



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 22, 2020 – 07:20 pm BST

PDB ID : 2X7L  
Title : Implications of the HIV-1 Rev dimer structure at 3.2Å resolution for multi-  
meric binding to the Rev response element  
Authors : DiMattia, M.A.; Watts, N.R.; Stahl, S.J.; Rader, C.; Wingfield, P.T.; Stuart,  
D.I.; Steven, A.C.; Grimes, J.M.  
Deposited on : 2010-03-01  
Resolution : 3.17 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

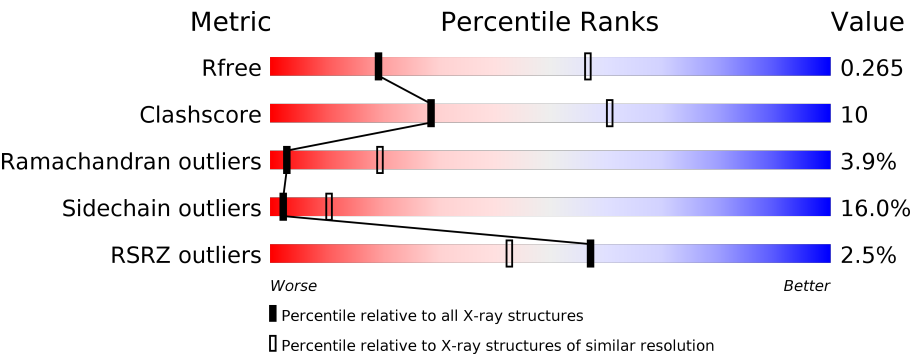
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.17 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.









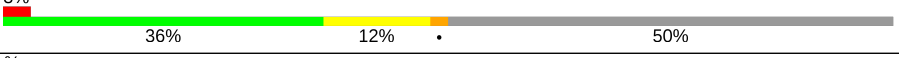


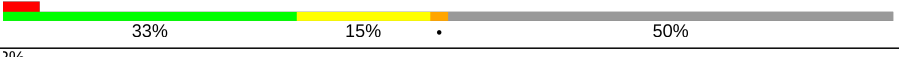


Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1467 (3.20-3.16)
Clashscore	141614	1599 (3.20-3.16)
Ramachandran outliers	138981	1574 (3.20-3.16)
Sidechain outliers	138945	1573 (3.20-3.16)
RSRZ outliers	127900	1423 (3.20-3.16)

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	231	<div><div>%</div><div><div></div><div>67%</div><div>26%</div><div>.</div><div>.</div></div></div>
1	C	231	<div><div>7%</div><div><div></div><div>69%</div><div>25%</div><div>.</div><div>.</div></div></div>
1	E	231	<div><div>2%</div><div><div></div><div>67%</div><div>26%</div><div>.</div><div>.</div></div></div>
1	G	231	<div><div>5%</div><div><div></div><div>70%</div><div>24%</div><div>.</div><div>.</div></div></div>
1	H	231	<div><div>2%</div><div><div></div><div>67%</div><div>26%</div><div>.</div><div>.</div></div></div>
1	J	231	<div><div>4%</div><div><div></div><div>68%</div><div>26%</div><div>.</div><div>.</div></div></div>

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Mol	Chain	Length	Quality of chain
2	B	217	
2	D	217	
2	F	217	
2	I	217	
2	K	217	
2	L	217	
3	M	115	
3	N	115	
3	O	115	
3	P	115	
3	Q	115	
3	R	115	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 22554 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 FAB HEAVY CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	221	Total	C	N	O	S	0	0	1
			1628	1033	267	323	5			
1	C	221	Total	C	N	O	S	0	0	1
			1628	1033	267	323	5			
1	E	221	Total	C	N	O	S	0	0	1
			1628	1033	267	323	5			
1	G	221	Total	C	N	O	S	0	0	1
			1628	1033	267	323	5			
1	H	221	Total	C	N	O	S	0	0	1
			1628	1033	267	323	5			
1	J	221	Total	C	N	O	S	0	0	1
			1628	1033	267	323	5			

- Molecule 2 is a protein called FAB LIGHT CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	217	Total	C	N	O	S	0	0	0
			1639	1026	269	337	7			
2	D	217	Total	C	N	O	S	0	0	0
			1639	1026	269	337	7			
2	F	217	Total	C	N	O	S	0	0	0
			1639	1026	269	337	7			
2	I	217	Total	C	N	O	S	0	0	0
			1639	1026	269	337	7			
2	K	217	Total	C	N	O	S	0	0	0
			1639	1026	269	337	7			
2	L	217	Total	C	N	O	S	0	0	0
			1639	1026	269	337	7			

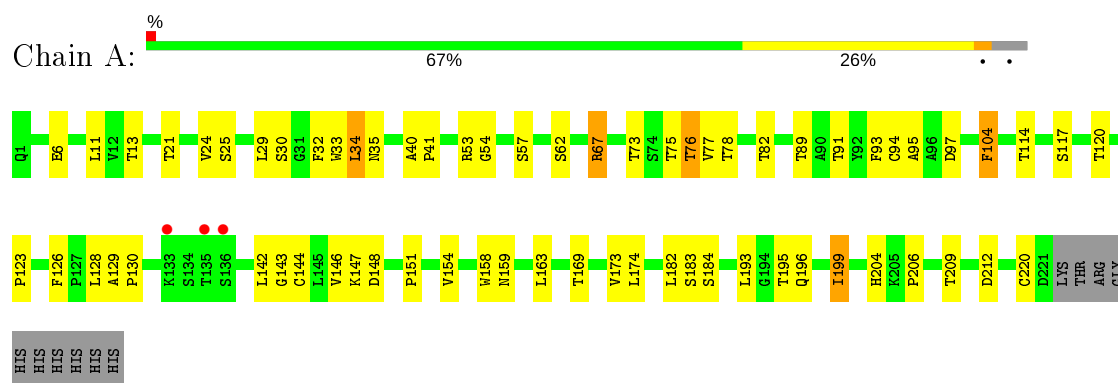
- Molecule 3 is a protein called PROTEIN REV.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	M	57	Total 492	C 303	N 105	O 84	0	0	0
3	N	57	Total 492	C 303	N 105	O 84	0	0	0
3	O	57	Total 492	C 303	N 105	O 84	0	0	0
3	P	57	Total 492	C 303	N 105	O 84	0	0	0
3	Q	57	Total 492	C 303	N 105	O 84	0	0	0
3	R	57	Total 492	C 303	N 105	O 84	0	0	0

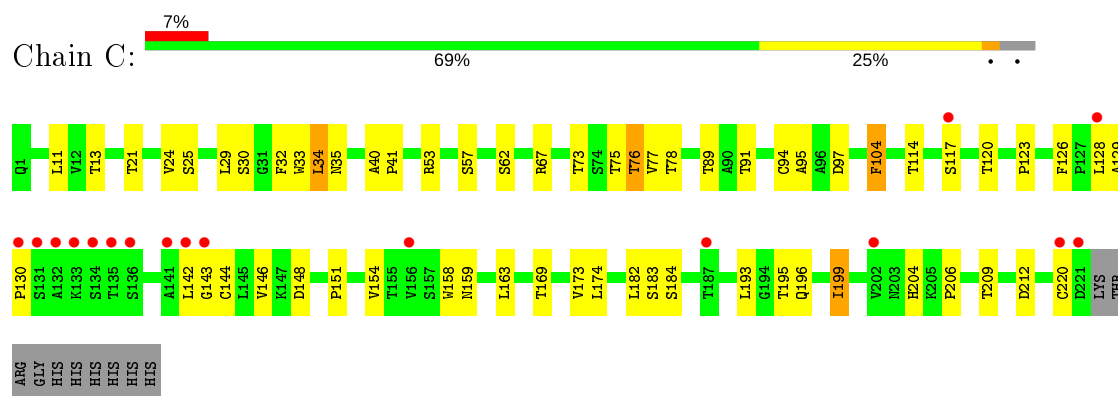
### 3 Residue-property plots

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.

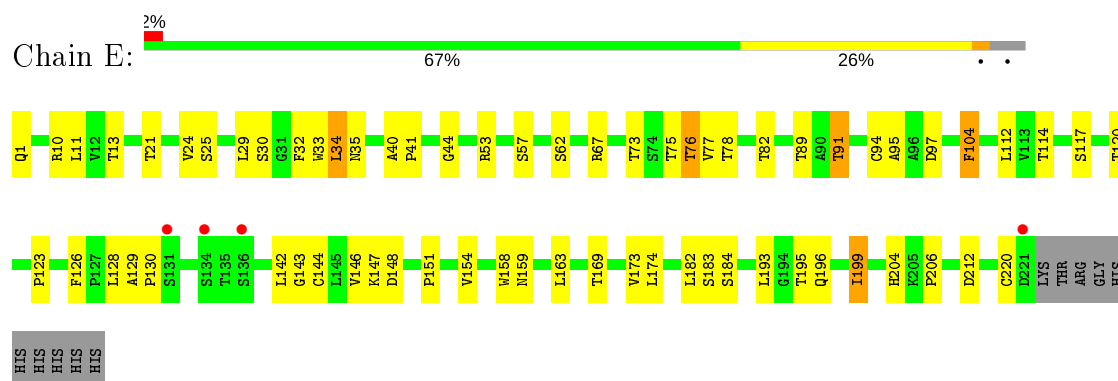
#### • Molecule 1: FAB HEAVY CHAIN



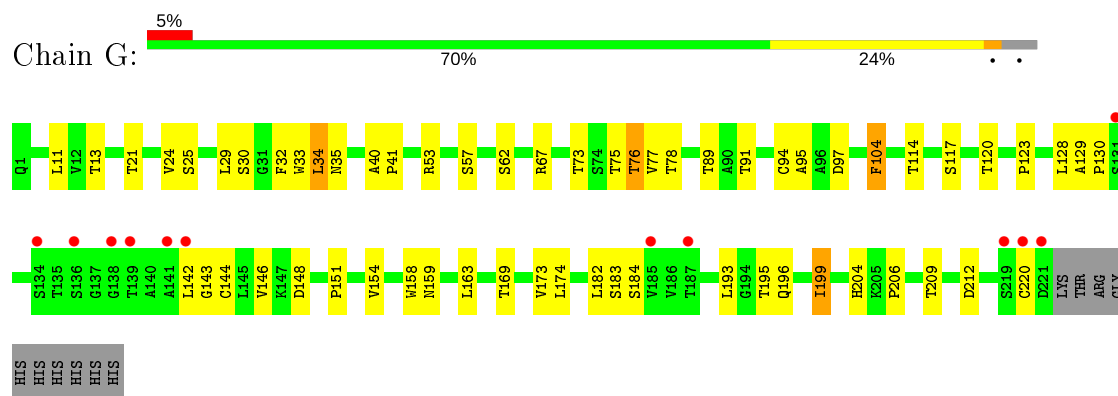
#### • Molecule 1: FAB HEAVY CHAIN



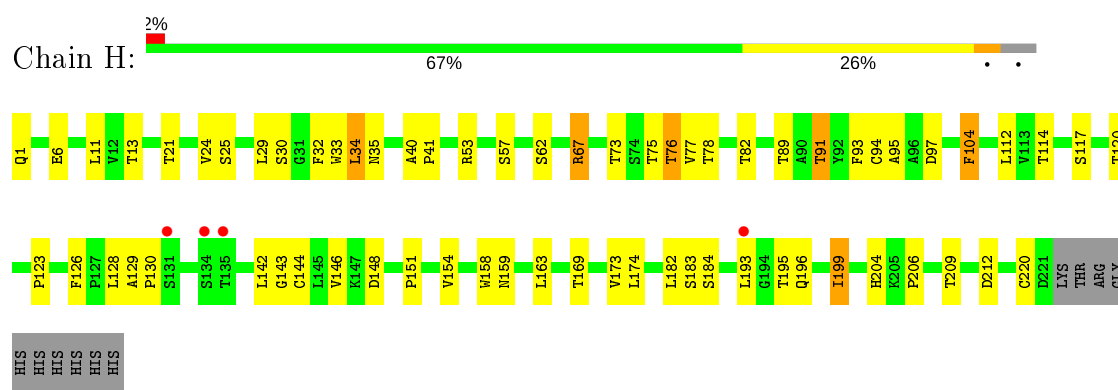
#### • Molecule 1: FAB HEAVY CHAIN



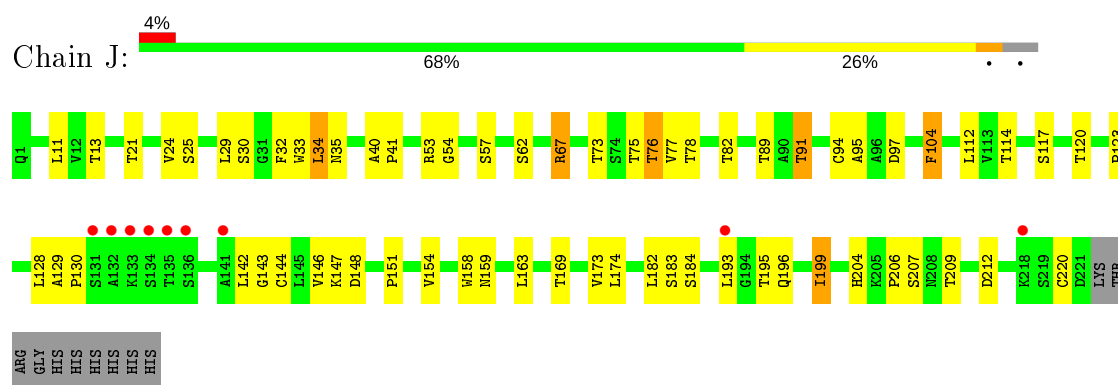
- Molecule 1: FAB HEAVY CHAIN



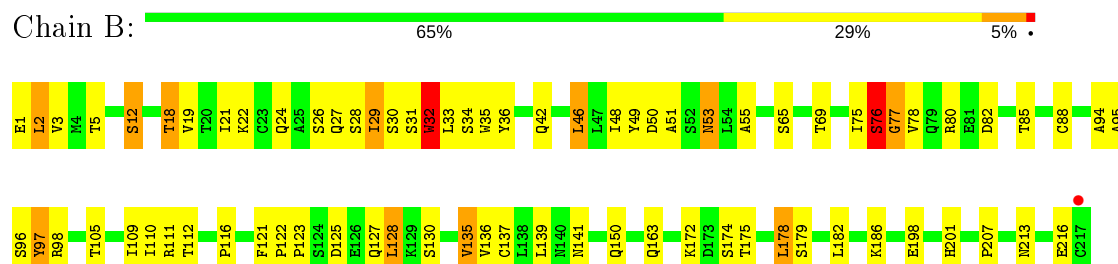
- Molecule 1: FAB HEAVY CHAIN



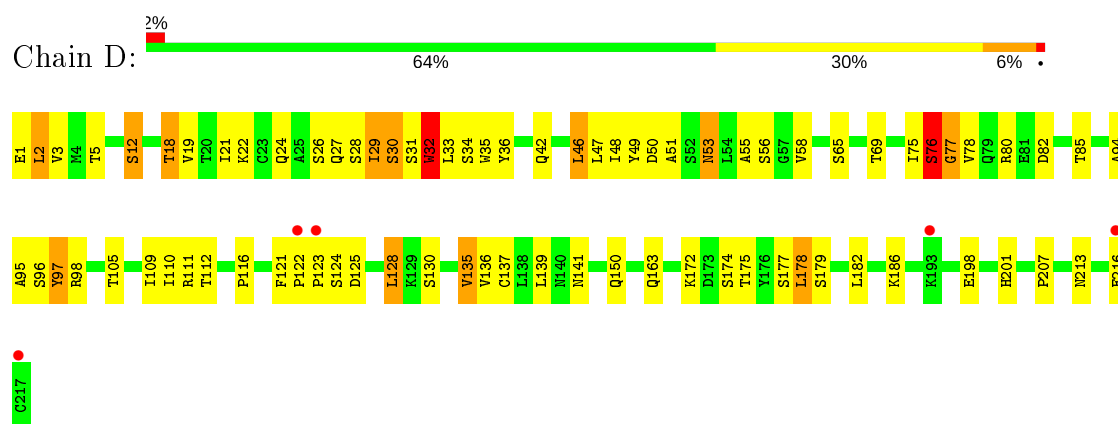
- Molecule 1: FAB HEAVY CHAIN



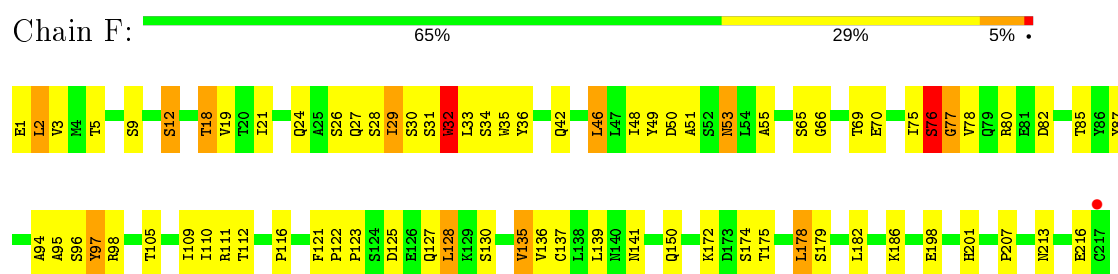
- Molecule 2: FAB LIGHT CHAIN



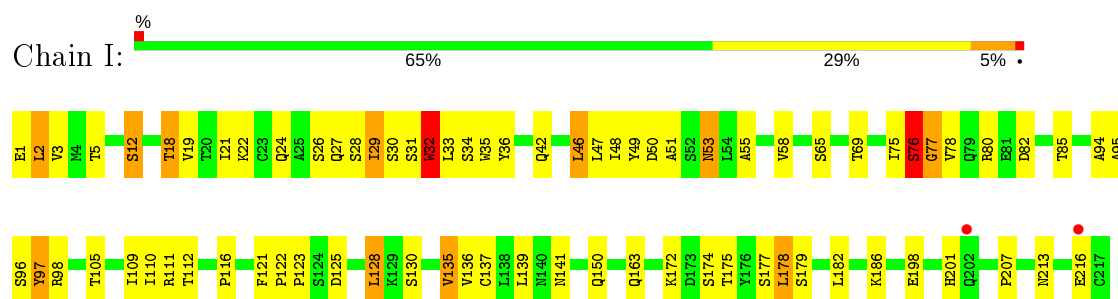
- Molecule 2: FAB LIGHT CHAIN



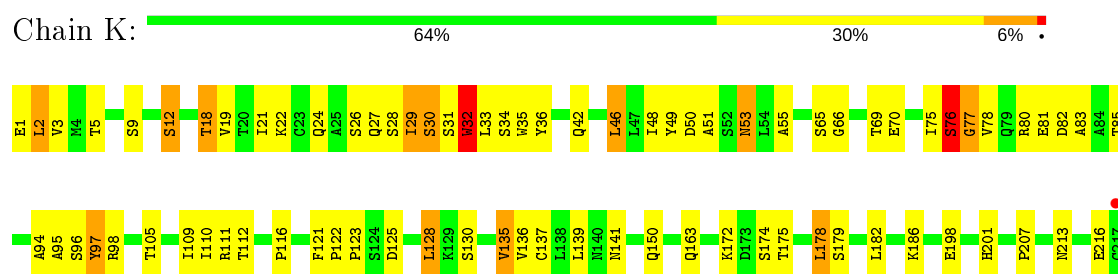
- Molecule 2: FAB LIGHT CHAIN



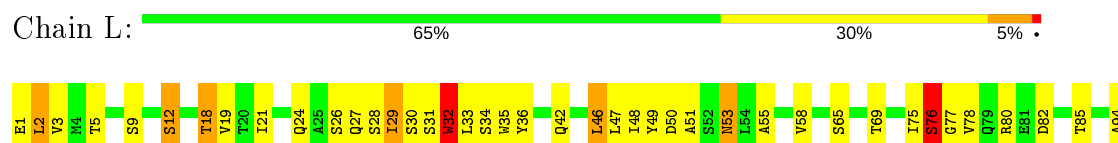
- Molecule 2: FAB LIGHT CHAIN



- Molecule 2: FAB LIGHT CHAIN



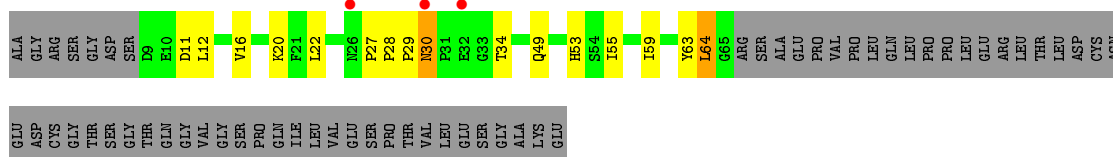
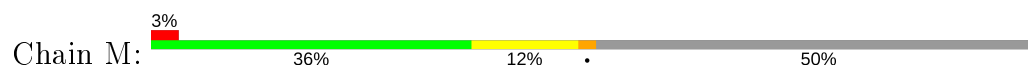
- Molecule 2: FAB LIGHT CHAIN



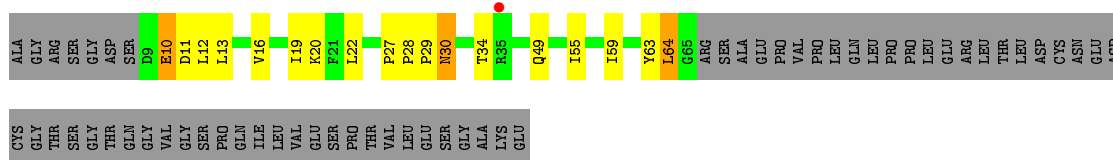
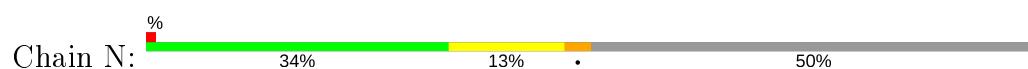




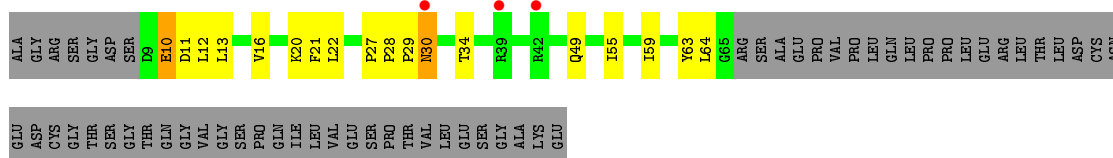
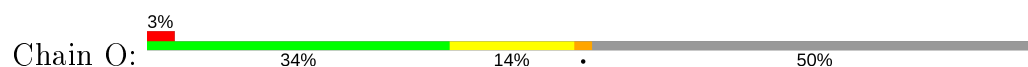
• Molecule 3: PROTEIN REV



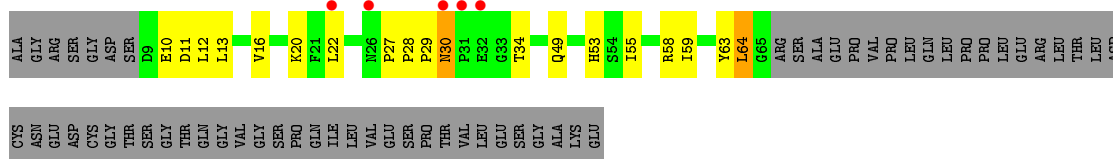
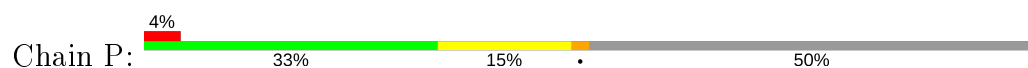
• Molecule 3: PROTEIN REV



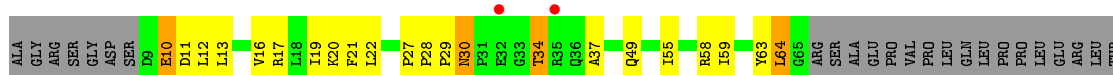
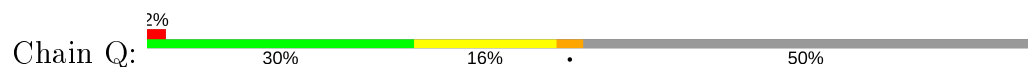
• Molecule 3: PROTEIN REV



• Molecule 3: PROTEIN REV

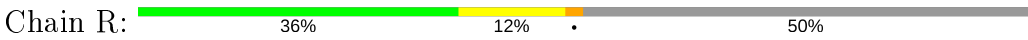


• Molecule 3: PROTEIN REV



LEU  
ASP  
CYS  
ASN  
GLU  
ASP  
CYS  
GLY  
THR  
SER  
GLY  
THR  
GLN  
GLY  
VAL  
GLY  
SER  
PRO  
GLN  
TLE  
LEU  
VAL  
GLU  
SER  
PRO  
THR  
VAL  
LEU  
SER  
GLY  
ALA  
LYS  
GLU

● Molecule 3: PROTEIN REV



ALA  
GLY  
ARG  
SER  
THR  
GLY  
ASP  
SER  
SER  
D9  
E10  
D11  
L12  
L13  
V16  
K20  
F21  
L22  
F27  
F28  
P29  
N30  
T34  
Q49  
I55  
I59  
Y63  
L64  
G65  
ARG  
SER  
SER  
ALA  
GLU  
PRO  
VAL  
PRO  
LEU  
GLN  
LEU  
PRO  
PRO  
LEU  
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VAL  
GLU  
SER  
PRO  
THR  
VAL  
LEU  
GLU  
SER  
GLY  
ALA  
LYS  
GLU

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	87.68Å 87.69Å 176.33Å 94.86° 95.50° 104.60°	Depositor
Resolution (Å)	48.78 – 3.17 48.77 – 3.17	Depositor EDS
% Data completeness (in resolution range)	(Not available) (48.78-3.17) 97.6 (48.77-3.17)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.74 (at 3.19Å)	Xtriage
Refinement program	BUSTER 2.9.2	Depositor
R, $R_{free}$	0.234 , 0.250 0.253 , 0.265	Depositor DCC
$R_{free}$ test set	4187 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	85.2	Xtriage
Anisotropy	0.532	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.21 , 36.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.327 for -k,-h,-l	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	22554	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	143.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.38% 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	0.62	0/1671	0.83	0/2288
1	C	0.46	0/1671	0.78	0/2288
1	E	0.59	0/1671	0.81	0/2288
1	G	0.47	0/1671	0.78	0/2288
1	H	0.56	0/1671	0.81	0/2288
1	J	0.54	0/1671	0.80	0/2288
2	B	0.60	0/1675	0.85	0/2278
2	D	0.50	0/1675	0.81	0/2278
2	F	0.59	0/1675	0.85	0/2278
2	I	0.49	0/1675	0.82	0/2278
2	K	0.57	0/1675	0.84	0/2278
2	L	0.59	0/1675	0.84	0/2278
3	M	0.53	0/501	0.69	0/672
3	N	0.55	0/501	0.68	0/672
3	O	0.60	0/501	0.72	0/672
3	P	0.52	0/501	0.68	0/672
3	Q	0.55	0/501	0.68	0/672
3	R	0.57	0/501	0.70	0/672
All	All	0.55	0/23082	0.80	0/31428

There are no bond length outliers.

There are no bond angle outliers.

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	A	1628	0	1594	29	0
1	C	1628	0	1594	25	0
1	E	1628	0	1594	28	0
1	G	1628	0	1594	24	0
1	H	1628	0	1594	29	0
1	J	1628	0	1594	28	0
2	B	1639	0	1581	40	0
2	D	1639	0	1581	43	0
2	F	1639	0	1581	41	0
2	I	1639	0	1581	40	0
2	K	1639	0	1581	42	0
2	L	1639	0	1581	39	0
3	M	492	0	504	7	0
3	N	492	0	504	9	0
3	O	492	0	504	7	0
3	P	492	0	504	11	0
3	Q	492	0	504	13	0
3	R	492	0	504	7	0
All	All	22554	0	22074	434	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 10.

The worst 5 of 434 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)
2:I:21:ILE:HG21	2:I:105:THR:HG21	1.26	1.14
2:L:21:ILE:HG21	2:L:105:THR:HG21	1.28	1.12
2:D:21:ILE:HG21	2:D:105:THR:HG21	1.24	1.11
2:K:21:ILE:HG21	2:K:105:THR:HG21	1.28	1.10
2:B:21:ILE:HG21	2:B:105:THR:HG21	1.27	1.09

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	219/231 (95%)	187 (85%)	28 (13%)	4 (2%)	8	38
1	C	219/231 (95%)	189 (86%)	26 (12%)	4 (2%)	8	38
1	E	219/231 (95%)	187 (85%)	28 (13%)	4 (2%)	8	38
1	G	219/231 (95%)	190 (87%)	25 (11%)	4 (2%)	8	38
1	H	219/231 (95%)	187 (85%)	28 (13%)	4 (2%)	8	38
1	J	219/231 (95%)	190 (87%)	25 (11%)	4 (2%)	8	38
2	B	215/217 (99%)	188 (87%)	14 (6%)	13 (6%)	1	11
2	D	215/217 (99%)	188 (87%)	14 (6%)	13 (6%)	1	11
2	F	215/217 (99%)	188 (87%)	14 (6%)	13 (6%)	1	11
2	I	215/217 (99%)	188 (87%)	14 (6%)	13 (6%)	1	11
2	K	215/217 (99%)	188 (87%)	14 (6%)	13 (6%)	1	11
2	L	215/217 (99%)	188 (87%)	15 (7%)	12 (6%)	2	12
3	M	55/115 (48%)	46 (84%)	7 (13%)	2 (4%)	3	21
3	N	55/115 (48%)	48 (87%)	5 (9%)	2 (4%)	3	21
3	O	55/115 (48%)	47 (86%)	6 (11%)	2 (4%)	3	21
3	P	55/115 (48%)	46 (84%)	7 (13%)	2 (4%)	3	21
3	Q	55/115 (48%)	46 (84%)	7 (13%)	2 (4%)	3	21
3	R	55/115 (48%)	47 (86%)	6 (11%)	2 (4%)	3	21
All	All	2934/3378 (87%)	2538 (86%)	283 (10%)	113 (4%)	3	19

5 of 113 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	174	SER
2	D	174	SER
2	F	174	SER
2	I	174	SER
2	K	174	SER

### 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	182/192 (95%)	152 (84%)	30 (16%)	2	10
1	C	182/192 (95%)	154 (85%)	28 (15%)	2	12
1	E	182/192 (95%)	151 (83%)	31 (17%)	2	9
1	G	182/192 (95%)	154 (85%)	28 (15%)	2	12
1	H	182/192 (95%)	152 (84%)	30 (16%)	2	10
1	J	182/192 (95%)	152 (84%)	30 (16%)	2	10
2	B	184/185 (100%)	154 (84%)	30 (16%)	2	10
2	D	184/185 (100%)	153 (83%)	31 (17%)	2	9
2	F	184/185 (100%)	155 (84%)	29 (16%)	2	11
2	I	184/185 (100%)	154 (84%)	30 (16%)	2	10
2	K	184/185 (100%)	154 (84%)	30 (16%)	2	10
2	L	184/185 (100%)	154 (84%)	30 (16%)	2	10
3	M	53/101 (52%)	46 (87%)	7 (13%)	4	17
3	N	53/101 (52%)	45 (85%)	8 (15%)	3	13
3	O	53/101 (52%)	45 (85%)	8 (15%)	3	13
3	P	53/101 (52%)	46 (87%)	7 (13%)	4	17
3	Q	53/101 (52%)	45 (85%)	8 (15%)	3	13
3	R	53/101 (52%)	46 (87%)	7 (13%)	4	17
All	All	2514/2868 (88%)	2112 (84%)	402 (16%)	2	10

5 of 402 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	25	SER
1	H	120	THR
3	N	64	LEU
1	G	67	ARG
1	G	196	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 37 such sidechains are listed below:

Mol	Chain	Res	Type
2	I	53	ASN

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Mol	Chain	Res	Type
2	I	201	HIS
3	P	51	GLN
2	I	79	GLN
2	I	127	GLN

### 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](#)

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	221/231 (95%)	-0.27	3 (1%) 75 63	75, 114, 192, 246	0
1	C	221/231 (95%)	0.11	17 (7%) 13 7	102, 173, 235, 263	0
1	E	221/231 (95%)	-0.31	4 (1%) 68 55	78, 118, 191, 251	0
1	G	221/231 (95%)	0.14	12 (5%) 25 14	100, 175, 246, 265	0
1	H	221/231 (95%)	-0.29	4 (1%) 68 55	67, 113, 195, 224	0
1	J	221/231 (95%)	-0.23	9 (4%) 37 23	74, 119, 201, 236	0
2	B	217/217 (100%)	-0.45	1 (0%) 91 86	73, 116, 189, 208	0
2	D	217/217 (100%)	-0.23	5 (2%) 60 46	98, 156, 248, 263	0
2	F	217/217 (100%)	-0.39	1 (0%) 91 86	74, 113, 200, 229	0
2	I	217/217 (100%)	-0.29	2 (0%) 84 75	88, 149, 251, 283	0
2	K	217/217 (100%)	-0.48	1 (0%) 91 86	75, 116, 188, 222	0
2	L	217/217 (100%)	-0.45	0 100 100	76, 116, 186, 211	0
3	M	57/115 (49%)	-0.10	3 (5%) 26 14	109, 164, 278, 284	0
3	N	57/115 (49%)	-0.26	1 (1%) 68 55	96, 155, 287, 298	0
3	O	57/115 (49%)	0.04	3 (5%) 26 14	97, 151, 278, 287	0
3	P	57/115 (49%)	0.01	5 (8%) 10 5	119, 165, 276, 280	0
3	Q	57/115 (49%)	0.03	2 (3%) 44 28	98, 151, 275, 277	0
3	R	57/115 (49%)	0.06	0 100 100	95, 156, 274, 280	0
All	All	2970/3378 (87%)	-0.23	73 (2%) 57 43	67, 129, 236, 298	0

The worst 5 of 73 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	J	134	SER	11.9
1	C	221	ASP	8.0
1	C	134	SER	7.0

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Mol	Chain	Res	Type	RSRZ
2	D	123	PRO	6.8
1	H	134	SER	6.2

## 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.