



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 22, 2023 – 10:34 AM EDT

PDB ID : 2R1D
Title : Crystal structure of rat neurexin 1beta in the Ca²⁺ containing form
Authors : Rudenko, G.
Deposited on : 2007-08-22
Resolution : 2.60 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 2.35
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) : 2.35

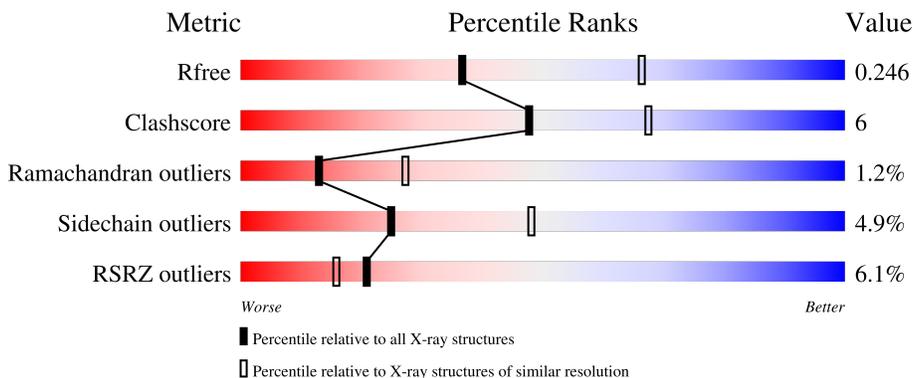
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.60 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	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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 $\leq 5\%$. 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	226	 2% 70% 8% 19%
1	B	226	 2% 65% 13% 20%
1	C	226	 2% 67% 12% 19%
1	D	226	 2% 70% 8% 21%
1	E	226	 3% 63% 16% 19%

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Mol	Chain	Length	Quality of chain
1	F	226	<p>4% 65% 14% 21%</p>
1	G	226	<p>1% 63% 17% 19%</p>
1	H	226	<p>2% 65% 12% 22%</p>
1	I	226	<p>25% 55% 9% 33%</p>
1	W	226	<p>3% 97%</p>

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 12217 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 Neurexin-1-beta.

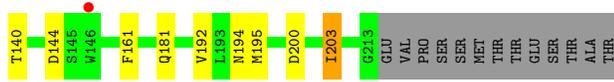
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	182	Total 1373	C 866	N 241	O 265	S 1	0	0	0
1	B	180	Total 1359	C 857	N 240	O 261	S 1	0	0	0
1	C	183	Total 1378	C 869	N 242	O 266	S 1	0	0	0
1	D	179	Total 1357	C 855	N 241	O 260	S 1	0	0	0
1	E	182	Total 1364	C 860	N 240	O 263	S 1	0	0	0
1	F	178	Total 1343	C 847	N 236	O 259	S 1	0	0	0
1	G	182	Total 1382	C 871	N 247	O 263	S 1	0	0	0
1	H	176	Total 1340	C 843	N 239	O 257	S 1	0	0	0
1	I	151	Total 1150	C 734	N 199	O 216	S 1	0	0	0
1	W	7	Total 55	C 35	N 13	O 7		0	0	0

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

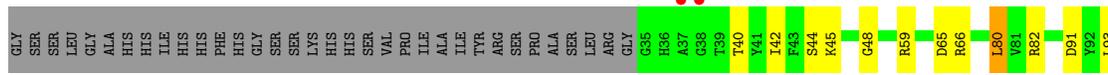
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total 1	Ca 1	0	0
2	D	1	Total 1	Ca 1	0	0
2	I	1	Total 1	Ca 1	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	6	Total O 6 6	0	0
3	B	22	Total O 22 22	0	0
3	C	7	Total O 7 7	0	0
3	D	20	Total O 20 20	0	0
3	E	11	Total O 11 11	0	0
3	F	16	Total O 16 16	0	0
3	G	18	Total O 18 18	0	0
3	H	10	Total O 10 10	0	0
3	I	3	Total O 3 3	0	0



● Molecule 1: Neurexin-1-beta



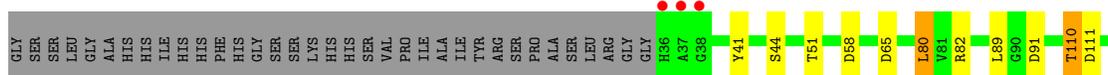
● Molecule 1: Neurexin-1-beta



● Molecule 1: Neurexin-1-beta



● Molecule 1: Neurexin-1-beta



● Molecule 1: Neurexin-1-beta

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	116.68Å 195.72Å 103.87Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.60 40.63 – 2.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (20.00-2.60) 99.6 (40.63-2.60)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.26 (at 2.61Å)	Xtrriage
Refinement program	REFMAC 5.2	Depositor
R, R_{free}	0.203 , 0.244 0.206 , 0.246	Depositor DCC
R_{free} test set	3755 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	38.0	Xtrriage
Anisotropy	0.555	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 56.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	12217	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 30.00 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.4078e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: CA

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	0.66	0/1400	0.84	1/1901 (0.1%)
1	B	0.85	0/1385	0.96	5/1878 (0.3%)
1	C	0.67	0/1405	0.83	2/1908 (0.1%)
1	D	0.77	0/1383	0.88	3/1876 (0.2%)
1	E	0.67	0/1390	0.88	4/1889 (0.2%)
1	F	0.76	1/1369 (0.1%)	0.99	5/1860 (0.3%)
1	G	0.75	0/1409	0.91	3/1912 (0.2%)
1	H	0.72	0/1366	0.90	7/1855 (0.4%)
1	I	1.35	5/1168 (0.4%)	0.78	3/1578 (0.2%)
1	W	0.77	0/57	0.94	0/76
All	All	0.81	6/12332 (0.0%)	0.89	33/16733 (0.2%)

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	I	44	SER	C-O	27.59	1.75	1.23
1	I	211	LEU	C-O	27.58	1.75	1.23
1	I	49	GLN	CA-CB	10.19	1.76	1.53
1	I	39	THR	C-O	5.42	1.33	1.23
1	F	212	VAL	C-O	5.22	1.33	1.23

The worst 5 of 33 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	212	VAL	CA-C-O	13.62	148.70	120.10
1	E	112	ASP	CB-CG-OD2	9.08	126.47	118.30
1	B	151	ARG	NE-CZ-NH2	-7.41	116.59	120.30
1	A	58	ASP	CB-CG-OD2	7.19	124.77	118.30
1	E	65	ASP	CB-CG-OD2	6.66	124.29	118.30

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	1373	0	1338	16	0
1	B	1359	0	1332	18	0
1	C	1378	0	1345	22	0
1	D	1357	0	1331	9	0
1	E	1364	0	1321	19	0
1	F	1343	0	1306	18	0
1	G	1382	0	1360	23	0
1	H	1340	0	1305	9	0
1	I	1150	0	1116	14	0
1	W	55	0	50	2	0
2	B	1	0	0	0	0
2	D	1	0	0	0	0
2	I	1	0	0	0	0
3	A	6	0	0	0	0
3	B	22	0	0	1	0
3	C	7	0	0	0	0
3	D	20	0	0	0	0
3	E	11	0	0	0	0
3	F	16	0	0	1	0
3	G	18	0	0	0	0
3	H	10	0	0	1	0
3	I	3	0	0	0	0
All	All	12217	0	11804	146	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 6.

The worst 5 of 146 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:I:49:GLN:CA	1:I:49:GLN:CB	1.76	1.62
1:I:44:SER:C	1:I:44:SER:O	1.75	1.24

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:I:211:LEU:C	1:I:211:LEU:O	1.75	1.24
1:C:192:VAL:HA	1:C:195:MET:HE3	1.30	1.09
1:G:192:VAL:HA	1:G:195:MET:HE3	1.34	1.05

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	180/226 (80%)	170 (94%)	8 (4%)	2 (1%)	14	30
1	B	178/226 (79%)	167 (94%)	9 (5%)	2 (1%)	14	30
1	C	181/226 (80%)	174 (96%)	5 (3%)	2 (1%)	14	30
1	D	177/226 (78%)	170 (96%)	6 (3%)	1 (1%)	25	47
1	E	180/226 (80%)	170 (94%)	7 (4%)	3 (2%)	9	18
1	F	176/226 (78%)	164 (93%)	9 (5%)	3 (2%)	9	18
1	G	180/226 (80%)	173 (96%)	6 (3%)	1 (1%)	25	47
1	H	174/226 (77%)	161 (92%)	11 (6%)	2 (1%)	14	30
1	I	139/226 (62%)	128 (92%)	9 (6%)	2 (1%)	11	22
1	W	5/226 (2%)	2 (40%)	2 (40%)	1 (20%)	0	0
All	All	1570/2260 (70%)	1479 (94%)	72 (5%)	19 (1%)	13	27

5 of 19 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	F	87	SER
1	I	174	GLN
1	A	174	GLN
1	B	213	GLY

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Mol	Chain	Res	Type
1	E	45	LYS

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	143/182 (79%)	138 (96%)	5 (4%)	36 62
1	B	141/182 (78%)	135 (96%)	6 (4%)	29 54
1	C	143/182 (79%)	136 (95%)	7 (5%)	25 48
1	D	141/182 (78%)	135 (96%)	6 (4%)	29 54
1	E	140/182 (77%)	131 (94%)	9 (6%)	17 35
1	F	139/182 (76%)	132 (95%)	7 (5%)	24 47
1	G	144/182 (79%)	139 (96%)	5 (4%)	36 62
1	H	139/182 (76%)	132 (95%)	7 (5%)	24 47
1	I	119/182 (65%)	111 (93%)	8 (7%)	16 33
1	W	5/182 (3%)	3 (60%)	2 (40%)	0 0
All	All	1254/1820 (69%)	1192 (95%)	62 (5%)	25 48

5 of 62 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	140	THR
1	I	142	GLN
1	F	121	ILE
1	I	89	LEU
1	I	209	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 19 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	123	ASN
1	I	96	HIS

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Mol	Chain	Res	Type
1	I	176	GLN
1	G	96	HIS
1	D	96	HIS

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](#)

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

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 [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	182/226 (80%)	0.09	3 (1%) 72 68	34, 39, 47, 59	0
1	B	180/226 (79%)	0.04	4 (2%) 62 56	34, 39, 50, 71	0
1	C	183/226 (80%)	0.11	3 (1%) 72 68	32, 39, 50, 61	0
1	D	179/226 (79%)	0.08	5 (2%) 53 46	33, 39, 51, 71	0
1	E	182/226 (80%)	0.19	6 (3%) 46 39	32, 39, 47, 56	0
1	F	178/226 (78%)	0.15	8 (4%) 33 26	32, 39, 48, 55	0
1	G	182/226 (80%)	0.10	2 (1%) 80 78	35, 39, 49, 59	0
1	H	176/226 (77%)	0.29	4 (2%) 60 54	32, 39, 48, 55	0
1	I	151/226 (66%)	1.70	57 (37%) 0 0	35, 39, 43, 44	0
1	W	7/226 (3%)	3.05	6 (85%) 0 0	59, 63, 74, 77	0
All	All	1600/2260 (70%)	0.29	98 (6%) 21 16	32, 39, 49, 77	0

The worst 5 of 98 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	I	41	TYR	8.3
1	C	154	ALA	7.2
1	W	9	ILE	5.4
1	I	194	ASN	5.1
1	I	186	TYR	4.6

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(\AA^2)	Q<0.9
2	CA	B	1000	1/1	0.84	0.16	50,50,50,50	0
2	CA	I	3000	1/1	0.89	0.06	33,33,33,33	0
2	CA	D	2000	1/1	0.96	0.08	46,46,46,46	0

6.5 Other polymers [i](#)

There are no such residues in this entry.