



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 23, 2023 – 12:31 AM JST

PDB ID : 8HBM  
Title : Structural basis of the farnesoid X receptor/retinoid X receptor heterodimer on inverted repeat DNA  
Authors : Jiang, L.; Chen, Y.  
Deposited on : 2022-10-29  
Resolution : 3.30 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](mailto: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>.

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

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
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) : 2.36

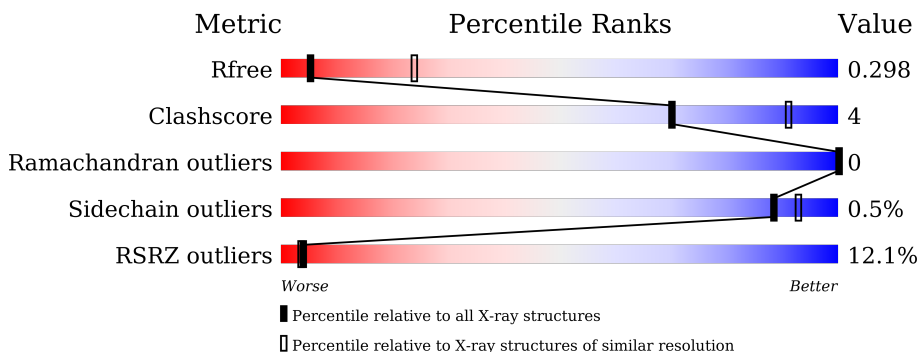
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.30 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.



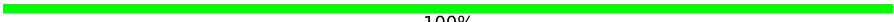
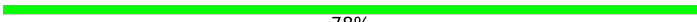
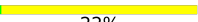
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1149 (3.34-3.26)
Clashscore	141614	1205 (3.34-3.26)
Ramachandran outliers	138981	1183 (3.34-3.26)
Sidechain outliers	138945	1182 (3.34-3.26)
RSRZ outliers	127900	1115 (3.34-3.26)

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  $\geq 3$ , 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	91	 2% 81% 5% 13%
1	E	91	 26% 78% 7% 15%
2	B	109	 5% 61% 6% 33%
2	F	109	 13% 63% 6% 34%
3	C	18	 100%
3	G	18	 89% 11%

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Mol	Chain	Length	Quality of chain
4	D	18	 100%
4	H	18	 78%  22%

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 3633 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 Retinoic acid receptor RXR-alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	79	619	376	120	112	11	0	0	0
1	E	77	514	310	94	100	10	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	122	LEU	-	expression tag	UNP P19793
A	123	GLU	-	expression tag	UNP P19793
A	124	VAL	-	expression tag	UNP P19793
A	125	LEU	-	expression tag	UNP P19793
A	126	PHE	-	expression tag	UNP P19793
A	127	GLN	-	expression tag	UNP P19793
A	128	GLY	-	expression tag	UNP P19793
A	129	PRO	-	expression tag	UNP P19793
E	122	LEU	-	expression tag	UNP P19793
E	123	GLU	-	expression tag	UNP P19793
E	124	VAL	-	expression tag	UNP P19793
E	125	LEU	-	expression tag	UNP P19793
E	126	PHE	-	expression tag	UNP P19793
E	127	GLN	-	expression tag	UNP P19793
E	128	GLY	-	expression tag	UNP P19793
E	129	PRO	-	expression tag	UNP P19793

- Molecule 2 is a protein called Bile acid receptor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	73	551	333	103	100	15	0	0	0
2	F	72	471	277	87	95	12	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	109	LEU	-	expression tag	UNP Q96RI1
B	110	GLU	-	expression tag	UNP Q96RI1
B	111	VAL	-	expression tag	UNP Q96RI1
B	112	LEU	-	expression tag	UNP Q96RI1
B	113	PHE	-	expression tag	UNP Q96RI1
B	114	GLN	-	expression tag	UNP Q96RI1
B	115	GLY	-	expression tag	UNP Q96RI1
B	116	PRO	-	expression tag	UNP Q96RI1
F	109	LEU	-	expression tag	UNP Q96RI1
F	110	GLU	-	expression tag	UNP Q96RI1
F	111	VAL	-	expression tag	UNP Q96RI1
F	112	LEU	-	expression tag	UNP Q96RI1
F	113	PHE	-	expression tag	UNP Q96RI1
F	114	GLN	-	expression tag	UNP Q96RI1
F	115	GLY	-	expression tag	UNP Q96RI1
F	116	PRO	-	expression tag	UNP Q96RI1

- Molecule 3 is a DNA chain called DNA (5'-D(P\*CP\*CP\*GP\*AP\*GP\*GP\*TP\*CP\*AP\*AP\*TP\*GP\*AP\*CP\*CP\*TP\*CP\*G)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	C	18	368	174	69	107	18	0	0	0
3	G	18	368	174	69	107	18	0	0	0

- Molecule 4 is a DNA chain called DNA (5'-D(P\*CP\*CP\*GP\*AP\*GP\*GP\*TP\*CP\*AP\*TP\*TP\*GP\*AP\*CP\*CP\*TP\*CP\*G)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	D	18	367	174	66	109	18	0	0	0
4	H	18	367	174	66	109	18	0	0	0

- Molecule 5 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	2	Total	Zn	0	0
			2	2		

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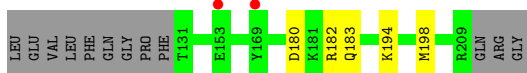
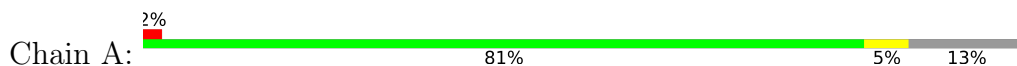
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<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
5	B	2	Total 2	Zn 2	0	0
5	E	2	Total 2	Zn 2	0	0
5	F	2	Total 2	Zn 2	0	0

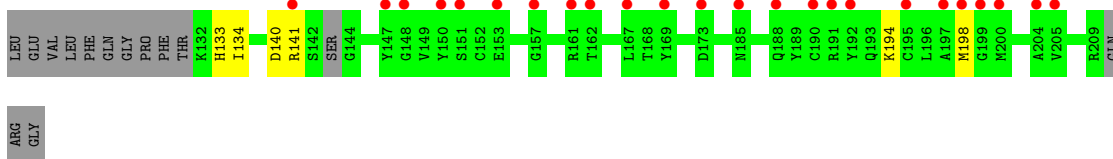
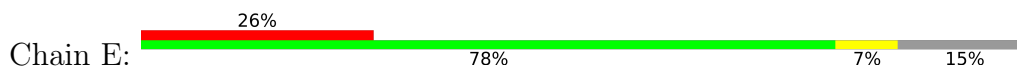
### 3 Residue-property plots [i](#)

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: Retinoic acid receptor RXR-alpha



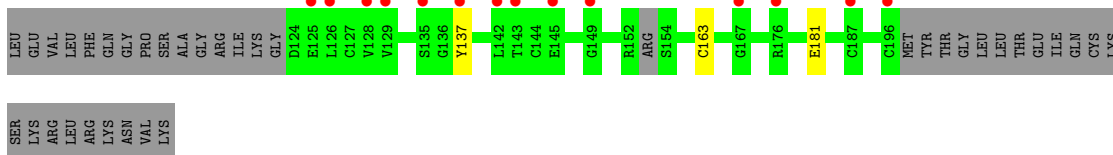
- Molecule 1: Retinoic acid receptor RXR-alpha



- Molecule 2: Bile acid receptor



- Molecule 2: Bile acid receptor




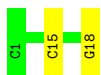
- Molecule 3: DNA (5'-D(P\*CP\*CP\*GP\*AP\*GP\*GP\*TP\*CP\*AP\*AP\*TP\*GP\*AP\*CP\*CP\*T P\*CP\*G)-3')

Chain C:  100%

There are no outlier residues recorded for this chain.

- Molecule 3: DNA (5'-D(P\*CP\*CP\*GP\*AP\*GP\*GP\*TP\*CP\*AP\*AP\*TP\*GP\*AP\*CP\*CP\*T P\*CP\*G)-3')

Chain G:  89% 11%




- Molecule 4: DNA (5'-D(P\*CP\*CP\*GP\*AP\*GP\*GP\*TP\*CP\*AP\*TP\*TP\*GP\*AP\*CP\*CP\*T P\*CP\*G)-3')

Chain D:  100%

There are no outlier residues recorded for this chain.

- Molecule 4: DNA (5'-D(P\*CP\*CP\*GP\*AP\*GP\*GP\*TP\*CP\*AP\*TP\*TP\*GP\*AP\*CP\*CP\*T P\*CP\*G)-3')

Chain H:  78% 22%





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	50.65Å 60.02Å 241.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.57 – 3.30 49.57 – 3.30	Depositor EDS
% Data completeness (in resolution range)	97.5 (49.57-3.30) 97.5 (49.57-3.30)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.89 (at 3.33Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, $R_{free}$	0.248 , 0.301 0.246 , 0.298	Depositor DCC
$R_{free}$ test set	1141 reflections (9.94%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	90.0	Xtrriage
Anisotropy	0.871	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 85.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.52$ , $\langle L^2 \rangle = 0.36$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.90	EDS
Total number of atoms	3633	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	124.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.23% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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:  
ZN

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	0.24	0/627	0.50	0/834
1	E	0.24	0/518	0.45	0/701
2	B	0.24	0/557	0.49	0/740
2	F	0.23	0/472	0.45	0/636
3	C	0.48	0/412	0.82	0/633
3	G	0.49	0/412	0.83	0/633
4	D	0.53	0/410	0.88	0/630
4	H	0.52	0/410	0.88	0/630
All	All	0.38	0/3818	0.68	0/5437

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	619	0	582	3	0
1	E	514	0	412	3	0
2	B	551	0	513	3	0
2	F	471	0	380	2	0
3	C	368	0	202	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	G	368	0	202	2	0
4	D	367	0	203	0	0
4	H	367	0	203	4	0
5	A	2	0	0	0	0
5	B	2	0	0	0	0
5	E	2	0	0	0	0
5	F	2	0	0	0	0
All	All	3633	0	2697	13	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 4.

All (13) 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:A:182:ARG:HB2	2:B:173:MET:HB2	1.83	0.60
3:G:15:DC:O2	4:H:5:DG:N2	2.32	0.59
3:G:18:DG:O6	4:H:1:DC:N4	2.38	0.56
2:F:163:CYS:N	2:F:181:GLU:OE1	2.44	0.51
2:B:163:CYS:N	2:B:181:GLU:OE1	2.43	0.50
1:E:133:HIS:ND1	1:E:134:ILE:N	2.62	0.47
1:E:194:LYS:O	1:E:198:MET:HG2	2.16	0.45
4:H:3:DG:H2''	4:H:4:DA:C8	2.54	0.43
2:F:137:TYR:HB2	4:H:3:DG:OP1	2.19	0.43
1:A:180:ASP:OD1	1:A:183:GLN:HG2	2.20	0.42
2:B:174:TYR:CZ	2:B:178:LYS:HE3	2.55	0.42
1:E:140:ASP:OD1	1:E:141:ARG:N	2.50	0.42
1:A:194:LYS:O	1:A:198:MET:HG2	2.22	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	77/91 (85%)	75 (97%)	2 (3%)	0	100	100
1	E	73/91 (80%)	69 (94%)	4 (6%)	0	100	100
2	B	71/109 (65%)	68 (96%)	3 (4%)	0	100	100
2	F	68/109 (62%)	65 (96%)	3 (4%)	0	100	100
All	All	289/400 (72%)	277 (96%)	12 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 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	64/80 (80%)	64 (100%)	0	100	100
1	E	44/80 (55%)	44 (100%)	0	100	100
2	B	57/93 (61%)	56 (98%)	1 (2%)	59	78
2	F	42/93 (45%)	42 (100%)	0	100	100
All	All	207/346 (60%)	206 (100%)	1 (0%)	88	93

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	177	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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](#)

Of 8 ligands modelled in this entry, 8 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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

### 6.1 Protein, DNA and RNA chains

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	79/91 (86%)	0.63	2 (2%) 57 54	56, 86, 140, 152	0
1	E	77/91 (84%)	1.21	24 (31%) 0 0	123, 175, 227, 246	0
2	B	73/109 (66%)	0.73	5 (6%) 17 17	61, 90, 140, 171	0
2	F	72/109 (66%)	0.87	14 (19%) 1 1	119, 153, 208, 242	0
3	C	18/18 (100%)	0.28	0 100 100	71, 91, 143, 154	0
3	G	18/18 (100%)	0.30	0 100 100	120, 137, 173, 197	0
4	D	18/18 (100%)	0.31	0 100 100	69, 103, 145, 163	0
4	H	18/18 (100%)	0.06	0 100 100	112, 136, 157, 159	0
All	All	373/472 (79%)	0.74	45 (12%) 4 3	56, 126, 197, 246	0

All (45) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	195	CYS	4.9
1	E	191	ARG	4.8
1	E	150	TYR	4.2
2	F	129	VAL	3.9
1	E	167	LEU	3.9
1	E	190	CYS	3.8
1	E	197	ALA	3.8
2	F	187	CYS	3.7
2	F	176	ARG	3.6
2	F	145	GLU	3.5
1	E	169	TYR	3.4
2	F	128	VAL	3.3
2	F	143	THR	3.3
1	E	199	GLY	3.1
1	E	185	ASN	3.1
1	E	151	SER	3.1

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Mol	Chain	Res	Type	RSRZ
2	F	135	SER	3.0
2	F	142	LEU	3.0
1	A	169	TYR	2.8
1	E	147	TYR	2.8
1	E	204	ALA	2.7
2	F	125	GLU	2.6
1	E	192	TYR	2.6
1	E	188	GLN	2.5
1	E	157	GLY	2.5
1	E	153	GLU	2.5
2	B	143	THR	2.4
1	E	198	MET	2.4
1	E	161	ARG	2.4
2	F	167	GLY	2.3
2	B	135	SER	2.3
1	E	173	ASP	2.3
2	B	173	MET	2.3
1	E	148	GLY	2.3
2	B	187	CYS	2.2
2	F	196	CYS	2.2
1	E	162	THR	2.2
2	B	177	ARG	2.2
1	A	153	GLU	2.1
1	E	200	MET	2.1
2	F	137	TYR	2.1
1	E	205	VAL	2.1
1	E	141	ARG	2.1
2	F	149	GLY	2.0
2	F	126	LEU	2.0

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
5	ZN	A	302	1/1	0.80	0.22	93,93,93,93	0
5	ZN	F	302	1/1	0.84	0.08	202,202,202,202	0
5	ZN	E	302	1/1	0.85	0.07	216,216,216,216	0
5	ZN	E	301	1/1	0.87	0.16	180,180,180,180	0
5	ZN	F	301	1/1	0.93	0.11	136,136,136,136	0
5	ZN	B	302	1/1	0.94	0.30	101,101,101,101	0
5	ZN	B	301	1/1	0.96	0.23	68,68,68,68	0
5	ZN	A	301	1/1	0.97	0.23	49,49,49,49	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.