

**Table S1. The top 50 slowest ribosomal motions characterized by ANM**

	ANM Mode Index	Eigenvalues	Estimated Time Scale ( $\mu\text{s}$ )
Slowest motion	1	4.46E-05	14293679.65
	2	6.50E-05	7033919.39
	3	8.38E-05	4352815.56
	4	1.17E-04	2320270.70
	5	3.25E-04	335825.34
	6	4.08E-04	219343.56
	7	5.57E-04	121698.60
	8	7.64E-04	67024.34
	9	8.93E-04	49911.72
	10	1.21E-03	28009.81
	11	1.50E-03	18632.15
	12	3.69E-03	3419.05
	13	3.94E-03	3018.11
	14	4.07E-03	2840.08
	15	5.35E-03	1696.67
	16	6.34E-03	1232.63
	17	7.45E-03	907.07
	18	8.56E-03	698.76
	19	9.20E-03	609.14
	20	1.10E-02	433.26
	21	1.12E-02	420.91
	22	1.22E-02	358.64
	23	1.62E-02	208.55
	24	1.73E-02	185.47
Ratcheting motion	25	1.86E-02	160.73
	26	1.91E-02	153.34
L1 stalk motion	27	2.10E-02	128.19
L1 stalk motion	28	2.33E-02	105.09
	29	2.54E-02	89.37
	30	2.62E-02	84.47
	31	2.76E-02	76.61
Head swiveling motion	32	2.90E-02	69.91
	33	3.15E-02	59.47
	34	3.51E-02	48.67
	35	3.81E-02	41.70
	36	4.17E-02	35.11
	37	4.31E-02	33.03

38	5.26E-02	22.64
39	5.32E-02	22.16
40	5.56E-02	20.36
41	5.69E-02	19.52
42	6.03E-02	17.50
43	6.48E-02	15.28
44	6.56E-02	14.90
45	6.80E-02	13.92
46	6.91E-02	13.51
47	7.32E-02	12.14
48	7.37E-02	11.97
49	7.41E-02	11.84
50	7.47E-02	11.67

ANM is performed on the *Thermus thermophilus* 70S ribosome whose missing atoms, residues and subunits were patched using the individually solved subunits as templates [14]. The estimated time scales of the vibrational modes are obtained from the general time power law for ANM eigenvalues of three proteins (ubiquitin, FGF2 and HPNAP).