Brain Facts and Figures

These data were obtained from several textbooks. All numbers are for humans unless otherwise indicated.

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**Neuron**

**Spinal Cord**

**Sensory Apparatus**

**Blood Supply**

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### Brain

#### Average Brain Weights (in grams)

<table>
<thead>
<tr>
<th>Species</th>
<th>Weight (g)</th>
<th>Species</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>adult human</td>
<td>1,300 - 1,400</td>
<td>newborn human</td>
<td>350 - 400</td>
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<tr>
<td>sperm whale</td>
<td>7,800</td>
<td>fin whale</td>
<td>6,930</td>
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<tr>
<td>elephant</td>
<td>4,783</td>
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<td>gray whale</td>
<td>4,317</td>
<td>killer whale</td>
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<td>bowhead whale</td>
<td>2,738</td>
<td>pilot whale</td>
<td>2,670</td>
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<tr>
<td>bottle-nosed dolphin</td>
<td>1,500 - 1,600</td>
<td>walrus</td>
<td>1,020 - 1,126</td>
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<tr>
<td>Pithecanthropus Man</td>
<td>850 - 1,000</td>
<td>camel</td>
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<tr>
<td>giraffe</td>
<td>680</td>
<td>hippopotamus</td>
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<td>leopard seal</td>
<td>542</td>
<td>horse</td>
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<td>Animal</td>
<td>Brain Weight</td>
<td>Animal</td>
<td>Brain Weight</td>
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<td>---------------------</td>
<td>--------------</td>
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<tr>
<td>polar bear</td>
<td>498</td>
<td>gorilla</td>
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<td>cow</td>
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<td>orangutan</td>
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<td>California sea lion</td>
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<td>manatee</td>
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<td>tiger</td>
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<td>rhesus monkey</td>
<td>90-97</td>
<td>dog (beagle)</td>
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<tr>
<td>aardvark</td>
<td>72</td>
<td>beaver</td>
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<td>shark (great white)</td>
<td>34</td>
<td>shark (nurse)</td>
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<td>cat</td>
<td>30</td>
<td>porcupine</td>
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<tr>
<td>squirrel monkey</td>
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<td>marmot</td>
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<td>rabbit</td>
<td>10-13</td>
<td>platypus</td>
<td>9</td>
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<tr>
<td>alligator</td>
<td>8.4</td>
<td>squirrel</td>
<td>7.6</td>
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<tr>
<td>opossum</td>
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<td>flying lemur</td>
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<td>fairy anteater</td>
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<td>guinea pig</td>
<td>4</td>
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<td>ring-necked pheasant</td>
<td>4.0</td>
<td>hedgehog</td>
<td>3.35</td>
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<tr>
<td>tree shrew</td>
<td>3</td>
<td>fairy armadillo</td>
<td>2.5</td>
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<tr>
<td>owl</td>
<td>2.2</td>
<td>grey partridge</td>
<td>1.9</td>
</tr>
<tr>
<td>rat (400 g body weight)</td>
<td>2</td>
<td>hamster</td>
<td>1.4</td>
</tr>
<tr>
<td>elephant shrew</td>
<td>1.3</td>
<td>house sparrow</td>
<td>1.0</td>
</tr>
<tr>
<td>european quail</td>
<td>0.9</td>
<td>turtle</td>
<td>0.3-0.7</td>
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<tr>
<td>bull frog</td>
<td>0.24</td>
<td>viper</td>
<td>0.1</td>
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<tr>
<td>goldfish</td>
<td>0.097</td>
<td>green lizard</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Reference for many of these brain weights:

1981.

% brain of total body weight (150 pound human) = 2%
Average brain width = 140 mm
Average brain length = 167 mm
Average brain height = 93 mm

Intracranial contents by volume (1,700 ml, 100%): brain = 1,400 ml (80%); blood = 150 ml (10%); cerebrospinal fluid = 150 ml (10%) (from Rengachary, S.S. and Ellenbogen, R.G., editors, *Principles of Neurosurgery*, Edinburgh: Elsevier Mosby, 2005)

Average number of neurons in the brain = 100 billion
Number of neurons in *octopus* brain = 300 million (from *How Animals See*, S. Sinclair, 1985)
Number of neurons in *Aplysia* nervous system = 18,000-20,000
Number of neurons in each segmental ganglia in the *leech* = 350
Volume of the brain of a *locust* = 6mm$^3$ (from *The Neurobiology of the Insect Brain*, Burrows, M., 1996)

Ratio of the volume of grey matter to white matter in the cerebral hemispheres (50 yrs. old) = 1.1 (Miller et al., 1980)
Ratio of the volume of grey matter to white matter in the cerebral hemispheres (100 yrs. old) = 1.5 (Miller et al., 1980)
% of cerebral oxygen consumption by white matter = 6%
% of cerebral oxygen consumption by gray matter = 94%

Average number of glial cells in brain = 10-50 times the number of neurons (New research suggests the neuron-to-glia ratio may be much smaller, closer to 1:1)


Number of neocortical neurons (males) = 22.8 billion (Pakkenberg et al., 1997; 2003)
Average loss of neocortical neurons = 85,000 per day (~31 million per year) (Pakkenberg et al., 1997; 2003)
Average loss of neocortical neurons = 1 per second (Pakkenberg et al., 1997; 2003)
Average number of neocortical glial cells (young adults) = 39 billion (Pakkenberg et al., 1997; 2003)
Average number of neocortical glial cells (older adults) = 36 billion (Pakkenberg et al., 1997; 2003)
Length of myelinated nerve fibers in brain = 150,000-180,000 km (Pakkenberg et al., 1997; 2003)
Number of synapses in cortex = 0.15 quadrillion (Pakkenberg et al., 1997; 2003)
Difference number of neurons in the right and left hemispheres = 186 million MORE neurons on left side than right side (Pakkenberg et al., 1997; 2003)

<table>
<thead>
<tr>
<th></th>
<th>Proportion by Volume (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rat</td>
</tr>
<tr>
<td>Cerebral Cortex</td>
<td>31</td>
</tr>
<tr>
<td>Diencephalon</td>
<td>7</td>
</tr>
<tr>
<td>Midbrain</td>
<td>6</td>
</tr>
<tr>
<td>Hindbrain</td>
<td>7</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>10</td>
</tr>
<tr>
<td>Spinal Cord</td>
<td>35</td>
</tr>
</tbody>
</table>


### Composition of Brain and Muscle

<table>
<thead>
<tr>
<th></th>
<th>Skeletal Muscle (%)</th>
<th>Whole Brain (%)</th>
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</thead>
<tbody>
<tr>
<td>Water</td>
<td>75</td>
<td>77 to 78</td>
</tr>
<tr>
<td>Lipids</td>
<td>5</td>
<td>10 to 12</td>
</tr>
<tr>
<td>Protein</td>
<td>18 to 20</td>
<td>8</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Soluble organic substances</td>
<td>3 to 5</td>
<td>2</td>
</tr>
<tr>
<td>Inorganic salts</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>


Total surface area of the cerebral cortex = 2,500 cm² (2.5 ft²; A. Peters, and E.G. Jones, Cerebral Cortex, 1984)

Total surface area of the cerebral cortex (lesser shrew) = 0.8 cm²
Total surface area of the cerebral cortex (rat) = 6 cm²
Total surface area of the cerebral cortex (cat) = 83 cm²
Total surface area of the cerebral cortex (African elephant) = 6,300 cm²
Total surface area of the cerebral cortex (Bottlenosed dolphin) = 3,745 cm² (S.H. Ridgway, The Cetacean Central Nervous System, p. 221)
Total surface area of the cerebral cortex (pilot whale) = 5,800 cm²
Total surface area of the cerebral cortex (false killer whale) = 7,400 cm²

Total number of synapses in cerebral cortex = 60 trillion (yes, trillion) (from G.M. Shepherd, The Synaptic Organization...

Percentage of total cerebral cortex volume (human): frontal lobe = 41%; temporal lobe = 22%; parietal lobe = 19%; occipital lobe = 18%. (Caviness Jr., et al. Cerebral Cortex, 8:372-384, 1998.)

Number of cortical layers = 6

 Thickness of cerebral cortex = 1.5-4.5 mm

 Thickness of cerebral cortex (Bottlenosed dolphin) = 1.3-1.8 mm (S.H. Ridgway, The Cetacean Central Nervous System, p. 221)

EEG - beta wave frequency = 13 to 30 Hz
EEG - alpha wave frequency = 8 to 13 Hz
EEG - theta wave frequency = 4 to 7 Hz
EEG - delta wave frequency = 0.5 to 4 Hz

World record, time without sleep = 264 hours (11 days) by Randy Gardner in 1965. Note: In Biopsychology (by J.P.J. Pinel, Boston: Allyn and Bacon, 2000, p. 322), the record for time awake is attributed to Mrs. Maureen Weston. She apparently spent 449 hours [18 days, 17 hours] awake in a rocking chair. The Guinness Book of World Records [1990] has the record belonging to Robert McDonald who spent 453 hours, 40 min in a rocking chair.

Time until unconsciousness after loss of blood supply to brain = 8-10 sec

Time until reflex loss after loss of blood supply to brain = 40-110 sec

Rate of neuron growth (early pregnancy) = 250,000 neurons/minute

Length of spiny terminals of a Purkinje cell = 40,700 micron

Number spines on a Purkinje cell dendritic branchlet = 61,000

Surface area of cerebellar cortex = 50,000 cm² (from G.M. Shepherd, The Synaptic Organization of the Brain, 1998, p. 255)


Number of Purkinje cells = 15-26 million

Number of synapses made on a Purkinje cell = up to 200,000

Weight of hypothalamus = 4 g

Volume of suprachiasmatic nucleus = 0.3 mm³

Number of fibers in pyramidal tract above decussation = 1,100,000

Number of fibers in corpus callosum = 250,000,000

Area of the corpus callosum (midsagittal section) = 6.2 cm²

<table>
<thead>
<tr>
<th>Species</th>
<th>Cerebellum Weight (grams)</th>
<th>Body Weight (grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>0.09</td>
<td>58</td>
</tr>
<tr>
<td>Bat</td>
<td>0.09</td>
<td>30</td>
</tr>
<tr>
<td>Flying Fox</td>
<td>0.3</td>
<td>130</td>
</tr>
<tr>
<td>Pigeon</td>
<td>0.4</td>
<td>500</td>
</tr>
<tr>
<td>Guinea Pig</td>
<td>0.9</td>
<td>485</td>
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<tr>
<td>Squirrel</td>
<td>1.5</td>
<td>350</td>
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<tr>
<td>Chinchilla</td>
<td>1.7</td>
<td>500</td>
</tr>
<tr>
<td>Rabbit</td>
<td>1.9</td>
<td>1,800</td>
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<tr>
<td>Hare</td>
<td>2.3</td>
<td>3,000</td>
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<tr>
<td>Cat</td>
<td>5.3</td>
<td>3,500</td>
</tr>
<tr>
<td>Dog</td>
<td>6.0</td>
<td>3,500</td>
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</table>
### Composition of Serum and Cerebrospinal Fluid (CSF)

<table>
<thead>
<tr>
<th></th>
<th>CSF</th>
<th>Serum</th>
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<tbody>
<tr>
<td>Water (%)</td>
<td>99</td>
<td>93</td>
</tr>
<tr>
<td>Protein (mg/dl)</td>
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<td>7000</td>
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<tr>
<td>Glucose (mg/dl)</td>
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<td>90</td>
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<tr>
<td>Osmolarity (mOsm/l)</td>
<td>295</td>
<td>295</td>
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<tr>
<td>Na (meq/l)</td>
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<td>138</td>
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<tr>
<td>K (meq/l)</td>
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<td>4.5</td>
</tr>
<tr>
<td>Ca (meq/l)</td>
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<td>4.8</td>
</tr>
<tr>
<td>Mg (meq/l)</td>
<td>0.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Cl (meq/l)</td>
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<td>102</td>
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<tr>
<td>pH</td>
<td>7.33</td>
<td>7.41</td>
</tr>
</tbody>
</table>


Number of cranial nerves = 12

I- olfactory

II- optic

Number of fibers in human optic nerve = 1,200,000
Number of fibers in cat optic nerve = 119,000
Number of fibers in albino rat optic nerve = 74,800

III- oculomotor

Number of fibers in oculomotor nerve = 25,000-35,000

IV- troclear

Number of fibers in troclear nerve = 2,000-3,500
Number of neurons in nucleus of the troclear nerve = 2,000-3,500

V- trigeminal

Number of fibers in motor root of trigeminal nerve = 8,100
Number of fibers in sensory root of trigeminal nerve = 140,000

VI- abducens

Number of fibers in abducens nerve (at exit from brain stem) = 3,700

VII- facial

Number of fibers in facial nerve (at exit from brain stem) = 9,000-10,000
Length of nucleus of the facial nerve = 2 to 5.6 mm
Number of neurons in nucleus of the facial nerve = 7,000

VIII-vestibulocochlear
IX- glossopharyngeal
X- vagus

Length of dorsal motor nucleus of the vagus nerve = 10 mm

XI- spinal accessory
XII- hypoglossal

Number of neurons in nucleus of the hypoglossal nerve = 4,500-7,500
Length of nucleus of the hypoglossal nerve = 10 mm

Spinal Cord

Length of human spinal cord = 45 cm (male); 43 cm (female)
Length of human vertebral column (male) = 71 cm
Length of human vertebral column (female) = 61 cm
Length of cat spinal cord = 34 cm
Length of rabbit spinal cord = 18 cm
Length of the filum terminale = 15 cm

Cross sectional area of the spinal cord (C2 level) = 110 mm$^2$
Cross sectional area of the spinal cord (C4 level) = 122 mm$^2$
Cross sectional area of the spinal cord (C5 level) = 78 mm²
Cross sectional area of the spinal cord (C7 level) = 85 mm²

Weight of human spinal cord = 35 g
Weight of rabbit spinal cord = 4 g

Weight of rat spinal cord (400 g body weight) = 0.7 g
Maximal circumference of cervical enlargement = 38 mm
Maximal circumference of lumbar enlargement = 35 mm
Pairs of Spinal Nerves = 31
Number of spinal cord segments (human)= 31

- 8 cervical segments
- 12 thoracic segments
- 5 lumbar segments
- 5 sacral segments
- 1 coccygeal segment

Number of Spinal Cord segments (rat)= 34

- 8 cervical segments
- 13 thoracic segments
- 6 lumbar segments
- 4 sacral segments
- 3 coccygeal segments

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**Sensory Apparatus**

**Audition**


Length of the eustachian tube = 3.5 to 3.9 cm (*Hearing, Its Physiology and Pathophysiology*, A.R. Moller, San Diego, Academic Press, 2000.)

Number of hair cells in cochlea = 3,500 inner hair cells; 12,000 outer hair cells (*Hearing, Its Physiology and Pathophysiology*, A.R. Moller, San Diego, Academic Press, 2000.)


Number of neurons in cochlear nuclei = 8,800 (Northern, J.L. and Downs, M.P., Hearing in Children, 5th edition, Philadelphia: Lippincott Williams & Wilkins, 2002.)

Number of neurons in inferior colliculus = 392,000 (Northern, J.L. and Downs, M.P., Hearing in Children, 5th edition, Philadelphia: Lippincott Williams & Wilkins, 2002.)

Number of neurons in medial geniculate body = 570,000

Number of neurons in auditory cortex = 100,000,000

Hearing Range (young adult human) = 20 to 20,000 Hz
Hearing Range (elderly human) = 50 to 8,000 Hz (*Guyton, A.C., Textbook of Medical Physiology*, 1986)

Hearing Range (rat) = 1,000 to 50,000 Hz
Hearing Range (cat) = 100 to 60,000 Hz
Hearing Range (dolphin) = 200 to 150,000 Hz
Hearing Range (elephant) = 1 to 20,000 Hz
Hearing Range (goldfish) = 5 to 2,000 Hz
Hearing Range (moth, noctuid) = 1,000 to 240,000 Hz
Hearing Range (mouse) = 1,000 to 100,000 Hz
Hearing Range (sea lion) = 100 to 40,000 Hz
Most sensitive range of human hearing = 1,000-4,000 Hz
Length of external auditory meatus (ear canal) = 2.7 cm

Diameter of external auditory meatus (ear canal)= 0.7 cm
Weight of malleus = 23 mg; length of malleus = 8-9 mm
Weight of incus = 30 mg; dimensions of incus = 5 mm by 7 mm
Weight of stapes = 3-4 mg; dimensions of stapes = 3.5 mm high, 3 mm long, 1.4 mm wide

Length of cochlea = 35 mm
Width of cochlea = 10 mm
Number of turns in the cochlea = 2.2-2.9
Length of basilar membrane = 25-35 mm
Auditory Pain Threshold = 130 db
Threshold for hearing damage = 90 db for an extended period of time

<table>
<thead>
<tr>
<th>Decibels</th>
<th>Sound</th>
</tr>
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<tbody>
<tr>
<td>180</td>
<td>Rocket launching pad</td>
</tr>
<tr>
<td>140</td>
<td>Jet plane</td>
</tr>
<tr>
<td>140</td>
<td>Gunshot blast</td>
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<tr>
<td>120</td>
<td>Automobile horn</td>
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<td>130</td>
<td>Pain threshold</td>
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<td>120</td>
<td>Discomfort</td>
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<tr>
<td>90</td>
<td>Subway</td>
</tr>
<tr>
<td>80</td>
<td>Noisy Restaurant</td>
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<tr>
<td>75</td>
<td>Busy traffic</td>
</tr>
<tr>
<td>66</td>
<td>Normal conversation</td>
</tr>
<tr>
<td>50</td>
<td>Average home</td>
</tr>
<tr>
<td>30</td>
<td>Soft whisper</td>
</tr>
</tbody>
</table>


**Taste**

Total number of human taste buds (tongue, palate, cheeks) = 10,000
Number of taste buds on the tongue = 9,000
Height of taste bud = 50-100 microns (From: Farbman, A.I., Taste Bud, in G. Adelman, eds., Encyclopedia of Neuroscience, 1987)
Diameter of taste bud = 30-60 microns (From: Farbman, A.I.)
Number of receptors on each taste bud = 50-150 (Boron, W.F. and Boulpaep, E.L., Medical Physiology. A Cellular and Molecular Approach, Philadelphia: Saunders, 2003)
Diameter of taste receptor = 10 micron
Diameter of taste fiber = less than 4 micron
Taste threshold for quinine sulfate = 3.376 mg/liter water

Smell

Number of rabbit olfactory receptor cells = 100 million
Number of dog olfactory receptor cells = 1 billion
Surface area of olfactory epithelium (contains olfactory receptor cells) in humans = 10 cm² (Bear, M.F., Connors, B.W. and Pradiso, M.A., Neuroscience: Exploring the Brain, 2nd edition, Baltimore: Lippincott Williams and Wilkins, 2001, p. 269)
Thickness of olfactory epithelium mucous layer = 20-50 microns. (Boron and Boulpaep, 2003)
Diameter of olfactory receptor axons = 0.1-0.2 micron
Diameter of distal end olfactory receptor cell = 1 micron
Diameter of olfactory receptor cell = 40-50 micron
Number of cilia per olfactory receptor cell = 10-30
Length of cilia on olfactory receptor cell = 100-150 micron
Concentration for detection threshold of musk = 0.00004 mg/liter air

Vision

Length of eyeball (newborn) = 16.5 mm (from Riordan-Eva and Whitcher, 2008)
Volume of eyeball = 5.5 cm³
Weight of eyeball = 7.5 g
Average time between blinks = 2.8 seconds
Average duration of a single blink = 0.1-0.4 seconds (Schiffman, H.R., Sensation and Perception. An Integrated Approach, New York: John Wiley and Sons, Inc., 2001)
Thickness of cornea = ~0.5 mm in center; ~1 mm in periphery (Foster, C.S., Azar, D.T. and Dohlman, C.H. Smolin and Thoft's The Cornea, Scientific Foundations and Clinical Practice, 4th edition, Philadelphia: Lippincott Williams & Wilkins, 2005)
Diameter of cornea = 11.5 mm
Thickness of lens = 4 mm (from Riordan-Eva and Whitcher, 2008)
Diameter of lens = 9 mm (from Riordan-Eva and Whitcher, 2008)
Composition of lens = 65% water; 35% protein (from Riordan-Eva and Whitcher, 2008)
Nerves in lens = 0 (from Riordan-Eva and Whitcher, 2008)
Blood vessels in lens = 0 (from Riordan-Eva and Whitcher, 2008)
Number of retinal receptor cells = 5-6 million cones; 120-140 million rods
Number of retinal ganglion cells = 800 thousand to 1 million
Number of fibers in optic nerve = 1,200,000
Number of neurons in lateral geniculate body = 570,000
Number of cells in visual cortex (area 17) = 538,000,000
Wavelength of visible light (human) = 400-700 nm
Amount of light necessary to excite a rod = 1 photon
Amount of light necessary to excite a cone = 100 photons
Location of the greatest density of rods = 20° from fovea
Highest density of rods = 160,000 per mm²
Peak density of rods (cat) = 400,000 per mm²
Density of cones in fovea = 200,000 per mm²
Diameter of fovea = 1.5 mm
Intraocular pressure = 10-20 mm Hg
Volume of orbit = 30 ml
Area of retina = 2,500 mm²
Thickness of retina = 120 microns (ranges from 100 to 230 microns)
Production rate of aqueous humor = 2 microliters/min
Turnover of aqueous humor = 15 times/day
% volume of eye occupied by the vitreous = 80%
Maximal sensitivity of red cones = 570 nm
Maximal sensitivity of green cones = 540 nm
Maximal sensitivity of blue cones = 440 nm
More Facts and Figures about the Human Retina from WebVision.

Touch

Surface area of skin (adult human) = 3,000 in² (~1.8 m²) (Source: Schiffman, H.R., Sensation and Perception. An Integrated Approach, New York: John Wiley and Sons, Inc., 2001)
Number of tactile receptors in the hand = 17,000
Number of nerve endings in hand = 1,300 per in²
von Frey threshold (Face) = 5 mg
2 point threshold (Finger) = 2-3 mm
Length of Meissner corpuscle = 90 - 120 micron
Density of receptors on finger tips = 2,500 per cm²
Density of Meissner's corpuscles on finger tips = 1,500 per cm²
Density of Merkel's cells on finger tips = 750 per cm²
Density of Pacinian corpuscles on finger tips = 75 per cm²
Density of Ruffini's corpuscles on finger tips = 75 per cm²
Thermal pain threshold = 45°C

Neurons

Number of synapses for a "typical" neuron = 1,000 to 10,000
Diameter of neuron = 4 micron (granule cell) to 100 micron (motor neuron in cord)
Diameter of neuron nucleus = 3 to 18 micron
Length of Giraffe primary afferent axon (from toe to neck) = 15 feet
Resting potential of squid giant axon = -70 mV
Conduction velocity of action potential = 0.6-120 m/s (1.2-250 miles/hr)

Single sodium pump maximum transport rate = 200 Na ions/sec; 130 K ions/sec
Typical number of sodium pumps = 1000 pumps/micron^2 of membrane surface (from Willis and Grossman, Medical Neurobiology, Mosby, St. Louis, 1981, p. 36)
Total number of sodium pumps for a small neuron = 1 million
Number of voltage-gated sodium channels at each node = 1,000 to 2,000 per micron^2 (from Nolte, J., The Human Brain, Mosby, 1999, p. 163.)
Number of voltage-gated sodium channels between nodes = 25 per micron^2 (from Nolte, J., The Human Brain, Mosby, 1999, p. 163.)
Number of voltage-gated sodium channels in unmyelinated axon = 100 to 200 per micron^2 (from Nolte, J., The Human Brain, Mosby, 1999, p. 163.)
Diameter of microtubule = 20 nanometer
Diameter of microfilament = 5 nanometer
Diameter of neurofilament = 10 nanometer
Thickness of neuronal membrane = 5 nanometer
Thickness of squid giant axon membrane = 50-100 A
Membrane surface area of a typical neuron = 250,000 um^2 (Bear et al., 2001)
Membrane surface area of 100 billion neurons = 25,000 m^2, the size of four soccer fields (Bear, M.F., Connors, B.W. and Pradiso, M.A., Neuroscience: Exploring the Brain, 2nd edition, Baltimore: Lippincott Williams and Wilkins, 2001, p. 97)

Typical synaptic cleft distance = 20-40 nanometers across (from Kandel et al., 2000, p. 176)
% neurons stained by the Golgi method = 5%
Slow axoplasmic transport rate = 0.2-4 mm/day (actin, tubulin)
Intermediate axoplasmic transport rate = 15-50 mm/day (mitochondrial protein)
Fast axoplasmic transport rate = 200-400 mm/day (peptides, glyolipids)
Number of molecules of neurotransmitter in one synaptic vesicle = 5,000 (from Kandel et al., 2000, p. 277)
Diameter of synaptic vesicle = 50 nanometer (small); 70-200 nanometer (large)
Diameter of neurofilament = 7 - 10 nm
Diameter of microtubule = 25 nm
Internodal Length = 150 - 1500 microns (depends on fiber diameter
% composition of myelin = 70-80% lipid; 20-30% protein

<table>
<thead>
<tr>
<th>Ion Concentration (mM) - SQUID NEURON</th>
</tr>
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<tbody>
<tr>
<td><strong>Intracellular</strong></td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Potassium</td>
</tr>
<tr>
<td>Sodium</td>
</tr>
<tr>
<td>Chloride</td>
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<tr>
<td>Calcium</td>
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</tbody>
</table>

http://faculty.washington.edu/chudler/facts.html
### Ion Concentration (mM) - MAMMALIAN NEURON

<table>
<thead>
<tr>
<th></th>
<th>Intracellular</th>
<th>Extracellular</th>
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</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>140</td>
<td>5</td>
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<tr>
<td>Sodium</td>
<td>5-15</td>
<td>145</td>
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<tr>
<td>Chloride</td>
<td>4-30</td>
<td>110</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.0001</td>
<td>1-2</td>
</tr>
</tbody>
</table>


### Neurotoxins

### Blood Supply

- % brain utilization of total resting oxygen = 20%
- % blood flow from heart to brain = 15-20%  (Kandel et al., 2000)
- Blood flow through whole brain (adult) = 750-1000 ml/min
- Blood flow through whole brain (adult) = 54 ml/100 g/min
- Blood flow through whole brain (child) = 105 ml/100 g/min
- Cerebral blood flow = 55 to 60 ml/100 g brain tissue/min
- Cerebral blood flow (gray matter) = 75 ml/100 g brain tissue/min
- Cerebral blood flow (white matter) = 45 ml/100 g brain tissue/min  (Rengachary, S.S. and Ellenbogen, R.G., editors, Principles of Neurosurgery, Edinburgh: Elsevier Mosby, 2005)
- Oxygen consumption whole brain = 46 cm³/min
- Oxygen consumption whole brain = 3.3 ml/100 g/min
- Blood flow rate through basilar artery = 100-200 ml/min  (Kandel et al., 2000)
- Diameter of vertebral artery = 2-3 mm
- Diameter of common carotid artery (adult) = 6 mm
- Diameter of common carotid artery (newborn) = 2.5 mm

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