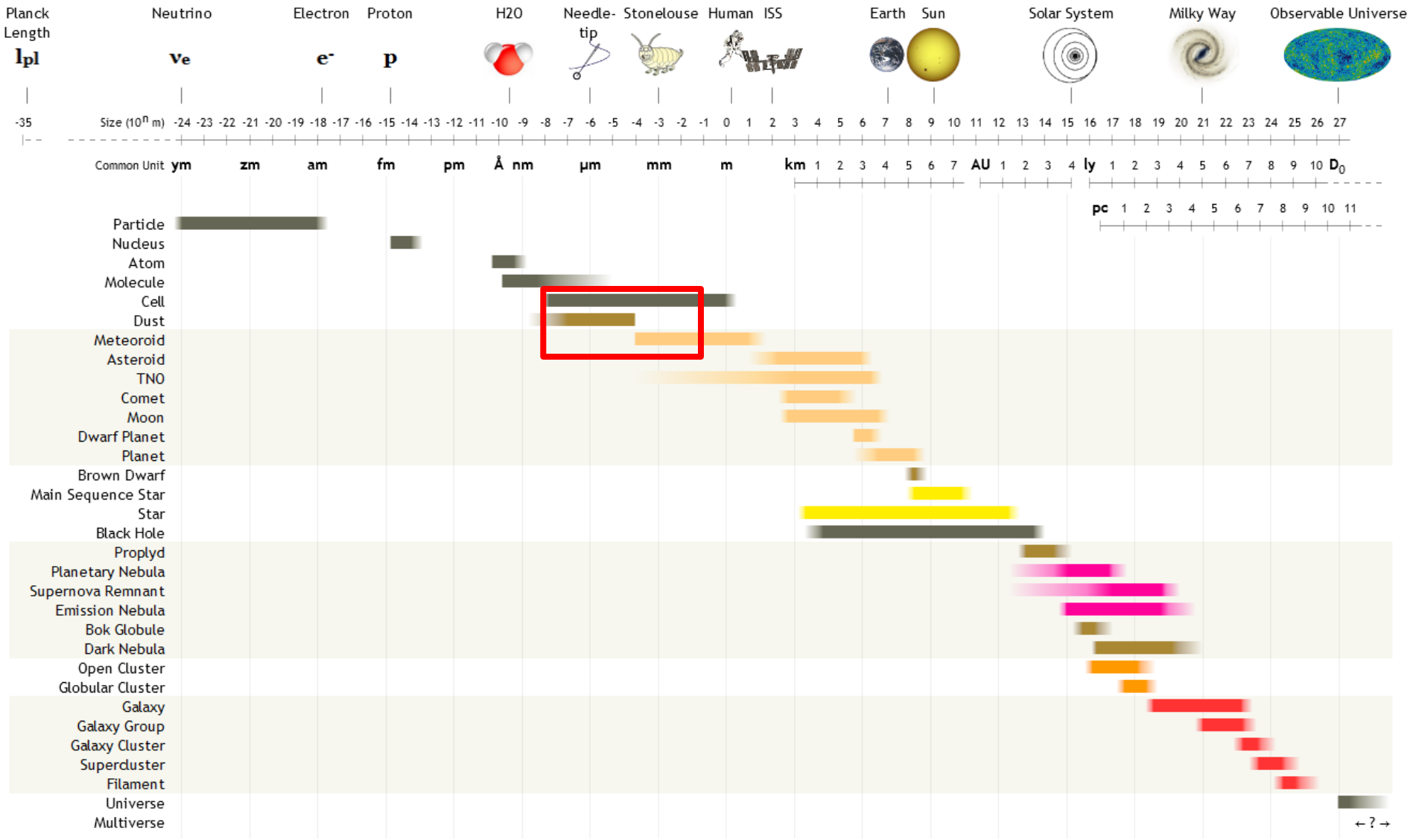

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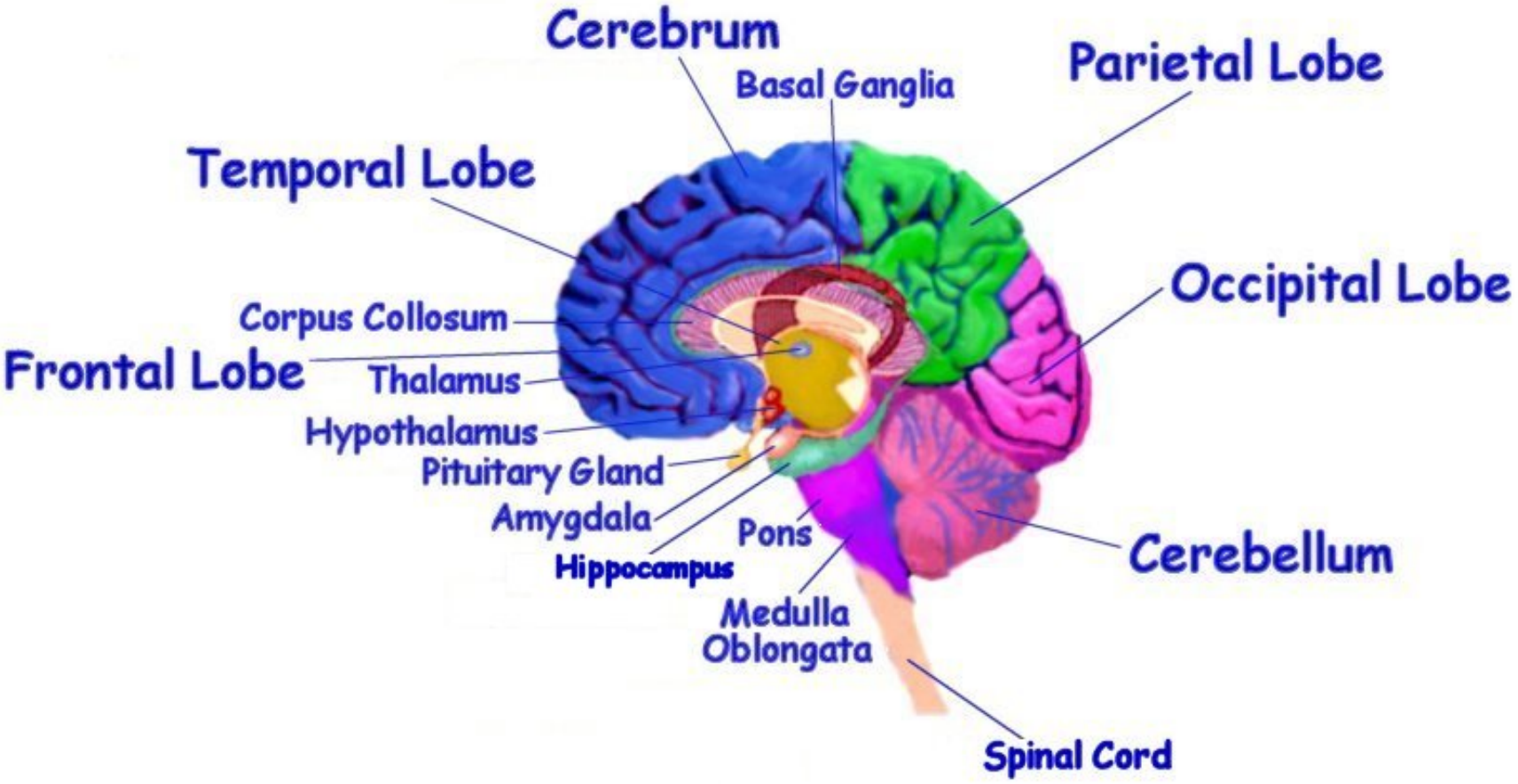

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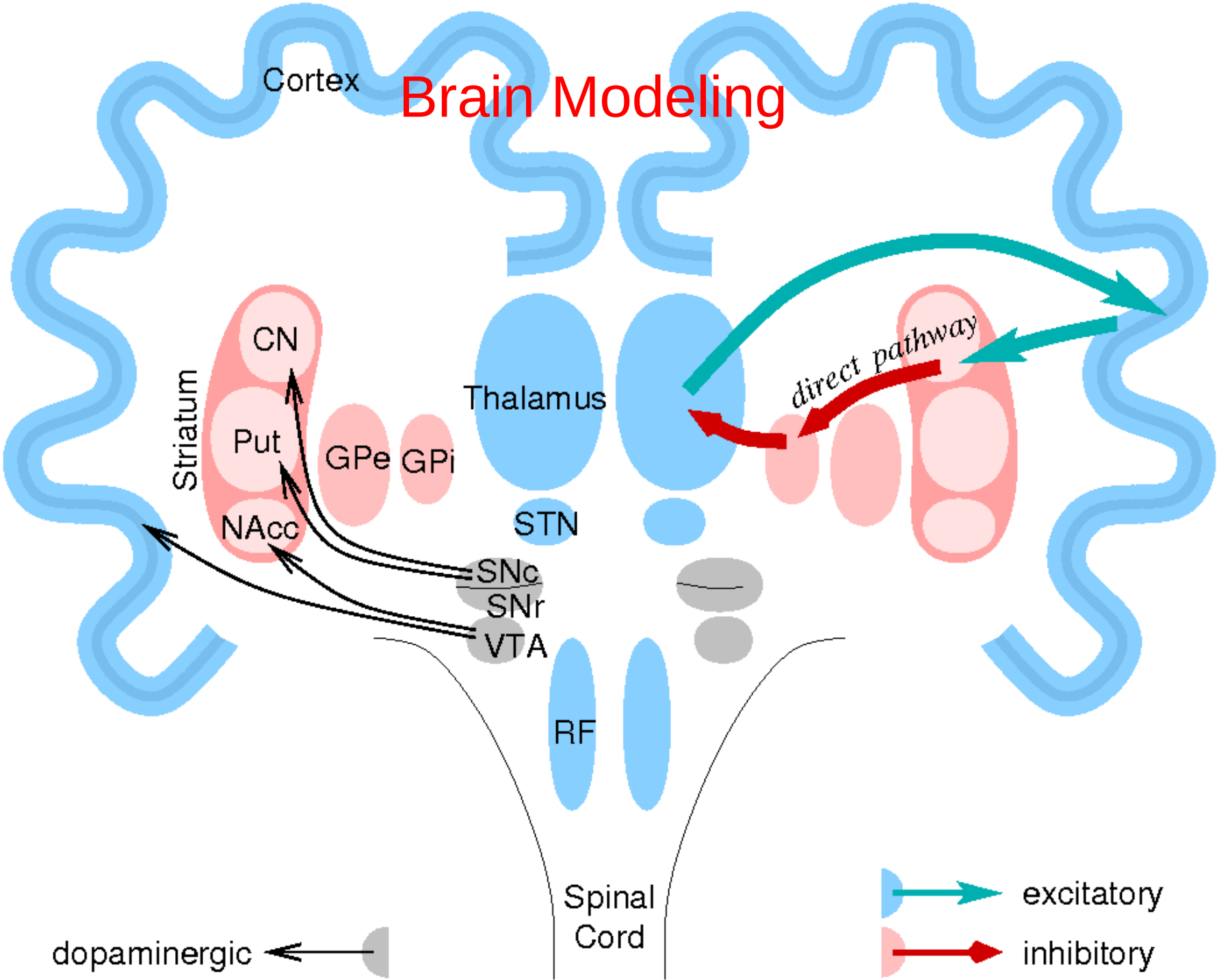

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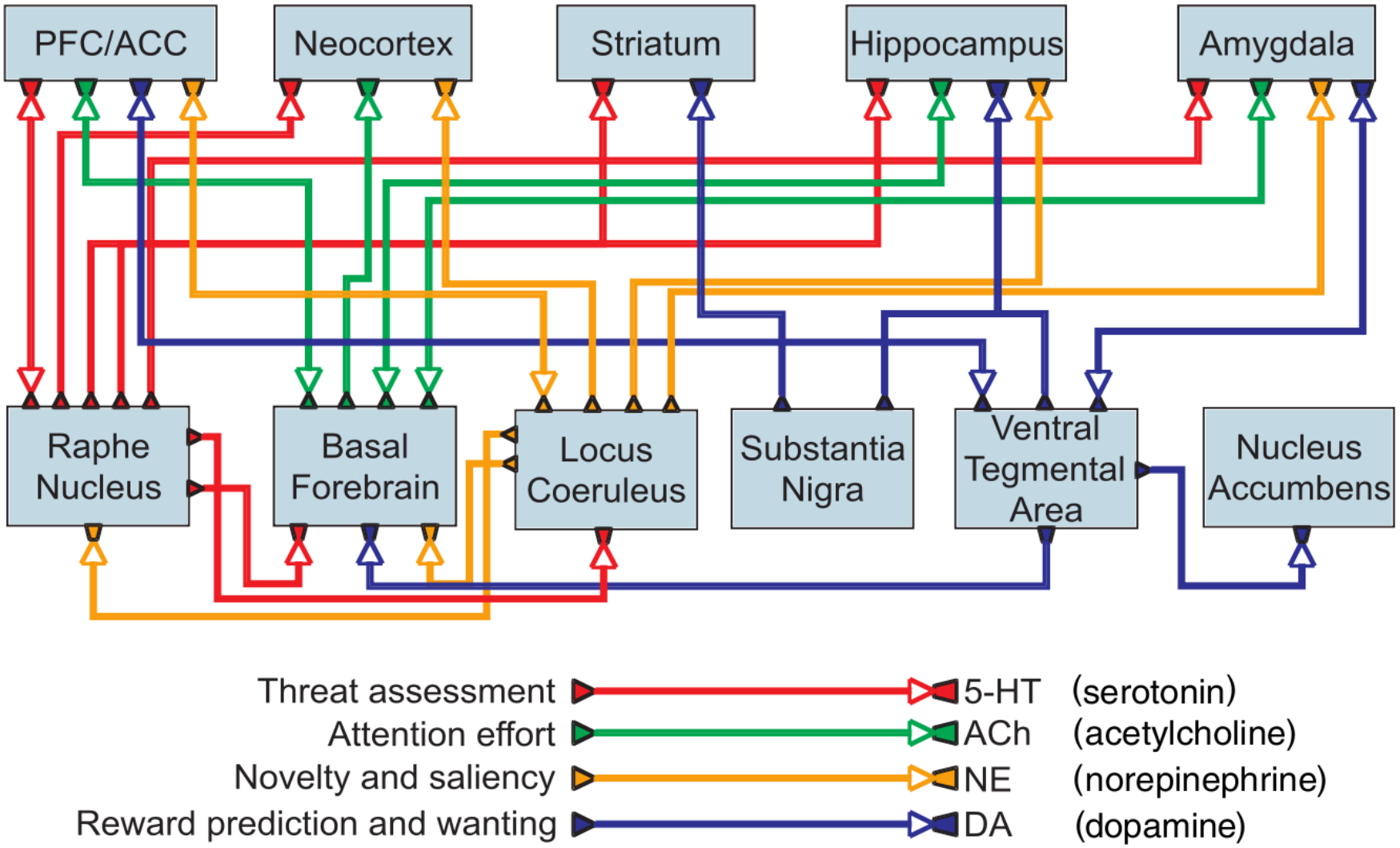

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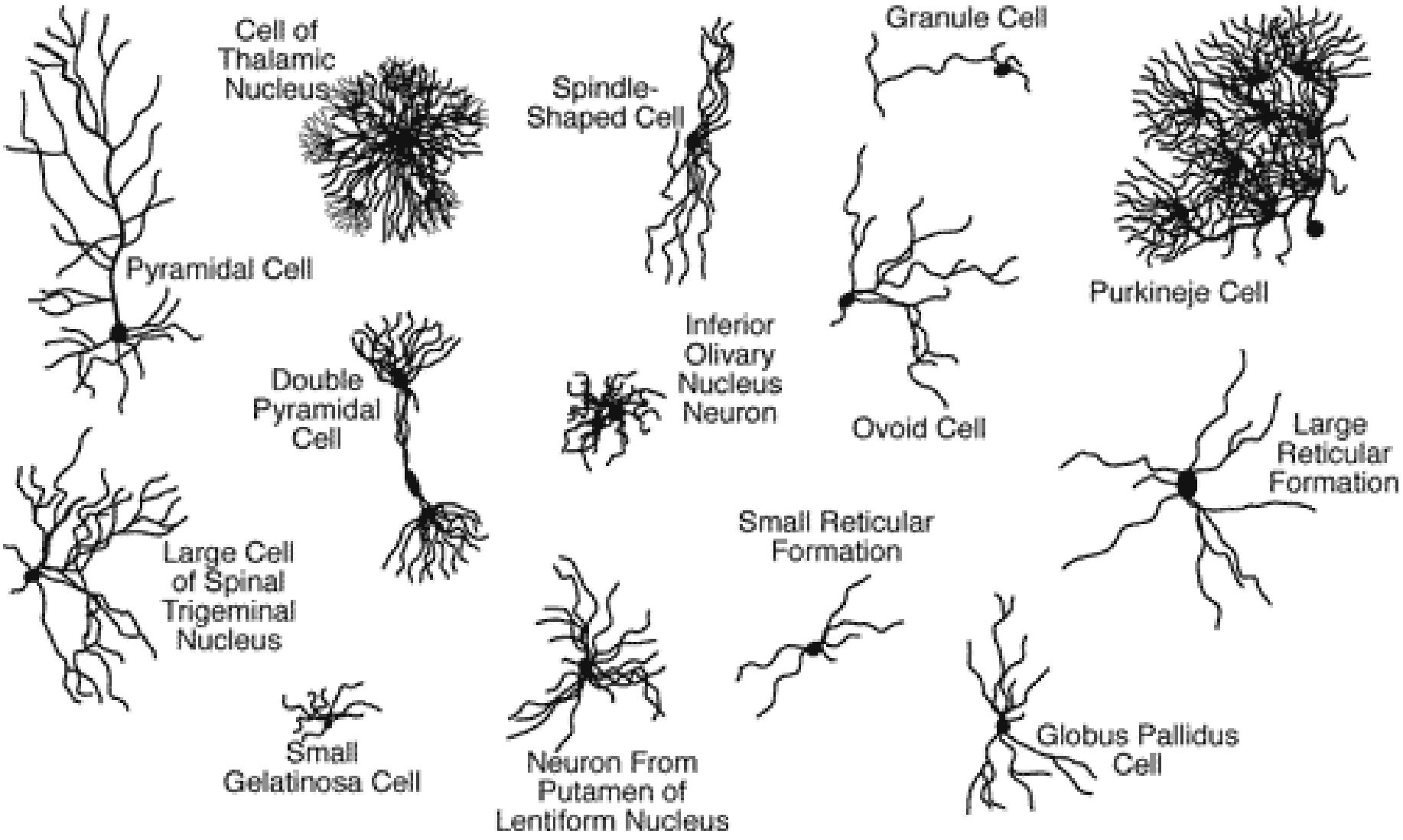

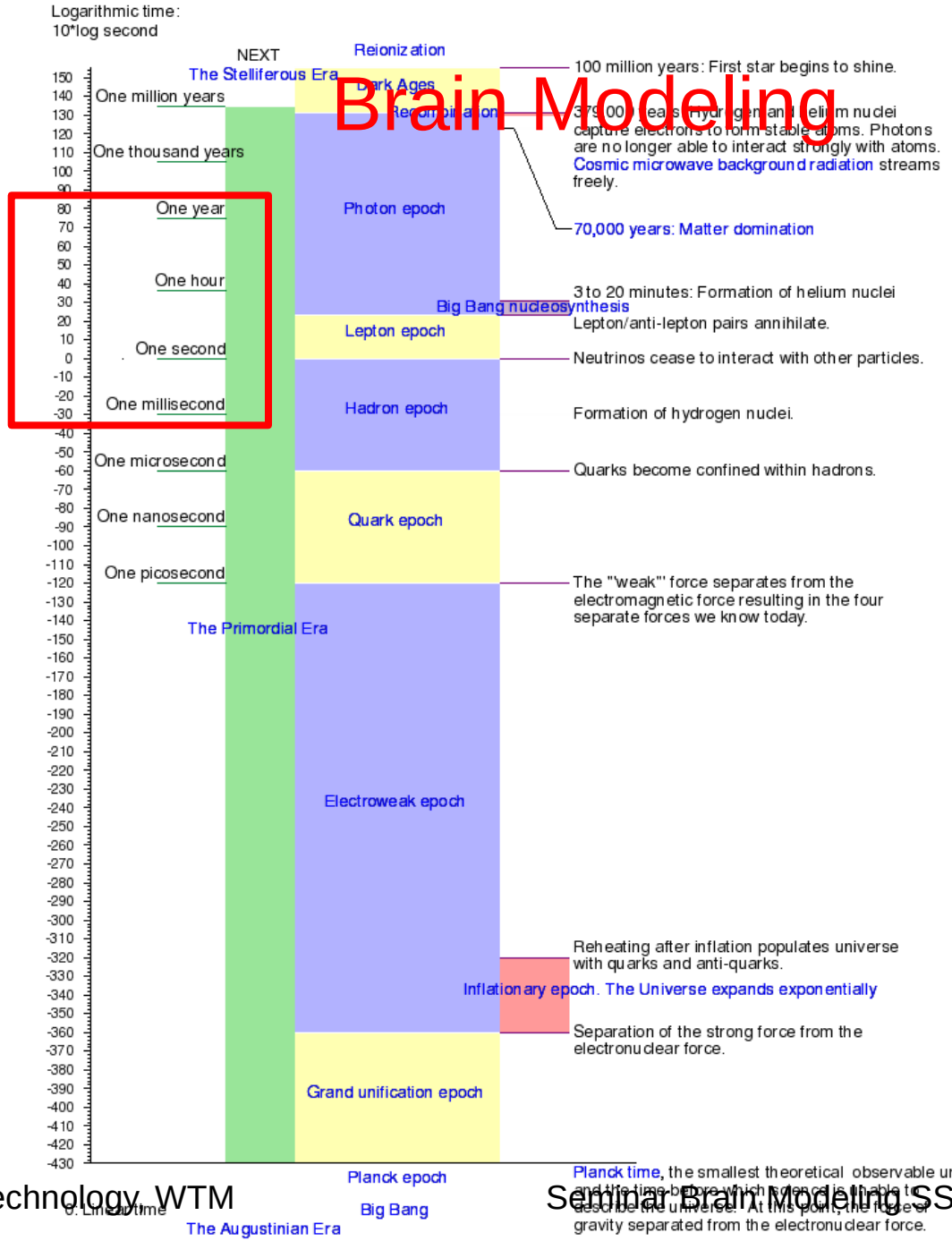

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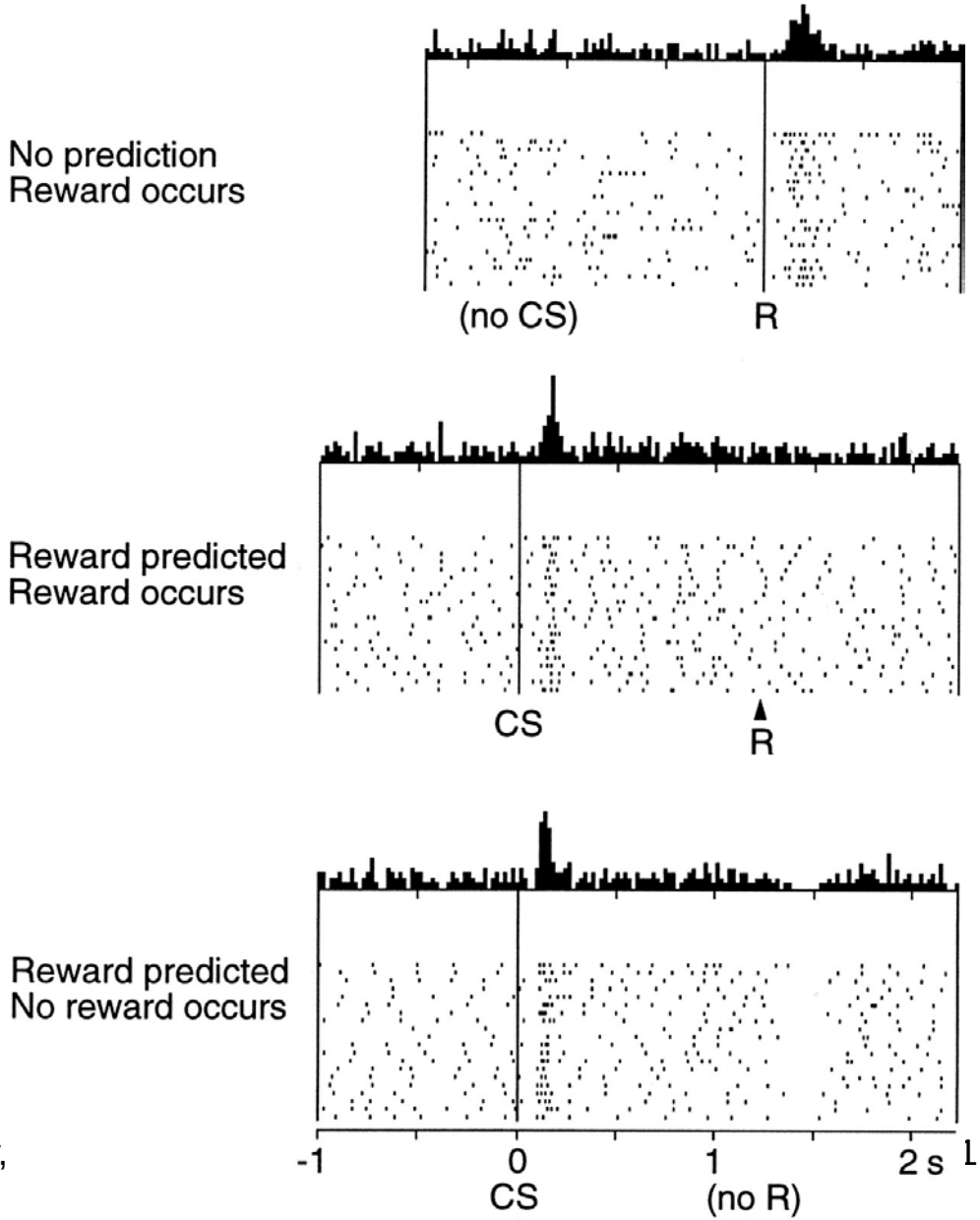

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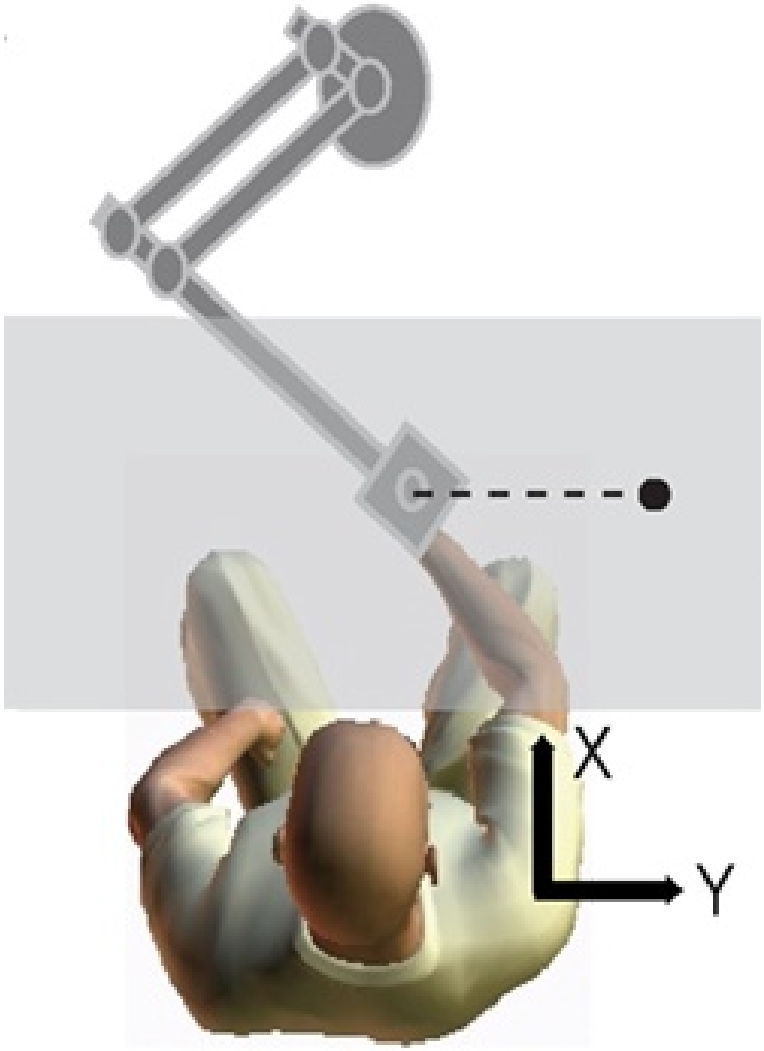

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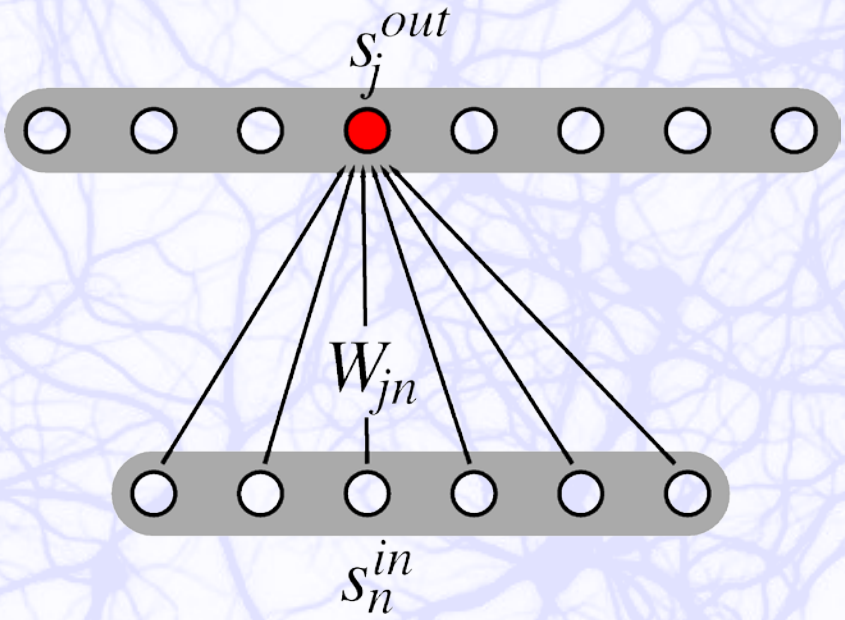
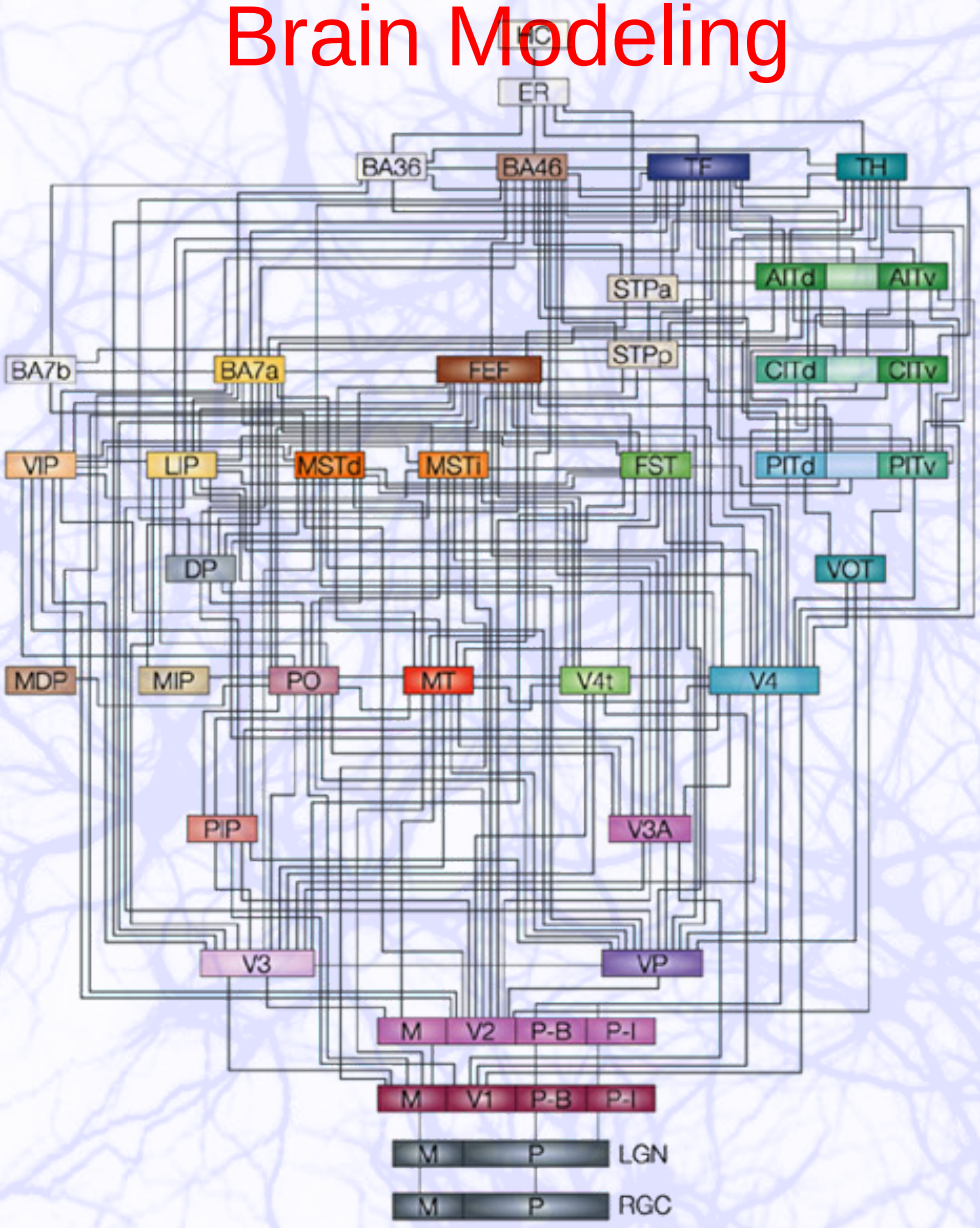


activate a neuron:

$$s_j^{out} = w_{j1}\, s_1^{in} + w_{j2}\, s_2^{in} + \ldots$$

Brain Modeling



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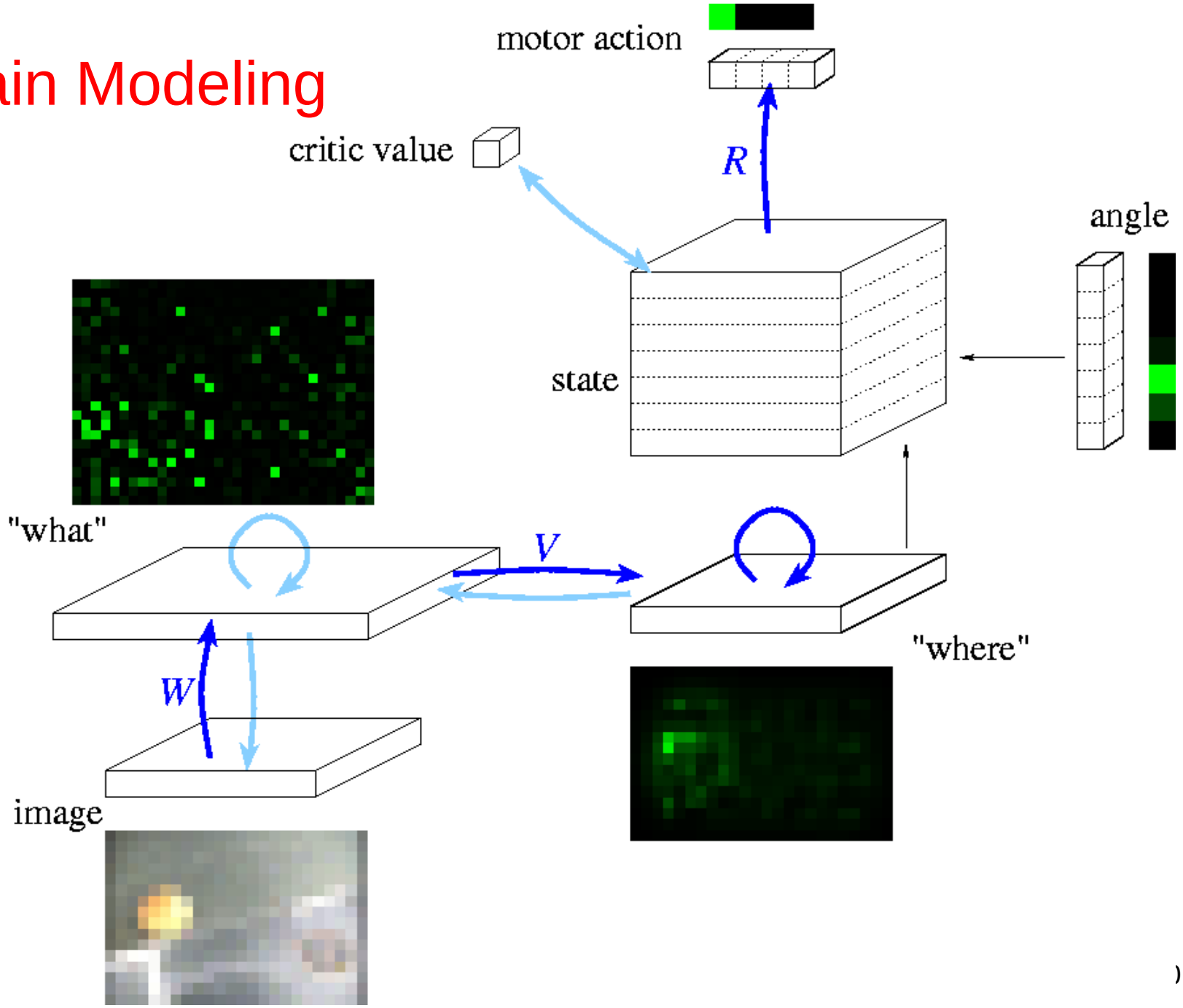

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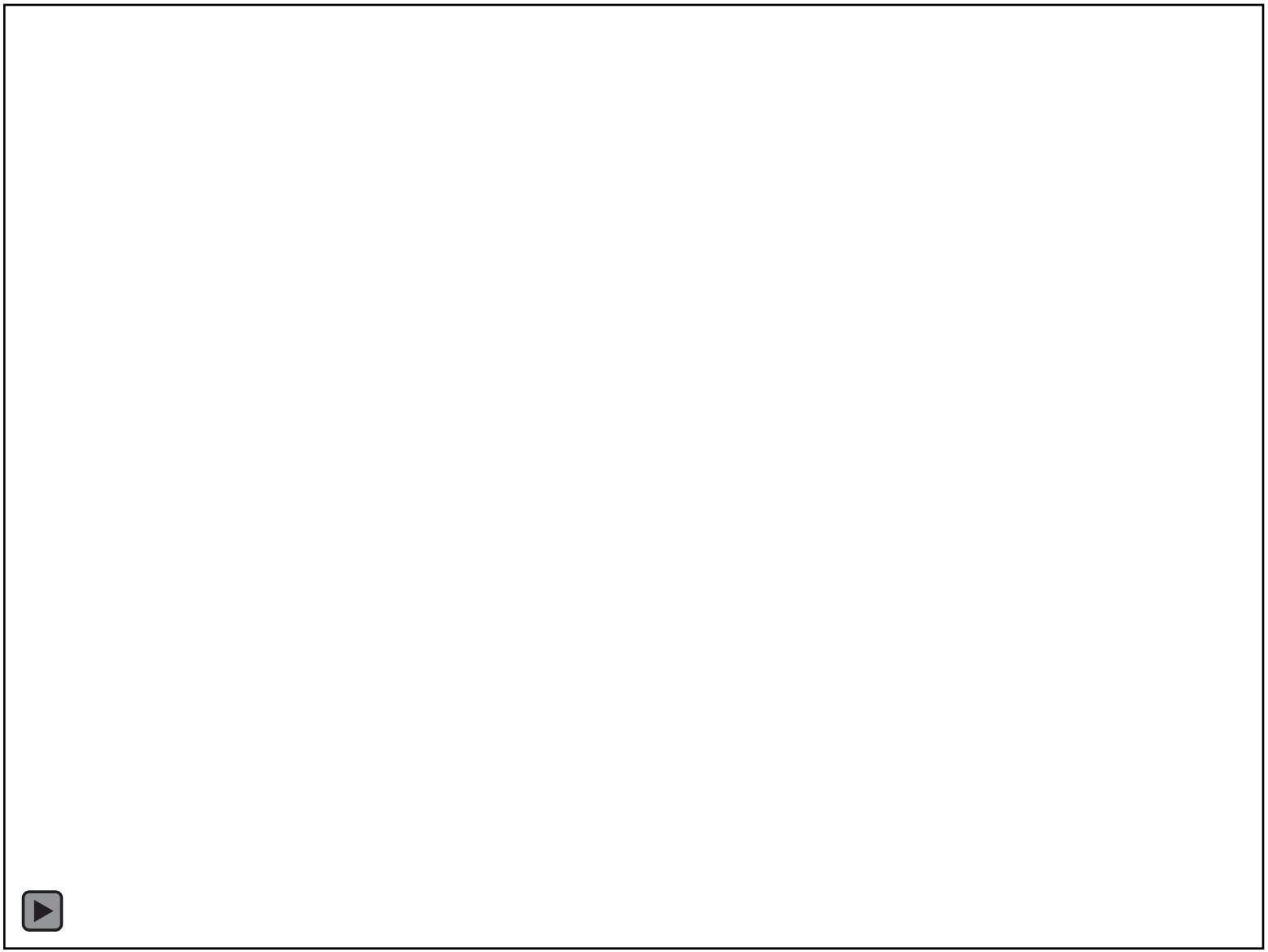

Goal of this Seminar

- Some experiences with the domain “Brain Modeling”
  - Get an overview
  - Learn how to classify problems and methods
  - Bridge the gap between neuroscience and computer science
  - It’s not a lecture!

- Some skills in scientific methodology
  - Search, select and evaluate literature, and read papers
  - Acquire a complex topic on your own
  - Present the topic in a paper and in a talk

Support to Reach the Goal

- Guidance and advice
  - Some introductions to methods
  - Literature to get started from the tutor
  - Individual talks with the tutor

- Feedback from the Group
  - Discussions
  - Reviews
  - Feedback on the presentation

Requirements

- Provide a paper
  - 8-12 pages, our paper templates are recommended
  - Abstract between 150 and 250 words
- Give a presentation
  - 20 min talk, 10 min discussion, slide templates recommended
  - Choose English or German language
- Participate actively
  - Review two other papers
  - Attend the complete seminar block
  - Discuss the presentations
  - Maintain the deadlines

Typical Paper Structure

- **Title**
- **Abstract** one sentence each: background, problem, solution, results, interpretation
- **Introduction** background, motivation, research question
- **Methods** details of approach and its implementation; in case of review: evaluation of approaches
- **Discussion** critical discussion of approach in the light of the results
- **Conclusion / Outlook**
- **Bibliography** the referenced literature
- **Appendices / Supplementary material** for non-essential data; detailed algorithms, tables, analysis methods, etc.

Write your own story with a critical view!

A Few Words about Plagiarism

- Most important quality in research: intellectual integrity
  - Cite idea, source code, figure sources, or material used
  - Search for a source even for used “common knowledge”
  - Quote any copied text with “” quotation marks

    optimally use also slanted font and indented text
  - Avoid long or too many quotes
- Plagiarism can lead to ...
  - Fail a module
  - Getting exmatriculated due to a cheating attempt
  - Losing doctoral degree and minister position
  - A career that does not suit your capabilities

Referencing

- Two different things that belong together:

  - Inline citations

    It was reported (Krüger et al., 2013) that ...

    Krüger et al. (2013) have reported …

    It was reported [1] …

Tells me which one was used!

  - Bibliography entry (References)

[1] N. Kruger, P. Janssen, S. Kalkan, M. Lappe, A. Leonardis, J. Piater, A. J. Rodriguez-Sanchez, L. Wiskott, "Deep Hierarchies in the Primate Visual Cortex: What Can We Learn for Computer Vision?," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 35, no. 8, pp. 1847-1871, Aug., 2013.

Tells me where to find the source!

FAZ Topics

Gedächtnis Sabrina & Vivian
Bewusstsein Nikolai
Neuroökonomie thomas
Musik Dominik and Stefan
control midi, visualising dreams
Sprache
Raum und Zeit Philip L.
Emotionen Christoph & Heiko
Neurologie Lasse

Article Topics

Deep Neural Networks

What/where in the Visual System

Deep Reinforcement Learning Tom & Felix
Hierarchical RL

Cognitive Architectures

Probabilistic Models

Practical Topics

Dynamic Neural Fields

Saliency / Attention

Saccade Control

Actor Critic RL

Topographica

What/Where Streams Philipp F.
Deep Hierarchies
Daniel? Fabian & Gregor?
Feature Detectors

Spike Computations

Detailed Models of Cortical Function

Mapping with Slow Feature Analysis

Mapping with RatSLAM

Planning and Navigation

Cognitive Architectures Marcel

Action Selection in BG

Suggested Meeting with Advisor, next Monday (April 20), F-233

morning	Afternoon	alternative 1:Tue
10:00	14:00 Hohendorf, Tom & Hennig, Felix	10:00
10:20	14:20 Westphal, Lasse	
10:40	14:40 Öhlenschläger, Vivian	11:00
11:00 Ganz, Sebastian	15:00 Schulz, Sabrina	11:50 Feuerbach, Philipp Daniel
11:20	15:20 Schütt, Christoph & Webel, Heiko	
11:40	15:40	16:00
12:00 Marcel Traut	16:00 Klinger, Thomas	17:00
12:20 Lysenko, Philip	16:20 Tschacher, Nikolai	
12:40 Speck, Daniel	16:40 Löhr, Stephan & Kirst, Dominik	18:00
	17:00 Weber, Gregor & Beterke, Fabian	
	17:20	

Your Immediate Next Steps

- Today:
  - Choose the topic & inform the tutor
  - Join the MIN-CommSy Room (membership code: “brainmod15”)
  - Verify that MIN-CommSy contains your active email address
- In the next two weeks (i.e. until week 5):
  - Read the initial material and possibly search for more
  - Organise the topic:
    - Divide important from unimportant content
    - Structure the content
  - Or, for practical work: Install and understand the computer program
- Use the help of the Tutor!

Your Next Steps

- Until week 5:
  - Submit the paper outline, after check with advisor
  - Outline contains:
    - Title of all sections
    - References
    - One sentence in each section

  → to be uploaded to the MIN-CommSy as:
  Outline_yourLastName_yourFirstName_yourShortTitle.pdf

- Until week 10:
  - Write a draft of your full paper
  - Keep using the help of the advisor!

And the Further Steps

- From week 10 on:
  - Review two other papers
  - Use the reviews you got to improve your own paper
  - Prepare slides
  - Deliver your final paper

- In the end of the lecture period:
  - Deliver your slides
  - Give a presentation
  - Support the other participants with discussion and feedback

Seminar Presentations

- As a block
  - Just after the lecture period (~Mon July 6th + 13th)
  - 2-4 days full of presentations
  - Each presentation ~20mins + 10mins discussion/feedback
  - Exact date might have to be revised dependent on exams etc

Criteria for Marks

- Paper
  - Goals: motivation, background, scope
  - Depth: description of models using equations and figures; bridge the gap between brain and model
  - Evaluation: critical analysis, discussion, conclusion
  - Presentation: structure; readability; language; literature citations; figures; equations

- Presentation
  - Technical quality: thorough, accurate, insightful; answer questions
  - Presentation clarity and style: slide quality, content, delivery, enthusiasm; adherence to schedule

Milestones and Deadlines

- Week 4 (20.4.): Choice of topic
- Week 5 (27.4.): Paper outline, incl. literature report
- Week 10 (1.6.): Paper draft for reviewing
- Week 11 (8.6.): Submission of reviews
- Week 14 (29.6.): Final paper, Slides draft
- Week 15+16 (6.7.+13.7.): Presentation

Deadlines are usually Mondays at 18:00!

End of Overview

Thank you for your attention.

Any question?

Websites:

- WTM: http://www.informatik.uni-hamburg.de/WTM/
- MIN-CommSy: http://www.mincommsy.uni-hamburg.de/

membership code for the MIM-CommSy: “brainmod15”