Data on protein:rRNA ratios, nitrogen:phosphorus (N:P) ratios, and growth rates of various microorganisms with the list of references for each data set.

Supplement to Loladze, I, Elser J.J (2011) "The origins of the Redfield nitrogen-to-phosphorus ratio are in a homoeostatic protein-to-rRNA ratio" Ecology Letters, 14(3):244-250.
available at http://sites.google.com/site/loladze/publications/redfield-ratio

Species	Protein:rRNA	N:P	Growth Rate h^{-1}	Ref.
Escherichia coli K-12,CYA288	3.62	18.8	0.83	(31)
Escherichia coli CJ352	2.68	14.9	1.04	(1)
Escherichia coli MA136-1	2.94	16.0	1.04	(1)
Escherichia coli ML308	2.26	13.1	1.08	(2)
Escherichia coli B	1.81	11.3	1.33	(3)
Escherichia coli	1.73	10.9	1.39	(3)
Escherichia coli C600	3.09	16.6	1.39	(30)
Escherichia coli B/r	2.78	15.3	1.43	(4)
Escherichia coli C600	1.84	11.4	1.58	(2)
Escherichia coli K12, S20505	1.34	9.3	1.58	(2)
Escherichia coli B/r	2.51	14.2	1.73	(29)
Escherichia coli ML30	1.96	11.9	1.78	(2)
Escherichia coli B	1.93	11.7	1.84	(2)
Average for *E. coli*	**2.34 ±0.18**	**13.5 ±0.8**	**1.39**	
Saccharomyces cerevisiae LBGH1022	6.01	28.8	0.3	(5)
Saccharomyces cerevisiae	2.80	15.4	0.32	(28)
Saccharomyces cerevisiae	4.16	21.1	0.36	(6)
Saccharomyces cerevisiae CBS 8066	5.84	28.1	0.4	(27)
Saccharomyces cerevisiae A364A	5.04	24.7	0.43	(7)
Saccharomyces cerevisiae 5015-D	1.08	8.2	0.44	(26)
Saccharomyces cerevisiae 1507-7A	3.51	18.3	0.46	(3)
Saccharomyces cerevisiae No.66	2.87	15.7	0.55	(3)
Saccharomyces cerevisiae FL521	1.85	11.4	0.63	(8)
Average for *S. cerevisiae*	**3.69 ±0.57**	**19.1 ±2.4**	**0.43**	
Aerobacter aerogenes	1.39	9.5	1.65	(3)
Aerobacter aerogenes NCTC418	4.40	22.1	0.8	(9)
Anacystis nidulans 625IUCC	6.33	30.1	0.19	(25)
Arthrobacter globiformis NCIB10683	2.28	13.2	0.34	(10)
Bacillus subtilis	1.66	10.6	0.4	(3)
Candida utilis NRRL-Y900	6.35	30.2	0.42	(11)
Candida utilis NCYC 321	3.89	19.9	0.35	(24)
Candida utilis NRRLY11868	9.41	43.0	0.42	(12)
Cellulomonas ATCC21399	2.07	12.3	0.4	(23)
Citrobacter freundii	1.59	10.3	1.39	(3)
Clostridium perfringens	2.15	12.7	0.9	(3)
Enterobacter aerogenes NCTC418	3.41	17.9	0.76	(13)
Erwinia carotovora	1.96	11.9	1.02	(3)
Lactobacillus bulgaricus	3.31	17.5	0.75	(3)
Micrococcus anhaemolyticus	2.18	12.8	0.96	(3)

Species	Protein:rRNA	N:P	Growth Rate h^{-1}	Ref.
Neurospora crassa 74A	2.61	14.6	0.63	(14)
Paracoccus denitrificans ATCC19367	3.68	19.0	0.5	(22)
Physarum polycephalum CL	6.07	29.0	0.06	(15)
Prototheca zopfii 68-16A	4.15	21.0	0.223	(21)
Pseudomonas aeruginosa	1.93	11.7	1.02	(3)
Saccharomyces uvarum	2.99	16.2	0.25	(17)
Salmonella typhimurium	1.85	11.4	1.39	(3)
Selenomonas ruminantium D29	5.71	27.5	0.35	(20)
Serratia marcescens	1.59	10.3	1.39	(3)
Streptomyces hygroscopicus	2.06	12.3	0.38	(19)
Streptomyes coelicolor A3(2)	1.70	10.8	0.3	(16)
Tetrahymena pyriformis GL	5.59	27.0	0.28	(18)
Tetrahymena pyriformis GL	5.11	25.0	0.35	(3)
Zymomonas mobilis ATCC 31821	3.15	16.9	0.26	(17)
Average over all data	**3.22 ±0.24**	**17.1 ±1.0**	**0.79**	

Table S1. Protein:rRNA ratio and the corresponding growth rates directly measured in 31 distinct studies. For any given protein:rRNA ratio, the N:P ratio of the total protein and rRNA is calculated using eqn 5. Despite variation in the methods for estimating macromolecular composition, the diversity of species, and the differences in growth media, the means for protein:rRNA ratio for *E. coli, S. cereveisiae,* and the entire data set all fall within 2-4 range (± the standard errors of the mean). The corresponding N:P ratios fall near the canonical Redfield value of 16.

References

1. Morris D.R. & Jorstad C.M. (1973). Growth and macromolecular composition of a mutant of *Escherichia coli* during polyamine limitation. *J Bacteriol*, 113, 271-7.
2. Rosset R., Julien J. & Monier R. (1966). Ribonucleic acid composition of bacteria as a function of growth rate. *Journal of Molecular Biology*, 18, 308-20.
3. Leick V. (1968). Ratios between contents of DNA, RNA and protein in different micro-organisms as a function of maximal growth rate. *Nature*, 217, 1153-5.
4. Brunschede H., Dove T.L. & Bremer H. (1977). Establishment of exponential growth after a nutritional shift-up in *Escherichia coli* B/r: accumulation of deoxyribonucleic acid, ribonucleic acid, and protein. *J Bacteriol*, 129, 1020-33.
5. Furukawa K., Heinzle E. & Dunn I.J. (1983). Influence of oxygen on the growth of *Saccharomyces cerevisiae* in continuous culture. *Biotechnol Bioeng*, 25, 2293-317.
6. McMurrough I. & Rose A.H. (1967). Effect of growth rate and substrate limitation on the composition and structure of the cell wall of *Saccharomyces cerevisiae*. *Biochem J*, 105, 189-203.
7. Boehlke K.W. & Friesen J.D. (1975). Cellular content of ribonucleic acid and protein in *Saccharomyces cerevisiae* as a function of exponential growth rate: calculation of the apparent peptide chain elongation rate. *Journal of Bacteriology*, 121, 429-433.
8. Waldron C. & Lacroute F. (1975). Effect of growth rate on the amounts of ribosomal and transfer ribonucleic acids in yeast. *J Bacteriol*, 122, 855-65.

9. Tempest D.W., Hunter J.R. & Sykes J. (1965). Magnesium-limited growth of *Aerobacter aerogenes* in a chemostat. *Journal of General Microbiology*, 39, 355-66.
10. Chapman S. & Gray T. (1981). Endogenous metabolism and macromolecular composition of *Arthrobacter globiformis*. *Soil Biology and Biochemistry*, 13, 11-18.
11. Alroy Y. & Tannenbaum S.R. (1973). The influence of environmental conditions on the macromolecular composition of *Candida utilis*. *Biotechnol Bioeng*, 15, 239-56.
12. Schwartzkoff C.L. & Rogers P.L. (1982). Glycogen synthesis by glucose-limited *Candida utilis*. *Journal of General Microbiology*, 128, 1635-8.
13. Cooney C.L., Wang D.I. & Mateles R.I. (1976). Growth of *Enterobacter aerogenes* in a chemostat with double nutrient limitations. *Appl. Environ. Microbiol.*, 31, 91-8.
14. Alberghina F.A., Sturani E. & Gohlke J.R. (1975). Levels and rates of synthesis of ribosomal ribonucleic acid, transfer ribonucleic acid, and protein in *Neurospora crassa* in different steady states of growth. *J Biol Chem*, 250, 4381-8.
15. Plaut B.S. & Turnock G. (1975). Coordination of macromolecular synthesis in the slime mould *Physarum polycephalum*. *Mol Gen Genet*, 137, 211-25.
16. Shahab N., Flett F., Oliver S.G. & Butler P.R. (1996). Growth rate control of protein and nucleic acid content in *Streptomyces coelicolor* A3(2) and *Escherichia coli* B/r. *Microbiology*, 142, 1927-35.
17. Low K. & Rogers P. (1984). The macromolecular composition and essential amino acid profiles of strains of *Zymomonas mobilis*. *Applied Microbiology and Biotechnology*, 19, 75-78.
18. Leick V. (1967). Growth rate dependency of protein and nucleic acid composition of *Tetrahymena pyriformis* and the control of synthesis of ribosomal and transfer RNA. *C R Trav Lab Carlsberg*, 36, 113-26.
19. Riesenberg D. & Bergter F. (1979). Dependence of macromolecular composition and morphology of *Streptomyces hygroscopicus* on specific growth rate. *Z Allg Mikrobiol*, 19, 415-30.
20. Mink R.W. & Hespell R.B. (1981). Long-term nutrient starvation of continuously cultured (glucose-limited) *Selenomonas ruminantium*. *J Bacteriol*, 148, 541-50.
21. Poyton R.O. (1973). Effect of growth rate on the macromolecular composition of *Prototheca zopfii*, a colorless alga which divides by multiple fission. *J Bacteriol*, 113, 203-11.
22. Hanegraaf P.P. & Muller E.B. (2001). The dynamics of the macromolecular composition of biomass. *Journal of Theoretical Biology*, 212, 237-51.
23. Summers R.J. & Srinivasan V.R. (1979). Macromolecular composition of a Cellulomonas sp. cultivated in continuous culture under glucose and zinc limitation. *Appl. Environ. Microbiol.*, 37, 1079-84.
24. Brown C.M. & Rose A.H. (1969). Effects of temperature on composition and cell volume of *Candida utilis*. *J Bacteriol*, 97, 261-70.
25. Parrott L.M. & Slater J.H. (1980). The DNA, RNA and protein composition of the cyanobacterium *Anacystis nidulans* grown in light- and carbon dioxide-limited chemostats. *Archives of Microbiology*, 127, 53-8.
26. Wehr C.T. & Parks L.W. (1969). Macromolecular synthesis in *Saccharomyces cerevisiae* in different growth media. *J Bacteriol*, 98, 458-66.

27. Nissen T.L., Schulze U., Nielsen J. & Villadsen J. (1997). Flux distributions in anaerobic, glucose-limited continuous cultures of *Saccharomyces cerevisiae*. *Microbiology*, 143, 203-18.
28. Parada G. & Acevedo F. (1983). On the relation of temperature and RNA content to the specific growth rate in *Saccharomyces cerevisiae*. *Biotechnol Bioeng*, 25, 2785-8.
29. Bremer H. & Dennis P.P. (1996). Modulation of chemical composition and other parameters of the cell by growth rate. In: *Escherichia coli and Salmonella: Cellular and Molecular Biology.* (ed. Neidhardt FC, Curtiss, R. III, Ingraham, J. L., Lin, E. C. C., Low, K. B., Magasanik, B., Reznikoff, W. S., Riley, M., Schaechter, M., and Umbarger, H. E.). ASM Press, Washington, D.C., pp. 1553–69.
30. Zimmerman S.B. & Trach S.O. (1991). Estimation of macromolecule concentrations and excluded volume effects for the cytoplasm of *Escherichia coli*. *J Mol Biol*, 222, 599-620.
31. Dennis P.P. & Herman R.K. (1970). Pyrimidine pools and macromolecular composition of pyrimidine-limited *Escherichia coli*. *J Bacteriol*, 102, 118-23.

Supplement to Loladze, I, Elser J.J (2011) "The origins of the Redfield nitrogen-to-phosphorus ratio are in a homoeostatic protein-to-rRNA ratio" Ecology Letters, 14(3):244-250.