Table 11.6. Estimated energy cost of RNA synthesis in adults.

	tRNA	rRNA	mRNA
A. Turnover rate, μmol $kg^{-1}\,d^{-1}$	0.63	0.037	0.99[a]
B. Nucleotides per molecule	100	13,500	8000[b]
C. Inter-nucleotide bonds synthesized, per day A × B	63	500	7900
D. Cost of this synthesis, kJ $kg^{-1}\,d^{-1}$	40×10^{-3}	31×10^{-3}	500×10^{-3}
E. Per cent of cost of protein synthesis	0.31	0.24	3.9

A. Sander *et al.*, 1986. B. H. Topp, personal communication. D. Blaxter, 1989; 2 ATP per bond, and 31 kJ per mol ATP. E. Protein turnover in adult taken as 4 g $kg^{-1}\,d^{-1}$ at cost of 3.2 kJ g^{-1}.

[a] H. Topp, personal communication.

[b] This is the number of nucleotides in the precursor or cap-mRNA. The number in the final mRNA is much smaller – about 1200 (Sander *et al.*, 1986).

If whole body prtotein synthesis is taken as 4gkg^{-1} d^{-1}, and if an average protein has MW 40,000 and contains 40 amino acids, then $4 \times {}^{400}/_{40,000} = 40$ mmol of peptide bonds are synthesized daily. If each amino acid is represented by three bases, then 120 mmol nucleotides are turned over per kg per day. If the coding length of an average mRNA needed for the synthesis of an average protein is taken to be 1200, then 120 mmol/1200 = 100 μmol RNA $kg^{-1}\,d^{-1}$ are involved in protein synthesis. This is 100 times higher than the turnover rate of mRNA, which means that one RNA molecule on average is translated 100 times. I am indebted to H. Topp for this calculation.