Full wwPDB X-ray Structure Validation Report (i)

Sep 28, 2024 – 10:17 AM EDT

PDB ID	:	3WD5
Title	:	Crystal structure of TNFalpha in complex with Adalimumab Fab fragment
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Deposited on	:	2013-06-06
Resolution	:	3.10 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 (i) 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 (1)) were used in the production of this report:

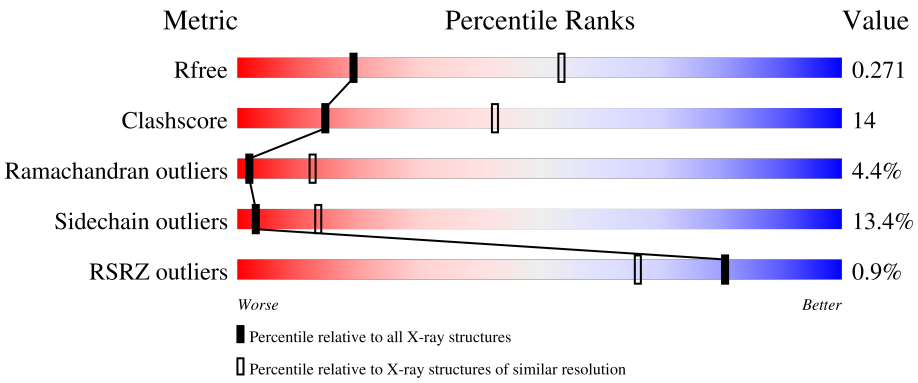
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.20.1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.10 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	1351 (3.10-3.10)
Clashscore	180529	1454 (3.10-3.10)
Ramachandran outliers	177936	1391 (3.10-3.10)
Sidechain outliers	177891	1391 (3.10-3.10)
RSRZ outliers	164620	1351 (3.10-3.10)

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 <=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	157	% 52% 34% 10% • •
2	L	213	68% 26% 5% •
3	H	219	% 67% 27% • •

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 4466 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 Tumor necrosis factor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	152	1187	756	204	225	2	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	31	ASP	ARG	conflict	UNP P01375

- Molecule 2 is a protein called Adalimumab Light Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	L	213	1640	1024	281	330	5	18	0	0

- Molecule 3 is a protein called Adalimumab Heavy Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	H	214	1605	1013	268	318	6	12	0	0

- Molecule 4 is water.

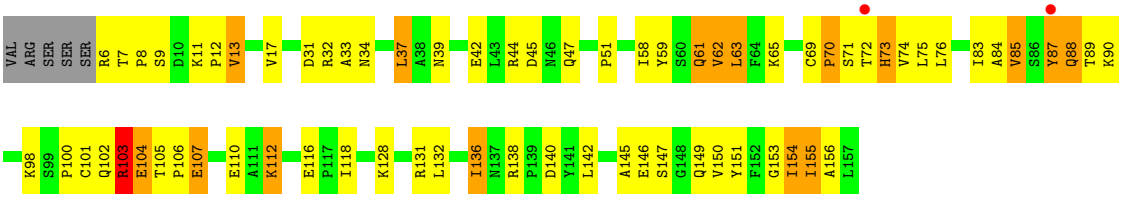
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	9	9	9	0	0
4	L	8	8	8	0	0
4	H	17	17	17	0	0

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.

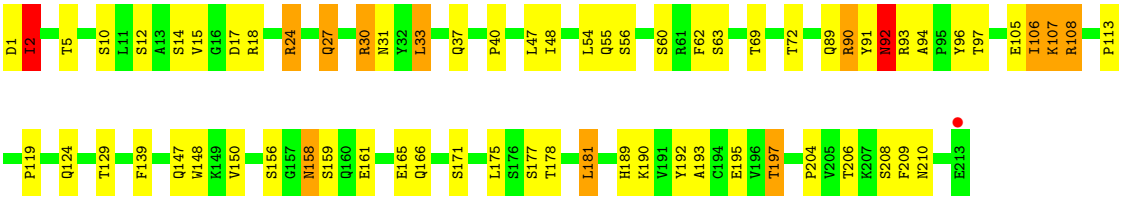
- Molecule 1: Tumor necrosis factor

Chain A:



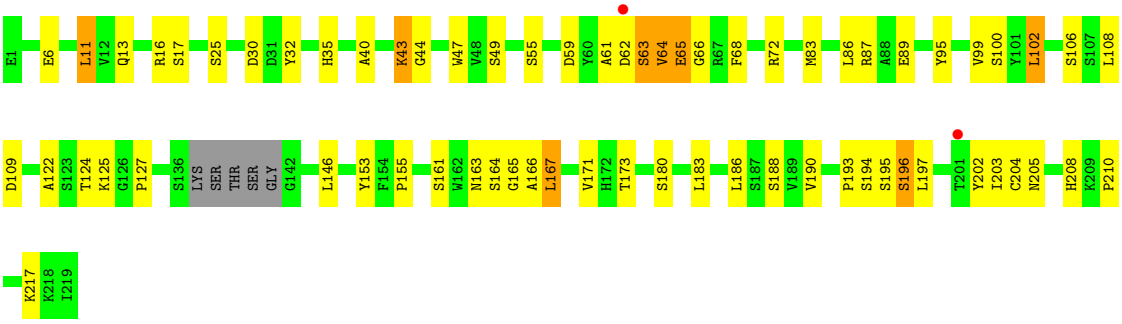
- Molecule 2: Adalimumab Light Chain

Chain L:



- Molecule 3: Adalimumab Heavy Chain

Chain H:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	I 21 3	Depositor
Cell constants a, b, c, α, β, γ	161.85Å 161.85Å 161.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.26 – 3.10 43.26 – 3.10	Depositor EDS
% Data completeness (in resolution range)	99.9 (43.26-3.10) 94.7 (43.26-3.10)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.15 (at 2.96Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.1_1168)	Depositor
R, R_{free}	0.187 , 0.275 0.186 , 0.271	Depositor DCC
R_{free} test set	646 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å^2)	44.9	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 32.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	0.037 for -l,-k,-h	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	4466	wwPDB-VP
Average B, all atoms (Å^2)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.95% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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)

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	0.53	0/1214	0.76	0/1653
2	L	0.45	0/1674	0.71	1/2272 (0.0%)
3	H	0.51	0/1643	0.64	0/2241
All	All	0.49	0/4531	0.70	1/6166 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	L	92	ASN	C-N-CA	5.97	136.64	121.70

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	1187	0	1176	40	0
2	L	1640	0	1605	45	0
3	H	1605	0	1558	36	0
4	A	9	0	0	1	0
4	H	17	0	0	7	0
4	L	8	0	0	0	0
All	All	4466	0	4339	120	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 14.

All (120) 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)
2:L:15:VAL:H	2:L:107:LYS:HG2	1.34	0.92
3:H:61:ALA:O	3:H:63:SER:N	2.17	0.78
1:A:34:ASN:HB2	4:A:203:HOH:O	1.82	0.78
2:L:14:SER:HB3	2:L:107:LYS:HE3	1.66	0.77
3:H:64:VAL:O	3:H:66:GLY:N	2.18	0.76
3:H:59:ASP:OD2	4:H:303:HOH:O	2.06	0.73
1:A:145:ALA:O	4:H:303:HOH:O	2.07	0.72
1:A:71:SER:O	1:A:73:HIS:N	2.24	0.69
2:L:107:LYS:HG3	2:L:108:ARG:H	1.57	0.69
1:A:105:THR:O	1:A:107:GLU:N	2.25	0.68
2:L:15:VAL:N	2:L:107:LYS:HG2	2.09	0.68
2:L:107:LYS:CG	2:L:108:ARG:H	2.06	0.67
3:H:89:GLU:N	3:H:89:GLU:OE1	2.29	0.66
3:H:125:LYS:HD2	3:H:183:LEU:HD21	1.78	0.66
1:A:59:TYR:CZ	1:A:153:GLY:HA3	2.32	0.65
3:H:30:ASP:OD1	4:H:305:HOH:O	2.15	0.65
1:A:103:ARG:O	1:A:105:THR:N	2.30	0.65
3:H:171:VAL:HG22	3:H:190:VAL:HG22	1.79	0.64
2:L:37:GLN:HB2	2:L:47:LEU:HD11	1.79	0.63
2:L:54:LEU:HD21	2:L:60:SER:HA	1.81	0.62
1:A:12:PRO:HA	1:A:39:ASN:HB2	1.81	0.62
2:L:40:PRO:HB3	2:L:165:GLU:HG3	1.81	0.61
2:L:150:VAL:HG11	2:L:189:HIS:CG	2.35	0.61
3:H:195:SER:O	3:H:197:LEU:N	2.29	0.61
2:L:161:GLU:HG2	2:L:175:LEU:HD21	1.82	0.61
1:A:102:GLN:O	1:A:104:GLU:N	2.32	0.60
2:L:14:SER:HA	2:L:107:LYS:HB3	1.83	0.60
1:A:85:VAL:O	1:A:88:GLN:NE2	2.35	0.59
3:H:127:PRO:HB3	3:H:153:TYR:HB3	1.85	0.58
2:L:14:SER:HA	2:L:107:LYS:HG2	1.85	0.58
3:H:32:TYR:O	3:H:72:ARG:NH2	2.36	0.58
1:A:102:GLN:C	1:A:104:GLU:H	2.08	0.57
1:A:63:LEU:HD12	1:A:149:GLN:HG2	1.88	0.56
1:A:7:THR:HG22	1:A:8:PRO:O	2.06	0.56
1:A:11:LYS:O	1:A:39:ASN:ND2	2.38	0.55
1:A:47:GLN:OE1	1:A:131:ARG:NH1	2.39	0.55
3:H:173:THR:HG23	3:H:188:SER:HB3	1.89	0.54
2:L:2:ILE:HG12	2:L:27:GLN:HG3	1.89	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:L:147:GLN:HB3	2:L:195:GLU:HB3	1.88	0.54
2:L:181:LEU:HD22	2:L:181:LEU:H	1.72	0.53
1:A:155:ILE:HG13	1:A:156:ALA:N	2.23	0.53
3:H:49:SER:HB2	3:H:59:ASP:O	2.07	0.53
1:A:45:ASP:H	1:A:131:ARG:HH22	1.57	0.52
1:A:62:VAL:HG22	1:A:142:LEU:HD21	1.92	0.52
2:L:113:PRO:HB3	2:L:139:PHE:HB3	1.92	0.52
3:H:35:HIS:CD2	3:H:108:LEU:HD21	2.44	0.51
1:A:44:ARG:HB2	1:A:131:ARG:NH2	2.25	0.51
1:A:65:LYS:O	2:L:30:ARG:NH2	2.34	0.51
3:H:11:LEU:HD12	3:H:124:THR:HG22	1.93	0.51
2:L:197:THR:HG23	2:L:204:PRO:HG3	1.92	0.50
3:H:202:TYR:HA	4:H:312:HOH:O	2.10	0.50
3:H:203:ILE:HA	3:H:217:LYS:O	2.11	0.50
2:L:158:ASN:OD1	2:L:158:ASN:N	2.43	0.50
2:L:90:ARG:HG2	2:L:92:ASN:HD21	1.76	0.49
1:A:61:GLN:HB3	1:A:151:TYR:CZ	2.46	0.49
2:L:15:VAL:H	2:L:107:LYS:CG	2.14	0.49
1:A:11:LYS:C	1:A:39:ASN:HD22	2.15	0.49
1:A:69:CYS:HA	1:A:70:PRO:HD3	1.68	0.49
1:A:13:VAL:HG13	1:A:155:ILE:HD12	1.95	0.48
2:L:119:PRO:HB3	2:L:209:PHE:CE1	2.48	0.48
3:H:11:LEU:HG	3:H:155:PRO:HG3	1.96	0.48
3:H:125:LYS:HD3	4:H:306:HOH:O	2.13	0.47
3:H:208:HIS:CD2	3:H:210:PRO:HD2	2.49	0.47
1:A:87:TYR:C	1:A:89:THR:H	2.16	0.47
2:L:33:LEU:HA	2:L:89:GLN:O	2.15	0.47
1:A:71:SER:O	1:A:71:SER:OG	2.30	0.47
2:L:106:ILE:HG23	2:L:107:LYS:N	2.30	0.47
2:L:93:ARG:HG2	2:L:94:ALA:O	2.14	0.46
2:L:106:ILE:HG21	2:L:171:SER:HB3	1.98	0.46
1:A:58:ILE:HG23	1:A:154:ILE:HG22	1.97	0.46
3:H:43:LYS:HG2	3:H:44:GLY:H	1.80	0.46
2:L:14:SER:HA	2:L:107:LYS:CB	2.46	0.46
3:H:163:ASN:ND2	4:H:312:HOH:O	2.43	0.45
2:L:40:PRO:CB	2:L:165:GLU:HG3	2.47	0.45
2:L:107:LYS:CG	2:L:108:ARG:N	2.76	0.45
1:A:62:VAL:HG21	1:A:136:ILE:HG21	1.98	0.45
2:L:30:ARG:HB3	2:L:31:ASN:H	1.56	0.45
2:L:193:ALA:HA	2:L:208:SER:HA	1.99	0.45
2:L:159:SER:HA	2:L:178:THR:O	2.16	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:100:PRO:HB3	1:A:116:GLU:HG3	2.00	0.44
2:L:24:ARG:HA	2:L:69:THR:O	2.17	0.44
2:L:14:SER:HB2	2:L:17:ASP:CG	2.36	0.44
3:H:165:GLY:C	3:H:167:LEU:H	2.20	0.44
1:A:89:THR:OG1	1:A:90:LYS:N	2.50	0.44
2:L:54:LEU:HD11	2:L:62:PHE:O	2.17	0.44
2:L:105:GLU:HA	2:L:166:GLN:HE22	1.83	0.44
1:A:12:PRO:HG2	1:A:156:ALA:HB2	1.99	0.44
2:L:15:VAL:HB	2:L:107:LYS:HD2	1.99	0.44
1:A:70:PRO:HB2	1:A:71:SER:H	1.52	0.44
1:A:87:TYR:O	1:A:89:THR:N	2.51	0.44
3:H:68:PHE:CE2	3:H:83:MET:HG2	2.52	0.44
3:H:161:SER:O	3:H:205:ASN:N	2.49	0.44
3:H:87:ARG:HD2	3:H:89:GLU:OE2	2.18	0.43
2:L:91:TYR:HA	2:L:96:TYR:HD1	1.82	0.43
1:A:138:ARG:NH1	1:A:140:ASP:OD1	2.51	0.43
3:H:193:PRO:C	3:H:195:SER:H	2.21	0.43
2:L:14:SER:HA	2:L:107:LYS:CG	2.49	0.43
3:H:61:ALA:C	3:H:63:SER:N	2.72	0.43
3:H:83:MET:HB3	3:H:86:LEU:HD21	2.01	0.43
1:A:11:LYS:HD3	1:A:11:LYS:HA	1.81	0.43
2:L:92:ASN:N	2:L:92:ASN:ND2	2.67	0.43
2:L:148:TRP:NE1	2:L:177:SER:OG	2.46	0.42
3:H:165:GLY:O	3:H:167:LEU:N	2.52	0.42
1:A:51:PRO:O	1:A:128:LYS:HG3	2.20	0.42
2:L:190:LYS:HE3	2:L:210:ASN:HB3	2.01	0.42
1:A:31:ASP:C	1:A:32:ARG:HG2	2.39	0.42
1:A:84:ALA:HB3	1:A:87:TYR:HB2	2.02	0.42
2:L:189:HIS:HB2	2:L:192:TYR:OH	2.20	0.42
3:H:43:LYS:HG2	3:H:44:GLY:N	2.35	0.42
1:A:112:LYS:HE2	1:A:112:LYS:HB2	1.80	0.42
3:H:196:SER:C	3:H:197:LEU:HD23	2.41	0.41
3:H:186:LEU:HA	3:H:186:LEU:HD23	1.72	0.41
1:A:62:VAL:HG12	1:A:118:ILE:HB	2.01	0.41
3:H:125:LYS:HB3	4:H:306:HOH:O	2.21	0.41
3:H:47:TRP:CZ2	3:H:49:SER:HA	2.55	0.41
3:H:6:GLU:OE2	3:H:95:TYR:HA	2.21	0.41
2:L:193:ALA:HB1	2:L:206:THR:CG2	2.50	0.40
2:L:106:ILE:HG21	2:L:171:SER:CB	2.52	0.40
1:A:6:ARG:HA	1:A:7:THR:HA	1.96	0.40
3:H:40:ALA:H	3:H:43:LYS:NZ	2.19	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	150/157 (96%)	126 (84%)	11 (7%)	13 (9%)	0 4
2	L	211/213 (99%)	194 (92%)	14 (7%)	3 (1%)	9 34
3	H	210/219 (96%)	190 (90%)	11 (5%)	9 (4%)	2 13
All	All	571/589 (97%)	510 (89%)	36 (6%)	25 (4%)	2 12

All (25) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	33	ALA
1	A	70	PRO
1	A	72	THR
1	A	103	ARG
1	A	104	GLU
2	L	107	LYS
2	L	108	ARG
3	H	62	ASP
3	H	63	SER
3	H	65	GLU
3	H	196	SER
1	A	87	TYR
1	A	101	CYS
3	H	122	ALA
3	H	166	ALA
1	A	9	SER
1	A	37	LEU
1	A	88	GLN
1	A	147	SER
2	L	2	ILE
3	H	102	LEU

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Mol	Chain	Res	Type
1	A	110	GLU
3	H	16	ARG
1	A	106	PRO
3	H	64	VAL

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	128/133 (96%)	105 (82%)	23 (18%)	1 6
2	L	185/185 (100%)	160 (86%)	25 (14%)	3 13
3	H	179/183 (98%)	161 (90%)	18 (10%)	6 23
All	All	492/501 (98%)	426 (87%)	66 (13%)	3 13

All (66) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	13	VAL
1	A	17	VAL
1	A	37	LEU
1	A	42	GLU
1	A	61	GLN
1	A	62	VAL
1	A	63	LEU
1	A	73	HIS
1	A	74	VAL
1	A	75	LEU
1	A	76	LEU
1	A	83	ILE
1	A	85	VAL
1	A	98	LYS
1	A	103	ARG
1	A	107	GLU
1	A	112	LYS
1	A	132	LEU

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Mol	Chain	Res	Type
1	A	136	ILE
1	A	146	GLU
1	A	150	VAL
1	A	154	ILE
1	A	155	ILE
2	L	1	ASP
2	L	2	ILE
2	L	5	THR
2	L	10	SER
2	L	12	SER
2	L	18	ARG
2	L	24	ARG
2	L	27	GLN
2	L	30	ARG
2	L	33	LEU
2	L	48	ILE
2	L	55	GLN
2	L	56	SER
2	L	63	SER
2	L	72	THR
2	L	90	ARG
2	L	92	ASN
2	L	97	THR
2	L	106	ILE
2	L	124	GLN
2	L	129	THR
2	L	156	SER
2	L	158	ASN
2	L	181	LEU
2	L	197	THR
3	H	11	LEU
3	H	13	GLN
3	H	17	SER
3	H	25	SER
3	H	43	LYS
3	H	55	SER
3	H	65	GLU
3	H	99	VAL
3	H	100	SER
3	H	102	LEU
3	H	106	SER
3	H	109	ASP

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Mol	Chain	Res	Type
3	H	146	LEU
3	H	164	SER
3	H	167	LEU
3	H	180	SER
3	H	194	SER
3	H	204	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
2	L	92	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)

There are no ligands in this entry.

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 (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	152/157 (96%)	-0.40	2 (1%)	74	58	26, 37, 84, 105	0
2	L	213/213 (100%)	-0.61	1 (0%)	87	75	26, 46, 71, 88	10 (4%)
3	H	214/219 (97%)	-0.53	2 (0%)	81	66	28, 46, 78, 100	9 (4%)
All	All	579/589 (98%)	-0.52	5 (0%)	81	66	26, 44, 77, 105	19 (3%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	H	62	ASP	3.9
3	H	201	THR	2.7
2	L	213	GLU	2.6
1	A	72	THR	2.4
1	A	87	TYR	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 monosaccharides in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.