



wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 10, 2023 – 01:21 PM EDT

PDB ID : 4JRE
Title : Crystal structure of nitrate/nitrite exchanger NarK with nitrite bound
Authors : Zheng, H.; Wisedchaisri, G.; Gonen, T.
Deposited on : 2013-03-21
Resolution : 2.80 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 ⓘ 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (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

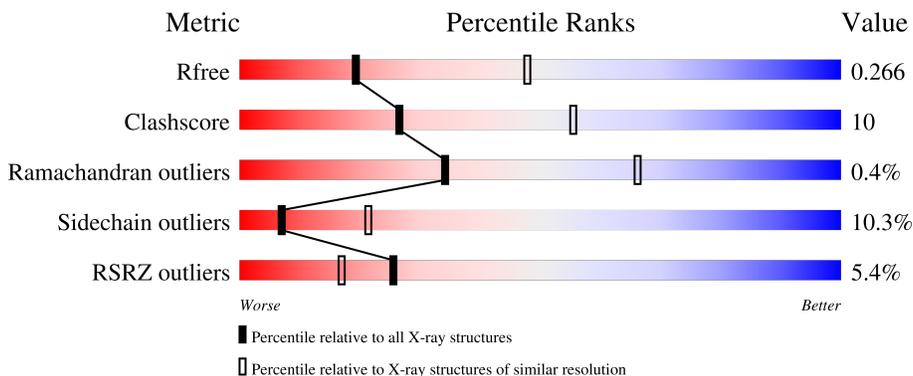
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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	466	 8% 67% 17% 12%
1	D	466	 11% 67% 17% 14%
2	B	217	 71% 22% 5%
2	H	217	 69% 25%
3	C	211	 73% 22%

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Mol	Chain	Length	Quality of chain
3	L	211	 <p>A horizontal bar chart representing the quality of chain. The bar is divided into two segments: a green segment on the left labeled '72%' and a yellow segment on the right labeled '25%'. A small red square is at the start of the bar, and a small black dot is at the end. A '%' symbol is positioned above the start of the bar.</p>

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 12589 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 Nitrite extrusion protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	409	3088	2055	492	521	20	0	0	0
1	D	402	3054	2040	484	510	20	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP P10903
A	-1	SER	-	expression tag	UNP P10903
A	0	HIS	-	expression tag	UNP P10903
D	-2	GLY	-	expression tag	UNP P10903
D	-1	SER	-	expression tag	UNP P10903
D	0	HIS	-	expression tag	UNP P10903

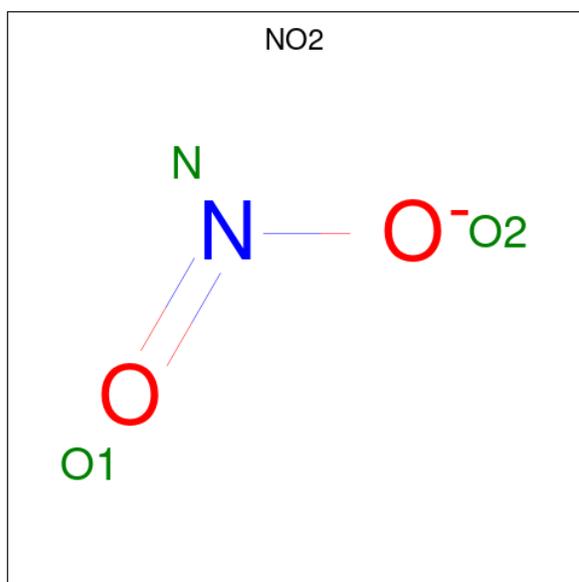
- Molecule 2 is a protein called Immunoglobulin Gamma-2a, Heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	213	1594	1017	261	309	7	0	0	0
2	H	213	1592	1016	261	308	7	0	0	0

- Molecule 3 is a protein called Immunoglobulin Kappa, Light chain.

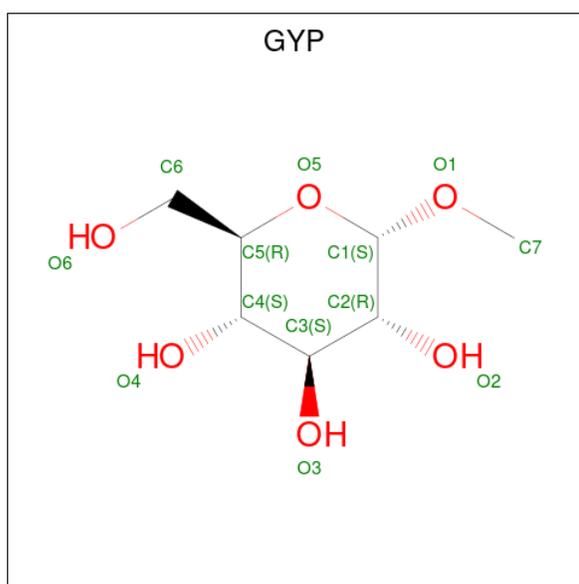
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	211	1597	1002	263	326	6	0	0	0
3	L	211	1597	1002	262	327	6	0	0	0

- Molecule 4 is NITRITE ION (three-letter code: NO2) (formula: NO₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	N	O	0	0
			3	1	2		
4	D	1	Total	N	O	0	0
			3	1	2		

- Molecule 5 is methyl alpha-D-glucopyranoside (three-letter code: GYP) (formula: C₇H₁₄O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			13	7	6		
5	D	1	Total	C	O	0	0
			13	7	6		

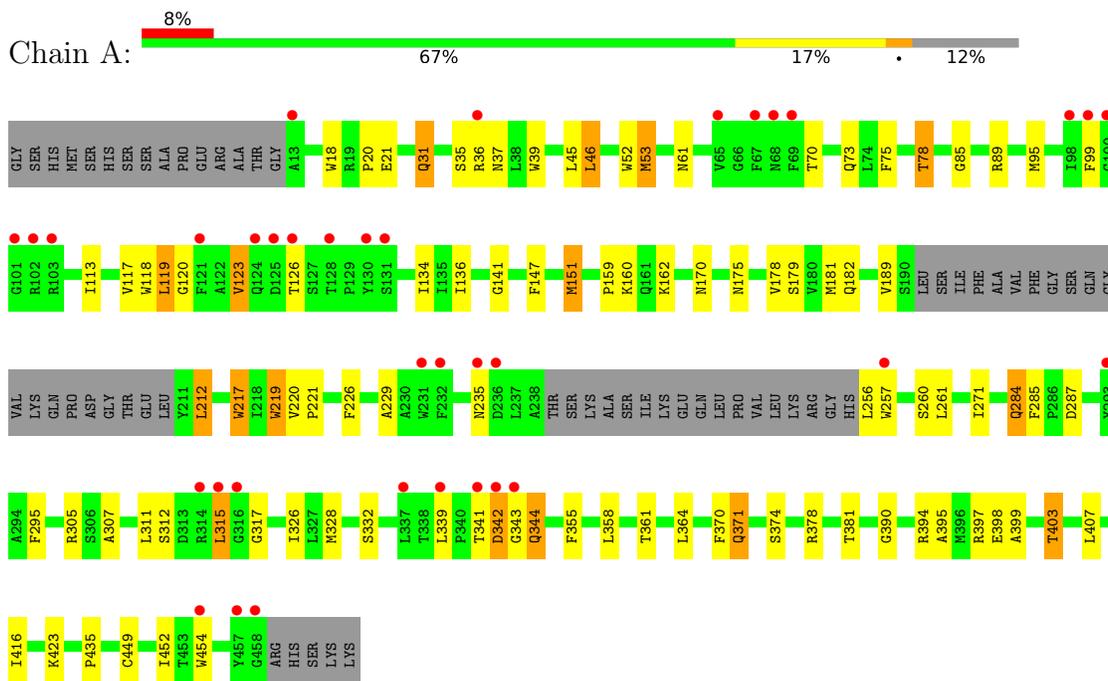
- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total O 1 1	0	0
6	B	9	Total O 9 9	0	0
6	C	6	Total O 6 6	0	0
6	D	1	Total O 1 1	0	0
6	H	11	Total O 11 11	0	0
6	L	7	Total O 7 7	0	0

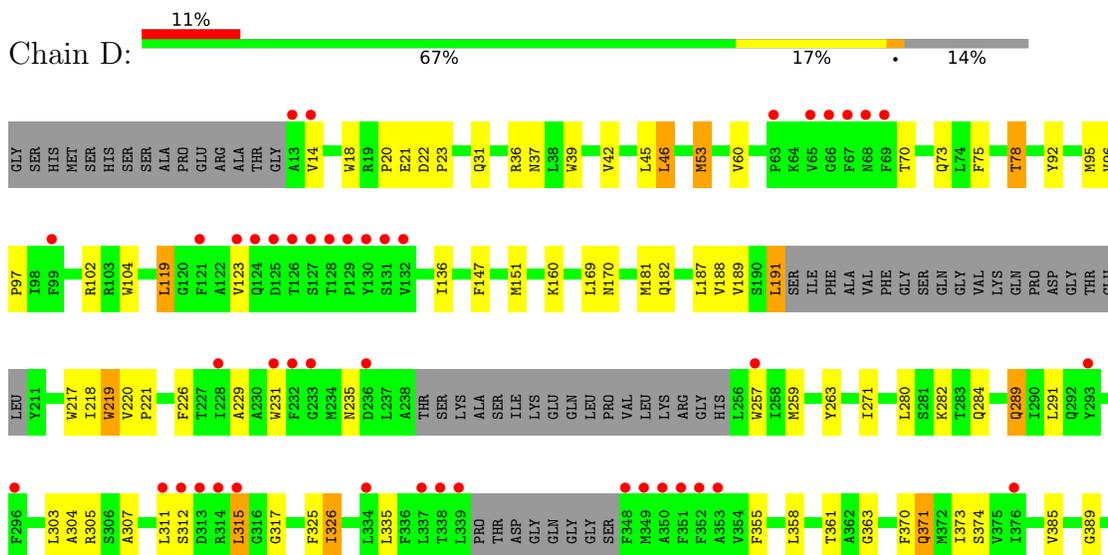
3 Residue-property plots [i](#)

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: Nitrite extrusion protein 1



- Molecule 1: Nitrite extrusion protein 1





- Molecule 2: Immunoglobulin Gamma-2a, Heavy chain

Chain B: 71% 22% 5% ..



- Molecule 2: Immunoglobulin Gamma-2a, Heavy chain

Chain H: 69% 25% ...



- Molecule 3: Immunoglobulin Kappa, Light chain

Chain C: % 73% 22% .



- Molecule 3: Immunoglobulin Kappa, Light chain

Chain L: % 72% 25% .



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	81.91Å 81.41Å 138.49Å 100.07° 96.38° 115.92°	Depositor
Resolution (Å)	50.00 – 2.80 47.04 – 2.80	Depositor EDS
% Data completeness (in resolution range)	94.5 (50.00-2.80) 94.6 (47.04-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.16	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.55 (at 2.81Å)	Xtrriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.223 , 0.269 0.223 , 0.266	Depositor DCC
R_{free} test set	3641 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	50.7	Xtrriage
Anisotropy	0.182	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 46.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.001 for -k,-h,-l	Xtrriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	12589	wwPDB-VP
Average B, all atoms (Å ²)	57.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.15% 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: GYP, NO2

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	0.53	6/3173 (0.2%)	0.56	2/4312 (0.0%)
1	D	0.53	5/3138 (0.2%)	0.57	2/4263 (0.0%)
2	B	0.65	4/1638 (0.2%)	0.74	2/2237 (0.1%)
2	H	0.65	6/1636 (0.4%)	0.73	1/2234 (0.0%)
3	C	0.54	2/1633 (0.1%)	0.64	1/2230 (0.0%)
3	L	0.54	2/1633 (0.1%)	0.63	1/2230 (0.0%)
All	All	0.56	25/12851 (0.2%)	0.63	9/17506 (0.1%)

The worst 5 of 25 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	L	162	TRP	CD2-CE2	6.91	1.49	1.41
3	C	162	TRP	CD2-CE2	6.50	1.49	1.41
2	B	100	TRP	CD2-CE2	5.99	1.48	1.41
2	H	100	TRP	CD2-CE2	5.84	1.48	1.41
2	B	159	TRP	CD2-CE2	5.79	1.48	1.41

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	315	LEU	CA-CB-CG	6.06	129.23	115.30
2	B	157	LEU	CA-CB-CG	6.00	129.09	115.30
2	H	157	LEU	CA-CB-CG	5.75	128.53	115.30
1	D	46	LEU	CA-CB-CG	5.60	128.17	115.30
1	A	315	LEU	CA-CB-CG	5.47	127.89	115.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	3088	0	3119	49	0
1	D	3054	0	3096	50	0
2	B	1594	0	1546	45	0
2	H	1592	0	1541	47	0
3	C	1597	0	1500	39	0
3	L	1597	0	1498	35	0
4	A	3	0	0	0	0
4	D	3	0	0	0	0
5	A	13	0	14	0	0
5	D	13	0	14	0	0
6	A	1	0	0	0	0
6	B	9	0	0	0	0
6	C	6	0	0	0	0
6	D	1	0	0	0	0
6	H	11	0	0	1	0
6	L	7	0	0	1	0
All	All	12589	0	12328	257	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 10.

The worst 5 of 257 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:B:100:TRP:HE3	2:B:100:TRP:O	1.39	1.05
2:H:18:VAL:HG23	2:H:86:LEU:HD11	1.43	1.01
1:A:37:ASN:HD21	1:A:235:ASN:HD22	1.04	0.99
2:H:142:THR:HB	2:H:187:THR:HG22	1.47	0.96
2:H:35:ASN:HD22	2:H:47:TRP:HE1	1.13	0.96

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	403/466 (86%)	384 (95%)	18 (4%)	1 (0%)	47	78
1	D	394/466 (84%)	377 (96%)	17 (4%)	0	100	100
2	B	209/217 (96%)	197 (94%)	10 (5%)	2 (1%)	15	44
2	H	209/217 (96%)	200 (96%)	8 (4%)	1 (0%)	29	61
3	C	209/211 (99%)	193 (92%)	15 (7%)	1 (0%)	29	61
3	L	209/211 (99%)	197 (94%)	11 (5%)	1 (0%)	29	61
All	All	1633/1788 (91%)	1548 (95%)	79 (5%)	6 (0%)	34	66

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	99	SER
1	A	342	ASP
3	C	210	ARG
2	H	99	SER
3	L	92	ASN

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	314/364 (86%)	285 (91%)	29 (9%)	9	27
1	D	311/364 (85%)	288 (93%)	23 (7%)	13	37
2	B	175/182 (96%)	155 (89%)	20 (11%)	5	18

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	H	174/182 (96%)	153 (88%)	21 (12%)	5	15
3	C	178/190 (94%)	159 (89%)	19 (11%)	6	20
3	L	178/190 (94%)	153 (86%)	25 (14%)	3	11
All	All	1330/1472 (90%)	1193 (90%)	137 (10%)	7	21

5 of 137 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	L	30	THR
3	L	60	SER
3	L	124	LEU
2	B	209	THR
2	B	201	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

Mol	Chain	Res	Type
2	H	39	GLN
3	L	197	HIS
3	C	197	HIS
1	D	163	GLN
1	D	182	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 monosaccharides in this entry.

5.6 Ligand geometry

4 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
5	GYP	A	502	-	13,13,13	0.77	1 (7%)	18,18,18	1.46	2 (11%)
4	NO2	A	501	-	1,2,2	0.19	0	0,1,1	-	-
4	NO2	D	501	-	1,2,2	0.15	0	0,1,1	-	-
5	GYP	D	502	-	13,13,13	0.81	1 (7%)	18,18,18	1.46	2 (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
5	GYP	A	502	-	-	2/4/24/24	0/1/1/1
5	GYP	D	502	-	-	2/4/24/24	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	D	502	GYP	O1-C1	2.37	1.44	1.40
5	A	502	GYP	O1-C1	2.33	1.44	1.40

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	502	GYP	O1-C1-C2	4.90	113.89	108.15
5	D	502	GYP	O1-C1-C2	4.58	113.52	108.15
5	D	502	GYP	C1-O5-C5	2.62	118.84	113.69
5	A	502	GYP	C1-C2-C3	2.48	115.17	110.00

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	D	502	GYP	C2-C1-O1-C7
5	D	502	GYP	O5-C1-O1-C7
5	A	502	GYP	C2-C1-O1-C7
5	A	502	GYP	O5-C1-O1-C7

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	409/466 (87%)	0.22	36 (8%) 10 5	30, 73, 105, 139	0
1	D	402/466 (86%)	0.45	49 (12%) 4 2	30, 78, 105, 125	0
2	B	213/217 (98%)	-0.45	0 100 100	23, 36, 62, 112	0
2	H	213/217 (98%)	-0.51	1 (0%) 91 88	24, 35, 63, 94	0
3	C	211/211 (100%)	-0.35	2 (0%) 84 80	25, 41, 69, 84	0
3	L	211/211 (100%)	-0.34	2 (0%) 84 80	23, 40, 70, 84	0
All	All	1659/1788 (92%)	-0.05	90 (5%) 25 17	23, 53, 100, 139	0

The worst 5 of 90 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	315	LEU	6.5
1	D	126	THR	6.4
1	D	127	SER	6.2
1	D	431	LEU	5.9
1	A	65	VAL	5.6

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 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	NO2	A	501	3/3	0.79	0.18	78,78,80,80	0
5	GYP	D	502	13/13	0.84	0.18	86,96,108,119	0
5	GYP	A	502	13/13	0.85	0.19	82,91,99,106	0
4	NO2	D	501	3/3	0.91	0.27	71,71,72,73	0

6.5 Other polymers [i](#)

There are no such residues in this entry.