Full wwPDB X-ray Structure Validation Report ⓘ

Aug 30, 2023 – 11:48 AM EDT

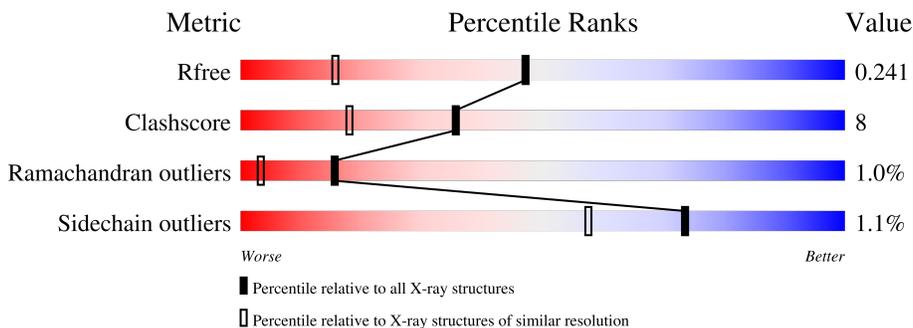|		
PDB ID	:	3OV1
Title	:	Crystal Structure of the Grb2 SH2 Domain in Complex with a pYXN-Derived Tripeptide
Authors	:	Clements, J.H.; Martin, S.F.
Deposited on	:	2010-09-15
Resolution	:	1.60 Å(reported)

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 1.60 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	Percentile Ranks	Value
Rfree		0.241
Clashscore		8
Ramachandran outliers		1.0%
Sidechain outliers		1.1%

Worse   *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3398 (1.60-1.60)
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)

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%

Mol	Chain	Length	Quality of chain
1	A	117	75% 7% 5% 13%
2	B	5	60% 40%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	GOL	A	174	-	X	X	-

WORLDWIDE **wwPDB** PROTEIN DATA BANK

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 1052 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 Growth factor receptor-bound protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	102	Total 894	C 577	N 159	O 155	S 3	10	7	1

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	164	HIS	-	expression tag	UNP P62993
A	165	HIS	-	expression tag	UNP P62993
A	166	HIS	-	expression tag	UNP P62993
A	167	HIS	-	expression tag	UNP P62993
A	168	HIS	-	expression tag	UNP P62993
A	169	HIS	-	expression tag	UNP P62993

- Molecule 2 is a protein called PYAC3CN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	5	Total 34	C 19	N 5	O 9	P 1	0	0	1

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

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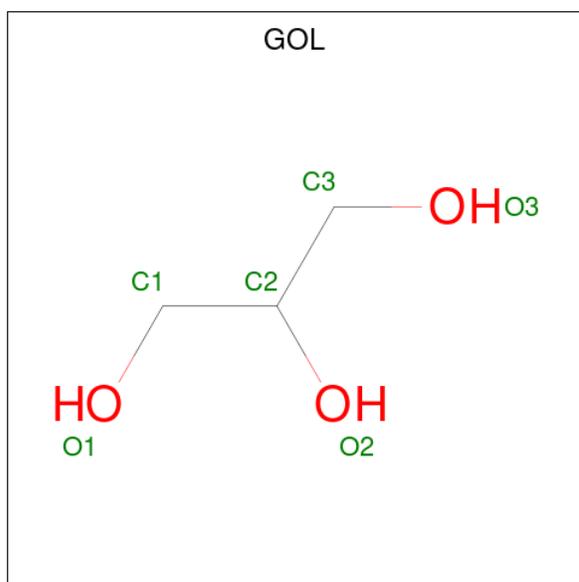
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 6	C 3	O 3	0	0
3	A	1	Total 6	C 3	O 3	0	0

- Molecule 4 is FORMIC ACID (three-letter code: FMT) (formula: CH_2O_2).

FMT
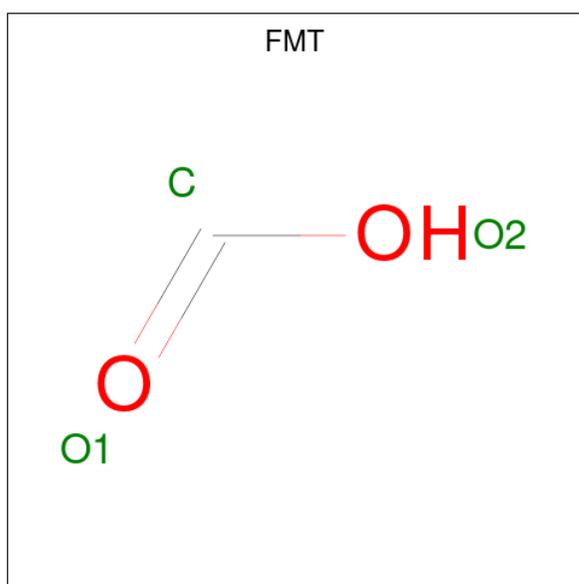
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total 3	C 1	O 2	0	0

- Molecule 5 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 1	Na 1	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	102	Total 102	O 102	0	0
6	B	6	Total 6	O 6	0	0

3 Residue-property plots ⓘ

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.

• Molecule 1: Growth factor receptor-bound protein 2

Chain A:
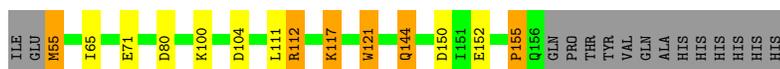
• Molecule 2: PYAC3CN

Chain B:

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	42.13Å 42.13Å 108.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	23.04 – 1.60 26.14 – 1.82	Depositor EDS
% Data completeness (in resolution range)	95.9 (23.04-1.60) 93.0 (26.14-1.82)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
$< I/\sigma(I) >$ [1]	9.95 (at 1.83Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.161 , 0.214 0.231 , 0.241	Depositor DCC
R_{free} test set	411 reflections (4.71%)	wwPDB-VP
Wilson B-factor (Å^2)	20.6	Xtriage
Anisotropy	0.233	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.40 , 55.2	EDS
L-test for twinning[2]	$< |L| > = 0.46$, $< L^2 > = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	1052	wwPDB-VP
Average B, all atoms (Å^2)	16.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.35% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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: FMT, ACT, PTR, GOL, NH2, 1AC, NA

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	1.38	3/918 (0.3%)	1.32	7/1234 (0.6%)
2	B	0.88	0/7	0.75	0/8
All	All	1.37	3/925 (0.3%)	1.32	7/1242 (0.6%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	65[A]	ILE	C-N	5.36	1.44	1.34
1	A	65[B]	ILE	C-N	5.36	1.44	1.34
1	A	121	TRP	CE3-CZ3	5.30	1.47	1.38

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	155	PRO	CB-CA-C	-13.13	79.18	112.00
1	A	112	ARG	NE-CZ-NH1	-6.49	117.05	120.30
1	A	150	ASP	CB-CG-OD2	-6.10	112.81	118.30
1	A	71	GLU	OE1-CD-OE2	-5.58	116.60	123.30
1	A	117	LYS	CD-CE-NZ	-5.39	99.31	111.70
1	A	80	ASP	CB-CG-OD2	5.29	123.06	118.30
1	A	55	MET	N-CA-CB	-5.01	101.59	110.60

There are no chirality outliers.

There are no planarity outliers.

5.2   Too-close contacts ⓘ

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	894	0	881	12	0
2	B	34	0	20	0	0
3	A	12	0	14	6	0
4	A	3	0	1	1	0
5	A	1	0	0	0	0
6	A	102	0	0	9	0
6	B	6	0	0	0	0
All	All	1052	0	916	15	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 8.

All (15) 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:100[A]:LYS:HE3	6:A:181:HOH:O	1.52	1.10
1:A:100[A]:LYS:CE	6:A:181:HOH:O	2.15	0.82
1:A:104[B]:ASP:OD1	6:A:223:HOH:O	1.98	0.81
3:A:174:GOL:H31	6:A:192:HOH:O	1.97	0.65
1:A:100[B]:LYS:HE2	6:A:47:HOH:O	2.03	0.58
3:A:174:GOL:C3	6:A:192:HOH:O	2.53	0.54
1:A:55:MET:N	6:A:218:HOH:O	2.41	0.52
3:A:174:GOL:H12	6:A:192:HOH:O	2.09	0.51
1:A:121:TRP:CD1	3:A:6:GOL:H11	2.49	0.48
1:A:111:LEU:HA	3:A:174:GOL:H11	1.97	0.47
1:A:112:ARG:HA	1:A:117:LYS:O	2.17	0.45
1:A:112:ARG:H	3:A:174:GOL:C1	2.29	0.45
1:A:100[A]:LYS:HE2	6:A:181:HOH:O	2.02	0.44
1:A:144:GLN:HE21	1:A:144:GLN:HB2	1.72	0.40
1:A:152:GLU:HG3	4:A:7:FMT:O1	2.22	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	107/117 (92%)	104 (97%)	2 (2%)	1 (1%)	17	4
2	B	1/5 (20%)	1 (100%)	0	0	100	100
All	All	108/122 (88%)	105 (97%)	2 (2%)	1 (1%)	15	4

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	155	PRO

5.3.2 Protein sidechains ⓘ

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	97/105 (92%)	96 (99%)	1 (1%)	76	61
2	B	1/1 (100%)	1 (100%)	0	100	100
All	All	98/106 (92%)	97 (99%)	1 (1%)	73	61

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

Mol	Chain	Res	Type
1	A	144	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	106	GLN
1	A	144	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

2 non-standard protein/DNA/RNA residues 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	1AC	B	3	2	4,6,7	1.83	1 (25%)	3,9,11	2.25	1 (33%)
2	PTR	B	2	2	15,16,17	1.42	2 (13%)	19,22,24	1.94	8 (42%)

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	1AC	B	3	2	-	0/0/7/10	0/1/1/1
2	PTR	B	2	2	-	0/10/11/13	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	3	1AC	CB-CA	-3.06	1.49	1.51
2	B	2	PTR	P-OH	2.97	1.63	1.59
2	B	2	PTR	P-O3P	-2.63	1.44	1.54

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	2	PTR	O3P-P-O2P	3.55	121.22	107.64
2	B	2	PTR	CG-CB-CA	-3.48	107.05	114.10
2	B	3	1AC	CB-CG-CA	-3.17	58.98	60.32
2	B	2	PTR	CB-CA-C	-3.17	105.53	111.47

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	2	PTR	CD2-CE2-CZ	2.89	123.26	119.73
2	B	2	PTR	CE2-CD2-CG	-2.87	117.08	121.03
2	B	2	PTR	OH-P-O1P	-2.61	99.46	109.31
2	B	2	PTR	OH-CZ-CE2	2.03	125.28	119.23
2	B	2	PTR	CE2-CZ-CE1	-2.02	117.06	120.18

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5   Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6   Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 1 is monoatomic - leaving 3 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	#$|Z| > 2$
4	FMT	A	7	-	2,2,2	0.75	0	1,1,1	0.94	0
3	GOL	A	174	-	5,5,5	2.11	2 (40%)	5,5,5	3.75	4 (80%)
3	GOL	A	6	-	5,5,5	0.41	0	5,5,5	0.54	0

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
3	GOL	A	174	-	-	2/4/4/4	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GOL	A	6	-	-	0/4/4/4	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	174	GOL	O3-C3	-3.57	1.27	1.42
3	A	174	GOL	O2-C2	2.17	1.49	1.43

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	174	GOL	C3-C2-C1	-7.47	82.66	111.70
3	A	174	GOL	O3-C3-C2	-2.26	99.38	110.20
3	A	174	GOL	O2-C2-C3	-2.24	99.24	109.12
3	A	174	GOL	O2-C2-C1	2.05	118.15	109.12

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	174	GOL	O1-C1-C2-C3
3	A	174	GOL	O1-C1-C2-O2

There are no ring outliers.

3 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	7	FMT	1	0
3	A	174	GOL	5	0
3	A	6	GOL	1	0

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.