



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 19, 2023 – 10:49 pm BST

PDB ID : 8A4K
Title : Human GDAP1, R282H mutant
Authors : Sutinen, A.; Kursula, P.
Deposited on : 2022-06-12
Resolution : 1.95 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
Xtriage (Phenix) : 1.13
EDS : 2.32.2
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) : 2.32.2

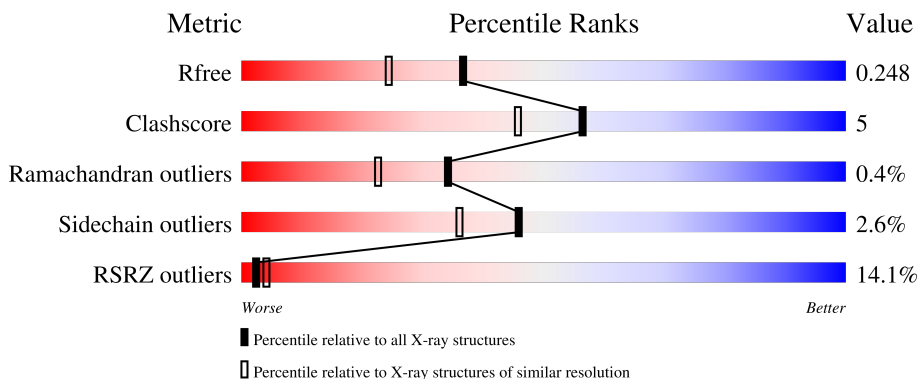
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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	2580 (1.96-1.96)
Clashscore	141614	2705 (1.96-1.96)
Ramachandran outliers	138981	2678 (1.96-1.96)
Sidechain outliers	138945	2678 (1.96-1.96)
RSRZ outliers	127900	2539 (1.96-1.96)

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	280	 10% 78% 12% • 9%
1	B	280	 15% 71% 13% • 15%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 8214 atoms, of which 4062 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 Ganglioside-induced differentiation-associated protein 1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	254	4211	1341	2105	368	388	9	0	1	0
1	B	237	3927	1256	1957	344	361	9	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	282	HIS	ARG	variant	UNP Q8TB36
B	282	HIS	ARG	variant	UNP Q8TB36

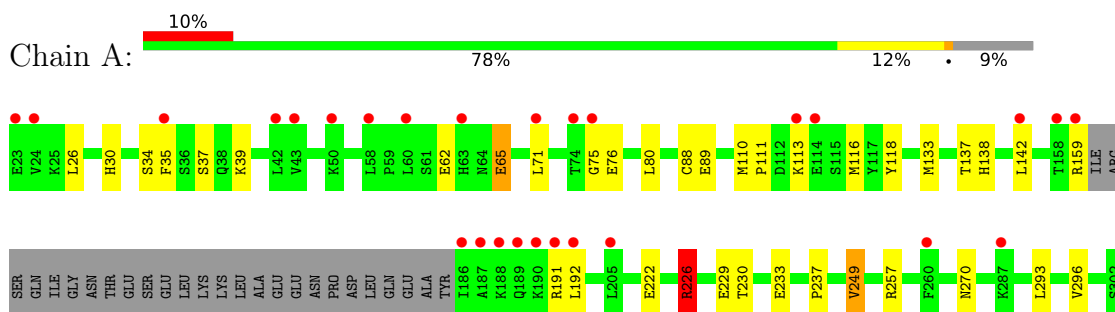
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	54	Total	O	0	0
			54	54		
2	B	22	Total	O	0	0
			22	22		

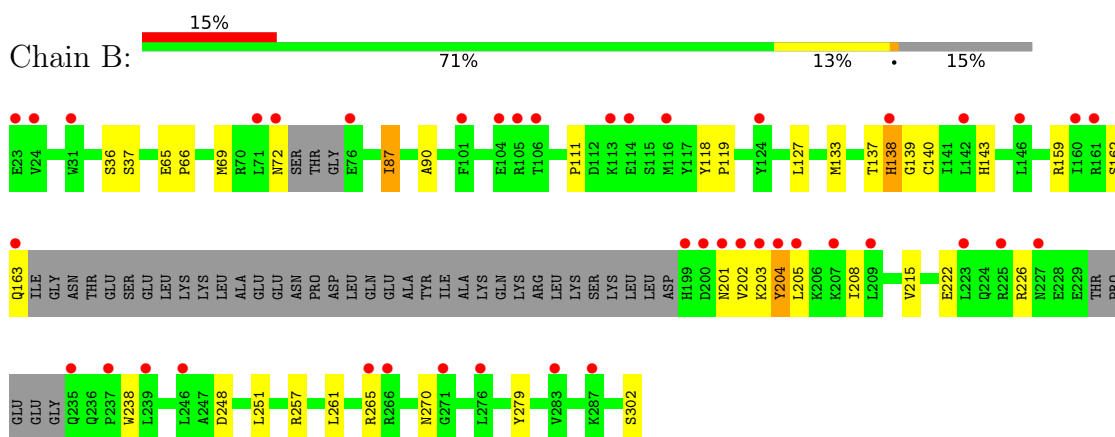
3 Residue-property plots [i](#)

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: Ganglioside-induced differentiation-associated protein 1



- Molecule 1: Ganglioside-induced differentiation-associated protein 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	73.28Å 113.37Å 115.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.84 – 1.95 44.84 – 1.95	Depositor EDS
% Data completeness (in resolution range)	96.3 (44.84-1.95) 84.7 (44.84-1.95)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.29 (at 1.95Å)	Xtrriage
Refinement program	PHENIX 1.20_4459	Depositor
R, R_{free}	0.225 , 0.251 0.223 , 0.248	Depositor DCC
R_{free} test set	1994 reflections (2.83%)	wwPDB-VP
Wilson B-factor (Å ²)	48.1	Xtrriage
Anisotropy	0.433	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.40 , 69.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.000 for -h,l,k	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	8214	wwPDB-VP
Average B, all atoms (Å ²)	96.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.45% 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](#)

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	0.80	3/2154 (0.1%)	0.84	2/2914 (0.1%)
1	B	0.56	0/2014	0.75	1/2724 (0.0%)
All	All	0.69	3/4168 (0.1%)	0.80	3/5638 (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	2
1	B	0	1
All	All	0	3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	65	GLU	CB-CG	-10.75	1.31	1.52
1	A	229	GLU	CB-CG	-5.50	1.41	1.52
1	A	249	VAL	CB-CG2	-5.09	1.42	1.52

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	226	ARG	CG-CD-NE	-8.05	94.89	111.80
1	A	110	MET	CG-SD-CE	-5.95	90.69	100.20
1	B	87	ILE	CG1-CB-CG2	-5.00	100.39	111.40

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	226	ARG	Sidechain
1	A	257	ARG	Sidechain
1	B	257	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	2106	2105	2102	21	0
1	B	1970	1957	1956	20	0
2	A	54	0	0	1	0
2	B	22	0	0	0	0
All	All	4152	4062	4058	41	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 5.

All (41) 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:B:222:GLU:OE2	1:B:226:ARG:NH2	1.89	1.05
1:A:222:GLU:OE2	1:A:226:ARG:NH2	2.04	0.89
1:A:138:HIS:NE2	1:A:142:LEU:HD11	2.03	0.73
1:B:133:MET:O	1:B:137:THR:HG23	2.00	0.61
1:B:36:SER:HB2	1:B:90:ALA:HB2	1.86	0.57
1:B:143:HIS:NE2	1:B:201:ASN:OD1	2.38	0.57
1:A:26:LEU:HD22	1:A:80:LEU:HD11	1.87	0.57
1:A:65:GLU:HG2	1:A:159:ARG:NH1	2.21	0.56
1:B:162:SER:O	1:B:163:GLN:HB2	2.05	0.55
1:A:133:MET:O	1:A:137:THR:HG23	2.06	0.55
1:A:65:GLU:HG2	1:A:159:ARG:HH12	1.73	0.54
1:A:34:SER:HB3	1:A:75:GLY:HA3	1.93	0.50
1:A:222:GLU:HG3	1:A:226:ARG:HH21	1.76	0.49
1:B:204:TYR:CE2	1:B:208:ILE:HD11	2.47	0.49
1:B:137:THR:HG22	1:B:261:LEU:HD11	1.96	0.47
1:B:65:GLU:HG2	1:B:159:ARG:NH1	2.30	0.47
1:A:113:LYS:HG3	1:A:113:LYS:O	2.16	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:138:HIS:CE1	1:A:142:LEU:HD11	2.50	0.46
1:B:87:ILE:HD12	1:B:87:ILE:N	2.31	0.46
1:A:111:PRO:HG2	1:A:118:TYR:HA	1.97	0.45
1:B:127:LEU:HD21	1:B:215:VAL:HG13	1.99	0.45
1:B:251:LEU:HD23	1:B:279:TYR:CZ	2.51	0.45
1:B:118:TYR:HB3	1:B:119:PRO:HD3	1.98	0.45
1:A:116:MET:O	2:A:401:HOH:O	2.21	0.45
1:A:35:PHE:CE2	1:A:39:LYS:HD2	2.52	0.44
1:B:139:GLY:HA3	1:B:205:LEU:HD21	1.98	0.44
1:B:72:ASN:HB3	1:B:138:HIS:CE1	2.52	0.44
1:B:202:VAL:HG12	1:B:203:LYS:N	2.33	0.43
1:B:238:TRP:HB3	1:B:248:ASP:OD1	2.18	0.43
1:A:230:THR:HG21	1:A:237:PRO:HD3	2.01	0.43
1:A:88:CYS:O	1:A:89:GLU:HB2	2.18	0.43
1:B:226:ARG:HD3	1:B:226:ARG:HA	1.78	0.43
1:A:293:LEU:O	1:A:296:VAL:HG22	2.19	0.42
1:B:65:GLU:HB3	1:B:69:MET:HB2	2.00	0.42
1:B:66:PRO:HD2	1:B:69:MET:HG3	2.01	0.42
1:B:202:VAL:HG12	1:B:204:TYR:H	1.84	0.41
1:A:65:GLU:OE2	1:A:159:ARG:NH2	2.54	0.41
1:A:65:GLU:CD	1:A:159:ARG:NH2	2.74	0.41
1:A:71:LEU:HD12	1:A:71:LEU:HA	1.90	0.41
1:A:30:HIS:HB2	1:A:37:SER:HB2	2.02	0.41
1:A:270:ASN:O	1:A:270:ASN:OD1	2.39	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	251/280 (90%)	245 (98%)	5 (2%)	1 (0%)	34 22

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	229/280 (82%)	225 (98%)	3 (1%)	1 (0%)	34	22
All	All	480/560 (86%)	470 (98%)	8 (2%)	2 (0%)	34	22

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	111	PRO
1	A	76	GLU

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	236/258 (92%)	231 (98%)	5 (2%)	53	46
1	B	221/258 (86%)	214 (97%)	7 (3%)	39	27
All	All	457/516 (89%)	445 (97%)	12 (3%)	46	36

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	62	GLU
1	A	191	ARG
1	A	192	LEU
1	A	233	GLU
1	A	249	VAL
1	B	37	SER
1	B	138	HIS
1	B	140	CYS
1	B	204	TYR
1	B	265	ARG
1	B	270	ASN
1	B	302	SER

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](#)

There are no ligands in this entry.

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	254/280 (90%)	0.97	27 (10%) 6 10	52, 71, 132, 159	0
1	B	237/280 (84%)	1.22	42 (17%) 1 1	65, 91, 146, 174	0
All	All	491/560 (87%)	1.09	69 (14%) 2 4	52, 80, 142, 174	0

All (69) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	201	ASN	6.6
1	A	186	ILE	5.8
1	A	187	ALA	5.7
1	A	188	LYS	5.1
1	A	192	LEU	4.5
1	B	24	VAL	4.3
1	B	235	GLN	4.3
1	A	189	GLN	4.2
1	B	105	ARG	4.1
1	B	199	HIS	3.9
1	B	113	LYS	3.7
1	B	71	LEU	3.6
1	B	104	GLU	3.5
1	A	159	ARG	3.5
1	B	23	GLU	3.5
1	B	202	VAL	3.5
1	B	203	LYS	3.4
1	B	207	LYS	3.3
1	B	72	ASN	3.2
1	A	190	LYS	3.2
1	A	24	VAL	3.2
1	B	31	TRP	3.2
1	B	265	ARG	3.2
1	B	239	LEU	3.2

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Mol	Chain	Res	Type	RSRZ
1	B	161	ARG	3.2
1	B	114	GLU	3.1
1	B	204	TYR	3.1
1	B	116	MET	3.0
1	B	163	GLN	3.0
1	B	205	LEU	3.0
1	A	74	THR	3.0
1	B	142	LEU	2.9
1	A	63	HIS	2.9
1	A	60	LEU	2.9
1	B	76	GLU	2.8
1	A	142	LEU	2.8
1	A	191	ARG	2.8
1	B	225	ARG	2.7
1	B	271	GLY	2.6
1	A	71	LEU	2.5
1	B	200	ASP	2.4
1	B	227	ASN	2.4
1	B	283	VAL	2.4
1	A	50	LYS	2.4
1	B	138	HIS	2.3
1	A	158	THR	2.3
1	A	287	LYS	2.3
1	A	58	LEU	2.3
1	B	209	LEU	2.3
1	B	276	LEU	2.3
1	B	160	ILE	2.2
1	B	106	THR	2.2
1	B	146	LEU	2.2
1	B	124	TYR	2.2
1	A	23	GLU	2.2
1	A	114	GLU	2.2
1	A	75	GLY	2.2
1	B	287	LYS	2.2
1	A	42	LEU	2.1
1	A	43	VAL	2.1
1	A	260	PHE	2.1
1	A	205	LEU	2.1
1	B	223	LEU	2.1
1	A	113	LYS	2.1
1	A	35	PHE	2.0
1	B	101	PHE	2.0

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Mol	Chain	Res	Type	RSRZ
1	B	237	PRO	2.0
1	B	246	LEU	2.0
1	B	266	ARG	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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.