



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 6, 2023 – 10:31 AM EST

PDB ID : 2ER7  
Title : X-RAY ANALYSES OF ASPARTIC PROTEINASES.III. THREE-DIMENSIONAL STRUCTURE OF ENDOTHAPEPSIN COMPLEXED WITH A TRANSITION-STATE ISOSTERE INHIBITOR OF RENIN AT 1.6 ANGSTROMS RESOLUTION  
Authors : Veerapandian, B.; Cooper, J.B.; Szelke, M.; Blundell, T.L.  
Deposited on : 1990-11-12  
Resolution : 1.60 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.

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 : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

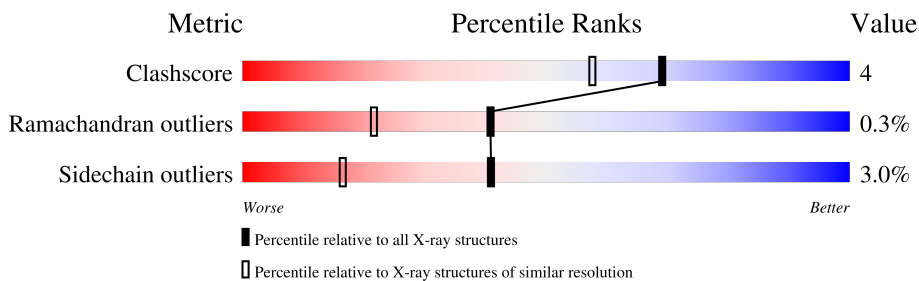
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.60 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))
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)

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  $\geq 3$ , 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	E	330	
2	I	8	

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 2804 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 ENDOTHIAPEPSIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	E	330	2389	1514	366	507	2	0	0	0

- Molecule 2 is a protein called TRANSITION-STATE ISOSTERE INHIBITOR OF RENIN.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	I	8	79	55	13	11	0	0	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
3	E	1	5	4	1	0	0
3	E	1	5	4	1	0	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	E	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is water.


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	E	311	Total	O	0	0
			311	311		
4	I	10	Total	O	0	0
			10	10		

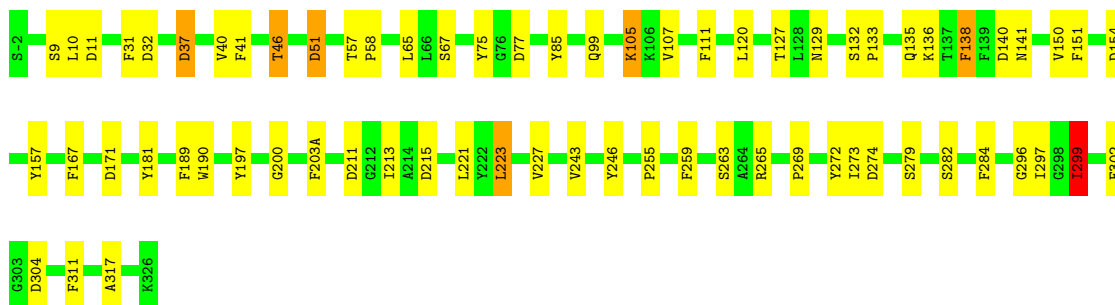
### 3 Residue-property plots [i](#)

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: ENDOTHIAPEPSIN

Chain E:  79% 19%



- Molecule 2: TRANSITION-STATE ISOSTERE INHIBITOR OF RENIN

Chain I:  25% 50% 25%



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	43.00Å 75.70Å 42.90Å 90.00° 97.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.60	Depositor
% Data completeness (in resolution range)	(Not available) (20.00-1.60)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, $R_{free}$	0.142 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	2804	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	0.0	wwPDB-VP

## 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: BOC, LOV, SO4

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	E	1.08	3/2445 (0.1%)	1.83	62/3345 (1.9%)
2	I	1.88	1/60 (1.7%)	2.29	5/78 (6.4%)
All	All	1.10	4/2505 (0.2%)	1.84	67/3423 (2.0%)

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	E	0	1
2	I	0	2
All	All	0	3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	I	3	PRO	N-CD	7.69	1.58	1.47
1	E	58	PRO	N-CD	7.12	1.57	1.47
1	E	57	THR	C-N	5.93	1.45	1.34
1	E	282	SER	CB-OG	5.34	1.49	1.42

All (67) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	189	PHE	CB-CG-CD1	-12.78	111.85	120.80
1	E	85	TYR	CB-CG-CD2	-11.45	114.13	121.00
1	E	311	PHE	CB-CG-CD2	-11.09	113.03	120.80
1	E	203(A)	PHE	CB-CG-CD2	-10.82	113.22	120.80
1	E	311	PHE	CB-CG-CD1	10.09	127.86	120.80

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	157	TYR	CG-CD1-CE1	9.99	129.29	121.30
1	E	32	ASP	CB-CG-OD2	9.75	127.08	118.30
1	E	211	ASP	CB-CG-OD1	-9.70	109.57	118.30
1	E	203(A)	PHE	CB-CG-CD1	9.35	127.34	120.80
1	E	75	TYR	CB-CG-CD1	-9.05	115.57	121.00
1	E	181	TYR	CB-CG-CD1	-8.79	115.72	121.00
2	I	2	HIS	C-N-CD	8.55	146.35	128.40
1	E	138	PHE	CB-CG-CD1	8.44	126.71	120.80
1	E	37	ASP	CB-CG-OD1	7.66	125.19	118.30
1	E	138	PHE	CB-CG-CD2	-7.54	115.52	120.80
1	E	279	SER	O-C-N	-7.54	110.63	122.70
1	E	171	ASP	CB-CG-OD1	-7.48	111.57	118.30
1	E	77	ASP	CB-CG-OD1	7.25	124.83	118.30
2	I	2	HIS	O-C-N	7.14	134.67	121.10
1	E	157	TYR	CD1-CE1-CZ	-7.06	113.44	119.80
2	I	8	HIS	CA-CB-CG	-7.00	101.71	113.60
1	E	75	TYR	CG-CD1-CE1	-6.95	115.74	121.30
1	E	259	PHE	CG-CD2-CE2	6.90	128.39	120.80
1	E	31	PHE	CB-CG-CD1	-6.75	116.08	120.80
1	E	75	TYR	CD1-CE1-CZ	6.74	125.86	119.80
1	E	167	PHE	CB-CG-CD1	-6.64	116.15	120.80
1	E	189	PHE	CD1-CG-CD2	6.39	126.61	118.30
1	E	57	THR	C-N-CD	6.36	141.75	128.40
1	E	189	PHE	CG-CD2-CE2	-6.29	113.89	120.80
1	E	299	ILE	O-C-N	6.23	132.66	122.70
1	E	111	PHE	CB-CG-CD2	-6.00	116.60	120.80
1	E	154	ASP	CB-CG-OD2	5.98	123.68	118.30
1	E	51	ASP	CB-CG-OD2	5.98	123.68	118.30
1	E	157	TYR	CB-CG-CD1	5.96	124.58	121.00
1	E	85	TYR	CG-CD1-CE1	-5.84	116.63	121.30
2	I	4	PHE	CB-CG-CD2	-5.82	116.72	120.80
1	E	200	GLY	O-C-N	5.82	132.01	122.70
1	E	189	PHE	CD1-CE1-CZ	-5.81	113.12	120.10
1	E	215	ASP	CB-CG-OD2	5.81	123.53	118.30
1	E	40	VAL	CA-CB-CG2	5.78	119.57	110.90
1	E	279	SER	CA-C-N	5.70	129.75	117.20
1	E	41	PHE	CB-CG-CD1	-5.70	116.81	120.80
1	E	197	TYR	CB-CG-CD2	-5.69	117.59	121.00
1	E	263	SER	O-C-N	-5.65	113.66	122.70
1	E	140	ASP	CB-CG-OD2	5.58	123.32	118.30
2	I	8	HIS	N-CA-CB	5.56	120.61	110.60
1	E	190	TRP	CE3-CZ3-CH2	5.54	127.30	121.20

*Continued on next page...*



Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	51	ASP	CA-CB-CG	5.48	125.46	113.40
1	E	246	TYR	CZ-CE2-CD2	-5.48	114.87	119.80
1	E	274	ASP	CB-CG-OD2	5.46	123.21	118.30
1	E	57	THR	CA-C-O	5.46	131.56	120.10
1	E	296	GLY	C-N-CA	5.38	135.16	121.70
1	E	246	TYR	CB-CG-CD1	-5.33	117.80	121.00
1	E	284	PHE	C-N-CA	-5.29	111.20	122.30
1	E	302	PHE	CB-CG-CD2	-5.28	117.11	120.80
1	E	107	VAL	CA-CB-CG2	5.27	118.81	110.90
1	E	304	ASP	CB-CG-OD2	-5.26	113.56	118.30
1	E	127	THR	O-C-N	-5.26	114.28	122.70
1	E	57	THR	CA-C-N	-5.25	102.39	117.10
1	E	273	ILE	CA-C-O	5.24	131.11	120.10
1	E	243	VAL	CA-CB-CG2	5.22	118.73	110.90
1	E	227	VAL	CA-CB-CG2	5.21	118.72	110.90
1	E	259	PHE	CB-CG-CD1	5.16	124.41	120.80
1	E	105	LYS	CA-CB-CG	-5.11	102.15	113.40
1	E	265	ARG	NE-CZ-NH2	-5.10	117.75	120.30
1	E	85	TYR	CD1-CG-CD2	5.05	123.46	117.90
1	E	274	ASP	CA-C-N	-5.04	106.12	117.20

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	E	151	PHE	Mainchain
2	I	6	LOV	Mainchain,Peptide

## 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	E	2389	0	2280	15	0
2	I	79	0	72	6	0
3	E	15	0	0	0	0
4	E	311	0	0	3	14
4	I	10	0	0	0	2

Continued on next page...

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	2804	0	2352	18	14

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.

All (18) 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:E:297:ILE:HG22	1:E:299:ILE:H	1.50	0.77
2:I:8:HIS:ND1	2:I:8:HIS:O	2.29	0.65
1:E:129:ASN:ND2	1:E:135:GLN:H	1.98	0.61
2:I:8:HIS:O	2:I:8:HIS:CG	2.60	0.54
1:E:255:PRO:HG3	4:E:1048:HOH:O	2.07	0.54
1:E:221:LEU:HG	1:E:223:LEU:HD22	1.89	0.53
1:E:99:GLN:NE2	1:E:138:PHE:HA	2.25	0.50
1:E:213:ILE:HD11	2:I:6:LOV:HG21	1.93	0.49
1:E:46:THR:HG23	1:E:105:LYS:O	2.13	0.48
1:E:299:ILE:HG22	4:E:1017:HOH:O	2.14	0.47
2:I:5:HIS:CE1	2:I:6:LOV:HG13	2.51	0.46
1:E:10:LEU:O	1:E:11:ASP:HB2	2.16	0.45
1:E:132:SER:OG	1:E:133:PRO:HA	2.18	0.43
1:E:9:SER:HB2	4:E:1040:HOH:O	2.19	0.43
1:E:136:LYS:HD2	1:E:141:ASN:ND2	2.33	0.43
1:E:120:LEU:HD21	2:I:6:LOV:HD23	2.02	0.42
1:E:213:ILE:HD11	2:I:6:LOV:CG2	2.50	0.41
1:E:269:PRO:HG2	1:E:272:TYR:CE1	2.56	0.41

All (14) 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)
4:E:1001:HOH:O	4:E:1203:HOH:O[1_554]	0.11	2.09
4:E:1000:HOH:O	4:E:1204:HOH:O[1_554]	0.14	2.06
4:E:960:HOH:O	4:E:999:HOH:O[1_556]	0.22	1.98
4:E:1134:HOH:O	4:I:17:HOH:O[1_554]	0.25	1.95
4:E:1171:HOH:O	4:E:1189:HOH:O[1_556]	0.29	1.91
4:E:1040:HOH:O	4:E:1201:HOH:O[2_646]	0.42	1.78
4:E:1188:HOH:O	4:I:18:HOH:O[1_554]	0.42	1.78
4:E:1056:HOH:O	4:E:1202:HOH:O[2_646]	0.43	1.77
4:E:1011:HOH:O	4:E:1141:HOH:O[1_455]	0.55	1.65

*Continued on next page...*

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:E:1009:HOH:O	4:E:1131:HOH:O[1_655]	0.58	1.62
4:E:1154:HOH:O	4:E:1200:HOH:O[1_554]	0.61	1.59
4:E:980:HOH:O	4:E:1197:HOH:O[2_646]	0.62	1.58
4:E:1076:HOH:O	4:E:1224:HOH:O[2_646]	1.59	0.61
4:E:1088:HOH:O	4:E:1198:HOH:O[2_646]	2.19	0.01

### 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	E	328/330 (99%)	325 (99%)	2 (1%)	1 (0%)	41	21
2	I	5/8 (62%)	5 (100%)	0	0	100	100
All	All	333/338 (98%)	330 (99%)	2 (1%)	1 (0%)	41	21

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	317	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	E	263/263 (100%)	255 (97%)	8 (3%)	41	16
2	I	6/6 (100%)	6 (100%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	269/269 (100%)	261 (97%)	8 (3%)	41 16

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	37	ASP
1	E	46	THR
1	E	51	ASP
1	E	65	LEU
1	E	67	SER
1	E	150	VAL
1	E	223	LEU
1	E	299	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	E	19	GLN
1	E	28	ASN
1	E	99	GLN
1	E	129	ASN
1	E	134(A)	GLN
1	E	135	GLN
1	E	141	ASN
1	E	166	ASN
1	E	300	ASN
2	I	5	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](#)

1 non-standard protein/DNA/RNA residue is 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	LOV	I	6	2	13,14,15	0.87	0	14,18,20	0.82	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
2	LOV	I	6	2	-	1/18/18/20	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	I	6	LOV	O-C-C1-CT

There are no ring outliers.

1 monomer is involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	I	6	LOV	4	0

## 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	$\# Z  > 2$
3	SO4	E	910	-	4,4,4	0.77	0	6,6,6	0.64	0
3	SO4	E	900	-	4,4,4	0.69	0	6,6,6	0.88	0
3	SO4	E	920	-	4,4,4	0.61	0	6,6,6	0.81	0

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

### 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.