Full wwPDB X-ray Structure Validation Report (i)

Oct 4, 2023 – 10:57 AM EDT

PDB ID	:	6O1I
Title	:	Alpha-L-fucosidase AlfC fucosyltransferase mutant E274A
Authors	:	Klontz, E.H.; Sundberg, E.J.
Deposited on	:	2019-02-20
Resolution	:	3.55 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:

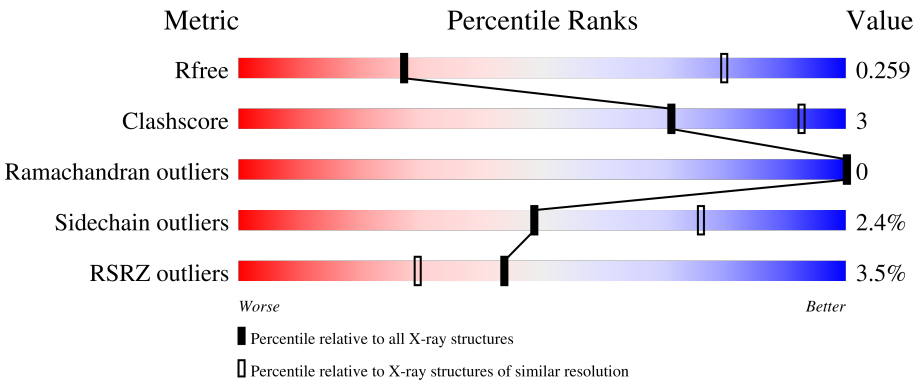
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

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 3.55 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	1020 (3.62-3.50)
Clashscore	141614	1100 (3.62-3.50)
Ramachandran outliers	138981	1065 (3.62-3.50)
Sidechain outliers	138945	1066 (3.62-3.50)
RSRZ outliers	127900	1009 (3.64-3.48)

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	345	2%, 88%, 6% • 5%
1	B	345	3%, 87%, 6% • 7%
1	C	345	4%, 86%, 7% • 6%
1	D	345	5%, 84%, 8% • 7%

2 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 10197 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 AlfC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	328	2581	1650	428	491	12	0	0	0
1	B	322	2535	1619	420	484	12	0	0	0
1	C	324	2544	1624	423	485	12	0	0	0
1	D	322	2537	1621	421	483	12	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

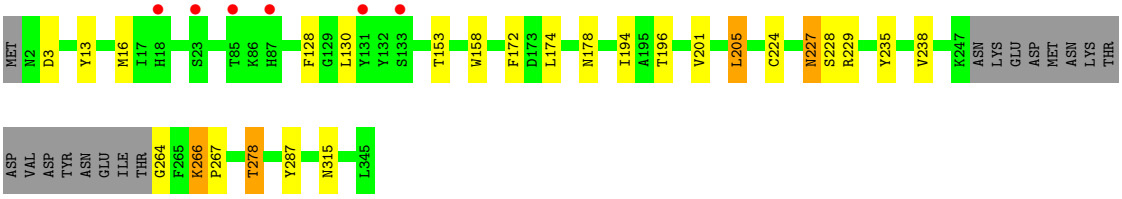
Chain	Residue	Modelled	Actual	Comment	Reference
A	274	ALA	GLU	engineered mutation	UNP K0NB39
A	345	LEU	-	expression tag	UNP K0NB39
B	274	ALA	GLU	engineered mutation	UNP K0NB39
B	345	LEU	-	expression tag	UNP K0NB39
C	274	ALA	GLU	engineered mutation	UNP K0NB39
C	345	LEU	-	expression tag	UNP K0NB39
D	274	ALA	GLU	engineered mutation	UNP K0NB39
D	345	LEU	-	expression tag	UNP K0NB39

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.

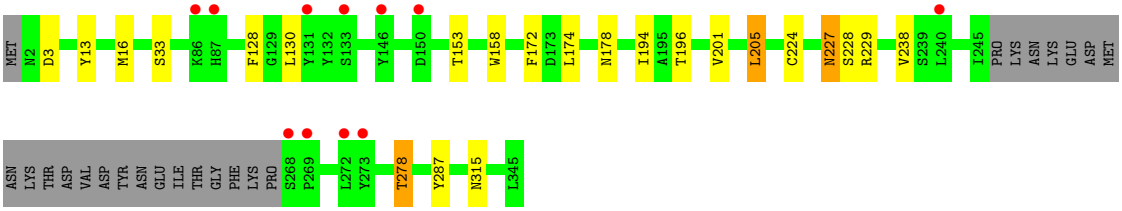
- Molecule 1: AlfC

Chain A:



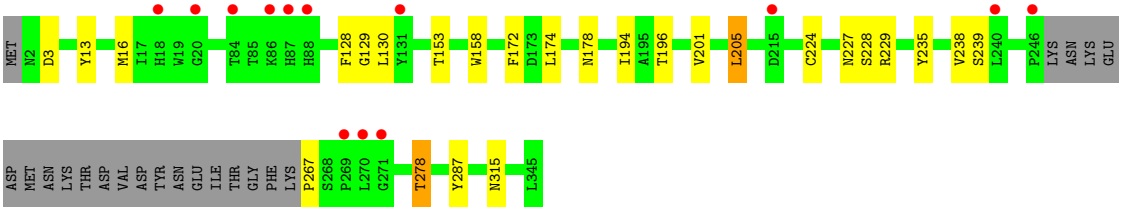
- Molecule 1: AlfC

Chain B:



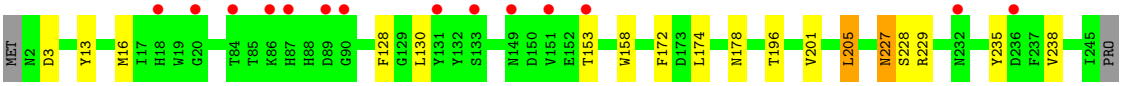
- Molecule 1: AlfC

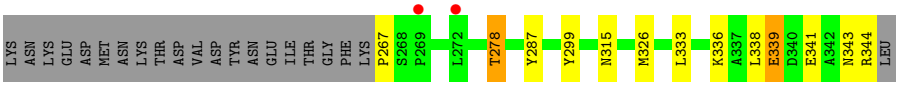
Chain C:



- Molecule 1: AlfC

Chain D:




LYS
ASN
LYS
GLU
ASP
MET
ASN
LYS
THR
ASP
VAL
ASP
TYR
ASN
GLU
ILE
THR
GLY
PHE
LYS
P267
S268
P269
L272
T278
Y287
Y299
N315
M326
L333
K336
A337
L338
E339
D340
E341
A342
N343
R344
LEU

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	87.75Å 139.30Å 265.59Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.12 – 3.55 29.12 – 3.55	Depositor EDS
% Data completeness (in resolution range)	90.8 (29.12-3.55) 91.0 (29.12-3.55)	Depositor EDS
R_{merge}	0.20	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.29 (at 3.55Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, R_{free}	0.246 , 0.261 0.239 , 0.259	Depositor DCC
R_{free} test set	914 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	119.2	Xtriage
Anisotropy	0.312	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 39.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.45$, $< L^2 > = 0.27$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	10197	wwPDB-VP
Average B, all atoms (Å^2)	105.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.17% 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	0.65	0/2655	0.70	0/3614
1	B	0.65	0/2606	0.69	0/3547
1	C	0.65	0/2616	0.70	0/3562
1	D	0.65	0/2609	0.70	0/3551
All	All	0.65	0/10486	0.70	0/14274

There are no bond length outliers.

There are no bond angle outliers.

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	2581	0	2380	17	0
1	B	2535	0	2335	16	0
1	C	2544	0	2344	19	0
1	D	2537	0	2343	19	1
All	All	10197	0	9402	68	1

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 3.

All (68) 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:287:TYR:CE1	1:D:287:TYR:CE1	2.76	0.74
1:A:227:ASN:HD21	1:A:229:ARG:HG3	1.55	0.70
1:D:227:ASN:HD21	1:D:229:ARG:HG3	1.56	0.70
1:B:227:ASN:HD21	1:B:229:ARG:HG3	1.56	0.70
1:C:227:ASN:ND2	1:C:239:SER:HB3	2.13	0.63
1:A:287:TYR:CE1	1:C:287:TYR:CE1	2.89	0.60
1:D:153:THR:HG22	1:D:158:TRP:CE2	2.38	0.59
1:D:227:ASN:HD21	1:D:229:ARG:CG	2.16	0.58
1:A:153:THR:HG22	1:A:158:TRP:CE2	2.38	0.58
1:C:153:THR:HG22	1:C:158:TRP:CE2	2.38	0.58
1:B:153:THR:HG22	1:B:158:TRP:CE2	2.38	0.58
1:B:227:ASN:HD21	1:B:229:ARG:CG	2.16	0.58
1:A:227:ASN:HD21	1:A:229:ARG:CG	2.16	0.57
1:C:227:ASN:HD21	1:C:239:SER:HB3	1.70	0.56
1:D:235:TYR:OH	1:D:267:PRO:O	2.22	0.54
1:A:264:GLY:O	1:A:266:LYS:HD2	2.08	0.54
1:B:16:MET:HB3	1:B:315:ASN:HA	1.90	0.54
1:D:16:MET:HB3	1:D:315:ASN:HA	1.90	0.53
1:D:201:VAL:HG13	1:D:229:ARG:HD2	1.91	0.53
1:A:16:MET:HB3	1:A:315:ASN:HA	1.90	0.53
1:B:201:VAL:HG13	1:B:229:ARG:HD2	1.92	0.52
1:C:16:MET:HB3	1:C:315:ASN:HA	1.90	0.52
1:C:201:VAL:HG13	1:C:229:ARG:HD2	1.92	0.52
1:A:201:VAL:HG13	1:A:229:ARG:HD2	1.91	0.50
1:C:278:THR:HG22	1:C:315:ASN:HD22	1.76	0.50
1:A:278:THR:HG22	1:A:315:ASN:HD22	1.76	0.50
1:B:278:THR:HG22	1:B:315:ASN:HD22	1.76	0.50
1:D:278:THR:HG22	1:D:315:ASN:HD22	1.76	0.50
1:C:227:ASN:HD21	1:C:239:SER:CB	2.25	0.49
1:B:174:LEU:O	1:B:178:ASN:ND2	2.48	0.47
1:A:227:ASN:OD1	1:A:229:ARG:HB2	2.15	0.47
1:B:227:ASN:OD1	1:B:229:ARG:HB2	2.15	0.46
1:C:174:LEU:O	1:C:178:ASN:ND2	2.48	0.46
1:D:227:ASN:OD1	1:D:229:ARG:HB2	2.15	0.46
1:D:333:LEU:O	1:D:336:LYS:HB3	2.15	0.46
1:D:339:GLU:O	1:D:343:ASN:ND2	2.49	0.46
1:A:174:LEU:O	1:A:178:ASN:ND2	2.48	0.46
1:C:228:SER:HB3	1:C:238:VAL:HA	1.98	0.46
1:A:228:SER:HB3	1:A:238:VAL:HA	1.98	0.45
1:A:235:TYR:OH	1:A:267:PRO:O	2.23	0.45
1:D:228:SER:HB3	1:D:238:VAL:HA	1.98	0.45
1:D:174:LEU:O	1:D:178:ASN:ND2	2.49	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:228:SER:HB3	1:B:238:VAL:HA	1.98	0.45
1:C:129:GLY:HA3	1:C:196:THR:HG23	1.97	0.45
1:B:172:PHE:CE2	1:B:205:LEU:HD12	2.53	0.44
1:A:201:VAL:HG13	1:A:229:ARG:CD	2.48	0.44
1:C:172:PHE:CE2	1:C:205:LEU:HD12	2.53	0.43
1:A:128:PHE:CE2	1:A:130:LEU:HD21	2.54	0.43
1:C:235:TYR:OH	1:C:267:PRO:O	2.23	0.43
1:D:172:PHE:CE2	1:D:205:LEU:HD12	2.53	0.43
1:C:201:VAL:HG13	1:C:229:ARG:CD	2.48	0.43
1:D:128:PHE:CE2	1:D:130:LEU:HD21	2.53	0.43
1:B:128:PHE:CE2	1:B:130:LEU:HD21	2.53	0.43
1:C:128:PHE:CE2	1:C:130:LEU:HD21	2.53	0.43
1:A:172:PHE:CE2	1:A:205:LEU:HD12	2.54	0.43
1:D:201:VAL:HG13	1:D:229:ARG:CD	2.49	0.42
1:D:338:LEU:HD23	1:D:338:LEU:N	2.34	0.42
1:D:299:TYR:CE1	1:D:339:GLU:HA	2.55	0.42
1:B:201:VAL:HG13	1:B:229:ARG:CD	2.50	0.41
1:C:194:ILE:HG22	1:C:224:CYS:SG	2.61	0.41
1:B:33:SER:HB2	1:D:326:MET:SD	2.61	0.41
1:A:194:ILE:HG22	1:A:224:CYS:SG	2.61	0.41
1:B:194:ILE:HG22	1:B:224:CYS:SG	2.61	0.41
1:C:278:THR:CG2	1:C:315:ASN:HD22	2.34	0.41
1:A:278:THR:CG2	1:A:315:ASN:HD22	2.34	0.41
1:B:278:THR:CG2	1:B:315:ASN:HD22	2.34	0.40
1:C:129:GLY:HA3	1:C:196:THR:CG2	2.51	0.40
1:C:278:THR:HG23	1:C:315:ASN:HB3	2.04	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:344:ARG:NH2	1:D:344:ARG:NH2[3_654]	2.16	0.04

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	324/345 (94%)	305 (94%)	19 (6%)	0	100	100
1	B	318/345 (92%)	299 (94%)	19 (6%)	0	100	100
1	C	320/345 (93%)	301 (94%)	19 (6%)	0	100	100
1	D	318/345 (92%)	299 (94%)	19 (6%)	0	100	100
All	All	1280/1380 (93%)	1204 (94%)	76 (6%)	0	100	100

There are no Ramachandran outliers to report.

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	261/292 (89%)	254 (97%)	7 (3%)	44	74
1	B	256/292 (88%)	250 (98%)	6 (2%)	50	77
1	C	257/292 (88%)	253 (98%)	4 (2%)	62	83
1	D	257/292 (88%)	249 (97%)	8 (3%)	40	71
All	All	1031/1168 (88%)	1006 (98%)	25 (2%)	49	76

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	ASP
1	A	13	TYR
1	A	196	THR
1	A	205	LEU
1	A	227	ASN
1	A	266	LYS
1	A	278	THR
1	B	3	ASP
1	B	13	TYR
1	B	196	THR

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Mol	Chain	Res	Type
1	B	205	LEU
1	B	227	ASN
1	B	278	THR
1	C	3	ASP
1	C	13	TYR
1	C	205	LEU
1	C	278	THR
1	D	3	ASP
1	D	13	TYR
1	D	196	THR
1	D	205	LEU
1	D	227	ASN
1	D	278	THR
1	D	339	GLU
1	D	341	GLU

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

Mol	Chain	Res	Type
1	C	95	HIS

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)

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	328/345 (95%)	-0.14	6 (1%)	68	52	47, 89, 147, 172	0
1	B	322/345 (93%)	-0.08	11 (3%)	45	31	44, 85, 151, 181	0
1	C	324/345 (93%)	0.02	13 (4%)	38	25	61, 107, 154, 177	0
1	D	322/345 (93%)	0.06	16 (4%)	28	18	62, 130, 205, 228	0
All	All	1296/1380 (93%)	-0.04	46 (3%)	44	29	44, 102, 172, 228	0

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	18	HIS	5.3
1	A	133	SER	4.4
1	C	87	HIS	4.3
1	A	87	HIS	4.3
1	D	236	ASP	4.2
1	D	133	SER	4.0
1	C	86	LYS	4.0
1	C	131	TYR	3.7
1	C	246	PRO	3.6
1	B	133	SER	3.5
1	B	268	SER	3.2
1	D	84	THR	2.9
1	B	273	TYR	2.8
1	C	84	THR	2.8
1	B	269	PRO	2.8
1	A	18	HIS	2.7
1	D	87	HIS	2.7
1	B	146	TYR	2.7
1	D	269	PRO	2.6
1	B	131	TYR	2.5
1	B	150	ASP	2.4

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Mol	Chain	Res	Type	RSRZ
1	C	271	GLY	2.4
1	D	151	VAL	2.4
1	C	18	HIS	2.4
1	D	86	LYS	2.4
1	D	90	GLY	2.3
1	C	269	PRO	2.3
1	A	85	THR	2.3
1	A	131	TYR	2.2
1	B	87	HIS	2.2
1	D	149	ASN	2.2
1	B	86	LYS	2.2
1	C	88	HIS	2.1
1	D	272	LEU	2.1
1	C	240	LEU	2.1
1	D	20	GLY	2.1
1	B	240	LEU	2.1
1	D	131	TYR	2.1
1	D	153	THR	2.1
1	A	23	SER	2.0
1	C	20	GLY	2.0
1	D	232	ASN	2.0
1	C	215	ASP	2.0
1	D	89	ASP	2.0
1	B	272	LEU	2.0
1	C	270	LEU	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)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.