

APPENDIX 3: Reactions Catalyzed by RNA and DNA Enzymes

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Table 1 Reactions catalyzed by RNA and DNA enzymes

Reaction ^a	Enzyme ^b	Catalytic activity ^c			Reference
		k_{cat} (min ⁻¹)	K_m (μM)	$k_{\text{cat}}/k_{\text{uncat}}$	
Phosphoester transfer	R-nat	0.1	1×10^{-3}	10^{11}	Herschlag and Cech (1990)
	R-lab	0.3	0.02	10^{13}	Tsang and Joyce (1996)
Phosphoester cleavage	R-nat	1	0.05	10^6	Fedor and Uhlenbeck (1992)
	R-lab	0.1	0.03	10^5	Vaish et al. (1998)
Polynucleotide ligation	D-lab	3	8×10^{-4}	10^6	Santoro and Joyce (1997)
	R-nat	4	3	10^6	Hegg and Fedor (1995)
	R-lab	100	9	10^9	Ekland et al. (1995)
	D-lab	0.04	100	10^4	Cuenoud and Szostak (1995)
Polynucleotide phosphorylation	R-lab	0.3	40	$>10^5$	Lorsch and Szostak (1994)
Mononucleotide polymerization	R-lab	0.3	5×10^3	$>10^7$	Ekland and Bartel (1996)
Polynucleotide aminoacylation	R-lab	1	9×10^3	10^6	Illangasekare and Yarus (1997)
Aminoacyl ester hydrolysis	R-nat	0.02	0.5	10	Piccirilli et al. (1992)
Aminoacyl transfer	R-lab	0.2	0.05	10^3	Lohse and Szostak (1996)

Amide bond cleavage	R-lab				10 ²	Dai et al. (1995)
Amide bond formation	R-lab ^d	0.04	2		10 ⁵	Wiegand et al. (1997)
Peptide bond formation	R-lab	0.05	200		10 ⁶	Zhang and Cech (1997)
<i>N</i> -alkylation	R-lab	0.6	1 × 10 ³		10 ⁷	Wilson and Szostak (1995)
<i>S</i> -alkylation	R-lab				10 ³	Wecker et al. (1996)
Oxidative DNA cleavage	D-lab				>10 ⁶	Carmi et al. (1996)
Biphenyl rotation	R-lab	3 × 10 ⁻⁵	500		10 ²	Prudent et al. (1994)
Porphyrin metallation	R-lab	0.9	10		10 ³	Conn et al. (1996)
	D-lab	0.2	3 × 10 ³		10 ³	Li and Sen (1996)
Diels-Alder cycloaddition	R-lab ^d	>0.1	>500		10 ³	Tarasow et al. (1997)

^aOne example is listed for each class of reaction and each type of enzyme. In some cases additional examples have been reported.

^b(R-nat) RNA enzyme derived from a naturally occurring catalytic RNA; (R-lab) RNA enzyme obtained by in vitro evolution; (D-lab) DNA enzyme obtained by in vitro evolution.

^cValues for k_{cat} and K_m are listed to one significant digit even if more precise data were reported. Not all k_{cat} values reflect the chemical step of the reaction.

^dContains 5-substituted uridine analogs that are essential for catalysis.

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