wwPDB X-ray Structure Validation Summary Report (i)

Feb 6, 2024 – 09:26 AM EST

PDB ID	:	2FLH
Title	:	Crystal structure of cytokinin-specific binding protein from mung bean in complex with cytokinin
Authors	:	Pasternak, O.; Bujacz, G.D.; Sikorski, M.M.; Jaskolski, M.
Deposited on	:	2006-01-06
Resolution	:	1.20 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 (i) 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 (1)) were used in the production of this report:

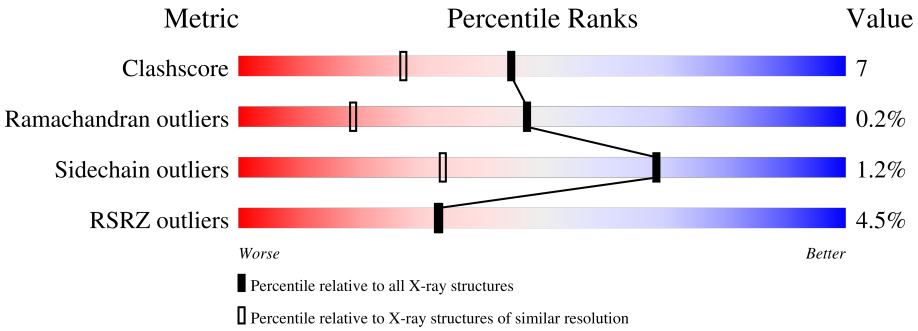
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.20 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	141614	1286 (1.22-1.18)
Ramachandran outliers	138981	1240 (1.22-1.18)
Sidechain outliers	138945	1239 (1.22-1.18)
RSRZ outliers	127900	1200 (1.22-1.18)

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 <=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	155	2% 76% 15% · 7%
1	B	155	4% 85% 12% ··
1	C	155	4% 82% 13% · ·
1	D	155	8% 88% 10% ··

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 5855 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.

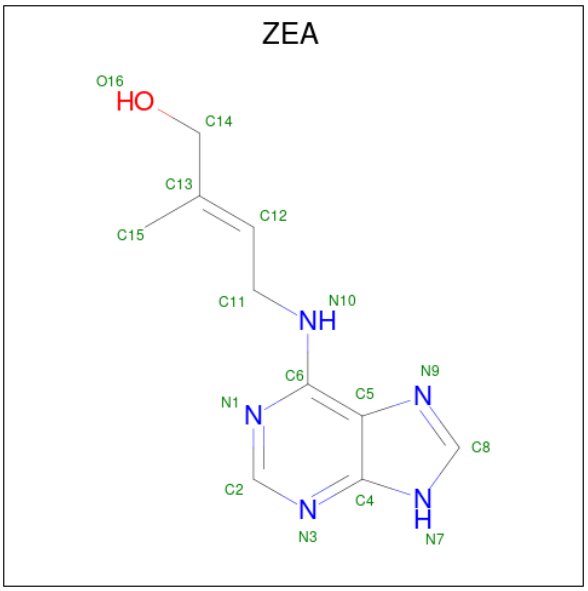
- Molecule 1 is a protein called cytokinin-specific binding protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	144	Total	C	N	O	S	40	11	0
			1217	786	194	234	3			
1	B	153	Total	C	N	O	S	37	10	0
			1265	810	196	257	2			
1	C	152	Total	C	N	O	S	31	13	0
			1288	834	202	250	2			
1	D	153	Total	C	N	O	S	34	6	0
			1263	804	206	252	1			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	92	SER	ASN	SEE REMARK 999	GB 4190976
B	92	SER	ASN	SEE REMARK 999	GB 4190976
C	92	SER	ASN	SEE REMARK 999	GB 4190976
D	92	SER	ASN	SEE REMARK 999	GB 4190976

- Molecule 2 is (2E)-2-methyl-4-(9H-purin-6-ylamino)but-2-en-1-ol (three-letter code: ZEA) (formula: $C_{10}H_{13}N_5O$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C N O 16 10 5 1	0	0
2	A	1	Total C N O 16 10 5 1	0	0
2	A	1	Total C N O 16 10 5 1	0	0
2	B	1	Total C N O 16 10 5 1	0	0
2	B	1	Total C N O 16 10 5 1	0	0
2	C	1	Total C N O 16 10 5 1	0	0
2	C	1	Total C N O 16 10 5 1	4	1
2	D	1	Total C N O 16 10 5 1	0	0
2	D	1	Total C N O 16 10 5 1	1	0

- Molecule 3 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total Na 1 1	0	0
3	C	1	Total Na 1 1	0	0

- Molecule 4 is water.

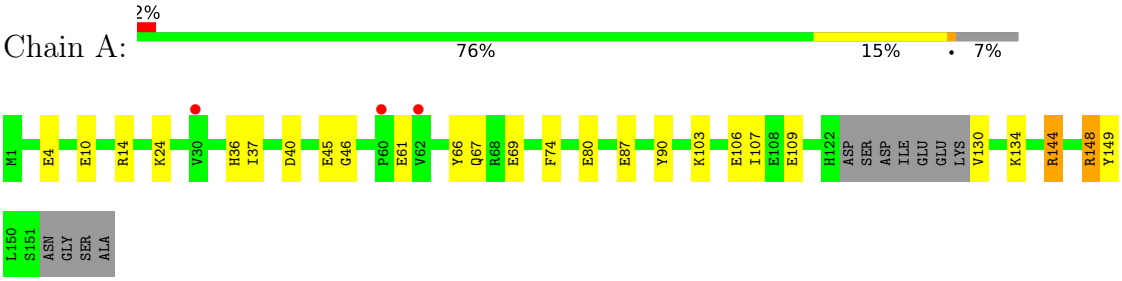
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	158	Total O 164 164	0	13
4	B	181	Total O 184 184	0	4
4	C	179	Total O 189 189	0	15
4	D	127	Total O 139 139	0	14

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.

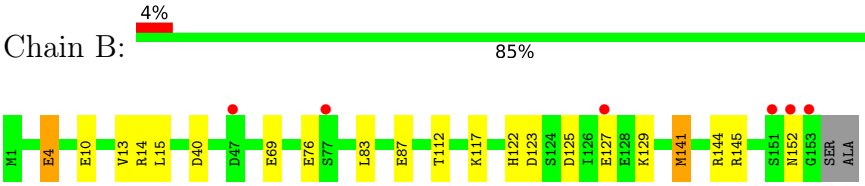
• Molecule 1: cytokinin-specific binding protein

Chain A:



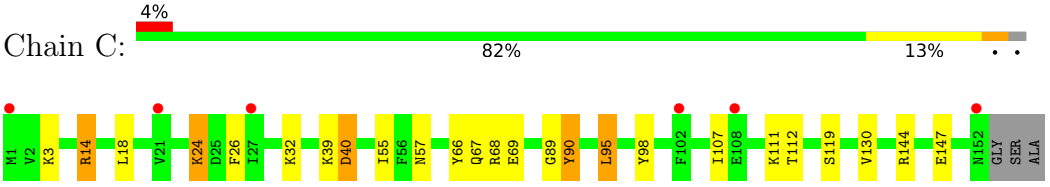
• Molecule 1: cytokinin-specific binding protein

Chain B:



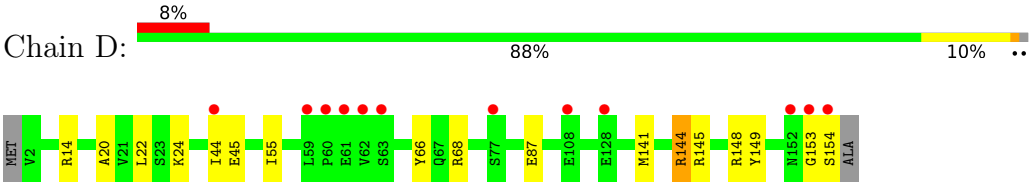
• Molecule 1: cytokinin-specific binding protein

Chain C:



• Molecule 1: cytokinin-specific binding protein

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 64	Depositor
Cell constants a, b, c, α, β, γ	113.79Å 113.79Å 86.98Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	15.00 – 1.20 28.29 – 1.20	Depositor EDS
% Data completeness (in resolution range)	(Not available) (15.00-1.20) 95.7 (28.29-1.20)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.44 (at 1.20Å)	Xtriage
Refinement program	SHELXL-97	Depositor
R, R_{free}	0.160 , 0.190 0.155 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	14.9	Xtriage
Anisotropy	0.343	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 65.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.029 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.98	EDS
Total number of atoms	5855	wwPDB-VP
Average B, all atoms (Å^2)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.05% 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, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NA, ZEA

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	0.93	0/1280	1.19	10/1729 (0.6%)
1	B	1.02	4/1331 (0.3%)	1.16	7/1802 (0.4%)
1	C	1.01	0/1364	1.24	10/1845 (0.5%)
1	D	0.96	0/1307	1.13	3/1767 (0.2%)
All	All	0.98	4/5282 (0.1%)	1.18	30/7143 (0.4%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	87	GLU	CG-CD	6.01	1.60	1.51
1	B	76	GLU	CB-CG	-5.86	1.41	1.52
1	B	4	GLU	CB-CG	-5.54	1.41	1.52
1	B	4	GLU	CD-OE2	-5.49	1.19	1.25

The worst 5 of 30 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	14	ARG	NE-CZ-NH1	10.34	125.47	120.30
1	A	148[A]	ARG	CD-NE-CZ	9.26	136.57	123.60
1	A	148[B]	ARG	CD-NE-CZ	9.26	136.57	123.60
1	B	145	ARG	NE-CZ-NH2	-8.96	115.82	120.30
1	D	144	ARG	NE-CZ-NH1	8.63	124.61	120.30

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	1217	0	1234	16	0
1	B	1265	0	1261	16	0
1	C	1288	0	1299	23	0
1	D	1263	0	1261	15	0
2	A	48	0	39	2	0
2	B	32	0	26	1	0
2	C	32	0	20	0	0
2	D	32	0	26	2	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
4	A	164	0	0	5	0
4	B	184	0	0	4	0
4	C	189	0	0	5	0
4	D	139	0	0	4	0
All	All	5855	0	5166	66	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 7.

The worst 5 of 66 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:24[A]:LYS:HE2	4:C:946:HOH:O	1.53	1.06
1:D:55:ILE:HG12	1:D:68[B]:ARG:HG2	1.44	0.99
1:C:95[A]:LEU:HD21	1:C:130:VAL:HG22	1.65	0.79
1:C:90:TYR:HB3	1:C:95[B]:LEU:HD12	1.66	0.78
1:C:24[B]:LYS:HE2	4:D:819:HOH:O	1.87	0.74

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	151/155 (97%)	148 (98%)	3 (2%)	0	100 100
1	B	161/155 (104%)	158 (98%)	2 (1%)	1 (1%)	25 5
1	C	163/155 (105%)	159 (98%)	4 (2%)	0	100 100
1	D	157/155 (101%)	154 (98%)	3 (2%)	0	100 100
All	All	632/620 (102%)	619 (98%)	12 (2%)	1 (0%)	47 19

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	152	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	145/143 (101%)	143 (99%)	2 (1%)	67 32
1	B	152/143 (106%)	150 (99%)	2 (1%)	69 33
1	C	155/143 (108%)	150 (97%)	5 (3%)	39 6
1	D	148/143 (104%)	148 (100%)	0	100 100
All	All	600/572 (105%)	591 (98%)	9 (2%)	69 29

5 of 9 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	95[A]	LEU
1	C	95[B]	LEU
1	B	141	MET
1	C	24[A]	LYS
1	C	24[B]	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	D	84	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 (i)

Of 11 ligands modelled in this entry, 2 are monoatomic - leaving 9 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	$\#\|Z\| > 2$
2	ZEA	C	705	-	13,17,17	1.85	2 (15%)	8,22,22	1.78	2 (25%)
2	ZEA	D	707	-	13,17,17	1.85	3 (23%)	8,22,22	1.70	1 (12%)
2	ZEA	A	702	-	13,17,17	1.77	1 (7%)	8,22,22	1.59	1 (12%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
2	ZEA	D	706	-	13,17,17	1.77	3 (23%)	8,22,22	1.20	1 (12%)
2	ZEA	A	701	-	13,17,17	1.78	3 (23%)	8,22,22	1.59	1 (12%)
2	ZEA	B	703	-	13,17,17	1.62	4 (30%)	8,22,22	1.63	2 (25%)
2	ZEA	A	708	-	13,17,17	1.78	5 (38%)	8,22,22	1.39	1 (12%)
2	ZEA	B	704	-	13,17,17	1.88	2 (15%)	8,22,22	1.47	2 (25%)

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	ZEA	C	705	-	-	0/8/8/8	0/2/2/2
2	ZEA	D	707	-	-	2/8/8/8	0/2/2/2
2	ZEA	A	702	-	-	0/8/8/8	0/2/2/2
2	ZEA	D	706	-	-	0/8/8/8	0/2/2/2
2	ZEA	A	701	-	-	0/8/8/8	0/2/2/2
2	ZEA	B	703	-	-	0/8/8/8	0/2/2/2
2	ZEA	A	708	-	-	0/8/8/8	0/2/2/2
2	ZEA	B	704	-	-	0/8/8/8	0/2/2/2

The worst 5 of 23 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	702	ZEA	C12-C13	5.46	1.46	1.33
2	C	705	ZEA	C12-C13	5.33	1.45	1.33
2	D	707	ZEA	C12-C13	5.30	1.45	1.33
2	B	704	ZEA	C12-C13	5.16	1.45	1.33
2	D	706	ZEA	C12-C13	4.90	1.44	1.33

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	707	ZEA	C2-N1-C6	4.18	120.17	116.59
2	C	705	ZEA	C2-N1-C6	3.83	119.87	116.59
2	A	701	ZEA	C2-N1-C6	3.51	119.60	116.59
2	A	702	ZEA	C2-N1-C6	3.27	119.39	116.59
2	B	703	ZEA	C11-N10-C6	-3.22	117.78	122.55

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	707	ZEA	C15-C13-C14-O16
2	D	707	ZEA	C12-C13-C14-O16

There are no ring outliers.

4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	702	ZEA	1	0
2	D	706	ZEA	2	0
2	A	701	ZEA	1	0
2	B	704	ZEA	1	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

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^{th} 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	144/155 (92%)	0.23	3 (2%)	63	63	12, 18, 34, 46	11 (7%)
1	B	153/155 (98%)	0.41	6 (3%)	39	39	13, 19, 38, 46	13 (8%)
1	C	152/155 (98%)	0.34	6 (3%)	39	39	11, 17, 33, 47	11 (7%)
1	D	153/155 (98%)	0.59	12 (7%)	13	12	13, 23, 45, 65	12 (7%)
All	All	602/620 (97%)	0.39	27 (4%)	33	33	11, 19, 37, 65	47 (7%)

The worst 5 of 27 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	152	ASN	10.2
1	D	153	GLY	7.8
1	D	60	PRO	7.5
1	B	153	GLY	6.8
1	D	154	SER	5.7

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

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^{th} 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
2	ZEA	D	707	16/16	0.78	0.16	30,32,35,38	1
2	ZEA	C	709[A]	16/16	0.85	0.20	23,36,38,40	16
2	ZEA	C	705	16/16	0.91	0.11	19,23,35,38	0
2	ZEA	A	702	16/16	0.92	0.12	19,21,32,45	0
2	ZEA	B	704	16/16	0.93	0.11	17,21,31,35	0
3	NA	C	801	1/1	0.93	0.18	31,31,31,31	0
2	ZEA	A	708	16/16	0.94	0.11	19,21,31,45	0
2	ZEA	D	706	16/16	0.94	0.08	16,19,24,28	0
3	NA	B	802	1/1	0.95	0.19	25,25,25,25	0
2	ZEA	A	701	16/16	0.95	0.08	15,19,23,29	0
2	ZEA	B	703	16/16	0.97	0.07	14,17,21,25	0

6.5 Other polymers (i)

There are no such residues in this entry.