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_{cat}/k_{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)
	D-lab	3	8×10^{-4}	10^{6}	Santoro and Joyce (1997)
Polynucleotide ligation	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)
N-alkylation	R-lab	0.6	1×10^3	10^7	Wilson and Szostak (1995)
S-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)

[a]One 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.

[c]Values 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.

[d]Contains 5-substituted uridine analogs that are essential for catalysis.

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