



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 05:36 PM UTC

PDB ID : 1W61 / pdb_00001w61
Title : proline racemase in complex with 2 molecules of pyrrole-2-carboxylic acid (holo form)
Authors : Buschiazzo, A.; Alzari, P.
Deposited on : 2004-08-11
Resolution : 2.10 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

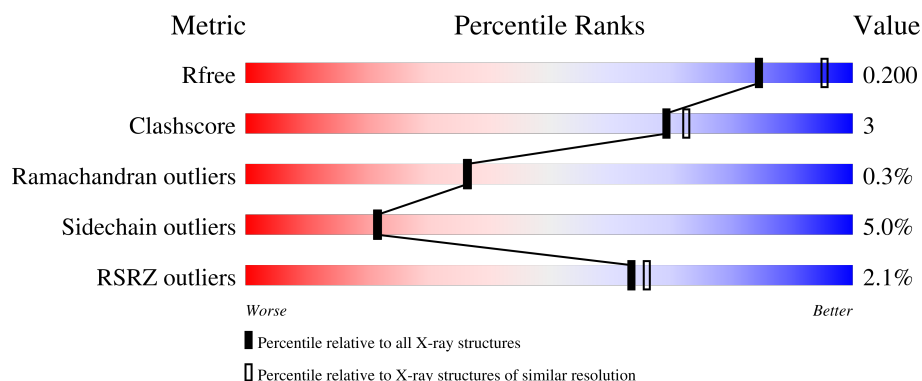
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

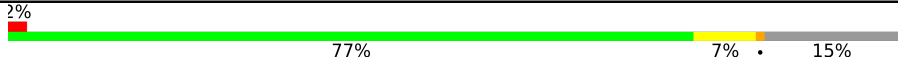
The reported resolution of this entry is 2.10 Å.

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}	180053	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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 $\leq 5\%$. 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	414	
1	B	414	

2 Entry composition [i](#)

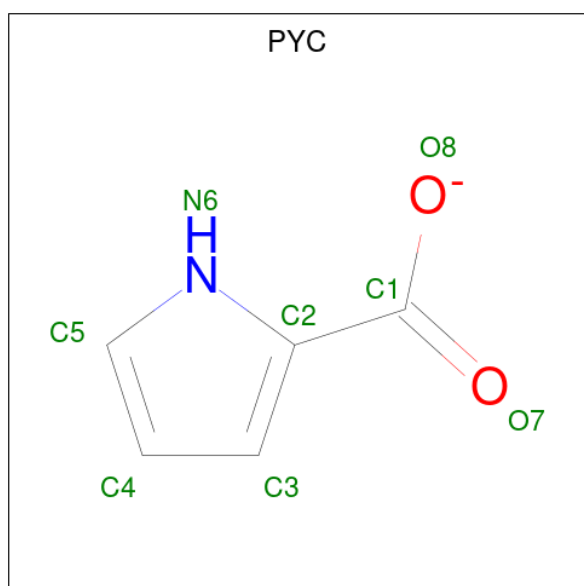
There are 3 unique types of molecules in this entry. The entry contains 5748 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 B-CELL MITOGEN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	353	Total	C	N	O	S	0	0	0
			2670	1692	452	511	15			
1	B	357	Total	C	N	O	S	0	0	0
			2704	1715	457	517	15			

- Molecule 2 is PYRROLE-2-CARBOXYLATE (CCD ID: PYC) (formula: $C_5H_4NO_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			8	5	1	2		
2	B	1	Total	C	N	O	0	0
			8	5	1	2		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	183	Total 183	O 183	0	0
3	B	175	Total 175	O 175	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	131.15Å 91.21Å 85.98Å 90.00° 126.52° 90.00°	Depositor
Resolution (Å)	30.00 – 2.10 30.00 – 2.10	Depositor EDS
% Data completeness (in resolution range)	98.8 (30.00-2.10) 98.8 (30.00-2.10)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.00 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.2.0003	Depositor
R, R_{free}	0.148 , 0.193 0.161 , 0.200	Depositor DCC
R_{free} test set	2331 reflections (4.91%)	wwPDB-VP
Wilson B-factor (Å ²)	22.2	Xtriage
Anisotropy	0.187	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 44.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5748	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.50% 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

5.1 Standard geometry

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

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	1.10	2/2724 (0.1%)	1.03	3/3700 (0.1%)
1	B	1.16	4/2760 (0.1%)	1.03	2/3750 (0.1%)
All	All	1.13	6/5484 (0.1%)	1.03	5/7450 (0.1%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	68	ILE	CA-CB	11.82	1.63	1.54
1	A	104	ALA	CA-CB	-6.75	1.42	1.53
1	B	68	ILE	N-CA	6.63	1.52	1.46
1	A	44	LYS	CG-CD	5.75	1.69	1.52
1	B	64	GLY	C-O	-5.40	1.16	1.24
1	B	51	MET	CG-SD	-5.15	1.67	1.80

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	44	LYS	N-CA-C	-7.10	96.06	108.20
1	B	68	ILE	N-CA-CB	-5.82	106.20	112.37
1	A	175	SER	N-CA-C	5.42	122.36	110.80
1	A	44	LYS	CA-CB-CG	5.36	124.81	114.10
1	B	217	GLY	N-CA-C	-5.08	108.14	113.58

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	2670	0	2641	21	0
1	B	2704	0	2672	19	0
2	A	8	0	4	0	0
2	B	8	0	4	0	0
3	A	183	0	0	1	0
3	B	175	0	0	1	0
All	All	5748	0	5321	37	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 3.

All (37) 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:48:CYS:SG	1:A:377:MET:CE	2.69	0.81
1:A:247:LEU:O	1:A:251:ILE:HG23	1.97	0.64
1:A:391:LEU:HD21	1:B:329:LEU:HD11	1.83	0.59
1:A:48:CYS:SG	1:A:377:MET:HE2	2.43	0.58
1:B:236:ASN:ND2	1:B:239:ARG:NH1	2.52	0.58
1:A:248:ARG:O	1:A:251:ILE:HD13	2.04	0.57
1:B:297:ARG:HB3	1:B:329:LEU:HD22	1.86	0.56
1:A:352:LYS:NZ	3:A:2156:HOH:O	2.39	0.55
1:B:236:ASN:ND2	1:B:239:ARG:HH11	2.03	0.55
1:A:251:ILE:HD11	1:A:268:VAL:HB	1.88	0.54
1:A:391:LEU:HD21	1:B:329:LEU:CD1	2.37	0.54
1:A:48:CYS:SG	1:A:377:MET:HE1	2.47	0.53
1:A:393:GLN:OE1	1:A:393:GLN:N	2.41	0.52
1:B:51:MET:SD	1:B:140:ALA:HB2	2.51	0.51
1:A:235:GLN:H	1:A:235:GLN:CD	2.17	0.51
1:B:368:LYS:HE3	1:B:370:PHE:CZ	2.46	0.50
1:A:224:PRO:HB2	1:A:226:GLU:HG2	1.92	0.50
1:B:197:ASP:HB3	1:B:210:ARG:NH2	2.27	0.50
1:B:65:LEU:HD11	1:B:105:PHE:HD2	1.77	0.50
1:A:393:GLN:H	1:A:393:GLN:CD	2.20	0.49
1:A:44:LYS:HB3	1:A:379:PHE:HB2	1.93	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:259:HIS:CE1	1:A:261:GLN:HE21	2.32	0.48
1:B:77:LYS:HE3	3:B:2021:HOH:O	2.14	0.47
1:B:266:ASN:C	1:B:266:ASN:HD22	2.23	0.47
1:B:65:LEU:HD11	1:B:105:PHE:CD2	2.51	0.46
1:A:155:ASN:ND2	1:A:172:HIS:ND1	2.64	0.46
1:A:266:ASN:HD22	1:A:266:ASN:C	2.24	0.45
1:A:368:LYS:HE3	1:A:370:PHE:CZ	2.51	0.45
1:B:68:ILE:O	1:B:76:LYS:NZ	2.49	0.45
1:A:233:SER:HB2	1:A:235:GLN:OE1	2.16	0.44
1:B:236:ASN:HD21	1:B:239:ARG:NH1	2.15	0.43
1:B:225:ALA:HB1	1:B:230:ILE:O	2.19	0.43
1:A:371:ILE:HG22	1:B:378:LEU:HD12	1.99	0.43
1:A:259:HIS:HE1	1:A:261:GLN:HE21	1.68	0.41
1:B:94:GLU:O	1:B:388:GLY:HA2	2.20	0.41
1:B:51:MET:HG2	1:B:371:ILE:HA	2.02	0.40
1:B:77:LYS:NZ	1:B:128:ASN:OD1	2.53	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	351/414 (85%)	344 (98%)	6 (2%)	1 (0%)	36	36
1	B	355/414 (86%)	347 (98%)	7 (2%)	1 (0%)	36	36
All	All	706/828 (85%)	691 (98%)	13 (2%)	2 (0%)	36	36

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	175	SER
1	A	175	SER

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	288/347 (83%)	271 (94%)	17 (6%)	18	16
1	B	292/347 (84%)	280 (96%)	12 (4%)	27	29
All	All	580/694 (84%)	551 (95%)	29 (5%)	22	22

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	73	MET
1	A	148	SER
1	A	154	THR
1	A	166	LEU
1	A	175	SER
1	A	209	VAL
1	A	251	ILE
1	A	266	ASN
1	A	316	GLN
1	A	325	TYR
1	A	328	ILE
1	A	347	LYS
1	A	352	LYS
1	A	355	GLU
1	A	377	MET
1	A	378	LEU
1	A	393	GLN
1	B	174	GLN
1	B	199	VAL
1	B	204	LYS
1	B	209	VAL
1	B	226	GLU
1	B	251	ILE
1	B	261	GLN
1	B	266	ASN
1	B	316	GLN
1	B	325	TYR

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Mol	Chain	Res	Type
1	B	329	LEU
1	B	391	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	155	ASN
1	A	195	GLN
1	A	227	GLN
1	A	236	ASN
1	A	261	GLN
1	A	266	ASN
1	A	334	GLN
1	B	81	GLN
1	B	155	ASN
1	B	195	GLN
1	B	196	GLN
1	B	236	ASN
1	B	261	GLN
1	B	266	ASN
1	B	334	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 oligosaccharides 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	PYC	B	700	-	8,8,8	1.48	1 (12%)	10,10,10	1.47	1 (10%)
2	PYC	A	700	-	8,8,8	1.14	0	10,10,10	2.04	5 (50%)

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	PYC	B	700	-	-	0/4/4/4	0/1/1/1
2	PYC	A	700	-	-	0/4/4/4	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	700	PYC	C2-N6	-3.14	1.33	1.37

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	700	PYC	C3-C2-N6	3.43	110.30	106.95
2	A	700	PYC	C4-C3-C2	-2.54	105.37	107.72
2	B	700	PYC	C3-C2-N6	2.49	109.38	106.95
2	A	700	PYC	C5-N6-C2	-2.31	106.94	109.42
2	A	700	PYC	C3-C2-C1	-2.30	124.63	130.39
2	A	700	PYC	O7-C1-C2	-2.10	116.75	121.01

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

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 [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	353/414 (85%)	0.03	7 (1%) 65 67	14, 22, 39, 57	0
1	B	357/414 (86%)	-0.02	8 (2%) 62 65	13, 23, 40, 50	0
All	All	710/828 (85%)	0.01	15 (2%) 63 66	13, 23, 40, 57	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	43	LYS	4.5
1	B	42	PHE	4.3
1	A	394	TYR	4.3
1	A	44	LYS	4.0
1	B	398	SER	3.2
1	B	176	GLY	3.2
1	A	42	PHE	3.1
1	B	175	SER	3.0
1	A	393	GLN	2.8
1	B	354	ALA	2.6
1	A	226	GLU	2.5
1	B	178	GLU	2.1
1	B	185	SER	2.1
1	B	43	LYS	2.1
1	A	176	GLY	2.1

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 oligosaccharides 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	PYC	A	700	8/8	0.97	0.09	14,17,19,19	0
2	PYC	B	700	8/8	0.97	0.10	18,22,23,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.