wwPDB X-ray Structure Validation Summary Report (i)

Sep 17, 2023 – 04:27 PM EDT

PDB ID	:	4XX1
Title	:	Low resolution structure of LCAT in complex with Fab1
Authors	:	Piper, D.E.; Walker, N.P.C.; Romanow, W.G.; Thibault, S.T.
Deposited on	:	2015-01-29
Resolution	:	3.60 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 types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

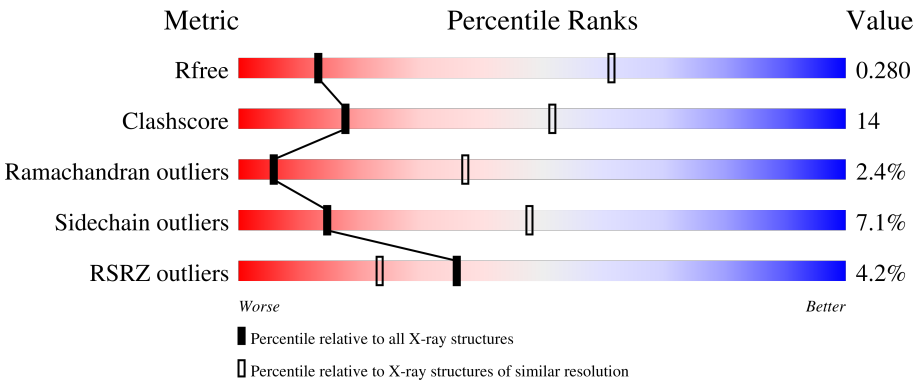
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (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 3.60 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	1257 (3.70-3.50)
Clashscore	141614	1353 (3.70-3.50)
Ramachandran outliers	138981	1307 (3.70-3.50)
Sidechain outliers	138945	1307 (3.70-3.50)
RSRZ outliers	127900	1161 (3.70-3.50)

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	G	213	5%, 67%, 27%, • •
1	L	213	3%, 68%, 27%, • •
1	O	213	15%, 24%, 19%, 5%, 51%
2	E	238	2%, 66%, 24%, •, 8%
2	H	238	7%, 68%, 22%, •, 8%

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Mol	Chain	Length	Quality of chain
2	M	238	7%, 17%, 26%, 8%, 48%
3	A	422	65%, 20%, 13%
3	B	422	66%, 19%, 13%
3	J	422	%, 54%, 28%, 14%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 17233 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 Fab1 light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	L	210	1577	990	259	323	5	0	0	0
			Total	C	N	O	S			
1	G	210	1577	990	259	323	5	0	0	0
			Total	C	N	O	S			
1	O	105	793	496	131	163	3	0	0	0

- Molecule 2 is a protein called Fab1 heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	219	1668	1059	281	321	7	0	0	0
			Total	C	N	O	S			
2	E	219	1670	1060	281	322	7	0	0	0
			Total	C	N	O	S			
2	M	124	973	616	166	186	5	0	0	0

- Molecule 3 is a protein called Phosphatidylcholine-sterol acyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	A	369	2970	1924	501	531	14	0	0	0
			Total	C	N	O	S			
3	B	369	2970	1924	501	531	14	0	0	0
			Total	C	N	O	S			
3	J	361	2909	1887	490	518	14	0	0	0

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	417	GLU	-	expression tag	UNP P04180
A	418	ASN	-	expression tag	UNP P04180

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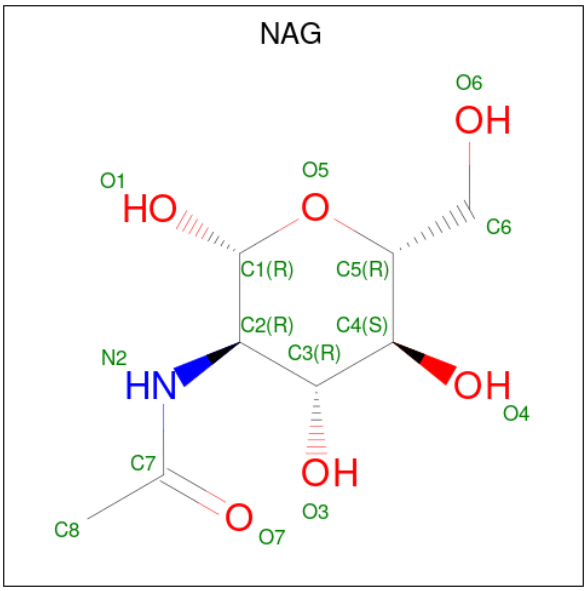
Chain	Residue	Modelled	Actual	Comment	Reference
A	419	LEU	-	expression tag	UNP P04180
A	420	TYR	-	expression tag	UNP P04180
A	421	PHE	-	expression tag	UNP P04180
A	422	GLN	-	expression tag	UNP P04180
B	417	GLU	-	expression tag	UNP P04180
B	418	ASN	-	expression tag	UNP P04180
B	419	LEU	-	expression tag	UNP P04180
B	420	TYR	-	expression tag	UNP P04180
B	421	PHE	-	expression tag	UNP P04180
B	422	GLN	-	expression tag	UNP P04180
J	417	GLU	-	expression tag	UNP P04180
J	418	ASN	-	expression tag	UNP P04180
J	419	LEU	-	expression tag	UNP P04180
J	420	TYR	-	expression tag	UNP P04180
J	421	PHE	-	expression tag	UNP P04180
J	422	GLN	-	expression tag	UNP P04180

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	A	1	14	8	1	5	0	0
			Total	C	N	O		
4	A	1	14	8	1	5	0	0
			Total	C	N	O		
4	A	1	14	8	1	5	0	0

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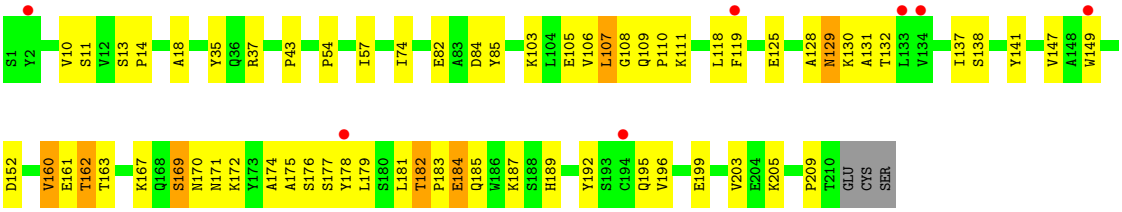
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	B	1	14	8	1	5	0	0
			Total	C	N	O		
4	B	1	14	8	1	5	0	0
			Total	C	N	O		
4	B	1	14	8	1	5	0	0
			Total	C	N	O		
4	J	1	14	8	1	5	0	0
			Total	C	N	O		
4	J	1	14	8	1	5	0	0
			Total	C	N	O		
4	J	1	14	8	1	5	0	0

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.

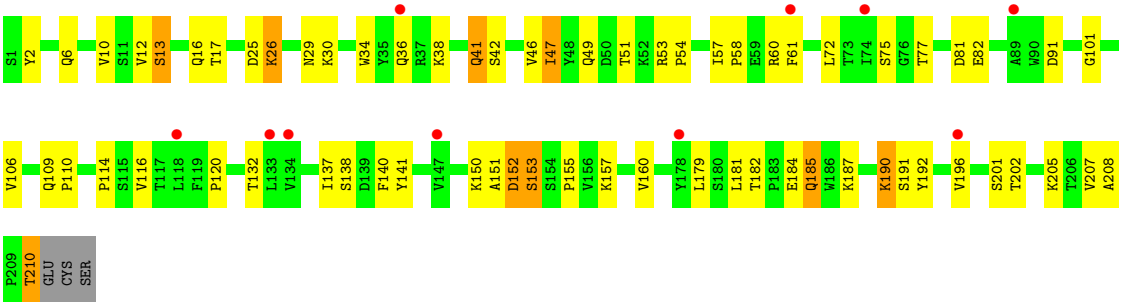
• Molecule 1: Fab1 light chain

Chain L:



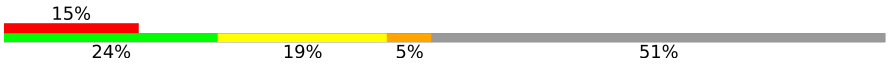
• Molecule 1: Fab1 light chain

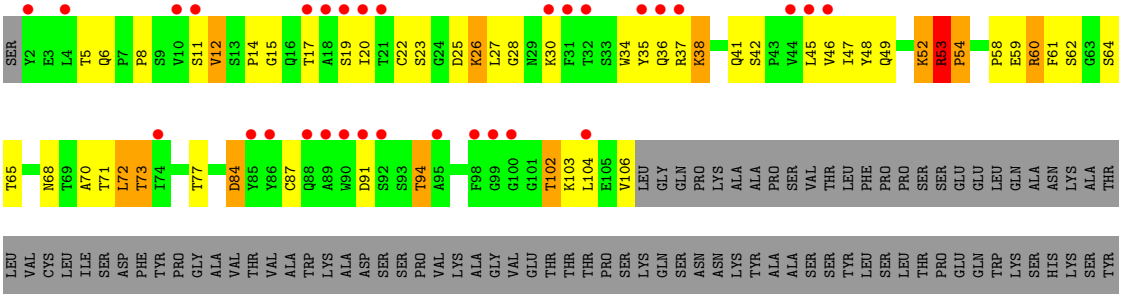
Chain G:

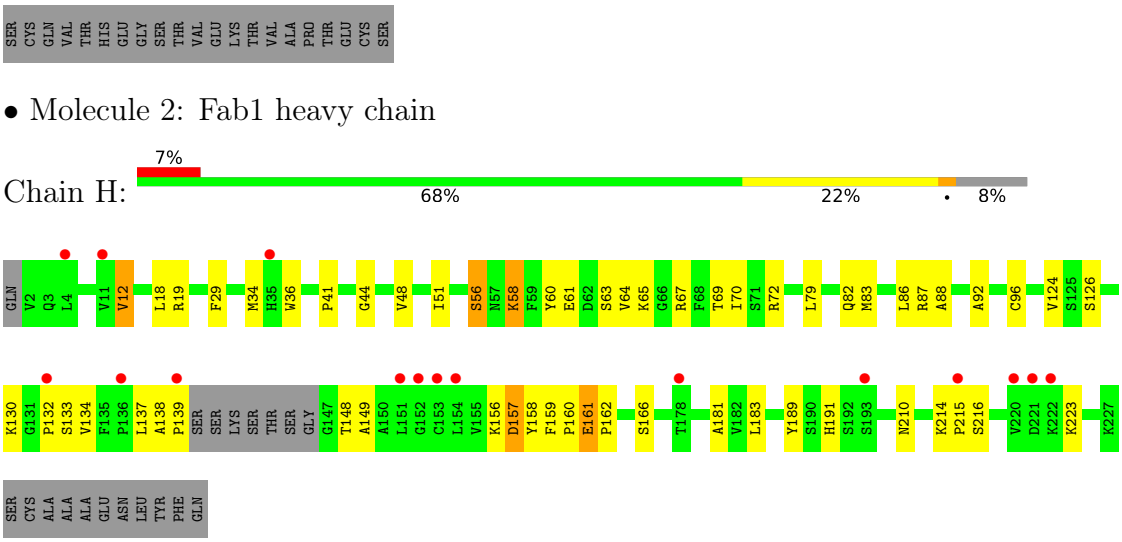


• Molecule 1: Fab1 light chain

Chain O:

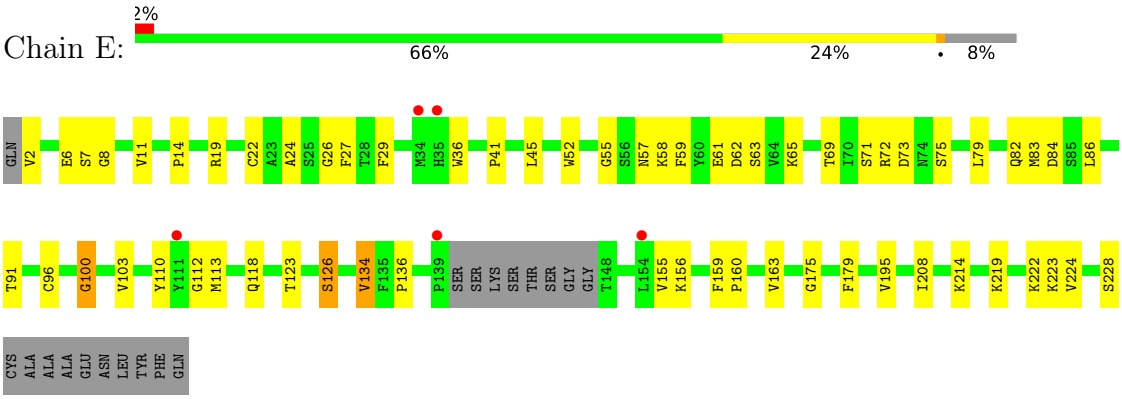




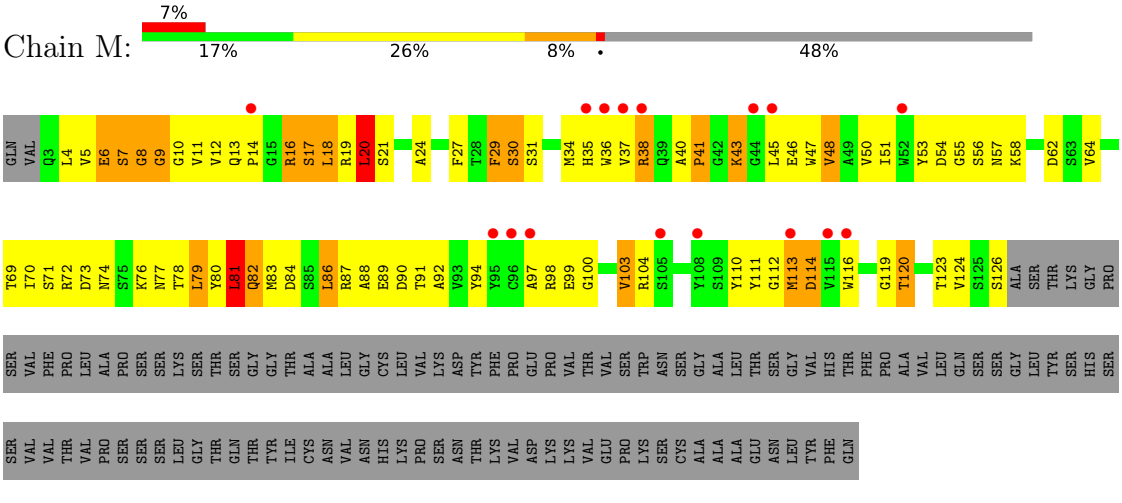


• Molecule 2: Fab1 heavy chain

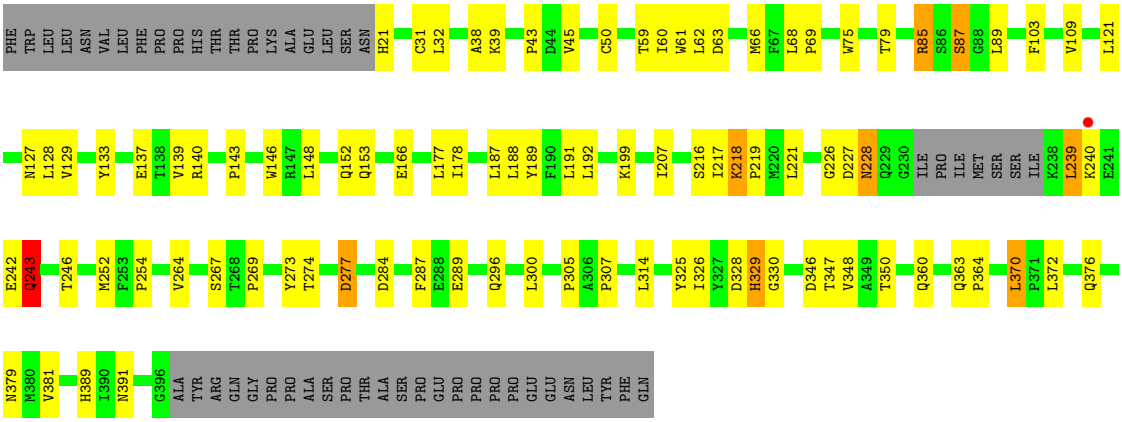
• Molecule 2: Fab1 heavy chain



• Molecule 2: Fab1 heavy chain

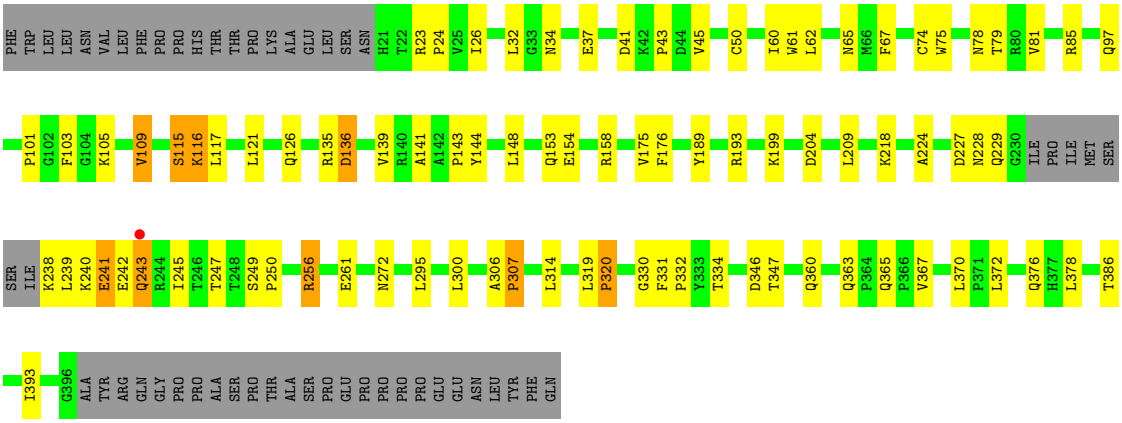


• Molecule 3: Phosphatidylcholine-sterol acyltransferase



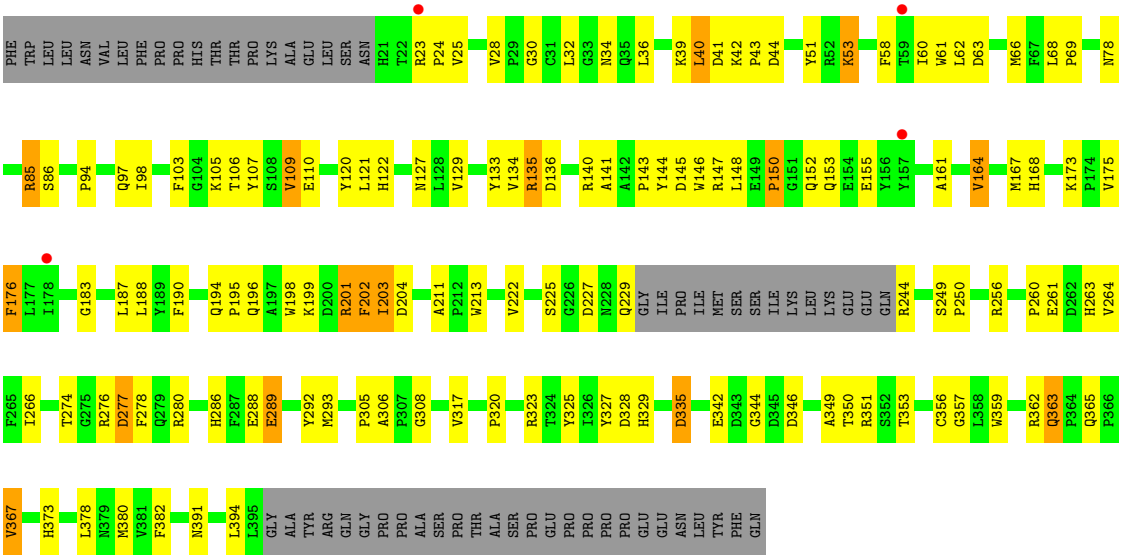
- Molecule 3: Phosphatidylcholine-sterol acyltransferase

Chain B:



- Molecule 3: Phosphatidylcholine-sterol acyltransferase

Chain J:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α, β, γ	166.42Å 166.42Å 97.66Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	72.06 – 3.60 80.85 – 3.60	Depositor EDS
% Data completeness (in resolution range)	99.3 (72.06-3.60) 99.3 (80.85-3.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.16	Depositor
$< I/\sigma(I) >$ [1]	1.98 (at 3.58Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.196 , 0.280 0.200 , 0.280	Depositor DCC
R_{free} test set	1751 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	123.7	Xtriage
Anisotropy	0.178	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 73.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.44$, $< L^2 > = 0.26$	Xtriage
Estimated twinning fraction	0.045 for -h,-k,l 0.063 for h,-h-k,-l 0.047 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	17233	wwPDB-VP
Average B, all atoms (Å^2)	127.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 20.29 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 8.9692e-03.*

[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: NAG

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	G	0.30	0/1618	0.49	0/2211
1	L	0.32	0/1618	0.56	0/2211
1	O	0.35	0/813	0.61	0/1108
2	E	0.30	0/1714	0.48	0/2333
2	H	0.29	0/1712	0.46	0/2330
2	M	0.33	0/998	0.63	2/1351 (0.1%)
3	A	0.30	0/3063	0.48	0/4177
3	B	0.33	0/3063	0.50	0/4177
3	J	0.31	0/3002	0.51	0/4098
All	All	0.31	0/17601	0.51	2/23996 (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	L	0	2
1	O	0	2
All	All	0	4

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	M	20	LEU	CA-CB-CG	5.14	127.13	115.30
2	M	81	LEU	CA-CB-CG	5.03	126.86	115.30

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	L	128	ALA	Peptide
1	L	184	GLU	Peptide
1	O	52	LYS	Peptide
1	O	53	ARG	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	G	1577	0	1527	43	0
1	L	1577	0	1527	36	0
1	O	793	0	753	39	0
2	E	1670	0	1613	32	0
2	H	1668	0	1611	36	0
2	M	973	0	916	66	0
3	A	2970	0	2877	60	0
3	B	2970	0	2877	53	0
3	J	2909	0	2814	110	0
4	A	42	0	39	0	0
4	B	42	0	39	1	0
4	J	42	0	39	0	0
All	All	17233	0	16632	464	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.

The worst 5 of 464 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)
3:A:216:SER:HG	3:A:218:LYS:HZ3	1.24	0.85
3:J:201:ARG:HG2	3:J:202:PHE:HD1	1.38	0.85
2:E:208:ILE:HG12	2:E:223:LYS:HB3	1.59	0.83
3:J:106:THR:HG23	3:J:135:ARG:HH12	1.41	0.83
2:M:8:GLY:HA3	2:M:20:LEU:HA	1.62	0.82

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	G	208/213 (98%)	185 (89%)	21 (10%)	2 (1%)	15	55
1	L	208/213 (98%)	184 (88%)	16 (8%)	8 (4%)	3	27
1	O	103/213 (48%)	79 (77%)	20 (19%)	4 (4%)	3	27
2	E	215/238 (90%)	193 (90%)	20 (9%)	2 (1%)	17	57
2	H	215/238 (90%)	185 (86%)	25 (12%)	5 (2%)	6	38
2	M	122/238 (51%)	88 (72%)	25 (20%)	9 (7%)	1	13
3	A	365/422 (86%)	329 (90%)	28 (8%)	8 (2%)	6	39
3	B	365/422 (86%)	331 (91%)	26 (7%)	8 (2%)	6	39
3	J	357/422 (85%)	321 (90%)	30 (8%)	6 (2%)	9	45
All	All	2158/2619 (82%)	1895 (88%)	211 (10%)	52 (2%)	6	37

5 of 52 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	L	107	LEU
1	L	160	VAL
1	L	170	ASN
1	L	209	PRO
3	A	239	LEU

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	G	178/181 (98%)	162 (91%)	16 (9%)	9	39
1	L	178/181 (98%)	172 (97%)	6 (3%)	37	69
1	O	88/181 (49%)	72 (82%)	16 (18%)	1	10
2	E	184/198 (93%)	177 (96%)	7 (4%)	33	66
2	H	183/198 (92%)	176 (96%)	7 (4%)	33	66
2	M	101/198 (51%)	79 (78%)	22 (22%)	1	6
3	A	319/367 (87%)	304 (95%)	15 (5%)	26	61
3	B	319/367 (87%)	302 (95%)	17 (5%)	22	58
3	J	313/367 (85%)	287 (92%)	26 (8%)	11	42
All	All	1863/2238 (83%)	1731 (93%)	132 (7%)	14	48

5 of 132 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	J	135	ARG
3	J	173	LYS
3	J	367	VAL
2	E	134	VAL
2	E	126	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
3	B	153	GLN
2	M	74	ASN
3	J	391	ASN
1	O	68	ASN
3	J	34	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)

9 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
4	NAG	A	502	3	14,14,15	0.44	0	17,19,21	0.55	0
4	NAG	J	502	3	14,14,15	0.62	0	17,19,21	0.64	0
4	NAG	A	501	3	14,14,15	0.32	0	17,19,21	0.38	0
4	NAG	J	503	3	14,14,15	0.51	0	17,19,21	0.36	0
4	NAG	A	503	3	14,14,15	0.50	0	17,19,21	0.45	0
4	NAG	B	501	3	14,14,15	0.40	0	17,19,21	0.42	0
4	NAG	B	502	3	14,14,15	0.46	0	17,19,21	0.64	0
4	NAG	J	501	3	14,14,15	0.26	0	17,19,21	0.41	0
4	NAG	B	503	3	14,14,15	0.40	0	17,19,21	0.33	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	A	502	3	-	2/6/23/26	0/1/1/1
4	NAG	J	502	3	-	2/6/23/26	0/1/1/1
4	NAG	A	501	3	-	2/6/23/26	0/1/1/1
4	NAG	J	503	3	-	2/6/23/26	0/1/1/1
4	NAG	A	503	3	-	2/6/23/26	0/1/1/1
4	NAG	B	501	3	-	2/6/23/26	0/1/1/1
4	NAG	B	502	3	-	0/6/23/26	0/1/1/1
4	NAG	J	501	3	-	2/6/23/26	0/1/1/1
4	NAG	B	503	3	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 14 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	501	NAG	O5-C5-C6-O6
4	B	501	NAG	O5-C5-C6-O6
4	A	501	NAG	C4-C5-C6-O6
4	A	502	NAG	C4-C5-C6-O6
4	A	502	NAG	O5-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	502	NAG	1	0

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	G	210/213 (98%)	0.14	10 (4%)	30	19	92, 144, 165, 174	0
1	L	210/213 (98%)	0.18	7 (3%)	46	31	78, 127, 171, 179	0
1	O	105/213 (49%)	1.36	31 (29%)	0	0	162, 187, 200, 202	0
2	E	219/238 (92%)	0.11	5 (2%)	60	44	89, 121, 140, 163	0
2	H	219/238 (92%)	0.44	16 (7%)	15	9	85, 134, 166, 173	0
2	M	124/238 (52%)	0.83	16 (12%)	3	2	146, 182, 192, 195	0
3	A	369/422 (87%)	0.06	1 (0%)	94	88	84, 106, 139, 165	0
3	B	369/422 (87%)	0.07	1 (0%)	94	88	69, 95, 126, 162	0
3	J	361/422 (85%)	0.09	4 (1%)	80	68	102, 133, 158, 179	0
All	All	2186/2619 (83%)	0.23	91 (4%)	36	23	69, 123, 184, 202	0

The worst 5 of 91 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	O	20	ILE	6.9
2	M	37	VAL	6.0
2	M	45	LEU	5.8
1	O	32	THR	5.4
1	O	89	ALA	5.4

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
4	NAG	B	503	14/15	0.71	0.32	164,187,192,193	0
4	NAG	J	503	14/15	0.80	0.28	169,181,191,191	0
4	NAG	J	501	14/15	0.82	0.28	157,174,183,183	0
4	NAG	A	503	14/15	0.83	0.39	168,181,189,192	0
4	NAG	A	501	14/15	0.83	0.27	153,164,174,174	0
4	NAG	J	502	14/15	0.90	0.35	102,134,141,142	0
4	NAG	A	502	14/15	0.91	0.23	100,122,132,136	0
4	NAG	B	502	14/15	0.92	0.36	96,111,124,124	0
4	NAG	B	501	14/15	0.93	0.22	126,140,150,152	0

6.5 Other polymers (i)

There are no such residues in this entry.