



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 05:04 AM UTC

PDB ID : 5DA8 / pdb_00005da8
Title : Crystal structure of chaperonin GroEL from
Authors : Chang, C.; Marshall, N.; Feldmann, B.; Joachimiak, A.; Midwest Center for
Structural Genomics (MCSG)
Deposited on : 2015-08-19
Resolution : 3.00 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

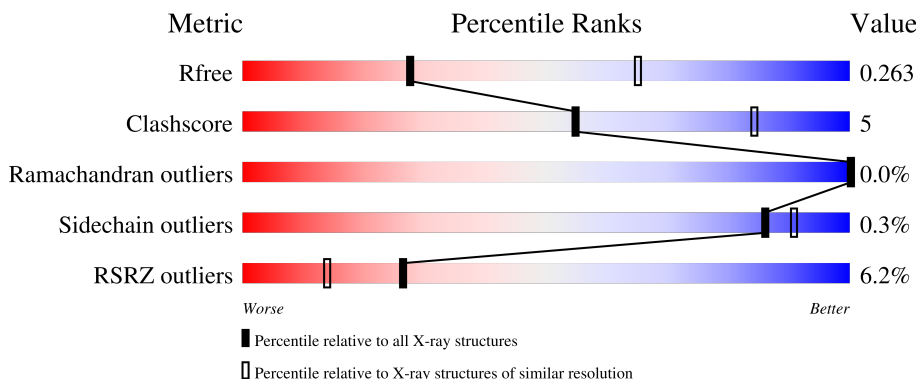
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	2672 (3.00-3.00)
Clashscore	190562	2977 (3.00-3.00)
Ramachandran outliers	187476	2877 (3.00-3.00)
Sidechain outliers	187428	2880 (3.00-3.00)
RSRZ outliers	180081	2671 (3.00-3.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	545	<div> <div>4%</div> <div>78%</div> <div>14%</div> <div>8%</div> </div>
1	B	545	<div> <div>6%</div> <div>86%</div> <div>10%</div> <div>5%</div> </div>
1	C	545	<div> <div>7%</div> <div>78%</div> <div>10%</div> <div>12%</div> </div>
1	D	545	<div> <div>5%</div> <div>83%</div> <div>12%</div> <div>5%</div> </div>
1	E	545	<div> <div>6%</div> <div>82%</div> <div>12%</div> <div>7%</div> </div>

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Mol	Chain	Length	Quality of chain
1	F	545	
1	G	545	
1	H	545	
1	I	545	
1	J	545	
1	K	545	
1	L	545	
1	M	545	
1	N	545	
1	O	545	
1	P	545	
1	Q	545	
1	R	545	
1	S	545	
1	T	545	
1	U	545	
1	V	545	
1	W	545	
1	X	545	
1	Y	545	
1	Z	545	
1	a	545	
1	b	545	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 99552 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called 60 kDa chaperonin.

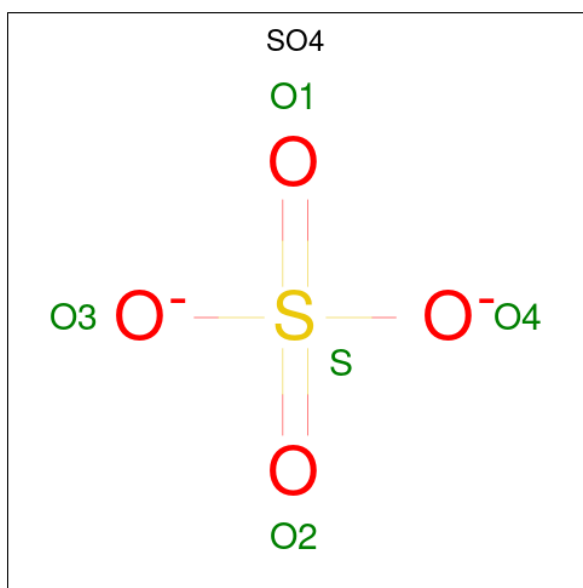
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	499	Total	C	N	O	S	0	0	0
			3601	2242	631	720	8			
1	B	519	Total	C	N	O	S	0	0	0
			3706	2296	655	745	10			
1	C	478	Total	C	N	O	S	0	0	0
			3335	2066	591	670	8			
1	D	517	Total	C	N	O	S	0	0	0
			3721	2316	654	743	8			
1	E	509	Total	C	N	O	S	0	0	0
			3631	2254	641	727	9			
1	F	497	Total	C	N	O	S	0	0	0
			3560	2201	630	720	9			
1	G	499	Total	C	N	O	S	0	0	0
			3500	2168	621	703	8			
1	H	515	Total	C	N	O	S	0	0	0
			3766	2342	659	757	8			
1	I	512	Total	C	N	O	S	0	0	0
			3697	2298	646	745	8			
1	J	507	Total	C	N	O	S	0	0	0
			3525	2175	624	719	7			
1	K	433	Total	C	N	O	S	0	0	0
			2968	1831	536	597	4			
1	L	484	Total	C	N	O	S	0	0	0
			3309	2033	591	679	6			
1	M	463	Total	C	N	O	S	0	0	0
			3247	2012	577	651	7			
1	N	511	Total	C	N	O	S	0	0	0
			3603	2232	638	725	8			
1	O	492	Total	C	N	O	S	0	0	0
			3451	2131	609	704	7			
1	P	522	Total	C	N	O	S	0	0	0
			3780	2350	661	760	9			

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	Q	502	Total	C	N	O	S	0	0	0
			3585	2229	633	715	8			
1	R	502	Total	C	N	O	S	0	0	0
			3576	2218	628	722	8			
1	S	512	Total	C	N	O	S	0	0	0
			3677	2286	646	737	8			
1	T	497	Total	C	N	O	S	0	0	0
			3494	2163	617	707	7			
1	U	518	Total	C	N	O	S	0	0	0
			3718	2315	648	746	9			
1	V	500	Total	C	N	O	S	0	0	0
			3575	2215	626	725	9			
1	W	517	Total	C	N	O	S	0	0	0
			3661	2269	647	737	8			
1	X	504	Total	C	N	O	S	0	0	0
			3581	2218	637	721	5			
1	Y	512	Total	C	N	O	S	0	0	0
			3695	2298	647	741	9			
1	Z	518	Total	C	N	O	S	0	0	0
			3703	2294	654	746	9			
1	a	522	Total	C	N	O	S	0	0	0
			3743	2324	658	752	9			
1	b	423	Total	C	N	O	S	0	0	0
			2961	1831	525	598	7			

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total O S 5 4 1	0	0
2	B	1	Total O S 5 4 1	0	0
2	C	1	Total O S 5 4 1	0	0
2	D	1	Total O S 5 4 1	0	0
2	E	1	Total O S 5 4 1	0	0
2	F	1	Total O S 5 4 1	0	0
2	G	1	Total O S 5 4 1	0	0
2	J	1	Total O S 5 4 1	0	0
2	K	1	Total O S 5 4 1	0	0
2	L	1	Total O S 5 4 1	0	0
2	M	1	Total O S 5 4 1	0	0
2	N	1	Total O S 5 4 1	0	0
2	P	1	Total O S 5 4 1	0	0
2	R	1	Total O S 5 4 1	0	0
2	T	1	Total O S 5 4 1	0	0
2	U	1	Total O S 5 4 1	0	0
2	V	1	Total O S 5 4 1	0	0
2	Y	1	Total O S 5 4 1	0	0
2	Z	1	Total O S 5 4 1	0	0
2	a	1	Total O S 5 4 1	0	0
2	b	1	Total O S 5 4 1	0	0

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Ca 1 1	0	0
3	B	1	Total Ca 1 1	0	0
3	F	1	Total Ca 1 1	0	0
3	G	1	Total Ca 1 1	0	0
3	I	1	Total Ca 1 1	0	0
3	J	1	Total Ca 1 1	0	0
3	K	1	Total Ca 1 1	0	0
3	M	1	Total Ca 1 1	0	0
3	O	1	Total Ca 1 1	0	0
3	P	1	Total Ca 1 1	0	0
3	Q	1	Total Ca 1 1	0	0
3	R	1	Total Ca 1 1	0	0
3	T	1	Total Ca 1 1	0	0
3	U	1	Total Ca 1 1	0	0
3	V	1	Total Ca 1 1	0	0
3	Y	1	Total Ca 1 1	0	0
3	Z	1	Total Ca 1 1	0	0
3	a	1	Total Ca 1 1	0	0

- Molecule 4 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	H	1	Total Mg 1 1	0	0
4	M	1	Total Mg 1 1	0	0

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	Q	1	Total 1	Mg 1	0	0
4	R	1	Total 1	Mg 1	0	0
4	S	1	Total 1	Mg 1	0	0
4	T	1	Total 1	Mg 1	0	0
4	V	1	Total 1	Mg 1	0	0

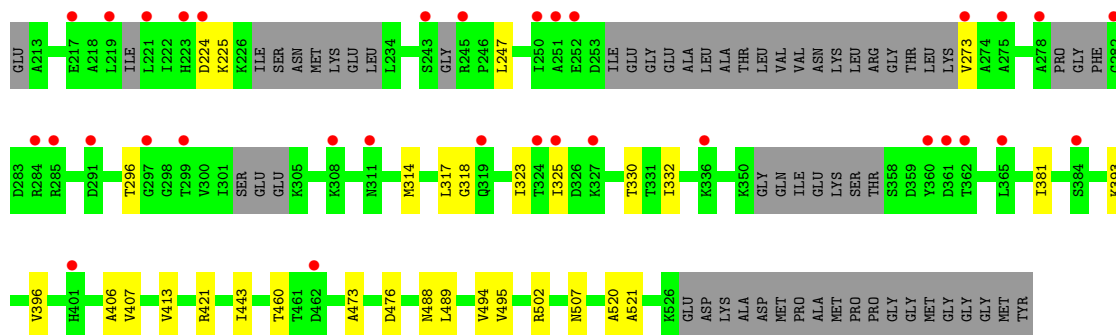
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	3	Total 3	O 3	0	0
5	B	2	Total 2	O 2	0	0
5	C	1	Total 1	O 1	0	0
5	D	2	Total 2	O 2	0	0
5	E	2	Total 2	O 2	0	0
5	F	2	Total 2	O 2	0	0
5	H	1	Total 1	O 1	0	0
5	I	3	Total 3	O 3	0	0
5	J	3	Total 3	O 3	0	0
5	L	3	Total 3	O 3	0	0
5	N	2	Total 2	O 2	0	0
5	O	3	Total 3	O 3	0	0
5	P	2	Total 2	O 2	0	0
5	Q	3	Total 3	O 3	0	0

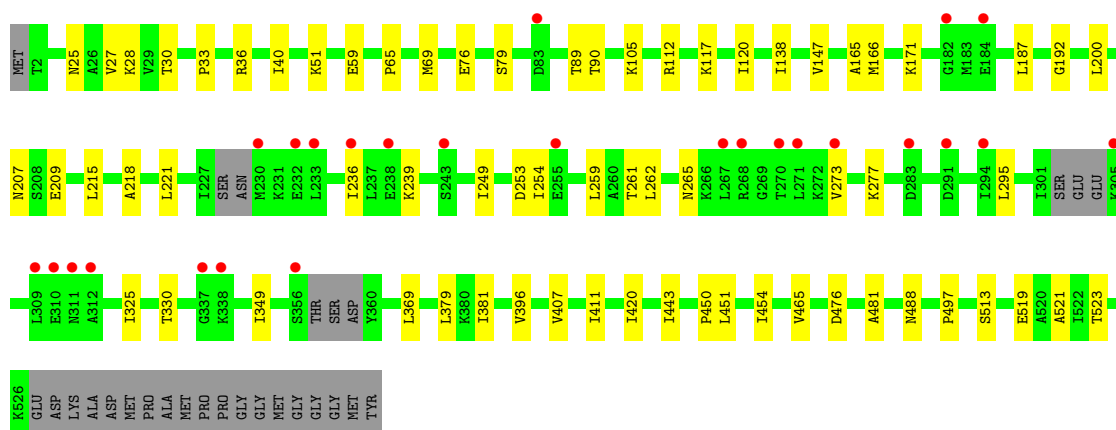
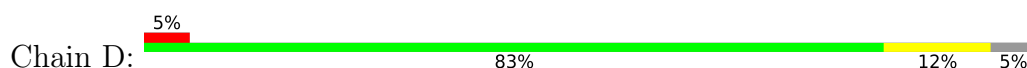
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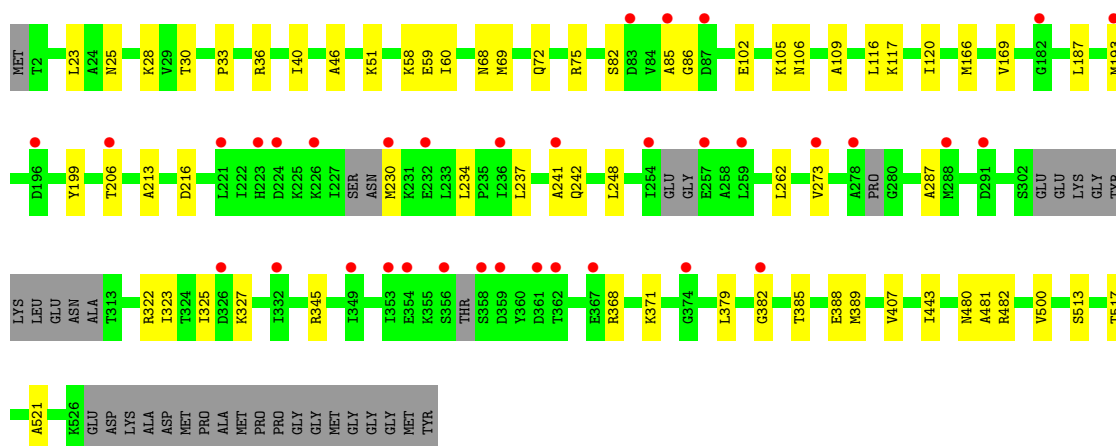
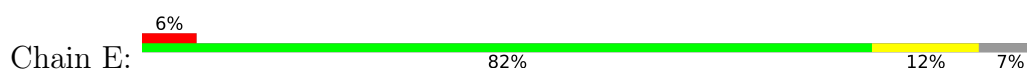
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	R	1	Total 1	O 1	0	0
5	S	3	Total 3	O 3	0	0
5	U	1	Total 1	O 1	0	0
5	V	2	Total 2	O 2	0	0
5	W	2	Total 2	O 2	0	0
5	X	5	Total 5	O 5	0	0
5	Y	3	Total 3	O 3	0	0
5	Z	1	Total 1	O 1	0	0
5	a	1	Total 1	O 1	0	0
5	b	2	Total 2	O 2	0	0



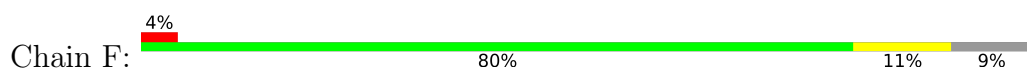
• Molecule 1: 60 kDa chaperonin

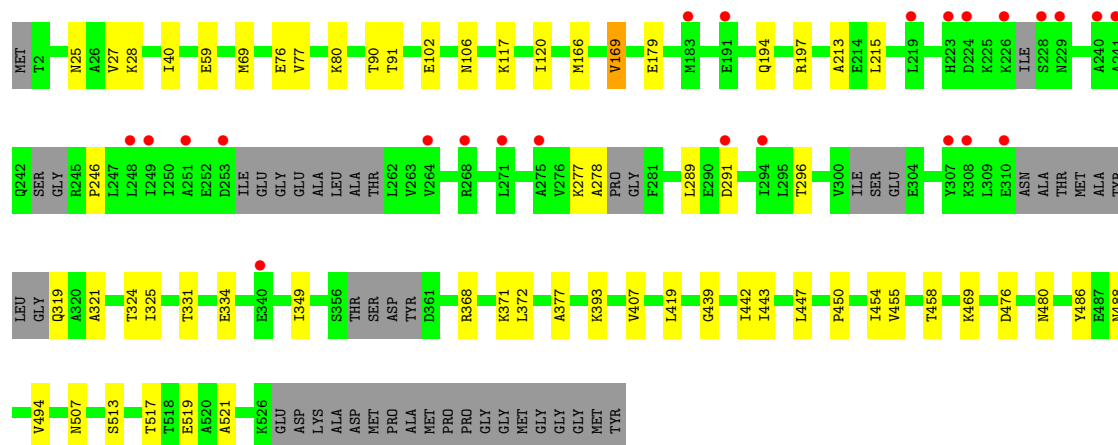


• Molecule 1: 60 kDa chaperonin

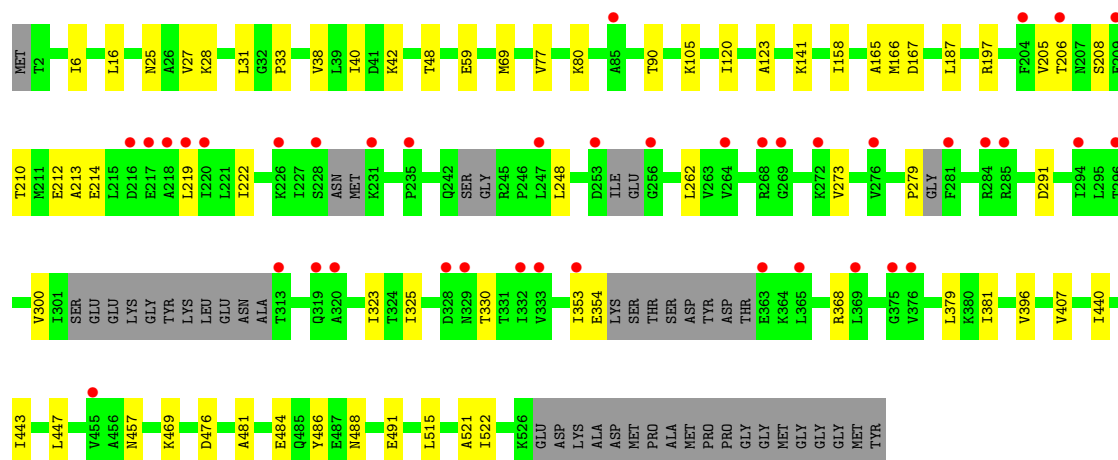
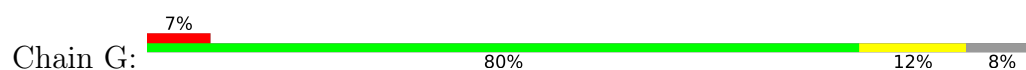


• Molecule 1: 60 kDa chaperonin

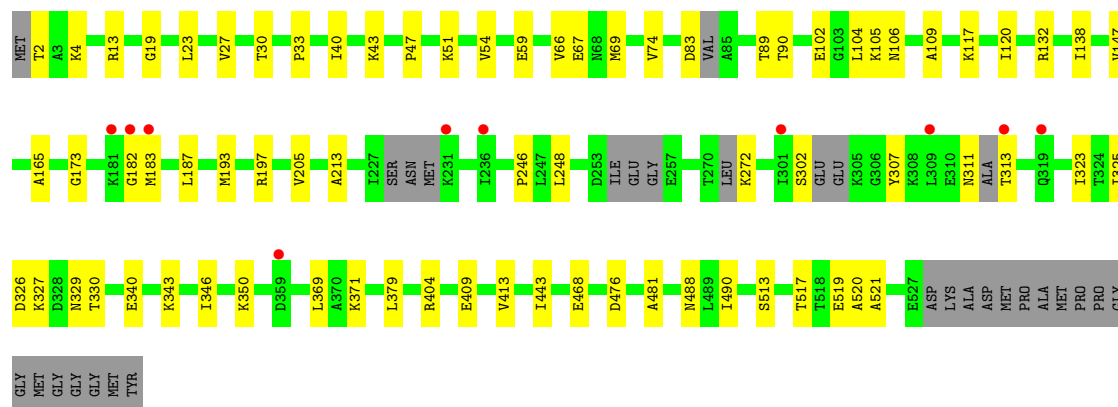
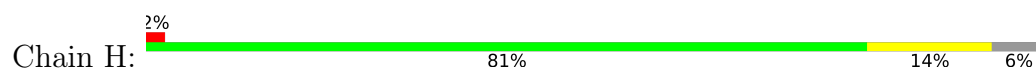




- Molecule 1: 60 kDa chaperonin

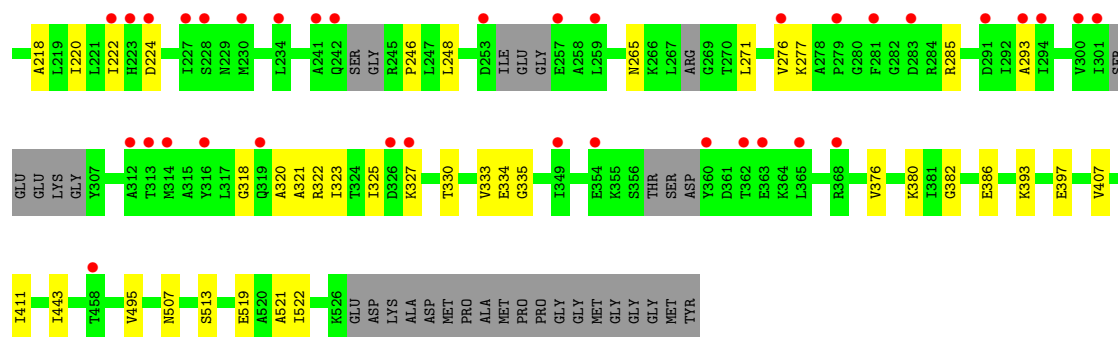


- Molecule 1: 60 kDa chaperonin

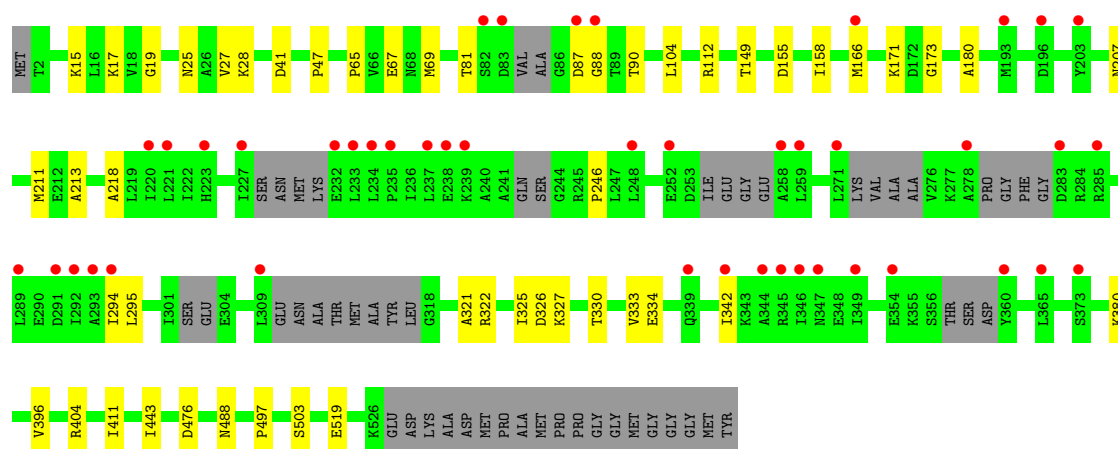
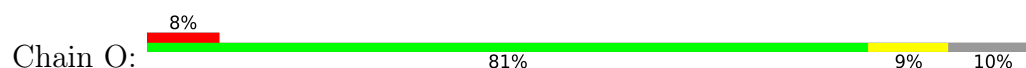


- Molecule 1: 60 kDa chaperonin

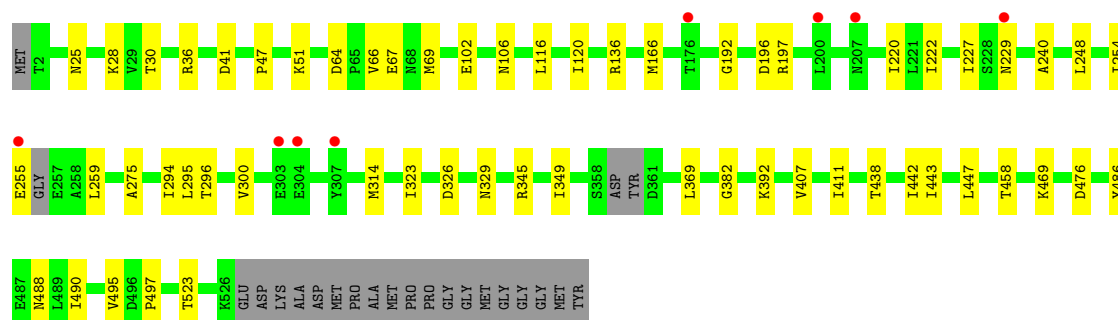
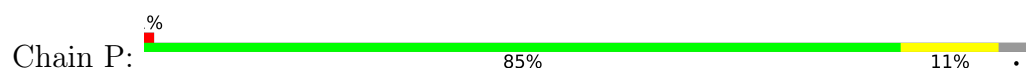




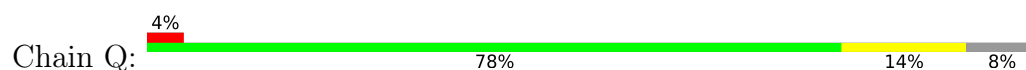
• Molecule 1: 60 kDa chaperonin

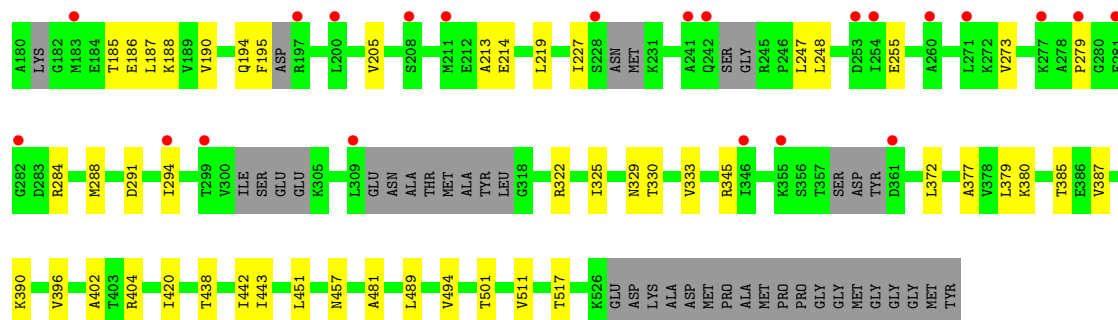


• Molecule 1: 60 kDa chaperonin

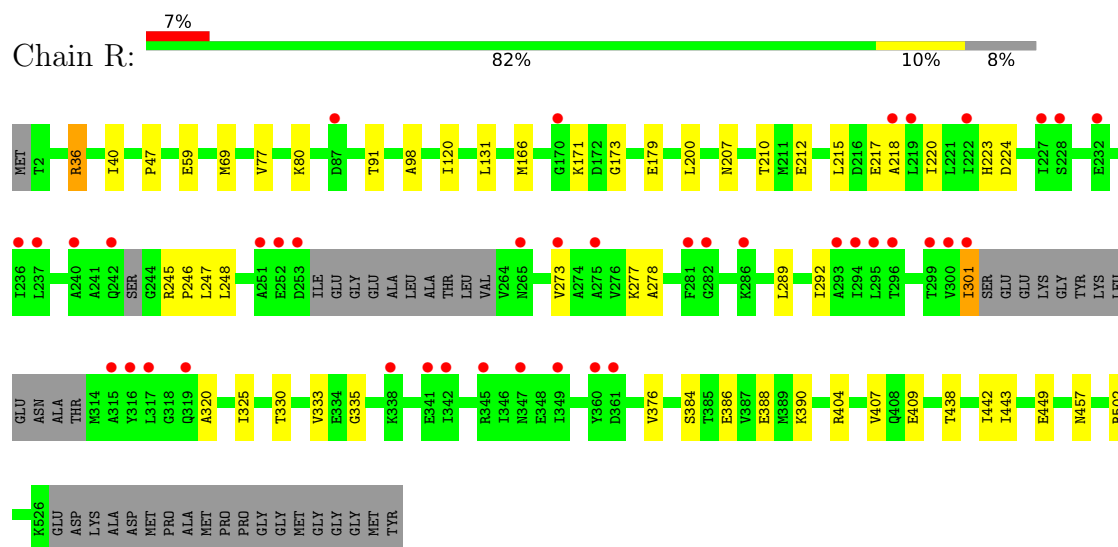


• Molecule 1: 60 kDa chaperonin

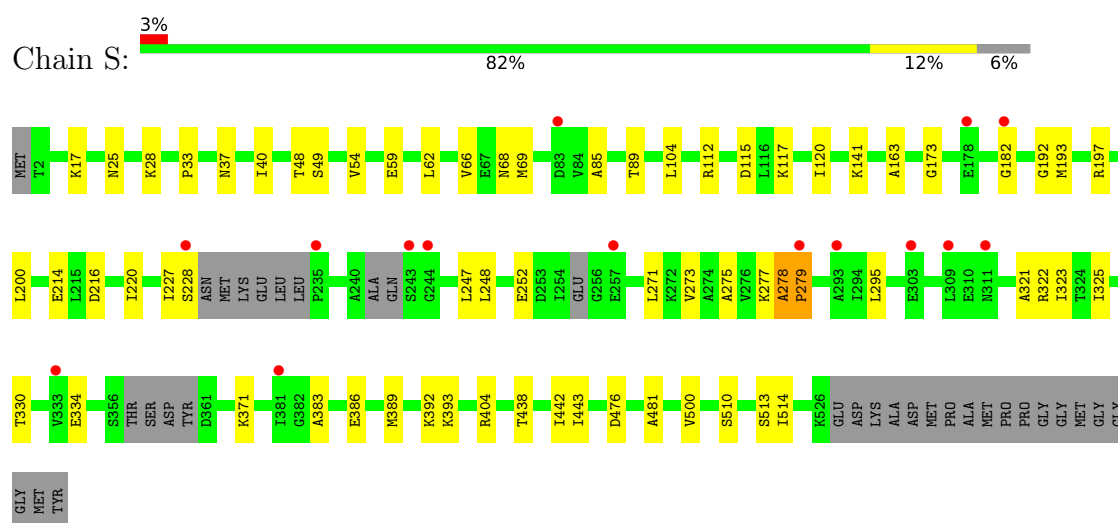




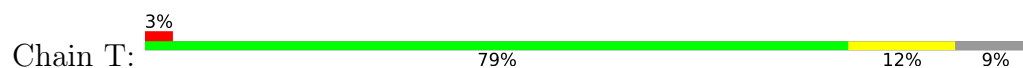
● Molecule 1: 60 kDa chaperonin

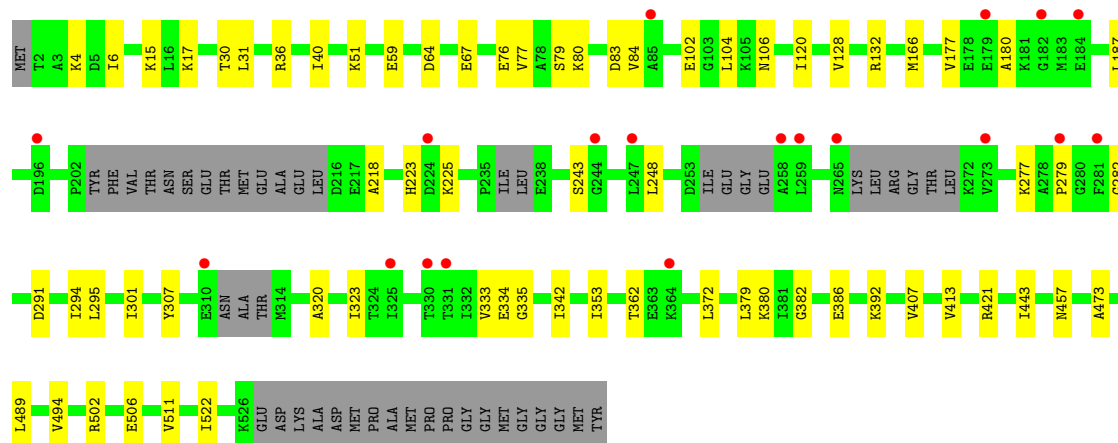


● Molecule 1: 60 kDa chaperonin

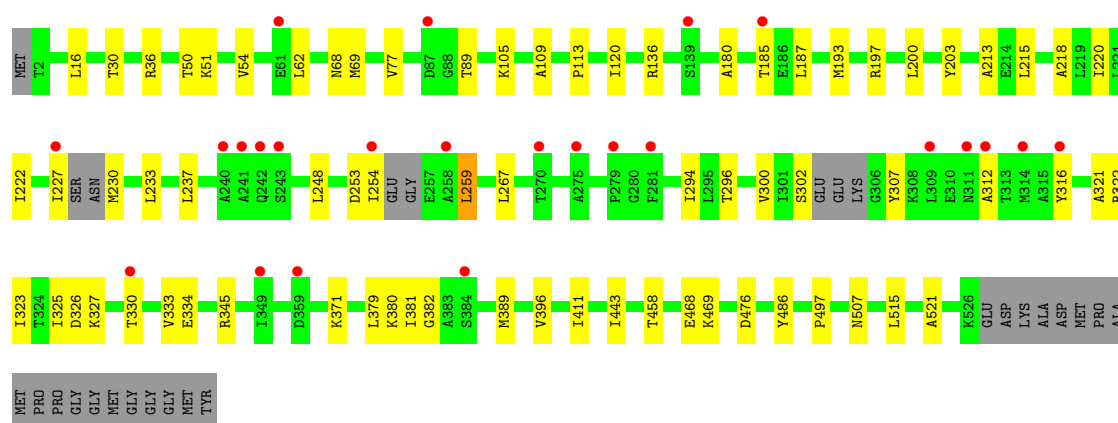
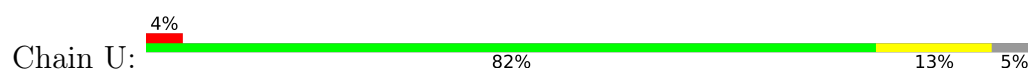


● Molecule 1: 60 kDa chaperonin

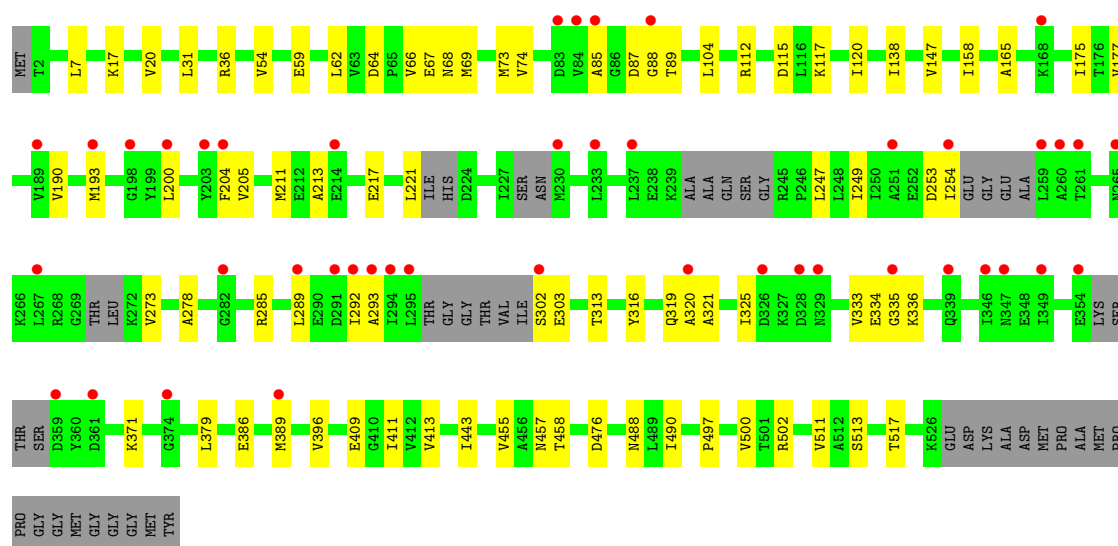
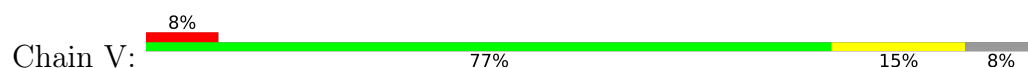




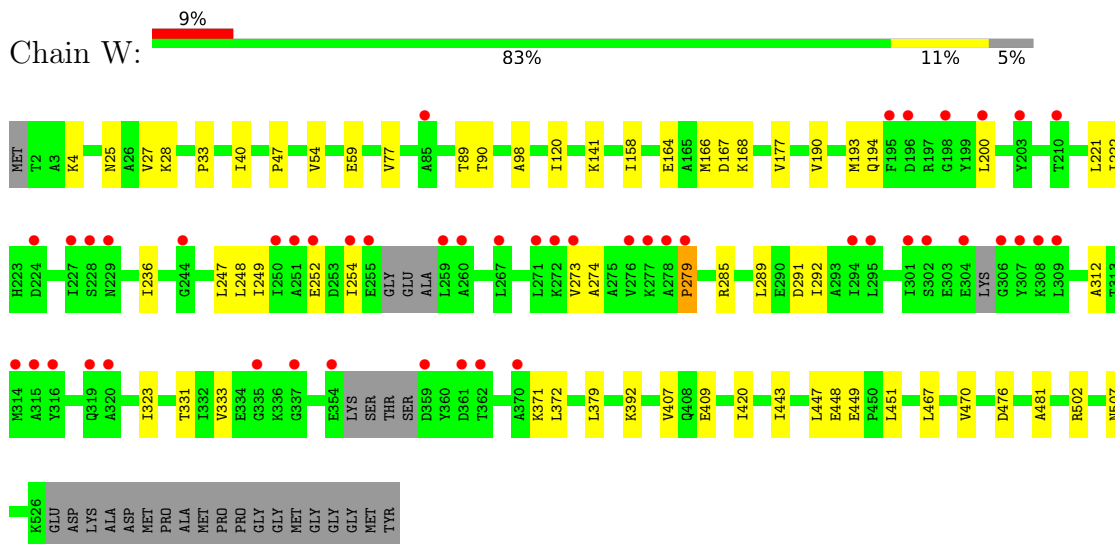
• Molecule 1: 60 kDa chaperonin



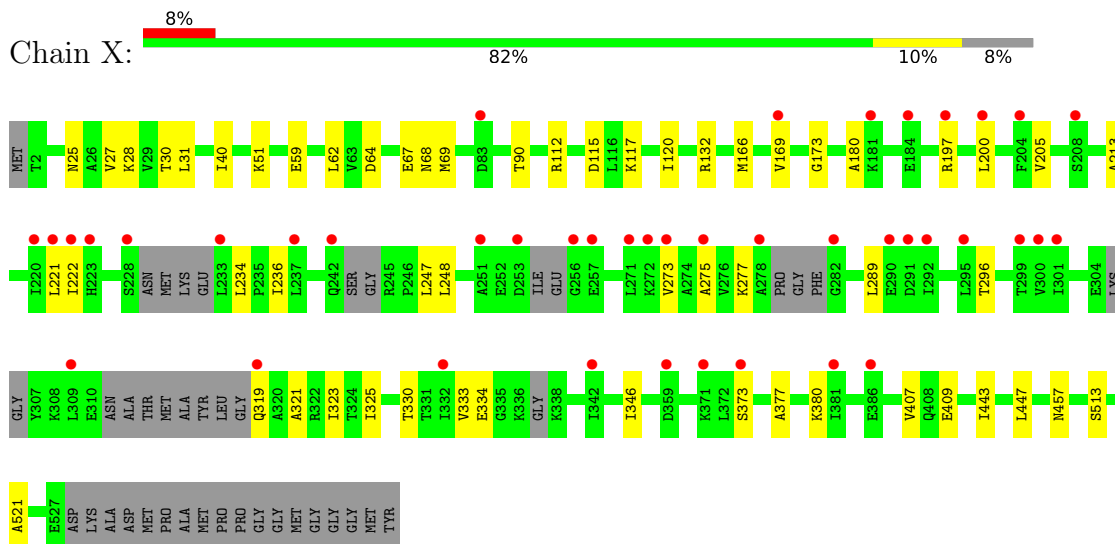
• Molecule 1: 60 kDa chaperonin



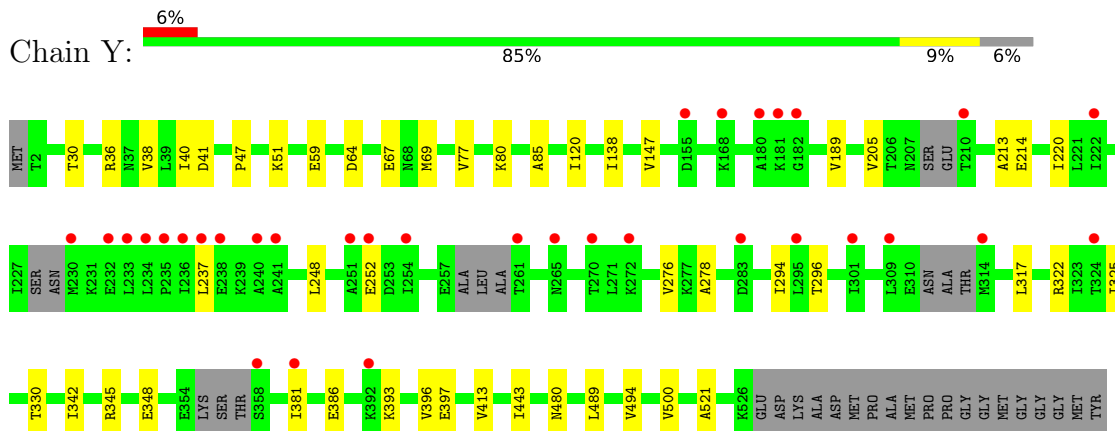
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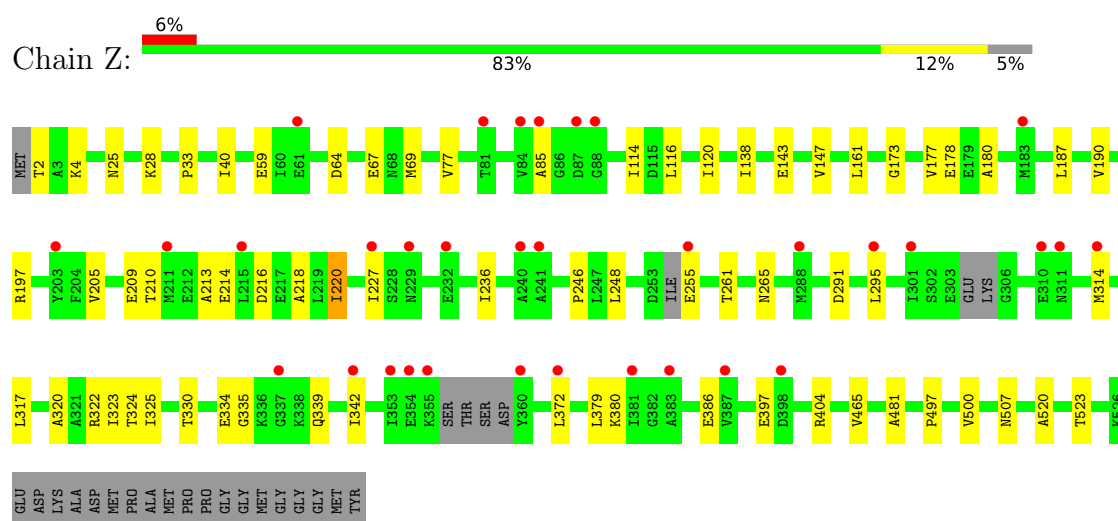
- Chain X:



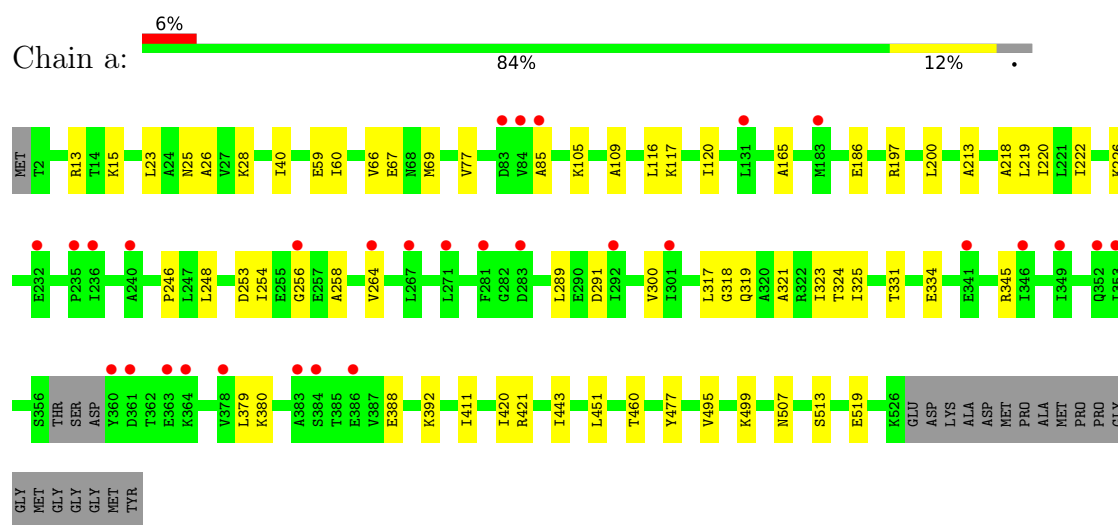
- Chain Y:



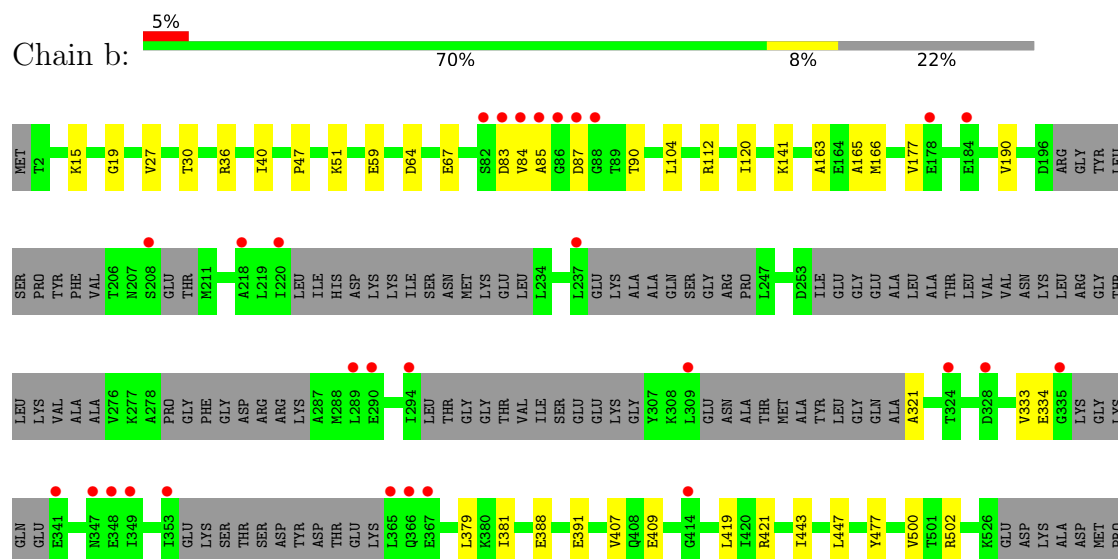
- Molecule 1: 60 kDa chaperonin



• Molecule 1: 60 kDa chaperonin



• Molecule 1: 60 kDa chaperonin



ALA
MET
PRO
PRO
GLY
GLY
MET
GLY
GLY
GLY
MET
TYR

4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	139.00Å 159.78Å 228.82Å 75.46° 90.51° 91.22°	Depositor
Resolution (Å)	48.60 – 3.00 48.60 – 3.00	Depositor EDS
% Data completeness (in resolution range)	95.9 (48.60-3.00) 95.9 (48.60-3.00)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.77 (at 3.01Å)	Xtriage
Refinement program	PHENIX (1.10_2155: ???)	Depositor
R, R_{free}	0.230 , 0.263 0.231 , 0.263	Depositor DCC
R_{free} test set	18192 reflections (4.78%)	wwPDB-VP
Wilson B-factor (Å ²)	53.7	Xtriage
Anisotropy	0.082	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 50.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.008 for h,-k,-l	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	99552	wwPDB-VP
Average B, all atoms (Å ²)	60.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.63% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MG, SO4, CA

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.08	0/3615	0.24	0/4880
1	B	0.08	0/3727	0.25	0/5041
1	C	0.08	0/3344	0.24	0/4527
1	D	0.08	0/3742	0.25	0/5062
1	E	0.08	0/3647	0.24	0/4933
1	F	0.08	0/3574	0.25	0/4827
1	G	0.08	0/3514	0.26	0/4756
1	H	0.08	0/3785	0.24	0/5106
1	I	0.09	0/3715	0.25	0/5024
1	J	0.08	0/3541	0.25	0/4799
1	K	0.08	0/2974	0.24	0/4025
1	L	0.07	0/3319	0.24	0/4501
1	M	0.09	0/3257	0.26	0/4407
1	N	0.08	0/3620	0.28	0/4902
1	O	0.08	0/3462	0.26	0/4684
1	P	0.08	0/3803	0.26	0/5142
1	Q	0.08	0/3600	0.26	0/4862
1	R	0.08	0/3595	0.25	0/4867
1	S	0.08	0/3697	0.27	1/5001 (0.0%)
1	T	0.09	0/3508	0.29	1/4751 (0.0%)
1	U	0.08	0/3739	0.25	0/5062
1	V	0.09	0/3591	0.27	0/4854
1	W	0.08	0/3679	0.28	1/4981 (0.0%)
1	X	0.08	0/3597	0.25	0/4865
1	Y	0.09	0/3715	0.25	0/5017
1	Z	0.08	0/3723	0.26	0/5039
1	a	0.08	0/3766	0.26	0/5099
1	b	0.08	0/2965	0.24	0/4007
All	All	0.08	0/99814	0.26	3/135021 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if

the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	J	0	1
1	T	0	1
All	All	0	2

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	S	279	PRO	N-CA-CB	7.31	110.93	103.25
1	W	279	PRO	N-CA-CB	7.18	110.78	103.25
1	T	279	PRO	N-CA-CB	6.97	110.56	103.25

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	J	367	GLU	Peptide
1	T	243	SER	Peptide

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3601	0	3651	43	0
1	B	3706	0	3668	29	0
1	C	3335	0	3252	33	0
1	D	3721	0	3751	41	0
1	E	3631	0	3624	38	0
1	F	3560	0	3514	34	0
1	G	3500	0	3438	39	0
1	H	3766	0	3823	44	0
1	I	3697	0	3728	41	0
1	J	3525	0	3391	38	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	K	2968	0	2840	35	0
1	L	3309	0	3145	35	0
1	M	3247	0	3211	31	0
1	N	3603	0	3541	41	0
1	O	3451	0	3335	28	0
1	P	3780	0	3812	34	0
1	Q	3585	0	3577	44	0
1	R	3576	0	3541	32	0
1	S	3677	0	3683	36	0
1	T	3494	0	3435	38	0
1	U	3718	0	3723	42	0
1	V	3575	0	3506	49	0
1	W	3661	0	3601	33	0
1	X	3581	0	3504	32	0
1	Y	3695	0	3689	28	0
1	Z	3703	0	3669	43	0
1	a	3743	0	3741	37	0
1	b	2961	0	2899	26	0
2	A	5	0	0	0	0
2	B	5	0	0	0	0
2	C	5	0	0	0	0
2	D	5	0	0	0	0
2	E	5	0	0	0	0
2	F	5	0	0	1	0
2	G	5	0	0	0	0
2	J	5	0	0	0	0
2	K	5	0	0	0	0
2	L	5	0	0	0	0
2	M	5	0	0	0	0
2	N	5	0	0	0	0
2	P	5	0	0	0	0
2	R	5	0	0	1	0
2	T	5	0	0	0	0
2	U	5	0	0	0	0
2	V	5	0	0	0	0
2	Y	5	0	0	0	0
2	Z	5	0	0	0	0
2	a	5	0	0	0	0
2	b	5	0	0	1	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	F	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	G	1	0	0	0	0
3	I	1	0	0	0	0
3	J	1	0	0	0	0
3	K	1	0	0	0	0
3	M	1	0	0	0	0
3	O	1	0	0	0	0
3	P	1	0	0	0	0
3	Q	1	0	0	0	0
3	R	1	0	0	0	0
3	T	1	0	0	0	0
3	U	1	0	0	0	0
3	V	1	0	0	0	0
3	Y	1	0	0	0	0
3	Z	1	0	0	0	0
3	a	1	0	0	0	0
4	H	1	0	0	0	0
4	M	1	0	0	0	0
4	Q	1	0	0	0	0
4	R	1	0	0	0	0
4	S	1	0	0	0	0
4	T	1	0	0	0	0
4	V	1	0	0	0	0
5	A	3	0	0	0	0
5	B	2	0	0	0	0
5	C	1	0	0	0	0
5	D	2	0	0	0	0
5	E	2	0	0	0	0
5	F	2	0	0	0	0
5	H	1	0	0	0	0
5	I	3	0	0	0	0
5	J	3	0	0	0	0
5	L	3	0	0	0	0
5	N	2	0	0	0	0
5	O	3	0	0	0	0
5	P	2	0	0	0	0
5	Q	3	0	0	1	0
5	R	1	0	0	0	0
5	S	3	0	0	0	0
5	U	1	0	0	0	0
5	V	2	0	0	0	0
5	W	2	0	0	0	0
5	X	5	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	Y	3	0	0	0	0
5	Z	1	0	0	0	0
5	a	1	0	0	0	0
5	b	2	0	0	0	0
All	All	99552	0	98292	955	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 5.

The worst 5 of 955 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:K:85:ALA:HB1	1:K:500:VAL:HG22	1.67	0.77
1:Y:252:GLU:HA	1:Y:278:ALA:HB2	1.68	0.75
1:X:333:VAL:HG12	1:X:334:GLU:HG3	1.69	0.74
1:Y:47:PRO:HG3	1:Z:69:MET:HG3	1.69	0.73
1:D:325:ILE:HG12	1:D:330:THR:HG23	1.71	0.72

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	483/545 (89%)	472 (98%)	11 (2%)	0	100	100
1	B	511/545 (94%)	496 (97%)	15 (3%)	0	100	100
1	C	460/545 (84%)	448 (97%)	12 (3%)	0	100	100
1	D	509/545 (93%)	497 (98%)	12 (2%)	0	100	100
1	E	497/545 (91%)	479 (96%)	18 (4%)	0	100	100
1	F	481/545 (88%)	468 (97%)	13 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	G	485/545 (89%)	467 (96%)	18 (4%)	0	100	100
1	H	501/545 (92%)	489 (98%)	12 (2%)	0	100	100
1	I	502/545 (92%)	490 (98%)	12 (2%)	0	100	100
1	J	493/545 (90%)	477 (97%)	16 (3%)	0	100	100
1	K	415/545 (76%)	399 (96%)	16 (4%)	0	100	100
1	L	470/545 (86%)	456 (97%)	14 (3%)	0	100	100
1	M	449/545 (82%)	434 (97%)	15 (3%)	0	100	100
1	N	499/545 (92%)	480 (96%)	19 (4%)	0	100	100
1	O	472/545 (87%)	449 (95%)	23 (5%)	0	100	100
1	P	516/545 (95%)	497 (96%)	19 (4%)	0	100	100
1	Q	484/545 (89%)	469 (97%)	15 (3%)	0	100	100
1	R	494/545 (91%)	475 (96%)	19 (4%)	0	100	100
1	S	502/545 (92%)	485 (97%)	15 (3%)	2 (0%)	30	65
1	T	485/545 (89%)	466 (96%)	19 (4%)	0	100	100
1	U	510/545 (94%)	498 (98%)	12 (2%)	0	100	100
1	V	484/545 (89%)	465 (96%)	19 (4%)	0	100	100
1	W	509/545 (93%)	476 (94%)	32 (6%)	1 (0%)	43	76
1	X	488/545 (90%)	469 (96%)	19 (4%)	0	100	100
1	Y	500/545 (92%)	486 (97%)	14 (3%)	0	100	100
1	Z	510/545 (94%)	487 (96%)	23 (4%)	0	100	100
1	a	518/545 (95%)	497 (96%)	21 (4%)	0	100	100
1	b	401/545 (74%)	386 (96%)	15 (4%)	0	100	100
All	All	13628/15260 (89%)	13157 (96%)	468 (3%)	3 (0%)	100	100

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	S	279	PRO
1	W	279	PRO
1	S	278	ALA

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	360/427 (84%)	359 (100%)	1 (0%)	86	91
1	B	358/427 (84%)	358 (100%)	0	100	100
1	C	310/427 (73%)	308 (99%)	2 (1%)	78	88
1	D	367/427 (86%)	367 (100%)	0	100	100
1	E	353/427 (83%)	352 (100%)	1 (0%)	86	91
1	F	347/427 (81%)	346 (100%)	1 (0%)	86	91
1	G	331/427 (78%)	331 (100%)	0	100	100
1	H	381/427 (89%)	381 (100%)	0	100	100
1	I	369/427 (86%)	368 (100%)	1 (0%)	86	91
1	J	328/427 (77%)	326 (99%)	2 (1%)	78	88
1	K	266/427 (62%)	264 (99%)	2 (1%)	73	86
1	L	299/427 (70%)	298 (100%)	1 (0%)	86	91
1	M	307/427 (72%)	306 (100%)	1 (0%)	86	91
1	N	343/427 (80%)	343 (100%)	0	100	100
1	O	324/427 (76%)	323 (100%)	1 (0%)	86	91
1	P	378/427 (88%)	378 (100%)	0	100	100
1	Q	349/427 (82%)	349 (100%)	0	100	100
1	R	347/427 (81%)	345 (99%)	2 (1%)	78	88
1	S	362/427 (85%)	360 (99%)	2 (1%)	78	88
1	T	332/427 (78%)	332 (100%)	0	100	100
1	U	366/427 (86%)	363 (99%)	3 (1%)	73	86
1	V	345/427 (81%)	345 (100%)	0	100	100
1	W	348/427 (82%)	347 (100%)	1 (0%)	86	91
1	X	340/427 (80%)	340 (100%)	0	100	100
1	Y	362/427 (85%)	361 (100%)	1 (0%)	86	91
1	Z	359/427 (84%)	358 (100%)	1 (0%)	86	91

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	a	368/427 (86%)	367 (100%)	1 (0%)	86	91
1	b	279/427 (65%)	278 (100%)	1 (0%)	84	90
All	All	9578/11956 (80%)	9553 (100%)	25 (0%)	86	91

5 of 25 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	R	301	ILE
1	U	50	THR
1	b	104	LEU
1	S	476	ASP
1	U	227	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 32 such sidechains are listed below:

Mol	Chain	Res	Type
1	X	329	ASN
1	Y	194	GLN
1	K	347	ASN
1	J	207	ASN
1	a	265	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 46 ligands modelled in this entry, 25 are monoatomic - leaving 21 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	SO4	T	602	-	4,4,4	0.23	0	6,6,6	0.07	0
2	SO4	M	602	-	4,4,4	0.24	0	6,6,6	0.07	0
2	SO4	N	601	-	4,4,4	0.24	0	6,6,6	0.08	0
2	SO4	V	602	-	4,4,4	0.23	0	6,6,6	0.12	0
2	SO4	G	601	-	4,4,4	0.23	0	6,6,6	0.07	0
2	SO4	R	602	-	4,4,4	0.24	0	6,6,6	0.08	0
2	SO4	C	601	-	4,4,4	0.23	0	6,6,6	0.11	0
2	SO4	A	601	-	4,4,4	0.24	0	6,6,6	0.08	0
2	SO4	L	601	-	4,4,4	0.23	0	6,6,6	0.08	0
2	SO4	P	601	-	4,4,4	0.24	0	6,6,6	0.10	0
2	SO4	b	601	-	4,4,4	0.23	0	6,6,6	0.10	0
2	SO4	B	601	-	4,4,4	0.22	0	6,6,6	0.08	0
2	SO4	K	601	-	4,4,4	0.22	0	6,6,6	0.07	0
2	SO4	Z	601	-	4,4,4	0.23	0	6,6,6	0.07	0
2	SO4	J	601	-	4,4,4	0.24	0	6,6,6	0.07	0
2	SO4	E	601	-	4,4,4	0.24	0	6,6,6	0.08	0
2	SO4	D	601	-	4,4,4	0.24	0	6,6,6	0.10	0
2	SO4	a	601	-	4,4,4	0.24	0	6,6,6	0.07	0
2	SO4	Y	601	-	4,4,4	0.24	0	6,6,6	0.08	0
2	SO4	U	601	-	4,4,4	0.23	0	6,6,6	0.08	0
2	SO4	F	601	-	4,4,4	0.25	0	6,6,6	0.05	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	R	602	SO4	1	0
2	b	601	SO4	1	0
2	F	601	SO4	1	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	499/545 (91%)	0.32	20 (4%) 42 23	18, 51, 104, 115	0
1	B	519/545 (95%)	0.23	32 (6%) 26 14	14, 44, 104, 121	0
1	C	478/545 (87%)	0.38	38 (7%) 18 10	18, 52, 103, 127	0
1	D	517/545 (94%)	0.35	26 (5%) 34 18	18, 58, 110, 129	0
1	E	509/545 (93%)	0.44	35 (6%) 23 12	20, 66, 110, 123	0
1	F	497/545 (91%)	0.34	24 (4%) 35 19	16, 46, 102, 122	0
1	G	499/545 (91%)	0.51	40 (8%) 18 9	19, 59, 113, 125	0
1	H	515/545 (94%)	0.27	10 (1%) 66 43	18, 60, 102, 111	0
1	I	512/545 (93%)	0.16	18 (3%) 47 27	17, 52, 97, 116	0
1	J	507/545 (93%)	0.46	36 (7%) 22 11	18, 63, 116, 133	0
1	K	433/545 (79%)	0.48	40 (9%) 14 8	20, 54, 121, 138	0
1	L	484/545 (88%)	0.56	52 (10%) 11 6	21, 53, 125, 136	0
1	M	463/545 (84%)	0.40	25 (5%) 31 16	24, 55, 108, 129	0
1	N	511/545 (93%)	0.54	38 (7%) 20 10	21, 65, 112, 128	0
1	O	492/545 (90%)	0.42	44 (8%) 15 8	20, 50, 122, 132	0
1	P	522/545 (95%)	0.11	8 (1%) 72 49	15, 49, 92, 116	0
1	Q	502/545 (92%)	0.22	24 (4%) 35 19	11, 44, 110, 134	0
1	R	502/545 (92%)	0.23	40 (7%) 18 9	11, 37, 106, 125	0
1	S	512/545 (93%)	0.26	15 (2%) 53 31	15, 61, 100, 118	0
1	T	497/545 (91%)	0.41	19 (3%) 44 24	23, 62, 98, 111	0
1	U	518/545 (95%)	0.50	24 (4%) 37 20	24, 74, 106, 124	0
1	V	500/545 (91%)	0.44	44 (8%) 15 8	15, 49, 119, 139	0
1	W	517/545 (94%)	0.42	48 (9%) 14 7	14, 55, 119, 127	0
1	X	504/545 (92%)	0.50	42 (8%) 17 9	15, 61, 124, 144	0

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Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	Y	512/545 (93%)	0.39	33 (6%) 25 13	21, 58, 110, 139	0
1	Z	518/545 (95%)	0.55	33 (6%) 25 13	25, 75, 113, 124	0
1	a	522/545 (95%)	0.61	30 (5%) 29 15	27, 74, 111, 126	0
1	b	423/545 (77%)	0.43	29 (6%) 23 12	19, 49, 119, 136	0
All	All	13984/15260 (91%)	0.39	867 (6%) 26 14	11, 56, 113, 144	0

The worst 5 of 867 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	V	335	GLY	5.1
1	F	253	ASP	4.9
1	G	376	VAL	4.7
1	N	253	ASP	4.7
1	O	278	ALA	4.6

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	MG	Q	601	1/1	0.52	0.35	67,67,67,67	0
4	MG	S	601	1/1	0.56	0.15	54,54,54,54	0
2	SO4	Z	601	5/5	0.59	0.25	49,51,72,74	5
2	SO4	T	602	5/5	0.61	0.23	37,47,50,59	5
2	SO4	M	602	5/5	0.66	0.19	54,55,71,77	5
2	SO4	P	601	5/5	0.66	0.23	29,35,57,64	5
4	MG	V	601	1/1	0.67	0.28	61,61,61,61	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	SO4	U	601	5/5	0.68	0.22	55,62,75,80	5
2	SO4	K	601	5/5	0.69	0.32	42,55,61,61	5
4	MG	M	601	1/1	0.70	0.16	53,53,53,53	0
2	SO4	L	601	5/5	0.70	0.18	38,55,60,64	5
2	SO4	C	601	5/5	0.70	0.17	41,46,67,74	5
4	MG	H	601	1/1	0.70	0.15	51,51,51,51	0
4	MG	T	601	1/1	0.71	0.24	58,58,58,58	0
2	SO4	A	601	5/5	0.71	0.22	37,61,63,70	5
2	SO4	b	601	5/5	0.72	0.36	62,84,95,96	0
2	SO4	E	601	5/5	0.74	0.22	43,47,62,63	5
2	SO4	G	601	5/5	0.74	0.20	36,48,56,57	5
2	SO4	B	601	5/5	0.75	0.25	24,30,35,36	5
2	SO4	V	602	5/5	0.75	0.22	34,35,45,48	5
3	CA	G	602	1/1	0.76	0.09	76,76,76,76	0
2	SO4	N	601	5/5	0.77	0.16	41,47,51,54	5
2	SO4	Y	601	5/5	0.77	0.14	34,41,58,58	5
4	MG	R	601	1/1	0.77	0.10	34,34,34,34	0
3	CA	M	603	1/1	0.79	0.12	78,78,78,78	0
3	CA	O	601	1/1	0.79	0.09	73,73,73,73	0
2	SO4	J	601	5/5	0.79	0.20	33,42,51,52	5
3	CA	B	602	1/1	0.80	0.10	77,77,77,77	0
2	SO4	a	601	5/5	0.81	0.16	50,53,63,69	5
3	CA	Z	602	1/1	0.82	0.10	92,92,92,92	0
2	SO4	D	601	5/5	0.83	0.16	33,44,50,50	5
3	CA	Y	602	1/1	0.84	0.10	72,72,72,72	0
2	SO4	F	601	5/5	0.84	0.18	25,34,38,38	5
3	CA	A	602	1/1	0.84	0.08	72,72,72,72	0
3	CA	K	602	1/1	0.86	0.08	82,82,82,82	0
3	CA	F	602	1/1	0.86	0.08	77,77,77,77	0
3	CA	P	602	1/1	0.88	0.09	71,71,71,71	0
3	CA	J	602	1/1	0.89	0.16	72,72,72,72	0
2	SO4	R	602	5/5	0.89	0.17	23,33,34,34	5
3	CA	R	603	1/1	0.90	0.06	64,64,64,64	0
3	CA	Q	602	1/1	0.90	0.11	78,78,78,78	0
3	CA	a	602	1/1	0.91	0.08	78,78,78,78	0
3	CA	I	601	1/1	0.91	0.07	79,79,79,79	0
3	CA	T	603	1/1	0.92	0.10	69,69,69,69	0
3	CA	U	602	1/1	0.94	0.07	62,62,62,62	0
3	CA	V	603	1/1	0.94	0.06	70,70,70,70	0

6.5 Other polymers [i](#)

There are no such residues in this entry.