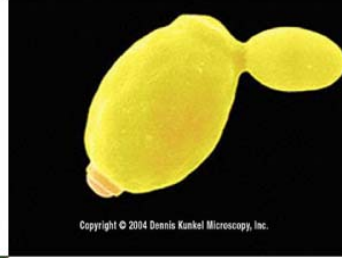


B10NUMB3R5

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: 1031
 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 μm^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 μm
 RNA to DNA ratio: 50



Total number of taste buds: 10,000
 Cell divisions in a life-time: 10^{17}
 Abundance of p53 per cell: ~160,000
 Average brain weight: ~1350g
 Hairs on the head: 90,000-150,00
 Diameter of erythrocytes: 7.5 μm
 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) 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.

Please let us know any suggestions and comments: ron_milo@hms.harvard.edu

The screenshot shows the BioNumbers website in a Mozilla Firefox browser. The page features a search bar with the query "r. rubrum, rfb, glucose, CO2" and a dropdown menu for "Organism: (all)". Below the search bar is a table of 10 random biological numbers. The table has columns for ID, Property, Organism, Value, Range, and Units.

ID	Property	Organism	Value	Range	Units
10001	The number of kinases in the <i>S. cerevisiae</i> genome	<i>Neurospora crassa</i>	438		genes
10004	Type of protein energy stores in a 150 lb. man	Human <i>Homo sapiens</i>	25000		cal
10007	Amount of water that cycles each year from the land to the atmosphere	Biosphere	~60	~60	trillion tonnes
10075	Rate of release of Oxygen to superoxide	Unspecified	1E-05		per second
10198A	Reagan of neurons	Influenza	3-5		hours
10241	Concentration of UAG	<i>Artemia Cystobranchium</i>	300		per cell
10157	Feruloyl absorbed by brazilian sugar cane as a percentage of total used	Not applicable	30		percent
100740	Affinity of colicinI factor and LacZ	Bacteria <i>Escherichia coli</i>	1.4		nM
10166	Transfer of aneuploidic oocyte	African clawed frog <i>Xenopus laevis</i>	1.3-1.3		times
100395	Ribosomes	African clawed frog <i>Xenopus laevis</i>	1E+12		ribosomes

Below the table is a section titled "BioNumbers aims to enable you to find in one minute any common biological number that can be important for your research". It includes a brief description of the database and contact information for suggestions and comments.

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

Solar flux:

Photon flux on earth's surface when sun directly overhead (full spectrum): $\sim 4 \cdot 10^{21}$ Photons/m²/sec
Photosynthetic photon flux (400-700nm) when sun directly overhead: ~ 2000 micromol/m²/sec
Mean photosynthetic flux (average during daytime over earth surface, clear sky): ~ 800 micromol/m²/sec

Chlorophyll:

Effective cross section of chlorophyll for useful photons: ~ 0.09 Angstrom²
Maximal absorption rate under full sun illumination of chlorophyll pigment: ~ 4 sec⁻¹

Photosystem:

Size of photosystem I (plants): 12-19 nm
Number of chlorophyll pigments per PSI (plants): ~ 168
Number of chlorophyll pigments per PSI (chlamy): ~ 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: ~ 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 CO₂ fixation: 2-20 msec
Incident radiation (photosynthetic) absorbed by a chloroplast: $\sim 30\%$
Delta pH sufficient to drive net ATP synthesis in chloroplasts: ~ 2.5 pH units
Intensity at which a Δ pH sufficient to drive net ATP synthesis is formed: $\sim 0.1\%$ of full sunlight
Rubisco catalytic rate: $2.5-3.4$ sec⁻¹ (C3 plants) $3.8-5.4$ sec⁻¹ (C4) $11.6-13.4$ sec⁻¹ (cyanobacteria)
Concentration of chlorophyll in a chloroplast: ~ 30 mM
Concentration of chlorophyll in a leaf: ~ 1 mM
Characteristic leaf area index of a plant: ~ 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): ~ 6.6 Gt Carbon/year
CO₂ equilibration time between atmosphere and near surface layer of the oceans: $\sim 10-30$ years
Time for CO₂ turnover in the atmosphere by photosynthesis: $\sim 6-8$ years
Time for O₂ replenishment in the atmosphere by photosynthesis: ~ 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): ~ 13.5 TW

Please send corrections and ideas for more bioNumbers to bioNumbers@gmail.com