



# Full wwPDB X-ray Structure Validation Report ⓘ

May 21, 2020 – 05:19 am BST

PDB ID : 2NW2  
Title : Crystal structure of ELS4 TCR at 1.4A  
Authors : Tynan, F.E.; Reid, H.H.; Rossjohn, J.  
Deposited on : 2006-11-14  
Resolution : 1.40 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
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

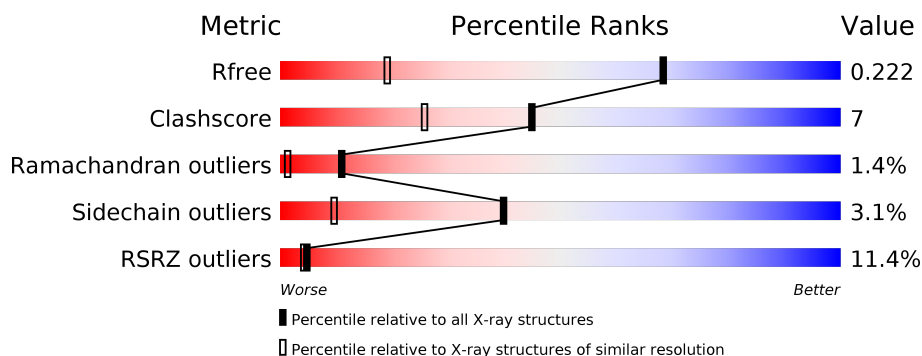
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.40 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	1714 (1.40-1.40)
Clashscore	141614	1812 (1.40-1.40)
Ramachandran outliers	138981	1763 (1.40-1.40)
Sidechain outliers	138945	1762 (1.40-1.40)
RSRZ outliers	127900	1674 (1.40-1.40)

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 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	A	200	<div> <div>21%</div> <div> <div></div> <div>79%</div> <div>12%</div> <div>7%</div> <div>••</div> </div> </div>
2	B	243	<div> <div>3%</div> <div> <div></div> <div>93%</div> <div>7%</div> </div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4059 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 ELS4 TCR alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	197	Total	C	N	O	S	0	5	2
			1557	988	251	308	10			

- Molecule 2 is a protein called ELS4 TCR beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	243	Total	C	N	O	S	0	9	0
			1979	1238	347	388	6			

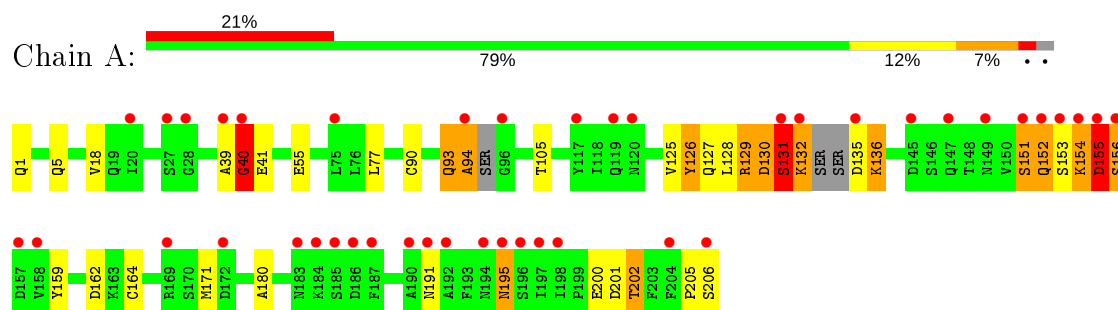
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	206	Total	O	0	0
			206	206		
3	B	317	Total	O	0	0
			317	317		

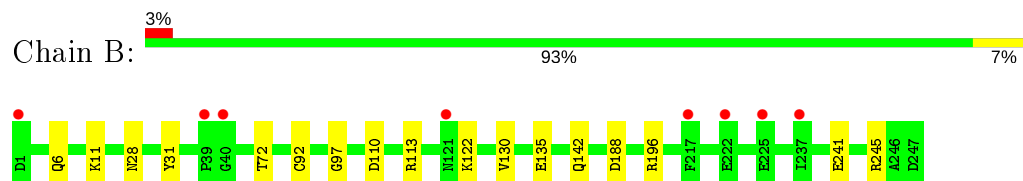
### 3 Residue-property plots [i](#)

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 ( $\text{RSRZ} > 2$ ). 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.

- Molecule 1: ELS4 TCR alpha chain



- Molecule 2: ELS4 TCR beta chain



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	46.56Å 84.16Å 59.27Å 90.00° 107.34° 90.00°	Depositor
Resolution (Å)	30.56 – 1.40 28.29 – 1.40	Depositor EDS
% Data completeness (in resolution range)	96.9 (30.56-1.40) 96.9 (28.29-1.40)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.40 (at 1.40Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.192 , 0.224 0.189 , 0.222	Depositor DCC
$R_{free}$ test set	4198 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	14.6	Xtriage
Anisotropy	0.020	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40 , 50.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	4059	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.79% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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

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	0.70	3/1606 (0.2%)	0.84	6/2172 (0.3%)
2	B	0.44	0/2059	0.63	0/2803
All	All	0.57	3/3665 (0.1%)	0.73	6/4975 (0.1%)

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	A	0	9

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	154	LYS	CA-CB	10.54	1.77	1.53
1	A	94	ALA	N-CA	9.44	1.65	1.46
1	A	155	ASP	N-CA	5.46	1.57	1.46

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	155	ASP	CB-CG-OD2	-7.02	111.98	118.30
1	A	126	TYR	N-CA-C	-6.65	93.04	111.00
1	A	129	ARG	N-CA-C	-6.56	93.28	111.00
1	A	154	LYS	C-N-CA	-5.78	107.25	121.70
1	A	131	SER	N-CA-C	5.60	126.12	111.00
1	A	127	GLN	N-CA-C	5.59	126.09	111.00

There are no chirality outliers.

All (9) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	125	VAL	Peptide
1	A	126	TYR	Peptide
1	A	128	LEU	Peptide
1	A	130	ASP	Peptide
1	A	151	SER	Peptide
1	A	155	ASP	Peptide
1	A	201	ASP	Peptide
1	A	40	GLY	Peptide
1	A	93	GLN	Peptide

## 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	1557	0	1492	34	0
2	B	1979	0	1880	13	0
3	A	206	0	0	9	0
3	B	317	0	0	9	0
All	All	4059	0	3372	45	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 7.

All (45) 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:154:LYS:CA	1:A:154:LYS:CB	1.77	1.54
1:A:155:ASP:CB	1:A:156:SER:HB2	1.66	1.25
1:A:155:ASP:HB2	1:A:156:SER:CB	1.84	1.06
1:A:131:SER:HB3	3:A:393:HOH:O	1.55	1.05
1:A:155:ASP:HB2	1:A:156:SER:HB2	1.08	1.03
1:A:156:SER:HB3	3:A:404:HOH:O	1.58	1.03
1:A:132:LYS:HD2	3:B:552:HOH:O	1.66	0.94
1:A:155:ASP:CA	1:A:156:SER:HB2	2.04	0.86
1:A:132:LYS:HE2	2:B:241:GLU:H	1.39	0.84
1:A:131:SER:CB	3:A:393:HOH:O	2.17	0.80
2:B:28[B]:ASN:OD1	2:B:72:THR:HG21	1.85	0.77

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:41:GLU:HB2	2:B:110[A]:ASP:OD2	1.86	0.74
2:B:142[B]:GLN:OE1	3:B:472:HOH:O	2.05	0.74
1:A:154:LYS:CA	1:A:154:LYS:CG	2.68	0.69
1:A:129:ARG:HD2	3:A:400:HOH:O	1.94	0.67
1:A:131:SER:CA	3:A:393:HOH:O	2.41	0.66
2:B:135:GLU:OE2	3:B:547:HOH:O	2.15	0.64
2:B:122:LYS:CE	2:B:188:ASP:HB2	2.27	0.64
2:B:122:LYS:HE2	2:B:188:ASP:HB2	1.80	0.62
1:A:135:ASP:O	1:A:136[B]:LYS:HG2	2.04	0.58
2:B:6:GLN:NE2	2:B:92:CYS:H	2.02	0.56
1:A:130:ASP:OD1	3:A:393:HOH:O	2.17	0.56
1:A:93:GLN:HG3	1:A:94:ALA:CA	2.36	0.56
1:A:1:GLN:NE2	1:A:105:THR:OG1	2.42	0.53
2:B:122:LYS:HE2	3:B:438:HOH:O	2.08	0.53
1:A:152:GLN:HB2	3:A:338:HOH:O	2.10	0.51
1:A:39:ALA:O	1:A:40:GLY:C	2.48	0.51
1:A:155:ASP:HA	1:A:156:SER:HB2	1.92	0.51
1:A:151:SER:HB2	1:A:195:ASN:HD22	1.74	0.51
1:A:5:GLN:HE22	1:A:90[A]:CYS:H	1.59	0.49
2:B:11:LYS:HE2	3:B:551:HOH:O	2.12	0.49
3:A:393:HOH:O	2:B:130:VAL:O	2.20	0.47
1:A:5:GLN:HE22	1:A:90[B]:CYS:H	1.60	0.47
1:A:132:LYS:HD3	3:A:329:HOH:O	2.14	0.47
1:A:154:LYS:HE2	1:A:195:ASN:HB2	1.97	0.46
2:B:113:ARG:NH2	3:B:557:HOH:O	2.49	0.45
1:A:151:SER:HB3	1:A:152:GLN:O	2.17	0.45
1:A:171:MET:HE2	3:B:563:HOH:O	2.19	0.43
1:A:171:MET:CE	3:B:563:HOH:O	2.67	0.42
1:A:129:ARG:HG2	3:B:298:HOH:O	2.19	0.42
1:A:159:TYR:O	1:A:180:ALA:HA	2.20	0.42
1:A:205:PRO:HA	1:A:206:SER:HA	1.76	0.42
1:A:155:ASP:CA	1:A:156:SER:CB	2.86	0.40
2:B:31:TYR:CE2	2:B:97:GLY:HA3	2.56	0.40
1:A:18:VAL:HG13	1:A:77[A]:LEU:HD13	2.03	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	196/200 (98%)	185 (94%)	4 (2%)	7 (4%)	3	0
2	B	250/243 (103%)	243 (97%)	7 (3%)	0	100	100
All	All	446/443 (101%)	428 (96%)	11 (2%)	7 (2%)	11	1

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	131	SER
1	A	136[A]	LYS
1	A	136[B]	LYS
1	A	152	GLN
1	A	156	SER
1	A	40	GLY
1	A	202	THR

### 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	177/176 (101%)	167 (94%)	10 (6%)	21	2
2	B	222/213 (104%)	220 (99%)	2 (1%)	78	58
All	All	399/389 (103%)	387 (97%)	12 (3%)	40	10

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	55	GLU
1	A	131	SER
1	A	132	LYS
1	A	153	SER
1	A	162	ASP
1	A	164	CYS
1	A	191	ASN
1	A	195	ASN
1	A	200	GLU
1	A	202	THR
2	B	196	ARG
2	B	245	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1	GLN
1	A	5	GLN
1	A	21	ASN
1	A	49	ASN
1	A	115	HIS
1	A	127	GLN
1	A	191	ASN
2	B	6	GLN
2	B	41	HIS
2	B	107	HIS
2	B	223	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

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 ⓘ

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	197/200 (98%)	1.13	42 (21%) 0 0	9, 18, 42, 58	0
2	B	243/243 (100%)	0.17	8 (3%) 46 46	9, 13, 25, 37	0
All	All	440/443 (99%)	0.60	50 (11%) 5 4	9, 14, 35, 58	0

All (50) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	135	ASP	14.6
1	A	185	SER	8.1
1	A	197	ILE	7.7
1	A	94	ALA	7.5
1	A	40	GLY	7.2
1	A	186	ASP	6.7
1	A	154	LYS	6.5
1	A	195	ASN	6.0
1	A	152	GLN	5.6
1	A	117	TYR	5.0
1	A	194	ASN	4.7
1	A	156	SER	4.4
1	A	132	LYS	4.1
1	A	206	SER	4.0
1	A	119	GLN	3.9
1	A	191	ASN	3.9
1	A	184	LYS	3.7
1	A	157	ASP	3.6
1	A	183	ASN	3.6
1	A	147	GLN	3.5
2	B	40	GLY	3.4
2	B	222	GLU	3.3
2	B	1	ASP	3.3
1	A	131	SER	3.2

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Mol	Chain	Res	Type	RSRZ
1	A	151	SER	3.1
1	A	187	PHE	3.1
1	A	153	SER	3.0
2	B	39	PRO	3.0
1	A	27	SER	2.9
1	A	198	ILE	2.8
1	A	28	GLY	2.7
1	A	158	VAL	2.7
1	A	39	ALA	2.6
1	A	155	ASP	2.6
1	A	172	ASP	2.6
1	A	190	ALA	2.6
1	A	20	ILE	2.6
1	A	96	GLY	2.5
1	A	149	ASN	2.4
2	B	237	ILE	2.3
1	A	204	PHE	2.3
2	B	225	GLU	2.2
2	B	217	PHE	2.2
2	B	121	ASN	2.2
1	A	196	SER	2.1
1	A	192	ALA	2.1
1	A	75	LEU	2.1
1	A	169	ARG	2.1
1	A	120	ASN	2.0
1	A	145	ASP	2.0

## 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 carbohydrates in this entry.

## 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.