Full wwPDB X-ray Structure Validation Report ⓘ

May 23, 2020 – 12:23 pm BST

PDB ID	:	2X11
Title	:	Crystal structure of the complete EphA2 ectodomain in complex with ephrin A5 receptor binding domain
Authors	:	Seiradake, E.; Harlos, K.; Sutton, G.; Aricescu, A.R.; Jones, E.Y.
Deposited on	:	2009-12-21
Resolution	:	4.83 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 following versions of software and data (see references ⓘ) were used in the production of this report:

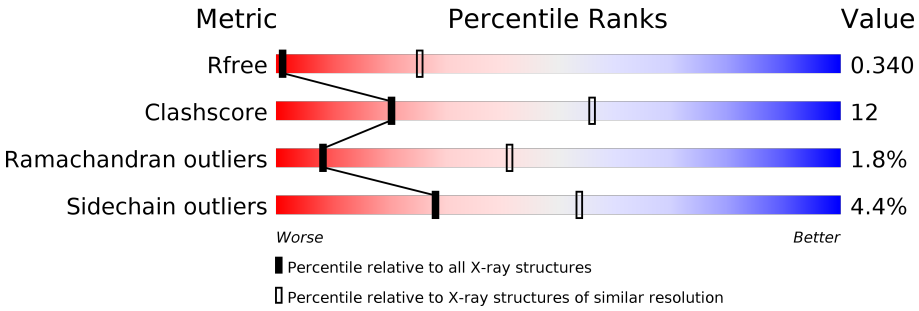
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 4.83 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	1098 (5.82-3.80)
Clashscore	141614	1172 (5.82-3.80)
Ramachandran outliers	138981	1107 (5.82-3.80)
Sidechain outliers	138945	1087 (5.82-3.80)

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 on 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%

Mol	Chain	Length	Quality of chain
1	A	545	65% 23% • 10%
2	B	177	54% 23% • • 21%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 4889 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 EPHRIN TYPE-A RECEPTOR 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	488	3738	2358	628	724	28	0	2	0

- Molecule 2 is a protein called EPHRIN-A5.

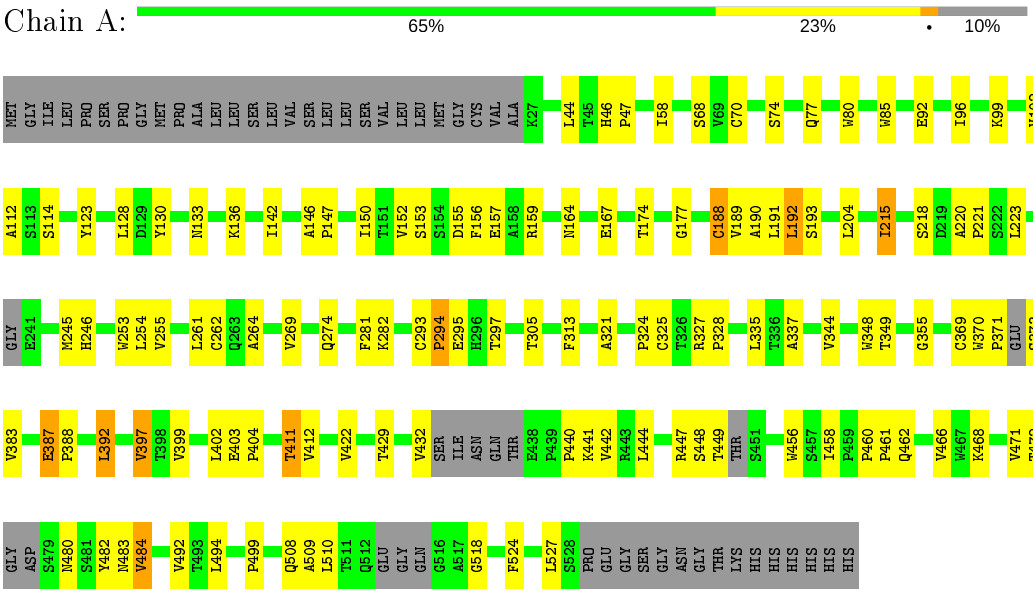
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	139	1151	736	199	208	8	0	0	1

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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.

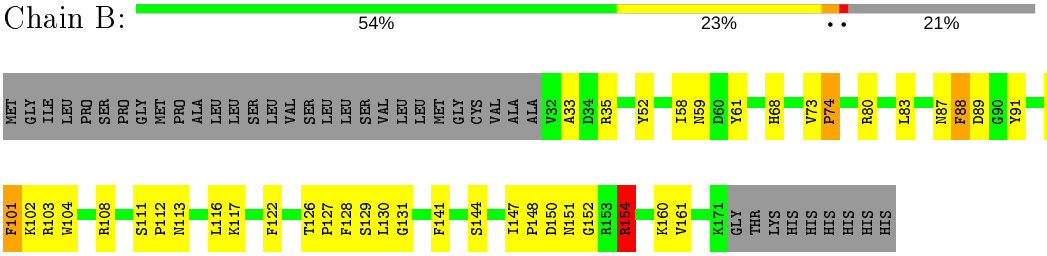
- Molecule 1: EPHRIN TYPE-A RECEPTOR 2

Chain A:



- Molecule 2: EPHRIN-A5

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	173.63Å 59.63Å 112.16Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.48 – 4.83 49.15 – 4.83	Depositor EDS
% Data completeness (in resolution range)	93.7 (40.48-4.83) 99.8 (49.15-4.83)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.03 (at 4.86Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, R_{free}	0.312 , 0.314 0.316 , 0.340	Depositor DCC
R_{free} test set	275 reflections (4.57%)	wwPDB-VP
Wilson B-factor (Å^2)	180.0	Xtriage
Anisotropy	0.319	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.21 , 170.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.80	EDS
Total number of atoms	4889	wwPDB-VP
Average B, all atoms (Å^2)	247.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.52% 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

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	0.22	0/3834	0.42	0/5226
2	B	0.27	0/1190	0.43	0/1612
All	All	0.23	0/5024	0.42	0/6838

There are no bond length outliers.

There are no bond angle outliers.

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	3738	0	3490	88	0
2	B	1151	0	1068	44	0
All	All	4889	0	4558	117	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 12.

All (117) 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)
2:B:126:THR:HG21	2:B:131:GLY:HA3	1.24	1.11
1:A:159:ARG:HA	2:B:130:LEU:CD1	1.89	1.02

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:159:ARG:HA	2:B:130:LEU:HD13	1.45	0.98
1:A:92:GLU:HB3	1:A:218:SER:HB2	1.51	0.93
1:A:156:PHE:O	2:B:130:LEU:HD21	1.70	0.91
2:B:154:ARG:HB2	2:B:154:ARG:HH11	1.37	0.90
2:B:87:ASN:OD1	2:B:99:LYS:HB3	1.80	0.81
1:A:293:CYS:HB3	1:A:297:THR:HG21	1.63	0.78
1:A:237:PRO:HD2	1:A:238:PRO:HD3	1.67	0.76
1:A:68:SER:HB2	2:B:127:PRO:HB2	1.69	0.75
2:B:126:THR:HG22	2:B:128:PHE:H	1.53	0.74
1:A:190:ALA:HB3	2:B:128:PHE:HD2	1.53	0.73
2:B:35:ARG:HG2	2:B:61:TYR:HB2	1.69	0.73
1:A:156:PHE:HA	2:B:130:LEU:HG	1.71	0.72
1:A:295:GLU:HB2	1:A:324:PRO:HB3	1.71	0.72
1:A:370:TRP:HB3	1:A:373:SER:HB3	1.71	0.71
1:A:103:ARG:HB3	1:A:188:CYS:HB3	1.76	0.65
2:B:141:PHE:CE2	2:B:160:LYS:HG3	2.32	0.65
2:B:126:THR:HG21	2:B:131:GLY:CA	2.16	0.64
1:A:215:ILE:N	1:A:215:ILE:HD13	2.11	0.64
2:B:88:PHE:O	2:B:91:TYR:N	2.32	0.62
1:A:237:PRO:CD	1:A:238:PRO:HD3	2.29	0.61
1:A:269:VAL:HB	1:A:274:GLN:HG3	1.82	0.61
1:A:335:LEU:HD22	1:A:412:VAL:HG12	1.84	0.59
2:B:80:ARG:HB3	2:B:147:ILE:HD12	1.83	0.59
1:A:153:SER:O	1:A:156:PHE:HB2	2.02	0.59
1:A:246:HIS:ND1	1:A:255:VAL:HG23	2.18	0.59
2:B:151:ASN:HB3	2:B:154:ARG:HH22	1.68	0.58
1:A:411:THR:HG22	1:A:429:THR:HG22	1.86	0.57
1:A:460:PRO:N	1:A:461:PRO:HD2	2.19	0.57
1:A:58:ILE:HG21	2:B:102:LYS:NZ	2.20	0.56
1:A:159:ARG:HA	2:B:130:LEU:HD11	1.83	0.56
1:A:380:GLU:O	1:A:383:VAL:HG22	2.05	0.56
1:A:448:SER:O	1:A:449:THR:HB	2.05	0.56
1:A:99:LYS:HB2	1:A:193:SER:HB3	1.85	0.56
2:B:154:ARG:HB2	2:B:154:ARG:NH1	2.15	0.56
1:A:223:LEU:HD21	1:A:254:LEU:HD12	1.87	0.56
1:A:482:TYR:N	1:A:482:TYR:CD2	2.74	0.55
2:B:58:ILE:O	2:B:59:ASN:HB2	2.06	0.55
1:A:473:TYR:CE2	1:A:483:ASN:HB2	2.41	0.55
2:B:102:LYS:NZ	2:B:102:LYS:HB3	2.21	0.55
1:A:508:GLN:HA	1:A:518:GLY:HA2	1.88	0.55
1:A:344:VAL:CG2	1:A:399:VAL:HB	2.37	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:159:ARG:CA	2:B:130:LEU:CD1	2.76	0.54
1:A:102:VAL:HG21	1:A:147:PRO:HG3	1.90	0.53
1:A:245:MET:HB3	1:A:253:TRP:CE3	2.44	0.53
1:A:293:CYS:HB3	1:A:297:THR:CG2	2.38	0.52
2:B:97:THR:O	2:B:99:LYS:HD3	2.08	0.52
2:B:122:PHE:CE1	2:B:161:VAL:HG11	2.45	0.51
1:A:152:VAL:O	1:A:155:ASP:HB2	2.10	0.51
1:A:70:CYS:HB2	2:B:127:PRO:HG3	1.93	0.51
1:A:474:ARG:HG2	1:A:475:LYS:N	2.27	0.50
2:B:101:PHE:N	2:B:101:PHE:CD1	2.79	0.50
1:A:108:PHE:HZ	1:A:188:CYS:SG	2.34	0.50
2:B:126:THR:CG2	2:B:131:GLY:HA3	2.17	0.50
1:A:123:TYR:HB3	1:A:142:ILE:HD11	1.94	0.49
1:A:85:TRP:CZ2	1:A:177:GLY:HA3	2.47	0.49
1:A:444:LEU:HD11	1:A:524:PHE:HB3	1.95	0.49
1:A:440:PRO:HA	1:A:458:ILE:HG23	1.94	0.49
1:A:449:THR:OG1	1:A:499:PRO:HA	2.13	0.49
1:A:471:VAL:O	1:A:484:VAL:HA	2.13	0.48
1:A:344:VAL:HG22	1:A:402:LEU:HD11	1.96	0.48
1:A:328:PRO:HG2	1:A:422:VAL:HG11	1.96	0.48
1:A:190:ALA:HB3	2:B:128:PHE:CD2	2.42	0.48
1:A:112:ALA:C	1:A:114:SER:H	2.17	0.47
1:A:237:PRO:HG2	1:A:261:LEU:HD12	1.97	0.47
1:A:236:VAL:HA	1:A:237:PRO:HD3	1.58	0.47
2:B:83:LEU:HD22	2:B:144:SER:HB3	1.97	0.46
1:A:313:PHE:HB3	1:A:325:CYS:HB3	1.96	0.46
1:A:327:ARG:O	1:A:355:GLY:HA3	2.16	0.46
1:A:392:LEU:HD21	1:A:397:VAL:HG11	1.97	0.46
1:A:468:LYS:O	1:A:510:LEU:HB2	2.16	0.46
2:B:103:ARG:HG3	2:B:104:TRP:CE2	2.51	0.46
1:A:456:TRP:HZ3	1:A:492:VAL:HG22	1.80	0.45
1:A:70:CYS:HB2	2:B:127:PRO:CA	2.46	0.45
2:B:73:VAL:HA	2:B:74:PRO:HD3	1.82	0.45
1:A:220:ALA:N	1:A:221:PRO:HD2	2.31	0.45
2:B:128:PHE:CD1	2:B:129:SER:O	2.70	0.45
1:A:447:ARG:HG3	1:A:527:LEU:CD1	2.47	0.45
1:A:294:PRO:HG3	1:A:321:ALA:O	2.17	0.45
1:A:188:CYS:SG	2:B:127:PRO:HA	2.57	0.45
1:A:369:CYS:O	1:A:371:PRO:HD3	2.18	0.44
1:A:440:PRO:HA	1:A:458:ILE:CG2	2.47	0.44
1:A:264:ALA:HB1	1:A:305:THR:HG22	1.99	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:348:TRP:CZ3	1:A:397:VAL:HG22	2.53	0.43
1:A:344:VAL:HG23	1:A:399:VAL:HB	1.99	0.43
1:A:74:SER:HB2	1:A:77:GLN:NE2	2.33	0.43
1:A:96:ILE:O	1:A:167:GLU:HA	2.18	0.43
1:A:348:TRP:CH2	1:A:397:VAL:HG22	2.53	0.43
1:A:46:HIS:HA	1:A:47:PRO:C	2.39	0.42
2:B:108:ARG:HB2	2:B:116:LEU:HD12	2.00	0.42
1:A:337:ALA:HB1	1:A:432:VAL:CG2	2.49	0.42
1:A:215:ILE:CD1	1:A:215:ILE:N	2.74	0.42
1:A:262:CYS:O	1:A:282:LYS:NZ	2.52	0.42
1:A:281:PHE:CD1	1:A:281:PHE:C	2.93	0.42
1:A:189:VAL:HG12	1:A:190:ALA:N	2.33	0.42
1:A:472:THR:HG23	1:A:482:TYR:HD1	1.85	0.42
2:B:68:HIS:HE1	2:B:111:SER:O	2.03	0.42
2:B:116:LEU:HD23	2:B:117:LYS:N	2.35	0.42
1:A:254:LEU:HD23	1:A:254:LEU:HA	1.78	0.42
1:A:92:GLU:HB3	1:A:218:SER:CB	2.36	0.42
1:A:130:TYR:HB3	1:A:133:ASN:HB2	2.01	0.42
1:A:44:LEU:HD23	1:A:44:LEU:C	2.40	0.42
1:A:70:CYS:HB2	2:B:127:PRO:CG	2.51	0.41
2:B:147:ILE:N	2:B:148:PRO:HD2	2.35	0.41
2:B:88:PHE:O	2:B:89:ASP:C	2.59	0.41
2:B:141:PHE:N	2:B:141:PHE:CD1	2.88	0.41
1:A:387:GLU:HG3	1:A:388:PRO:HD2	2.02	0.41
1:A:466:VAL:HG12	1:A:509:ALA:HB1	2.03	0.41
1:A:80:TRP:NE1	1:A:136:LYS:HE3	2.35	0.41
2:B:126:THR:HA	2:B:127:PRO:HD3	1.74	0.41
1:A:99:LYS:HA	1:A:164:ASN:O	2.21	0.40
1:A:192:LEU:HD21	2:B:128:PHE:CE2	2.56	0.40
2:B:122:PHE:CZ	2:B:161:VAL:HG11	2.57	0.40
1:A:146:ALA:HA	1:A:147:PRO:HD3	1.92	0.40
1:A:403:GLU:HA	1:A:404:PRO:HD3	1.84	0.40
1:A:448:SER:HA	1:A:527:LEU:HD22	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	476/545 (87%)	436 (92%)	37 (8%)	3 (1%)	25 64
2	B	137/177 (77%)	123 (90%)	6 (4%)	8 (6%)	1 20
All	All	613/722 (85%)	559 (91%)	43 (7%)	11 (2%)	8 41

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	112	PRO
2	B	154	ARG
2	B	113	ASN
1	A	480	ASN
2	B	33	ALA
2	B	88	PHE
2	B	150	ASP
2	B	152	GLY
1	A	237	PRO
1	A	294	PRO
2	B	74	PRO

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	402/464 (87%)	382 (95%)	20 (5%)	24 50
2	B	127/159 (80%)	124 (98%)	3 (2%)	49 69

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	529/623 (85%)	506 (96%)	23 (4%)	28 54

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	128	LEU
1	A	150	ILE
1	A	157	GLU
1	A	174	THR
1	A	188	CYS
1	A	191	LEU
1	A	192	LEU
1	A	204	LEU
1	A	215	ILE
1	A	349	THR
1	A	379	CYS
1	A	387	GLU
1	A	392	LEU
1	A	397	VAL
1	A	411	THR
1	A	441	LYS
1	A	442	VAL
1	A	462	GLN
1	A	484	VAL
1	A	494	LEU
2	B	52	TYR
2	B	101	PHE
2	B	154	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	259	GLN
1	A	333	HIS
2	B	48	GLN
2	B	68	HIS

5.3.3 RNA

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers

Unable to reproduce the depositors R factor - this section is therefore empty.