



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 23, 2021 – 09:06 AM EDT

PDB ID : 1DTN  
Title : MANDELATE RACEMASE MUTANT D270N CO-CRYSTALLIZED WITH (S)-ATROLACTATE  
Authors : Clifton, J.G.; Petsko, G.A.  
Deposited on : 1996-03-28  
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](mailto: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.

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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) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

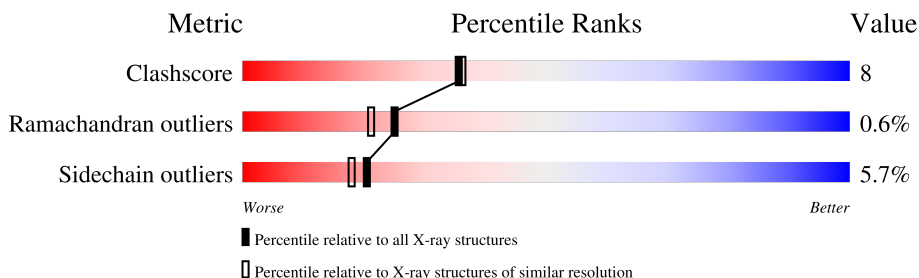
# 1 Overall quality at a glance

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))
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (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  $\geq 3$ , 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	359	77% 18% . .

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	APG	A	399	-	-	X	-

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 2923 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 MANDELATE RACEMASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	357	2800	1793	480	514	13	0	15	0

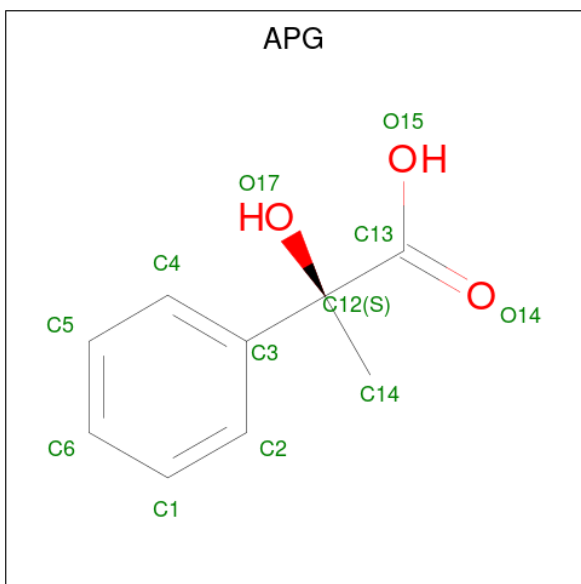
There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	317	GLN	GLU	engineered mutation	UNP P11444

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Mg	0	0
			1	1		

- Molecule 3 is ATROLACTIC ACID (2-PHENYL-LACTIC ACID) (three-letter code: APG) (formula: C<sub>9</sub>H<sub>10</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			12	9	3		

- Molecule 4 is water.


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	110	Total	O	0	0
			110	110		

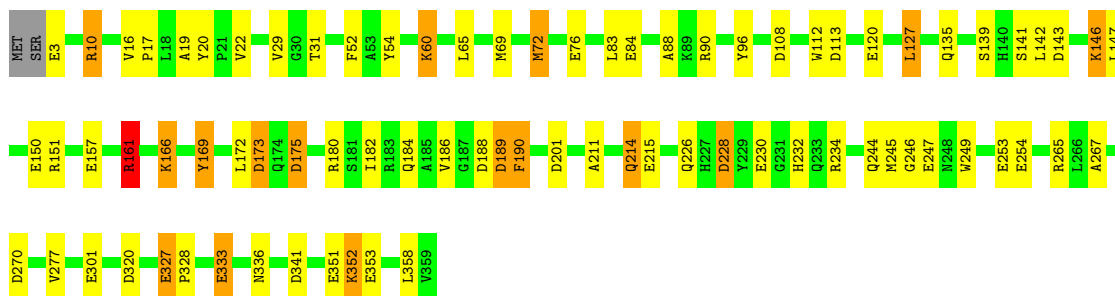
### 3 Residue-property plots [i](#)

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.

Note EDS was not executed.

- Molecule 1: MANDELATE RACEMASE

Chain A:  77% 18%



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	125.50Å 125.50Å 107.30Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.10	Depositor
% Data completeness (in resolution range)	85.3 (20.00-2.10)	Depositor
$R_{merge}$	0.13	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	TNT, X-PLOR	Depositor
R, $R_{free}$	0.171 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	2923	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	19.0	wwPDB-VP

## 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: APG, MG

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	0.77	16/2859 (0.6%)	1.26	26/3898 (0.7%)

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	247	GLU	CD-OE2	6.53	1.32	1.25
1	A	150	GLU	CD-OE2	6.33	1.32	1.25
1	A	333	GLU	CD-OE1	6.23	1.32	1.25
1	A	3	GLU	CD-OE2	5.85	1.32	1.25
1	A	157	GLU	CD-OE1	5.84	1.32	1.25
1	A	76	GLU	CD-OE1	5.83	1.32	1.25
1	A	351	GLU	CD-OE1	5.83	1.32	1.25
1	A	301	GLU	CD-OE1	5.73	1.31	1.25
1	A	254	GLU	CD-OE2	5.67	1.31	1.25
1	A	120	GLU	CD-OE1	5.64	1.31	1.25
1	A	230	GLU	CD-OE2	5.61	1.31	1.25
1	A	253	GLU	CD-OE1	5.54	1.31	1.25
1	A	215	GLU	CD-OE1	5.42	1.31	1.25
1	A	353	GLU	CD-OE1	5.19	1.31	1.25
1	A	327	GLU	CD-OE1	5.17	1.31	1.25
1	A	84	GLU	CD-OE1	5.17	1.31	1.25

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	161	ARG	NE-CZ-NH1	10.64	125.62	120.30
1	A	161	ARG	NE-CZ-NH2	-8.99	115.81	120.30
1	A	201	ASP	CB-CG-OD2	-7.57	111.49	118.30
1	A	201	ASP	CB-CG-OD1	7.07	124.66	118.30
1	A	341	ASP	CB-CG-OD2	-6.76	112.22	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	151	ARG	NE-CZ-NH2	6.67	123.64	120.30
1	A	173	ASP	CB-CG-OD1	-6.50	112.45	118.30
1	A	189	ASP	CB-CG-OD2	-6.46	112.49	118.30
1	A	108	ASP	CB-CG-OD2	6.39	124.05	118.30
1	A	173	ASP	CB-CG-OD2	6.38	124.04	118.30
1	A	10	ARG	NE-CZ-NH1	6.37	123.49	120.30
1	A	113	ASP	CB-CG-OD2	6.30	123.97	118.30
1	A	270	ASP	CB-CG-OD2	6.04	123.74	118.30
1	A	341	ASP	CB-CG-OD1	6.00	123.70	118.30
1	A	188	ASP	CB-CG-OD2	-6.00	112.90	118.30
1	A	320	ASP	CB-CG-OD1	-5.86	113.03	118.30
1	A	143	ASP	CB-CG-OD2	5.74	123.47	118.30
1	A	234	ARG	NE-CZ-NH1	5.72	123.16	120.30
1	A	228	ASP	CB-CG-OD1	-5.68	113.19	118.30
1	A	169	TYR	CB-CG-CD1	-5.64	117.61	121.00
1	A	54	TYR	CB-CG-CD2	-5.50	117.70	121.00
1	A	320	ASP	CB-CG-OD2	5.45	123.20	118.30
1	A	108	ASP	CB-CG-OD1	-5.44	113.40	118.30
1	A	265	ARG	NE-CZ-NH2	5.31	122.96	120.30
1	A	175	ASP	CB-CG-OD1	-5.26	113.57	118.30
1	A	143	ASP	CB-CG-OD1	-5.01	113.79	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	2800	0	2853	46	0
2	A	1	0	0	0	0
3	A	12	0	9	7	0
4	A	110	0	0	0	0
All	All	2923	0	2862	46	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 (46) 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:22[A]:VAL:HG13	1:A:29[A]:VAL:HG13	1.59	0.83
1:A:161:ARG:HH11	1:A:161:ARG:H	1.25	0.81
1:A:72:MET:CE	1:A:90:ARG:HG3	2.13	0.77
1:A:166:LYS:NZ	3:A:399:APG:H142	2.07	0.69
1:A:211:ALA:O	1:A:214:GLN:HG3	1.93	0.67
1:A:135:GLN:HA	1:A:336:ASN:HD22	1.58	0.67
1:A:72:MET:HE1	1:A:90:ARG:HG3	1.78	0.65
1:A:112:TRP:CD1	1:A:277:VAL:HB	2.35	0.62
1:A:161:ARG:N	1:A:161:ARG:HD3	2.16	0.59
1:A:180:ARG:O	1:A:184:GLN:HG3	2.03	0.58
1:A:65:LEU:O	1:A:69:MET:HG3	2.04	0.57
1:A:146:LYS:HZ2	1:A:147:LEU:H	1.53	0.57
1:A:228:ASP:O	1:A:232:HIS:HD2	1.87	0.57
1:A:166:LYS:HZ1	3:A:399:APG:H142	1.69	0.57
1:A:189:ASP:OD1	1:A:190:PHE:N	2.39	0.55
1:A:352:LYS:H	1:A:352:LYS:CD	2.19	0.55
1:A:52:PHE:HE2	3:A:399:APG:H6	1.72	0.54
1:A:244:GLN:HE21	1:A:245:MET:H	1.56	0.53
1:A:22[A]:VAL:HG13	1:A:29[A]:VAL:CG1	2.34	0.53
1:A:22[A]:VAL:CG1	1:A:29[A]:VAL:HG13	2.34	0.53
1:A:60:LYS:H	1:A:60:LYS:NZ	2.12	0.48
1:A:142:LEU:HD12	1:A:166:LYS:O	2.13	0.48
1:A:88:ALA:HB2	1:A:96:TYR:CE2	2.48	0.48
1:A:166:LYS:NZ	3:A:399:APG:C14	2.75	0.48
1:A:146:LYS:NZ	1:A:147:LEU:H	2.11	0.47
1:A:352:LYS:H	1:A:352:LYS:HD2	1.81	0.46
1:A:16:VAL:O	1:A:31[A]:THR:HA	2.16	0.46
1:A:244:GLN:HE22	1:A:267:ALA:N	2.13	0.46
1:A:246:GLY:HA2	1:A:249:TRP:CD2	2.51	0.46
1:A:146:LYS:HG2	1:A:147:LEU:N	2.31	0.46
1:A:166:LYS:CE	3:A:399:APG:H142	2.48	0.44
1:A:72:MET:HE3	1:A:90:ARG:NH1	2.34	0.43
1:A:166:LYS:CE	3:A:399:APG:C14	2.97	0.43
1:A:169:TYR:HD2	1:A:175:ASP:OD1	2.02	0.42
1:A:22[A]:VAL:HG23	1:A:141:SER:CB	2.49	0.42
1:A:166:LYS:HE3	3:A:399:APG:C14	2.49	0.42
1:A:17:PRO:HA	1:A:31[A]:THR:HG22	2.00	0.42
1:A:244:GLN:HE21	1:A:245:MET:N	2.17	0.42
1:A:72:MET:HE1	1:A:90:ARG:CG	2.47	0.42
1:A:60:LYS:H	1:A:60:LYS:HZ2	1.68	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:182:ILE:O	1:A:186:VAL:HG22	2.20	0.41
1:A:244:GLN:HE22	1:A:267:ALA:CA	2.34	0.41
1:A:172:LEU:O	1:A:175:ASP:HB2	2.21	0.41
1:A:327:GLU:OE1	1:A:328:PRO:HD2	2.20	0.41
1:A:72:MET:HE1	1:A:90:ARG:CB	2.51	0.41
1:A:127:LEU:HD12	1:A:127:LEU:HA	1.86	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	370/359 (103%)	351 (95%)	16 (4%)	3 (1%)	19 15

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	190	PHE
1	A	19[A]	ALA
1	A	19[B]	ALA

### 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	290/282 (103%)	273 (94%)	17 (6%)	19 17

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

Mol	Chain	Res	Type
1	A	10	ARG
1	A	20[A]	TYR
1	A	20[B]	TYR
1	A	60	LYS
1	A	72	MET
1	A	83	LEU
1	A	127	LEU
1	A	139	SER
1	A	146	LYS
1	A	161	ARG
1	A	166	LYS
1	A	173	ASP
1	A	214	GLN
1	A	226	GLN
1	A	333	GLU
1	A	352	LYS
1	A	358	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	135	GLN
1	A	197	ASN
1	A	214	GLN
1	A	226	GLN
1	A	227	HIS
1	A	232	HIS
1	A	244	GLN
1	A	336	ASN

### 5.3.3 RNA

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](#)

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	$\# Z  > 2$
3	APG	A	399	2	8,12,12	0.54	0	10,17,17	0.74	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	APG	A	399	2	-	0/6/12/12	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	399	APG	7	0

## 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](#)

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.