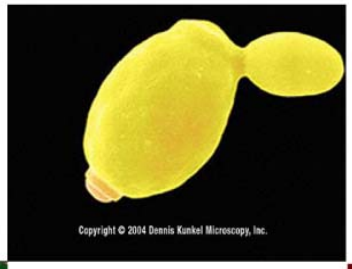
B10NUMB3R5

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 µm/sec
Ribosomes: 6,800 - 72,000
Proteins: ~$3.6x10^6$
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

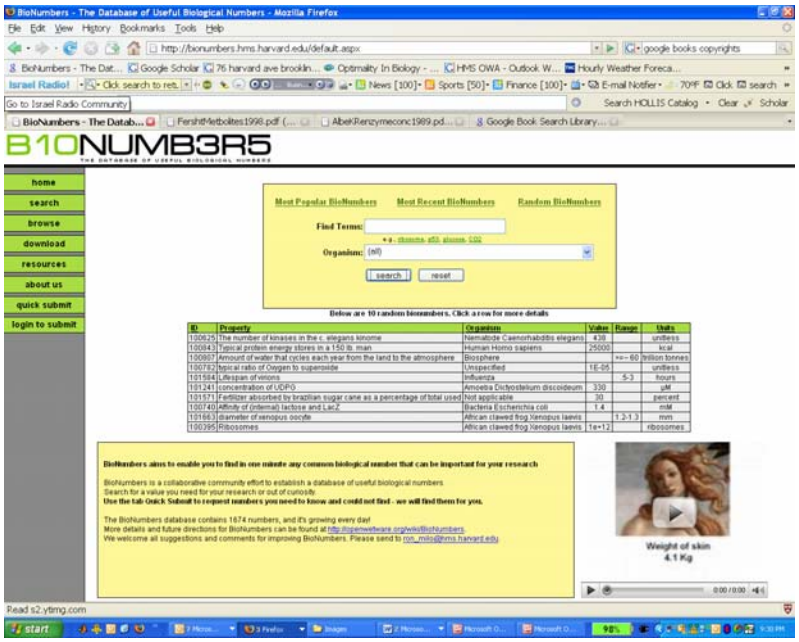
Median haploid volume: 42 μm^3
Number of ribosomes: ~200,000
Nucleus volume: 7% of cell
mRNA out of total RNA: 5%
mRNA in cell: 15,000
Kcat of Pyruvate kinase: 71,400/min
Cell diameter: ~5µm
RNA to DNA ratio: 50

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: 7.5µm
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



Photosynthesis-related useful numbers

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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): ~ $4*10^{21}$ Photons/m^2/sec
Photosynthetic photon flux (400-700nm) when sun directly overhead: ~ 2000 micromol/m^2/sec
Mean photosynthetic flux (average during daytime over earth surface, clear sky): ~ 800 micromol/m^2/sec

Chlorophyll:
Effective cross section of chlorophyll for useful photons: ~ 0.09 $Angstrom^2$
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 $*10^6$ /cell
Quinone A (QA) per cell (chlamy): ~ 4 $*10^6$ /cell
Chlorophyll pigments (Chla & b) per cell (chlamy): ~ $2*10^9$ /cell
Ratio of chlorophyll a/b (chlamy): ~ 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: ~ 27%

Carbon fixation, chloroplasts and leaves:
Processing time of an absorbed photon by the chemical reactions leading to CO_2 fixation: 2-20 msec
Incident radiation (photosynthetic) absorbed by a chloroplast: ~ 30%
Delta pH sufficient to drive net ATP synthesis in chloroplasts: ~ 2.5 pH units
Intensity at which a ΔpH sufficient to drive net ATP synthesis is formed: ~ 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: ~ 45-60 Gt Carbon/year
Net primary productivity by ocean phytoplankton: ~ 45-60 Gt Carbon/year
Humanity carbon emission rate (2001): ~ 6.6 Gt Carbon/year
CO_2 equilibration time between atmosphere and near surface layer of the oceans: ~ 10-30 years
Time for CO_2 turnover in the atmosphere by photosynthesis: ~ 6-8 years
Time for O_2 replenishment in the atmosphere by photosynthesis: ~ 2000 years
Global photosynthetic efficiency (NPP, averaged over a year): ~ 0.3%
Percent of global photosynthetic carbon fixation performed by diatoms: ~ 20%
Worldwide primary energy consumption by humanity (average 2001): ~ 13.5 TW

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