



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 25, 2024 – 05:52 PM EST

PDB ID : 3D62
Title : Development of Broad-Spectrum Halomethyl Ketone Inhibitors Against Coronavirus Main Protease 3CLpro
Authors : Bacha, U.; Barrila, J.; Gabelli, S.B.; Kiso, Y.; Amzel, L.M.; Freire, E.
Deposited on : 2008-05-18
Resolution : 2.70 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 : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.21
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.004 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.40

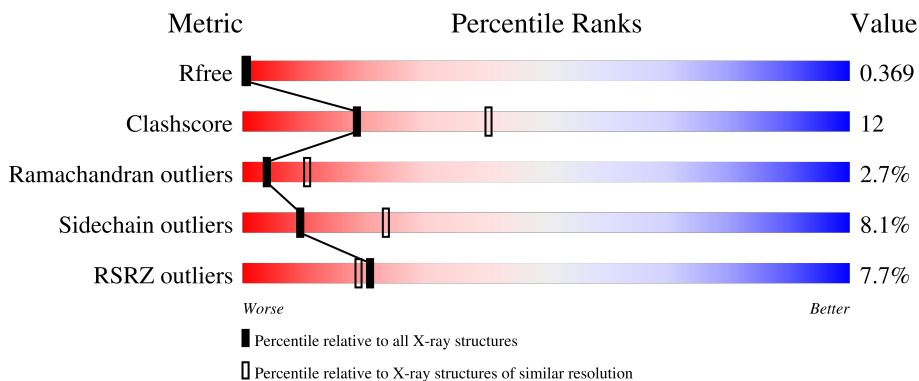
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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}	164625	3333 (2.70-2.70)
Clashscore	180529	3684 (2.70-2.70)
Ramachandran outliers	177936	3633 (2.70-2.70)
Sidechain outliers	177891	3633 (2.70-2.70)
RSRZ outliers	164620	3333 (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 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	299	

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
2	959	A	350	-	-	X	-

2 Entry composition [i](#)

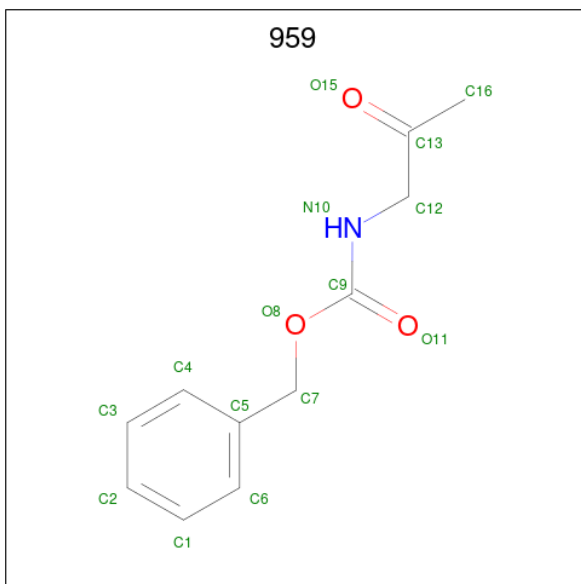
There are 3 unique types of molecules in this entry. The entry contains 2390 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 3C-like proteinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	299	2322	1469	397	434	22	0	0	0

- Molecule 2 is benzyl (2-oxopropyl)carbamate (three-letter code: 959) (formula: $C_{11}H_{13}NO_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	15	11	1	3	0	0

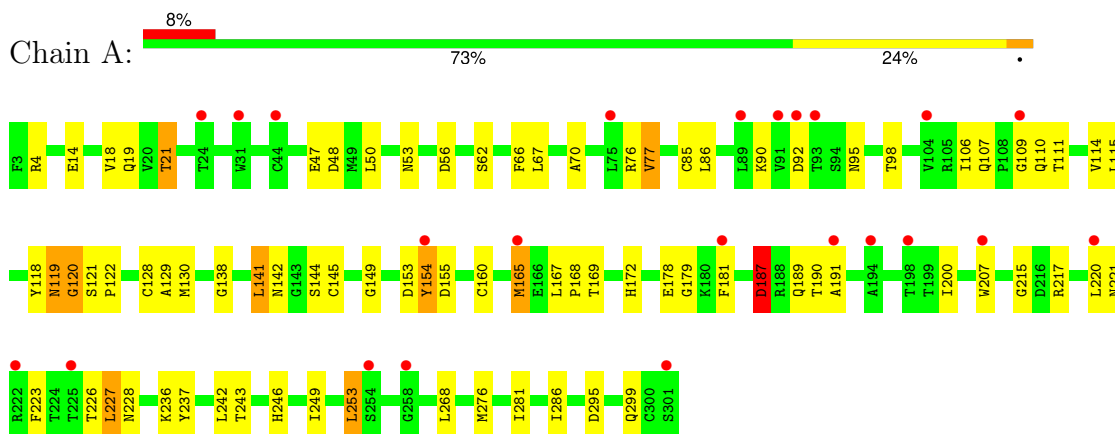
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	53	Total	O	0	0
			53	53		

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. 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: 3C-like proteinase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	106.67Å 45.16Å 53.97Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	34.46 – 2.70 34.46 – 2.70	Depositor EDS
% Data completeness (in resolution range)	98.9 (34.46-2.70) 98.8 (34.46-2.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.86 (at 2.68Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.259 , 0.363 0.309 , 0.369	Depositor DCC
R_{free} test set	372 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	55.4	Xtrriage
Anisotropy	0.358	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 27.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.53$, $\langle L^2 \rangle = 0.37$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	2390	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.76% 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: 959

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	0.43	2/2374 (0.1%)	0.56	0/3226

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	299	GLN	CD-OE1	5.99	1.37	1.24
1	A	299	GLN	CD-NE2	5.07	1.45	1.32

There are no bond angle outliers.

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	2322	0	2274	54	0
2	A	15	0	12	7	0
3	A	53	0	0	11	0
All	All	2390	0	2286	54	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 12.

All (54) 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:149:GLY:HA2	3:A:393:HOH:O	1.51	1.07
1:A:149:GLY:CA	3:A:393:HOH:O	2.05	1.05
1:A:145:CYS:H	2:A:350:959:H16B	1.39	0.86
1:A:119:ASN:O	1:A:121:SER:N	2.13	0.82
1:A:114:VAL:HA	3:A:393:HOH:O	1.81	0.81
1:A:165:MET:HE2	2:A:350:959:H2	1.66	0.77
1:A:243:THR:H	1:A:246:HIS:HD2	1.32	0.77
1:A:19:GLN:HE21	1:A:119:ASN:HB3	1.53	0.73
1:A:243:THR:H	1:A:246:HIS:CD2	2.08	0.70
1:A:165:MET:HE2	2:A:350:959:C2	2.21	0.70
1:A:86:LEU:HG	1:A:179:GLY:HA2	1.73	0.69
1:A:115:LEU:HD11	1:A:122:PRO:HB3	1.77	0.66
1:A:118:TYR:CE2	1:A:144:SER:HB3	2.32	0.65
1:A:215:GLY:HA2	1:A:217:ARG:HH21	1.61	0.65
1:A:21:THR:HG23	1:A:67:LEU:HB3	1.79	0.65
1:A:226:THR:O	1:A:227:LEU:HB3	1.96	0.64
1:A:19:GLN:HG2	3:A:369:HOH:O	1.98	0.63
1:A:207:TRP:CH2	1:A:281:ILE:HB	2.32	0.63
1:A:181:PHE:HB3	3:A:371:HOH:O	2.00	0.60
1:A:207:TRP:HH2	1:A:281:ILE:HB	1.69	0.56
1:A:95:ASN:HB3	1:A:98:THR:OG1	2.06	0.56
1:A:165:MET:CE	2:A:350:959:H2	2.33	0.55
1:A:167:LEU:HB3	3:A:351:HOH:O	2.06	0.54
1:A:107:GLN:N	1:A:110:GLN:OE1	2.40	0.54
1:A:141:LEU:HD22	1:A:142:ASN:H	1.74	0.52
1:A:138:GLY:H	1:A:172:HIS:CD2	2.27	0.52
1:A:14:GLU:HG2	1:A:122:PRO:HG2	1.91	0.52
1:A:153:ASP:O	1:A:154:TYR:HB3	2.10	0.51
1:A:276:MET:HA	3:A:368:HOH:O	2.11	0.51
1:A:217:ARG:HB2	1:A:220:LEU:HD12	1.91	0.51
1:A:153:ASP:HB2	3:A:381:HOH:O	2.09	0.51
1:A:189:GLN:HE21	2:A:350:959:H1	1.77	0.49
1:A:145:CYS:N	2:A:350:959:H16B	2.16	0.48
1:A:85:CYS:HB2	1:A:179:GLY:O	2.13	0.48
1:A:138:GLY:H	1:A:172:HIS:HD2	1.62	0.48
1:A:114:VAL:HG22	3:A:393:HOH:O	2.14	0.48
1:A:66:PHE:HB2	1:A:77:VAL:HG11	1.96	0.47
1:A:111:THR:HG22	1:A:129:ALA:HB2	1.95	0.47
1:A:76:ARG:HB3	1:A:92:ASP:HB3	1.97	0.46
1:A:221:ASN:OD1	1:A:223:PHE:HB2	2.16	0.45
1:A:109:GLY:HA2	1:A:200:ILE:HD13	1.98	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:236:LYS:HE3	1:A:237:TYR:CE1	2.53	0.44
1:A:149:GLY:HA3	3:A:393:HOH:O	1.93	0.44
1:A:249:ILE:O	1:A:249:ILE:HG22	2.18	0.44
1:A:189:GLN:HB2	2:A:350:959:H1	2.00	0.44
1:A:19:GLN:HG3	1:A:120:GLY:H	1.84	0.43
1:A:295:ASP:HB3	3:A:357:HOH:O	2.18	0.43
1:A:167:LEU:O	1:A:169:THR:N	2.48	0.43
1:A:18:VAL:HG12	1:A:70:ALA:HA	2.01	0.42
1:A:106:ILE:HG23	1:A:160:CYS:HB2	2.02	0.42
1:A:121:SER:HA	1:A:122:PRO:HD3	1.85	0.41
1:A:130:MET:HE3	1:A:130:MET:HA	2.02	0.41
1:A:187:ASP:OD1	1:A:187:ASP:N	2.54	0.41
1:A:253:LEU:HD13	1:A:253:LEU:HA	1.96	0.40

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	297/299 (99%)	268 (90%)	21 (7%)	8 (3%)	4 10

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	120	GLY
1	A	119	ASN
1	A	154	TYR
1	A	191	ALA
1	A	50	LEU
1	A	187	ASP
1	A	227	LEU
1	A	168	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	258/258 (100%)	237 (92%)	21 (8%)	9 23

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	ARG
1	A	21	THR
1	A	47	GLU
1	A	48	ASP
1	A	53	ASN
1	A	56	ASP
1	A	62	SER
1	A	77	VAL
1	A	90	LYS
1	A	128	CYS
1	A	141	LEU
1	A	155	ASP
1	A	165	MET
1	A	178	GLU
1	A	187	ASP
1	A	190	THR
1	A	228	ASN
1	A	242	LEU
1	A	253	LEU
1	A	268	LEU
1	A	286	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	19	GLN
1	A	28	ASN
1	A	51	ASN
1	A	53	ASN

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Mol	Chain	Res	Type
1	A	72	ASN
1	A	172	HIS
1	A	189	GLN
1	A	246	HIS
1	A	274	ASN
1	A	299	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](#)

1 ligand is 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	959	A	350	1	15,15,15	2.73	5 (33%)	18,18,18	2.42	5 (27%)

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	959	A	350	1	-	4/10/10/10	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	350	959	O8-C9	7.28	1.49	1.35
2	A	350	959	C12-N10	5.17	1.58	1.45
2	A	350	959	O11-C9	3.59	1.28	1.21
2	A	350	959	O8-C7	2.27	1.50	1.45
2	A	350	959	C9-N10	2.21	1.39	1.34

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	350	959	C13-C12-N10	-5.90	102.41	112.13
2	A	350	959	C16-C13-C12	5.15	122.84	115.51
2	A	350	959	O8-C9-N10	4.08	117.35	110.62
2	A	350	959	O8-C9-O11	-3.06	118.39	124.26
2	A	350	959	O15-C13-C16	-2.62	114.93	121.48

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	350	959	C13-C12-N10-C9
2	A	350	959	N10-C9-O8-C7
2	A	350	959	O11-C9-O8-C7
2	A	350	959	N10-C12-C13-O15

There are no ring outliers.

1 monomer is involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	350	959	7	0

5.7 Other polymers [\(i\)](#)

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

Warning: The R factor obtained from EDS is 0.3125, which does not match the depositor's R factor of 0.259. Please interpret the results in this section carefully.

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	299/299 (100%)	0.86	23 (7%) 21 19	16, 36, 45, 48	4 (1%)

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	104	VAL	7.5
1	A	254	SER	6.6
1	A	165	MET	5.7
1	A	225	THR	4.1
1	A	191	ALA	3.7
1	A	258	GLY	3.0
1	A	93	THR	2.8
1	A	24	THR	2.8
1	A	31	TRP	2.8
1	A	89	LEU	2.5
1	A	220	LEU	2.5
1	A	44	CYS	2.5
1	A	301	SER	2.3
1	A	109	GLY	2.3
1	A	194	ALA	2.3
1	A	222	ARG	2.2
1	A	154	TYR	2.2
1	A	207	TRP	2.2
1	A	91	VAL	2.2
1	A	181	PHE	2.1
1	A	198	THR	2.1
1	A	75	LEU	2.1
1	A	92	ASP	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 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	959	A	350	15/15	0.79	0.12	44,49,50,50	0

6.5 Other polymers [i](#)

There are no such residues in this entry.