



wwPDB X-ray Structure Validation Summary Report

Jan 20, 2024 – 03:37 pm GMT


PDB ID : 6ZLR
Title : Soaking competent crystal form of the SARS-CoV-2 Receptor Binding Domain (RBD):CR3022 complex.
Authors : de Nicola, G.F.; Nichols, C.E.
Deposited on : 2020-07-01
Resolution : 3.10 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
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
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) : 2.36

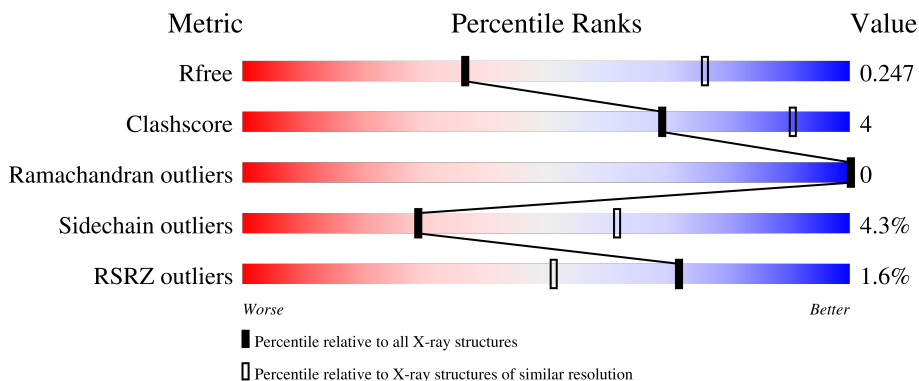
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.10 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.



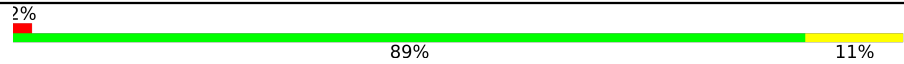

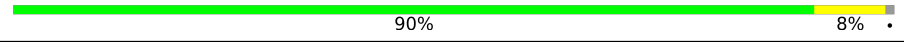

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1094 (3.10-3.10)
Clashscore	141614	1184 (3.10-3.10)
Ramachandran outliers	138981	1141 (3.10-3.10)
Sidechain outliers	138945	1141 (3.10-3.10)
RSRZ outliers	127900	1067 (3.10-3.10)

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	AAA	231	 3% 75% 9% 15%
1	DDD	231	 3% 77% 7% 15%
1	EEE	231	 4% 77% 8% 15%
2	BBB	222	 % 87% 12% .
2	FFF	222	 % 88% 11% .

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Mol	Chain	Length	Quality of chain
2	HHH	222	 2% 89% 11%
3	CCC	221	 89% 10%
3	GGG	221	 90% 8%
3	LLL	221	 89% 10%

2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 14736 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 Spike glycoprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	EEE	196	1548	992	258	290	8	0	0	0
1	AAA	196	1548	992	258	290	8	0	0	0
1	DDD	196	1548	992	258	290	8	0	0	0

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
EEE	542	SER	-	expression tag	UNP P0DTC2
EEE	543	GLY	-	expression tag	UNP P0DTC2
EEE	544	HIS	-	expression tag	UNP P0DTC2
EEE	545	HIS	-	expression tag	UNP P0DTC2
EEE	546	HIS	-	expression tag	UNP P0DTC2
EEE	547	HIS	-	expression tag	UNP P0DTC2
EEE	548	HIS	-	expression tag	UNP P0DTC2
EEE	549	HIS	-	expression tag	UNP P0DTC2
AAA	542	SER	-	expression tag	UNP P0DTC2
AAA	543	GLY	-	expression tag	UNP P0DTC2
AAA	544	HIS	-	expression tag	UNP P0DTC2
AAA	545	HIS	-	expression tag	UNP P0DTC2
AAA	546	HIS	-	expression tag	UNP P0DTC2
AAA	547	HIS	-	expression tag	UNP P0DTC2
AAA	548	HIS	-	expression tag	UNP P0DTC2
AAA	549	HIS	-	expression tag	UNP P0DTC2
DDD	542	SER	-	expression tag	UNP P0DTC2
DDD	543	GLY	-	expression tag	UNP P0DTC2
DDD	544	HIS	-	expression tag	UNP P0DTC2
DDD	545	HIS	-	expression tag	UNP P0DTC2
DDD	546	HIS	-	expression tag	UNP P0DTC2
DDD	547	HIS	-	expression tag	UNP P0DTC2
DDD	548	HIS	-	expression tag	UNP P0DTC2

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Chain	Residue	Modelled	Actual	Comment	Reference
DDD	549	HIS	-	expression tag	UNP P0DTC2

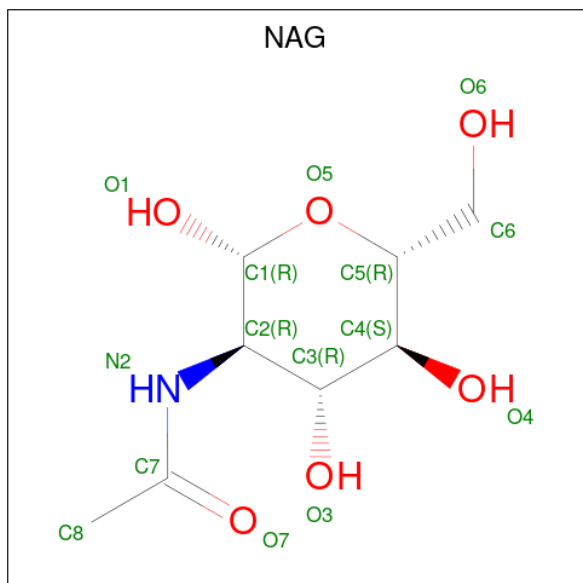
- Molecule 2 is a protein called CR3022 FAB HEAVY CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	HHH	222	Total 1647	C 1043	N 268	O 327	S 9	0	0	0
2	BBB	222	Total 1647	C 1043	N 268	O 327	S 9	0	0	0
2	FFF	222	Total 1647	C 1043	N 268	O 327	S 9	0	0	0

- Molecule 3 is a protein called CR3022 FAB LIGHT CHAIN.

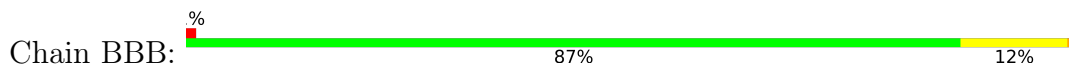
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	LLL	219	Total 1703	C 1070	N 282	O 347	S 4	0	0	0
3	CCC	219	Total 1703	C 1070	N 282	O 347	S 4	0	0	0
3	GGG	219	Total 1703	C 1070	N 282	O 347	S 4	0	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).

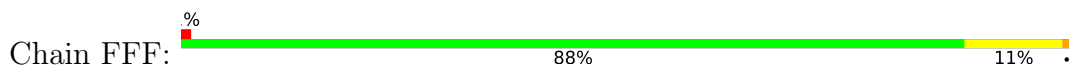


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	EEE	1	Total 14	C 8	N 1	O 5	0	0
4	AAA	1	Total 14	C 8	N 1	O 5	0	0
4	DDD	1	Total 14	C 8	N 1	O 5	0	0

- Molecule 2: CR3022 FAB HEAVY CHAIN



- Molecule 2: CR3022 FAB HEAVY CHAIN



- Molecule 3: CR3022 FAB LIGHT CHAIN



- Molecule 3: CR3022 FAB LIGHT CHAIN



- Molecule 3: CR3022 FAB LIGHT CHAIN



4 Data and refinement statistics i

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	207.13Å 207.13Å 199.87Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	68.03 – 3.10 67.94 – 3.10	Depositor EDS
% Data completeness (in resolution range)	90.5 (68.03-3.10) 90.5 (67.94-3.10)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.71 (at 3.13Å)	Xtrriage
Refinement program	REFMAC 5.8.0253	Depositor
R, R_{free}	0.218 , 0.247 0.217 , 0.247	Depositor DCC
R_{free} test set	3669 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å ²)	52.5	Xtrriage
Anisotropy	0.054	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 28.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.000 for -h,-l,-k 0.001 for l,-k,h	Xtrriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	14736	wwPDB-VP
Average B, all atoms (Å ²)	61.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.00% 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

5.1 Standard geometry

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

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	AAA	0.68	0/1592	0.85	0/2168
1	DDD	0.67	0/1592	0.84	0/2168
1	EEE	0.66	0/1592	0.82	0/2168
2	BBB	0.68	0/1689	0.89	1/2299 (0.0%)
2	FFF	0.67	0/1689	0.88	0/2299
2	HHH	0.67	0/1689	0.89	0/2299
3	CCC	0.67	0/1741	0.87	1/2367 (0.0%)
3	GGG	0.65	0/1741	0.86	1/2367 (0.0%)
3	LLL	0.67	0/1741	0.87	0/2367
All	All	0.67	0/15066	0.86	3/20502 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
3	GGG	148	ARG	NE-CZ-NH1	6.79	123.69	120.30
3	CCC	148	ARG	NE-CZ-NH1	5.72	123.16	120.30
2	BBB	102	ILE	N-CA-C	-5.04	97.39	111.00

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	AAA	1548	0	1462	18	0
1	DDD	1548	0	1460	7	0
1	EEE	1548	0	1461	9	0
2	BBB	1647	0	1623	21	0
2	FFF	1647	0	1623	18	0
2	HHH	1647	0	1623	17	0
3	CCC	1703	0	1649	16	0
3	GGG	1703	0	1649	12	0
3	LLL	1703	0	1649	13	0
4	AAA	14	0	13	4	0
4	DDD	14	0	13	0	0
4	EEE	14	0	13	1	0
All	All	14736	0	14238	106	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 4.

The worst 5 of 106 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:AAA:343:ASN:HD21	4:AAA:601:NAG:C1	1.31	1.38
1:AAA:343:ASN:ND2	4:AAA:601:NAG:C1	1.93	1.29
2:FFF:39:GLN:HE22	3:GGG:44:GLN:HE22	1.02	0.94
2:BBB:39:GLN:HE22	3:CCC:44:GLN:HE22	1.11	0.93
2:HHH:39:GLN:HE22	3:LLL:44:GLN:HE22	1.21	0.89

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	AAA	194/231 (84%)	185 (95%)	9 (5%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	DDD	194/231 (84%)	185 (95%)	9 (5%)	0	100	100
1	EEE	194/231 (84%)	185 (95%)	9 (5%)	0	100	100
2	BBB	220/222 (99%)	214 (97%)	6 (3%)	0	100	100
2	FFF	220/222 (99%)	212 (96%)	8 (4%)	0	100	100
2	HHH	220/222 (99%)	215 (98%)	5 (2%)	0	100	100
3	CCC	217/221 (98%)	206 (95%)	11 (5%)	0	100	100
3	GGG	217/221 (98%)	207 (95%)	10 (5%)	0	100	100
3	LLL	217/221 (98%)	206 (95%)	11 (5%)	0	100	100
All	All	1893/2022 (94%)	1815 (96%)	78 (4%)	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	AAA	168/203 (83%)	161 (96%)	7 (4%)	30	62
1	DDD	168/203 (83%)	162 (96%)	6 (4%)	35	67
1	EEE	168/203 (83%)	164 (98%)	4 (2%)	49	76
2	BBB	187/187 (100%)	179 (96%)	8 (4%)	29	62
2	FFF	187/187 (100%)	179 (96%)	8 (4%)	29	62
2	HHH	187/187 (100%)	179 (96%)	8 (4%)	29	62
3	CCC	194/196 (99%)	184 (95%)	10 (5%)	23	55
3	GGG	194/196 (99%)	184 (95%)	10 (5%)	23	55
3	LLL	194/196 (99%)	184 (95%)	10 (5%)	23	55
All	All	1647/1758 (94%)	1576 (96%)	71 (4%)	29	62

5 of 71 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	FFF	135	LYS
2	FFF	212	LYS
3	GGG	87	GLU
1	AAA	378	LYS
1	AAA	377	PHE

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](#)

3 ligands are 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	$\# Z > 2$
4	NAG	DDD	601	1	14,14,15	0.66	0	17,19,21	1.92	4 (23%)
4	NAG	EEE	601	1	14,14,15	0.82	0	17,19,21	1.90	5 (29%)
4	NAG	AAA	601	-	14,14,15	0.69	0	17,19,21	1.08	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the

Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	DDD	601	1	-	2/6/23/26	0/1/1/1
4	NAG	EEE	601	1	-	4/6/23/26	0/1/1/1
4	NAG	AAA	601	-	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	DDD	601	NAG	C1-O5-C5	4.88	118.80	112.19
4	EEE	601	NAG	C1-O5-C5	-4.22	106.47	112.19
4	DDD	601	NAG	O5-C1-C2	3.96	117.54	111.29
4	EEE	601	NAG	O5-C5-C6	-3.53	101.67	107.20
4	EEE	601	NAG	C3-C4-C5	3.08	115.74	110.24

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	EEE	601	NAG	C8-C7-N2-C2
4	EEE	601	NAG	O7-C7-N2-C2
4	AAA	601	NAG	C8-C7-N2-C2
4	AAA	601	NAG	O7-C7-N2-C2
4	DDD	601	NAG	C8-C7-N2-C2

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	EEE	601	NAG	1	0
4	AAA	601	NAG	4	0

5.7 Other polymers [i](#)

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 [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	AAA	196/231 (84%)	0.04	6 (3%) 49 26	36, 65, 120, 143	0
1	DDD	196/231 (84%)	0.03	6 (3%) 49 26	33, 61, 116, 153	0
1	EEE	196/231 (84%)	0.42	9 (4%) 32 16	39, 95, 142, 165	0
2	BBB	222/222 (100%)	-0.18	3 (1%) 75 56	27, 47, 79, 143	0
2	FFF	222/222 (100%)	-0.17	2 (0%) 84 69	28, 48, 82, 203	0
2	HHH	222/222 (100%)	-0.19	4 (1%) 68 47	26, 45, 88, 161	0
3	CCC	219/221 (99%)	-0.31	0 100 100	31, 51, 76, 98	0
3	GGG	219/221 (99%)	-0.19	1 (0%) 91 81	33, 56, 90, 103	0
3	LLL	219/221 (99%)	-0.28	0 100 100	32, 54, 79, 115	0
All	All	1911/2022 (94%)	-0.10	31 (1%) 72 51	26, 54, 114, 203	0

The worst 5 of 31 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	FFF	222	CYS	7.0
1	EEE	333	THR	5.6
2	HHH	222	CYS	5.1
1	DDD	333	THR	3.6
2	BBB	222	CYS	3.6

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(Å ²)	Q<0.9
4	NAG	AAA	601	14/15	0.73	0.22	80,110,124,124	0
4	NAG	EEE	601	14/15	0.80	0.31	77,128,145,155	0
4	NAG	DDD	601	14/15	0.84	0.23	76,107,112,112	0

6.5 Other polymers [i](#)

There are no such residues in this entry.