



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 07:47 PM UTC

PDB ID : 1STS / pdb_00001sts
Title : STREPTAVIDIN DIMERIZED BY DISULFIDE-BONDED PEPTIDE
FCHPQNT-NH2 DIMER
Authors : Katz, B.A.; Cass, R.T.; Liu, B.; Arze, R.; Collins, N.
Deposited on : 1995-09-12
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 : 4-5-2 with Phenix2.0
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

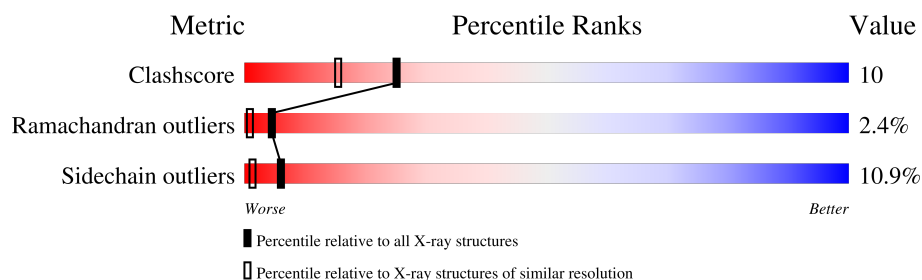
1 Overall quality at a glance

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))
Clashscore	190562	3612 (1.96-1.96)
Ramachandran outliers	187476	3587 (1.96-1.96)
Sidechain outliers	187428	3587 (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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	B	123	 64% 29% 6% •
1	D	123	 61% 31% 5% • •
2	M	8	 62% 25% 12%
2	P	8	 25% 25% 38% 12%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2904 atoms, of which 787 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 STREPTAVIDIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	123	Total	C	H	N	O	8	3	0
			1156	588	222	159	187			
1	D	121	Total	C	H	N	O	15	4	0
			1139	575	221	158	185			

- Molecule 2 is a protein called FCHPQNT-NH2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	M	7	Total	C	H	N	O	S	8	0	1
			60	27	12	11	9	1			
2	P	8	Total	C	H	N	O	S	0	0	1
			75	36	16	12	10	1			

- Molecule 3 is water.

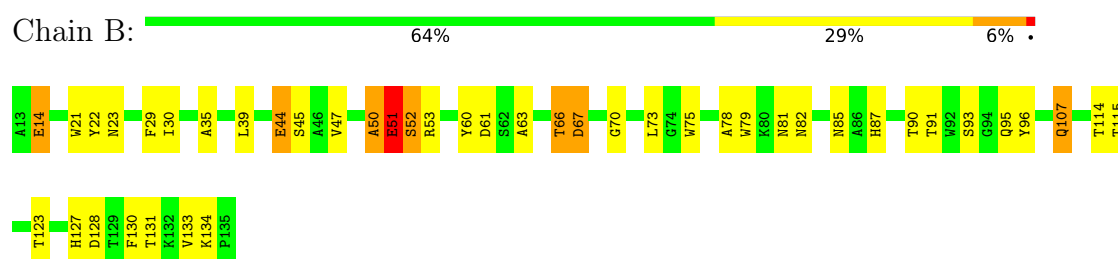
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	79	Total	H	O	0	0
			237	158	79		
3	D	73	Total	H	O	0	0
			219	146	73		
3	M	2	Total	H	O	0	0
			6	4	2		
3	P	4	Total	H	O	0	0
			12	8	4		

3 Residue-property plots [i](#)

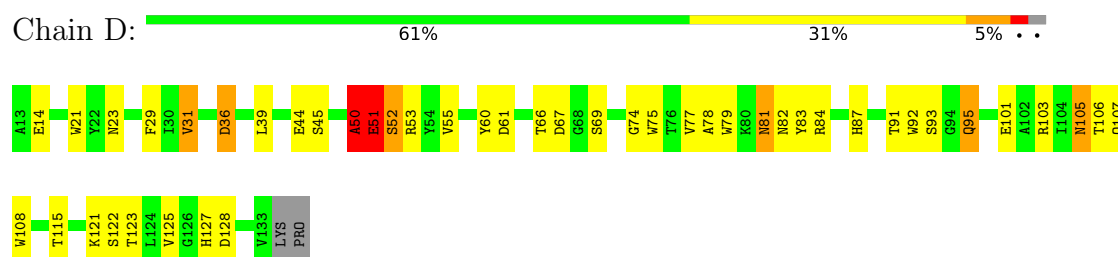
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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.

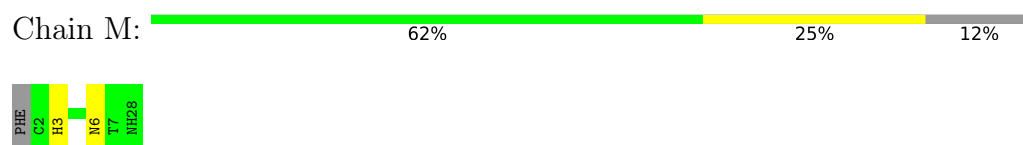
• Molecule 1: STREPTAVIDIN



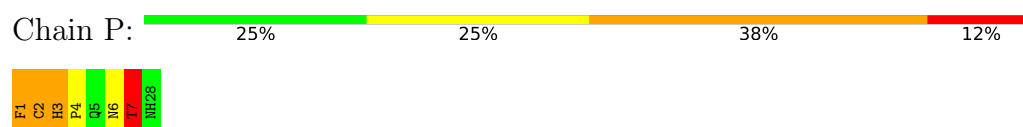
• Molecule 1: STREPTAVIDIN



• Molecule 2: FCHPQNT-NH2



• Molecule 2: FCHPQNT-NH2



4 Data and refinement statistics

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

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	97.84Å 105.79Å 49.08Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	7.50 – 1.95	Depositor
% Data completeness (in resolution range)	72.2 (7.50-1.95)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.191 , 0.238	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2904	wwPDB-VP
Average B, all atoms (Å ²)	16.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NH2

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	B	1.27	2/936 (0.2%)	2.13	36/1277 (2.8%)
1	D	1.25	3/922 (0.3%)	2.22	47/1259 (3.7%)
2	M	1.56	1/48 (2.1%)	2.78	4/65 (6.2%)
2	P	1.40	1/60 (1.7%)	2.93	7/81 (8.6%)
All	All	1.28	7/1966 (0.4%)	2.22	94/2682 (3.5%)

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	B	0	3
1	D	0	3
All	All	0	6

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	127	HIS	CD2-NE2	-6.71	1.30	1.37
2	M	3	HIS	CD2-NE2	-6.50	1.30	1.37
1	B	87	HIS	CD2-NE2	-6.18	1.31	1.37
1	D	125	VAL	CA-CB	5.87	1.63	1.54
1	D	127	HIS	CD2-NE2	-5.77	1.31	1.37
1	D	79	TRP	CA-CB	5.69	1.60	1.52
2	P	3	HIS	CD2-NE2	-5.43	1.31	1.37

All (94) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	51	GLU	N-CA-C	13.46	136.56	107.49
1	D	52	SER	N-CA-C	-11.46	96.33	114.09
1	B	128	ASP	CA-CB-CG	10.76	123.36	112.60
1	D	128	ASP	CA-CB-CG	10.75	123.35	112.60
1	B	23	ASN	CA-CB-CG	10.59	123.19	112.60
1	B	52	SER	N-CA-C	-10.58	97.69	114.09
2	P	1	PHE	CA-CB-CG	10.09	123.89	113.80
2	M	3	HIS	ND1-CG-CD2	9.02	115.12	106.10
1	D	31	VAL	CB-CA-C	-8.80	96.60	110.69
1	B	29	PHE	CA-CB-CG	8.79	122.59	113.80
1	D	67	ASP	CA-CB-CG	8.15	120.75	112.60
1	D	51	GLU	CA-C-O	7.99	131.94	120.51
1	D	106	THR	N-CA-C	7.72	121.15	109.41
1	D	92	TRP	CG-CD2-CE3	7.65	141.55	133.90
1	D	61	ASP	CA-CB-CG	7.60	120.20	112.60
1	D	123	THR	N-CA-C	7.54	121.18	108.90
1	B	85	ASN	OD1-CG-ND2	-7.48	115.12	122.60
1	D	82	ASN	N-CA-C	7.45	122.19	113.18
1	D	95	GLN	OE1-CD-NE2	-7.43	115.17	122.60
1	D	92	TRP	CB-CG-CD1	-7.34	115.89	126.90
2	P	6	ASN	O-C-N	7.34	132.21	123.33
1	D	51	GLU	CB-CG-CD	7.29	124.98	112.60
1	D	31	VAL	N-CA-C	7.25	120.68	108.86
1	D	23	ASN	CA-CB-CG	7.25	119.85	112.60
1	D	51	GLU	CA-CB-CG	-7.23	99.65	114.10
1	D	107[1]	GLN	O-C-N	-7.18	113.82	123.15
1	D	107[2]	GLN	O-C-N	-7.18	113.82	123.15
1	D	78	ALA	N-CA-C	-7.14	97.60	109.24
1	B	67	ASP	CA-CB-CG	7.05	119.65	112.60
1	B	63	ALA	CA-C-N	7.04	127.03	119.78
1	B	63	ALA	C-N-CA	7.04	127.03	119.78
1	D	93	SER	O-C-N	-6.87	115.27	123.31
1	D	36	ASP	N-CA-C	6.76	120.42	112.72
2	M	6	ASN	OD1-CG-ND2	-6.71	115.89	122.60
1	D	29	PHE	CA-CB-CG	6.65	120.45	113.80
1	D	50	ALA	N-CA-C	6.61	124.89	110.80
1	B	78	ALA	N-CA-C	-6.56	99.01	109.76
1	D	79	TRP	N-CA-C	6.48	119.69	110.68
1	B	79	TRP	N-CA-C	6.40	119.21	109.62
1	B	107	GLN	CG-CD-NE2	6.39	125.98	116.40
1	B	44	GLU	CA-CB-CG	6.37	126.84	114.10
1	B	61	ASP	CA-CB-CG	6.30	118.90	112.60
1	B	127	HIS	CB-CG-CD2	-6.26	123.06	131.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	84	ARG	N-CA-C	6.24	118.66	109.24
1	D	108	TRP	CG-CD2-CE3	6.21	140.11	133.90
2	P	3	HIS	N-CA-C	-6.16	96.20	109.81
1	B	50	ALA	CA-C-N	-6.12	113.29	123.33
1	B	50	ALA	C-N-CA	-6.12	113.29	123.33
1	B	35	ALA	N-CA-C	6.10	120.33	113.01
1	B	123	THR	N-CA-C	6.09	118.82	108.90
1	B	51	GLU	CA-C-O	6.00	130.87	120.85
1	B	30	ILE	O-C-N	-5.99	116.89	123.18
2	P	3	HIS	CA-CB-CG	-5.93	107.87	113.80
2	M	3	HIS	CG-CD2-NE2	-5.92	101.28	107.20
2	M	6	ASN	CA-CB-CG	5.87	118.47	112.60
1	B	87	HIS	CB-CG-CD2	-5.81	123.65	131.20
1	D	74	GLY	CA-C-O	-5.72	115.40	121.29
1	D	67	ASP	N-CA-C	-5.71	101.50	110.36
1	D	108	TRP	CB-CG-CD1	-5.71	118.33	126.90
1	B	75	TRP	CE2-CD2-CG	-5.71	100.35	107.20
1	D	127	HIS	CB-CG-CD2	-5.68	123.82	131.20
1	D	81	ASN	CA-CB-CG	5.67	118.27	112.60
1	D	122	SER	N-CA-C	5.61	119.85	112.89
1	B	47	VAL	N-CA-C	-5.61	104.04	111.05
1	D	69	SER	N-CA-C	5.59	117.90	110.53
1	B	51	GLU	CB-CG-CD	5.58	122.09	112.60
1	D	87	HIS	CB-CG-CD2	-5.58	123.95	131.20
1	D	51	GLU	CA-C-N	5.53	130.23	121.44
1	D	51	GLU	C-N-CA	5.53	130.23	121.44
1	D	75	TRP	CA-C-N	5.53	131.48	122.81
1	D	75	TRP	C-N-CA	5.53	131.48	122.81
1	B	75	TRP	CG-CD2-CE3	5.48	139.38	133.90
2	P	3	HIS	N-CA-CB	5.44	120.05	110.37
1	B	93	SER	CA-CB-OG	5.43	121.96	111.10
2	P	7	THR	N-CA-CB	-5.43	102.26	111.50
1	D	21	TRP	CG-CD2-CE3	5.41	139.31	133.90
1	B	21	TRP	CG-CD2-CE3	5.41	139.31	133.90
1	D	87	HIS	N-CA-C	5.30	118.51	111.30
1	B	82	ASN	OD1-CG-ND2	-5.26	117.34	122.60
1	D	50	ALA	CA-C-N	5.25	131.58	121.54
1	D	50	ALA	C-N-CA	5.25	131.58	121.54
2	P	3	HIS	ND1-CG-CD2	5.24	111.34	106.10
1	D	77	VAL	CB-CA-C	-5.23	103.01	110.12
1	D	92	TRP	CE2-CD2-CG	-5.23	100.93	107.20
1	B	82	ASN	CB-CG-ND2	5.21	124.21	116.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	55	VAL	N-CA-C	5.21	116.29	109.21
1	B	73[1]	LEU	CA-C-O	-5.16	115.71	121.23
1	B	73[2]	LEU	CA-C-O	-5.16	115.71	121.23
1	B	85	ASN	CB-CG-ND2	5.15	124.13	116.40
1	D	60	TYR	O-C-N	-5.12	116.98	123.17
1	B	90	THR	CA-C-O	-5.11	115.30	120.71
1	D	29	PHE	CB-CA-C	5.08	118.26	110.14
1	B	115	THR	N-CA-C	-5.07	103.25	110.59
1	B	21	TRP	CE2-CD2-CG	-5.02	101.17	107.20

There are no chirality outliers.

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	134	LYS	Peptide
1	B	51	GLU	Mainchain
1	B	96	TYR	Sidechain
1	D	105[1]	ASN	Sidechain
1	D	105[2]	ASN	Sidechain
1	D	51	GLU	Mainchain

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	B	934	222	878	16	1
1	D	918	221	859	21	0
2	M	48	12	39	0	0
2	P	59	16	51	1	0
3	B	79	158	0	2	1
3	D	73	146	0	0	0
3	M	2	4	0	0	0
3	P	4	8	0	0	0
All	All	2117	787	1827	36	1

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 10.

All (36) 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:D:105[1]:ASN:HB3	1:D:105[1]:ASN:OD1	1.22	1.33
1:D:105[2]:ASN:ND2	1:D:105[2]:ASN:HB2	1.56	1.18
1:B:22[2]:TYR:CD1	3:B:852:HOH:O	2.02	1.09
1:D:105[1]:ASN:CB	1:D:105[1]:ASN:ND2	2.20	1.05
1:D:105[2]:ASN:HB2	1:D:105[2]:ASN:OD1	1.61	0.99
1:B:22[2]:TYR:CE1	1:B:131:THR:HB	2.04	0.91
1:D:105[1]:ASN:HB3	1:D:105[1]:ASN:ND2	1.84	0.91
1:D:105[1]:ASN:OD1	1:D:105[1]:ASN:CB	2.18	0.88
1:D:105[2]:ASN:OD1	1:D:105[2]:ASN:CB	2.24	0.85
1:B:22[2]:TYR:HD1	3:B:852:HOH:O	1.50	0.84
1:D:105[2]:ASN:ND2	1:D:105[2]:ASN:OD1	2.15	0.79
1:B:22[2]:TYR:HE2	1:B:133:VAL:HB	1.47	0.78
1:D:105[1]:ASN:ND2	1:D:105[1]:ASN:HB2	1.98	0.77
1:D:105[2]:ASN:ND2	1:D:105[2]:ASN:CB	2.43	0.75
1:D:105[1]:ASN:OD1	1:D:105[1]:ASN:ND2	2.22	0.72
1:B:114:THR:H	1:D:95:GLN:HE22	1.38	0.71
1:B:22[1]:TYR:HE2	1:B:133:VAL:HG11	1.58	0.67
1:B:22[2]:TYR:CE2	1:B:133:VAL:HB	2.29	0.66
1:B:50:ALA:HA	1:B:53:ARG:HH21	1.62	0.64
1:B:14:GLU:HB3	1:B:60:TYR:OH	2.02	0.60
1:B:22[1]:TYR:CE2	1:B:133:VAL:HG11	2.39	0.57
1:D:51:GLU:HG2	1:D:83:TYR:CD1	2.39	0.57
1:D:51:GLU:HA	1:D:53:ARG:H	1.71	0.56
1:D:51:GLU:HG2	1:D:83:TYR:CE1	2.41	0.55
1:D:105[1]:ASN:ND2	1:D:105[1]:ASN:CG	2.68	0.52
1:D:44:GLU:HB3	1:D:53:ARG:HG2	1.93	0.50
1:B:70:GLY:HA3	1:B:95:GLN:HE21	1.78	0.48
1:D:50:ALA:O	1:D:51:GLU:HB2	2.15	0.47
1:B:91:THR:HB	1:D:91:THR:HB	1.97	0.46
1:B:44:GLU:HA	1:B:52:SER:O	2.15	0.46
1:B:51:GLU:HG2	1:B:81:ASN:ND2	2.32	0.44
1:B:133:VAL:O	1:B:133:VAL:HG22	2.17	0.43
1:D:44:GLU:HA	1:D:52:SER:O	2.20	0.42
1:D:51:GLU:HG3	1:D:81:ASN:ND2	2.35	0.41
2:P:3:HIS:CE1	2:P:4:PRO:HD2	2.56	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:22[2]:TYR:CE1	3:B:852:HOH:O[3_655]	1.93	0.27

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	B	124/123 (101%)	118 (95%)	5 (4%)	1 (1%)	16	8
1	D	123/123 (100%)	112 (91%)	8 (6%)	3 (2%)	4	1
2	M	5/8 (62%)	5 (100%)	0	0	100	100
2	P	6/8 (75%)	4 (67%)	0	2 (33%)	0	0
All	All	258/262 (98%)	239 (93%)	13 (5%)	6 (2%)	4	1

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	66	THR
1	D	14	GLU
1	D	51	GLU
2	P	2	CYS
2	P	7	THR
1	D	50	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	B	87/90 (97%)	80 (92%)	7 (8%)	11	3
1	D	84/90 (93%)	74 (88%)	10 (12%)	5	1
2	M	6/7 (86%)	6 (100%)	0	100	100
2	P	7/7 (100%)	4 (57%)	3 (43%)	0	0
All	All	184/194 (95%)	164 (89%)	20 (11%)	6	1

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	14	GLU
1	B	39	LEU
1	B	45	SER
1	B	51	GLU
1	B	66	THR
1	B	67	ASP
1	B	107	GLN
1	D	31	VAL
1	D	36	ASP
1	D	39	LEU
1	D	45	SER
1	D	51	GLU
1	D	66	THR
1	D	101	GLU
1	D	103	ARG
1	D	115	THR
1	D	121	LYS
2	P	1	PHE
2	P	2	CYS
2	P	7	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	95	GLN
1	D	95	GLN
1	D	118	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 oligosaccharides 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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.