Full wwPDB X-ray Structure Validation Report ⓘ

Jul 26, 2023 – 10:23 pm BST

PDB ID	:	8ADX
Title	:	Structure of the Reconstructed Ancestor of Phenolic Acid Decarboxylase AncPAD55
Authors	:	Schruefer, A.; Mokos, D.; Gruber, K.; Daniel, B.
Deposited on	:	2022-07-12
Resolution	:	1.60 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:

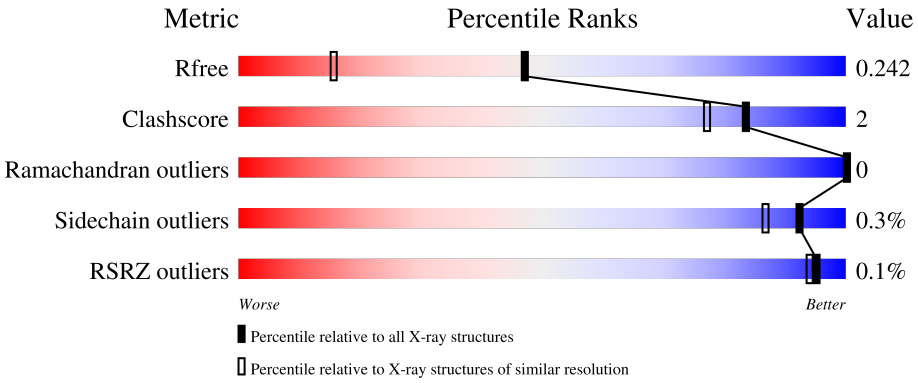
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.34
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.34

1 Overall quality at a glance (i)

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	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)
RSRZ outliers	127900	3321 (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% 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	192	81% 6% · 12%
1	B	192	76% 11% · 12%
1	C	192	79% 9% 12%
1	D	192	% 83% 5% 12%

2 Entry composition

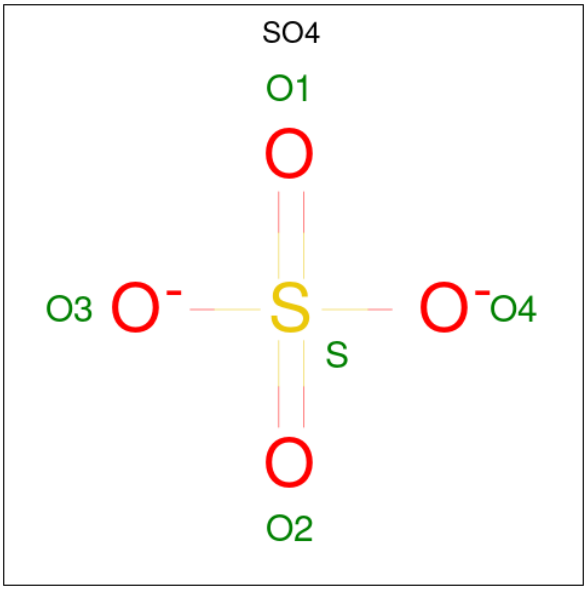
There are 3 unique types of molecules in this entry. The entry contains 11415 atoms, of which 5228 are hydrogens and 0 are deuteriums.

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 Phenolic acid decarboxylase N55.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	168	Total	C	H	N	O	S	40	0	0
			2663	863	1304	233	256	7			
1	B	168	Total	C	H	N	O	S	40	0	0
			2663	863	1304	233	256	7			
1	C	169	Total	C	H	N	O	S	40	0	0
			2677	867	1310	235	258	7			
1	D	169	Total	C	H	N	O	S	40	0	0
			2677	867	1310	235	258	7			

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is water.

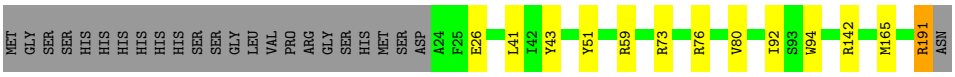
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	185	Total O 185 185	0	0
3	B	189	Total O 189 189	0	0
3	C	171	Total O 171 171	0	0
3	D	185	Total O 185 185	0	0

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: Phenolic acid decarboxylase N55

Chain A:

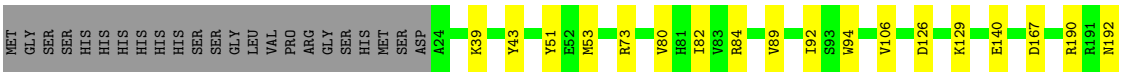


• Molecule 1: Phenolic acid decarboxylase N55

Chain B:

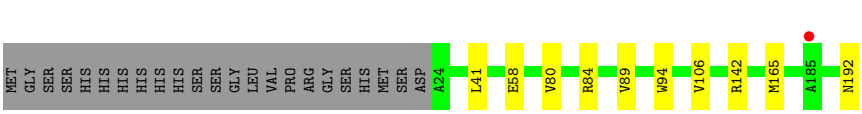
• Molecule 1: Phenolic acid decarboxylase N55

Chain C:



• Molecule 1: Phenolic acid decarboxylase N55

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	57.74Å 104.85Å 81.50Å 90.00° 109.86° 90.00°	Depositor
Resolution (Å)	43.27 – 1.60 43.27 – 1.60	Depositor EDS
% Data completeness (in resolution range)	97.1 (43.27-1.60) 93.0 (43.27-1.60)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.12 (at 1.59Å)	Xtriage
Refinement program	REFMAC 5.8.0405, REFMAC 5.8.0405	Depositor
R, R_{free}	0.188 , 0.235 0.198 , 0.242	Depositor DCC
R_{free} test set	5842 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	16.9	Xtriage
Anisotropy	0.230	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 30.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.46$, $< L^2 > = 0.28$	Xtriage
Estimated twinning fraction	0.145 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	11415	wwPDB-VP
Average B, all atoms (Å^2)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.17% of the height of the origin peak. No significant pseudotranslation is detected.*

[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: SO4

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	0.71	0/1395	0.96	1/1897 (0.1%)
1	B	0.82	5/1395 (0.4%)	1.06	5/1897 (0.3%)
1	C	0.79	2/1403 (0.1%)	0.95	3/1908 (0.2%)
1	D	0.77	1/1403 (0.1%)	1.00	2/1908 (0.1%)
All	All	0.77	8/5596 (0.1%)	0.99	11/7610 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3
1	B	0	3
1	D	0	1
All	All	0	7

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	166	GLU	CD-OE2	7.74	1.34	1.25
1	C	192	ASN	C-O	7.54	1.37	1.23
1	B	110	GLU	CD-OE2	-7.14	1.17	1.25
1	B	173	GLU	CD-OE2	6.42	1.32	1.25
1	C	140	GLU	CD-OE1	6.20	1.32	1.25
1	B	32	GLU	CD-OE2	5.67	1.31	1.25
1	B	31	GLU	CD-OE1	5.52	1.31	1.25
1	D	58	GLU	CD-OE1	5.27	1.31	1.25

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	191	ARG	NE-CZ-NH1	12.88	126.74	120.30
1	B	73	ARG	NE-CZ-NH2	-9.10	115.75	120.30
1	A	73	ARG	NE-CZ-NH2	-6.38	117.11	120.30
1	C	190	ARG	NE-CZ-NH1	6.08	123.34	120.30
1	B	167	ASP	CB-CG-OD1	5.93	123.63	118.30
1	B	76	ARG	NE-CZ-NH2	-5.84	117.38	120.30
1	B	191	ARG	NE-CZ-NH2	-5.71	117.44	120.30
1	C	84	ARG	NE-CZ-NH1	5.62	123.11	120.30
1	D	84	ARG	NE-CZ-NH1	5.24	122.92	120.30
1	C	73	ARG	NE-CZ-NH2	-5.18	117.71	120.30
1	D	192	ASN	CB-CA-C	5.14	120.68	110.40

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	142	ARG	Sidechain
1	A	191	ARG	Sidechain
1	A	59	ARG	Sidechain
1	B	145	ARG	Sidechain
1	B	191	ARG	Sidechain
1	B	59	ARG	Sidechain
1	D	142	ARG	Sidechain

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	1359	1304	1298	6	0
1	B	1359	1304	1298	7	0
1	C	1367	1310	1304	8	0
1	D	1367	1310	1304	4	0
2	D	5	0	0	0	0
3	A	185	0	0	1	0
3	B	189	0	0	0	0
3	C	171	0	0	0	0
3	D	185	0	0	0	0
All	All	6187	5228	5204	25	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 2.

All (25) 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:165:MET:H	1:A:191:ARG:HH12	1.43	0.66
1:A:80:VAL:HG12	1:A:94:TRP:HB3	1.86	0.57
1:B:165:MET:H	1:B:191:ARG:HH22	1.56	0.54
1:C:39:LYS:NZ	1:C:167:ASP:OD1	2.41	0.53
1:D:80:VAL:HG12	1:D:94:TRP:HB3	1.91	0.52
1:C:80:VAL:HG12	1:C:94:TRP:HB3	1.91	0.51
1:B:80:VAL:HG12	1:B:94:TRP:HB3	1.93	0.51
1:A:92:ILE:HD12	1:A:92:ILE:N	2.30	0.47
1:B:92:ILE:HD12	1:B:92:ILE:N	2.31	0.45
1:A:76:ARG:NH2	3:A:211:HOH:O	2.49	0.45
1:C:80:VAL:HG23	1:C:82:ILE:HG13	1.98	0.44
1:B:111:ARG:HH22	1:B:191:ARG:HH21	1.65	0.44
1:C:43:TYR:CE2	1:C:51:TYR:HB2	2.53	0.44
1:C:53:MET:SD	1:C:92:ILE:HD12	2.58	0.43
1:C:126:ASP:OD2	1:C:129:LYS:HE3	2.17	0.43
1:B:43:TYR:CE2	1:B:51:TYR:HB2	2.53	0.43
1:B:80:VAL:HG23	1:B:82:ILE:HG13	2.00	0.43
1:C:126:ASP:HB3	1:C:129:LYS:HD2	2.01	0.43
1:D:41:LEU:HD22	1:D:165:MET:SD	2.59	0.42
1:C:89:VAL:HA	1:C:106:VAL:O	2.20	0.42
1:A:26:GLU:HG3	1:A:26:GLU:O	2.19	0.42
1:D:41:LEU:CD2	1:D:165:MET:SD	3.09	0.41
1:A:43:TYR:CE2	1:A:51:TYR:HB2	2.56	0.40
1:D:89:VAL:HA	1:D:106:VAL:O	2.21	0.40
1:B:126:ASP:HB3	1:B:129:LYS:HD3	2.04	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	166/192 (86%)	163 (98%)	3 (2%)	0	100	100
1	B	166/192 (86%)	162 (98%)	4 (2%)	0	100	100
1	C	167/192 (87%)	165 (99%)	2 (1%)	0	100	100
1	D	167/192 (87%)	165 (99%)	2 (1%)	0	100	100
All	All	666/768 (87%)	655 (98%)	11 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	144/165 (87%)	143 (99%)	1 (1%)	84	73
1	B	144/165 (87%)	143 (99%)	1 (1%)	84	73
1	C	145/165 (88%)	145 (100%)	0	100	100
1	D	145/165 (88%)	145 (100%)	0	100	100
All	All	578/660 (88%)	576 (100%)	2 (0%)	92	87

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	LEU
1	B	41	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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)

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	SO4	D	201	-	4,4,4	0.32	0	6,6,6	0.18	0

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.

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, 95^{th} 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	168/192 (87%)	0.19	0	100	100	12, 19, 28, 35	0
1	B	168/192 (87%)	0.07	0	100	100	12, 18, 27, 34	1 (0%)
1	C	169/192 (88%)	0.12	0	100	100	11, 19, 30, 34	0
1	D	169/192 (88%)	0.14	1 (0%)	89	89	11, 18, 27, 34	0
All	All	674/768 (87%)	0.13	1 (0%)	95	94	11, 19, 29, 35	1 (0%)

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	185	ALA	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

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, 95^{th} 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	SO4	D	201	5/5	0.95	0.14	49,55,58,62	0

6.5 Other polymers (i)

There are no such residues in this entry.