

Scale of the Brain : Space

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[10⁰ \(m\)](#)

[10⁻² \(cm\)](#)

[10⁻³ \(mm\)](#)

[10⁻⁶ \(micron\)](#)

[10⁻⁹ \(nm\)](#)

[Glossary](#)

[Image Gallery](#)

[Interactive Brain from Australia Open Colleges](#)

10¹ (m)

human

Bonus Stats:

Surface Area of human [cerebral cortex](#) = 2,500 cm² (2.69 ft²); A. Peters, and E.G. Jones, *Cerebral Cortex*, 1984

[Interesting species comparisons from U Washington](#)

10⁻² (cm)

brain

adult human (weight: 3 lbs or 1,300 - 1,400 g; volume: 15 cm³)

2% of human body weight (150 lb)

contains ~80 billion [Neurons](#)

contains ~150 trillion [Synapses](#)*

Bonus Stats:

~at least a km of wiring in every mm³ of brain

~300M synapses/mm³ of brain*

10⁻³ (mm) *it is currently unclear how to define a brain circuit

circuits = ~1-50 mm

[Hippocampal circuit example, ex 2](#)

[cerebral cortex](#) = ~2-3 mm thick;

6 layers organized into cortical columns

[cortical column](#): ~0.5 mm³ width; ~2mm depth

uncertain how many there are because we lack a concise definition

≥10,000 cells to ≤100,000 cells in each
ex [image](#)
microcircuit ≈0.1-1 mm
contains 2 to thousands of cells
subcircuit of hippocampal circuit

10⁻⁶ (micron)

[Neurons](#) (excitatory or inhibitory) = generally ~0.01 to 1 mm (but the axon can travel for cms and meters beyond the brain)

The size of a neuron isn't so well defined. The dendritic arbor (branched area) is typically less than 1 mm across.

[Neurite](#): branch of a neuron

[myelinated](#) (insulated) ≈1 micron

unmyelinated = 1/10 to 1/100th speed of myelinated

cell body (soma) = 10 - 50 microns diameter

[Pyramidal cells](#) are the dominant excitatory neuron in cerebral cortex and hippocampus

[Cerebellum](#) contains some of the smallest neurons in the brain ([Granule cells](#))

[Purkinje cells](#) in cerebellum are among largest neurons in humans

[Betz cells](#) (type of purkinje cell) are the largest neuron cell body in human central nervous system

synapses per neuron = ~100 to >10,000

10⁻⁹ (nm)

[vesicles](#) (contain neurotransmitter and are released across synapses)
≈50 - 100 nm

[receptors](#) and signal pathway proteins

[neurotransmitters](#) like GABA or glutamate = ~1 nm

water molecule = ~0.3 nm

* 150T Synapses: Pakkenberg et al., Experimental Gerontology 2003

* 300M synapses/mm³: 300M - Van Essen & Ugurbil, NeuroImage 2012