



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 09:22 PM UTC

PDB ID : 1DE4 / pdb_00001de4
Title : HEMOCHROMATOSIS PROTEIN HFE COMPLEXED WITH TRANSFER-RIN RECEPTOR
Authors : Bennett, M.J.; Lebron, J.A.; Bjorkman, P.J.
Deposited on : 1999-11-12
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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

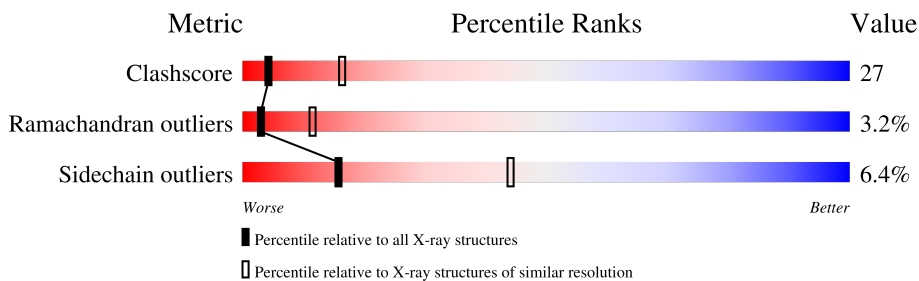
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 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))
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (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 $\leq 5\%$

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	275	48% 41% 8% ..
1	D	275	49% 41% 7% ..
1	G	275	48% 43% 7% ..
2	B	99	52% 44% .
2	E	99	49% 45% 5%
2	H	99	52% 43% 5%
3	C	640	53% 39% 7% .
3	F	640	52% 41% 6% .

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Mol	Chain	Length	Quality of chain
3	I	640	 55% 38% 6%

2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 24315 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 HEMOCHROMATOSIS PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	272	2242	1424	390	416	12	0	0	0
1	D	272	2242	1424	390	416	12	0	0	0
1	G	272	2242	1424	390	416	12	0	0	0

- Molecule 2 is a protein called BETA-2-MICROGLOBULIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	99	821	522	138	158	3	0	0	0
2	E	99	821	522	138	158	3	0	0	0
2	H	99	821	522	138	158	3	0	0	0

- Molecule 3 is a protein called TRANSFERRIN RECEPTOR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	635	5022	3223	845	940	14	0	0	0
3	F	635	5022	3223	845	940	14	0	0	0
3	I	635	5022	3223	845	940	14	0	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).



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

- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Ca		
5	C	1	1	1	0	0
5	F	1	1	1	0	0
5	I	1	1	1	0	0

- Molecule 6 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



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

- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	C	4	Total O 4 4	0	0
7	F	2	Total O 2 2	0	0
7	I	3	Total O 3 3	0	0

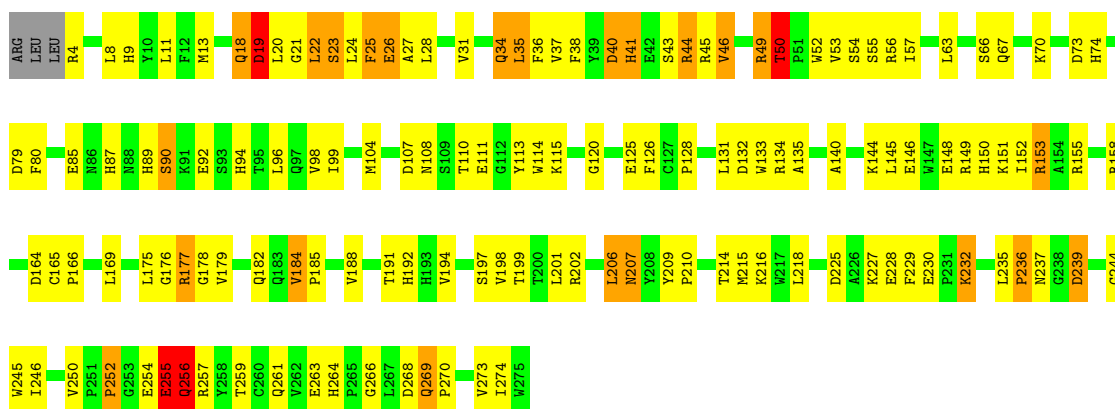
3 Residue-property plots [i](#)

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. 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. 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.

Note EDS was not executed.

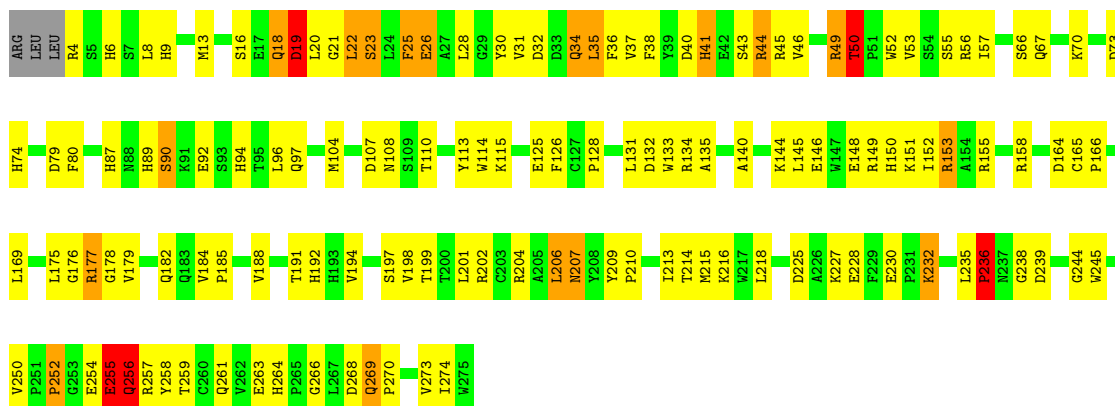
- Molecule 1: HEMOCHROMATOSIS PROTEIN

Chain A:  48% 41% 8% ..



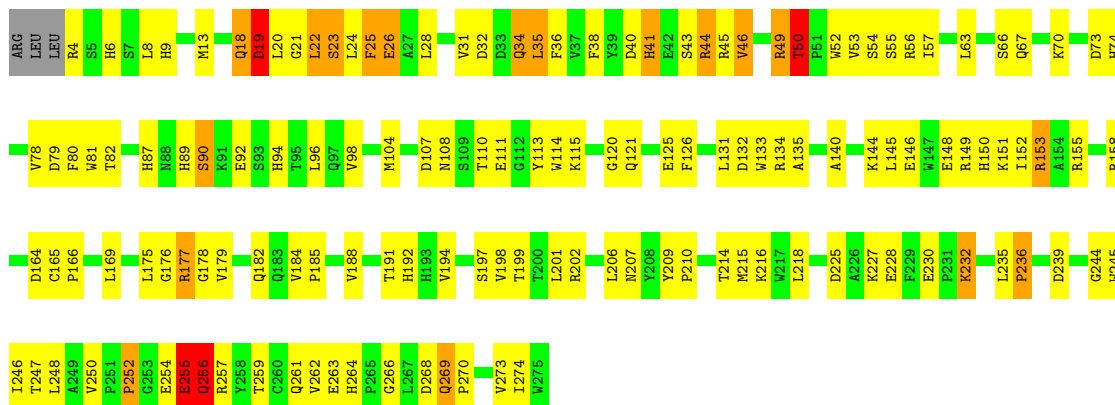
- Molecule 1: HEMOCHROMATOSIS PROTEIN

Chain D:  49% 41% 7% ..



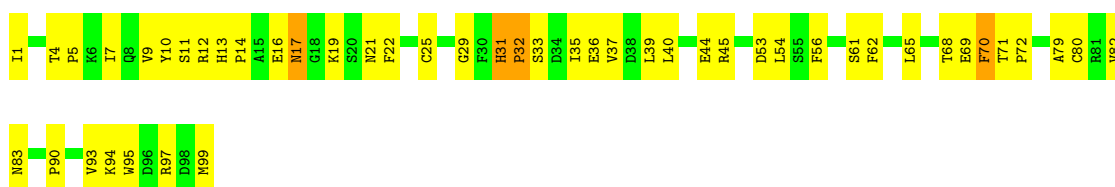
- Molecule 1: HEMOCHROMATOSIS PROTEIN

Chain G:  48% 43% 7% ..



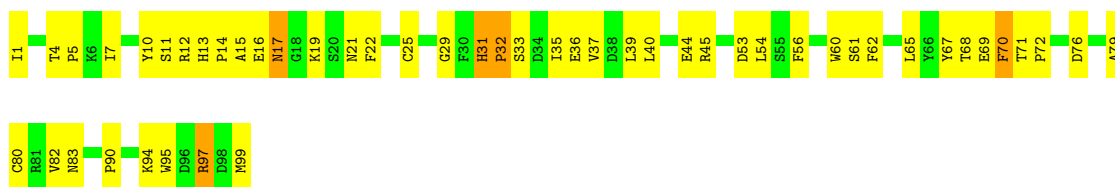
• Molecule 2: BETA-2-MICROGLOBULIN

Chain B: 52% 44%



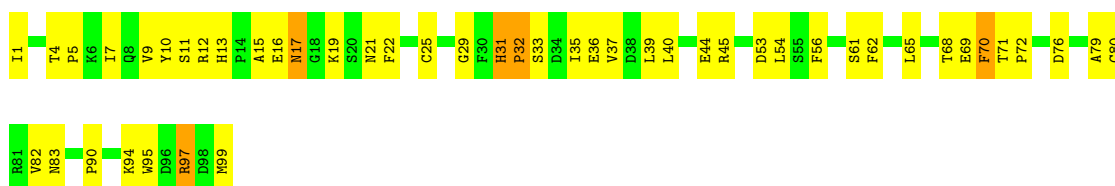
• Molecule 2: BETA-2-MICROGLOBULIN

Chain E: 49% 45% 5%



• Molecule 2: BETA-2-MICROGLOBULIN

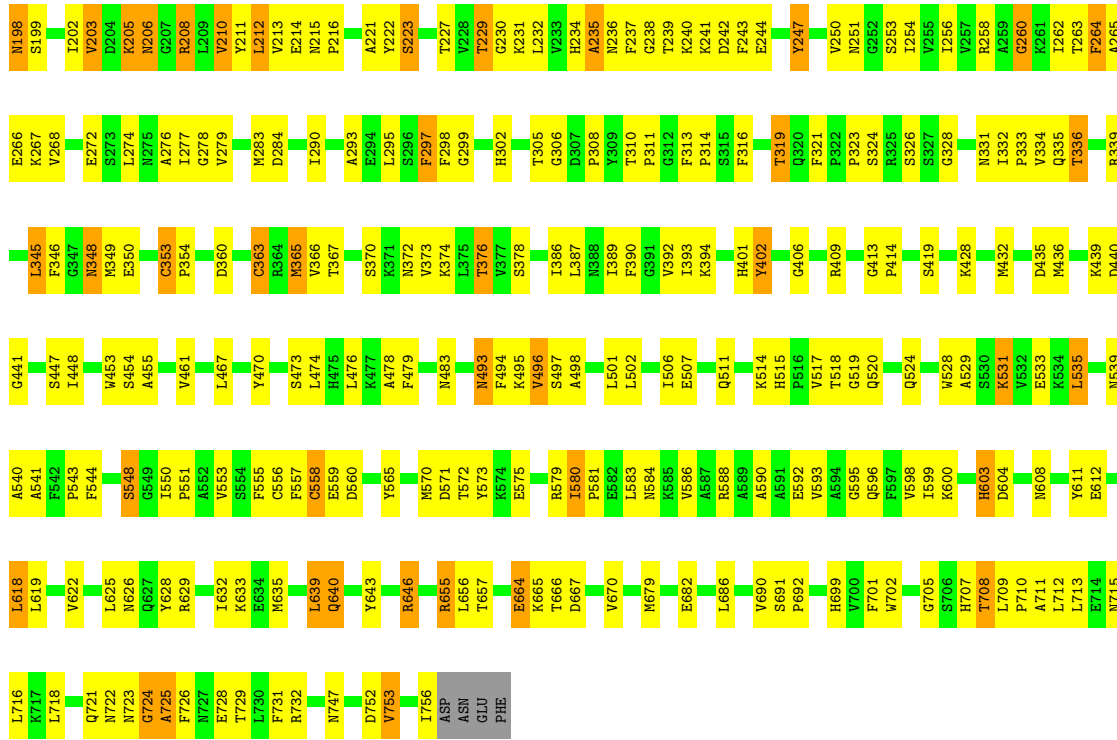
Chain H: 52% 43% 5%



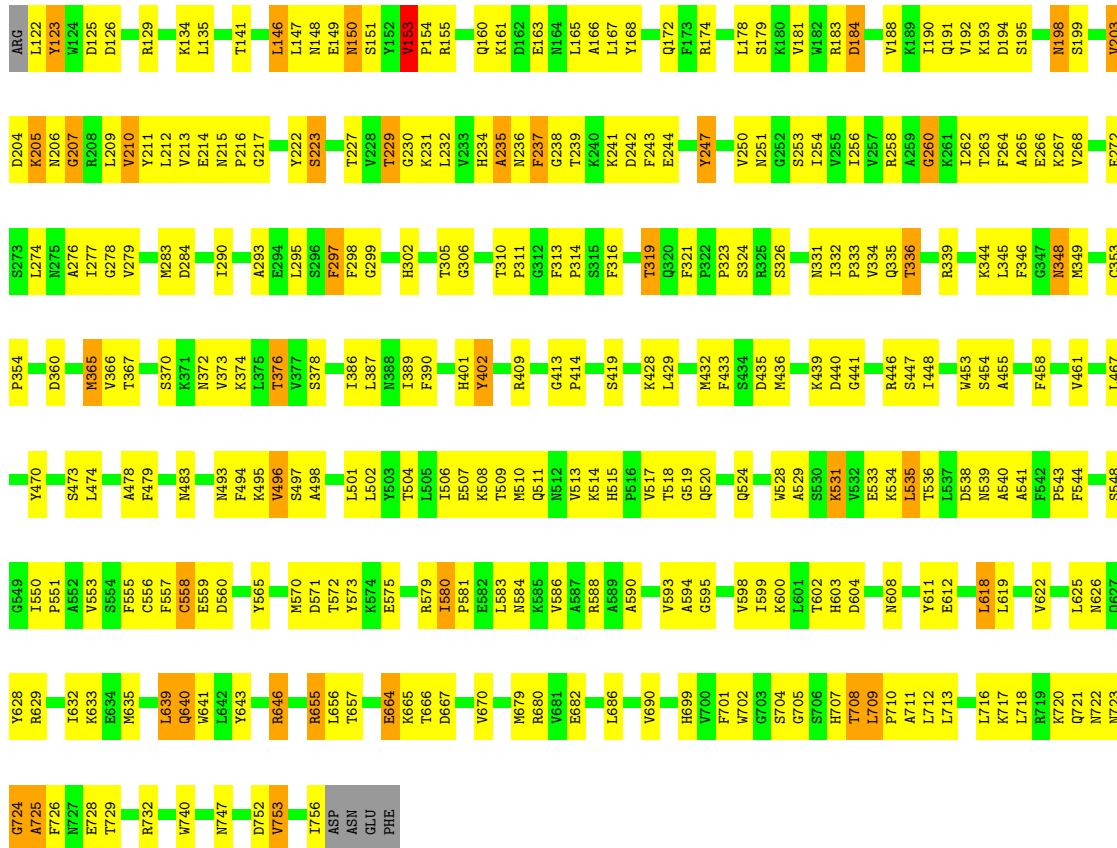
• Molecule 3: TRANSFERRIN RECEPTOR

Chain C: 53% 39% 7%



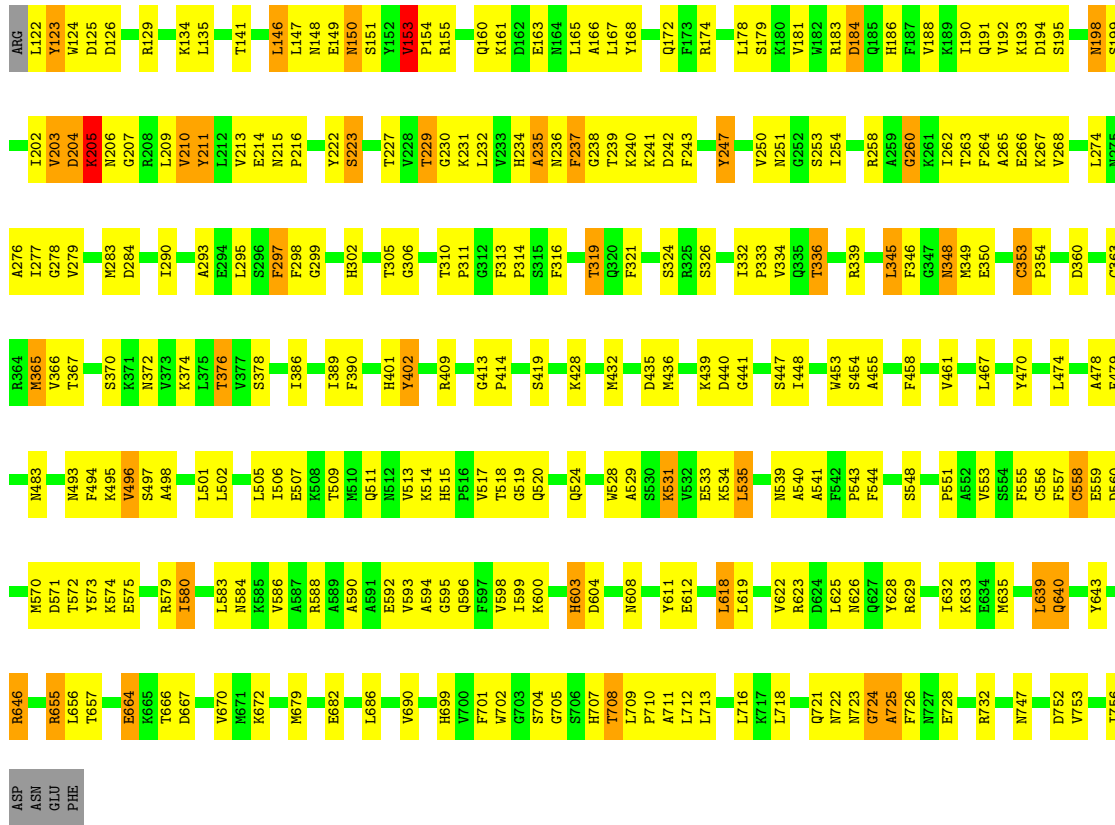


● Molecule 3: TRANSFERRIN RECEPTOR



● Molecule 3: TRANSFERRIN RECEPTOR

Chain I:  55% 38% 6%



4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	110.40Å 144.40Å 327.10Å 90.00° 93.60° 90.00°	Depositor
Resolution (Å)	30.00 – 2.80	Depositor
% Data completeness (in resolution range)	94.3 (30.00-2.80)	Depositor
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 0.5	Depositor
R, R_{free}	0.231 , 0.265	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	24315	wwPDB-VP
Average B, all atoms (Å ²)	66.0	wwPDB-VP

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, CA, GOL

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	0.43	0/2310	0.92	11/3143 (0.3%)
1	D	0.40	0/2310	0.92	6/3143 (0.2%)
1	G	0.43	0/2310	0.91	9/3143 (0.3%)
2	B	0.36	0/844	0.83	1/1144 (0.1%)
2	E	0.34	0/844	0.82	1/1144 (0.1%)
2	H	0.35	0/844	0.82	1/1144 (0.1%)
3	C	0.47	0/5142	0.98	24/6973 (0.3%)
3	F	0.46	0/5142	0.98	21/6973 (0.3%)
3	I	0.52	0/5142	1.00	23/6973 (0.3%)
All	All	0.45	0/24888	0.95	97/33780 (0.3%)

There are no bond length outliers.

The worst 5 of 97 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
3	I	215	ASN	CA-C-N	7.65	127.71	119.90
3	I	215	ASN	C-N-CA	7.65	127.71	119.90
3	I	153	VAL	CA-C-N	-7.42	110.56	119.84
3	I	153	VAL	C-N-CA	-7.42	110.56	119.84
3	C	557	PHE	N-CA-C	-7.42	93.01	107.62

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	2242	0	2126	146	0
1	D	2242	0	2126	148	0
1	G	2242	0	2126	142	0
2	B	821	0	772	52	0
2	E	821	0	772	56	0
2	H	821	0	772	51	0
3	C	5022	0	4965	266	0
3	F	5022	0	4965	264	0
3	I	5022	0	4965	251	0
4	C	14	0	13	0	0
4	F	14	0	13	0	0
4	I	14	0	13	0	0
5	C	1	0	0	0	0
5	F	1	0	0	0	0
5	I	1	0	0	0	0
6	G	6	0	8	3	0
7	C	4	0	0	0	0
7	F	2	0	0	0	0
7	I	3	0	0	0	0
All	All	24315	0	23636	1300	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 27.

The worst 5 of 1300 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:C:708:THR:HG22	3:C:711:ALA:H	1.18	1.09
3:C:708:THR:HG23	3:C:710:PRO:HD2	1.29	1.08
3:I:708:THR:HG23	3:I:710:PRO:HD2	1.29	1.07
3:F:708:THR:HG23	3:F:710:PRO:HD2	1.31	1.04
3:I:708:THR:HG22	3:I:711:ALA:H	1.18	1.03

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	270/275 (98%)	233 (86%)	24 (9%)	13 (5%)	2	6
1	D	270/275 (98%)	230 (85%)	26 (10%)	14 (5%)	1	5
1	G	270/275 (98%)	230 (85%)	27 (10%)	13 (5%)	2	6
2	B	97/99 (98%)	83 (86%)	9 (9%)	5 (5%)	1	5
2	E	97/99 (98%)	84 (87%)	8 (8%)	5 (5%)	1	5
2	H	97/99 (98%)	84 (87%)	8 (8%)	5 (5%)	1	5
3	C	633/640 (99%)	575 (91%)	45 (7%)	13 (2%)	5	20
3	F	633/640 (99%)	572 (90%)	47 (7%)	14 (2%)	5	19
3	I	633/640 (99%)	573 (90%)	47 (7%)	13 (2%)	5	20
All	All	3000/3042 (99%)	2664 (89%)	241 (8%)	95 (3%)	3	11

5 of 95 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	19	ASP
1	A	22	LEU
1	A	44	ARG
2	B	31	HIS
3	C	153	VAL

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	244/249 (98%)	231 (95%)	13 (5%)	20	52
1	D	244/249 (98%)	230 (94%)	14 (6%)	18	49
1	G	244/249 (98%)	231 (95%)	13 (5%)	20	52
2	B	92/94 (98%)	91 (99%)	1 (1%)	65	87
2	E	92/94 (98%)	91 (99%)	1 (1%)	65	87
2	H	92/94 (98%)	91 (99%)	1 (1%)	65	87
3	C	544/549 (99%)	501 (92%)	43 (8%)	11	35
3	F	544/549 (99%)	504 (93%)	40 (7%)	13	37
3	I	544/549 (99%)	502 (92%)	42 (8%)	12	36
All	All	2640/2676 (99%)	2472 (94%)	168 (6%)	16	44

5 of 168 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	34	GLN
3	I	348	ASN
1	G	153	ARG
3	I	183	ARG
3	I	531	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 118 such sidechains are listed below:

Mol	Chain	Res	Type
2	E	24	ASN
3	I	493	ASN
3	F	493	ASN
3	I	483	ASN
3	I	186	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 7 ligands modelled in this entry, 3 are monoatomic - leaving 4 for Mogul analysis.

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
6	GOL	G	309	-	5,5,5	1.82	2 (40%)	5,5,5	0.99	0
4	NAG	I	902	3	14,14,15	0.46	0	17,19,21	1.04	2 (11%)
4	NAG	F	901	3	14,14,15	0.59	0	17,19,21	0.87	1 (5%)
4	NAG	C	900	3	14,14,15	0.66	0	17,19,21	0.82	1 (5%)

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
6	GOL	G	309	-	-	2/4/4/4	-
4	NAG	I	902	3	-	2/6/23/26	0/1/1/1
4	NAG	F	901	3	-	2/6/23/26	0/1/1/1
4	NAG	C	900	3	-	2/6/23/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	G	309	GOL	O2-C2	2.98	1.52	1.43
6	G	309	GOL	C3-C2	2.20	1.60	1.51

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	F	901	NAG	C2-N2-C7	-2.79	119.16	122.90
4	I	902	NAG	C2-N2-C7	-2.64	119.36	122.90
4	C	900	NAG	C2-N2-C7	-2.49	119.56	122.90
4	I	902	NAG	C4-C3-C2	-2.04	108.03	111.02

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	G	309	GOL	C1-C2-C3-O3
6	G	309	GOL	O2-C2-C3-O3
4	F	901	NAG	O5-C5-C6-O6
4	F	901	NAG	C4-C5-C6-O6
4	I	902	NAG	C4-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	G	309	GOL	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

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.