



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 18, 2018 – 08:04 am GMT

PDB ID : 2AXM  
Title : HEPARIN-LINKED BIOLOGICALLY-ACTIVE DIMER OF FIBROBLAST GROWTH FACTOR  
Authors : Digabriele, A.D.; Lax, I.; Chen, D.I.; Svahn, C.M.; Jaye, M.; Schlessinger, J.; Hendrickson, W.A.  
Deposited on : 1997-10-20  
Resolution : 3.00 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](mailto: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.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20171227.v01 (using entries in the PDB archive December 27th 2017)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk30686

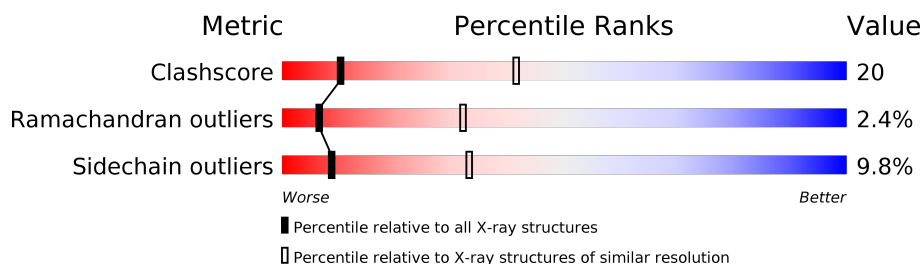
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.00 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	122078	2167 (3.00-3.00)
Ramachandran outliers	120005	2101 (3.00-3.00)
Sidechain outliers	119972	2104 (3.00-3.00)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	135	
1	B	135	

## 2 Entry composition [i](#)

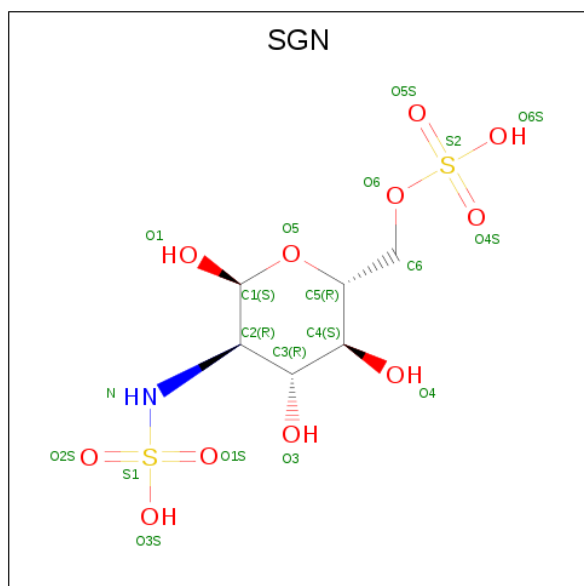
There are 4 unique types of molecules in this entry. The entry contains 2167 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 ACIDIC FIBROBLAST GROWTH FACTOR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	130	Total	C	N	O	S	0	0	0
			1037	655	182	196	4			
1	B	127	Total	C	N	O	S	0	0	0
			1011	638	177	192	4			

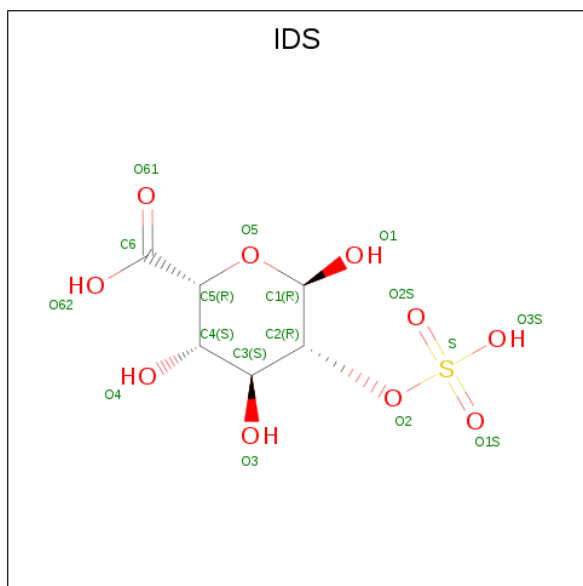
- Molecule 2 is N,O6-DISULFO-GLUCOSAMINE (three-letter code: SGN) (formula:  $C_6H_{13}NO_{11}S_2$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	N	O	S	0	0
			20	6	1	11	2		
2	B	1	Total	C	N	O	S	0	0
			19	6	1	10	2		
2	B	1	Total	C	N	O	S	0	0
			19	6	1	10	2		

- Molecule 3 is 2-O-sulfo-alpha-L-idopyranuronic acid (three-letter code: IDS) (formula:

C<sub>6</sub>H<sub>10</sub>O<sub>10</sub>S).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	B	1	Total	C	O	S	0	0
			16	6	9	1		
3	B	1	Total	C	O	S	0	0
			16	6	9	1		
3	B	1	Total	C	O	S	0	0
			16	6	9	1		

- Molecule 4 is water.

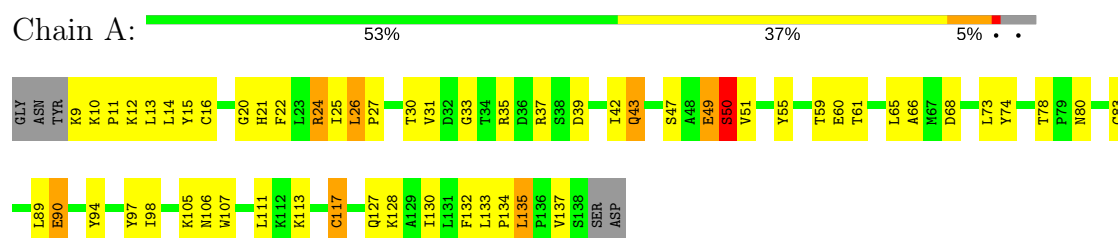
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	10	Total	O	0	0
			10	10		
4	B	3	Total	O	0	0
			3	3		

### 3 Residue-property plots [i](#)

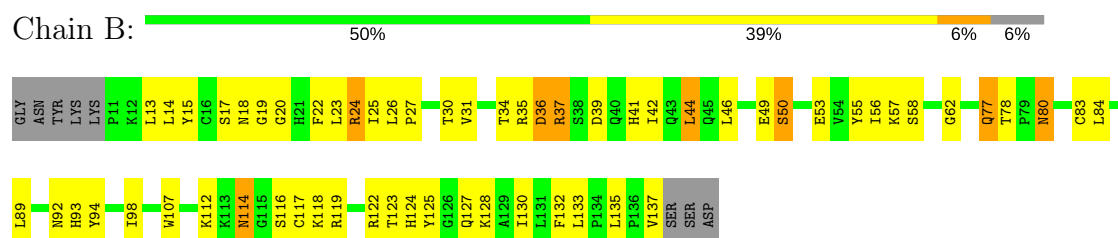
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are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

Note EDS was not executed.

#### • Molecule 1: ACIDIC FIBROBLAST GROWTH FACTOR



#### • Molecule 1: ACIDIC FIBROBLAST GROWTH FACTOR



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	91.10Å 91.10Å 193.90Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	13.00 – 3.00	Depositor
% Data completeness (in resolution range)	98.1 (13.00-3.00)	Depositor
$R_{merge}$	0.18	Depositor
$R_{sym}$	0.18	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, $R_{free}$	0.218 , 0.307	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2167	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	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: IDS, SGN

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	0.64	0/1060	0.83	0/1429
1	B	0.64	1/1033 (0.1%)	0.81	0/1394
All	All	0.64	1/2093 (0.0%)	0.82	0/2823

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	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	83	CYS	CB-SG	-5.03	1.73	1.81

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	94	TYR	Sidechain

### 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	1037	0	1025	42	0
1	B	1011	0	989	41	0
2	B	58	0	26	4	0
3	B	48	0	16	3	0
4	A	10	0	0	0	0
4	B	3	0	0	0	0
All	All	2167	0	2056	84	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 20.

All (84) 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:A:43:GLN:HG2	1:A:59:THR:OG1	1.78	0.83
1:B:14:LEU:HD12	1:B:44:LEU:HD13	1.61	0.82
1:B:24:ARG:HG2	1:B:34:THR:HG22	1.72	0.72
1:A:49:GLU:O	1:A:50:SER:HB2	1.88	0.71
1:B:55:TYR:CE1	1:B:84:LEU:HD13	2.26	0.71
1:B:49:GLU:HG3	1:B:55:TYR:CE1	2.29	0.68
1:A:26:LEU:CD1	1:A:30:THR:HB	2.27	0.65
1:A:26:LEU:HD13	1:A:30:THR:HB	1.78	0.64
1:A:16:CYS:HB2	1:A:132:PHE:CE1	2.33	0.64
1:B:27:PRO:HG3	1:B:41:HIS:CE1	2.32	0.64
1:B:25:ILE:HG13	1:B:31:VAL:HG22	1.79	0.63
1:B:53:GLU:HB3	1:B:84:LEU:HD11	1.82	0.62
1:B:15:TYR:HB3	1:B:133:LEU:HB3	1.81	0.61
1:B:57:LYS:HZ3	1:B:62:GLY:HA2	1.65	0.61
1:B:57:LYS:NZ	1:B:62:GLY:HA2	2.15	0.61
1:A:39:ASP:HB3	1:A:42:ILE:HG23	1.84	0.60
1:B:49:GLU:HG2	1:B:55:TYR:CD1	2.38	0.59
1:A:11:PRO:HB2	1:A:137:VAL:HG11	1.84	0.59
1:B:112:LYS:HB2	1:B:114:ASN:ND2	2.19	0.58
1:B:49:GLU:O	1:B:50:SER:HB2	2.05	0.57
1:A:90:GLU:OE2	1:A:94:TYR:HB2	2.05	0.57
1:B:24:ARG:HB3	1:B:42:ILE:HG22	1.87	0.57
1:B:127:GLN:O	1:B:130:ILE:HG12	2.05	0.56
1:A:10:LYS:O	1:A:12:LYS:HG2	2.05	0.56
1:A:37:ARG:HG3	1:A:37:ARG:HH11	1.71	0.56
1:A:98:ILE:HD11	1:A:106:ASN:HA	1.88	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:128:LYS:N	2:B:305:SGN:O2S	2.39	0.55
1:A:13:LEU:HD22	1:A:42:ILE:HG13	1.87	0.55
1:A:21:HIS:CD2	1:A:35:ARG:HG3	2.42	0.55
1:B:15:TYR:HB2	1:B:135:LEU:HD12	1.89	0.55
1:B:20:GLY:O	1:B:35:ARG:HD3	2.09	0.53
1:A:24:ARG:HB3	1:A:42:ILE:HG22	1.90	0.53
1:B:37:ARG:O	1:B:42:ILE:HD11	2.09	0.52
1:A:105:LYS:HD3	1:A:107:TRP:CZ2	2.45	0.52
1:A:127:GLN:HG2	3:B:302:IDS:S	2.49	0.51
1:B:49:GLU:CG	1:B:55:TYR:CD1	2.93	0.51
1:A:37:ARG:NH1	1:A:37:ARG:HG3	2.26	0.51
1:B:15:TYR:HB2	1:B:135:LEU:CD1	2.42	0.50
1:B:98:ILE:HG13	1:B:107:TRP:O	2.11	0.50
1:B:49:GLU:HG2	1:B:55:TYR:HD1	1.77	0.50
1:B:114:ASN:ND2	1:B:116:SER:H	2.11	0.49
1:A:65:LEU:HD11	1:A:73:LEU:HD13	1.93	0.49
1:A:66:ALA:HB2	1:A:83:CYS:SG	2.53	0.49
1:B:58:SER:O	1:B:62:GLY:N	2.45	0.48
1:A:127:GLN:O	1:A:130:ILE:HG12	2.13	0.48
1:A:49:GLU:HG3	1:A:55:TYR:HE2	1.79	0.48
1:A:13:LEU:O	1:A:134:PRO:HA	2.14	0.47
1:B:46:LEU:HA	1:B:55:TYR:O	2.13	0.47
1:A:25:ILE:HG23	1:A:31:VAL:HG22	1.96	0.46
1:A:133:LEU:O	1:A:135:LEU:HD22	2.15	0.46
1:A:47:SER:HB2	1:A:55:TYR:HB2	1.98	0.46
1:B:36:ASP:OD1	1:B:39:ASP:HB2	2.16	0.46
1:B:23:LEU:HB2	1:B:132:PHE:HE2	1.80	0.46
1:A:43:GLN:HG2	1:A:59:THR:HG1	1.79	0.45
1:B:44:LEU:HD22	1:B:56:ILE:HG22	1.98	0.45
1:A:68:ASP:HB3	1:A:74:TYR:CE2	2.51	0.45
1:B:39:ASP:HB3	1:B:42:ILE:HG23	1.99	0.45
1:A:43:GLN:CD	1:A:43:GLN:H	2.20	0.44
1:A:111:LEU:HD23	1:A:117:CYS:HA	2.00	0.44
1:A:26:LEU:HD12	1:A:30:THR:HB	2.00	0.44
1:A:43:GLN:NE2	1:A:60:GLU:H	2.15	0.44
1:B:14:LEU:CD1	1:B:44:LEU:HD13	2.41	0.44
1:A:14:LEU:HA	1:A:14:LEU:HD23	1.58	0.44
1:B:118:LYS:NZ	2:B:305:SGN:O3S	2.51	0.43
1:B:77:GLN:OE1	1:B:78:THR:HG23	2.17	0.43
1:A:9:LYS:HB2	1:A:9:LYS:HE3	1.79	0.43
1:A:22:PHE:O	1:A:33:GLY:HA2	2.19	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:127:GLN:HG2	3:B:302:IDS:O2S	2.19	0.43
1:A:27:PRO:HA	1:A:61:THR:HG21	2.02	0.42
1:A:128:LYS:HG2	1:A:128:LYS:O	2.19	0.42
2:B:305:SGN:C6	3:B:306:IDS:C1	2.97	0.42
1:B:24:ARG:CZ	1:B:26:LEU:HD21	2.49	0.42
1:B:49:GLU:CG	1:B:55:TYR:CE1	3.01	0.42
1:A:49:GLU:HG3	1:A:55:TYR:CE2	2.55	0.41
1:B:17:SER:O	1:B:19:GLY:N	2.53	0.41
1:A:89:LEU:HD22	1:A:94:TYR:O	2.20	0.41
1:A:113:LYS:HB2	2:B:303:SGN:O1S	2.21	0.41
1:A:97:TYR:N	1:A:97:TYR:CD1	2.88	0.41
1:B:26:LEU:HD12	1:B:30:THR:HB	2.02	0.41
1:B:119:ARG:O	1:B:123:THR:HG23	2.20	0.41
1:B:124:HIS:ND1	1:B:125:TYR:N	2.68	0.41
1:B:80:ASN:C	1:B:80:ASN:HD22	2.24	0.41
1:B:22:PHE:HE1	1:B:135:LEU:HD13	1.86	0.40
1:A:15:TYR:CE1	1:A:20:GLY:HA2	2.55	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 5.3.1 Protein backbone

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	128/135 (95%)	117 (91%)	9 (7%)	2 (2%)	11	43
1	B	125/135 (93%)	112 (90%)	9 (7%)	4 (3%)	4	24
All	All	253/270 (94%)	229 (90%)	18 (7%)	6 (2%)	6	32

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	18	ASN

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Mol	Chain	Res	Type
1	A	50	SER
1	B	50	SER
1	B	93	HIS
1	B	92	ASN
1	A	51	VAL

### 5.3.2 Protein sidechains ⓘ

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	114/118 (97%)	104 (91%)	10 (9%)	11	39
1	B	110/118 (93%)	98 (89%)	12 (11%)	7	27
All	All	224/236 (95%)	202 (90%)	22 (10%)	9	33

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	ARG
1	A	26	LEU
1	A	43	GLN
1	A	49	GLU
1	A	50	SER
1	A	78	THR
1	A	80	ASN
1	A	90	GLU
1	A	117	CYS
1	A	135	LEU
1	B	13	LEU
1	B	24	ARG
1	B	36	ASP
1	B	37	ARG
1	B	44	LEU
1	B	77	GLN
1	B	80	ASN
1	B	89	LEU

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Mol	Chain	Res	Type
1	B	114	ASN
1	B	117	CYS
1	B	122	ARG
1	B	137	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	21	HIS
1	A	80	ASN
1	B	21	HIS
1	B	41	HIS
1	B	80	ASN
1	B	92	ASN
1	B	114	ASN

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

6 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
2	SGN	B	301	3	19,20,20	1.74	3 (15%)	24,31,31	1.23	3 (12%)
3	IDS	B	302	2	13,16,17	1.98	1 (7%)	14,24,26	1.07	1 (7%)
2	SGN	B	303	3	18,19,20	1.31	1 (5%)	21,29,31	1.18	2 (9%)
3	IDS	B	304	2	13,16,17	1.98	2 (15%)	14,24,26	1.32	1 (7%)
2	SGN	B	305	3	18,19,20	1.42	3 (16%)	21,29,31	1.74	4 (19%)
3	IDS	B	306	2	13,16,17	1.83	3 (23%)	14,24,26	1.59	2 (14%)

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
2	SGN	B	301	3	-	0/10/31/31	0/1/1/1
3	IDS	B	302	2	-	0/5/26/29	0/1/1/1
2	SGN	B	303	3	-	0/10/28/31	0/1/1/1
3	IDS	B	304	2	-	0/5/26/29	0/1/1/1
2	SGN	B	305	3	-	0/10/28/31	0/1/1/1
3	IDS	B	306	2	-	0/5/26/29	0/1/1/1

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	302	IDS	O2-C2	-6.32	1.37	1.47
3	B	306	IDS	O2-C2	-5.08	1.39	1.47
3	B	304	IDS	O5-C5	-4.73	1.38	1.43
3	B	304	IDS	O2-C2	-4.31	1.40	1.47
3	B	306	IDS	O5-C5	-2.88	1.40	1.43
2	B	305	SGN	C2-N	-2.39	1.43	1.47
2	B	305	SGN	O5-C5	-2.22	1.38	1.43
2	B	301	SGN	O2S-S1	2.06	1.44	1.42
3	B	306	IDS	C4-C3	2.08	1.57	1.52
2	B	305	SGN	S1-N	2.49	1.62	1.59
2	B	301	SGN	O1S-S1	2.58	1.45	1.42
2	B	303	SGN	S1-N	3.99	1.64	1.59
2	B	301	SGN	S1-N	5.94	1.66	1.59

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	305	SGN	C4-C3-C2	-4.18	104.89	111.02

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	305	SGN	O2S-S1-N	-3.93	103.47	108.57
2	B	303	SGN	O2S-S1-O1S	-3.45	111.31	120.24
2	B	305	SGN	O2S-S1-O1S	-3.31	111.69	120.24
2	B	301	SGN	O2S-S1-O1S	-3.18	112.03	120.24
2	B	305	SGN	C3-C4-C5	-2.96	104.95	110.24
2	B	301	SGN	C1-C2-C3	-2.58	107.03	110.54
2	B	301	SGN	C4-C3-C2	-2.13	107.17	110.33
2	B	303	SGN	O5-C1-C2	-2.00	108.76	111.52
3	B	306	IDS	C4-C3-C2	2.04	113.89	110.24
3	B	302	IDS	C1-C2-C3	2.89	113.72	109.40
3	B	304	IDS	C1-C2-C3	3.83	115.12	109.40
3	B	306	IDS	C1-C2-C3	4.27	115.78	109.40

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	302	IDS	2	0
2	B	303	SGN	1	0
2	B	305	SGN	3	0
3	B	306	IDS	1	0

## 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.