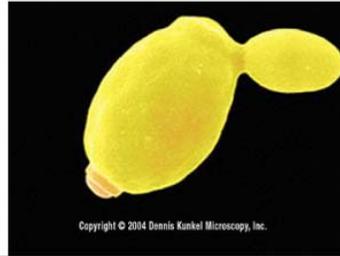


# B10NUMB3R5

THE DATABASE OF USEFUL BIOLOGICAL NUMBERS

ATP to make one cell: ~55 billion  
 Volume occupied by RNA: 6%  
 Number of tRNA/cell: ~200,000  
 Speed: 50  $\mu\text{m}/\text{sec}$   
 Ribosomes: 6,800 - 72,000  
 Proteins:  $\sim 3.6 \times 10^6$   
 Translation rate: 12 - 21 aa/sec  
 Volume occupied by water: 70%



Generation time: 4 days  
 Cells in an adult male: 10<sup>31</sup>  
 Number of genes: 20,621  
 Eggs laid during lifetime: 300  
 Size of Genome: 100Mbp  
 Life span: 2-3 weeks  
 Run speed at 20°C: 0.13mm/sec  
 Cells in hatched larvae: 556



Median haploid volume: 42  $\mu\text{m}^3$   
 Number of ribosomes: ~200,000  
 Nucleus volume: 7% of cell  
 mRNA out of total RNA: 5%  
 mRNA in cell: 15,000  
 Kcat of Pyruvate kinase: 71,400/min  
 Cell diameter: ~5 $\mu\text{m}$   
 RNA to DNA ratio: 50



Total number of taste buds: 10,000  
 Cell divisions in a life-time: 10<sup>17</sup>  
 Abundance of p53 per cell: ~160,000  
 Average brain weight: ~1350g  
 Hairs on the head: 90,000-150,00  
 Diameter of erythrocytes: 7.5 $\mu\text{m}$   
 Weight of skin: 4.1 Kg  
 Average time between blinks: 2.8 Sec

See photosynthesis-related useful numbers on other side of page

BioNumbers ([bioNumbers.org](http://bioNumbers.org)) is the database of useful biological numbers. It aims to enable you to find in one minute any common biological number important for your research, such as the rate of translation of the ribosome, concentrations of metabolites or the number of bacteria in your gut. You will find full references, comments and related numbers that are useful. Check it out at: [www.bioNumbers.hms.harvard.edu](http://www.bioNumbers.hms.harvard.edu).

Please let us know any suggestions and comments: [ron\\_milo@hms.harvard.edu](mailto:ron_milo@hms.harvard.edu)

**B10NUMB3R5**  
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Find Terms:   
 Organism: (all)

Below are 10 random bioNumbers. Click a row for more details

ID	Property	Organism	Value	Range	Units
10004	The number of kinases in the <i>S. cerevisiae</i> genome	<i>Saccharomyces cerevisiae</i>	438		kinases
10004	Type of protein energy stores in a 150 lb. man	Human Homo sapiens	25000		cal
10002	Amount of water that cycles each year from the land to the atmosphere	Biosphere	~60	~60	trillion tonnes
100752	Rate of release of Oxygen to superoxide	Unspecified	1E-05		per second
101984	Reagan of neurons	Influenza	300		hours
102241	Concentration of UAG	<i>Artemia Cystobranchium</i>	300		per cent
101571	Feruloyl absorbed by brazilian sugar cane as a percentage of total used	Not applicable	30		per cent
100740	Affinity of (colony) factor and LacZ	Bacteria <i>Escherichia coli</i>	1.4		mM
101163	Transfer of aneuploidic oocyte	African clawed frog <i>Xenopus laevis</i>	1.3-1.3		per cent
100285	Ribosomes	African clawed frog <i>Xenopus laevis</i>	1E+12		ribosomes

BioNumbers aims to enable you to find in one minute any common biological number that can be important for your research. BioNumbers is a collaborative community effort to establish a database of useful biological numbers. Search for a value you need for your research or out of curiosity. Use the tab Quick Submit to request numbers you need to know and could not find - we will find them for you. The BioNumbers database contains 1874 numbers, and it's growing every day! More details and future directions for BioNumbers can be found at <http://bioNumbers.org/wiki/BioNumbers>. We welcome all suggestions and comments for improving BioNumbers. Please send to [ron\\_milo@hms.harvard.edu](mailto:ron_milo@hms.harvard.edu).

Weight of skin  
4.1 Kg

## Photosynthesis-related useful numbers

The numbers quoted here were extracted from the literature. They should only serve as an initial value. Consult the full references to learn about the specific system under study, growth conditions, measurement method etc. Full references at: [www.bioNumbers.org](http://www.bioNumbers.org)

### **Solar flux:**

Photon flux on earth's surface when sun directly overhead (full spectrum):  $\sim 4 \cdot 10^{21}$  Photons/m<sup>2</sup>/sec  
Photosynthetic photon flux (400-700nm) when sun directly overhead:  $\sim 2000$  micromol/m<sup>2</sup>/sec  
Mean photosynthetic flux (average during daytime over earth surface, clear sky):  $\sim 800$  micromol/m<sup>2</sup>/sec

### **Chlorophyll:**

Effective cross section of chlorophyll for useful photons:  $\sim 0.09$  Angstrom<sup>2</sup>  
Maximal absorption rate under full sun illumination of chlorophyll pigment:  $\sim 4$  sec<sup>-1</sup>

### **Photosystem:**

Size of photosystem I (plants): 12-19 nm  
Number of chlorophyll pigments per PSI (plants):  $\sim 168$   
Number of chlorophyll pigments per PSI (chlamy):  $\sim 240$   
P700 per cell (chlamy):  $2-5 \cdot 10^6$  /cell  
Quinone A (QA) per cell (chlamy):  $\sim 4 \cdot 10^6$  /cell  
Chlorophyll pigments (Chla & b) per cell (chlamy):  $\sim 2 \cdot 10^9$  /cell  
Ratio of chlorophyll a/b (chlamy):  $\sim 2.7-3.2$

### **Carboxysome (in Synechococcus 8102):**

Diameter: 114-137 nm  
Number of Rubisco per carboxysome:  $\sim 250$  (207-269)  
Volume of carboxysome occupied by Rubisco:  $\sim 27\%$

### **Carbon fixation, chloroplasts and leaves:**

Processing time of an absorbed photon by the chemical reactions leading to CO<sub>2</sub> fixation: 2-20 msec  
Incident radiation (photosynthetic) absorbed by a chloroplast:  $\sim 30\%$   
Delta pH sufficient to drive net ATP synthesis in chloroplasts:  $\sim 2.5$  pH units  
Intensity at which a  $\Delta$ pH sufficient to drive net ATP synthesis is formed:  $\sim 0.1\%$  of full sunlight  
Rubisco catalytic rate:  $2.5-3.4$  sec<sup>-1</sup> (C3 plants)  $3.8-5.4$  sec<sup>-1</sup> (C4)  $11.6-13.4$  sec<sup>-1</sup> (cyanobacteria)  
Concentration of chlorophyll in a chloroplast:  $\sim 30$  mM  
Concentration of chlorophyll in a leaf:  $\sim 1$  mM  
Characteristic leaf area index of a plant:  $\sim 4$

### **Biosphere:**

Net primary productivity by land plants:  $\sim 45-60$  Gt Carbon/year  
Net primary productivity by ocean phytoplankton:  $\sim 45-60$  Gt Carbon/year  
Humanity carbon emission rate (2001):  $\sim 6.6$  Gt Carbon/year  
CO<sub>2</sub> equilibration time between atmosphere and near surface layer of the oceans:  $\sim 10-30$  years  
Time for CO<sub>2</sub> turnover in the atmosphere by photosynthesis:  $\sim 6-8$  years  
Time for O<sub>2</sub> replenishment in the atmosphere by photosynthesis:  $\sim 2000$  years  
Global photosynthetic efficiency (NPP, averaged over a year):  $\sim 0.3\%$   
Percent of global photosynthetic carbon fixation performed by diatoms:  $\sim 20\%$   
Worldwide primary energy consumption by humanity (average 2001):  $\sim 13.5$  TW

Please send corrections and ideas for more bioNumbers to [bioNumbers@gmail.com](mailto:bioNumbers@gmail.com)