W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

May 29, 2020 – 05:32 am BST

PDB ID	:	4NIY
Title	:	Crystal structure of trypsiligase (K60E/N143H/Y151H/D189K trypsin) complexed to YRH-ecotin (M84Y/M85R/A86H ecotin)
Authors	:	Schoepfel, M.; Parthier, C.; Stubbs, M.T.
Deposited on	:	2013-11-08
Resolution	:	2.84 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 2.84 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.
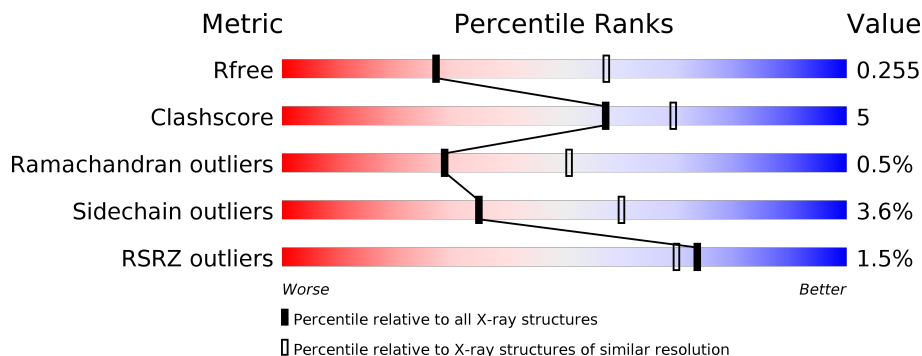
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1031 (2.86-2.82)
Clashscore	141614	1078 (2.86-2.82)
Ramachandran outliers	138981	1050 (2.86-2.82)
Sidechain outliers	138945	1051 (2.86-2.82)
RSRZ outliers	127900	1019 (2.86-2.82)

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 on 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	223	83% 13% · ·
1	B	223	81% 13% 5%
1	C	223	% 79% 15% 5%
1	D	223	7% 68% 18% · 13%
2	E	142	85% 9% · ·
2	F	142	% 87% 10% ·

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Mol	Chain	Length	Quality of chain
2	G	142	83%　　　　　　　　　　　　　11%　　·　5%
2	H	142	80%　　　　　　　　　　　　　15%　　·

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 10574 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 Cationic trypsin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	216	Total 1585	C 987	N 274	O 310	S 14	0	0	0
1	B	211	Total 1546	C 963	N 266	O 303	S 14	0	0	0
1	C	212	Total 1552	C 966	N 266	O 306	S 14	0	0	0
1	D	195	Total 1435	C 894	N 244	O 284	S 13	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	60	GLU	LYS	ENGINEERED MUTATION	UNP P00760
A	143	HIS	ASN	ENGINEERED MUTATION	UNP P00760
A	151	HIS	TYR	ENGINEERED MUTATION	UNP P00760
A	189	LYS	ASP	ENGINEERED MUTATION	UNP P00760
B	60	GLU	LYS	ENGINEERED MUTATION	UNP P00760
B	143	HIS	ASN	ENGINEERED MUTATION	UNP P00760
B	151	HIS	TYR	ENGINEERED MUTATION	UNP P00760
B	189	LYS	ASP	ENGINEERED MUTATION	UNP P00760
C	60	GLU	LYS	ENGINEERED MUTATION	UNP P00760
C	143	HIS	ASN	ENGINEERED MUTATION	UNP P00760
C	151	HIS	TYR	ENGINEERED MUTATION	UNP P00760
C	189	LYS	ASP	ENGINEERED MUTATION	UNP P00760
D	60	GLU	LYS	ENGINEERED MUTATION	UNP P00760
D	143	HIS	ASN	ENGINEERED MUTATION	UNP P00760
D	151	HIS	TYR	ENGINEERED MUTATION	UNP P00760
D	189	LYS	ASP	ENGINEERED MUTATION	UNP P00760

- Molecule 2 is a protein called Ecotin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	E	137	Total 1107	C 708	N 186	O 209	S 4	0	0	0
2	F	137	Total 1112	C 711	N 187	O 210	S 4	0	0	0
2	G	135	Total 1096	C 701	N 184	O 207	S 4	0	0	0
2	H	136	Total 1103	C 705	N 185	O 209	S 4	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	84	TYR	MET	ENGINEERED MUTATION	UNP P23827
E	85	ARG	MET	ENGINEERED MUTATION	UNP P23827
E	86	HIS	ALA	ENGINEERED MUTATION	UNP P23827
F	84	TYR	MET	ENGINEERED MUTATION	UNP P23827
F	85	ARG	MET	ENGINEERED MUTATION	UNP P23827
F	86	HIS	ALA	ENGINEERED MUTATION	UNP P23827
G	84	TYR	MET	ENGINEERED MUTATION	UNP P23827
G	85	ARG	MET	ENGINEERED MUTATION	UNP P23827
G	86	HIS	ALA	ENGINEERED MUTATION	UNP P23827
H	84	TYR	MET	ENGINEERED MUTATION	UNP P23827
H	85	ARG	MET	ENGINEERED MUTATION	UNP P23827
H	86	HIS	ALA	ENGINEERED MUTATION	UNP P23827

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total 1	Ca 1	0	0
3	A	1	Total 1	Ca 1	0	0
3	D	1	Total 1	Ca 1	0	0
3	C	1	Total 1	Ca 1	0	0

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total 1	Zn 1	0	0

• Molecule 5 is water.

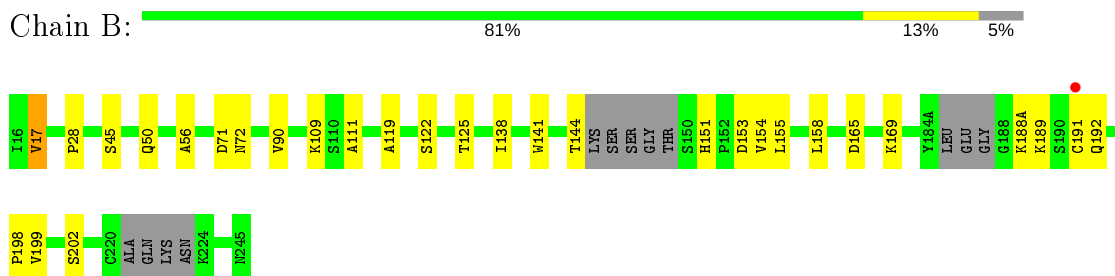| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	5	Total 5	O 5	0	0
5	B	7	Total 7	O 7	0	0
5	C	9	Total 9	O 9	0	0
5	D	2	Total 2	O 2	0	0
5	E	2	Total 2	O 2	0	0
5	F	5	Total 5	O 5	0	0
5	G	2	Total 2	O 2	0	0
5	H	1	Total 1	O 1	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA and DNA 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.
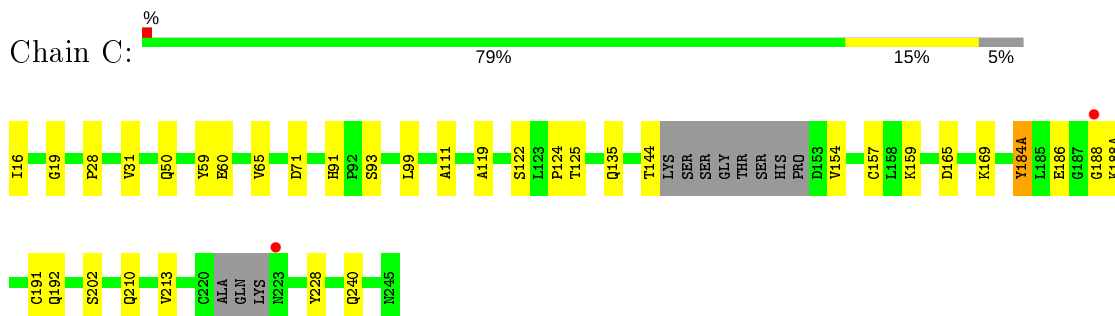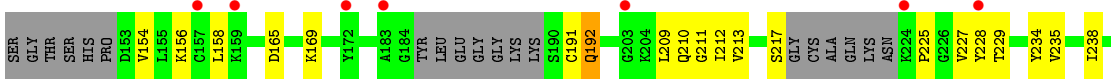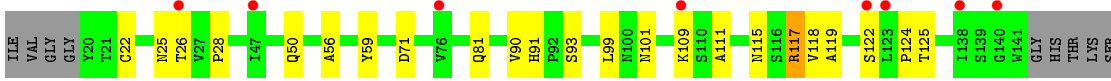
- Molecule 1: Cationic trypsin

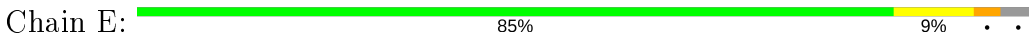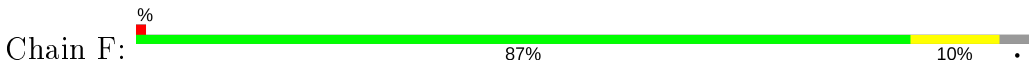- Molecule 1: Cationic trypsin

- Molecule 1: Cationic trypsin

- Molecule 1: Cationic trypsin

ILE VAL GLY GLY Y20 T21 C22 N25 T26 V27 P28 I47 Q50 A56 Y59 D71 V76 Q81 V90 H91 P92 S93 L99 N100 N101 K109 S110 A111 N115 S116 R117 V118 A119 S122 L123 P124 T125 I138 S139 G140 W141 GLY HIS THR LYS SER

SER GLY THR SER HIS PRO D153 V154 L155 K156 C157 L158 K159 D165 K169 Y172 A183 G184 TYR LEU GLU GLY GLY LYS LYS S190 C191 Q192 G203 K204 L209 Q210 G211 I212 V213 S217 GLY CYS ALA GLN LYS ASN K224 P225 G226 V227 Y228 T229 Y234 V235 I238

N245

• Molecule 2: Ecotin

Chain E:

85%   9% • •

ALA GLU SER VAL GLN P6 E17 E47 G56 G57 T63 F74 S78 R85 H86 D89 G90 K91 K94 D103 D121 D137 N138 R142

• Molecule 2: Ecotin

Chain F:

%

87%   10% •

ALA GLU SER VAL Q5 E17 L46 E47 R54 L55 G56 T63 W67 S78 R85 D89 GLY K91 K94 D103 D121 K135 I136 D137 R142

• Molecule 2: Ecotin

Chain G:

83%   11% • 5%

ALA GLU SER VAL GLN PRO L7 L46 E47 R54 L55 G56 T63 S78 R85 H86 D89 GLY K91 K94 D121 W130 K131 A132 D137 N138 A139 V140 V141 R142

• Molecule 2: Ecotin

Chain H:

80%   15% •

ALA GLU SER VAL Q5 E17 R22 Q23 V24 K37 L46 E47 R54 L55 G56 G57 E60 N61 K62 T63 W67 F74 S78 H86 D89 GLY LYS K92 E93 K94 D121 K126 W130 R142

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	94.24Å 78.61Å 98.08Å 90.00° 96.62° 90.00°	Depositor
Resolution (Å)	49.60 – 2.84 49.60 – 2.84	Depositor EDS
% Data completeness (in resolution range)	99.6 (49.60-2.84) 99.6 (49.60-2.84)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.21 (at 2.86Å)	Xtriage
Refinement program	PHENIX 1.8_1069	Depositor
R, R_{free}	0.192 , 0.252 0.196 , 0.255	Depositor DCC
R_{free} test set	1682 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	49.7	Xtriage
Anisotropy	0.717	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 33.5	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.018 for l,-k,h	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	10574	wwPDB-VP
Average B, all atoms (Å^2)	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.25% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, 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	0.48	0/1616	0.58	0/2189
1	B	0.47	0/1575	0.58	0/2132
1	C	0.50	0/1580	0.58	0/2139
1	D	0.46	0/1460	0.59	0/1978
2	E	0.52	0/1131	0.93	3/1528 (0.2%)
2	F	0.55	0/1135	0.66	2/1533 (0.1%)
2	G	0.50	0/1118	0.71	2/1509 (0.1%)
2	H	0.52	0/1126	0.63	0/1522
All	All	0.50	0/10741	0.65	7/14530 (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	A	0	2
1	C	0	1
1	D	0	1
2	E	0	1
All	All	0	5

There are no bond length outliers.

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	E	85	ARG	NE-CZ-NH1	-16.91	111.84	120.30
2	E	85	ARG	NE-CZ-NH2	15.35	127.97	120.30
2	G	85	ARG	NE-CZ-NH2	-9.54	115.53	120.30
2	G	85	ARG	NE-CZ-NH1	7.80	124.20	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	E	85	ARG	CD-NE-CZ	7.54	134.16	123.60

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	152	PRO	Peptide
1	A	59	TYR	Peptide
1	C	59	TYR	Peptide
1	D	59	TYR	Peptide
2	E	91	LYS	Peptide

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	1585	0	1543	14	0
1	B	1546	0	1501	14	0
1	C	1552	0	1509	18	0
1	D	1435	0	1395	24	0
2	E	1107	0	1115	9	0
2	F	1112	0	1118	7	0
2	G	1096	0	1103	14	0
2	H	1103	0	1105	18	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	B	1	0	0	0	0
5	A	5	0	0	0	0
5	B	7	0	0	0	0
5	C	9	0	0	0	0
5	D	2	0	0	0	0
5	E	2	0	0	0	0
5	F	5	0	0	0	0
5	G	2	0	0	0	0
5	H	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	10574	0	10389	103	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 103 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:E:89:ASP:HB2	2:E:90:GLY:HA3	1.44	0.95
1:D:115:ASN:OD1	1:D:117:ARG:HG3	1.85	0.76
2:G:139:ALA:HB1	2:H:23:GLN:HB3	1.70	0.72
1:B:138:ILE:HG12	1:B:199:VAL:HG22	1.74	0.70
2:E:89:ASP:HB2	2:E:90:GLY:CA	2.21	0.67

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	212/223 (95%)	199 (94%)	12 (6%)	1 (0%)	29	51
1	B	203/223 (91%)	198 (98%)	5 (2%)	0	100	100
1	C	206/223 (92%)	199 (97%)	7 (3%)	0	100	100
1	D	187/223 (84%)	174 (93%)	11 (6%)	2 (1%)	14	30
2	E	135/142 (95%)	127 (94%)	6 (4%)	2 (2%)	10	22
2	F	133/142 (94%)	130 (98%)	2 (2%)	1 (1%)	19	38
2	G	131/142 (92%)	128 (98%)	3 (2%)	0	100	100
2	H	132/142 (93%)	126 (96%)	5 (4%)	1 (1%)	19	38
All	All	1339/1460 (92%)	1281 (96%)	51 (4%)	7 (0%)	29	51

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	192	GLN
2	E	17	GLU
2	H	17	GLU
1	D	225	PRO
2	F	17	GLU

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	178/184 (97%)	171 (96%)	7 (4%)	32	58
1	B	175/184 (95%)	168 (96%)	7 (4%)	31	57
1	C	175/184 (95%)	168 (96%)	7 (4%)	31	57
1	D	164/184 (89%)	158 (96%)	6 (4%)	34	59
2	E	122/126 (97%)	117 (96%)	5 (4%)	30	56
2	F	123/126 (98%)	120 (98%)	3 (2%)	49	72
2	G	121/126 (96%)	117 (97%)	4 (3%)	38	63
2	H	122/126 (97%)	119 (98%)	3 (2%)	47	71
All	All	1180/1240 (95%)	1138 (96%)	42 (4%)	35	60

5 of 42 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	191	CYS
1	D	125	THR
2	G	121	ASP
1	C	192	GLN
1	D	117	ARG

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

Mol	Chain	Res	Type
1	C	135	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 5 ligands modelled in this entry, 5 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 (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(Å²)	Q<0.9
1	A	216/223 (96%)	-0.23	1 (0%)	91	89	4, 21, 53, 67	0
1	B	211/223 (94%)	-0.27	1 (0%)	91	89	9, 22, 42, 62	0
1	C	212/223 (95%)	-0.26	2 (0%)	84	83	5, 17, 47, 76	0
1	D	195/223 (87%)	0.49	15 (7%)	13	8	18, 44, 61, 67	0
2	E	137/142 (96%)	-0.21	0	100	100	9, 23, 53, 58	0
2	F	137/142 (96%)	-0.25	1 (0%)	87	86	4, 17, 39, 46	0
2	G	135/142 (95%)	-0.16	0	100	100	13, 26, 48, 59	0
2	H	136/142 (95%)	-0.12	0	100	100	10, 24, 55, 73	0
All	All	1379/1460 (94%)	-0.12	20 (1%)	73	70	4, 24, 54, 76	0

The worst 5 of 20 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	224	LYS	3.6
2	F	78	SER	3.4
1	C	188	GLY	3.2
1	A	78	GLY	2.7
1	C	223	ASN	2.6

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 carbohydrates 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	CA	D	301	1/1	0.81	0.07	56,56,56,56	0
3	CA	A	301	1/1	0.88	0.12	43,43,43,43	0
3	CA	C	301	1/1	0.94	0.12	32,32,32,32	0
4	ZN	B	302	1/1	0.95	0.09	81,81,81,81	0
3	CA	B	301	1/1	0.96	0.10	20,20,20,20	0

6.5 Other polymers (i)

There are no such residues in this entry.