



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 21, 2020 – 07:05 am BST

PDB ID : 3NN8  
Title : Crystal structure of engineered antibody fragment based on 3D5  
Authors : Lieberman, R.L.; Maynard, J.A.; Drury, J.E.; Pai, J.; Culver, J.A.  
Deposited on : 2010-06-23  
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](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

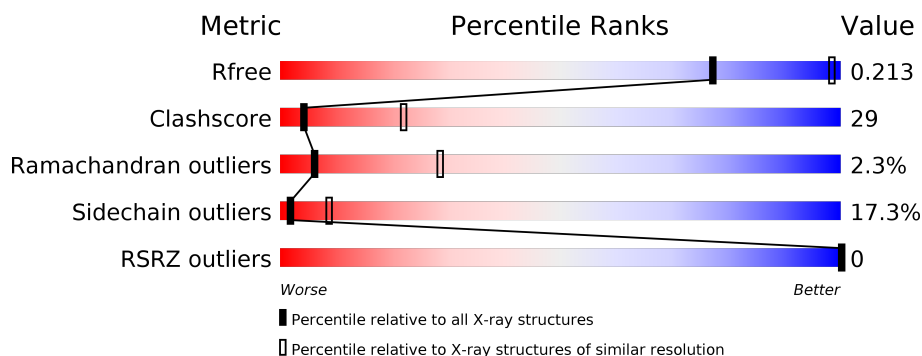
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 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 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	122	<div> <div>50%</div> <div>42%</div> <div>7%</div> <div>.</div> </div>
1	C	122	<div> <div>50%</div> <div>43%</div> <div>6%</div> <div>.</div> </div>
1	D	122	<div> <div>47%</div> <div>43%</div> <div>8%</div> <div>..</div> </div>
1	G	122	<div> <div>43%</div> <div>47%</div> <div>10%</div> <div>.</div> </div>
2	B	116	<div> <div>45%</div> <div>43%</div> <div>11%</div> <div>.</div> </div>
2	E	116	<div> <div>50%</div> <div>40%</div> <div>9%</div> <div>..</div> </div>

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Mol	Chain	Length	Quality of chain
2	F	116	 41% 45% 12% •
2	H	116	 49% 39% 11% •

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7272 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 Engineered scFv, heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	121	Total	C	N	O	S	0	0	0
			938	586	160	188	4			
1	C	122	Total	C	N	O	S	0	0	0
			944	589	161	190	4			
1	D	121	Total	C	N	O	S	0	0	0
			938	586	160	188	4			
1	G	121	Total	C	N	O	S	0	0	0
			938	586	160	188	4			

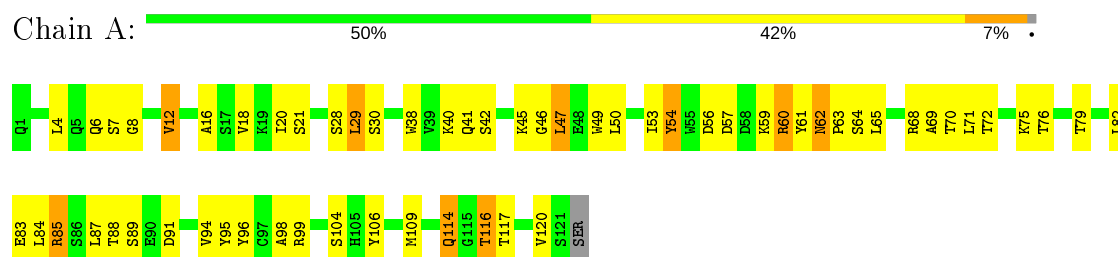
- Molecule 2 is a protein called Engineered scFv, light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	115	Total	C	N	O	S	0	0	0
			874	552	148	171	3			
2	E	115	Total	C	N	O	S	0	0	0
			874	552	148	171	3			
2	F	116	Total	C	N	O	S	0	0	0
			883	558	150	172	3			
2	H	116	Total	C	N	O	S	0	0	0
			883	558	150	172	3			

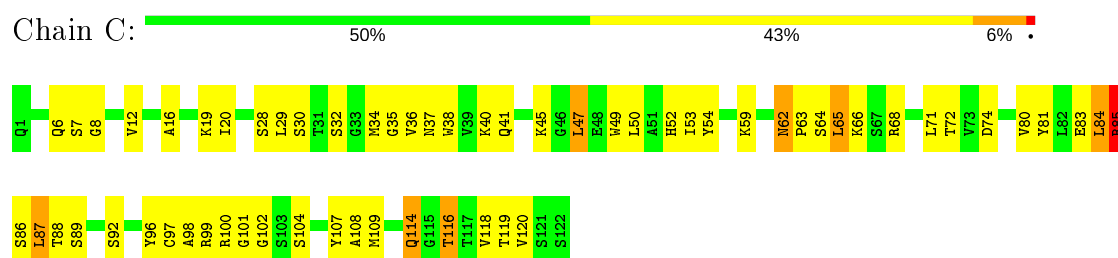
### 3 Residue-property plots

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.

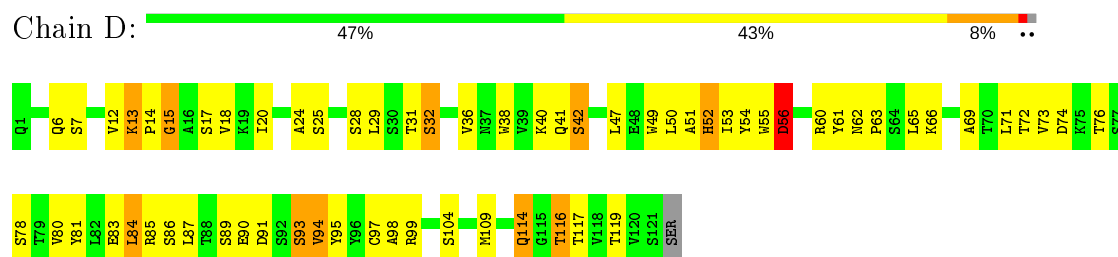
- Molecule 1: Engineered scFv, heavy chain



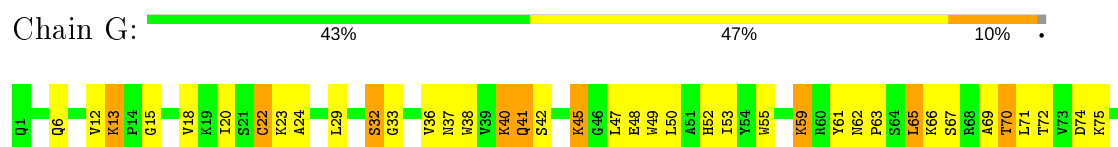
- Molecule 1: Engineered scFv, heavy chain



- Molecule 1: Engineered scFv, heavy chain

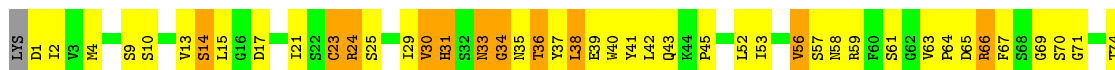


- Molecule 1: Engineered scFv, heavy chain

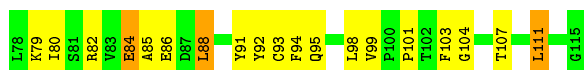
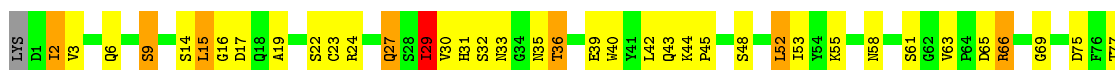




• Molecule 2: Engineered scFv, light chain



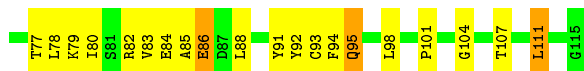
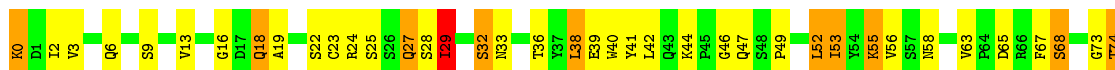
• Molecule 2: Engineered scFv, light chain



• Molecule 2: Engineered scFv, light chain



• Molecule 2: Engineered scFv, light chain



## 4 Data and refinement statistics

Property	Value	Source
Space group	F 2 3	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	266.64Å 266.64Å 266.64Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	154.30 – 3.10 19.87 – 3.10	Depositor EDS
% Data completeness (in resolution range)	99.5 (154.30-3.10) 100.0 (19.87-3.10)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	0.12	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.79 (at 3.09Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.183 , 0.238 0.195 , 0.213	Depositor DCC
$R_{free}$ test set	1439 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	35.1	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.25 , -6.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.469 for k,h,-l	Xtriage
$F_o, F_c$ correlation	0.91	EDS
Total number of atoms	7272	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	69.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.70% 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	0.81	0/960	0.87	0/1302
1	C	0.83	0/966	0.86	2/1310 (0.2%)
1	D	0.82	0/960	0.91	1/1302 (0.1%)
1	G	0.85	1/960 (0.1%)	0.93	1/1302 (0.1%)
2	B	0.71	0/893	0.84	1/1208 (0.1%)
2	E	0.71	0/893	0.79	1/1208 (0.1%)
2	F	0.72	0/902	0.87	3/1219 (0.2%)
2	H	0.71	0/902	0.86	2/1219 (0.2%)
All	All	0.77	1/7436 (0.0%)	0.87	11/10070 (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	C	0	1
1	D	0	1
2	E	0	1
All	All	0	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	G	22	CYS	CB-SG	-5.33	1.73	1.81

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	F	46	GLY	N-CA-C	-6.97	95.66	113.10
2	H	23	CYS	CA-CB-SG	-6.92	101.54	114.00
2	F	23	CYS	CA-CB-SG	-6.88	101.62	114.00
2	E	23	CYS	CA-CB-SG	-6.26	102.73	114.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	86	SER	N-CA-C	-6.21	94.22	111.00

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	85	ARG	Peptide
1	D	15	GLY	Peptide
2	E	45	PRO	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	A	938	0	904	56	0
1	C	944	0	909	56	0
1	D	938	0	904	57	0
1	G	938	0	904	53	0
2	B	874	0	866	56	0
2	E	874	0	866	46	0
2	F	883	0	879	66	0
2	H	883	0	879	49	0
All	All	7272	0	7111	423	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 29.

The worst 5 of 423 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:G:41:GLN:HG3	1:G:47:LEU:HD12	1.29	1.08
2:B:24:ARG:HB2	2:B:24:ARG:NH1	1.74	1.01
1:A:6:GLN:HB3	1:A:116:THR:HG22	1.40	1.01
2:F:29:ILE:HD11	2:F:95:GLN:HG3	1.46	0.97
1:D:6:GLN:H	1:D:114:GLN:HE22	1.07	0.96

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	119/122 (98%)	107 (90%)	9 (8%)	3 (2%)	5	27
1	C	120/122 (98%)	110 (92%)	9 (8%)	1 (1%)	19	54
1	D	119/122 (98%)	109 (92%)	9 (8%)	1 (1%)	19	54
1	G	119/122 (98%)	107 (90%)	12 (10%)	0	100	100
2	B	113/116 (97%)	100 (88%)	8 (7%)	5 (4%)	2	15
2	E	113/116 (97%)	101 (89%)	9 (8%)	3 (3%)	5	25
2	F	114/116 (98%)	105 (92%)	4 (4%)	5 (4%)	2	15
2	H	114/116 (98%)	99 (87%)	12 (10%)	3 (3%)	5	26
All	All	931/952 (98%)	838 (90%)	72 (8%)	21 (2%)	6	28

5 of 21 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	56	ASP
2	E	32	SER
2	F	29	ILE
2	F	33	ASN
1	A	46	GLY

### 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	104/105 (99%)	89 (86%)	15 (14%)	3	14
1	C	105/105 (100%)	90 (86%)	15 (14%)	3	14
1	D	104/105 (99%)	85 (82%)	19 (18%)	1	7
1	G	104/105 (99%)	84 (81%)	20 (19%)	1	6
2	B	99/100 (99%)	82 (83%)	17 (17%)	2	9
2	E	99/100 (99%)	81 (82%)	18 (18%)	1	7
2	F	100/100 (100%)	82 (82%)	18 (18%)	1	7
2	H	100/100 (100%)	81 (81%)	19 (19%)	1	6
All	All	815/820 (99%)	674 (83%)	141 (17%)	2	9

5 of 141 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	114	GLN
2	E	75	ASP
2	H	47	GLN
1	D	119	THR
2	E	29	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 30 such sidechains are listed below:

Mol	Chain	Res	Type
2	E	35	ASN
2	E	95	GLN
2	H	43	GLN
2	E	58	ASN
2	F	6	GLN

### 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 [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 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 ⓘ

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	121/122 (99%)	-0.44	0 100 100	16, 52, 91, 111	0
1	C	122/122 (100%)	-0.42	0 100 100	16, 53, 91, 116	0
1	D	121/122 (99%)	-0.42	0 100 100	15, 53, 95, 115	0
1	G	121/122 (99%)	-0.42	0 100 100	16, 51, 97, 119	0
2	B	115/116 (99%)	-0.12	0 100 100	37, 82, 130, 150	0
2	E	115/116 (99%)	-0.06	0 100 100	40, 89, 154, 174	0
2	F	116/116 (100%)	-0.11	0 100 100	33, 83, 132, 158	0
2	H	116/116 (100%)	-0.08	0 100 100	34, 91, 153, 166	0
All	All	947/952 (99%)	-0.26	0 100 100	15, 65, 131, 174	0

There are no RSRZ outliers to report.

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

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

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

### 6.4 Ligands ⓘ

There are no ligands in this entry.

### 6.5 Other polymers ⓘ

There are no such residues in this entry.