



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 9, 2026 – 10:10 PM UTC

PDB ID : 28KD / pdb_000028kd
Title : ACE2 extracellular domain in complex with the macrocyclic peptide GR3.1.2
Authors : Brear, P.; Hyvonen, M.
Deposited on : 2026-02-04
Resolution : 2.02 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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
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

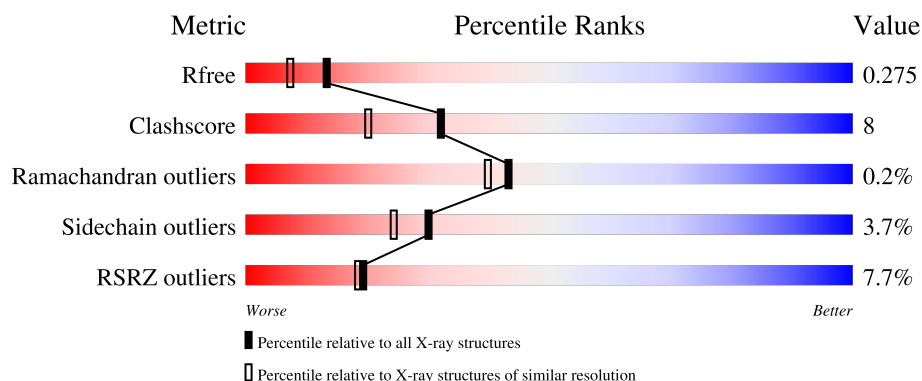
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.02 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	13299 (2.04-2.00)
Clashscore	190562	1022 (2.02-2.02)
Ramachandran outliers	187476	1014 (2.02-2.02)
Sidechain outliers	187428	1014 (2.02-2.02)
RSRZ outliers	180081	13314 (2.04-2.00)

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	609	
1	B	609	
2	C	18	
2	D	18	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 10621 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 Processed angiotensin-converting enzyme 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	596	Total	C	N	O	S	0	1	0
			4872	3117	808	918	29			
1	A	596	Total	C	N	O	S	0	1	0
			4872	3117	808	918	29			

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	18	GLY	-	expression tag	UNP Q9BYF1
B	616	SER	-	expression tag	UNP Q9BYF1
B	617	SER	-	expression tag	UNP Q9BYF1
B	618	PRO	-	expression tag	UNP Q9BYF1
B	619	HIS	-	expression tag	UNP Q9BYF1
B	620	HIS	-	expression tag	UNP Q9BYF1
B	621	HIS	-	expression tag	UNP Q9BYF1
B	622	HIS	-	expression tag	UNP Q9BYF1
B	623	HIS	-	expression tag	UNP Q9BYF1
B	624	HIS	-	expression tag	UNP Q9BYF1
B	625	HIS	-	expression tag	UNP Q9BYF1
B	626	HIS	-	expression tag	UNP Q9BYF1
A	18	GLY	-	expression tag	UNP Q9BYF1
A	616	SER	-	expression tag	UNP Q9BYF1
A	617	SER	-	expression tag	UNP Q9BYF1
A	618	PRO	-	expression tag	UNP Q9BYF1
A	619	HIS	-	expression tag	UNP Q9BYF1
A	620	HIS	-	expression tag	UNP Q9BYF1
A	621	HIS	-	expression tag	UNP Q9BYF1
A	622	HIS	-	expression tag	UNP Q9BYF1
A	623	HIS	-	expression tag	UNP Q9BYF1
A	624	HIS	-	expression tag	UNP Q9BYF1
A	625	HIS	-	expression tag	UNP Q9BYF1
A	626	HIS	-	expression tag	UNP Q9BYF1

- Molecule 2 is a protein called ALA-CYS-PHE-LEU-ARG-CYS-HIS-ARG-ASP-VAL-LYS-CYS-TRP-LEU-TRP-CYS-SER-GLY.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	18	Total	C	N	O	S	0	0	0
			151	96	29	22	4			
2	D	18	Total	C	N	O	S	0	0	0
			151	96	29	22	4			

- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Zn	0	0
			1	1		
3	A	1	Total	Zn	0	0
			1	1		

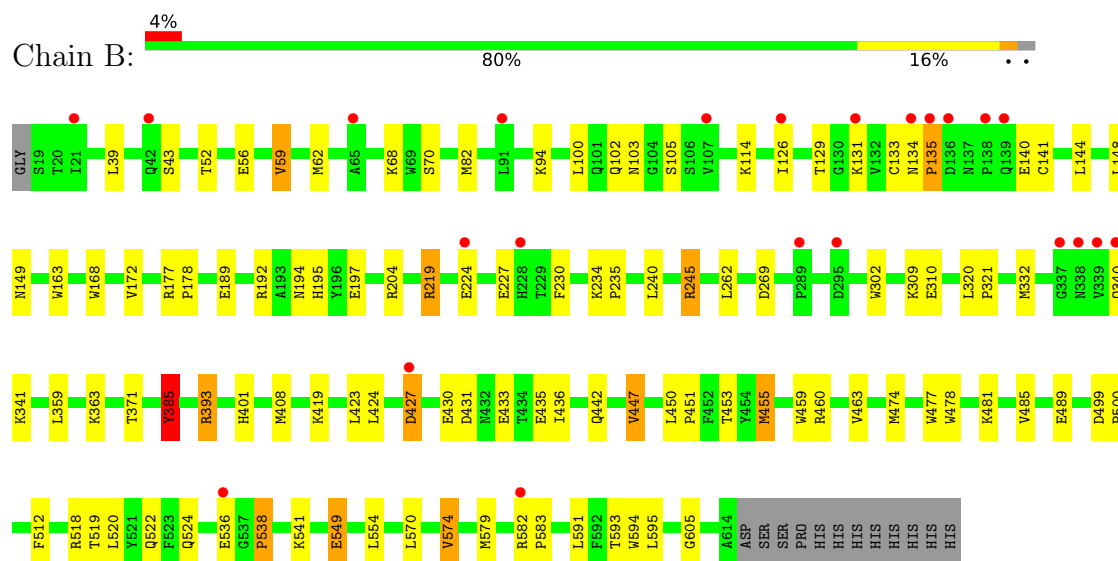
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	343	Total	O	0	1
			344	344		
4	C	6	Total	O	0	0
			6	6		
4	A	218	Total	O	0	0
			218	218		
4	D	5	Total	O	0	0
			5	5		

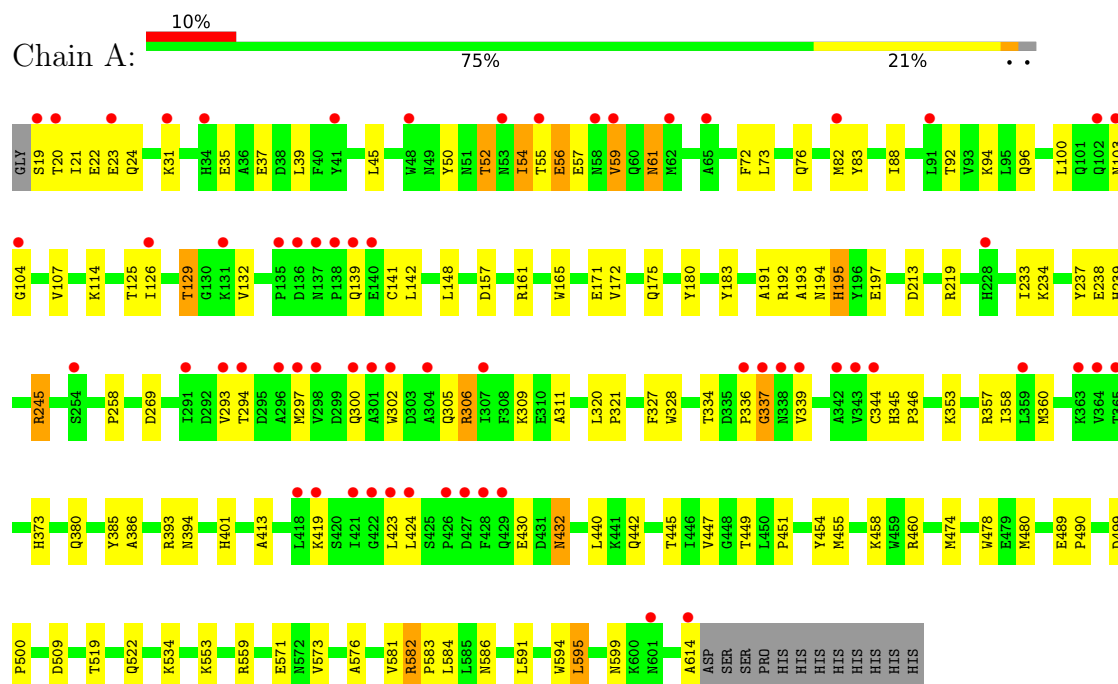
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

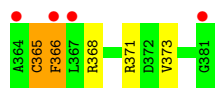
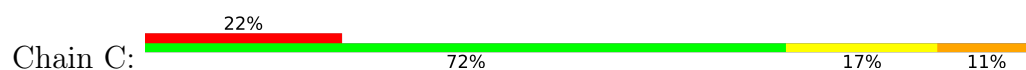
- Molecule 1: Processed angiotensin-converting enzyme 2



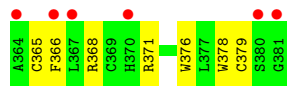
- Molecule 1: Processed angiotensin-converting enzyme 2



- Molecule 2: ALA-CYS-PHE-LEU-ARG-CYS-HIS-ARG-ASP-VAL-LYS-CYS-TRP-LEU-TRP-CYS-SER-GLY



- Molecule 2: ALA-CYS-PHE-LEU-ARG-CYS-HIS-ARG-ASP-VAL-LYS-CYS-TRP-LEU-TRP-CYS-SER-GLY



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	74.26Å 77.82Å 115.18Å 90.00° 100.82° 90.00°	Depositor
Resolution (Å)	64.11 – 2.02 64.11 – 2.02	Depositor EDS
% Data completeness (in resolution range)	99.9 (64.11-2.02) 99.9 (64.11-2.02)	Depositor EDS
R_{merge}	0.23	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.05 (at 2.02Å)	Xtriage
Refinement program	REFMAC 5.8.0430	Depositor
R, R_{free}	0.218 , 0.273 0.228 , 0.275	Depositor DCC
R_{free} test set	2065 reflections (2.43%)	wwPDB-VP
Wilson B-factor (Å ²)	34.1	Xtriage
Anisotropy	0.180	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 40.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	10621	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.02% 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: ZN

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	0.70	0/5010	1.19	8/6807 (0.1%)
1	B	0.71	0/5010	1.23	21/6807 (0.3%)
2	C	0.76	0/156	1.40	3/208 (1.4%)
2	D	0.84	0/156	1.18	0/208
All	All	0.71	0/10332	1.21	32/14030 (0.2%)

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	A	0	7
1	B	0	4
2	C	0	2
2	D	0	1
All	All	0	14

There are no bond length outliers.

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	269	ASP	CA-CB-CG	7.75	120.36	112.60
1	A	195	HIS	CB-CA-C	7.67	117.42	109.83
1	B	189	GLU	CB-CA-C	-7.44	98.44	110.79
1	B	310	GLU	N-CA-CB	-7.25	99.43	110.16
1	B	245	ARG	NE-CZ-NH1	-7.13	114.37	121.50
1	A	595	LEU	N-CA-CB	-7.03	99.40	110.22
2	C	366	PHE	CB-CA-C	-6.63	99.65	110.79
1	B	371	THR	CA-CB-OG1	-6.63	99.66	109.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	574	VAL	N-CA-CB	-6.59	104.96	112.21
1	A	56	GLU	N-CA-C	-6.49	105.49	113.41
2	C	365	CYS	CB-CA-C	6.36	121.45	110.01
1	B	332	MET	CG-SD-CE	-6.16	87.35	100.90
1	B	385	TYR	CA-CB-CG	6.04	124.77	113.90
1	B	593	THR	CA-CB-OG1	-5.97	100.64	109.60
1	A	445	THR	CA-CB-OG1	-5.94	100.69	109.60
1	B	455	MET	CG-SD-CE	-5.90	87.92	100.90
1	B	230	PHE	CA-CB-CG	-5.75	108.05	113.80
1	B	605	GLY	CA-C-O	-5.74	117.02	122.13
1	B	102	GLN	CB-CA-C	-5.58	102.09	110.24
1	A	339	VAL	N-CA-C	-5.55	107.04	111.81
1	B	538	PRO	CB-CA-C	-5.52	104.17	111.23
1	B	227	GLU	CB-CG-CD	5.41	121.80	112.60
2	C	365	CYS	N-CA-CB	-5.33	102.28	110.44
1	B	427	ASP	N-CA-C	-5.26	106.17	112.59
1	B	340	GLN	N-CA-CB	-5.26	102.86	110.70
1	B	189	GLU	N-CA-CB	5.26	117.85	110.12
1	B	245	ARG	NE-CZ-NH2	5.21	123.89	119.20
1	B	135	PRO	N-CA-C	-5.21	107.07	113.84
1	A	245	ARG	NE-CZ-NH1	-5.16	116.34	121.50
1	B	536	GLU	CB-CG-CD	5.14	121.34	112.60
1	A	269	ASP	CA-CB-CG	5.12	117.72	112.60
1	A	139	GLN	N-CA-C	-5.06	105.85	112.23

There are no chirality outliers.

All (14) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	192	ARG	Sidechain
1	A	219	ARG	Sidechain
1	A	306	ARG	Sidechain
1	A	357	ARG	Sidechain
1	A	460	ARG	Sidechain
1	A	559	ARG	Sidechain
1	A	582	ARG	Sidechain
1	B	204	ARG	Sidechain
1	B	219	ARG	Sidechain
1	B	393	ARG	Sidechain
1	B	460	ARG	Sidechain
2	C	368	ARG	Sidechain
2	C	371	ARG	Sidechain

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Mol	Chain	Res	Type	Group
2	D	371	ARG	Sidechain

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	4872	0	4645	89	0
1	B	4872	0	4645	68	0
2	C	151	0	138	3	0
2	D	151	0	138	3	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	218	0	0	17	0
4	B	344	0	0	15	0
4	C	6	0	0	0	0
4	D	5	0	0	1	0
All	All	10621	0	9566	156	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 8.

All (156) 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:A:19:SER:OG	1:A:22:GLU:HB2	1.69	0.92
1:A:300:GLN:OE1	1:A:423:LEU:HD23	1.74	0.88
1:A:300:GLN:OE1	1:A:423:LEU:CD2	2.33	0.77
1:B:455:MET:HE1	1:B:481:LYS:HD3	1.65	0.76
1:B:43:SER:HB3	2:C:366:PHE:CE1	2.27	0.70
1:A:52:THR:HG21	4:A:978:HOH:O	1.92	0.70
1:B:455:MET:CE	1:B:481:LYS:HD3	2.24	0.68
1:B:43:SER:HB3	2:C:366:PHE:HE1	1.59	0.65
1:A:19:SER:OG	1:A:22:GLU:CB	2.46	0.64
1:B:134:ASN:HA	1:B:163:TRP:NE1	2.14	0.63
1:B:455:MET:HE1	1:B:481:LYS:CD	2.28	0.63
1:B:419:LYS:HG3	1:B:424:LEU:HB3	1.81	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:237:TYR:CE1	1:A:451:PRO:HG2	2.35	0.62
1:A:126:ILE:HB	4:A:954:HOH:O	1.99	0.61
1:A:125:THR:O	1:A:129:THR:HB	2.00	0.61
1:A:386:ALA:HA	1:A:393:ARG:HD3	1.82	0.61
1:B:245:ARG:HD2	4:B:868:HOH:O	1.99	0.61
1:A:37:GLU:HG2	1:A:353:LYS:HE3	1.82	0.61
1:B:477:TRP:CE3	1:B:500:PRO:HG3	2.36	0.60
1:A:126:ILE:HG13	4:A:954:HOH:O	2.00	0.60
1:A:239:HIS:HD2	1:A:599:ASN:HD22	1.48	0.60
1:B:134:ASN:HA	1:B:163:TRP:HE1	1.66	0.60
1:B:129:THR:HB	4:B:991:HOH:O	2.03	0.57
1:B:519:THR:O	1:B:522:GLN:HG2	2.04	0.57
1:B:135:PRO:HD2	1:B:163:TRP:NE1	2.20	0.57
1:A:297:MET:HA	4:A:953:HOH:O	2.04	0.56
1:A:239:HIS:CD2	1:A:599:ASN:HD22	2.22	0.56
1:B:453:THR:HG23	1:B:512:PHE:CD2	2.40	0.56
1:A:336:PRO:O	1:A:337:GLY:C	2.48	0.56
1:A:172:VAL:HG13	4:A:954:HOH:O	2.05	0.56
1:A:126:ILE:CG1	4:A:954:HOH:O	2.52	0.56
1:A:442:GLN:HE21	1:A:442:GLN:HA	1.71	0.55
1:B:103:ASN:O	1:B:194:ASN:ND2	2.38	0.55
1:A:534:LYS:HE2	4:A:992:HOH:O	2.07	0.54
1:A:171:GLU:O	1:A:175:GLN:NE2	2.41	0.54
1:A:31:LYS:HE3	1:A:35:GLU:OE1	2.07	0.54
1:B:131:LYS:HG2	1:B:141:CYS:HB3	1.89	0.54
1:B:538:PRO:HG2	1:B:541:LYS:HD3	1.90	0.53
1:A:24:GLN:HB3	1:A:83:TYR:HE1	1.74	0.53
1:A:586:ASN:HB3	4:A:951:HOH:O	2.08	0.53
1:B:459:TRP:O	1:B:463:VAL:HG23	2.08	0.53
1:A:474:MET:HE3	1:A:474:MET:HA	1.91	0.53
1:A:344:CYS:O	1:A:345:HIS:C	2.51	0.53
1:A:311:ALA:HA	1:A:373:HIS:NE2	2.25	0.52
1:A:519:THR:O	1:A:522:GLN:HG2	2.09	0.52
1:B:591:LEU:O	1:B:595:LEU:HB2	2.10	0.52
1:B:135:PRO:HD2	1:B:163:TRP:CD1	2.46	0.51
1:A:394:ASN:HB2	4:D:404:HOH:O	2.11	0.50
1:A:157:ASP:O	1:A:161:ARG:HG3	2.11	0.50
1:B:442:GLN:NE2	4:B:809:HOH:O	2.45	0.49
1:A:571:GLU:HA	1:A:576:ALA:O	2.12	0.49
1:B:582:ARG:HB2	1:B:583:PRO:HD3	1.93	0.49
1:B:450:LEU:HB2	1:B:451:PRO:HD3	1.95	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:454:TYR:CZ	1:A:458:LYS:HD2	2.48	0.49
1:B:408:MET:HE1	1:B:554:LEU:HD21	1.95	0.49
1:B:129:THR:CB	4:B:991:HOH:O	2.60	0.49
1:B:474:MET:HE1	1:B:499:ASP:HB2	1.94	0.48
1:A:23:GLU:O	1:A:24:GLN:C	2.56	0.48
1:A:50:TYR:CE1	1:A:54:ILE:HG23	2.48	0.48
1:B:455:MET:CE	1:B:485:VAL:HG21	2.43	0.48
1:A:584:LEU:HD23	1:A:584:LEU:C	2.37	0.48
1:B:455:MET:HE2	1:B:485:VAL:CG2	2.43	0.48
1:A:103:ASN:O	1:A:194:ASN:ND2	2.46	0.48
1:B:129:THR:HG22	4:B:991:HOH:O	2.12	0.48
1:A:165:TRP:CH2	1:A:490:PRO:HD2	2.48	0.48
1:A:55:THR:HG22	1:A:56:GLU:H	1.79	0.48
1:A:591:LEU:HG	1:A:595:LEU:HD22	1.96	0.48
1:A:440:LEU:C	1:A:440:LEU:HD13	2.39	0.48
1:B:56:GLU:HB2	4:B:954:HOH:O	2.14	0.48
1:B:168:TRP:CZ3	1:B:172:VAL:HG21	2.49	0.47
1:A:582:ARG:HB2	1:A:583:PRO:HD3	1.96	0.47
1:A:132:VAL:O	1:A:141:CYS:HA	2.14	0.47
1:B:149:ASN:ND2	4:B:934[B]:HOH:O	2.47	0.47
1:A:50:TYR:CE1	1:A:59:VAL:HG23	2.49	0.47
1:B:431:ASP:O	1:B:435:GLU:HG2	2.15	0.47
1:B:455:MET:HE2	1:B:481:LYS:HA	1.96	0.47
1:A:233:ILE:HD11	1:A:581:VAL:HG23	1.97	0.47
1:B:133:CYS:HA	1:B:140:GLU:O	2.14	0.46
1:B:135:PRO:HD2	1:B:163:TRP:HE1	1.80	0.46
1:B:520:LEU:O	1:B:524:GLN:HG3	2.15	0.46
1:A:293:VAL:O	1:A:297:MET:HG3	2.14	0.46
1:A:591:LEU:O	1:A:595:LEU:HB2	2.15	0.46
1:A:57:GLU:O	1:A:61:ASN:HB2	2.16	0.46
1:A:103:ASN:OD1	1:A:194:ASN:ND2	2.48	0.46
1:B:436:ILE:HD13	1:B:594:TRP:CD1	2.50	0.46
1:A:132:VAL:CG2	1:A:148:LEU:HD21	2.46	0.46
1:A:432:ASN:ND2	4:A:810:HOH:O	2.49	0.46
1:B:129:THR:CG2	4:B:991:HOH:O	2.63	0.46
1:A:499:ASP:N	1:A:500:PRO:CD	2.78	0.46
1:A:72:PHE:O	1:A:76:GLN:HG2	2.16	0.45
1:A:509:ASP:O	2:D:368:ARG:NH2	2.50	0.45
1:A:180:TYR:O	1:A:183:TYR:HB3	2.16	0.45
1:B:82:MET:HE2	1:A:82:MET:HE2	1.99	0.45
1:B:100:LEU:HD12	2:C:373:VAL:HG11	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:55:THR:HG22	1:A:56:GLU:N	2.31	0.45
1:A:126:ILE:CB	4:A:954:HOH:O	2.63	0.45
1:A:245:ARG:HD3	1:A:258:PRO:HA	1.98	0.45
1:A:478:TRP:CD2	1:A:489:GLU:HB3	2.52	0.45
1:A:55:THR:HG22	1:A:57:GLU:H	1.82	0.44
1:B:192:ARG:HD3	1:B:197:GLU:O	2.18	0.44
1:B:219:ARG:NH2	1:A:195:HIS:O	2.45	0.44
1:B:224:GLU:HG2	4:B:1117:HOH:O	2.17	0.44
1:B:455:MET:HE2	1:B:485:VAL:HG21	1.98	0.44
1:B:455:MET:HE3	1:B:455:MET:HB3	1.63	0.44
1:B:474:MET:HE3	1:B:474:MET:HA	1.98	0.44
1:A:237:TYR:CD1	1:A:451:PRO:HG2	2.52	0.44
1:A:104:GLY:O	1:A:107:VAL:HG22	2.18	0.43
1:A:294:THR:O	1:A:297:MET:HB2	2.18	0.43
1:A:297:MET:HG2	4:A:1016:HOH:O	2.16	0.43
1:A:309:LYS:HD2	1:A:328:TRP:CZ2	2.53	0.43
1:A:455:MET:HE3	1:A:480:MET:HB2	2.00	0.43
1:A:327:PHE:HE2	1:A:358:ILE:HG13	1.83	0.43
1:A:114:LYS:HB2	4:A:902:HOH:O	2.18	0.43
1:A:321:PRO:HD2	1:A:380:GLN:OE1	2.18	0.43
1:A:419:LYS:HG3	1:A:424:LEU:HB3	2.00	0.43
1:B:56:GLU:O	1:B:59:VAL:HG12	2.18	0.43
1:B:177:ARG:HB3	1:B:178:PRO:CD	2.49	0.43
1:B:579:MET:HE2	4:B:857:HOH:O	2.16	0.43
1:A:52:THR:CG2	4:A:978:HOH:O	2.57	0.43
4:B:803:HOH:O	1:A:195:HIS:HD2	2.00	0.43
1:A:234:LYS:O	1:A:238:GLU:HB2	2.19	0.43
1:A:45:LEU:HD12	1:A:45:LEU:HA	1.83	0.43
1:B:144:LEU:HA	1:B:148:LEU:HB2	2.01	0.43
1:B:320:LEU:HB3	1:B:321:PRO:HD2	2.01	0.42
1:B:549:GLU:CD	1:B:549:GLU:H	2.28	0.42
1:A:306:ARG:HD2	1:A:306:ARG:HA	1.88	0.42
1:B:240:LEU:HD22	1:B:447:VAL:HG22	2.00	0.42
1:B:245:ARG:HB2	1:B:262:LEU:HD21	1.99	0.42
1:B:570:LEU:O	1:B:574:VAL:HG22	2.19	0.42
1:B:234:LYS:HB2	1:B:235:PRO:HD3	2.01	0.42
1:A:320:LEU:HB3	1:A:321:PRO:HD2	2.01	0.42
1:B:39:LEU:HD21	1:B:68:LYS:HE3	2.01	0.42
1:B:363:LYS:HE2	4:B:1057:HOH:O	2.19	0.42
1:A:22:GLU:HG3	1:A:88:ILE:HG23	2.01	0.42
1:A:454:TYR:OH	1:A:458:LYS:HD2	2.20	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:385:TYR:O	1:B:393:ARG:HG2	2.19	0.41
1:A:100:LEU:HD12	1:A:100:LEU:HA	1.89	0.41
1:A:346:PRO:HB3	1:A:360:MET:HG3	2.01	0.41
1:A:442:GLN:HA	1:A:442:GLN:NE2	2.33	0.41
1:A:614:ALA:C	4:A:920:HOH:O	2.62	0.41
1:B:478:TRP:CD2	1:B:489:GLU:HB3	2.56	0.41
1:A:302:TRP:CE2	1:A:306:ARG:HG2	2.56	0.41
1:B:62:MET:HE2	1:B:62:MET:HB3	1.97	0.41
1:B:68:LYS:HA	4:B:1107:HOH:O	2.20	0.41
1:B:195:HIS:HD2	4:A:823:HOH:O	2.03	0.41
1:A:132:VAL:O	1:A:142:LEU:N	2.47	0.41
1:A:413:ALA:HB3	4:A:805:HOH:O	2.20	0.41
1:B:433:GLU:HG3	4:B:804:HOH:O	2.21	0.41
2:D:366:PHE:HA	2:D:376:TRP:CZ2	2.55	0.41
1:A:92:THR:O	1:A:96:GLN:HG3	2.21	0.41
1:A:594:TRP:CD1	4:A:838:HOH:O	2.74	0.41
1:A:107:VAL:HG21	1:A:193:ALA:HB3	2.02	0.40
1:B:302:TRP:CZ2	1:B:423:LEU:HD21	2.56	0.40
1:A:191:ALA:HA	2:D:378:TRP:CH2	2.57	0.40
1:B:114:LYS:NZ	4:B:833:HOH:O	2.53	0.40
1:B:477:TRP:CD2	1:B:500:PRO:HG3	2.57	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	595/609 (98%)	571 (96%)	22 (4%)	2 (0%)	36	31
1	B	595/609 (98%)	581 (98%)	14 (2%)	0	100	100
2	C	16/18 (89%)	15 (94%)	1 (6%)	0	100	100
2	D	16/18 (89%)	14 (88%)	2 (12%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	1222/1254 (97%)	1181 (97%)	39 (3%)	2 (0%)	43 40

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	337	GLY
1	A	54	ILE

5.3.2 Protein sidechains [i](#)

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	527/538 (98%)	506 (96%)	21 (4%)	28 22
1	B	527/538 (98%)	511 (97%)	16 (3%)	36 32
2	C	16/16 (100%)	15 (94%)	1 (6%)	16 9
2	D	16/16 (100%)	14 (88%)	2 (12%)	4 1
All	All	1086/1108 (98%)	1046 (96%)	40 (4%)	30 24

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	52	THR
1	B	59	VAL
1	B	70	SER
1	B	94	LYS
1	B	105	SER
1	B	126	ILE
1	B	309	LYS
1	B	341	LYS
1	B	359	LEU
1	B	385	TYR
1	B	401	HIS
1	B	427	ASP
1	B	430	GLU

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Mol	Chain	Res	Type
1	B	447	VAL
1	B	518	ARG
1	B	549	GLU
2	C	365	CYS
1	A	20	THR
1	A	21	ILE
1	A	39	LEU
1	A	52	THR
1	A	59	VAL
1	A	61	ASN
1	A	73	LEU
1	A	94	LYS
1	A	129	THR
1	A	197	GLU
1	A	213	ASP
1	A	305	GLN
1	A	334	THR
1	A	385	TYR
1	A	401	HIS
1	A	430	GLU
1	A	432	ASN
1	A	447	VAL
1	A	449	THR
1	A	553	LYS
1	A	573	VAL
2	D	365	CYS
2	D	379	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (27) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	63	ASN
1	B	76	GLN
1	B	149	ASN
1	B	305	GLN
1	B	340	GLN
1	B	345	HIS
1	B	394	ASN
1	B	442	GLN
1	B	572	ASN
1	B	586	ASN
2	C	370	HIS

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Mol	Chain	Res	Type
1	A	51	ASN
1	A	149	ASN
1	A	175	GLN
1	A	194	ASN
1	A	195	HIS
1	A	417	HIS
1	A	432	ASN
1	A	442	GLN
1	A	472	GLN
1	A	505	HIS
1	A	522	GLN
1	A	531	GLN
1	A	572	ASN
1	A	586	ASN
1	A	599	ASN
1	A	601	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 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

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.

No monomer is involved in short contacts.

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	596/609 (97%)	0.54	62 (10%) 11 11	15, 40, 84, 140	1 (0%)
1	B	596/609 (97%)	0.17	23 (3%) 43 43	14, 33, 61, 138	1 (0%)
2	C	18/18 (100%)	1.51	4 (22%) 2 2	33, 44, 80, 81	0
2	D	18/18 (100%)	1.54	6 (33%) 1 1	40, 54, 83, 95	0
All	All	1228/1254 (97%)	0.39	95 (7%) 19 18	14, 36, 77, 140	2 (0%)

All (95) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	381	GLY	6.5
1	A	302	TRP	5.8
1	A	339	VAL	5.5
1	B	339	VAL	5.4
1	A	19	SER	5.3
1	B	135	PRO	4.9
2	C	364	ALA	4.7
1	A	291	ILE	4.2
1	A	304	ALA	4.1
2	D	381	GLY	4.0
1	A	421	ILE	3.9
1	A	423	LEU	3.9
2	D	364	ALA	3.8
1	A	138	PRO	3.7
1	B	134	ASN	3.4
2	D	367	LEU	3.4
1	A	103	ASN	3.3
1	A	424	LEU	3.3
1	A	55	THR	3.2
1	A	307	ILE	3.2
2	D	366	PHE	3.2

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Mol	Chain	Res	Type	RSRZ
1	A	59	VAL	3.1
1	A	298	VAL	3.1
1	A	102	GLN	3.1
1	A	428	PHE	3.1
1	A	293	VAL	3.1
1	A	65	ALA	3.0
1	A	338	ASN	2.9
2	C	366	PHE	2.9
1	A	614	ALA	2.9
1	B	91	LEU	2.8
2	C	367	LEU	2.8
1	B	138	PRO	2.8
1	B	289	PRO	2.8
1	A	131	LYS	2.8
1	A	337	GLY	2.8
1	A	135	PRO	2.8
1	A	343	VAL	2.8
1	A	48	TRP	2.8
1	A	300	GLN	2.7
1	A	301	ALA	2.7
1	A	20	THR	2.7
1	A	139	GLN	2.7
1	A	104	GLY	2.6
1	A	254	SER	2.6
1	B	139	GLN	2.6
1	B	340	GLN	2.6
1	A	429	GLN	2.6
1	B	295	ASP	2.6
1	A	364	VAL	2.6
1	A	342	ALA	2.6
1	A	344	CYS	2.5
1	B	228[A]	HIS	2.5
1	A	136	ASP	2.5
1	B	126	ILE	2.5
1	A	31	LYS	2.5
1	A	91	LEU	2.5
1	A	422	GLY	2.5
1	A	296	ALA	2.4
1	A	23	GLU	2.4
1	B	107	VAL	2.4
1	A	140	GLU	2.4
1	B	42	GLN	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	62	MET	2.4
1	A	336	PRO	2.3
1	B	21	ILE	2.3
1	B	536	GLU	2.3
1	B	582	ARG	2.3
1	A	427	ASP	2.3
1	A	601	ASN	2.3
1	B	337	GLY	2.3
1	A	137	ASN	2.2
1	A	363	LYS	2.2
1	A	34	HIS	2.2
1	A	365	THR	2.2
1	B	136	ASP	2.2
1	A	359	LEU	2.2
1	A	228[A]	HIS	2.2
2	D	380	SER	2.2
1	B	338	ASN	2.2
1	A	426	PRO	2.2
1	A	419	LYS	2.2
1	A	53	ASN	2.2
1	A	58	ASN	2.2
1	A	41	TYR	2.1
1	B	131	LYS	2.1
1	A	82	MET	2.1
1	B	427	ASP	2.1
2	D	370	HIS	2.1
1	A	126	ILE	2.1
1	B	65	ALA	2.1
1	A	418	LEU	2.0
1	A	294	THR	2.0
1	B	224	GLU	2.0
1	A	297	MET	2.0

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
3	ZN	B	701	1/1	0.92	0.11	91,91,91,91	0
3	ZN	A	701	1/1	0.95	0.08	99,99,99,99	0

6.5 Other polymers [i](#)

There are no such residues in this entry.