Full wwPDB X-ray Structure Validation Report (i)

Oct 23, 2021 – 10:57 AM EDT

PDB ID	:	1EZS
Title	:	CRYSTAL STRUCTURE OF ECOTIN MUTANT M84R, W67A, G68A, Y69A, D70A BOUND TO RAT ANIONIC TRYPSIN II
Authors	:	Gillmor, S.A.; Takeuchi, T.; Yang, S.Q.; Craik, C.S.; Fletterick, R.J.
Deposited on	:	2000-05-11
Resolution	:	2.30 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 following versions of software and data (see references (1)) were used in the production of this report:

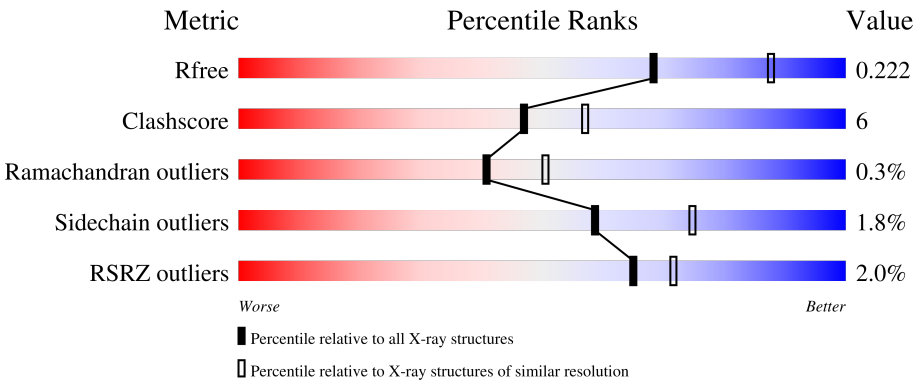
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 2.30 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	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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	142	2%, 76%, 11%, •, 12%
1	B	142	4%, 79%, 8%, •, 12%
2	C	223	3%, 86%, 13%, •
2	D	223	85%, 14%, •

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 5332 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 ECOTIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	125	956	604	159	188	5	0	0	0
1	B	125	956	604	159	188	5	0	0	0

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	67	ALA	TRP	engineered mutation	UNP P23827
A	68	ALA	GLY	engineered mutation	UNP P23827
A	69	ALA	TYR	engineered mutation	UNP P23827
A	70	ALA	ASP	engineered mutation	UNP P23827
A	84	ARG	MET	engineered mutation	UNP P23827
B	267	ALA	TRP	engineered mutation	UNP P23827
B	268	ALA	GLY	engineered mutation	UNP P23827
B	269	ALA	TYR	engineered mutation	UNP P23827
B	270	ALA	ASP	engineered mutation	UNP P23827
B	284	ARG	MET	engineered mutation	UNP P23827

- Molecule 2 is a protein called TRYPSIN II, ANIONIC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	223	1666	1041	285	326	14	0	0	0
2	D	223	1666	1041	285	326	14	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	479	ASP	ASN	SEE REMARK 999	UNP P00763
C	502	ASN	ASP	engineered mutation	UNP P00763

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Chain	Residue	Modelled	Actual	Comment	Reference
D	779	ASP	ASN	SEE REMARK 999	UNP P00763
D	802	ASN	ASP	engineered mutation	UNP P00763

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

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

- Molecule 4 is water.

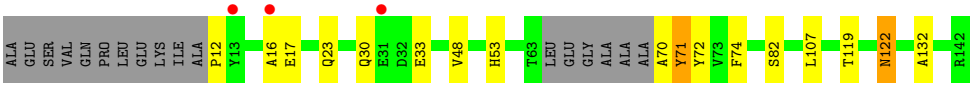
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	8	Total O 8 8	0	0
4	B	6	Total O 6 6	0	0
4	C	36	Total O 36 36	0	0
4	D	36	Total O 36 36	0	0

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: ECOTIN

Chain A:

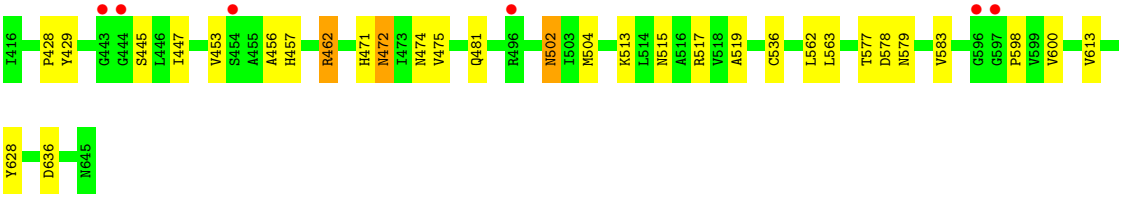


- Molecule 1: ECOTIN

Chain B:

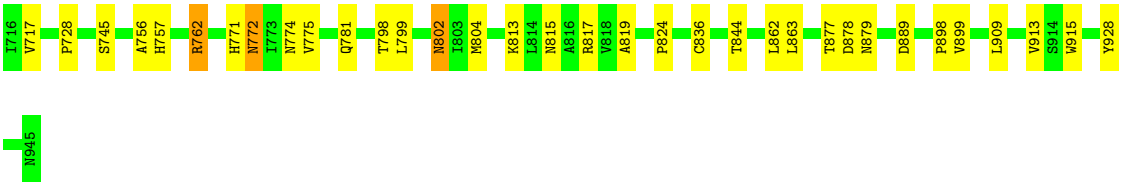
- Molecule 2: TRYPSIN II, ANIONIC

Chain C:



- Molecule 2: TRYPSIN II, ANIONIC

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	45.83Å 59.68Å 71.04Å 103.57° 93.27° 94.62°	Depositor
Resolution (Å)	25.00 – 2.30 27.14 – 2.30	Depositor EDS
% Data completeness (in resolution range)	92.7 (25.00-2.30) 92.8 (27.14-2.30)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.40 (at 2.31Å)	Xtriage
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.188 , 0.235 0.180 , 0.222	Depositor DCC
R_{free} test set	1512 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	31.5	Xtriage
Anisotropy	0.282	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 52.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	5332	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.40% 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)

Bond lengths and bond angles in the following residue types are not validated in this section: 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	0.61	0/972	0.70	1/1321 (0.1%)
1	B	0.59	0/972	0.73	1/1321 (0.1%)
2	C	0.60	0/1701	0.75	0/2318
2	D	0.68	0/1701	0.80	1/2318 (0.0%)
All	All	0.63	0/5346	0.76	3/7278 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	212	PRO	N-CA-CB	5.66	110.09	103.30
1	A	12	PRO	N-CA-CB	5.59	110.01	103.30
2	D	889	ASP	CB-CG-OD1	5.42	123.17	118.30

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	956	0	908	10	0
1	B	956	0	908	8	0
2	C	1666	0	1603	23	0
2	D	1666	0	1603	25	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	8	0	0	0	0
4	B	6	0	0	0	0
4	C	36	0	0	3	0
4	D	36	0	0	2	0
All	All	5332	0	5022	64	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 6.

All (64) 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:C:481:GLN:HE22	2:C:513:LYS:H	1.35	0.74
1:B:322:ASN:HD22	1:B:322:ASN:H	1.38	0.71
2:C:457:HIS:H	2:C:502:ASN:HD21	1.39	0.70
2:D:757:HIS:H	2:D:802:ASN:HD21	1.39	0.70
2:D:781:GLN:HE22	2:D:813:LYS:H	1.40	0.70
2:D:728:PRO:HB2	2:D:819:ALA:HB3	1.78	0.64
2:C:428:PRO:HB2	2:C:519:ALA:HB3	1.80	0.63
2:D:877:THR:HG22	2:D:878:ASP:N	2.13	0.63
1:A:122:ASN:HD22	1:A:122:ASN:H	1.48	0.60
2:D:772:ASN:HD22	2:D:774:ASN:H	1.50	0.58
2:C:456:ALA:HA	2:C:504:MET:HB2	1.86	0.57
2:D:836:CYS:SG	2:D:862:LEU:HD13	2.45	0.57
2:C:472:ASN:ND2	2:C:475:VAL:HG12	2.20	0.57
2:D:879:ASN:HB2	4:D:44:HOH:O	2.05	0.57
1:A:16:ALA:O	1:A:17:GLU:HB3	2.04	0.56
2:C:583:VAL:HB	2:C:628:TYR:CE1	2.40	0.56
1:B:216:ALA:O	1:B:217:GLU:HB3	2.07	0.55
2:C:536:CYS:SG	2:C:562:LEU:HD13	2.48	0.54
2:D:877:THR:HG22	2:D:878:ASP:H	1.71	0.54
2:C:636:ASP:HB2	4:C:69:HOH:O	2.06	0.54
2:C:577:THR:HG22	2:C:578:ASP:N	2.23	0.53
2:C:579:ASN:HB2	4:C:88:HOH:O	2.09	0.53
2:C:613:VAL:HG22	2:C:628:TYR:HE2	1.75	0.52
1:B:248:VAL:HB	1:B:253:HIS:CE1	2.45	0.52
1:B:272:TYR:OH	1:B:307:LEU:HD22	2.09	0.51
1:A:30:GLN:HB2	1:A:33:GLU:HG2	1.93	0.51
2:D:756:ALA:HA	2:D:804:MET:HB2	1.93	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:613:VAL:HA	2:C:628:TYR:CD2	2.47	0.49
1:A:72:TYR:OH	1:A:107:LEU:HD22	2.13	0.48
2:C:577:THR:HG22	2:C:578:ASP:H	1.79	0.48
2:D:824:PRO:HD3	2:D:909:LEU:O	2.14	0.48
2:C:462:ARG:HA	2:C:462:ARG:NE	2.29	0.47
2:C:472:ASN:HD22	2:C:474:ASN:H	1.62	0.47
2:C:445:SER:OG	2:C:598:PRO:HB3	2.16	0.46
1:B:230:GLN:HB2	1:B:233:GLU:HG2	1.97	0.46
2:C:456:ALA:N	2:C:502:ASN:ND2	2.64	0.46
2:D:745:SER:OG	2:D:898:PRO:HB3	2.16	0.46
1:A:132:ALA:HB2	1:B:330:TRP:CE2	2.52	0.45
2:C:429:TYR:CZ	2:C:600:VAL:HG21	2.51	0.45
1:A:74:PHE:HB3	1:A:119:THR:HG22	1.98	0.44
2:D:913:VAL:HG22	2:D:928:TYR:CE2	2.52	0.44
2:D:717:VAL:HG22	2:D:844:THR:C	2.38	0.44
2:C:515:ASN:OD1	2:C:517:ARG:HG2	2.17	0.43
1:A:23:GLN:NE2	1:A:119:THR:OG1	2.51	0.43
2:C:471:HIS:HD2	4:C:85:HOH:O	2.00	0.43
1:B:322:ASN:HD22	1:B:322:ASN:N	2.06	0.43
2:D:877:THR:CG2	2:D:878:ASP:N	2.81	0.43
2:C:472:ASN:ND2	2:C:474:ASN:H	2.16	0.43
2:D:899:VAL:HG21	2:D:928:TYR:CD2	2.54	0.42
2:D:913:VAL:HG22	2:D:928:TYR:HE2	1.83	0.42
2:D:798:THR:O	2:D:799:LEU:HB2	2.20	0.42
2:D:772:ASN:ND2	2:D:774:ASN:H	2.15	0.42
1:B:223:GLN:NE2	1:B:319:THR:OG1	2.52	0.42
2:D:771:HIS:HD2	4:D:41:HOH:O	2.02	0.42
2:D:928:TYR:CD1	2:D:928:TYR:N	2.87	0.42
2:C:447:ILE:HD13	2:C:453:VAL:CG2	2.49	0.41
2:C:613:VAL:HG22	2:C:628:TYR:CE2	2.53	0.41
2:D:815:ASN:OD1	2:D:817:ARG:HG2	2.21	0.41
1:A:48:VAL:HB	1:A:53:HIS:CE1	2.54	0.41
1:A:82:SER:O	2:D:915:TRP:HB2	2.21	0.41
2:D:772:ASN:ND2	2:D:775:VAL:HG12	2.36	0.41
2:D:836:CYS:SG	2:D:862:LEU:CD1	3.09	0.41
1:A:70:ALA:O	1:A:71:TYR:HB3	2.21	0.40
2:D:762:ARG:NE	2:D:762:ARG:HA	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	121/142 (85%)	113 (93%)	7 (6%)	1 (1%)	19	23
1	B	121/142 (85%)	113 (93%)	7 (6%)	1 (1%)	19	23
2	C	221/223 (99%)	212 (96%)	9 (4%)	0	100	100
2	D	221/223 (99%)	213 (96%)	8 (4%)	0	100	100
All	All	684/730 (94%)	651 (95%)	31 (4%)	2 (0%)	41	50

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	71	TYR
1	B	217	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	100/122 (82%)	99 (99%)	1 (1%)	76	87
1	B	100/122 (82%)	99 (99%)	1 (1%)	76	87
2	C	185/185 (100%)	181 (98%)	4 (2%)	52	69
2	D	185/185 (100%)	181 (98%)	4 (2%)	52	69
All	All	570/614 (93%)	560 (98%)	10 (2%)	59	75

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	122	ASN
1	B	322	ASN
2	C	462	ARG
2	C	472	ASN
2	C	502	ASN
2	C	563	LEU
2	D	762	ARG
2	D	772	ASN
2	D	802	ASN
2	D	863	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	23	GLN
1	A	44	GLN
1	A	53	HIS
1	A	122	ASN
1	B	223	GLN
1	B	230	GLN
1	B	253	HIS
1	B	322	ASN
2	C	472	ASN
2	C	481	GLN
2	C	502	ASN
2	D	771	HIS
2	D	772	ASN
2	D	781	GLN
2	D	802	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 monosaccharides 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 (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	125/142 (88%)	-0.09	3 (2%) 59 66	15, 42, 73, 84	0
1	B	125/142 (88%)	-0.13	5 (4%) 38 45	18, 43, 76, 85	0
2	C	223/223 (100%)	-0.03	6 (2%) 54 62	18, 37, 58, 77	0
2	D	223/223 (100%)	-0.37	0 100 100	10, 26, 50, 70	0
All	All	696/730 (95%)	-0.17	14 (2%) 65 71	10, 36, 67, 85	0

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	216	ALA	3.4
2	C	596	GLY	3.0
1	B	231	GLU	2.9
1	A	16	ALA	2.6
2	C	444	GLY	2.6
1	A	13	TYR	2.6
1	B	271	TYR	2.4
1	A	31	GLU	2.3
2	C	443	GLY	2.2
1	B	215	GLN	2.1
2	C	454	SER	2.1
2	C	597	GLY	2.1
2	C	496	ARG	2.1
1	B	212	PRO	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(Å^2)	Q<0.9
3	CA	C	650	1/1	0.90	0.08	55,55,55,55	0
3	CA	D	950	1/1	0.94	0.06	33,33,33,33	0

6.5 Other polymers (i)

There are no such residues in this entry.