wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 07:38 AM GMT

PDB ID	:	3BK3
Title	:	Crystal structure of the complex of BMP-2 and the first Von Willebrand domain type C of Crossveinless-2
Authors	:	Mueller, T.D.; Sebald, W.; Zhang, J.-L.
Deposited on	:	2007-12-05
Resolution	:	2.70 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:

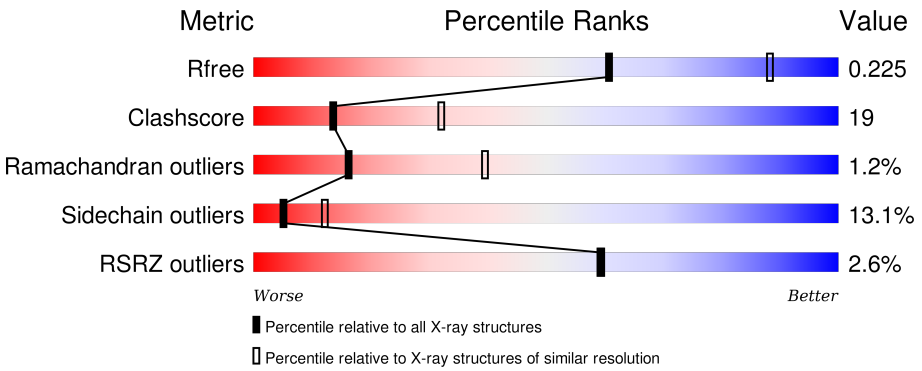
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	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 2.70 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	2103 (2.70-2.70)
Clashscore	102246	2422 (2.70-2.70)
Ramachandran outliers	100387	2382 (2.70-2.70)
Sidechain outliers	100360	2382 (2.70-2.70)
RSRZ outliers	91569	2107 (2.70-2.70)

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	114	% 65% 21% 5% 9%
1	B	114	69% 18% • • 9%
2	C	67	3% 60% 30% 10%
2	D	67	9% 67% 22% 10%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 2635 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 Bone morphogenetic protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	104	803	505	136	151	11	0	0	0
1	B	104	807	508	137	151	11	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	41	MET	PHE	ENGINEERED	UNP P12643
A	91	MET	TYR	ENGINEERED	UNP P12643
B	41	MET	PHE	ENGINEERED	UNP P12643
B	91	MET	TYR	ENGINEERED	UNP P12643

- Molecule 2 is a protein called Crossveinless 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	67	489	296	82	101	10	0	0	0
2	D	67	489	296	82	101	10	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-1	TRP	-	EXPRESSION TAG	UNP Q5D734
D	-1	TRP	-	EXPRESSION TAG	UNP Q5D734

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	18	18	18	0	0

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	B	17	17	17	0	0
			Total	O		
3	C	7	7	7	0	0
			Total	O		
3	D	5	5	5	0	0

3 Residue-property plots (i)

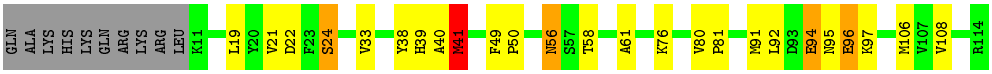
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according 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: Bone morphogenetic protein 2

Chain A:

- Molecule 1: Bone morphogenetic protein 2

Chain B:

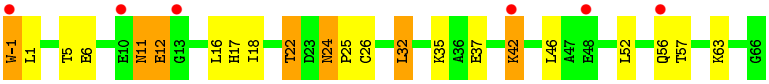


- Molecule 2: Crossveinless 2

Chain C:

- Molecule 2: Crossveinless 2

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	I 41	Depositor
Cell constants a, b, c, α, β, γ	83.75Å 83.75Å 139.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 2.70 41.88 – 2.70	Depositor EDS
% Data completeness (in resolution range)	5.0 (40.00-2.70) 96.5 (41.88-2.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$< I/\sigma(I) >$ [1]	3.66 (at 2.69Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.203 , 0.245 0.211 , 0.225	Depositor DCC
R_{free} test set	651 reflections (5.36%)	DCC
Wilson B-factor (Å^2)	44.9	Xtriage
Anisotropy	0.051	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 25.6	EDS
Estimated twinning fraction	0.148 for h,-k,-l	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.44$, $< L^2 > = 0.26$	Xtriage
Outliers	0 of 12788 reflections	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	2635	wwPDB-VP
Average B, all atoms (Å^2)	56.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.86% 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)

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	0.69	1/824 (0.1%)	0.73	2/1122 (0.2%)
1	B	0.64	0/828	0.70	0/1126
2	C	0.72	0/494	0.85	0/668
2	D	0.61	0/494	0.76	0/668
All	All	0.66	1/2640 (0.0%)	0.75	2/3584 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	78	CYS	CB-SG	-5.69	1.72	1.81

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	66	LEU	CA-CB-CG	-6.68	99.93	115.30
1	A	78	CYS	CA-CB-SG	-5.33	104.41	114.00

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	803	0	763	24	0
1	B	807	0	774	24	0
2	C	489	0	466	26	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	489	0	466	24	0
3	A	18	0	0	3	0
3	B	17	0	0	5	0
3	C	7	0	0	4	0
3	D	5	0	0	1	0
All	All	2635	0	2469	94	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 19.

The worst 5 of 94 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:B:76:LYS:HD3	3:B:128:HOH:O	1.55	1.04
1:A:41:MET:HG3	3:A:130:HOH:O	1.67	0.94
1:B:19:LEU:H	1:B:41:MET:HE2	1.31	0.94
1:B:58:THR:HG21	3:B:118:HOH:O	1.69	0.92
1:A:93:ASP:OD2	1:A:97:LYS:HB2	1.70	0.91

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	102/114 (90%)	93 (91%)	7 (7%)	2 (2%)	9 24
1	B	102/114 (90%)	97 (95%)	4 (4%)	1 (1%)	19 45
2	C	65/67 (97%)	60 (92%)	4 (6%)	1 (2%)	13 32
2	D	65/67 (97%)	63 (97%)	2 (3%)	0	100 100
All	All	334/362 (92%)	313 (94%)	17 (5%)	4 (1%)	16 39

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	C	1	LEU
1	A	41	MET
1	A	94	GLU
1	B	41	MET

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	92/102 (90%)	83 (90%)	9 (10%)	10	23
1	B	93/102 (91%)	84 (90%)	9 (10%)	10	23
2	C	56/57 (98%)	46 (82%)	10 (18%)	2	5
2	D	56/57 (98%)	45 (80%)	11 (20%)	1	4
All	All	297/318 (93%)	258 (87%)	39 (13%)	5	12

5 of 39 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	97	LYS
2	C	35	LYS
2	D	42	LYS
2	C	11	ASN
2	C	22	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
2	C	11	ASN
2	C	24	ASN
2	D	24	ASN
1	B	102	ASN
2	D	20	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)

There are no ligands in this entry.

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	104/114 (91%)	0.27	1 (0%) 84 85	47, 56, 64, 69	0
1	B	104/114 (91%)	0.17	0 100 100	49, 56, 65, 73	0
2	C	67/67 (100%)	0.22	2 (2%) 54 54	42, 56, 62, 65	0
2	D	67/67 (100%)	0.32	6 (8%) 12 9	41, 56, 61, 64	0
All	All	342/362 (94%)	0.24	9 (2%) 59 59	41, 56, 63, 73	0

The worst 5 of 9 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	10	GLU	3.4
2	C	66	GLY	2.9
2	D	56	GLN	2.8
2	D	-1	TRP	2.7
1	A	97	LYS	2.5

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)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.