

Key functional motifs and residues in well-studied kinase families.

Kinase Family	Key Residues/Motifs	Function
protein S/T-Y kinase/ atypical protein kinase <i>example: protein kinase A</i> (<i>pdb 1cdk</i>)	glycine-rich loop <i>Gly50-Gly55</i>	interacts with phosphate tail of ATP
	K/R <i>Lys72</i>	interacts with α - and β -phosphates of ATP
	DxxxxN <i>Asp166-Asn171</i>	catalysis (Asp); Mg^{2+} coordination (Asn)
	DFG <i>Asp184</i>	Mg^{2+} coordination
lipid kinase <i>example: I3P3K</i> (<i>pdb 1w2c</i>)	K <i>Lys209</i>	interacts with α - and β -phosphates of ATP
	DLK <i>Asp262-Lys264</i>	interacts with sugar group of ATP (Asp); stabilizes γ -phosphate during transfer (Lys)
	SLL <i>Ser398-Leu401</i>	Mg^{2+} coordination
	D <i>Asp416</i>	Mg^{2+} coordination
ATP-grasp <i>example: carbamoyl-phosphate synthase</i> (<i>pdb 1bxr</i>)	R <i>Arg129</i>	interacts with α -phosphate of ATP
	K/R <i>Arg169</i>	interacts with α - and β -phosphates of ATP
	GG <i>Gly175-Gly176</i>	interacts with phosphate tail of ATP
	Q <i>Gln285</i>	interacts with α -phosphate of ATP
	ExN <i>Glu299-Asn301</i>	Mn^{2+} coordination
P-loop kinase <i>example: adenosylcobinamide kinase</i> (<i>pdb 1cbu</i>)	GxxxxGKT/S (Walker A motif) <i>Gly6-Ser13</i>	interacts with phosphate tail of ATP (glycine-rich loop); interacts with β - and γ -phosphate of ATP (Lys); and Mg^{2+} coordination (Thr/Ser)
	zzzzD/E (Walker B motif) <i>Ala76-Glu80</i>	Mg^{2+} coordination
PEPCK <i>example: phosphoenolpyruvate carboxykinase</i> (<i>pdb 1aq2</i>)	GxxxxGKT/S (Walker A motif) <i>Gly248-Thr255</i>	interacts with phosphate tail of ATP (glycine-rich loop); interacts with β - and γ -phosphate of ATP (Lys); and Mg^{2+} coordination (Thr/Ser)
	zzzDD (Walker B motif) <i>Leu265-Glu269</i>	Mg^{2+} coordination
phosphoglycerate kinase <i>example: phosphoglycerate kinase</i> (<i>pdb 1vjc</i>)	DK <i>Asp218-Lys219</i>	interacts with β -phosphate of ATP (Asp); interacts with α -phosphate of ATP (Lys)
	E <i>Glu343</i>	interacts with sugar group of ATP
aspartokinase <i>example: acetylglutamate kinase</i> (<i>pdb 1gs5</i>)	K <i>Lys8</i>	interacts with γ -phosphate of ATP
	G <i>Gly11</i>	interacts with γ -phosphate of ATP
	S/T <i>Ser180</i>	interacts with β -phosphate of ATP
	DV <i>Asp181-Val182</i>	interacts with sugar group of ATP

	K <i>Lys217</i>	interacts with β -phosphate of ATP
phosphofructokinase-like <i>example: phosphofructokinase</i> (<i>pdb 4pfk</i>)	R <i>R72</i>	interacts with α -phosphate of ATP
	D <i>D103</i>	Mg ²⁺ coordination
	S/TxDxD <i>Thr125-Asp129</i>	interacts with γ -phosphate of ATP (Ser/Thr and first Asp); Mg ²⁺ coordination (second Asp)
ribokinase-like <i>example: pyridoxal kinase</i> (<i>pdb 1lhr</i>)	D <i>Asp113</i>	K ⁺ coordination
	D <i>Asp118</i>	interacts with β -phosphate of ATP
	Y <i>Tyr127</i>	interacts with γ -phosphate of ATP
	TxN <i>Thr148-Asn150</i>	K ⁺ coordination (Thr); interacts with β -phosphate of ATP (Asn)
	TS <i>Thr186-Ser187</i>	K ⁺ coordination (Thr); interacts with α -phosphate of ATP (Ser)
	TG <i>Thr233-Gly234</i>	interacts with γ -phosphate of ATP (Thr); interacts with β -phosphate of ATP (Gly)
nucleoside-diphosphate kinase <i>example: NDP kinase</i> (<i>pdb 1lcn</i>)	Y <i>Try56</i>	interacts with γ -phosphate of ATP
	R <i>Arg88</i>	interacts with β - and γ -phosphates of ATP
	R <i>Arg105</i>	interacts with β -phosphate of ATP
	H <i>His118</i>	interacts with γ -phosphate of ATP
HPPK <i>example: HPPK</i> (<i>pdb 1eqo</i>)	R <i>Arg92</i>	interacts with β -phosphate of ATP
	DxD <i>Asp95-Asp97</i>	Mg ²⁺ coordination
	H <i>His115</i>	interacts with γ -phosphate of ATP
	R <i>Arg121</i>	interacts with γ -phosphate of ATP
guanido kinases <i>example: arginine kinase</i> (<i>pdb 1bg0</i>)	RxR <i>Arg124-R126</i>	interact with β -phosphate of ATP
	R <i>Arg229</i>	interacts with γ -phosphate of ATP
	R <i>Arg280</i>	interacts with α - and β -phosphates of ATP
	R <i>Arg309</i>	interacts with α - and γ -phosphates of ATP
histidine kinase <i>example: histidine kinase</i> (<i>pdb 1i59</i>)	N <i>Asn409</i>	Mg ²⁺ coordination
	H <i>His413</i>	interacts with β -phosphate and adenine of ATP
	S <i>Ser498</i>	interacts with γ -phosphate of ATP
ribonuclease H-like <i>example: hexokinase</i> (<i>pdb 1dgc</i>)	D/ExGxxxxR/K (PHOSPHATE I motif) <i>Asp532-Arg539</i>	Mg ²⁺ coordination
	D <i>Asp657</i>	putative catalytic base

	GS/TG (PHOSPHATE II motif) <i>Gly679-Gly681</i>	interact with β - and γ -phosphates of ATP
pyruvate kinase <i>example: pyruvate kinase</i> <i>(pdb 1a49)</i>	RxNxS <i>Arg72-Ser76</i>	interacts with α - and γ -phosphates of ATP (Arg); K^+ coordination (Asn and Ser)
	D <i>Asp112</i>	K^+ coordination
	R <i>Arg119</i>	interact with β - and γ -phosphates of ATP
	K <i>Lys206</i>	interacts with sugar group of ATP
	E <i>Glu271</i>	Mg^{2+} coordination
	D <i>Asp295</i>	Mg^{2+} coordination
GHMP kinases <i>example: homoserine</i> <i>kinase (PDB 1h72)</i>	PxxxGLGSSAA <i>Pro90-Ala100</i>	interacts with phosphate tail of ATP
	E <i>Glu130</i>	Mg^{2+} coordination
riboflavin kinase <i>example: riboflavin kinase</i> <i>(pdb 1nb9)</i>	PTAN <i>Pro33-Asn36</i>	interacts with adenine of ATP (Pro); Mg^{2+} coordination (Thr and Asn); interacts with β -phosphate of ATP (Asn)
	FY <i>Phe97-Tyr98</i>	interacts with adenine of ATP (Phe); interacts with β -phosphate of ATP (Tyr)
dihydroxyacetone kinase <i>example: dihydroxyacetone</i> <i>kinase (pdb 1un9)</i>	DxxxxDxD <i>Asp380-Asp387</i>	Mg^{2+} coordination
	GGSSG <i>Gly429-Gly433</i>	interacts with phosphate tail of ATP (first Ser with β - and γ -phosphates, second Ser with α -phosphate)

Bold indicates those residues directly involved in the specified functional role. In the motifs, x is any residue and z is any hydrophobic residue. Representative members are not all kinases, as non-kinase representatives were chosen in cases where the solved structure of a homolog is more informative (e.g. the solved structure of carbamoyl-phosphate synthase, *pdb|1bxx*, has a bound nucleotide substrate, unlike the kinase members of the ATP-grasp family). It should be noted that not all members of a family necessarily utilize all of the listed residues for nucleotide binding and catalysis. Residues and motifs specified in this table will often, but not always, correspond to functional residues in homologous proteins.