



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 29, 2025 – 04:29 AM EDT

PDB ID : 3E1V / pdb_00003e1v
Title : H. influenzae beta-carbonic anhydrase, variant D44N
Authors : Rowlett, R.S.; Chapnick, D.A.; Shah, S.
Deposited on : 2008-08-04
Resolution : 2.80 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 Phenix2.0rc1
Xtriage (Phenix) : 2.0rc1
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.006 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.43.1

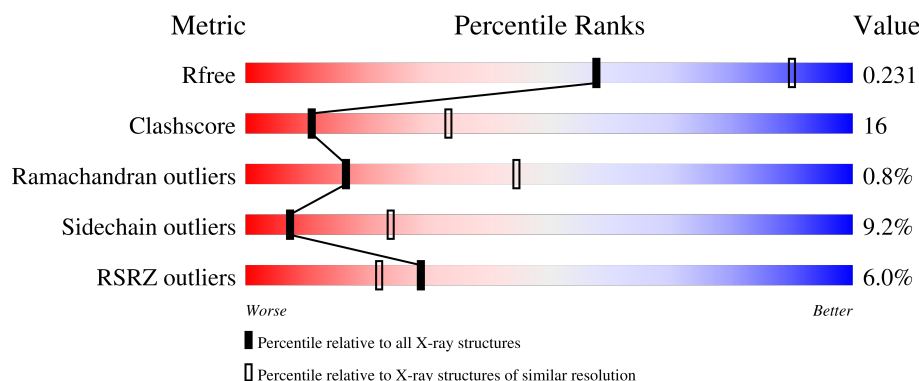
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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}	164625	3657 (2.80-2.80)
Clashscore	180529	4123 (2.80-2.80)
Ramachandran outliers	177936	4071 (2.80-2.80)
Sidechain outliers	177891	4073 (2.80-2.80)
RSRZ outliers	164620	3659 (2.80-2.80)

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	229	
1	B	229	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2913 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 Carbonic anhydrase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	182	Total 1445	C 920	N 260	O 258	S 7	0	0	0
1	B	182	Total 1445	C 920	N 260	O 258	S 7	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	44	ASN	ASP	engineered mutation	UNP P45148
B	44	ASN	ASP	engineered mutation	UNP P45148

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

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

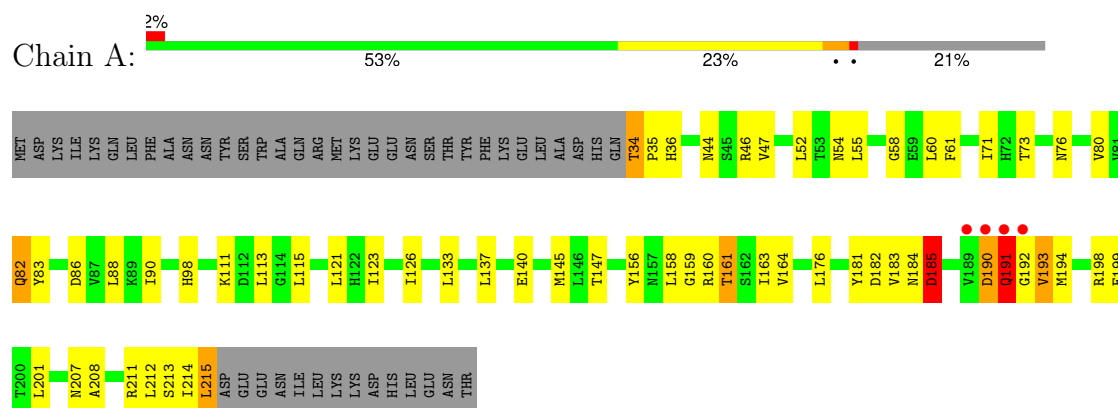
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	12	Total 12	O 12	0	0
3	B	9	Total 9	O 9	0	0

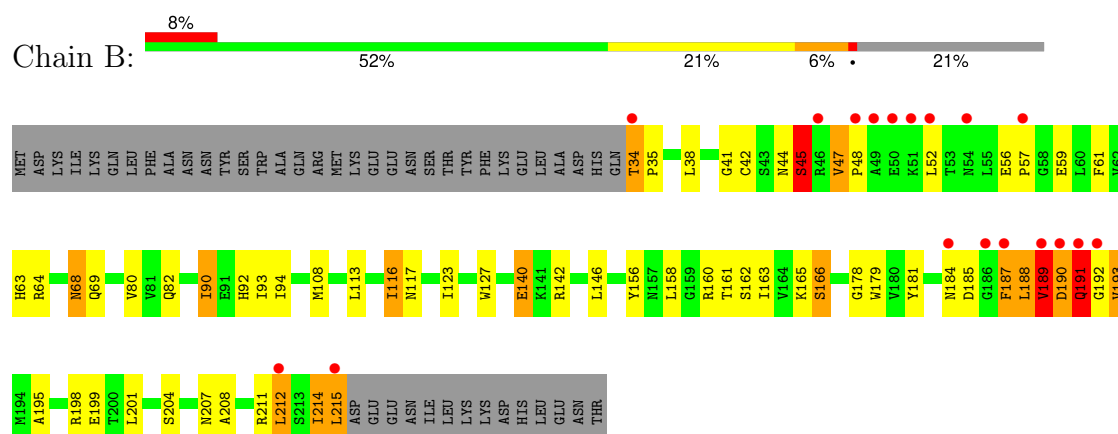
3 Residue-property plots

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: Carbonic anhydrase 2



• Molecule 1: Carbonic anhydrase 2



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	81.57Å 81.57Å 187.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.84 – 2.80 28.84 – 2.80	Depositor EDS
% Data completeness (in resolution range)	98.1 (28.84-2.80) 98.0 (28.84-2.80)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.39 (at 2.80Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.194 , 0.233 0.205 , 0.231	Depositor DCC
R_{free} test set	811 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	39.8	Xtriage
Anisotropy	0.344	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 73.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	2913	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.84% 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	0.74	0/1477	0.95	4/2005 (0.2%)
1	B	0.75	0/1477	1.34	13/2005 (0.6%)
All	All	0.75	0/2954	1.16	17/4010 (0.4%)

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	1
1	B	0	1
All	All	0	2

There are no bond length outliers.

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	190	ASP	N-CA-C	-18.73	78.91	109.07
1	B	189	VAL	N-CA-C	-18.68	83.09	108.12
1	B	190	ASP	CB-CA-C	-14.43	84.76	109.72
1	B	191	GLN	CA-C-N	13.50	147.88	121.41
1	B	191	GLN	C-N-CA	13.50	147.88	121.41
1	B	191	GLN	CB-CA-C	11.66	133.62	110.42
1	B	185	ASP	N-CA-C	8.28	128.44	110.80
1	B	187	PHE	N-CA-C	8.03	121.39	110.55
1	A	192	GLY	N-CA-C	7.71	131.44	113.18
1	A	193	VAL	N-CA-CB	7.42	123.47	111.23
1	B	185	ASP	CB-CA-C	-7.40	95.69	110.42
1	B	69	GLN	N-CA-C	7.09	120.97	110.48

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	191	GLN	CB-CA-C	-6.62	97.24	110.42
1	B	68	ASN	N-CA-C	5.82	123.19	110.80
1	B	192	GLY	N-CA-C	-5.57	99.98	113.18
1	A	190	ASP	CB-CA-C	-5.38	101.63	110.08
1	B	45	SER	N-CA-C	5.07	116.89	111.36

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	191	GLN	Peptide
1	B	191	GLN	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	1445	0	1445	49	0
1	B	1445	0	1445	49	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	12	0	0	0	0
3	B	9	0	0	3	0
All	All	2913	0	2890	94	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 16.

All (94) 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:B:189:VAL:O	1:B:189:VAL:HG13	1.67	0.94
1:A:161:THR:HG22	1:A:164:VAL:H	1.37	0.88
1:B:215:LEU:HD12	1:B:215:LEU:O	1.81	0.81
1:A:145:MET:SD	1:A:212:LEU:HD12	2.26	0.76

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:189:VAL:O	1:B:189:VAL:CG1	2.33	0.75
1:B:34:THR:HG22	1:B:35:PRO:HD2	1.71	0.72
1:A:47:VAL:HG12	1:A:47:VAL:O	1.91	0.70
1:B:191:GLN:OE1	1:B:212:LEU:HG	1.91	0.70
1:A:191:GLN:O	1:A:191:GLN:HG2	1.92	0.68
1:B:162:SER:O	1:B:166:SER:OG	2.11	0.68
1:A:60:LEU:O	1:B:45:SER:HB3	1.93	0.68
1:B:193:VAL:HG12	1:B:193:VAL:O	1.94	0.67
1:A:82:GLN:NE2	1:A:86:ASP:OD2	2.29	0.65
1:B:193:VAL:HG23	1:B:208:ALA:HB2	1.77	0.65
1:B:178:GLY:O	1:B:190:ASP:O	2.16	0.63
1:B:93:ILE:HG21	1:B:158:LEU:HD21	1.79	0.62
1:A:190:ASP:O	1:A:191:GLN:CB	2.48	0.61
1:A:208:ALA:O	1:A:212:LEU:HD23	2.00	0.60
1:A:158:LEU:O	1:A:161:THR:HB	2.00	0.60
1:B:82:GLN:HB2	1:B:163:ILE:HD13	1.83	0.60
1:B:42:CYS:HB2	1:B:68:ASN:HD22	1.67	0.59
1:B:181:TYR:HA	1:B:187:PHE:HB3	1.84	0.59
1:A:161:THR:CG2	1:A:163:ILE:HB	2.32	0.59
1:B:56:GLU:HG3	1:B:57:PRO:HD2	1.85	0.58
1:B:94:ILE:HD13	1:B:179:TRP:CH2	2.38	0.58
1:B:47:VAL:HG12	3:B:234:HOH:O	2.04	0.58
1:A:34:THR:HG22	1:A:35:PRO:HD2	1.86	0.56
1:A:182:ASP:OD1	1:A:185:ASP:HB2	2.05	0.56
1:B:47:VAL:HG11	3:B:236:HOH:O	2.06	0.56
1:A:98:HIS:O	1:A:147:THR:HG21	2.05	0.55
1:A:44:ASN:HD22	1:A:46:ARG:H	1.54	0.55
1:B:56:GLU:HB3	1:B:59:GLU:HG3	1.89	0.55
1:A:161:THR:HG21	1:A:163:ILE:HB	1.90	0.54
1:A:190:ASP:O	1:A:191:GLN:HB3	2.07	0.53
1:B:108:MET:HE2	1:B:127:TRP:CE2	2.43	0.53
1:B:161:THR:CG2	1:B:163:ILE:HB	2.39	0.53
1:A:207:ASN:O	1:A:211:ARG:HG2	2.09	0.52
1:A:55:LEU:HD12	1:A:60:LEU:HG	1.91	0.52
1:A:83:TYR:HB2	1:B:116:ILE:HD13	1.91	0.51
1:A:156:TYR:O	1:A:160:ARG:HD3	2.10	0.51
1:A:176:LEU:O	1:A:194:MET:HA	2.10	0.51
1:A:58:GLY:HA2	1:B:45:SER:HB2	1.93	0.51
1:B:108:MET:HE3	1:B:146:LEU:HD22	1.92	0.51
1:B:187:PHE:CD2	1:B:187:PHE:C	2.90	0.50
1:B:56:GLU:CG	1:B:57:PRO:HD2	2.42	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:108:MET:HE1	1:B:142:ARG:HG2	1.94	0.49
1:B:215:LEU:O	1:B:215:LEU:CD1	2.57	0.48
1:A:199:GLU:H	1:A:199:GLU:CD	2.20	0.48
1:B:191:GLN:HE21	1:B:211:ARG:NH1	2.12	0.48
1:A:111:LYS:HD3	1:A:113:LEU:HD21	1.95	0.48
1:B:189:VAL:HG22	1:B:191:GLN:O	2.13	0.47
1:A:199:GLU:CD	1:A:199:GLU:N	2.73	0.47
1:A:183:VAL:HG13	1:A:184:ASN:ND2	2.29	0.47
1:B:195:ALA:HB2	1:B:201:LEU:HA	1.96	0.47
1:B:34:THR:HG22	1:B:35:PRO:CD	2.42	0.47
1:B:90:ILE:HG22	1:B:92:HIS:H	1.80	0.46
1:A:36:HIS:O	1:A:90:ILE:HG23	2.15	0.46
1:B:44:ASN:O	1:B:47:VAL:HG23	2.16	0.46
1:B:161:THR:HG22	1:B:163:ILE:N	2.31	0.46
1:B:199:GLU:H	1:B:199:GLU:CD	2.24	0.46
1:A:133:LEU:HD11	1:A:215:LEU:HD13	1.97	0.45
1:B:181:TYR:HA	1:B:187:PHE:CB	2.46	0.45
1:A:54:ASN:CG	1:A:54:ASN:O	2.60	0.45
1:B:156:TYR:O	1:B:160:ARG:HD3	2.17	0.45
1:B:198:ARG:NH1	3:B:233:HOH:O	2.48	0.45
1:A:161:THR:HG22	1:A:164:VAL:N	2.19	0.44
1:A:158:LEU:HD23	1:A:176:LEU:HD22	2.00	0.44
1:B:188:LEU:HD23	1:B:188:LEU:H	1.81	0.44
1:B:82:GLN:HB2	1:B:163:ILE:CD1	2.47	0.44
1:A:137:LEU:HD11	1:A:145:MET:HG2	1.98	0.44
1:A:76:ASN:C	1:A:76:ASN:OD1	2.60	0.44
1:A:133:LEU:CD1	1:A:215:LEU:HD13	2.48	0.43
1:A:213:SER:O	1:A:215:LEU:HD22	2.18	0.43
1:B:94:ILE:HD13	1:B:179:TRP:CZ3	2.53	0.43
1:A:71:ILE:HG22	1:A:73:THR:H	1.83	0.43
1:B:48:PRO:HD2	1:B:52:LEU:HD23	2.01	0.43
1:A:158:LEU:CD2	1:A:176:LEU:HD22	2.49	0.42
1:A:82:GLN:HG2	1:A:163:ILE:HG12	2.00	0.42
1:B:191:GLN:CD	1:B:212:LEU:HG	2.44	0.42
1:A:83:TYR:HA	1:B:116:ILE:HD11	2.02	0.42
1:A:123:ILE:HA	1:A:126:ILE:HD12	2.01	0.42
1:A:137:LEU:CD2	1:A:215:LEU:HD12	2.50	0.42
1:B:63:HIS:HB2	1:B:80:VAL:HG11	2.02	0.42
1:A:52:LEU:HD22	1:A:181:TYR:CE1	2.54	0.42
1:A:61:PHE:CE2	1:A:80:VAL:HG13	2.54	0.41
1:B:38:LEU:HD12	1:B:61:PHE:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:159:GLY:HA3	1:A:201:LEU:HD22	2.01	0.41
1:B:41:GLY:O	1:B:64:ARG:HA	2.21	0.41
1:A:183:VAL:CG1	1:A:184:ASN:HD22	2.33	0.41
1:B:113:LEU:N	1:B:117:ASN:OD1	2.37	0.41
1:A:35:PRO:HG2	1:A:88:LEU:HD13	2.03	0.41
1:A:183:VAL:HG13	1:A:184:ASN:HD22	1.86	0.40
1:A:98:HIS:C	1:A:147:THR:HG21	2.46	0.40
1:A:211:ARG:NH1	1:A:214:ILE:HD12	2.36	0.40

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	180/229 (79%)	170 (94%)	9 (5%)	1 (1%)	22	51
1	B	180/229 (79%)	167 (93%)	11 (6%)	2 (1%)	12	37
All	All	360/458 (79%)	337 (94%)	20 (6%)	3 (1%)	16	44

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	185	ASP
1	B	140	GLU
1	B	214	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	157/201 (78%)	147 (94%)	10 (6%)	14	41
1	B	157/201 (78%)	138 (88%)	19 (12%)	4	13
All	All	314/402 (78%)	285 (91%)	29 (9%)	7	24

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	THR
1	A	82	GLN
1	A	115	LEU
1	A	121	LEU
1	A	140	GLU
1	A	161	THR
1	A	185	ASP
1	A	193	VAL
1	A	198	ARG
1	A	215	LEU
1	B	34	THR
1	B	45	SER
1	B	47	VAL
1	B	90	ILE
1	B	116	ILE
1	B	123	ILE
1	B	140	GLU
1	B	165	LYS
1	B	166	SER
1	B	184	ASN
1	B	188	LEU
1	B	189	VAL
1	B	191	GLN
1	B	193	VAL
1	B	204	SER
1	B	207	ASN
1	B	212	LEU
1	B	214	ILE
1	B	215	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	44	ASN
1	A	54	ASN
1	A	100	ASN
1	A	118	ASN
1	A	184	ASN
1	B	36	HIS
1	B	68	ASN
1	B	191	GLN
1	B	207	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 ⓘ

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	182/229 (79%)	0.07	4 (2%) 62 53	32, 38, 48, 51	0
1	B	182/229 (79%)	0.32	18 (9%) 14 11	29, 37, 60, 70	0
All	All	364/458 (79%)	0.19	22 (6%) 29 22	29, 38, 54, 70	0

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	191	GLN	9.0
1	B	192	GLY	5.0
1	B	189	VAL	4.7
1	A	192	GLY	4.1
1	B	49	ALA	4.0
1	A	189	VAL	3.4
1	B	54	ASN	3.4
1	A	191	GLN	3.3
1	B	51	LYS	3.2
1	B	190	ASP	3.2
1	B	187	PHE	2.9
1	B	48	PRO	2.9
1	B	50	GLU	2.8
1	B	46	ARG	2.6
1	B	215	LEU	2.4
1	B	52	LEU	2.3
1	B	184	ASN	2.2
1	B	57	PRO	2.2
1	B	212	LEU	2.2
1	B	186	GLY	2.2
1	A	190	ASP	2.1
1	B	34	THR	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 monosaccharides 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($\text{\AA}^2$)	Q<0.9
2	ZN	B	230	1/1	0.98	0.07	37,37,37,37	0
2	ZN	A	230	1/1	0.99	0.08	36,36,36,36	0

6.5 Other polymers [i](#)

There are no such residues in this entry.