

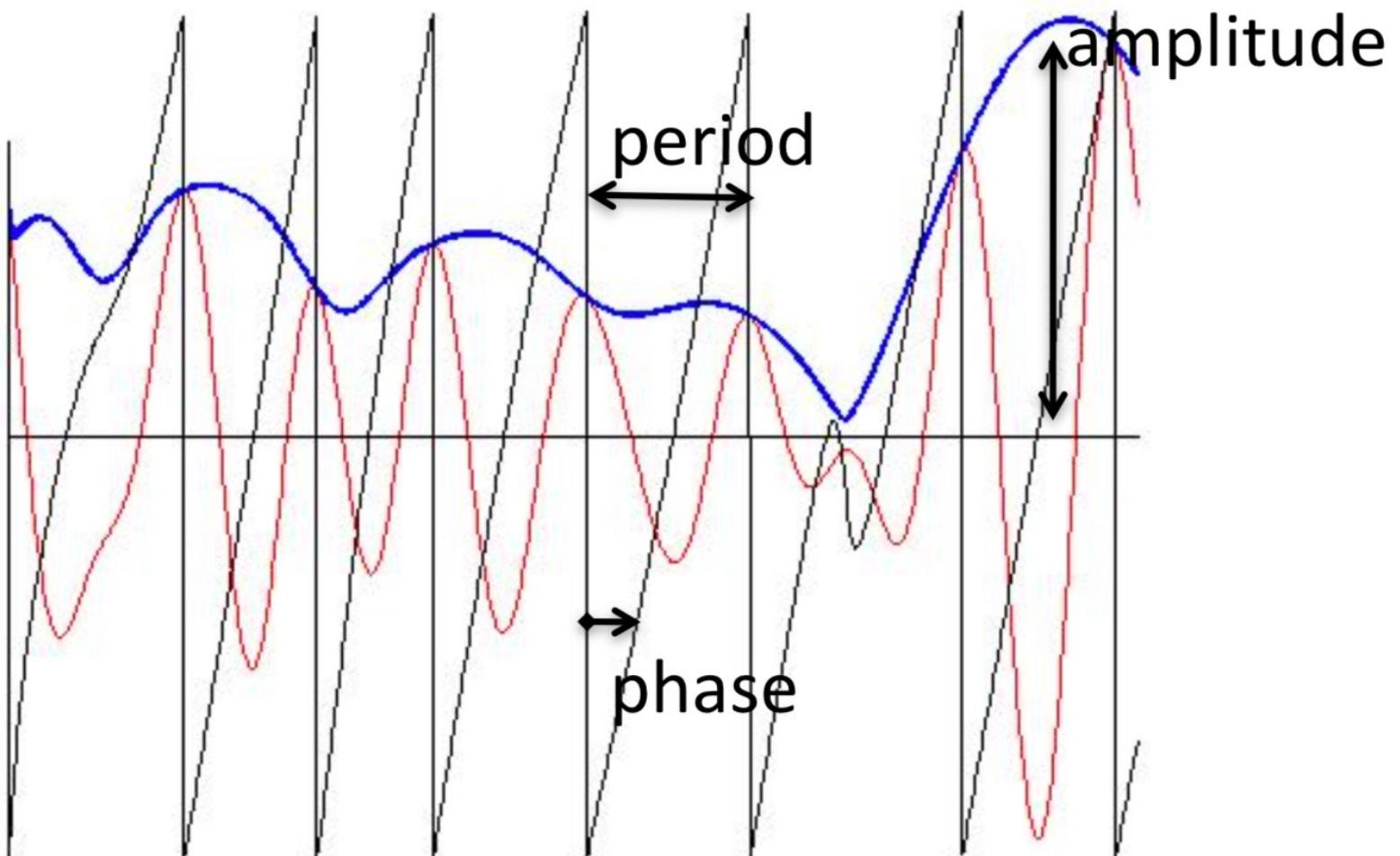
Oscillations



<https://www.youtube.com/watch?v=Au5tGPPcPus>

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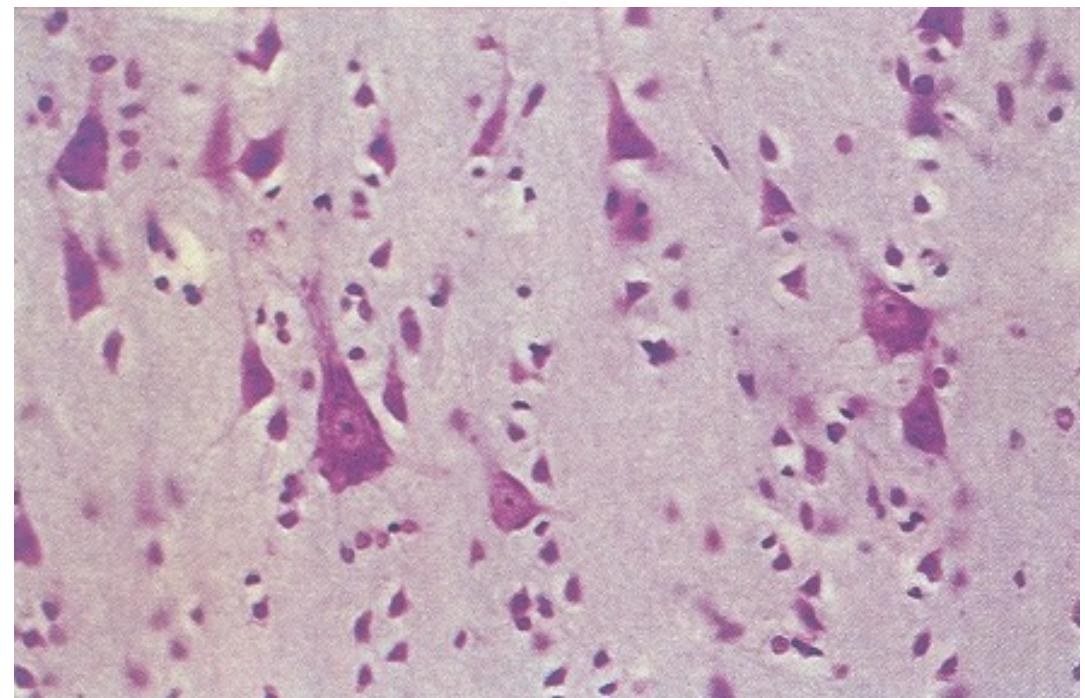
Oscillations



Overview

- Structure of the neocortex
- How is information transported?
- How can we record signals from the neocortex?
- Role of neural oscillations for cognition

Anatomy



<https://www.youtube.com/watch?v=Aaxw4zbULMs>

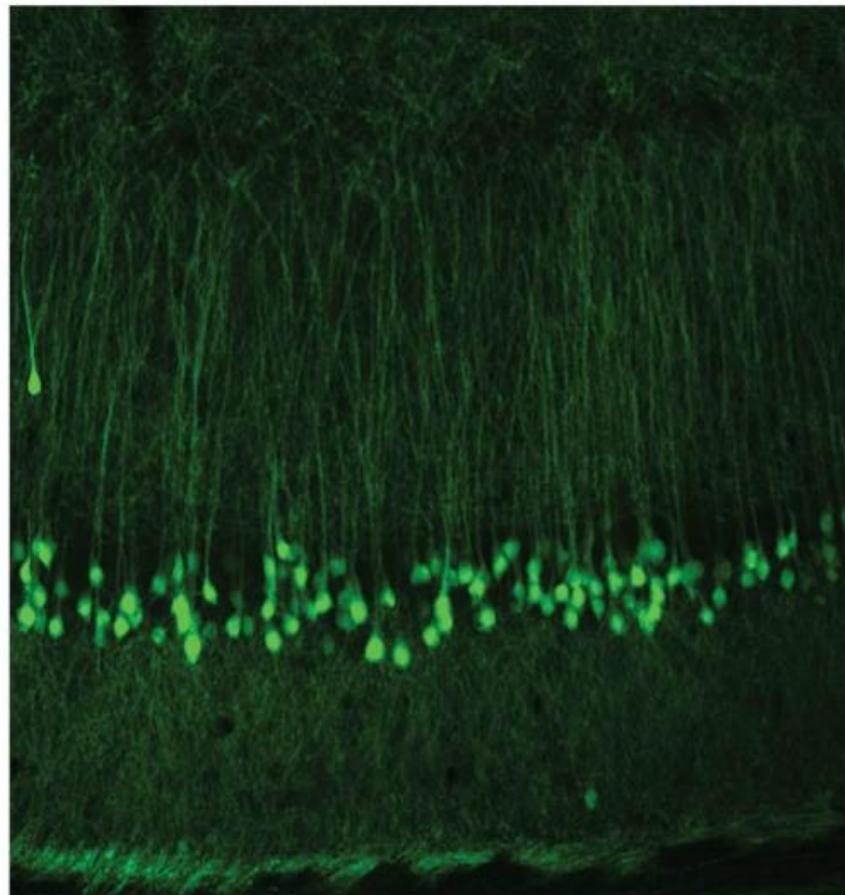
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Structure of the neocortex

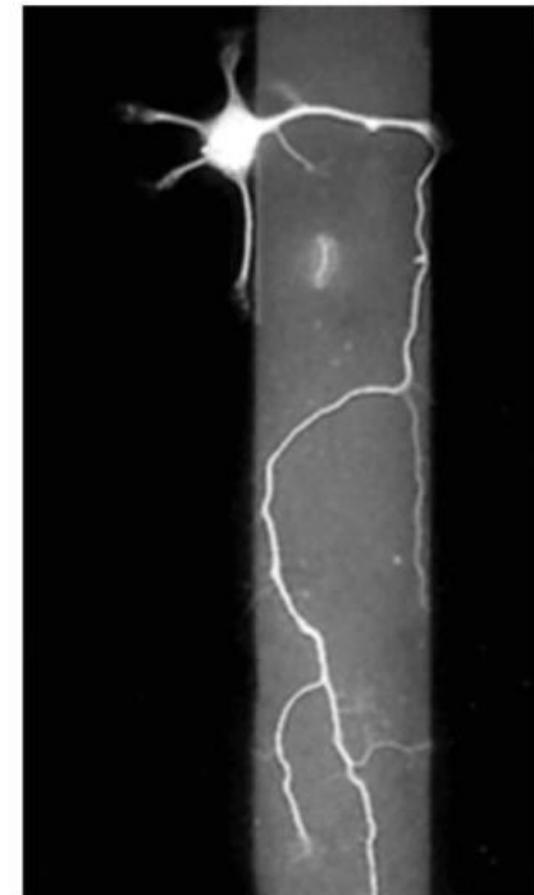
A

Dendrites

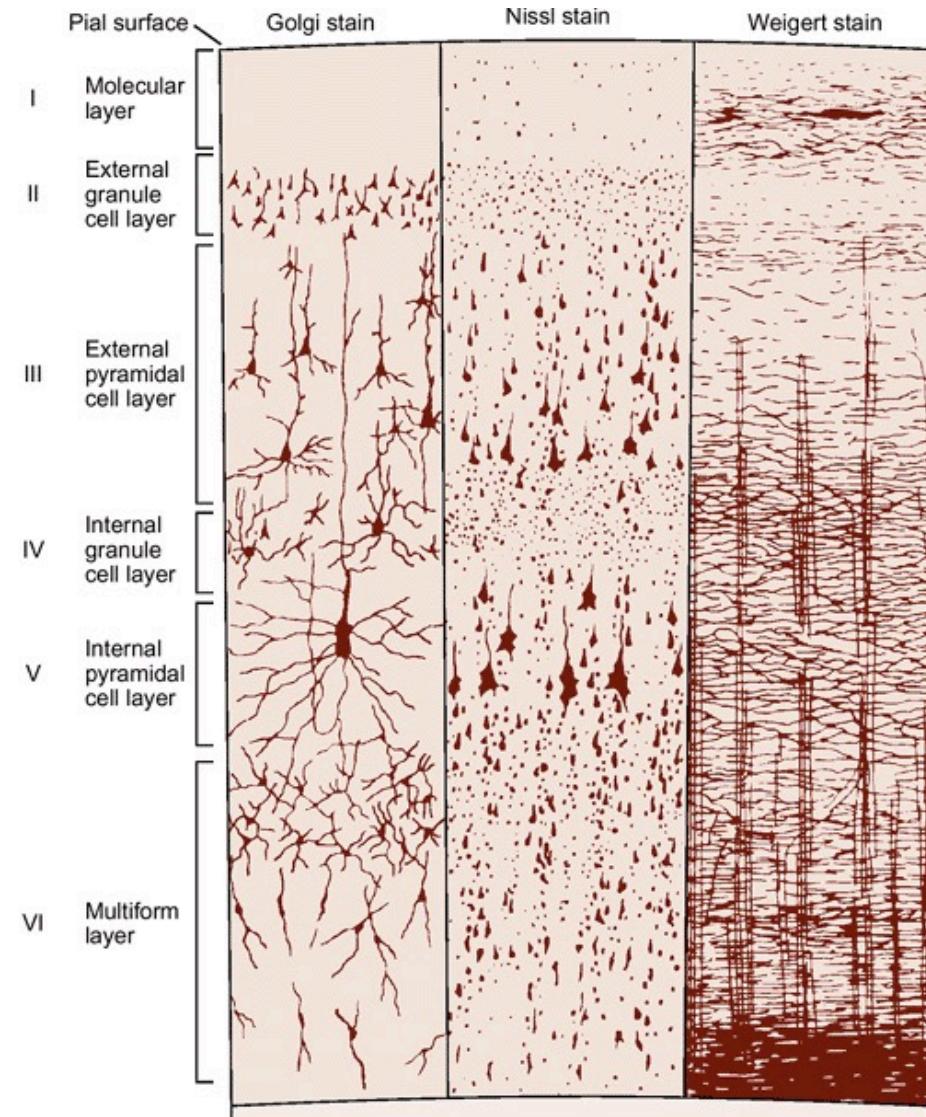
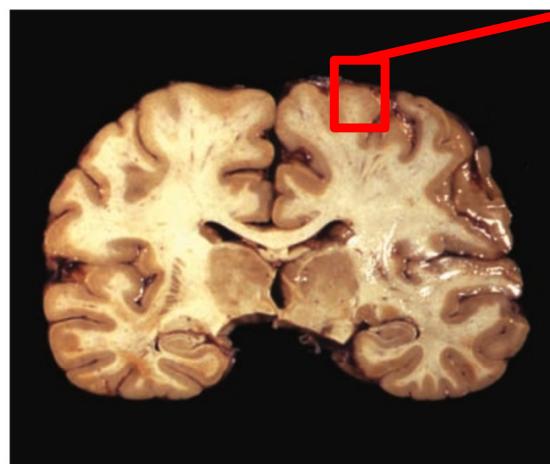
Axons



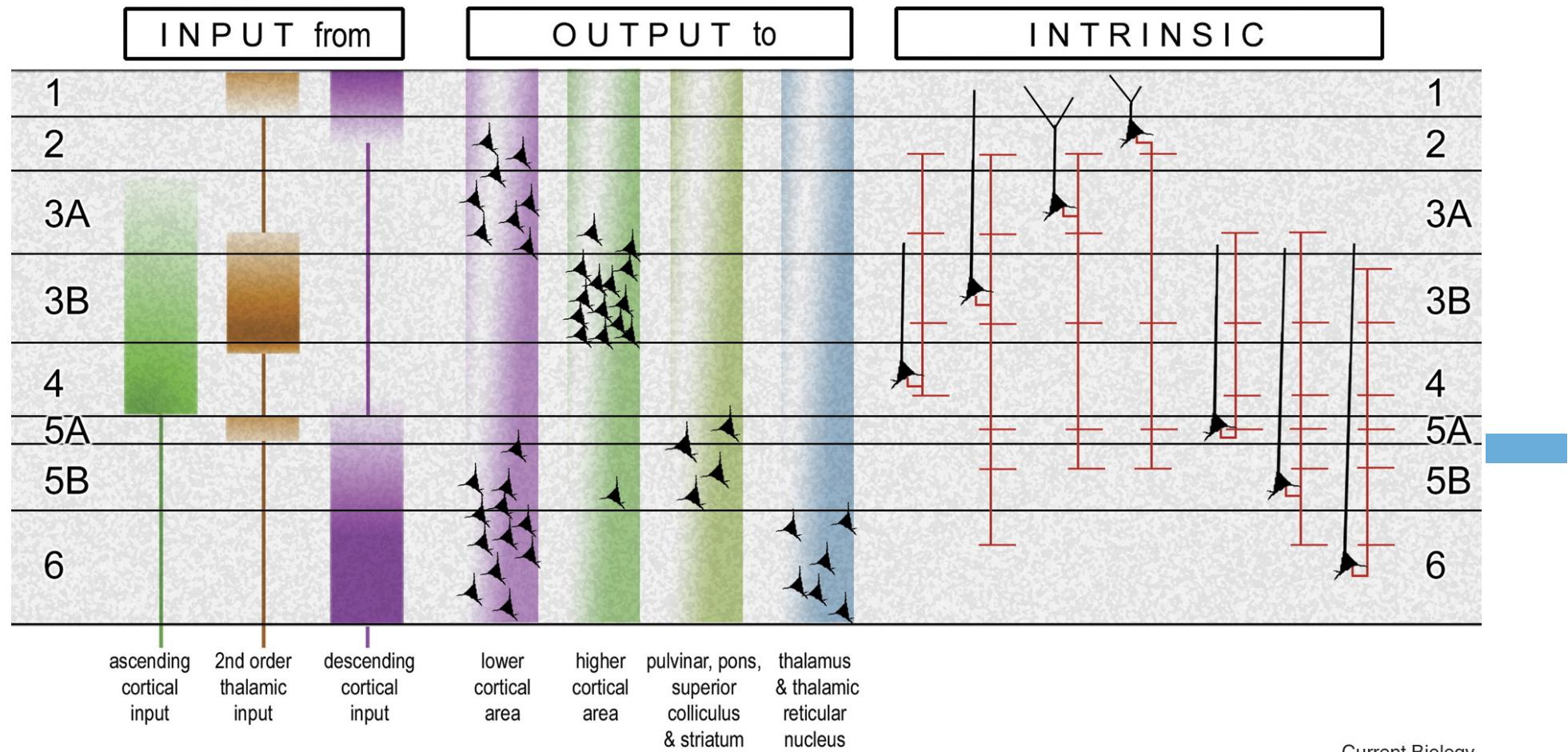
B



Structure of the neocortex



Structure of the neocortex

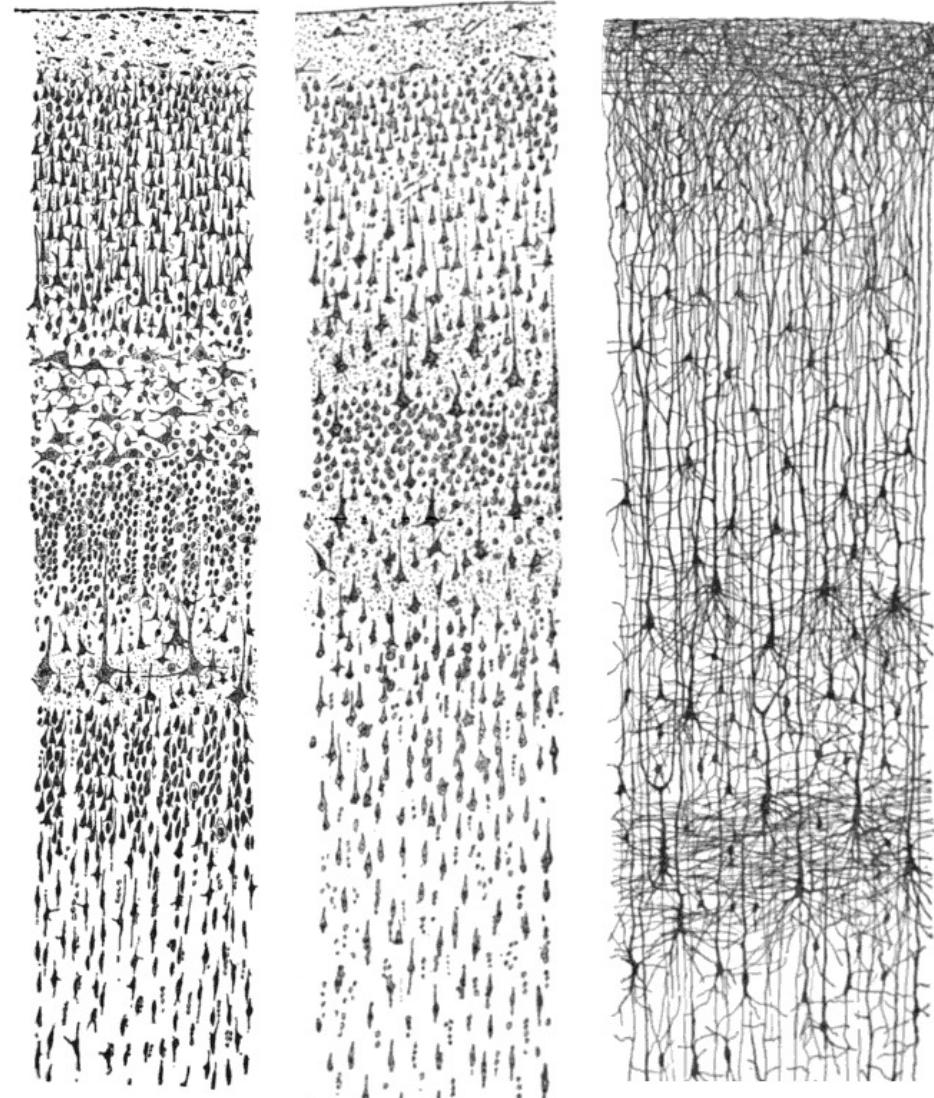


Interim Summary: Structure of the Neocortex

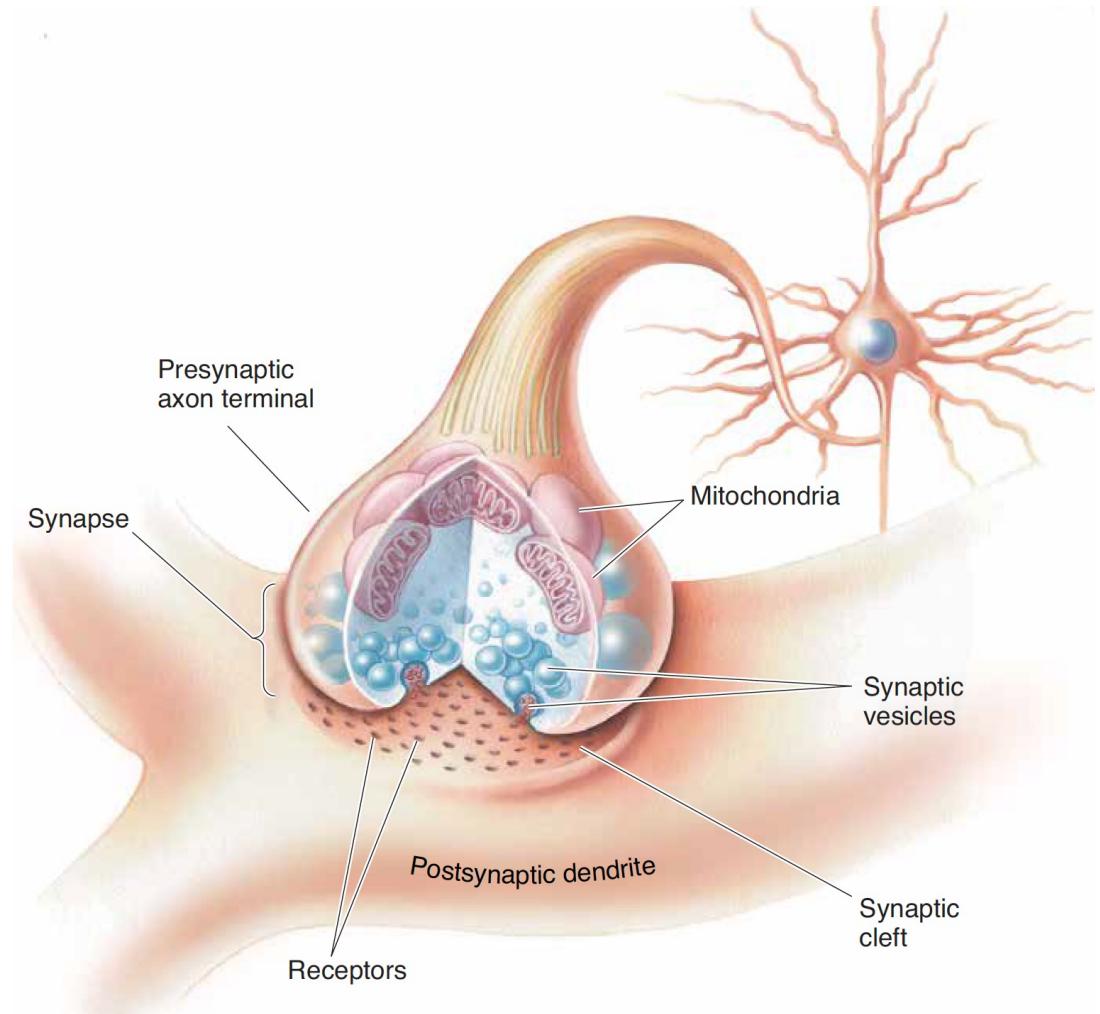
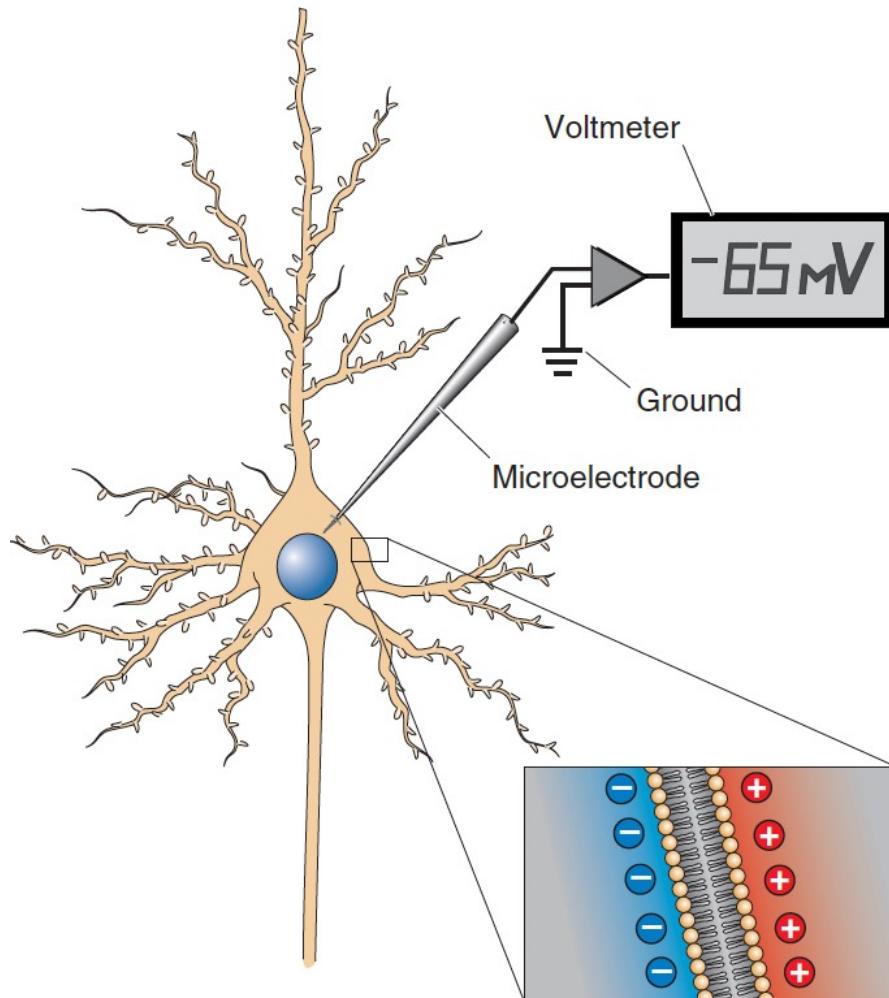
C | A | U

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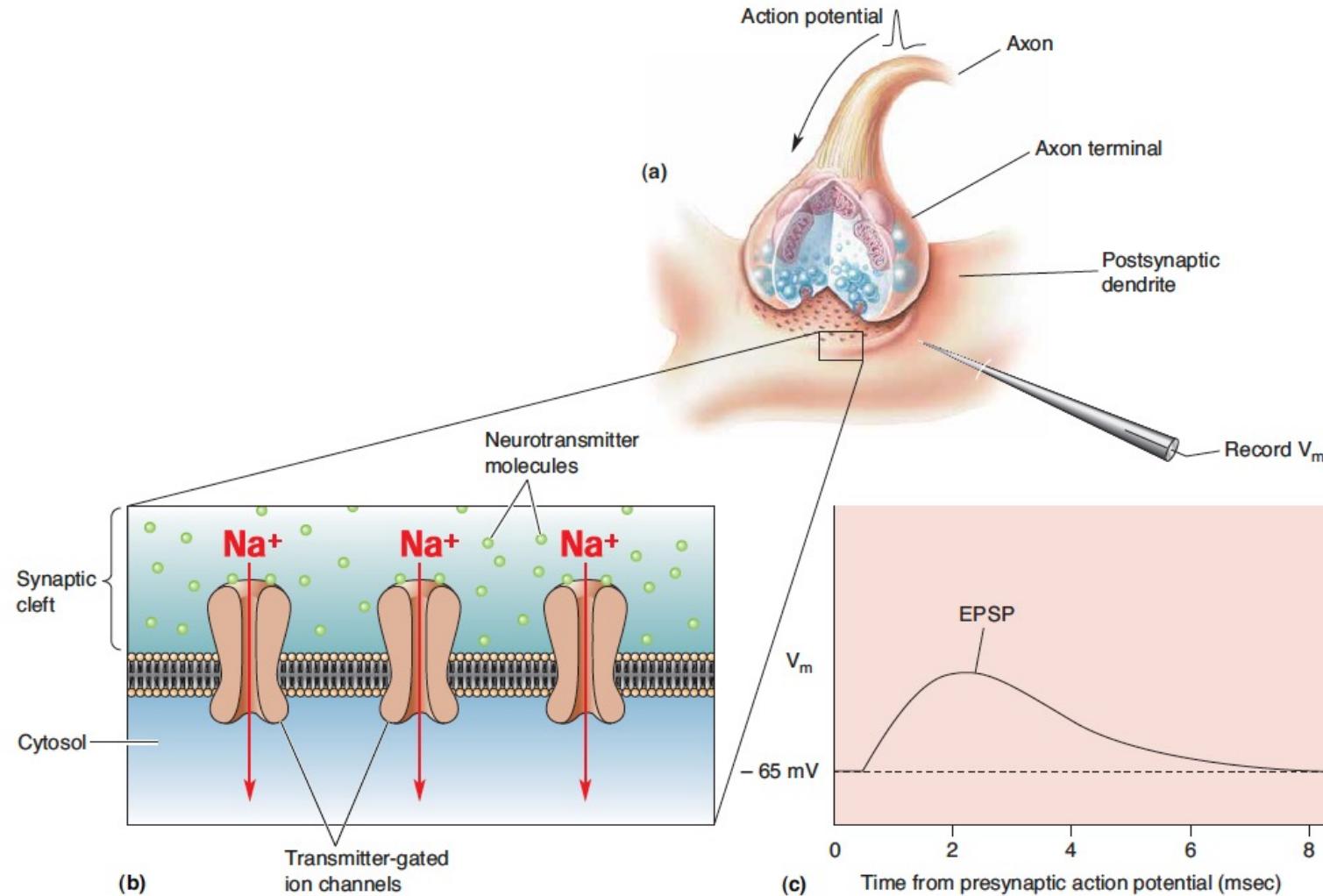
- Gray matter consists of (usually) 6 layers of neurons
- Different layers serve different purposes
- White matter consists of axon fibre bundles



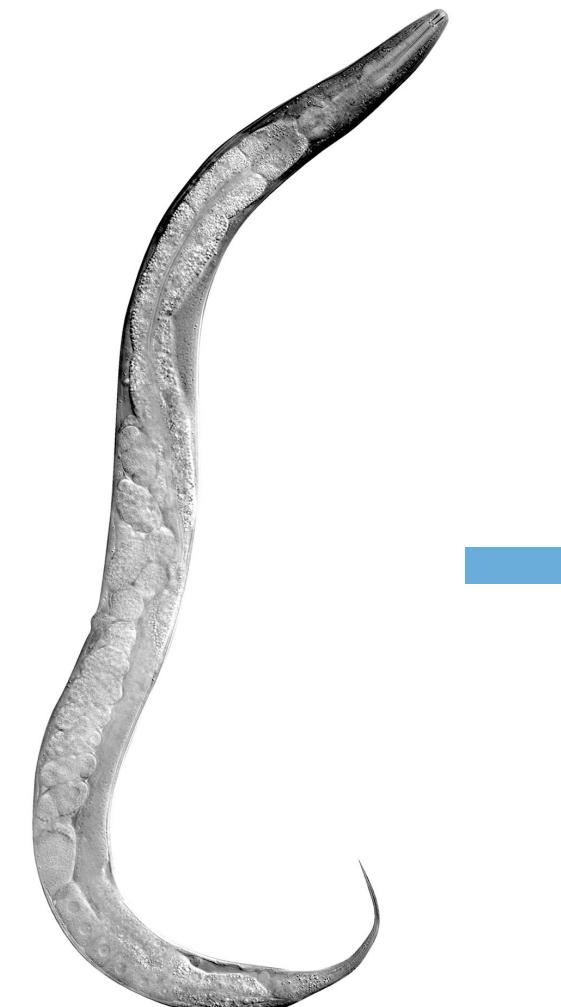
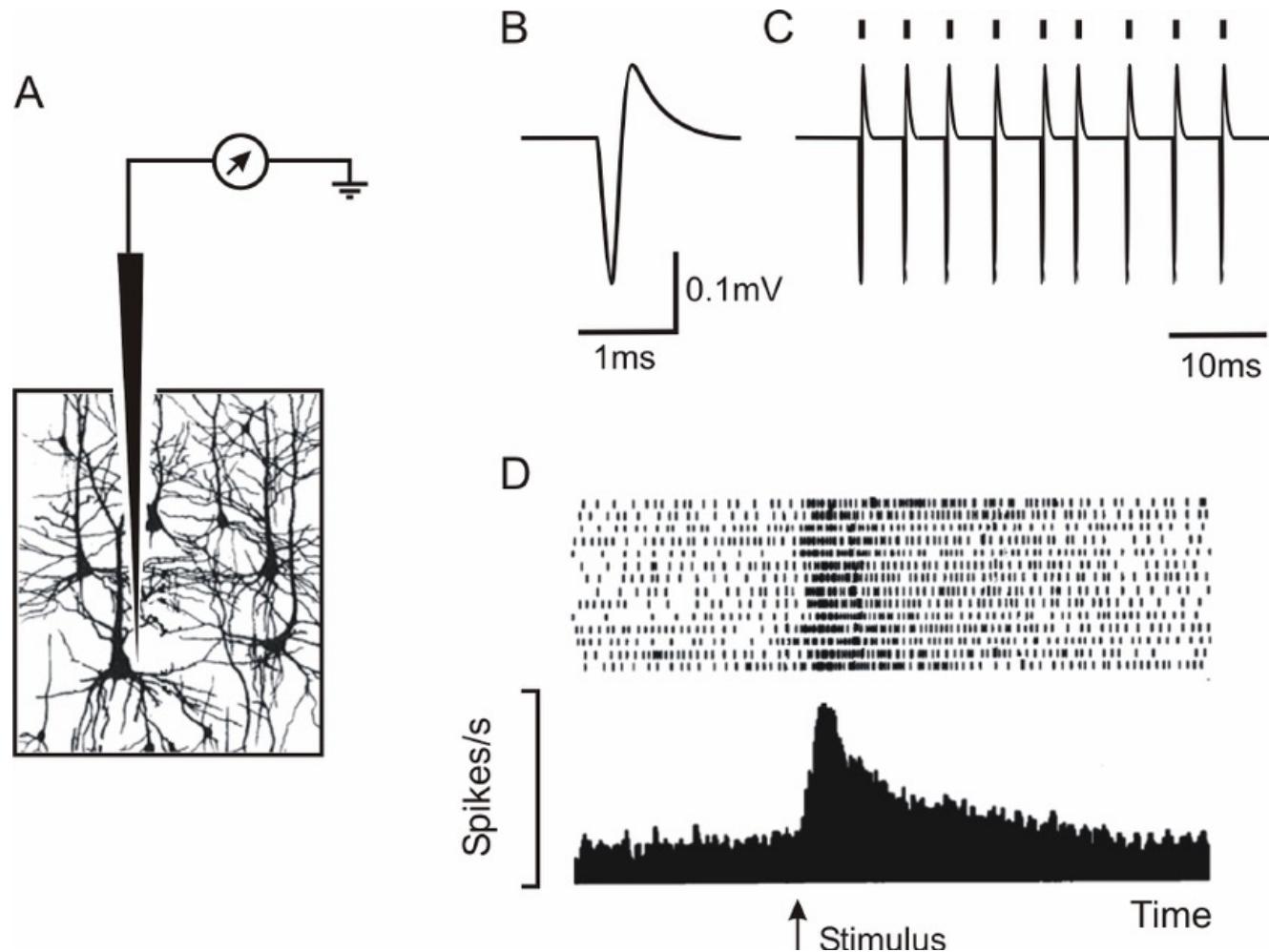
Neural Signals



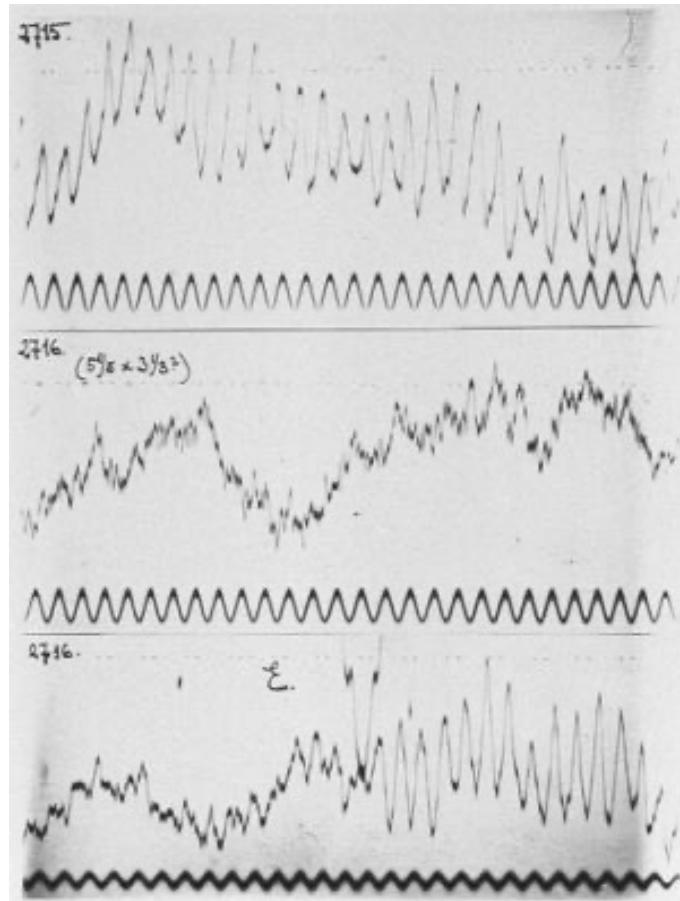
Neural Signals



Single cell recordings



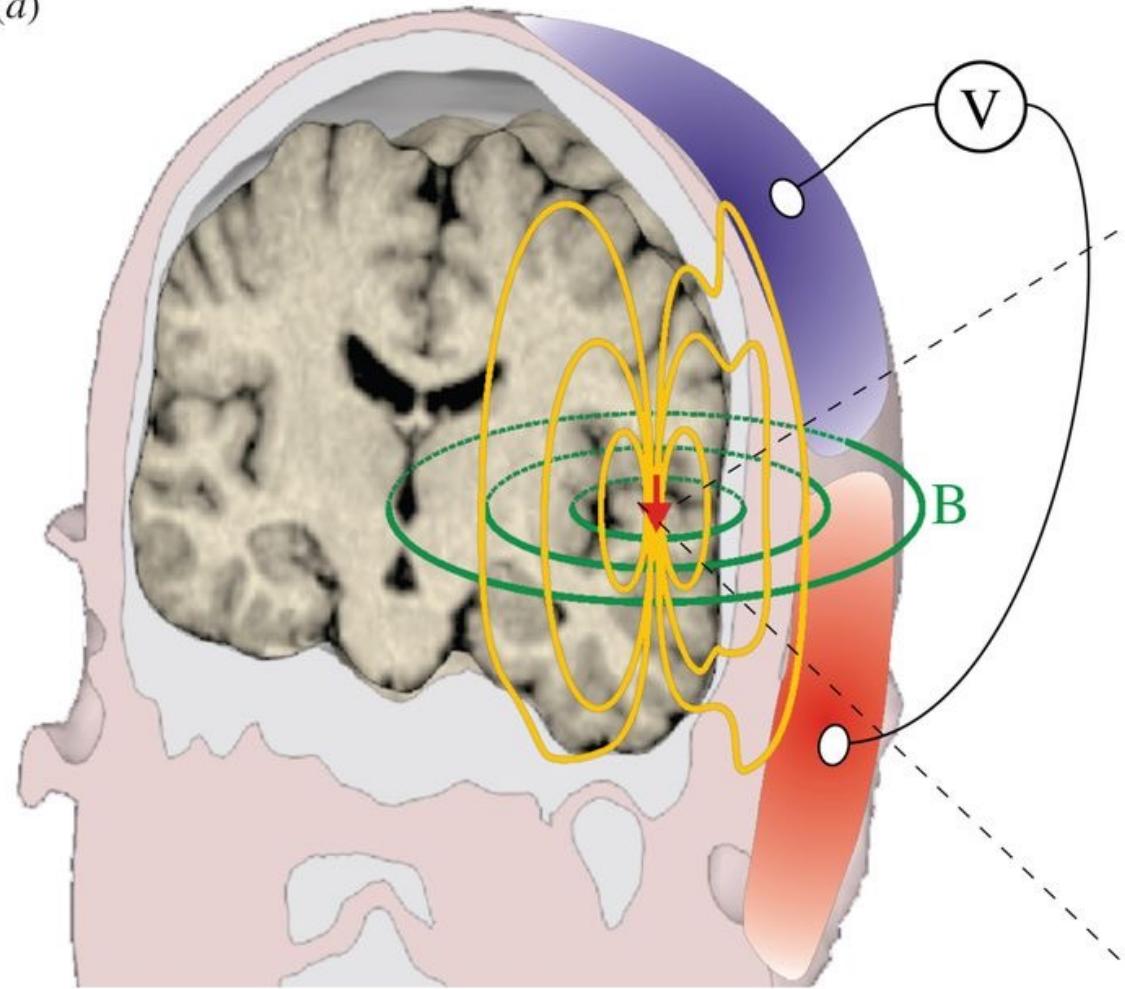
Scalp recordings: History



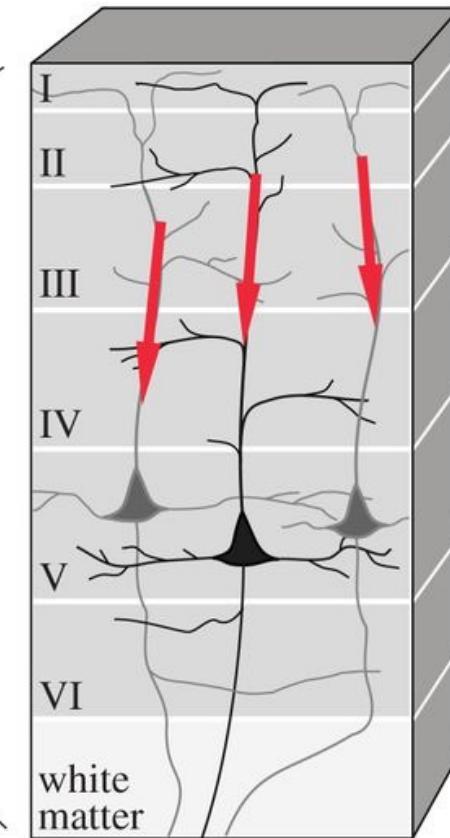
Berger, 1929

Electrophysiology

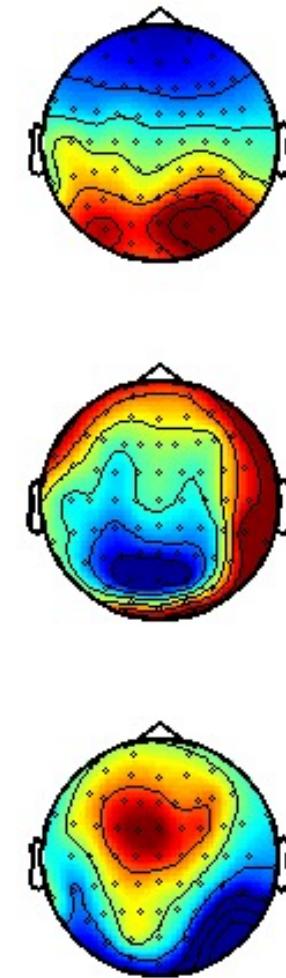
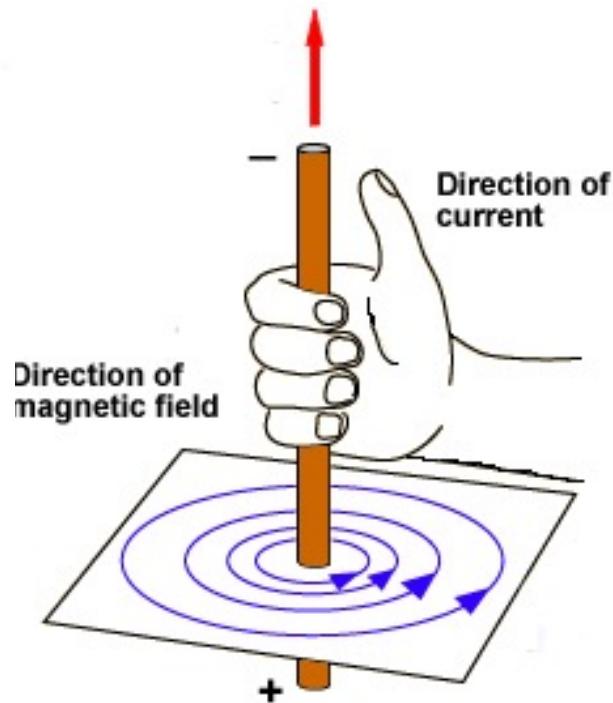
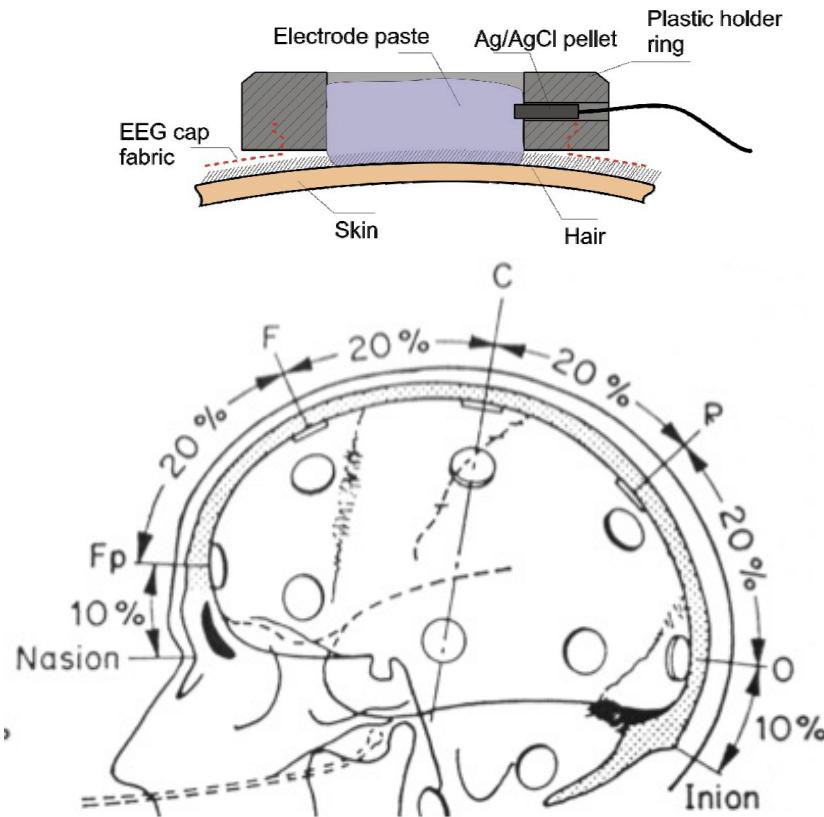
(a)



(b)



Electrophysiology

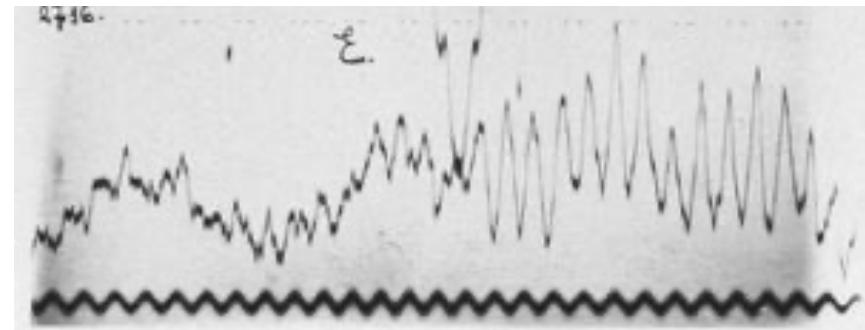
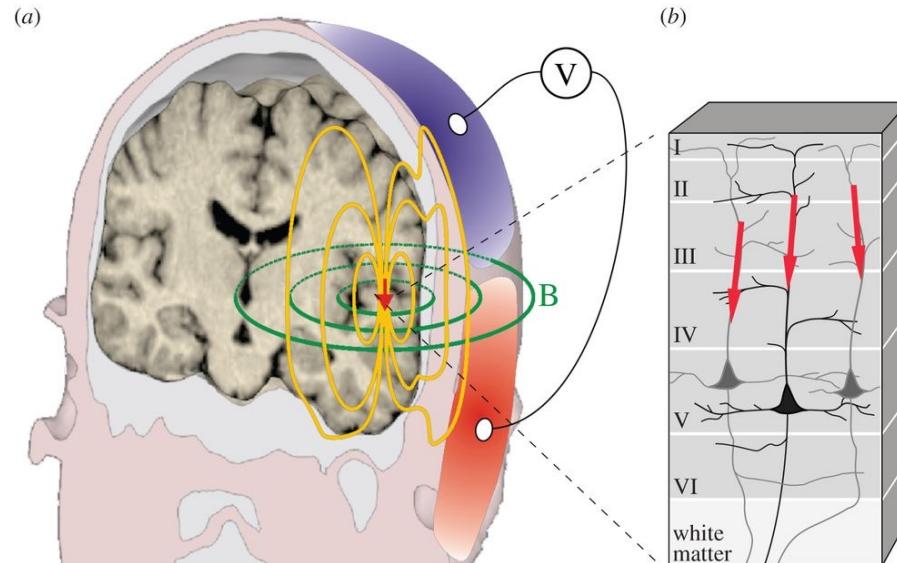


Interim Summary: How is information transported and how can we record it?

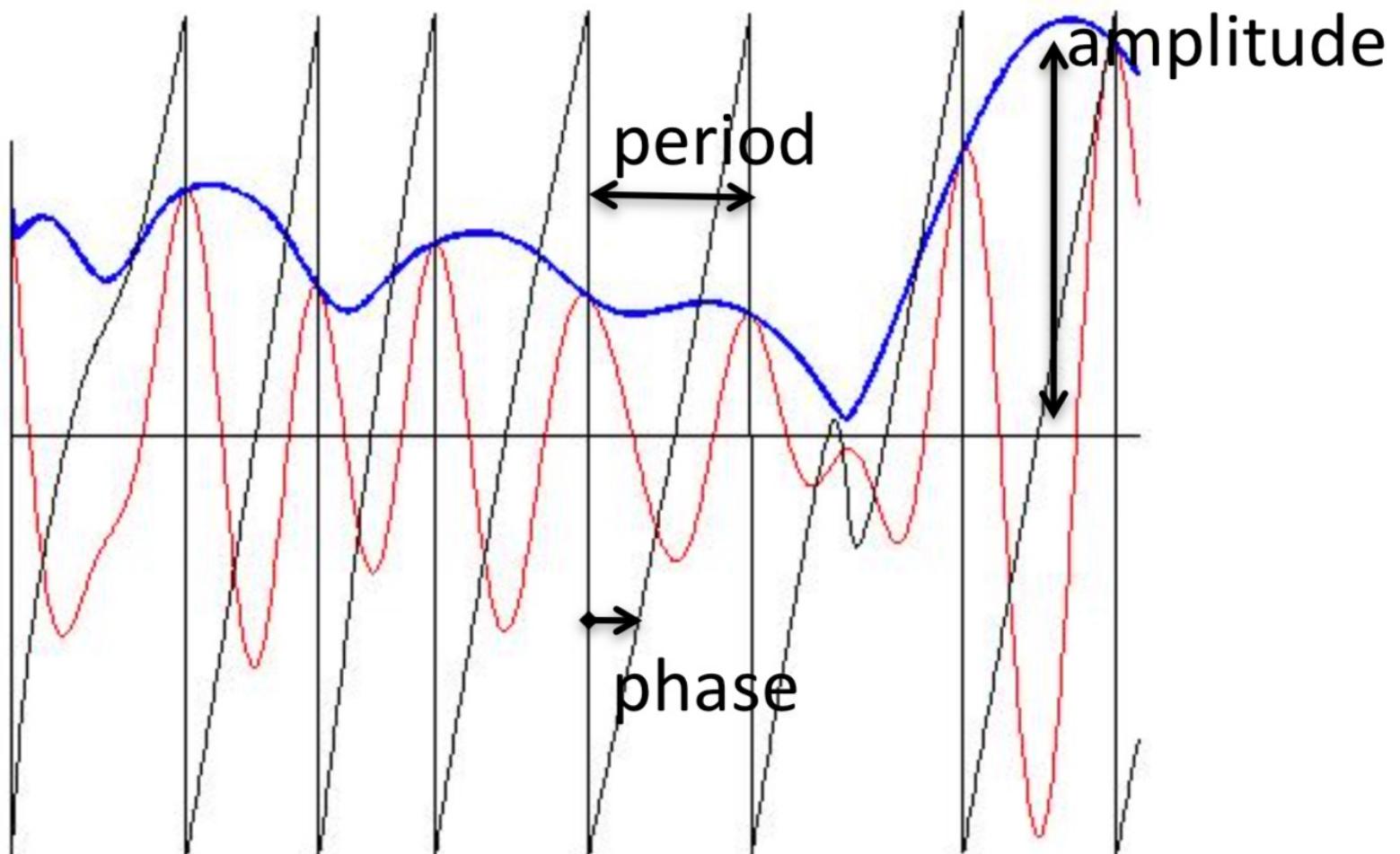
C | A | U

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- Neurons communicate by electrical signals
- Electrical signals encode information
- Summed electrical signals at the dendrites can be recorded through EEG
 - Rhythmic changes in local activity

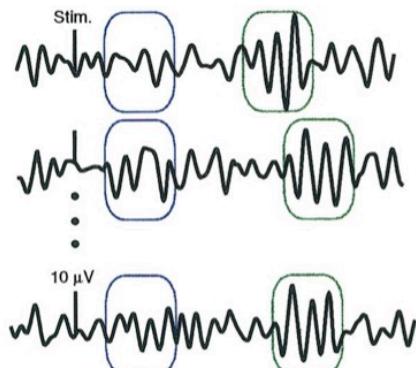


Neural Oscillations

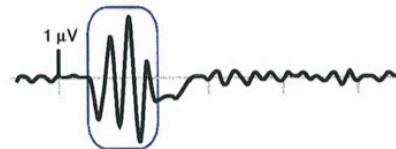


Neural Oscillations

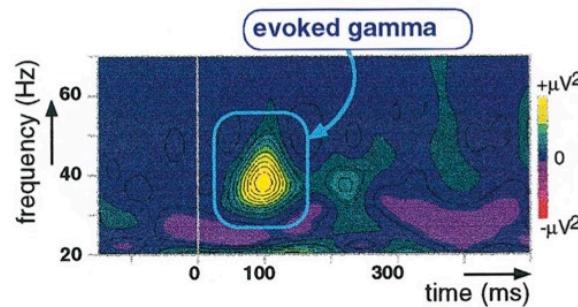
A Single-trials



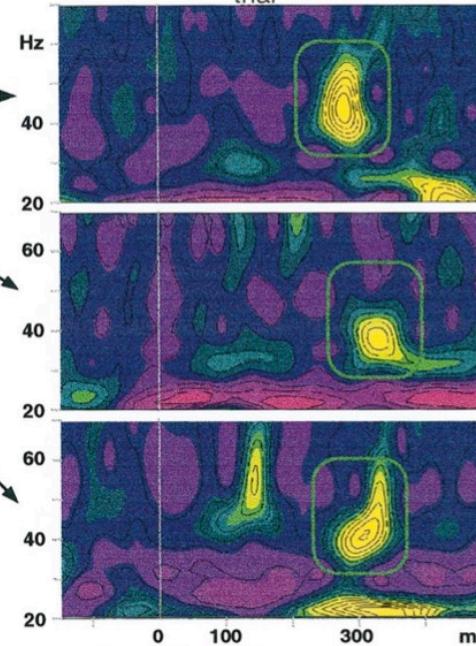
B Time average : evoked potential



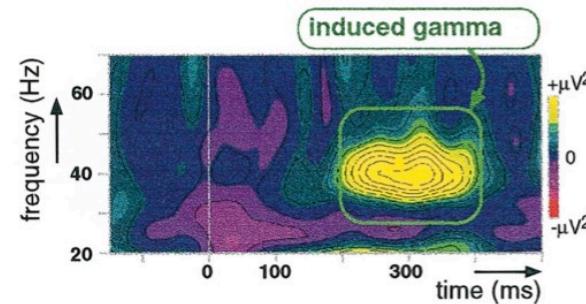
C Time-frequency power of the evoked potential



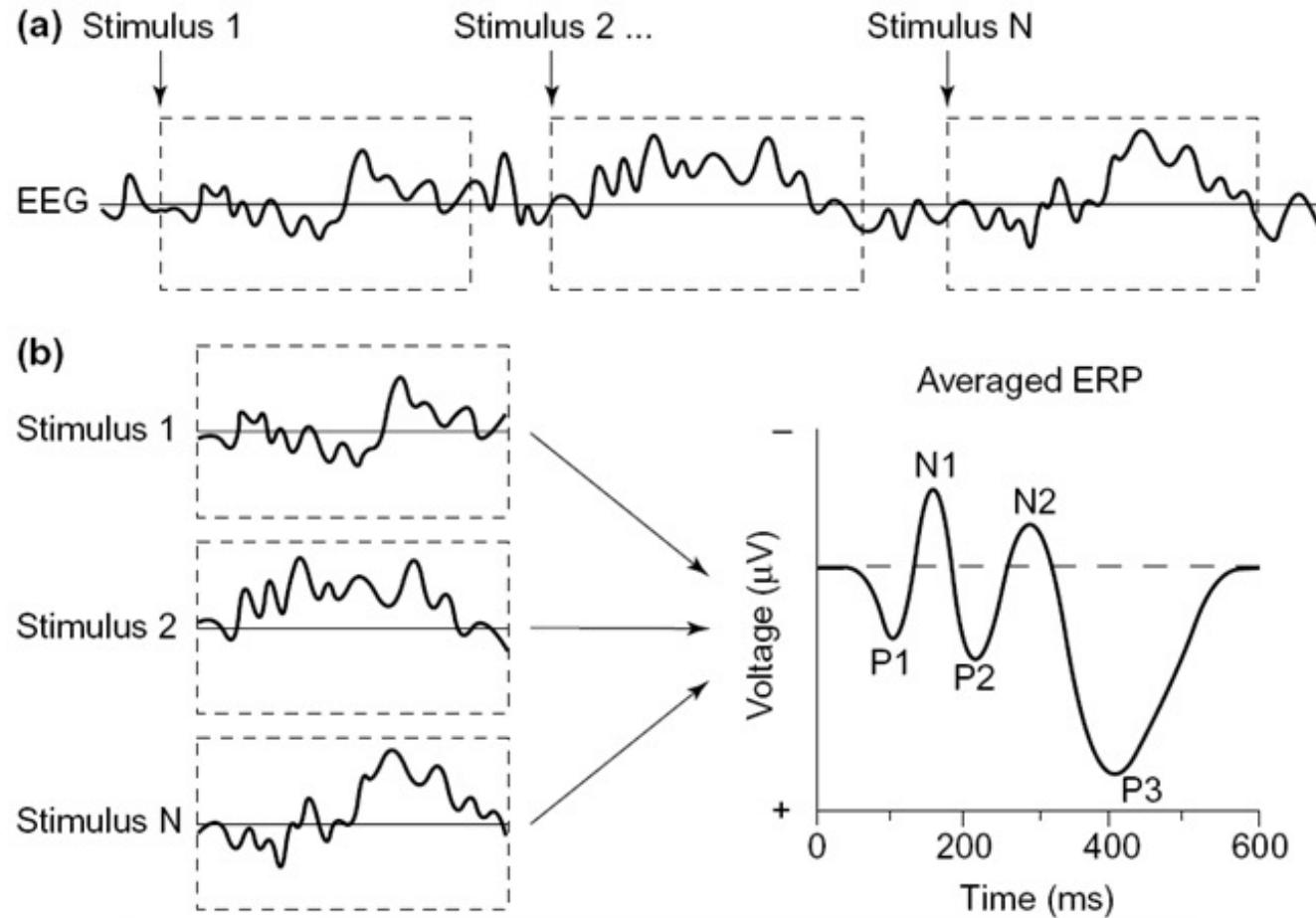
D Time-frequency power of each single trial



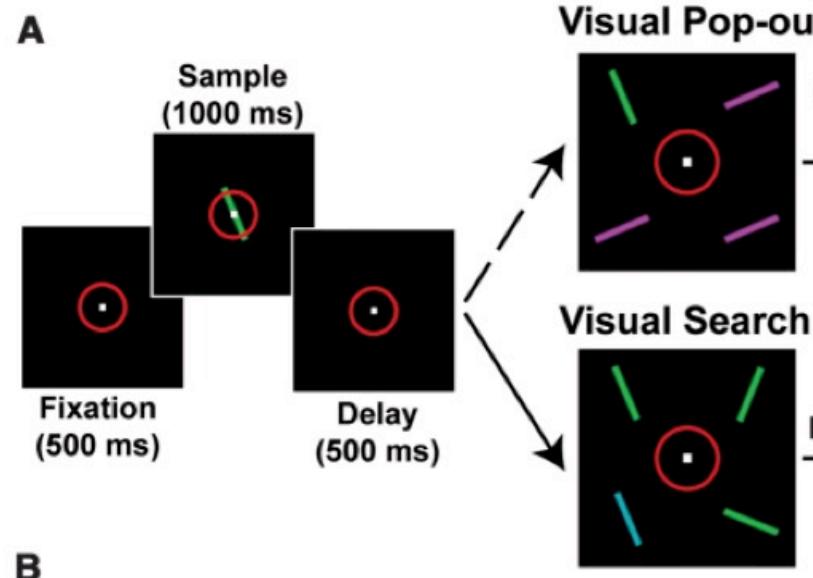
E Time-frequency power average



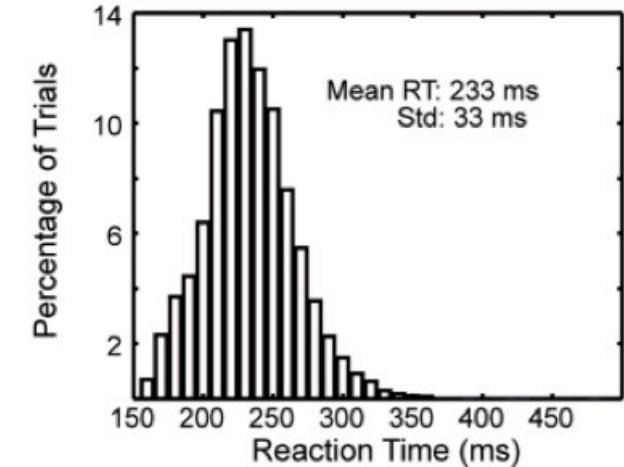
Neural Oscillations: Evoked Potentials



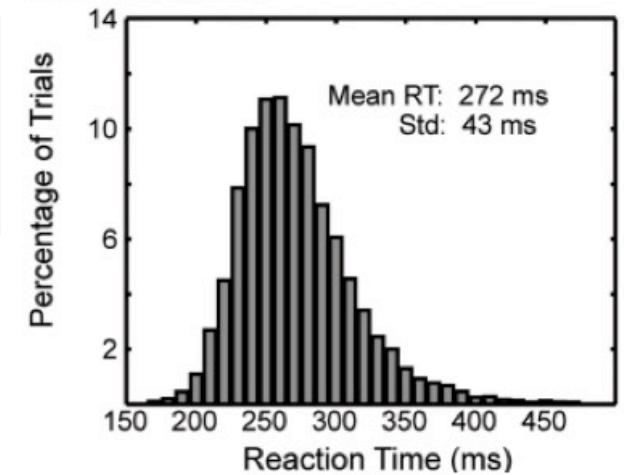
Visual Perception



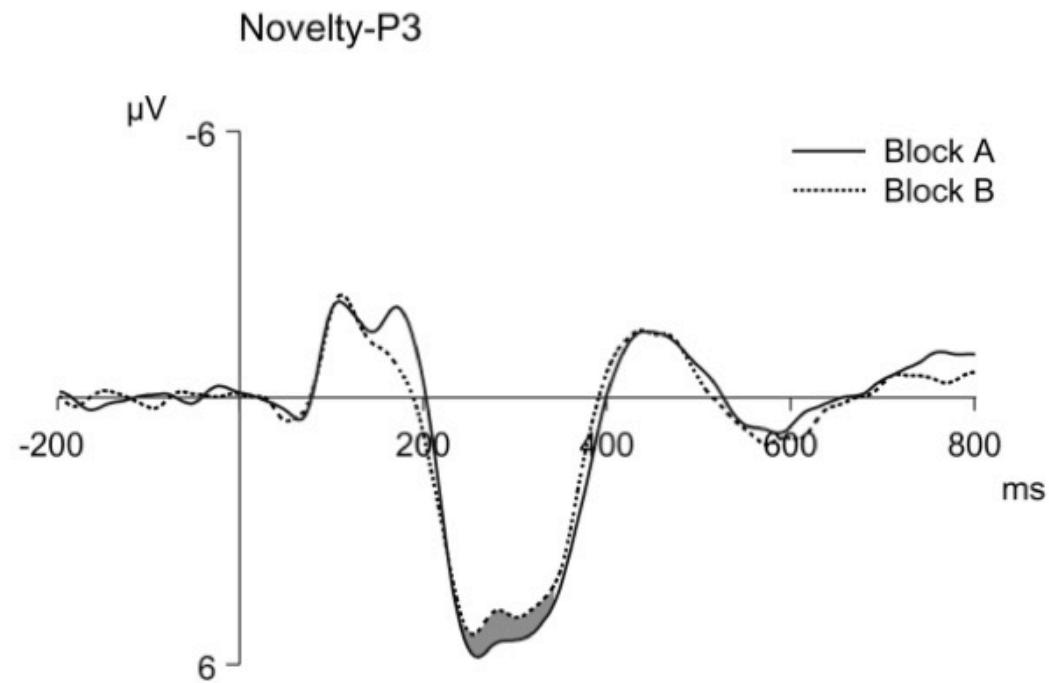
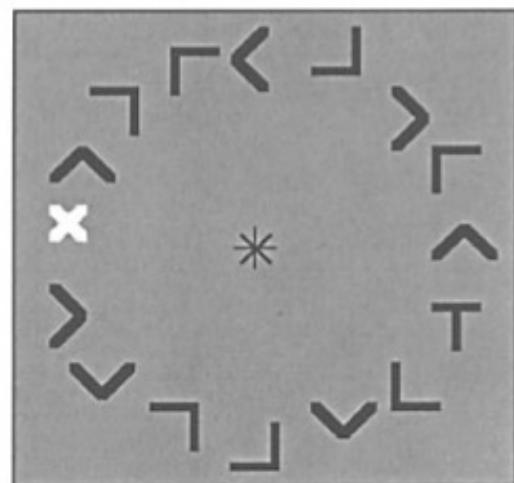
Visual Pop-out



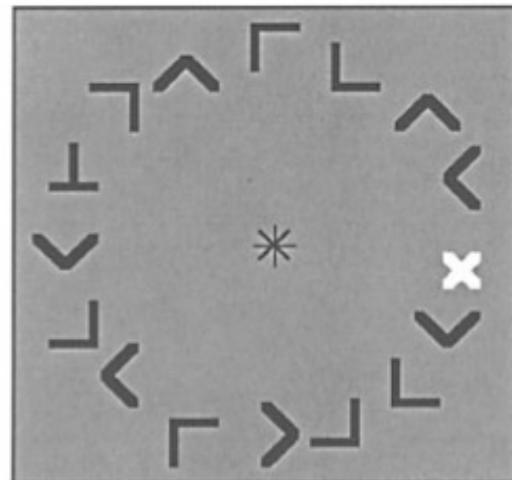
Visual Search



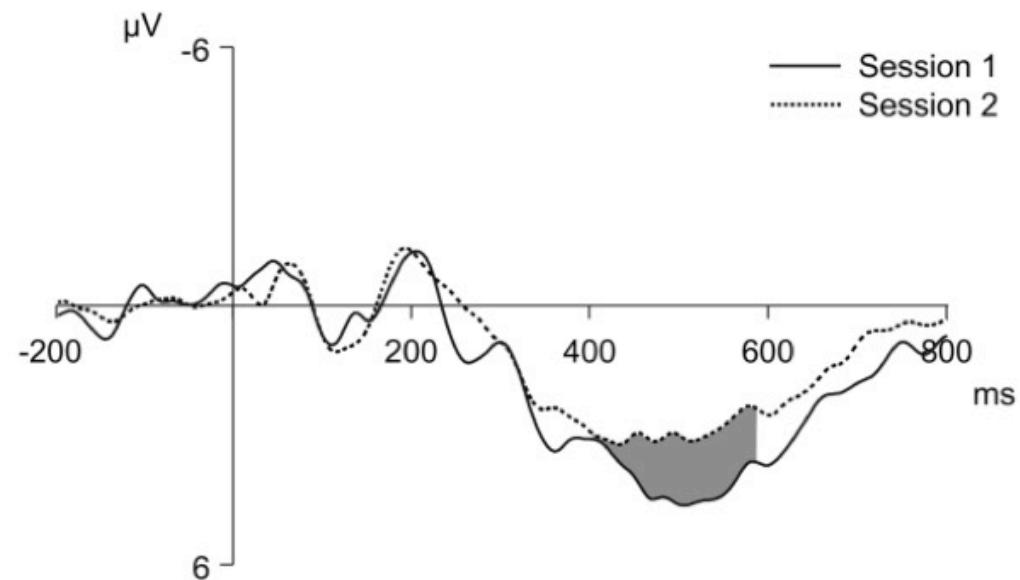
Visual Pop-put



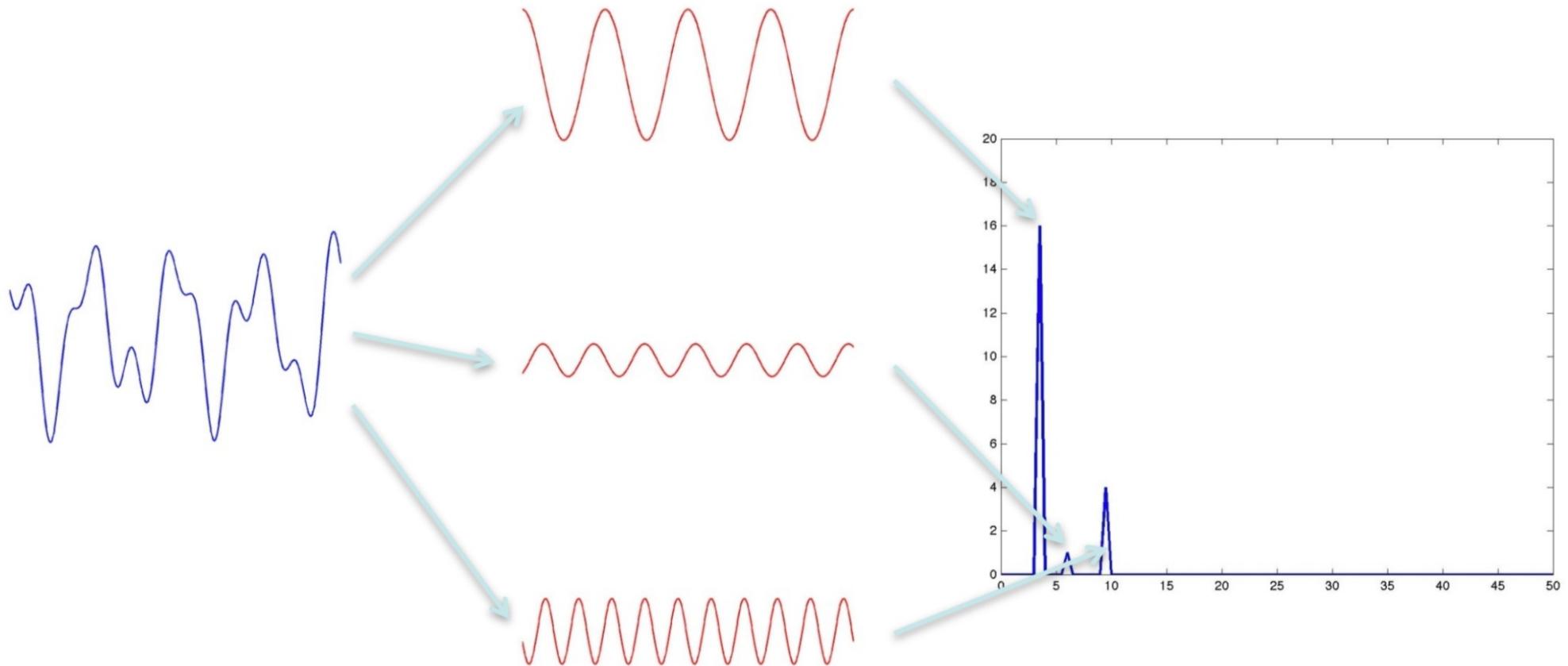
Visual Search



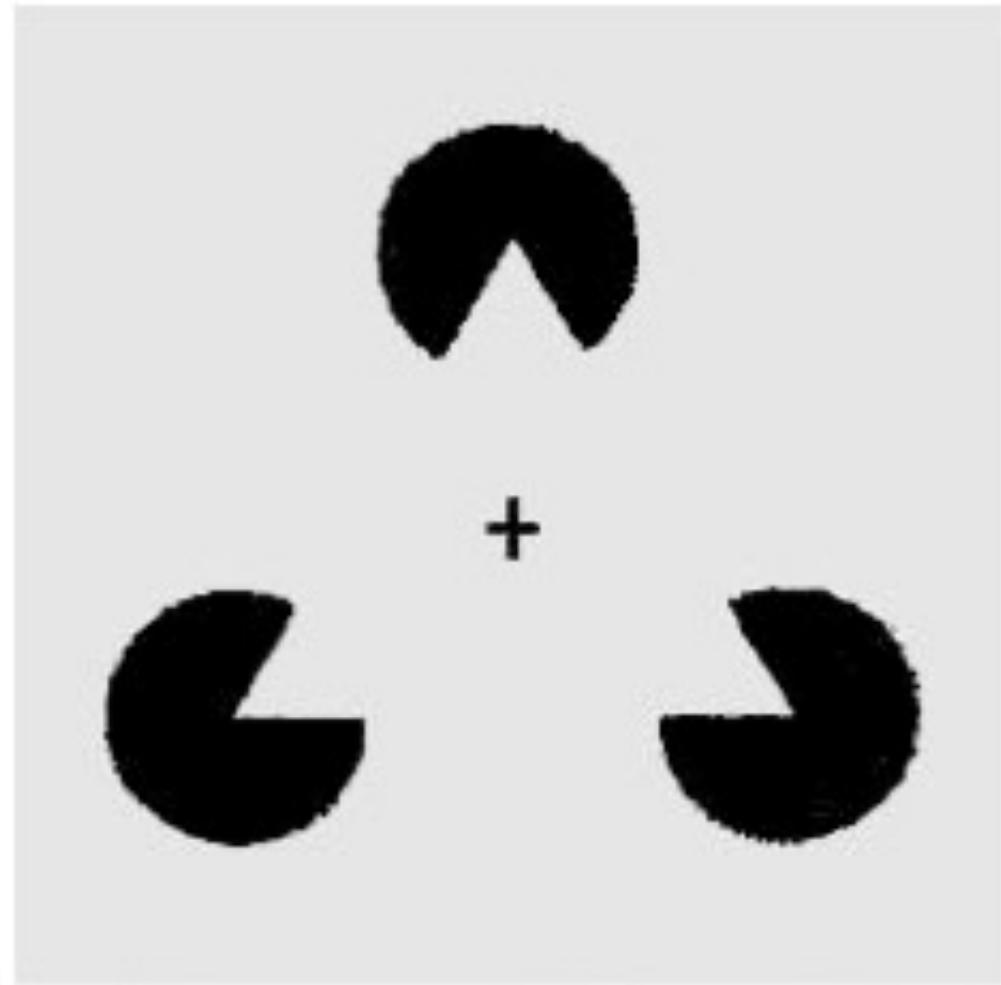
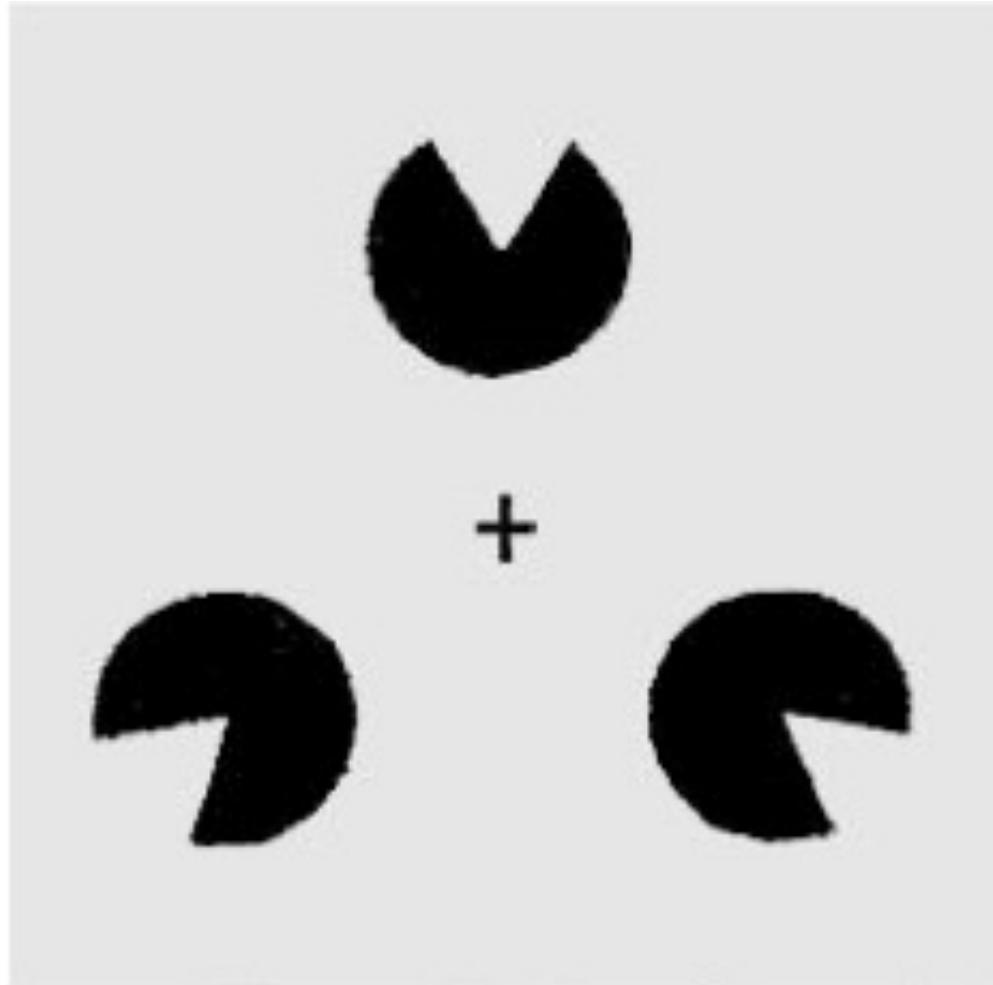
Target-P3



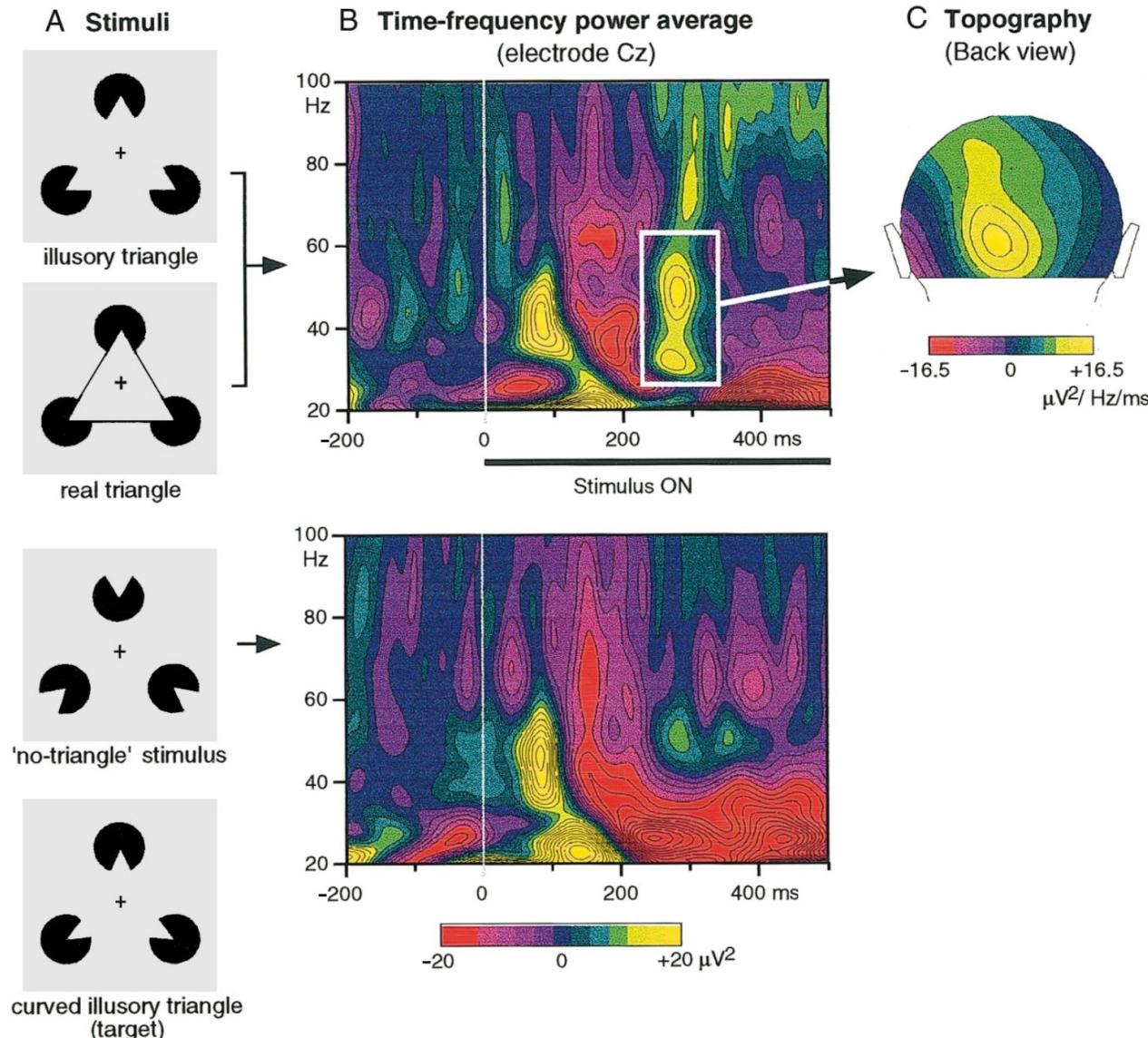
Fourier Analysis



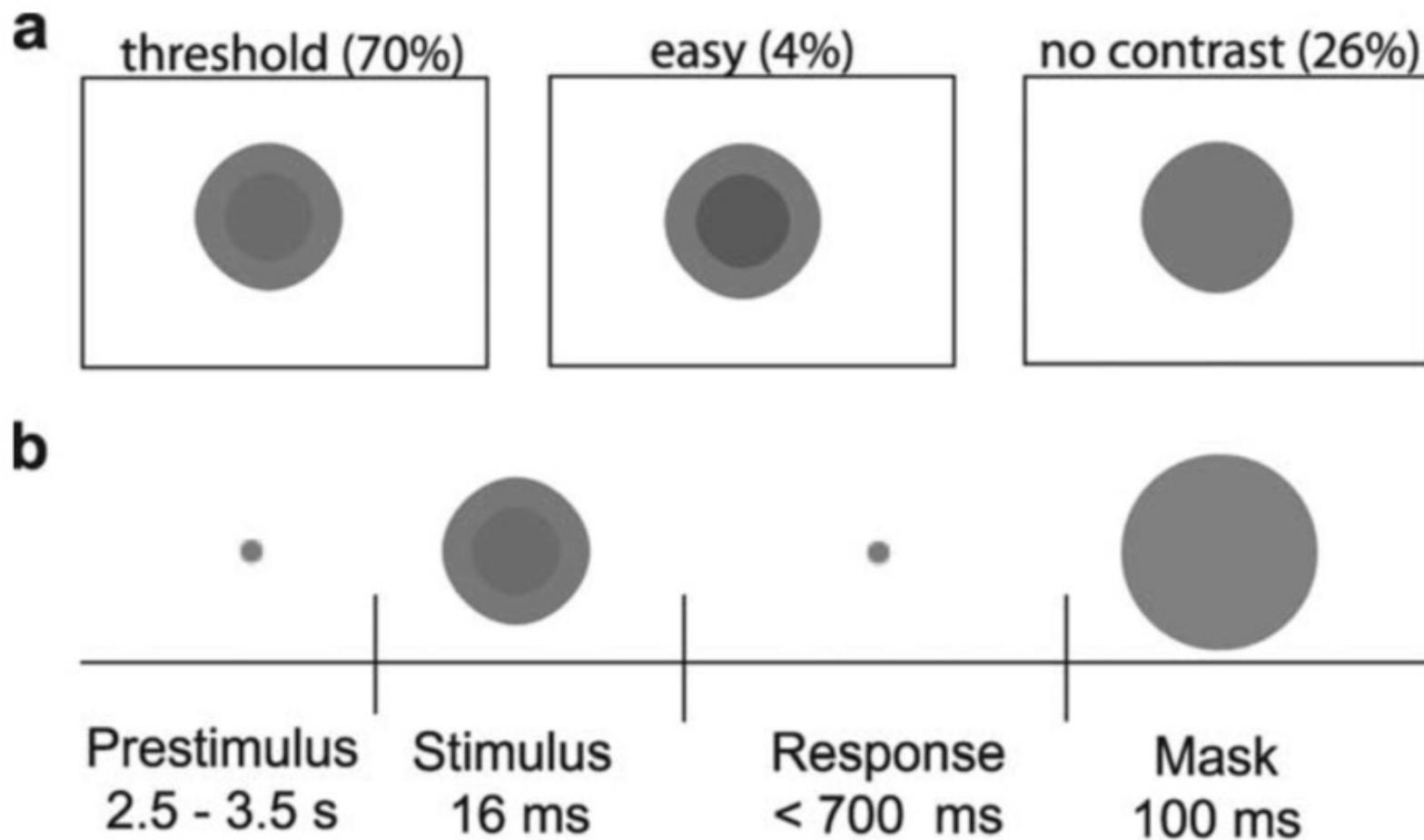
Visual Perception



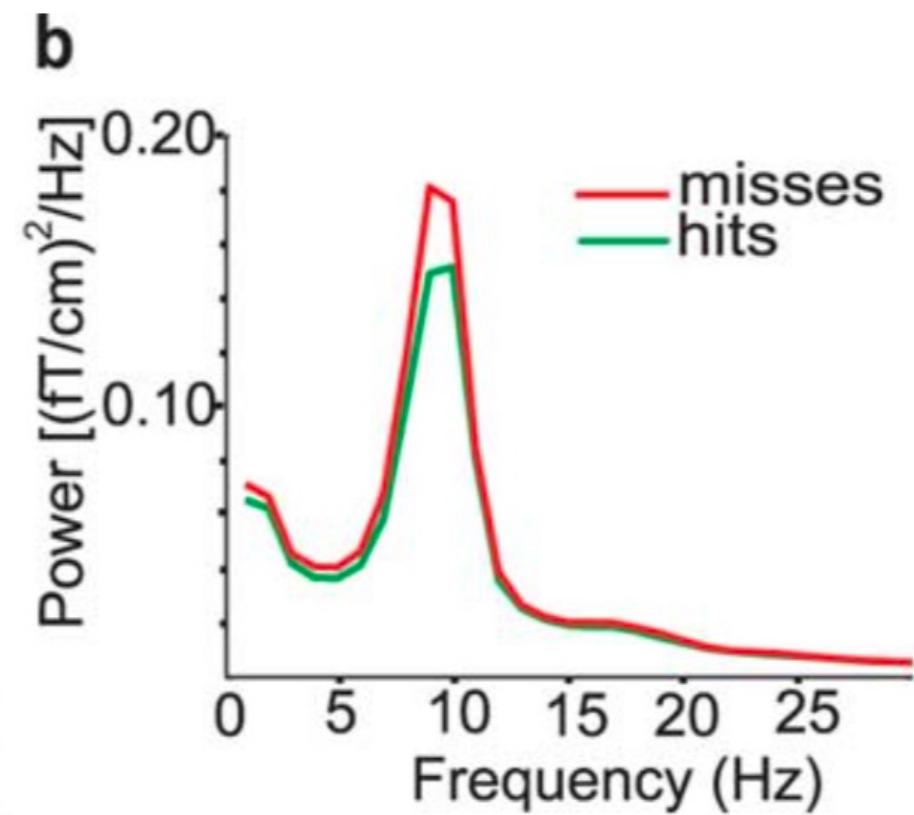
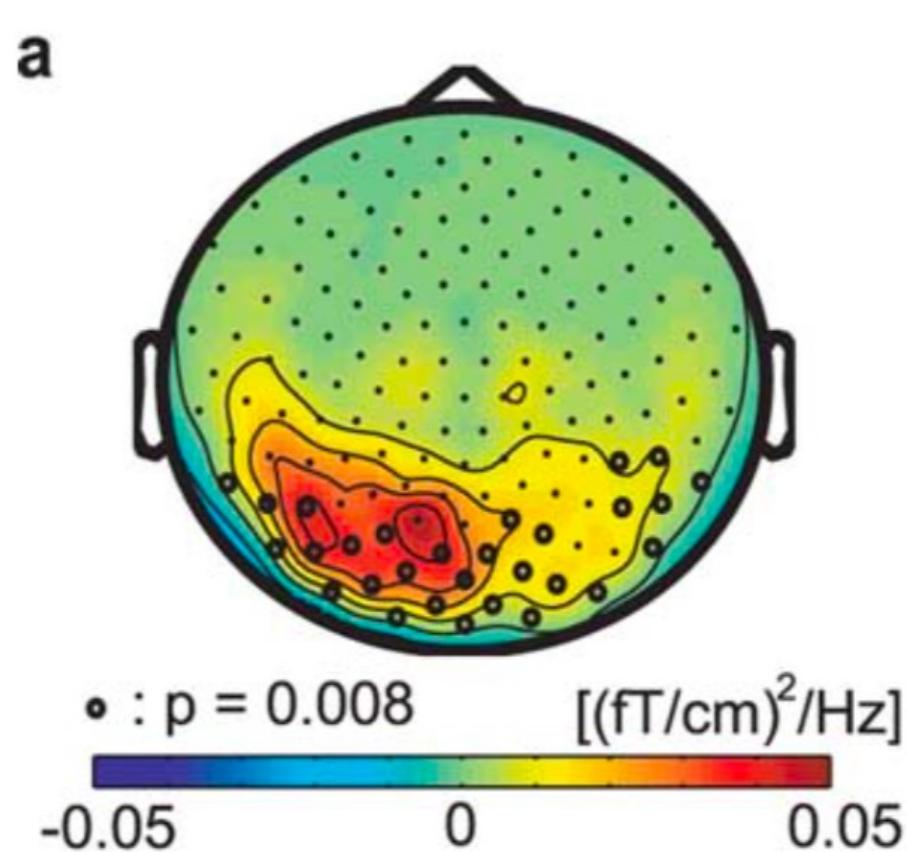
Neural Oscillations: Induced Potentials



Visual Detection

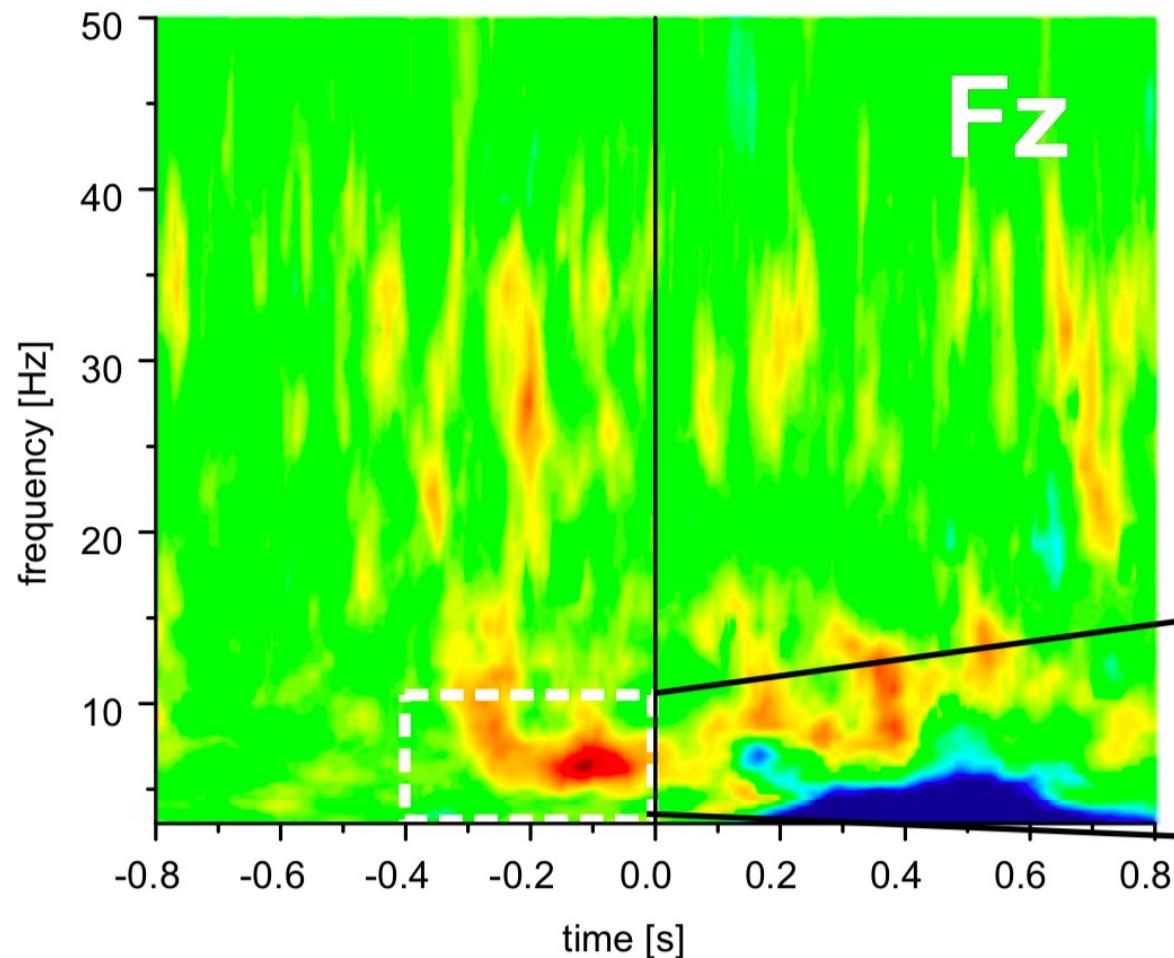


Influences on visual perception

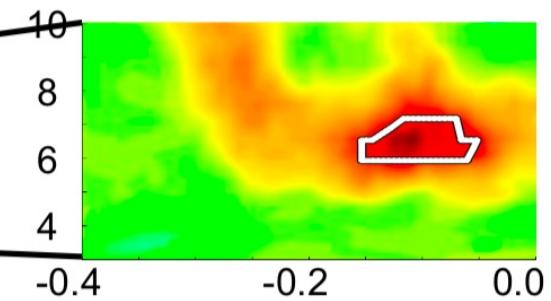
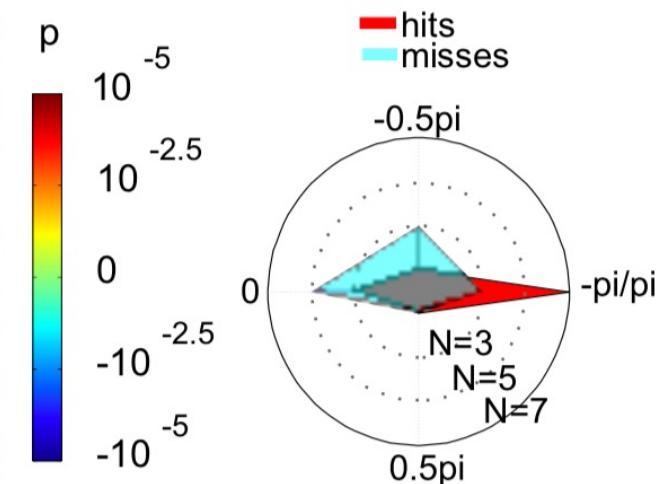


Influences on visual perception

B

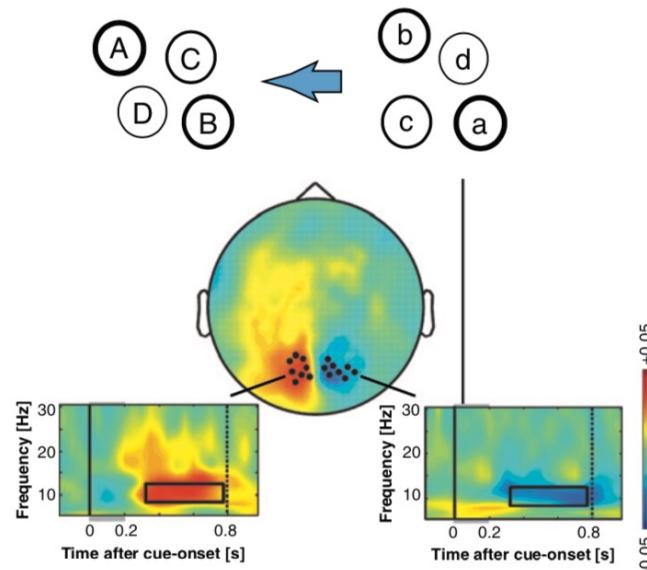


Phase bifurcation index

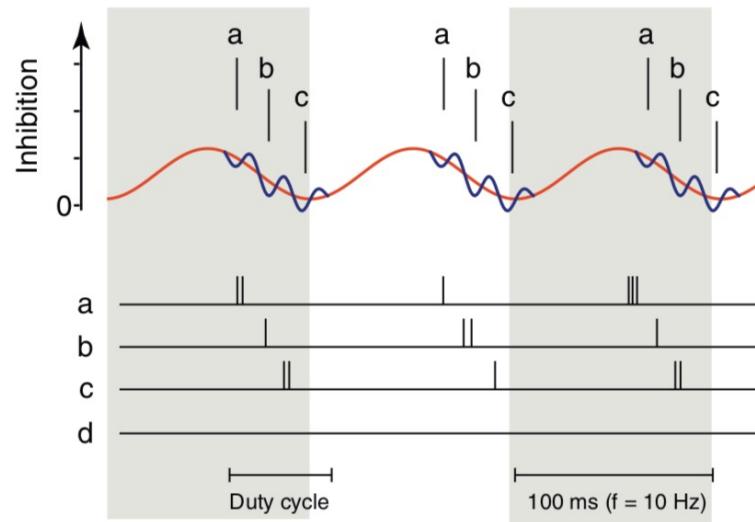


Influences on visual perception: Attention

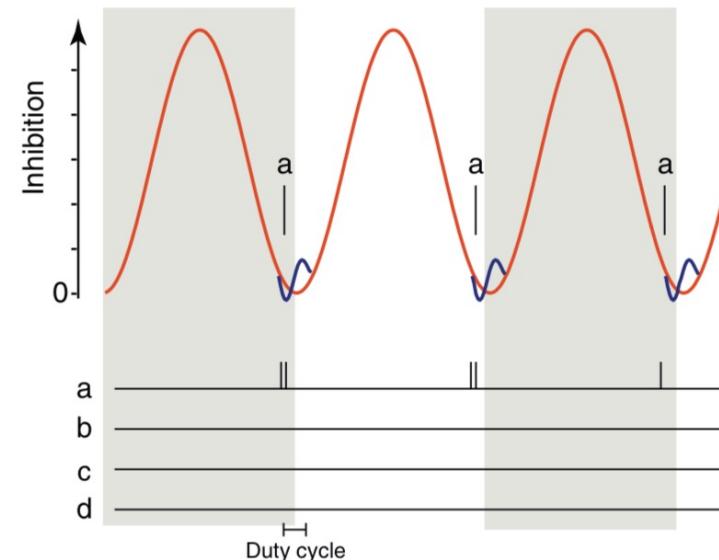
(a)



(b) Medium alpha ('medium attention')



(c) High alpha ('low attention')

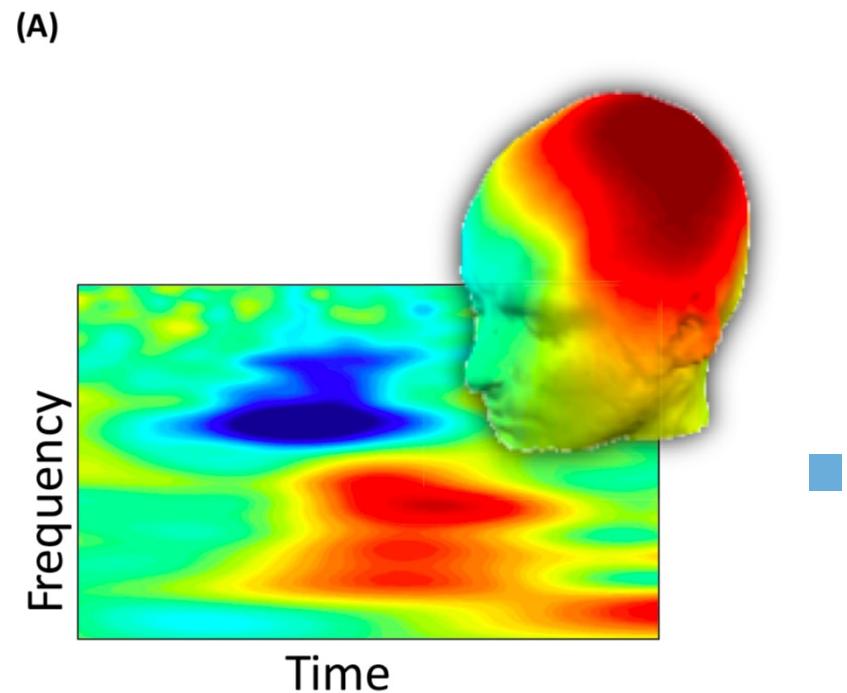


Summary: Role of neural oscillations for cognition

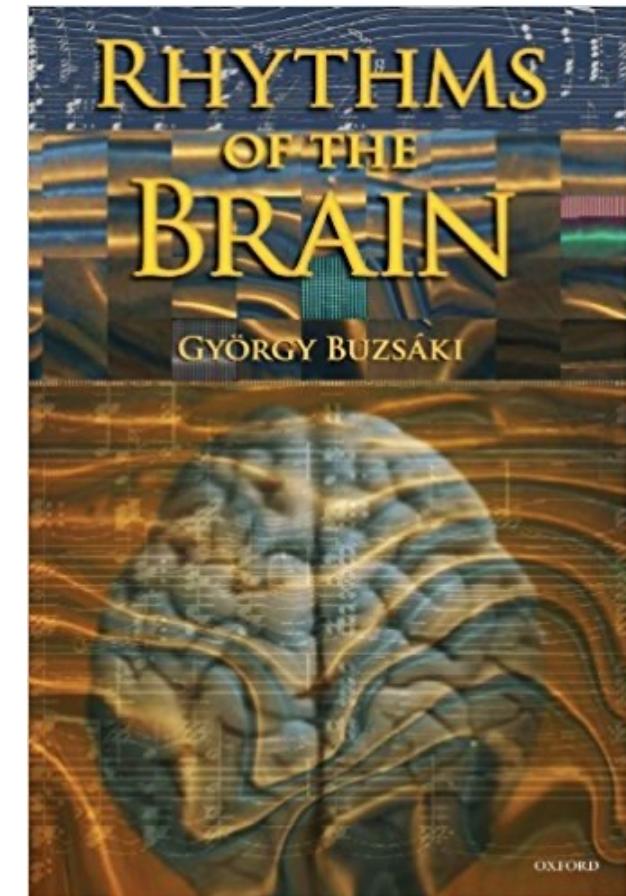
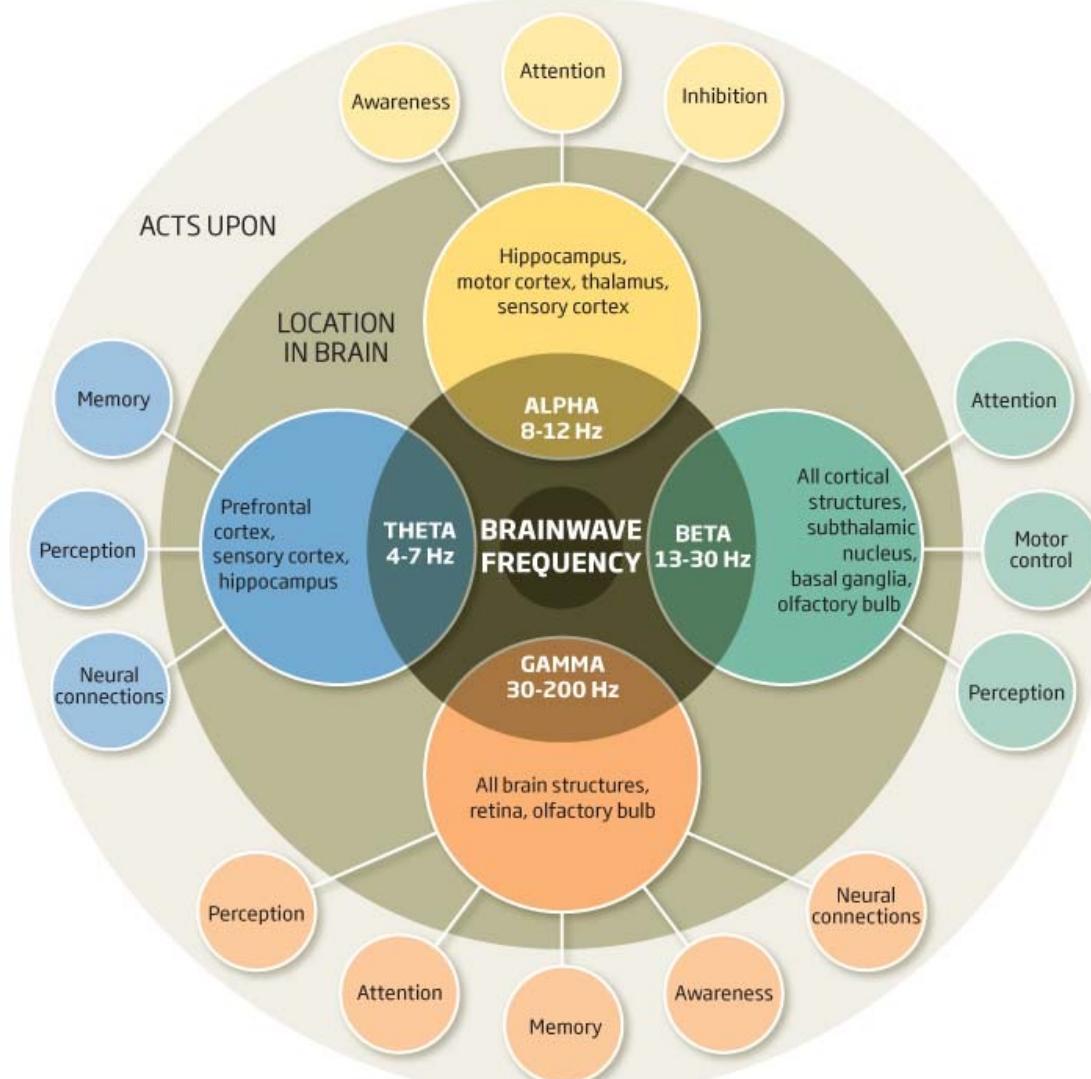
C | A | U

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- Changes in summed postsynaptic potentials encode stimulus processing and cognitive processes
 - ERPs are summed fixed-latency (same phase) signals
 - Time-frequency analysis can recover time-varying amplitude changes
- Changes in neural activity influence perception and cognition



Summary



References

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