wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 07:50 AM GMT

PDB ID	:	3CD0
Title	:	Thermodynamic and structure guided design of statin hmg-coa reductase inhibitors
Authors	:	Pavlovsky, A.; Sarver, R.W.; Harris, M.S.; Finzel, B.C.
Deposited on	:	2008-02-26
Resolution	:	2.40 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

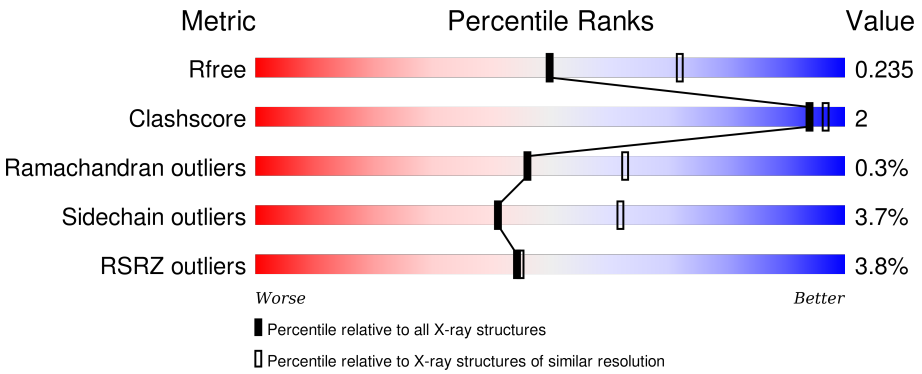
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

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 2.40 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}	91344	2919 (2.40-2.40)
Clashscore	102246	3407 (2.40-2.40)
Ramachandran outliers	100387	3351 (2.40-2.40)
Sidechain outliers	100360	3352 (2.40-2.40)
RSRZ outliers	91569	2928 (2.40-2.40)

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 on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. 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	441	3% 87% 7% • 5%
1	B	441	2% 88% 7% 5%
1	C	441	5% 88% 6% 6%
1	D	441	4% 83% 7% 10%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 13075 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 3-hydroxy-3-methylglutaryl-coenzyme A reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	421	3133	1951	551	601	30	0	0	0
1	B	421	3136	1952	552	602	30	0	1	0
1	C	414	3079	1918	541	590	30	0	1	0
1	D	396	2934	1826	518	561	29	0	0	0

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	435	HIS	-	expression tag	UNP P04035
A	436	HIS	-	expression tag	UNP P04035
A	437	HIS	-	expression tag	UNP P04035
A	438	HIS	-	expression tag	UNP P04035
A	439	HIS	-	expression tag	UNP P04035
A	440	HIS	-	expression tag	UNP P04035
A	485	ILE	MET	engineered	UNP P04035
B	435	HIS	-	expression tag	UNP P04035
B	436	HIS	-	expression tag	UNP P04035
B	437	HIS	-	expression tag	UNP P04035
B	438	HIS	-	expression tag	UNP P04035
B	439	HIS	-	expression tag	UNP P04035
B	440	HIS	-	expression tag	UNP P04035
B	485	ILE	MET	engineered	UNP P04035
C	435	HIS	-	expression tag	UNP P04035
C	436	HIS	-	expression tag	UNP P04035
C	437	HIS	-	expression tag	UNP P04035
C	438	HIS	-	expression tag	UNP P04035
C	439	HIS	-	expression tag	UNP P04035
C	440	HIS	-	expression tag	UNP P04035
C	485	ILE	MET	engineered	UNP P04035

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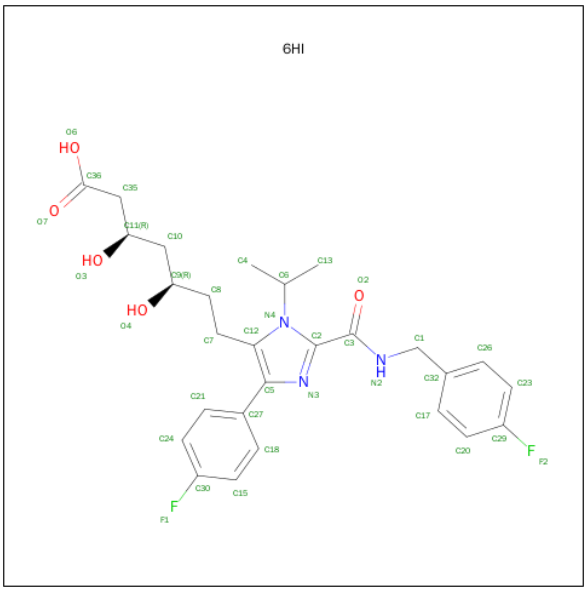
Chain	Residue	Modelled	Actual	Comment	Reference
D	435	HIS	-	expression tag	UNP P04035
D	436	HIS	-	expression tag	UNP P04035
D	437	HIS	-	expression tag	UNP P04035
D	438	HIS	-	expression tag	UNP P04035
D	439	HIS	-	expression tag	UNP P04035
D	440	HIS	-	expression tag	UNP P04035
D	485	ILE	MET	engineered	UNP P04035

- Molecule 2 is (3R,5R)-7-{2-[(4-FLUOROBENZYL)CARBAMOYL]-4-(4-FLUOROPHENYL)-1-(1-METHYLETHYL)-1H-IMIDAZOL-5-YL}-3,5-DIHYDROXYHEPTANOIC ACID (three-letter code: 6HI) (formula: $C_{27}H_{31}F_2N_3O_5$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	F	N	O	0	0
			37	27	2	3	5		
2	B	1	Total	C	F	N	O	0	0
			37	27	2	3	5		
2	C	1	Total	C	F	N	O	0	0
			37	27	2	3	5		
2	D	1	Total	C	F	N	O	0	0
			37	27	2	3	5		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	185	Total	O	0	0
			185	185		

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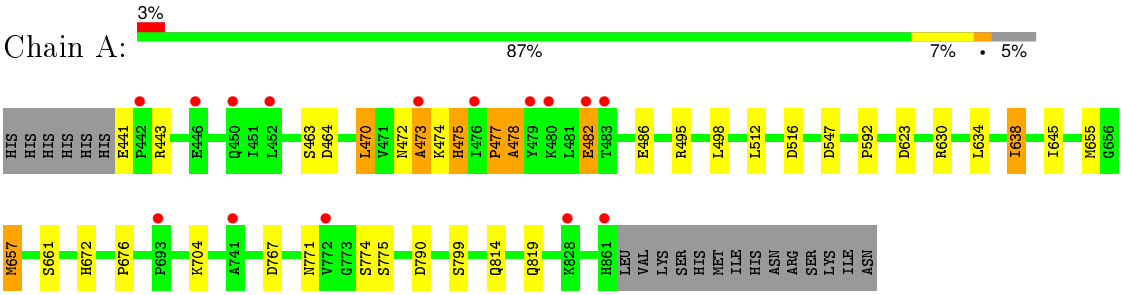
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	B	167	167	167	0	0
			Total	O		
3	C	118	118	118	0	0
			Total	O		
3	D	175	175	175	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

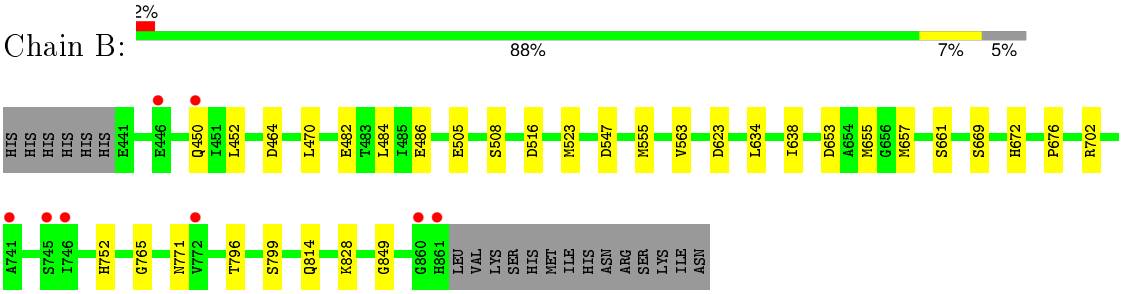
- Molecule 1: 3-hydroxy-3-methylglutaryl-coenzyme A reductase

Chain A:



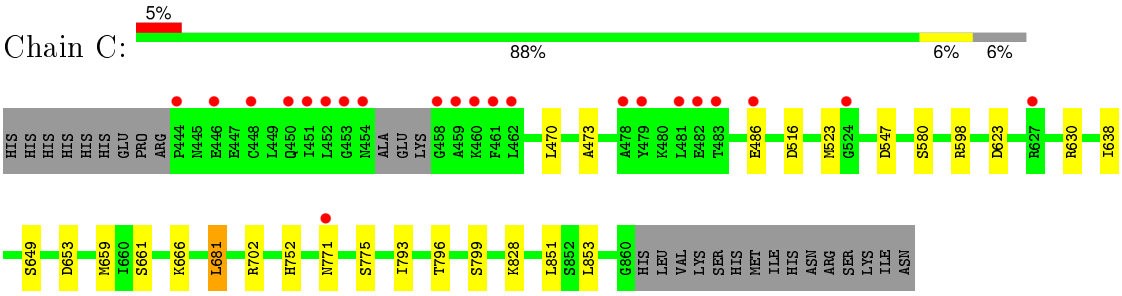
- Molecule 1: 3-hydroxy-3-methylglutaryl-coenzyme A reductase

Chain B:



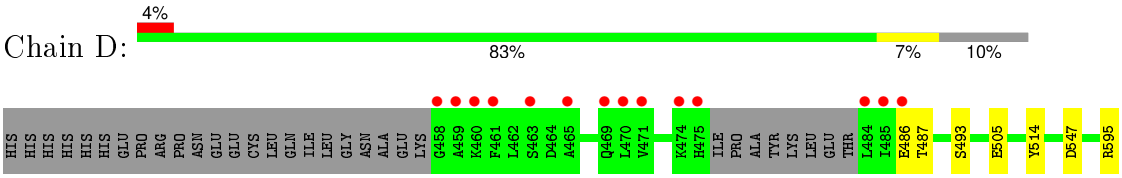
- Molecule 1: 3-hydroxy-3-methylglutaryl-coenzyme A reductase

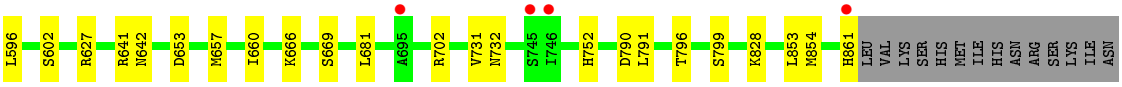
Chain C:



- Molecule 1: 3-hydroxy-3-methylglutaryl-coenzyme A reductase

Chain D:




L596
S602
R627
R641
N642
D653
M657
I660
K666
S669
L681
A695
R702
V731
N732
S745
I746
H752
D790
L791
T796
S799
K828
L853
M854
H861
LEU
VAL
LYS
SER
HIS
MET
ILE
HIS
ASN
ARG
SER
LYS
ILE
ASN

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	73.68Å 173.96Å 76.40Å 90.00° 119.06° 90.00°	Depositor
Resolution (Å)	50.00 – 2.40 43.78 – 2.40	Depositor EDS
% Data completeness (in resolution range)	97.8 (50.00-2.40) 97.4 (43.78-2.40)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.32 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.190 , 0.238 0.192 , 0.235	Depositor DCC
R_{free} test set	3290 reflections (5.41%)	DCC
Wilson B-factor (Å^2)	34.1	Xtriage
Anisotropy	0.438	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 41.6	EDS
Estimated twinning fraction	0.000 for l,k,-h-l 0.000 for -h-l,k,h 0.021 for h,-k,-h-l 0.020 for l,-k,h 0.020 for -h-l,-k,l	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Outliers	0 of 64107 reflections	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	13075	wwPDB-VP
Average B, all atoms (Å^2)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.97% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: 6HI

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	0.38	0/3179	0.65	6/4298 (0.1%)
1	B	0.37	0/3187	0.64	5/4309 (0.1%)
1	C	0.36	0/3127	0.62	4/4225 (0.1%)
1	D	0.38	0/2975	0.64	3/4019 (0.1%)
All	All	0.37	0/12468	0.64	18/16851 (0.1%)

There are no bond length outliers.

The worst 5 of 18 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	623	ASP	CB-CG-OD2	6.19	123.88	118.30
1	C	623	ASP	CB-CG-OD2	5.99	123.69	118.30
1	C	547	ASP	CB-CG-OD2	5.95	123.65	118.30
1	B	623	ASP	CB-CG-OD2	5.93	123.64	118.30
1	D	790	ASP	CB-CG-OD2	5.86	123.57	118.30

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	3133	0	3167	14	0
1	B	3136	0	3169	12	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	3079	0	3119	9	0
1	D	2934	0	2967	11	0
2	B	74	0	60	2	0
2	C	37	0	30	1	0
2	D	37	0	30	2	0
3	A	185	0	0	0	0
3	B	167	0	0	1	0
3	C	118	0	0	1	0
3	D	175	0	0	1	0
All	All	13075	0	12542	46	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 2.

The worst 5 of 46 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:C:771:ASN:OD1	1:C:775:SER:OG	2.18	0.61
2:B:2:6HI:H7A	2:B:2:6HI:H4A	1.83	0.59
2:C:4:6HI:H7A	2:C:4:6HI:H4A	1.84	0.57
1:B:752:HIS:HE1	1:B:849:GLY:C	2.09	0.56
1:D:595:ARG:HD2	1:D:681:LEU:HD22	1.87	0.56

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	419/441 (95%)	398 (95%)	17 (4%)	4 (1%)	19 28
1	B	420/441 (95%)	405 (96%)	15 (4%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	411/441 (93%)	398 (97%)	13 (3%)	0	100	100
1	D	392/441 (89%)	375 (96%)	16 (4%)	1 (0%)	46	63
All	All	1642/1764 (93%)	1576 (96%)	61 (4%)	5 (0%)	46	63

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	473	ALA
1	A	478	ALA
1	A	475	HIS
1	D	514	TYR
1	A	477	PRO

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	335/355 (94%)	320 (96%)	15 (4%)	34	52
1	B	336/355 (95%)	322 (96%)	14 (4%)	36	56
1	C	330/355 (93%)	319 (97%)	11 (3%)	45	66
1	D	313/355 (88%)	302 (96%)	11 (4%)	43	64
All	All	1314/1420 (92%)	1263 (96%)	51 (4%)	41	59

5 of 51 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	634	LEU
1	B	828	LYS
1	D	669	SER
1	B	669	SER
1	C	486	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	529	ASN
1	B	752	HIS
1	D	518	ASN
1	B	472	ASN
1	D	472	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 carbohydrates in this entry.

5.6 Ligand geometry (i)

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	$\#\|Z\| > 2$
2	6HI	B	1	-	32,39,39	1.74	1 (3%)	39,54,54	1.33	4 (10%)
2	6HI	B	2	-	32,39,39	1.79	1 (3%)	39,54,54	1.27	3 (7%)
2	6HI	C	4	-	32,39,39	1.57	1 (3%)	39,54,54	1.31	5 (12%)
2	6HI	D	3	-	32,39,39	1.64	1 (3%)	39,54,54	1.30	4 (10%)

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
2	6HI	B	1	-	-	0/24/30/30	0/3/3/3
2	6HI	B	2	-	-	0/24/30/30	0/3/3/3
2	6HI	C	4	-	-	0/24/30/30	0/3/3/3
2	6HI	D	3	-	-	0/24/30/30	0/3/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2	6HI	C2-C3	-9.40	1.49	1.53
2	B	1	6HI	C2-C3	-8.91	1.49	1.53
2	D	3	6HI	C2-C3	-8.26	1.49	1.53
2	C	4	6HI	C2-C3	-8.00	1.49	1.53

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	3	6HI	O2-C3-C2	-3.28	116.58	121.01
2	B	2	6HI	C5-C12-N4	-3.12	103.03	107.08
2	B	1	6HI	C5-C12-N4	-3.07	103.09	107.08
2	C	4	6HI	C5-C12-N4	-2.95	103.25	107.08
2	D	3	6HI	C5-C12-N4	-2.85	103.38	107.08

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1	6HI	1	0
2	B	2	6HI	1	0
2	C	4	6HI	1	0
2	D	3	6HI	2	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	421/441 (95%)	-0.05	15 (3%)	46	47	22, 33, 63, 71	0
1	B	421/441 (95%)	-0.15	8 (1%)	70	69	22, 34, 46, 59	0
1	C	414/441 (93%)	0.09	22 (5%)	30	30	21, 38, 71, 94	1 (0%)
1	D	396/441 (89%)	-0.06	18 (4%)	37	38	21, 34, 70, 99	0
All	All	1652/1764 (93%)	-0.05	63 (3%)	44	45	21, 34, 62, 99	1 (0%)

The worst 5 of 63 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	861	HIS	7.4
1	D	458	GLY	6.8
1	D	475	HIS	6.0
1	C	452	LEU	5.9
1	D	470	LEU	5.7

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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å^2)	Q<0.9
2	6HI	D	3	37/37	0.90	0.17	1.18	23,35,38,39	0
2	6HI	C	4	37/37	0.86	0.17	0.73	24,38,42,45	0
2	6HI	B	1	37/37	0.90	0.15	-0.06	26,33,39,41	0
2	6HI	B	2	37/37	0.93	0.14	-0.34	23,30,36,39	0

6.5 Other polymers (i)

There are no such residues in this entry.