



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 02:15 AM UTC

PDB ID : 3VM5 / pdb_00003vm5
Title : Recombinant medaka fish alpha-amylase expressed in yeast *Pichia pastoris*
Authors : Mizutani, K.; Toyoda, M.; Mikami, B.
Deposited on : 2011-12-08
Resolution : 2.85 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
Xtrriage (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

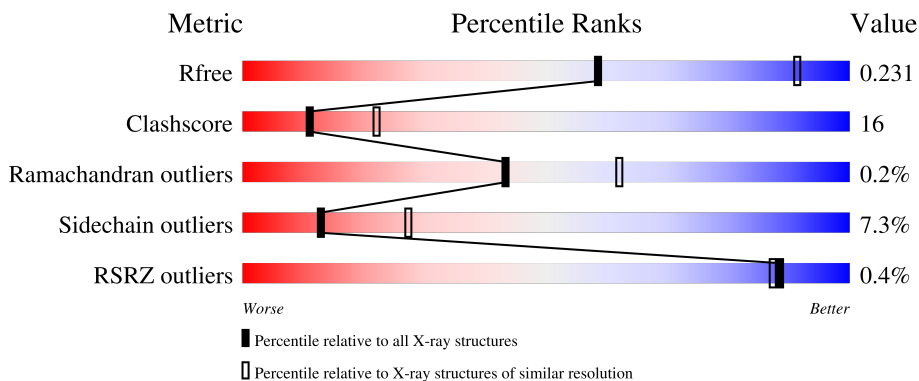
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


The reported resolution of this entry is 2.85 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	1407 (2.88-2.84)
Clashscore	190562	1446 (2.88-2.84)
Ramachandran outliers	187476	1406 (2.88-2.84)
Sidechain outliers	187428	1407 (2.88-2.84)
RSRZ outliers	180081	1408 (2.88-2.84)

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	505	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3987 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 alpha-amylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	499	3938	2473	713	729	23	0	0	0

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Ca	0	0
			1	1		

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Cl	0	0
			1	1		

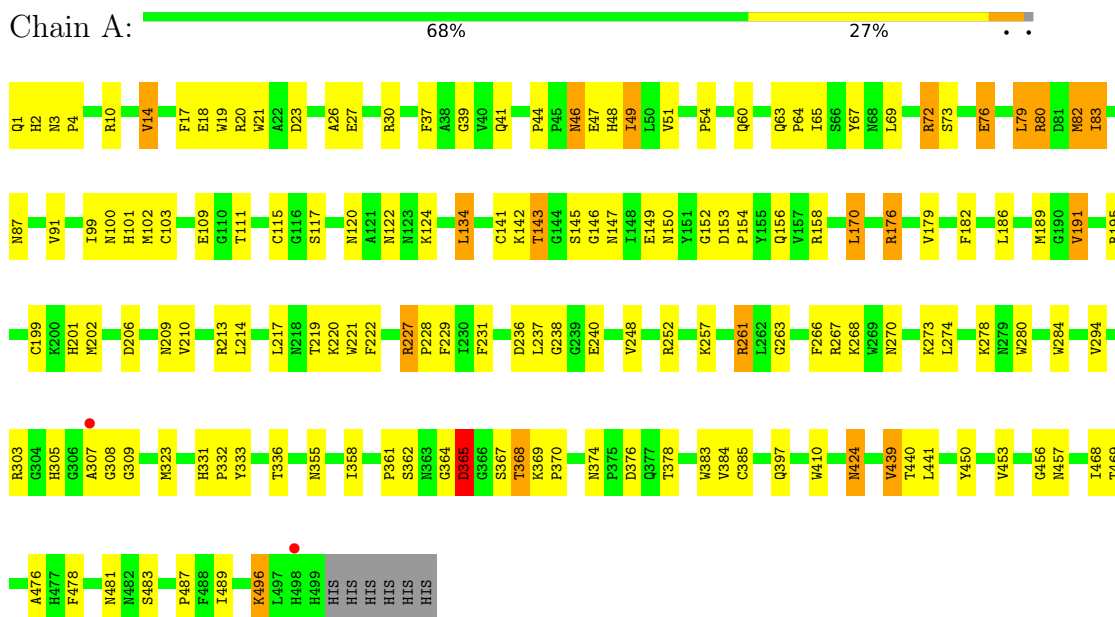
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	47	Total	O	0	0
			47	47		

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: alpha-amylase



4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α , β , γ	83.05Å 83.05Å 174.23Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	27.73 – 2.85 27.73 – 2.85	Depositor EDS
% Data completeness (in resolution range)	94.9 (27.73-2.85) 93.0 (27.73-2.85)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.68 (at 2.85Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.6.4_486)	Depositor
R, R_{free}	0.177 , 0.248 0.168 , 0.231	Depositor DCC
R_{free} test set	863 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	40.7	Xtrriage
Anisotropy	0.100	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 20.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.037 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3987	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.15% 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 [i](#)

5.1 Standard geometry [i](#)

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

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	0.54	0/4055	0.88	6/5506 (0.1%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	153	ASP	CA-C-N	6.97	126.67	119.56
1	A	153	ASP	C-N-CA	6.97	126.67	119.56
1	A	439	VAL	N-CA-C	5.91	116.15	107.75
1	A	14	VAL	CB-CA-C	-5.56	102.36	110.81
1	A	44	PRO	CA-C-N	5.08	127.04	120.89
1	A	44	PRO	C-N-CA	5.08	127.04	120.89

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	3938	0	3666	125	0
2	A	1	0	0	0	0
3	A	1	0	0	1	0
4	A	47	0	0	3	0
All	All	3987	0	3666	125	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 (125) 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:374:ASN:HD22	1:A:378:THR:HG23	1.30	0.97
1:A:481:ASN:HD22	1:A:483:SER:H	1.15	0.89
1:A:134:LEU:HD23	1:A:134:LEU:H	1.37	0.89
1:A:72:ARG:HD3	1:A:368:THR:HG22	1.54	0.88
1:A:170:LEU:O	1:A:176:ARG:HD3	1.74	0.88
1:A:424:ASN:HD22	1:A:424:ASN:H	1.27	0.81
1:A:39:GLY:HA2	1:A:91:VAL:HG13	1.68	0.76
1:A:100:ASN:HD22	1:A:202:MET:HG3	1.52	0.75
1:A:49:ILE:HD13	1:A:51:VAL:HG23	1.67	0.74
1:A:331:HIS:HD2	1:A:333:TYR:H	1.34	0.74
1:A:76:GLU:O	1:A:80:ARG:HG3	1.90	0.71
1:A:150:ASN:H	1:A:156:GLN:HE22	1.38	0.71
1:A:364:GLY:O	1:A:365:ASP:HB3	1.91	0.70
1:A:47:GLU:OE2	1:A:115:CYS:HB2	1.90	0.69
1:A:47:GLU:CD	1:A:115:CYS:HB2	2.17	0.69
1:A:263:GLY:O	1:A:267:ARG:HG3	1.94	0.68
1:A:376:ASP:OD1	1:A:378:THR:HG22	1.97	0.65
1:A:323:MET:SD	1:A:487:PRO:HG2	2.37	0.64
1:A:46:ASN:H	1:A:46:ASN:ND2	1.96	0.63
1:A:143:THR:HG22	1:A:146:GLY:H	1.64	0.62
1:A:100:ASN:ND2	1:A:202:MET:HG3	2.13	0.61
1:A:1:GLN:HE21	1:A:227:ARG:NH1	1.97	0.61
1:A:362:SER:HB2	1:A:367:SER:O	2.01	0.60
1:A:150:ASN:H	1:A:156:GLN:NE2	2.00	0.60
1:A:72:ARG:CD	1:A:368:THR:HG22	2.30	0.60
1:A:236:ASP:HA	1:A:240:GLU:HG3	1.84	0.60
1:A:48:HIS:HD2	1:A:49:ILE:O	1.85	0.59
1:A:266:PHE:HE1	1:A:323:MET:HE2	1.68	0.59
1:A:331:HIS:CG	1:A:332:PRO:HD2	2.37	0.58
1:A:46:ASN:H	1:A:46:ASN:HD22	1.52	0.58
1:A:49:ILE:HD12	1:A:60:GLN:HB2	1.85	0.57
1:A:294:VAL:HG23	1:A:336:THR:HG22	1.86	0.57
1:A:179:VAL:O	1:A:182:PHE:HB3	2.04	0.57
1:A:453:VAL:HA	1:A:456:GLY:O	2.05	0.57
1:A:1:GLN:HE21	1:A:227:ARG:HH12	1.52	0.56
1:A:331:HIS:CD2	1:A:333:TYR:H	2.19	0.56
1:A:100:ASN:HB3	1:A:101:HIS:CD2	2.40	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:364:GLY:O	1:A:365:ASP:CB	2.54	0.56
1:A:64:PRO:HG2	1:A:102:MET:HA	1.89	0.54
1:A:39:GLY:HA2	1:A:91:VAL:CG1	2.37	0.54
1:A:266:PHE:CE1	1:A:323:MET:HE2	2.43	0.54
1:A:48:HIS:HE1	1:A:72:ARG:H	1.55	0.53
1:A:79:LEU:HD13	1:A:189:MET:HE1	1.90	0.53
1:A:206:ASP:O	1:A:210:VAL:HG23	2.09	0.53
1:A:69:LEU:HB2	1:A:76:GLU:HG3	1.91	0.53
1:A:441:LEU:HD12	1:A:478:PHE:CD2	2.45	0.53
1:A:219:THR:HA	1:A:222:PHE:O	2.09	0.52
1:A:41:GLN:NE2	1:A:195:ARG:HD3	2.24	0.52
1:A:149:GLU:H	1:A:156:GLN:NE2	2.07	0.52
1:A:214:LEU:O	1:A:227:ARG:NH2	2.42	0.52
1:A:80:ARG:HH11	1:A:80:ARG:HB3	1.74	0.52
1:A:384:VAL:O	1:A:385:CYS:HB2	2.08	0.52
1:A:450:TYR:CZ	1:A:496:LYS:HD2	2.45	0.52
1:A:1:GLN:NE2	1:A:227:ARG:HH12	2.08	0.52
1:A:49:ILE:HG13	1:A:63:GLN:HB2	1.93	0.51
1:A:331:HIS:CD2	1:A:332:PRO:HD2	2.46	0.50
1:A:51:VAL:H	1:A:60:GLN:HE21	1.60	0.50
1:A:468:ILE:HD11	1:A:489:ILE:HG21	1.95	0.49
1:A:63:GLN:HB3	1:A:103:CYS:HA	1.95	0.49
1:A:468:ILE:HD13	1:A:478:PHE:CE1	2.48	0.49
1:A:120:ASN:OD1	1:A:122:ASN:HB2	2.13	0.48
1:A:141:CYS:C	1:A:142:LYS:HD2	2.38	0.48
1:A:51:VAL:HG12	1:A:54:PRO:O	2.13	0.48
1:A:217:LEU:HD21	1:A:228:PRO:HA	1.95	0.48
1:A:100:ASN:ND2	1:A:201:HIS:HB2	2.29	0.48
1:A:209:ASN:HD21	1:A:213:ARG:HH21	1.62	0.48
1:A:149:GLU:H	1:A:156:GLN:HE22	1.62	0.47
1:A:158:ARG:HA	1:A:201:HIS:O	2.13	0.47
1:A:195:ARG:NH1	3:A:507:CL:CL	2.83	0.47
1:A:355:ASN:HB3	1:A:358:ILE:CD1	2.43	0.47
1:A:278:LYS:HB2	1:A:410:TRP:CE2	2.50	0.47
1:A:1:GLN:NE2	1:A:227:ARG:NH1	2.63	0.47
1:A:23:ASP:OD2	1:A:370:PRO:HA	2.14	0.47
1:A:199:CYS:C	1:A:201:HIS:N	2.73	0.46
1:A:229:PHE:CZ	1:A:252:ARG:HD3	2.51	0.46
1:A:267:ARG:O	1:A:268:LYS:HB2	2.15	0.46
1:A:67:TYR:HB3	1:A:182:PHE:CD1	2.51	0.46
1:A:26:ALA:O	1:A:30:ARG:HG2	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:51:VAL:H	1:A:60:GLN:NE2	2.14	0.46
1:A:209:ASN:ND2	1:A:213:ARG:HH21	2.14	0.46
1:A:99:ILE:HA	4:A:542:HOH:O	2.16	0.46
1:A:134:LEU:HD23	1:A:134:LEU:N	2.16	0.46
1:A:27:GLU:HA	1:A:27:GLU:OE1	2.15	0.46
1:A:294:VAL:CG2	1:A:336:THR:HG22	2.45	0.46
1:A:257:LYS:O	1:A:261:ARG:HB2	2.16	0.45
1:A:19:TRP:N	1:A:19:TRP:CD1	2.84	0.45
1:A:80:ARG:HG2	1:A:189:MET:HE3	1.97	0.45
1:A:143:THR:HG22	1:A:145:SER:N	2.31	0.45
1:A:397:GLN:HG3	4:A:526:HOH:O	2.16	0.45
1:A:481:ASN:ND2	1:A:483:SER:H	1.97	0.45
1:A:79:LEU:HD23	1:A:82:MET:CE	2.47	0.45
1:A:49:ILE:HG23	1:A:65:ILE:HD11	1.97	0.45
1:A:109:GLU:CB	1:A:120:ASN:HA	2.46	0.45
1:A:111:THR:HA	1:A:117:SER:O	2.18	0.44
1:A:209:ASN:O	1:A:213:ARG:HG3	2.18	0.44
1:A:21:TRP:CZ2	1:A:73:SER:HB2	2.53	0.44
1:A:2:HIS:O	1:A:252:ARG:HD2	2.17	0.44
1:A:195:ARG:HB2	1:A:231:PHE:CZ	2.53	0.43
1:A:150:ASN:N	1:A:156:GLN:HE22	2.11	0.43
1:A:10:ARG:HD3	1:A:37:PHE:O	2.19	0.43
1:A:152:GLY:O	1:A:154:PRO:HD3	2.19	0.43
1:A:143:THR:HG21	1:A:147:ASN:O	2.18	0.43
1:A:87:ASN:HB3	1:A:221:TRP:CD1	2.54	0.42
1:A:280:TRP:HA	1:A:284:TRP:CD1	2.54	0.42
1:A:199:CYS:C	1:A:201:HIS:H	2.27	0.42
1:A:3:ASN:HA	1:A:4:PRO:HD3	1.84	0.42
1:A:143:THR:HG22	1:A:146:GLY:N	2.31	0.42
1:A:143:THR:HG23	1:A:149:GLU:CD	2.44	0.42
1:A:274:LEU:HD23	1:A:274:LEU:HA	1.87	0.42
1:A:237:LEU:HD11	1:A:307:ALA:HB1	2.00	0.42
1:A:49:ILE:CG1	1:A:63:GLN:HB2	2.49	0.42
1:A:20:ARG:HD2	1:A:368:THR:O	2.20	0.42
1:A:3:ASN:OD1	1:A:3:ASN:C	2.62	0.42
1:A:83:ILE:HD12	1:A:191:VAL:HG23	2.01	0.42
1:A:440:THR:HA	1:A:476:ALA:O	2.20	0.41
1:A:227:ARG:HB3	1:A:228:PRO:HD2	2.02	0.41
1:A:361:PRO:HG2	1:A:383:TRP:CE2	2.55	0.41
1:A:362:SER:HA	1:A:369:LYS:HG3	2.03	0.41
1:A:236:ASP:OD1	1:A:240:GLU:HG3	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:240:GLU:H	1:A:240:GLU:HG2	1.69	0.41
1:A:17:PHE:O	1:A:18:GLU:HB2	2.20	0.41
1:A:273:LYS:HE2	4:A:535:HOH:O	2.21	0.41
1:A:361:PRO:HG2	1:A:383:TRP:CZ2	2.56	0.40
1:A:238:GLY:C	1:A:240:GLU:H	2.30	0.40
1:A:308:GLY:O	1:A:309:GLY:C	2.64	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	497/505 (98%)	461 (93%)	35 (7%)	1 (0%)	43 62

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	365	ASP

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	411/417 (99%)	381 (93%)	30 (7%)	13 27

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	VAL
1	A	46	ASN
1	A	49	ILE
1	A	72	ARG
1	A	76	GLU
1	A	79	LEU
1	A	80	ARG
1	A	82	MET
1	A	83	ILE
1	A	124	LYS
1	A	134	LEU
1	A	143	THR
1	A	170	LEU
1	A	176	ARG
1	A	186	LEU
1	A	191	VAL
1	A	220	LYS
1	A	227	ARG
1	A	248	VAL
1	A	261	ARG
1	A	270	ASN
1	A	303	ARG
1	A	305	HIS
1	A	365	ASP
1	A	368	THR
1	A	424	ASN
1	A	439	VAL
1	A	457	ASN
1	A	469	THR
1	A	496	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1	GLN
1	A	2	HIS
1	A	46	ASN
1	A	48	HIS
1	A	77	ASN
1	A	100	ASN
1	A	101	HIS

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Mol	Chain	Res	Type
1	A	156	GLN
1	A	209	ASN
1	A	302	GLN
1	A	331	HIS
1	A	355	ASN
1	A	374	ASN
1	A	409	ASN
1	A	424	ASN
1	A	442	ASN
1	A	477	HIS
1	A	481	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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	499/505 (98%)	-0.60	2 (0%) 88 87	23, 36, 55, 82	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	307	ALA	2.9
1	A	498	HIS	2.3

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	CL	A	507	1/1	0.94	0.10	58,58,58,58	0
2	CA	A	506	1/1	0.99	0.06	34,34,34,34	0

6.5 Other polymers [i](#)

There are no such residues in this entry.