

A cheatsheet for computational neuroscientists

Yifan Gu

School of Physics and ARC Centre of Excellence for Integrative Brain Function,
University of Sydney, NSW 2006, Australia

770-2900 $\mu\text{m}/\text{ms}$	conduction speed of action potential in myelinated axons in the cortex [3]
250-380 $\mu\text{m}/\text{ms}$	conduction speed of action potential in unmyelinated axons in the cortex [3]
140 $\mu\text{m}/\text{ms}$	propagating speed of epileptiform waves in disinhibited hippocampal slices [6]
60-90 $\mu\text{m}/\text{ms}$	propagating speed of epileptiform waves in disinhibited neocortical slices [7, 1]
6-10 $\mu\text{m}/\text{ms}$	propagating speed of population activation in neocortical slices under conditions of unaltered excitability [8]

Table 1: Activity propagation speed

200-450 $\times 10^{-6} \mu\text{m}^{-3}$	density of pyramidal neurons in rodent hippocampus [5]
50-60 μm	thickness of stratum pyramidal of rodent hippocampus (where pyramidal neurons lie) [4]
2261 mm^2	total cortical surface area of a hemisphere of a galago [2]
127 $\times 10^6$	estimated number of neurons in the above cortical area [2]
18577 mm^2	total cortical surface area of a hemisphere of a Baboon [2]
2.36 $\times 10^9$	estimated number of neurons in the above cortical area [2]

Table 2: Neuron density

References

- [1] RD Chervin, PA Pierce, and BW Connors. Periodicity and directionality in the propagation of epileptiform discharges across neocortex. *Journal of Neurophysiology*, 60(5): 1695–1713, 1988.
- [2] Christine E Collins, David C Airey, Nicole A Young, Duncan B Leitch, and Jon H Kaas. Neuron densities vary across and within cortical areas in primates. *Proceedings of the National Academy of Sciences*, 107(36):15927–15932, 2010.
- [3] Dominique Debanne, Emilie Campanac, Andrzej Bialowas, Edmond Carlier, and Gisèle Alcaraz. Axon physiology. *Physiological reviews*, 91(2):555–602, 2011.
- [4] Soraya Ghafari and Mohammad Jafar Ghalipour. Prenatal morphine exposure reduces pyramidal neurons in ca1, ca2 and ca3 subfields of mice hippocampus. *Iranian journal of basic medical sciences*, 17(3):155, 2014.
- [5] Shozo Jinno and Toshio Kosaka. Stereological estimation of numerical densities of glutamatergic principal neurons in the mouse hippocampus. *Hippocampus*, 20(7):829–840, 2010.

- [6] Richard Miles, Roger D Traub, and RK Wong. Spread of synchronous firing in longitudinal slices from the ca3 region of the hippocampus. *Journal of Neurophysiology*, 60(4):1481–1496, 1988.
- [7] David J Pinto, Sandra L Patrick, Wendy C Huang, and Barry W Connors. Initiation, propagation, and termination of epileptiform activity in rodent neocortex in vitro involve distinct mechanisms. *Journal of Neuroscience*, 25(36):8131–8140, 2005.
- [8] Jian-young Wu, Li Guan, and Yang Tsau. Propagating activation during oscillations and evoked responses in neocortical slices. *Journal of Neuroscience*, 19(12):5005–5015, 1999.