



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:51 AM UTC

PDB ID : 2XFW / pdb_00002xfw
Title : Structure of the E192N mutant of E. coli N-acetylneuraminic acid lyase in complex with pyruvate in crystal form III
Authors : Campeotto, I.; Murshudov, G.N.; Bolt, A.H.; Trinh, C.H.; Phillips, S.E.V.; Nelson, A.; Pearson, A.R.; Berry, A.
Deposited on : 2010-05-28
Resolution : 1.65 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

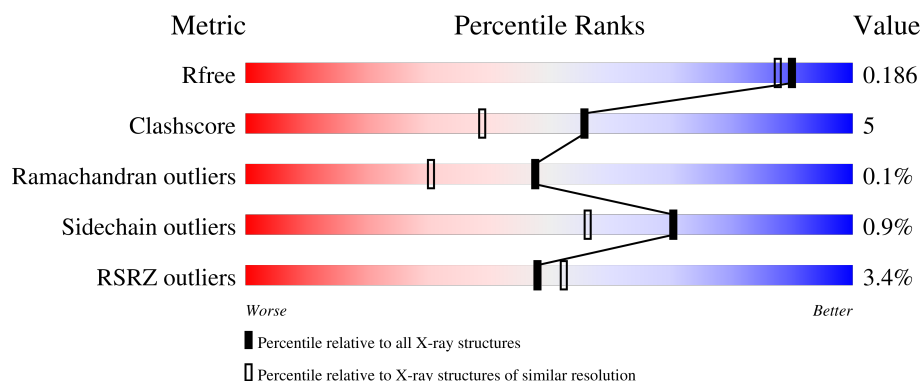
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.65 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}	180053	2563 (1.66-1.66)
Clashscore	190562	2662 (1.66-1.66)
Ramachandran outliers	187476	2621 (1.66-1.66)
Sidechain outliers	187428	2621 (1.66-1.66)
RSRZ outliers	180081	2564 (1.66-1.66)

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 $\leq 5\%$. 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	304	4% 87% 12% .
1	B	304	3% 88% 10% .
1	C	304	3% 88% 10% .
1	D	304	3% 90% 9% .

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	PYR	A	1298	-	X	-	-
2	PYR	C	1298	-	X	-	-
2	PYR	C	1299	-	X	-	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 10447 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 N-ACETYLNEURAMINIC ACID LYASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	299	Total	C	N	O	S	0	6	0
			2351	1497	402	441	11			
1	B	298	Total	C	N	O	S	0	8	0
			2360	1507	402	439	12			
1	C	299	Total	C	N	O	S	0	5	0
			2345	1494	400	440	11			
1	D	299	Total	C	N	O	S	0	5	0
			2347	1494	402	440	11			

There are 36 discrepancies between the modelled and reference sequences:

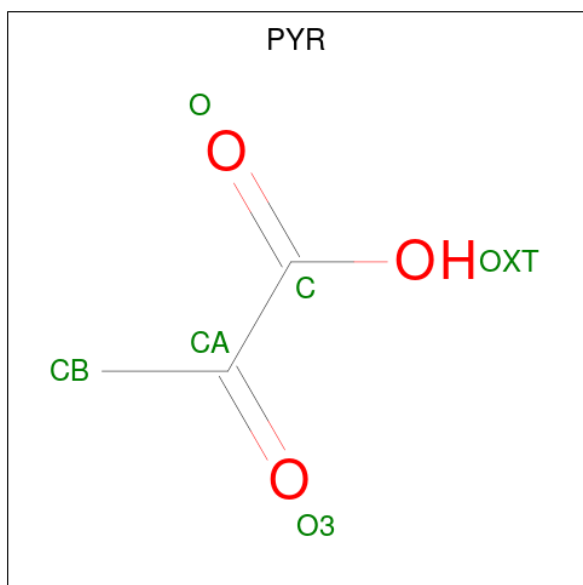
Chain	Residue	Modelled	Actual	Comment	Reference
A	-6	MET	-	expression tag	UNP B7M0T7
A	-5	GLU	-	expression tag	UNP B7M0T7
A	-4	HIS	-	expression tag	UNP B7M0T7
A	-3	HIS	-	expression tag	UNP B7M0T7
A	-2	HIS	-	expression tag	UNP B7M0T7
A	-1	HIS	-	expression tag	UNP B7M0T7
A	0	HIS	-	expression tag	UNP B7M0T7
A	1	HIS	-	expression tag	UNP B7M0T7
A	192	ASN	GLU	engineered mutation	UNP B7M0T7
B	-6	MET	-	expression tag	UNP B7M0T7
B	-5	GLU	-	expression tag	UNP B7M0T7
B	-4	HIS	-	expression tag	UNP B7M0T7
B	-3	HIS	-	expression tag	UNP B7M0T7
B	-2	HIS	-	expression tag	UNP B7M0T7
B	-1	HIS	-	expression tag	UNP B7M0T7
B	0	HIS	-	expression tag	UNP B7M0T7
B	1	HIS	-	expression tag	UNP B7M0T7
B	192	ASN	GLU	engineered mutation	UNP B7M0T7
C	-6	MET	-	expression tag	UNP B7M0T7
C	-5	GLU	-	expression tag	UNP B7M0T7
C	-4	HIS	-	expression tag	UNP B7M0T7

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-3	HIS	-	expression tag	UNP B7M0T7
C	-2	HIS	-	expression tag	UNP B7M0T7
C	-1	HIS	-	expression tag	UNP B7M0T7
C	0	HIS	-	expression tag	UNP B7M0T7
C	1	HIS	-	expression tag	UNP B7M0T7
C	192	ASN	GLU	engineered mutation	UNP B7M0T7
D	-6	MET	-	expression tag	UNP B7M0T7
D	-5	GLU	-	expression tag	UNP B7M0T7
D	-4	HIS	-	expression tag	UNP B7M0T7
D	-3	HIS	-	expression tag	UNP B7M0T7
D	-2	HIS	-	expression tag	UNP B7M0T7
D	-1	HIS	-	expression tag	UNP B7M0T7
D	0	HIS	-	expression tag	UNP B7M0T7
D	1	HIS	-	expression tag	UNP B7M0T7
D	192	ASN	GLU	engineered mutation	UNP B7M0T7

- Molecule 2 is PYRUVIC ACID (CCD ID: PYR) (formula: $C_3H_4O_3$).



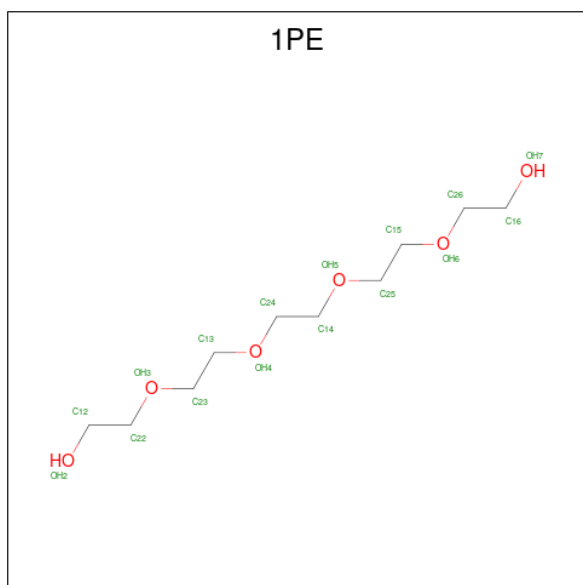
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			6	3	3		
2	B	1	Total	C	O	0	0
			6	3	3		
2	C	1	Total	C	O	0	0
			6	3	3		
2	C	1	Total	C	O	0	0
			6	3	3		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	C	1	Total	C	O	0	0
			6	3	3		
2	D	1	Total	C	O	0	0
			6	3	3		

- Molecule 3 is PENTAETHYLENE GLYCOL (CCD ID: 1PE) (formula: $C_{10}H_{22}O_6$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			8	5	3		
3	A	1	Total	C	O	0	0
			8	5	3		
3	D	1	Total	C	O	0	0
			7	4	3		
3	D	1	Total	C	O	0	0
			8	5	3		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	256	Total	O	0	0
			256	256		
4	B	221	Total	O	0	0
			221	221		
4	C	242	Total	O	0	0
			242	242		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	D	258	Total 258	O 258	0	0



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	78.11Å 116.53Å 83.74Å 90.00° 117.95° 90.00°	Depositor
Resolution (Å)	73.98 – 1.65 73.97 – 1.65	Depositor EDS
% Data completeness (in resolution range)	99.1 (73.98-1.65) 99.8 (73.97-1.65)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.85 (at 1.64Å)	Xtriage
Refinement program	REFMAC 5.5.0097	Depositor
R, R_{free}	0.156 , 0.182 0.164 , 0.186	Depositor DCC
R_{free} test set	9108 reflections (5.69%)	wwPDB-VP
Wilson B-factor (Å ²)	13.5	Xtriage
Anisotropy	0.044	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 39.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	0.128 for h,-k,-h-l	Xtriage
Reported twinning fraction	0.904 for H, K, L 0.096 for -H, -K, H+L	Depositor
Outliers	0 of 158864 reflections	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	10447	wwPDB-VP
Average B, all atoms (Å ²)	14.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.37% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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: 1PE, KPI, PYR

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	0.63	0/2397	0.78	0/3243
1	B	0.59	0/2412	0.76	0/3261
1	C	0.61	0/2388	0.77	0/3231
1	D	0.62	0/2390	0.77	0/3233
All	All	0.61	0/9587	0.77	0/12968

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	2351	0	2376	29	0
1	B	2360	0	2401	25	0
1	C	2345	0	2369	17	0
1	D	2347	0	2369	18	0
2	A	6	0	0	0	0
2	B	6	0	0	0	0
2	C	18	0	0	0	0
2	D	6	0	0	0	0
3	A	16	0	18	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	15	0	18	3	0
4	A	256	0	0	2	0
4	B	221	0	0	1	0
4	C	242	0	0	2	0
4	D	258	0	0	6	0
All	All	10447	0	9551	89	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.

All (89) 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:9[B]:MET:HE3	1:B:77:ILE:HD11	1.25	1.14
1:B:9[B]:MET:HE3	1:B:77:ILE:CD1	1.80	1.11
1:B:9[B]:MET:CE	1:B:77:ILE:HD11	1.84	1.06
1:D:37:GLN:NE2	4:D:2042:HOH:O	2.04	0.90
1:C:79:HIS:HE1	1:C:106:VAL:H	1.30	0.80
1:D:79:HIS:HE1	1:D:106:VAL:H	1.33	0.76
1:A:79:HIS:HE1	1:A:106:VAL:H	1.33	0.75
1:B:79:HIS:HE1	1:B:106:VAL:H	1.34	0.74
1:B:96[B]:LYS:HD3	1:B:132:LEU:HD13	1.68	0.73
1:B:9[B]:MET:HE3	1:B:77:ILE:HD12	1.69	0.73
1:A:4:ASN:HD22	1:A:75:LYS:HZ1	1.37	0.71
1:A:224:LEU:O	1:C:229:ILE:HD12	1.89	0.71
1:A:4:ASN:HD22	1:A:75:LYS:NZ	1.89	0.70
1:A:218:GLN:NE2	4:A:2193:HOH:O	2.26	0.68
1:A:223:ALA:CB	1:A:231[A]:THR:HG23	2.26	0.66
1:A:173:GLN:HA	1:A:176:GLN:HE21	1.60	0.65
1:C:173:GLN:HA	1:C:176:GLN:HE21	1.64	0.63
1:B:215:TRP:CE3	1:B:296:ARG:HD3	2.33	0.62
1:D:173:GLN:HA	1:D:176:GLN:HE21	1.65	0.61
1:B:9[B]:MET:CE	1:B:77:ILE:CD1	2.58	0.61
1:B:9[B]:MET:HE1	1:B:77:ILE:HD11	1.80	0.60
1:D:6:ARG:NE	1:D:203:ASP:OD2	2.35	0.59
1:A:20[B]:GLN:HE22	1:A:272:LYS:H	1.50	0.59
1:D:296:ARG:NE	4:D:2255:HOH:O	2.37	0.58
1:B:38:GLY:O	1:B:218[B]:GLN:NE2	2.34	0.58
1:D:97[A]:ARG:NH2	4:D:2111:HOH:O	2.36	0.57
1:B:96[B]:LYS:HD3	1:B:132:LEU:CD1	2.35	0.56
1:A:223:ALA:HB1	1:A:231[A]:THR:HG23	1.88	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:192:ASN:HA	1:A:240:ASN:HD21	1.73	0.54
1:B:25:ALA:HB1	4:B:2032:HOH:O	2.07	0.53
1:B:108:PRO:HD2	1:B:118:HIS:HD2	1.74	0.53
1:B:153:ASN:OD1	1:B:181:HIS:HE1	1.92	0.53
1:B:9[B]:MET:HE2	1:B:187:TYR:OH	2.09	0.52
1:A:0:HIS:O	1:A:3:THR:OG1	2.27	0.51
1:A:223:ALA:HB1	1:A:231[A]:THR:CG2	2.41	0.50
1:A:223:ALA:HB2	1:A:231[A]:THR:HG23	1.93	0.50
1:A:228:ASP:CG	1:A:231[A]:THR:HG22	2.37	0.50
1:B:192:ASN:HA	1:B:240:ASN:HD21	1.77	0.48
1:A:153:ASN:OD1	1:A:181:HIS:HE1	1.96	0.48
1:C:156:VAL:HA	1:C:161:VAL:HG11	1.95	0.48
1:D:0:HIS:HA	1:D:3:THR:HG23	1.96	0.48
1:C:79:HIS:CE1	1:C:106:VAL:H	2.20	0.48
1:A:135:VAL:HG22	1:A:163:ALA:HB3	1.95	0.48
1:D:9[B]:MET:HE3	1:D:9[B]:MET:HB3	1.62	0.48
1:C:96:LYS:HD3	1:C:132:LEU:HD13	1.95	0.48
1:D:181:HIS:HD2	4:D:2001:HOH:O	1.97	0.47
1:D:108:PRO:HD2	1:D:118:HIS:HD2	1.80	0.47
1:C:192:ASN:HA	1:C:240:ASN:HD21	1.80	0.47
1:D:153:ASN:OD1	1:D:181:HIS:HE1	1.97	0.47
1:A:263:ASP:HA	3:A:1299:1PE:H221	1.95	0.47
1:A:223:ALA:CB	1:A:231[A]:THR:CG2	2.93	0.47
1:D:236:GLN:HE21	1:D:240:ASN:ND2	2.13	0.47
1:B:79:HIS:CE1	1:B:106:VAL:H	2.24	0.47
1:C:118:HIS:HE1	4:C:2119:HOH:O	1.98	0.47
1:C:108:PRO:HD2	1:C:118:HIS:HD2	1.81	0.46
1:A:96:LYS:HD3	1:A:132:LEU:HD13	1.97	0.46
1:C:86:ALA:HA	1:C:89:GLN:HE21	1.81	0.46
1:C:96:LYS:HE2	4:C:2137:HOH:O	2.16	0.45
1:C:153:ASN:OD1	1:C:181:HIS:HE1	1.99	0.45
1:A:156:VAL:HA	1:A:161:VAL:HG11	1.98	0.45
1:B:236:GLN:HE21	1:B:240:ASN:ND2	2.15	0.45
1:D:20:GLN:NE2	4:D:2018:HOH:O	2.49	0.45
1:B:194:PHE:CE2	1:B:198:LEU:HD11	2.52	0.45
1:D:192:ASN:HA	1:D:240:ASN:HD21	1.82	0.45
1:A:108:PRO:HD2	1:A:118:HIS:HD2	1.83	0.44
1:A:228:ASP:CG	1:A:231[B]:THR:OG1	2.60	0.44
1:B:45:GLY:O	1:B:79:HIS:HD2	2.01	0.44
1:C:22:LEU:HD21	1:C:54[B]:GLN:HE21	1.83	0.43
1:D:194:PHE:CE2	1:D:198:LEU:HD11	2.54	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:37:GLN:HE22	1:B:214:GLY:H	1.66	0.43
1:C:2:ALA:HB1	1:C:5:LEU:HD12	2.01	0.42
1:D:236:GLN:HE21	1:D:240:ASN:HD21	1.68	0.42
1:C:236:GLN:HE21	1:C:240:ASN:ND2	2.18	0.42
1:A:24:LYS:HD3	1:A:65:ILE:HD11	2.01	0.42
1:A:75:LYS:HE2	3:A:1300:1PE:H222	2.02	0.42
1:A:144:GLY:HA2	3:D:1300:1PE:H131	2.02	0.42
1:D:9[B]:MET:HE2	1:D:77:ILE:HD12	2.02	0.41
1:C:221:VAL:HG12	1:C:225:LYS:HE3	2.02	0.41
1:A:236:GLN:HE21	1:A:240:ASN:ND2	2.17	0.41
1:B:6:ARG:HE	1:B:6:ARG:HB2	1.66	0.41
1:B:96[A]:LYS:HD3	1:B:132:LEU:HD13	2.02	0.41
1:B:86:ALA:HA	1:B:89:GLN:HE21	1.86	0.41
1:A:144:GLY:CA	3:D:1300:1PE:H131	2.51	0.41
1:B:253:ARG:HG3	1:B:277:VAL:HG22	2.03	0.40
1:A:234:LYS:HG2	4:A:2195:HOH:O	2.21	0.40
1:D:37:GLN:CG	4:D:2255:HOH:O	2.69	0.40
3:D:1300:1PE:H221	3:D:1300:1PE:H132	1.66	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	302/304 (99%)	297 (98%)	4 (1%)	1 (0%)	36	21
1	B	303/304 (100%)	298 (98%)	5 (2%)	0	100	100
1	C	301/304 (99%)	294 (98%)	7 (2%)	0	100	100
1	D	301/304 (99%)	296 (98%)	5 (2%)	0	100	100
All	All	1207/1216 (99%)	1185 (98%)	21 (2%)	1 (0%)	48	30

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	147	LEU

5.3.2 Protein sidechains ⓘ

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	251/250 (100%)	249 (99%)	2 (1%)	73	60
1	B	253/250 (101%)	252 (100%)	1 (0%)	84	77
1	C	250/250 (100%)	246 (98%)	4 (2%)	55	34
1	D	250/250 (100%)	248 (99%)	2 (1%)	73	60
All	All	1004/1000 (100%)	995 (99%)	9 (1%)	70	56

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	166	GLN
1	A	263	ASP
1	B	166	GLN
1	C	36	GLN
1	C	166	GLN
1	C	230	GLN
1	C	263	ASP
1	D	166	GLN
1	D	230	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (42) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	4	ASN
1	A	37	GLN
1	A	79	HIS
1	A	118	HIS
1	A	166	GLN
1	A	176	GLN
1	A	181	HIS

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Mol	Chain	Res	Type
1	A	188	ASN
1	A	233	GLN
1	A	240	ASN
1	A	260	HIS
1	A	291	GLN
1	B	32	GLN
1	B	37	GLN
1	B	79	HIS
1	B	89	GLN
1	B	118	HIS
1	B	166	GLN
1	B	181	HIS
1	B	240	ASN
1	B	260	HIS
1	B	294	GLN
1	C	34	ASN
1	C	79	HIS
1	C	89	GLN
1	C	118	HIS
1	C	166	GLN
1	C	176	GLN
1	C	181	HIS
1	C	211	ASN
1	C	240	ASN
1	C	291	GLN
1	C	294	GLN
1	D	0	HIS
1	D	37	GLN
1	D	79	HIS
1	D	118	HIS
1	D	166	GLN
1	D	176	GLN
1	D	181	HIS
1	D	230	GLN
1	D	240	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

4 non-standard protein/DNA/RNA residues 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$
1	KPI	A	165	1	11,13,14	1.05	1 (9%)	9,15,17	0.81	0
1	KPI	D	165	1	11,13,14	1.19	2 (18%)	9,15,17	1.39	1 (11%)
1	KPI	B	165	1	11,13,14	0.99	0	9,15,17	1.14	1 (11%)
1	KPI	C	165	1	11,13,14	1.03	1 (9%)	9,15,17	1.34	1 (11%)

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
1	KPI	A	165	1	-	2/13/14/16	-
1	KPI	D	165	1	-	1/13/14/16	-
1	KPI	B	165	1	-	1/13/14/16	-
1	KPI	C	165	1	-	1/13/14/16	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	165	KPI	O1-CX2	-2.80	1.23	1.30
1	D	165	KPI	CX2-CX1	2.50	1.52	1.49
1	A	165	KPI	O1-CX2	-2.34	1.24	1.30
1	D	165	KPI	O1-CX2	-2.07	1.24	1.30

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	165	KPI	C1-CX1-CX2	3.29	121.22	118.11
1	D	165	KPI	O2-CX2-CX1	-3.03	117.65	121.35
1	B	165	KPI	O2-CX2-CX1	-2.28	118.57	121.35

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	165	KPI	C1-CX1-NZ-CE
1	A	165	KPI	CX2-CX1-NZ-CE
1	B	165	KPI	C1-CX1-NZ-CE
1	C	165	KPI	C1-CX1-NZ-CE
1	D	165	KPI	C1-CX1-NZ-CE

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

10 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$
3	1PE	D	1299	-	6,6,15	0.50	0	5,5,14	0.47	0
3	1PE	A	1300	-	7,7,15	0.67	0	6,6,14	0.26	0
2	PYR	C	1300	-	5,5,5	3.02	3 (60%)	3,6,6	1.75	1 (33%)
2	PYR	D	1298	-	5,5,5	3.25	3 (60%)	3,6,6	1.56	0
2	PYR	A	1298	-	5,5,5	3.17	3 (60%)	3,6,6	1.68	1 (33%)
3	1PE	A	1299	-	7,7,15	0.57	0	6,6,14	0.34	0
2	PYR	C	1299	-	5,5,5	2.97	3 (60%)	3,6,6	1.83	1 (33%)
2	PYR	B	1297	-	5,5,5	3.21	3 (60%)	3,6,6	0.96	0
2	PYR	C	1298	-	5,5,5	3.34	3 (60%)	3,6,6	0.80	0
3	1PE	D	1300	-	7,7,15	0.75	0	6,6,14	0.86	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
3	1PE	D	1299	-	-	1/4/4/13	-
3	1PE	A	1300	-	-	2/5/5/13	-
2	PYR	C	1300	-	-	0/4/4/4	-
2	PYR	D	1298	-	-	2/4/4/4	-
2	PYR	A	1298	-	-	4/4/4/4	-
3	1PE	A	1299	-	-	4/5/5/13	-
2	PYR	C	1299	-	-	2/4/4/4	-
2	PYR	B	1297	-	-	2/4/4/4	-
2	PYR	C	1298	-	-	4/4/4/4	-
3	1PE	D	1300	-	-	2/5/5/13	-

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1298	PYR	CA-C	-5.01	1.37	1.54
2	B	1297	PYR	CA-C	-4.96	1.37	1.54
2	C	1298	PYR	CA-C	-4.93	1.38	1.54
2	D	1298	PYR	CA-C	-4.82	1.38	1.54
2	C	1299	PYR	CA-C	-4.48	1.39	1.54
2	C	1300	PYR	CA-C	-4.44	1.39	1.54
2	C	1298	PYR	O-C	4.22	1.33	1.22
2	B	1297	PYR	O-C	3.89	1.32	1.22
2	D	1298	PYR	O3-CA	3.88	1.32	1.23
2	D	1298	PYR	O-C	3.77	1.31	1.22
2	C	1298	PYR	O3-CA	3.69	1.31	1.23
2	A	1298	PYR	O3-CA	3.62	1.31	1.23
2	C	1300	PYR	O3-CA	3.61	1.31	1.23
2	C	1300	PYR	O-C	3.56	1.31	1.22
2	C	1299	PYR	O-C	3.45	1.31	1.22
2	C	1299	PYR	O3-CA	3.45	1.31	1.23
2	B	1297	PYR	O3-CA	3.43	1.31	1.23
2	A	1298	PYR	O-C	3.43	1.31	1.22

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1299	PYR	OXT-C-CA	2.50	120.53	113.59

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1298	PYR	OXT-C-CA	2.50	120.51	113.59
2	C	1300	PYR	OXT-C-CA	2.46	120.41	113.59

There are no chirality outliers.

All (23) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1298	PYR	O-C-CA-O3
2	A	1298	PYR	O-C-CA-CB
2	A	1298	PYR	OXT-C-CA-O3
2	A	1298	PYR	OXT-C-CA-CB
2	B	1297	PYR	OXT-C-CA-CB
2	C	1298	PYR	O-C-CA-O3
2	C	1298	PYR	O-C-CA-CB
2	C	1298	PYR	OXT-C-CA-O3
2	C	1298	PYR	OXT-C-CA-CB
2	C	1299	PYR	OXT-C-CA-CB
2	D	1298	PYR	OXT-C-CA-CB
3	D	1299	1PE	C13-C23-OH3-C22
3	D	1300	1PE	OH4-C13-C23-OH3
3	D	1300	1PE	C13-C23-OH3-C22
3	A	1299	1PE	OH2-C12-C22-OH3
2	B	1297	PYR	O-C-CA-CB
3	A	1300	1PE	OH2-C12-C22-OH3
3	A	1299	1PE	C12-C22-OH3-C23
2	C	1299	PYR	O-C-CA-CB
2	D	1298	PYR	O-C-CA-CB
3	A	1300	1PE	C13-C23-OH3-C22
3	A	1299	1PE	C13-C23-OH3-C22
3	A	1299	1PE	OH4-C13-C23-OH3

There are no ring outliers.

3 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1300	1PE	1	0
3	A	1299	1PE	1	0
3	D	1300	1PE	3	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	A	298/304 (98%)	-0.21	12 (4%)	42 46	7, 11, 25, 38	7 (2%)
1	B	297/304 (97%)	-0.20	8 (2%)	56 61	6, 11, 24, 40	9 (3%)
1	C	298/304 (98%)	-0.22	10 (3%)	48 52	5, 11, 25, 41	5 (1%)
1	D	298/304 (98%)	-0.25	10 (3%)	48 52	7, 11, 23, 39	5 (1%)
All	All	1191/1216 (97%)	-0.22	40 (3%)	48 52	5, 11, 25, 41	26 (2%)

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	1	HIS	6.0
1	A	0	HIS	5.5
1	B	0	HIS	5.1
1	B	1	HIS	4.9
1	B	3	THR	4.4
1	D	1	HIS	4.4
1	C	296	ARG	4.2
1	A	1	HIS	4.0
1	A	146	LYS	3.9
1	D	3	THR	3.9
1	C	297	GLY	3.7
1	A	3	THR	3.6
1	D	0	HIS	3.4
1	B	22[A]	LEU	3.3
1	A	297	GLY	3.1
1	D	2	ALA	3.1
1	C	0	HIS	3.1
1	D	296	ARG	2.8
1	C	-1	HIS	2.8
1	C	3	THR	2.8
1	A	296	ARG	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	4	ASN	2.7
1	A	36	GLN	2.6
1	A	230	GLN	2.6
1	B	2	ALA	2.6
1	A	268	PRO	2.5
1	C	290	GLN	2.4
1	C	2	ALA	2.4
1	D	4	ASN	2.4
1	B	296	ARG	2.4
1	C	36	GLN	2.3
1	B	294	GLN	2.3
1	A	147	LEU	2.3
1	D	147	LEU	2.2
1	C	229	ILE	2.2
1	A	37	GLN	2.2
1	D	6	ARG	2.2
1	D	146	LYS	2.2
1	D	230	GLN	2.0
1	B	6	ARG	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	KPI	B	165	14/15	0.96	0.06	7,8,10,11	0
1	KPI	A	165	14/15	0.97	0.04	7,8,10,11	0
1	KPI	C	165	14/15	0.97	0.05	7,8,9,13	0
1	KPI	D	165	14/15	0.98	0.04	7,8,9,10	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides 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($\text{\AA}^2$)	Q<0.9
2	PYR	C	1300	6/6	0.57	0.28	57,58,58,59	0
3	1PE	A	1300	8/16	0.61	0.32	53,54,55,55	0
2	PYR	C	1299	6/6	0.63	0.24	46,46,47,47	0
2	PYR	D	1298	6/6	0.71	0.17	25,29,30,32	0
2	PYR	C	1298	6/6	0.79	0.15	21,25,29,29	0
3	1PE	D	1299	7/16	0.81	0.18	38,39,40,41	0
3	1PE	A	1299	8/16	0.83	0.14	31,33,35,35	0
3	1PE	D	1300	8/16	0.84	0.14	30,32,32,32	0
2	PYR	B	1297	6/6	0.87	0.13	26,29,33,33	0
2	PYR	A	1298	6/6	0.88	0.12	23,27,30,32	0

6.5 Other polymers [i](#)

There are no such residues in this entry.