



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 8, 2023 – 12:48 PM EDT

PDB ID : 1NZO
Title : The crystal structure of wild type penicillin-binding protein 5 from *E. coli*
Authors : Nicholas, R.A.; Krings, S.; Tomberg, J.; Nicola, G.; Davies, C.
Deposited on : 2003-02-19
Resolution : 1.85 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

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>.

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

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : 1.13
EDS : 2.35
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) : 2.35

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 2916 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.

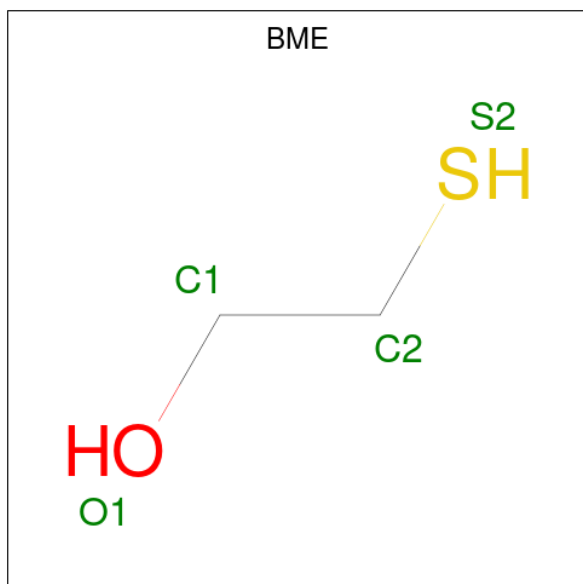
- Molecule 1 is a protein called Penicillin-binding protein 5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	352	2718	1715	471	519	13	0	2	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	358	GLY	-	SEE REMARK 999	UNP P04287
A	359	ASP	-	SEE REMARK 999	UNP P04287
A	360	PRO	-	SEE REMARK 999	UNP P04287
A	361	VAL	-	SEE REMARK 999	UNP P04287
A	362	ILE	-	SEE REMARK 999	UNP P04287
A	363	ASP	-	SEE REMARK 999	UNP P04287

- Molecule 2 is BETA-MERCAPTOETHANOL (three-letter code: BME) (formula: C₂H₆OS).



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

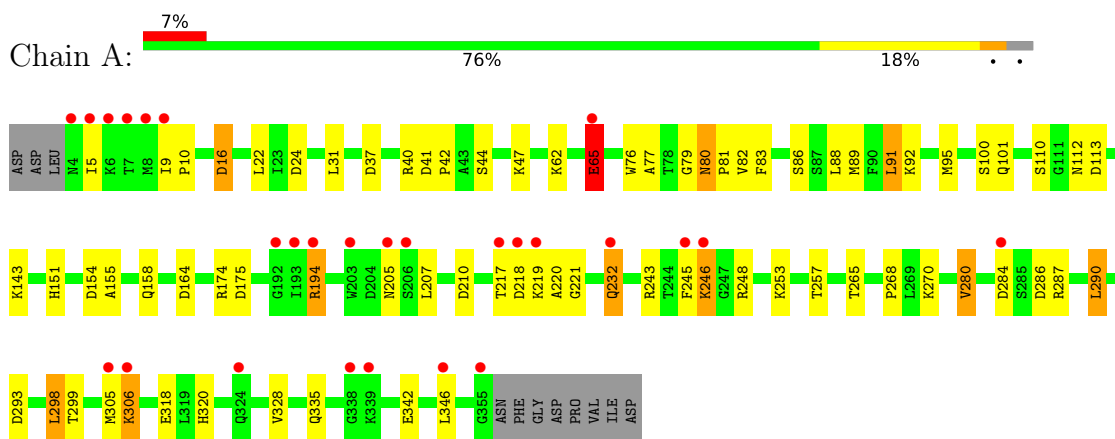
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	190	Total	O	0	0
			190	190		

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: Penicillin-binding protein 5



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	109.35Å 50.28Å 84.53Å 90.00° 120.90° 90.00°	Depositor
Resolution (Å)	14.92 – 1.85 14.90 – 1.85	Depositor EDS
% Data completeness (in resolution range)	93.4 (14.92-1.85) 90.1 (14.90-1.85)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.75 (at 1.86Å)	Xtrriage
Refinement program	REFMAC 5.0	Depositor
R, R_{free}	0.208 , 0.245 0.214 , 0.246	Depositor DCC
R_{free} test set	1542 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	31.1	Xtrriage
Anisotropy	0.057	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 42.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	2916	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.84% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: BME

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	0.61	1/2777 (0.0%)	0.92	14/3753 (0.4%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	65	GLU	CD-OE2	7.85	1.34	1.25

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	41	ASP	CB-CG-OD2	8.24	125.71	118.30
1	A	40	ARG	NE-CZ-NH2	-7.29	116.66	120.30
1	A	40	ARG	NE-CZ-NH1	7.27	123.94	120.30
1	A	293	ASP	CB-CG-OD2	7.16	124.74	118.30
1	A	284	ASP	CB-CG-OD2	7.14	124.73	118.30
1	A	113	ASP	CB-CG-OD2	7.10	124.69	118.30
1	A	154	ASP	CB-CG-OD2	6.99	124.59	118.30
1	A	210	ASP	CB-CG-OD2	6.77	124.39	118.30
1	A	164	ASP	CB-CG-OD2	6.36	124.02	118.30
1	A	16	ASP	CB-CG-OD2	5.61	123.35	118.30
1	A	280	VAL	CB-CA-C	-5.59	100.79	111.40
1	A	37	ASP	CB-CG-OD2	5.32	123.08	118.30
1	A	218	ASP	CB-CG-OD2	5.26	123.03	118.30
1	A	286	ASP	CB-CG-OD2	5.14	122.93	118.30

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	2718	0	2716	56	1
2	A	8	0	12	0	0
3	A	190	0	0	5	0
All	All	2916	0	2728	56	1

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 10.

All (56) 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:306:LYS:HD3	3:A:548:HOH:O	1.42	1.15
1:A:217:THR:HG22	1:A:219:LYS:H	1.23	1.00
1:A:217:THR:HG22	1:A:219:LYS:N	1.82	0.93
1:A:217:THR:CG2	1:A:219:LYS:HB2	2.02	0.88
1:A:335:GLN:HG3	3:A:526:HOH:O	1.72	0.88
1:A:217:THR:HG21	1:A:219:LYS:HB2	1.56	0.88
1:A:65:GLU:HG3	1:A:100:SER:HB3	1.56	0.85
1:A:253:LYS:O	1:A:257[B]:THR:HG23	1.76	0.84
1:A:253:LYS:O	1:A:257[B]:THR:CG2	2.26	0.83
1:A:31:LEU:HD21	1:A:299:THR:HG21	1.64	0.79
1:A:101:GLN:NE2	3:A:422:HOH:O	2.23	0.72
1:A:194:ARG:HG2	1:A:194:ARG:HH11	1.55	0.72
1:A:9:ILE:O	3:A:528:HOH:O	2.09	0.71
1:A:24:ASP:OD2	1:A:265:THR:OG1	2.09	0.71
1:A:207:LEU:HD21	1:A:257[A]:THR:HG22	1.74	0.70
1:A:217:THR:CG2	1:A:219:LYS:CB	2.73	0.66
1:A:217:THR:HG22	1:A:219:LYS:CB	2.28	0.64
1:A:318:GLU:OE1	1:A:320:HIS:HE1	1.80	0.64
1:A:232:GLN:OE1	1:A:232:GLN:N	2.24	0.64
1:A:174:ARG:HD2	1:A:175:ASP:OD2	1.98	0.63
1:A:217:THR:HG22	1:A:219:LYS:HB2	1.78	0.62
1:A:217:THR:CG2	1:A:219:LYS:H	2.06	0.59
1:A:217:THR:O	1:A:221:GLY:N	2.26	0.58
1:A:253:LYS:O	1:A:257[B]:THR:HG22	2.02	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:245:PHE:O	1:A:248:ARG:HB2	2.05	0.56
1:A:174:ARG:NH1	1:A:175:ASP:OD1	2.43	0.52
1:A:80[B]:ASN:HD22	1:A:82:VAL:H	1.58	0.51
1:A:83:PHE:HB3	1:A:88:LEU:HD21	1.93	0.51
1:A:232:GLN:H	1:A:232:GLN:CD	2.12	0.50
1:A:217:THR:HG22	1:A:219:LYS:CA	2.39	0.50
1:A:253:LYS:O	1:A:257[A]:THR:HG23	2.11	0.50
1:A:89:MET:HB2	1:A:91:LEU:HD13	1.95	0.49
1:A:194:ARG:HH11	1:A:194:ARG:CG	2.23	0.48
1:A:217:THR:HG21	1:A:219:LYS:CB	2.35	0.48
1:A:280:VAL:HG23	1:A:287:ARG:HA	1.96	0.48
1:A:290:LEU:HB3	1:A:346:LEU:HD11	1.95	0.47
1:A:92:LYS:O	1:A:95:MET:HG3	2.15	0.47
1:A:77:ALA:HB1	1:A:88:LEU:HD13	1.97	0.46
1:A:80[B]:ASN:ND2	1:A:82:VAL:H	2.13	0.46
1:A:298:LEU:HG	1:A:342:GLU:HG3	1.98	0.45
1:A:47:LYS:HE2	1:A:110:SER:O	2.17	0.45
1:A:155:ALA:O	1:A:158:GLN:HG2	2.17	0.45
1:A:246:LYS:N	1:A:246:LYS:HD3	2.32	0.45
1:A:86:SER:HB2	1:A:112:ASN:ND2	2.32	0.45
1:A:306:LYS:CD	1:A:306:LYS:N	2.80	0.45
1:A:217:THR:HB	1:A:220:ALA:HB3	1.98	0.44
1:A:76:TRP:CD2	1:A:79:GLY:HA3	2.52	0.44
1:A:101:GLN:NE2	3:A:531:HOH:O	2.50	0.43
1:A:16:ASP:OD2	1:A:243:ARG:HD2	2.19	0.43
1:A:9:ILE:O	1:A:9:ILE:HG23	2.19	0.43
1:A:318:GLU:OE1	1:A:320:HIS:CE1	2.65	0.42
1:A:268:PRO:HG3	1:A:298:LEU:HD22	2.01	0.42
1:A:305:MET:O	1:A:305:MET:HG2	2.20	0.41
1:A:9:ILE:HA	1:A:10:PRO:HD3	1.87	0.41
1:A:328:VAL:O	1:A:328:VAL:HG23	2.21	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:5:ILE:O	1:A:62:LYS:NZ[1_545]	1.65	0.55

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	352/363 (97%)	342 (97%)	9 (3%)	1 (0%)	41 26

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	81	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	293/301 (97%)	276 (94%)	17 (6%)	20 6

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	22	LEU
1	A	42	PRO
1	A	44	SER
1	A	65	GLU
1	A	80[A]	ASN
1	A	80[B]	ASN
1	A	91	LEU
1	A	143	LYS
1	A	151	HIS
1	A	194	ARG

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Mol	Chain	Res	Type
1	A	205	ASN
1	A	232	GLN
1	A	246	LYS
1	A	270	LYS
1	A	290	LEU
1	A	298	LEU
1	A	306	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	26	ASN
1	A	320	HIS
1	A	333	ASN
1	A	343	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](#)

2 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	BME	A	365	-	3,3,3	0.54	0	1,2,2	0.34	0
2	BME	A	364	-	3,3,3	0.26	0	1,2,2	0.40	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
2	BME	A	365	-	-	1/1/1/1	-
2	BME	A	364	-	-	0/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	365	BME	O1-C1-C2-S2

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, 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	352/363 (96%)	0.37	27 (7%) 13 13	21, 30, 42, 59	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	5	ILE	8.1
1	A	219	LYS	5.6
1	A	8	MET	5.2
1	A	232	GLN	4.7
1	A	7	THR	4.5
1	A	9	ILE	4.3
1	A	6	LYS	3.6
1	A	217	THR	3.4
1	A	284	ASP	3.4
1	A	218	ASP	3.2
1	A	246	LYS	2.8
1	A	203	TRP	2.8
1	A	338	GLY	2.7
1	A	306	LYS	2.5
1	A	192	GLY	2.5
1	A	4	ASN	2.5
1	A	205	ASN	2.5
1	A	206	SER	2.5
1	A	339	LYS	2.3
1	A	355	GLY	2.2
1	A	305	MET	2.2
1	A	194	ARG	2.1
1	A	324	GLN	2.1
1	A	346	LEU	2.1
1	A	245	PHE	2.1
1	A	193	ILE	2.0
1	A	65	GLU	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, 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	B-factors(Å ²)	Q<0.9
2	BME	A	365	4/4	0.68	0.17	57,57,57,59	0
2	BME	A	364	4/4	0.74	0.25	57,57,58,60	0

6.5 Other polymers [i](#)

There are no such residues in this entry.