

**Table S3**

Parameter	Description	Value	Unit
$k_3$	Forward rate for phosphorylation complex	1	$(\mu\text{Ms})^{-1}$
$k_4$	Reverse rate for phosphorylation complex	39	$\text{s}^{-1}$
$k^*_3$	Forward rate for phosphorylation complex with CheA2	1	$(\mu\text{Ms})^{-1}$
$k^*_4$	Reverse rate for phosphorylation complex with CheA2	39	$\text{s}^{-1}$
$k_5$	$K_{\text{cat}}$ for phosphorylation of CheA3 by CheA4	varied	$\text{s}^{-1}$
$k^*_5$	$K_{\text{cat}}$ for phosphorylation of CheA2	varied	$\text{s}^{-1}$
$k^*_6$	CheA2-P to CheY6 Phosphotransfer	0.775	$(\mu\text{Ms})^{-1}$
$k^*_7$	CheA2-P to CheY6 Reverse phosphotransfer	0.00283	$(\mu\text{Ms})^{-1}$