



# wwPDB X-ray Structure Validation Summary Report ⓘ

Dec 12, 2023 – 05:20 pm GMT

PDB ID : 4TWH  
Title : X-ray structure of a pentameric ligand gated ion channel from *Erwinia chrysanthemi* (ELIC) mutant F16'S  
Authors : Ulens, C.; Spurny, R.; Thompson, A.J.; Alqazzaz, M.; Debaveye, S.; Lu, H.; Price, K.; Villalgordo, J.M.; Tresadern, G.; Lynch, J.W.; Lummis, S.C.R.  
Deposited on : 2014-06-30  
Resolution : 3.60 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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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 : 2.36  
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) : 2.36

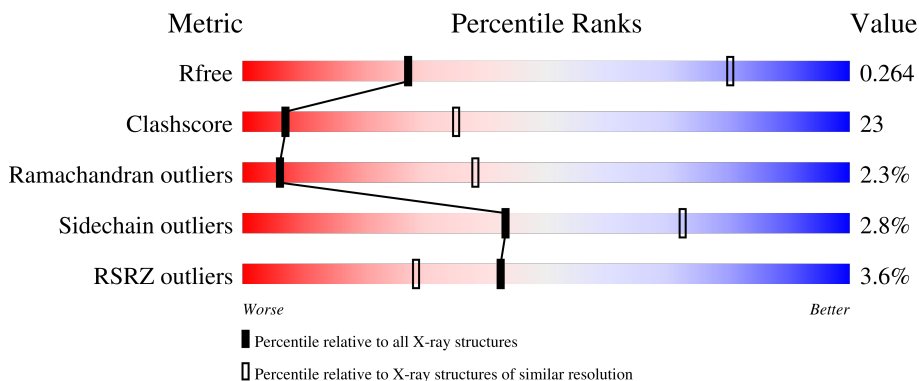
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.60 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.



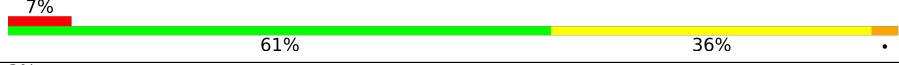
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1257 (3.70-3.50)
Clashscore	141614	1353 (3.70-3.50)
Ramachandran outliers	138981	1307 (3.70-3.50)
Sidechain outliers	138945	1307 (3.70-3.50)
RSRZ outliers	127900	1161 (3.70-3.50)

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  $\leq 5\%$ . 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	307	 3% 63% 34%
1	B	307	 3% 57% 39%
1	C	307	 3% 58% 39%
1	D	307	 3% 56% 39%
1	E	307	 4% 54% 43%

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Mol	Chain	Length	Quality of chain
1	F	307	
1	G	307	
1	H	307	
1	I	307	
1	J	307	

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 24970 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 Cys-loop ligand-gated ion channel.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	307	2497	1624	416	451	6	0	0	0
1	B	307	2497	1624	416	451	6	0	0	0
1	C	307	2497	1624	416	451	6	0	0	0
1	D	307	2497	1624	416	451	6	0	0	0
1	E	307	2497	1624	416	451	6	0	0	0
1	F	307	2497	1624	416	451	6	0	0	0
1	G	307	2497	1624	416	451	6	0	0	0
1	H	307	2497	1624	416	451	6	0	0	0
1	I	307	2497	1624	416	451	6	0	0	0
1	J	307	2497	1624	416	451	6	0	0	0

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	152	ALA	ILE	conflict	UNP P0C7B7
A	164	GLY	-	insertion	UNP P0C7B7
A	247	SER	PHE	engineered mutation	UNP P0C7B7
A	289	ASN	MET	conflict	UNP P0C7B7
B	152	ALA	ILE	conflict	UNP P0C7B7
B	164	GLY	-	insertion	UNP P0C7B7
B	247	SER	PHE	engineered mutation	UNP P0C7B7
B	289	ASN	MET	conflict	UNP P0C7B7
C	152	ALA	ILE	conflict	UNP P0C7B7

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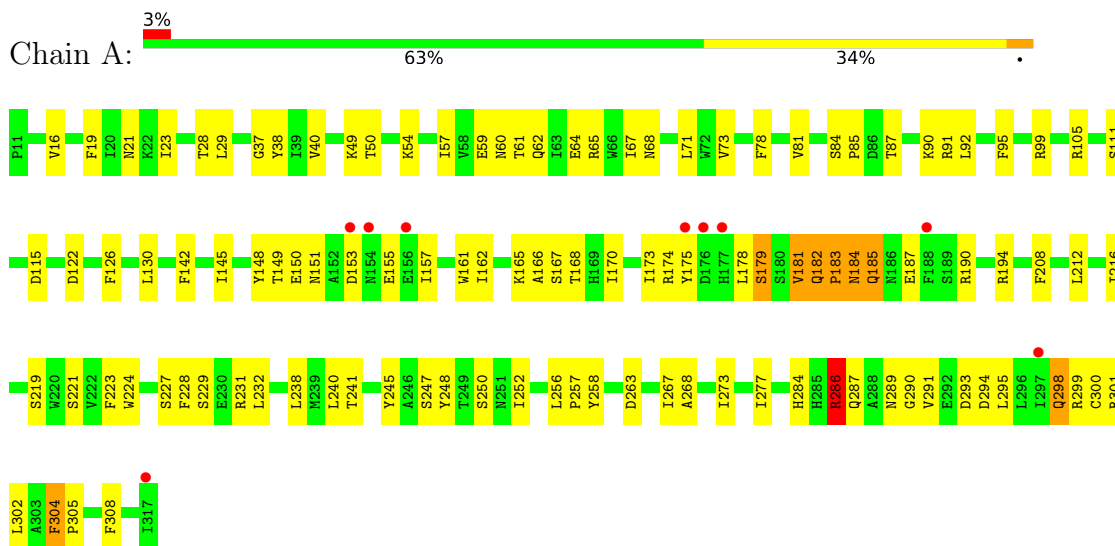
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Chain	Residue	Modelled	Actual	Comment	Reference
C	164	GLY	-	insertion	UNP P0C7B7
C	247	SER	PHE	engineered mutation	UNP P0C7B7
C	289	ASN	MET	conflict	UNP P0C7B7
D	152	ALA	ILE	conflict	UNP P0C7B7
D	164	GLY	-	insertion	UNP P0C7B7
D	247	SER	PHE	engineered mutation	UNP P0C7B7
D	289	ASN	MET	conflict	UNP P0C7B7
E	152	ALA	ILE	conflict	UNP P0C7B7
E	164	GLY	-	insertion	UNP P0C7B7
E	247	SER	PHE	engineered mutation	UNP P0C7B7
E	289	ASN	MET	conflict	UNP P0C7B7
F	152	ALA	ILE	conflict	UNP P0C7B7
F	164	GLY	-	insertion	UNP P0C7B7
F	247	SER	PHE	engineered mutation	UNP P0C7B7
F	289	ASN	MET	conflict	UNP P0C7B7
G	152	ALA	ILE	conflict	UNP P0C7B7
G	164	GLY	-	insertion	UNP P0C7B7
G	247	SER	PHE	engineered mutation	UNP P0C7B7
G	289	ASN	MET	conflict	UNP P0C7B7
H	152	ALA	ILE	conflict	UNP P0C7B7
H	164	GLY	-	insertion	UNP P0C7B7
H	247	SER	PHE	engineered mutation	UNP P0C7B7
H	289	ASN	MET	conflict	UNP P0C7B7
I	152	ALA	ILE	conflict	UNP P0C7B7
I	164	GLY	-	insertion	UNP P0C7B7
I	247	SER	PHE	engineered mutation	UNP P0C7B7
I	289	ASN	MET	conflict	UNP P0C7B7
J	152	ALA	ILE	conflict	UNP P0C7B7
J	164	GLY	-	insertion	UNP P0C7B7
J	247	SER	PHE	engineered mutation	UNP P0C7B7
J	289	ASN	MET	conflict	UNP P0C7B7

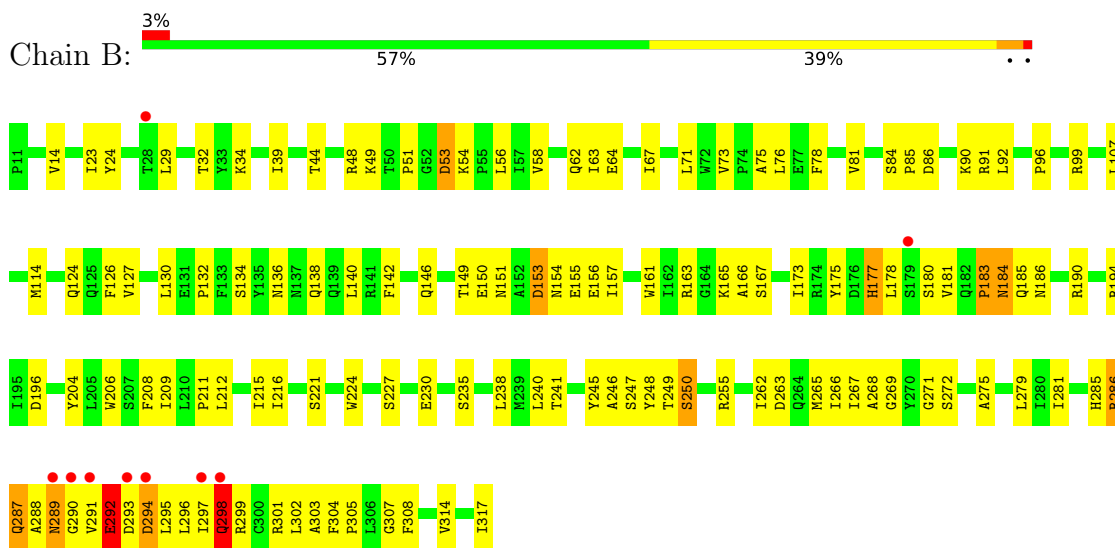
### 3 Residue-property plots [i](#)

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 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: Cys-loop ligand-gated ion channel

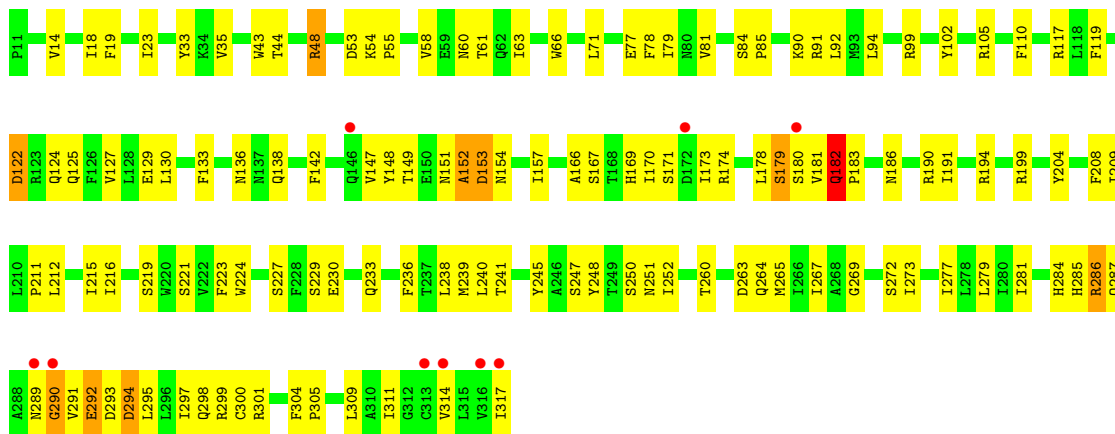


- Molecule 1: Cys-loop ligand-gated ion channel

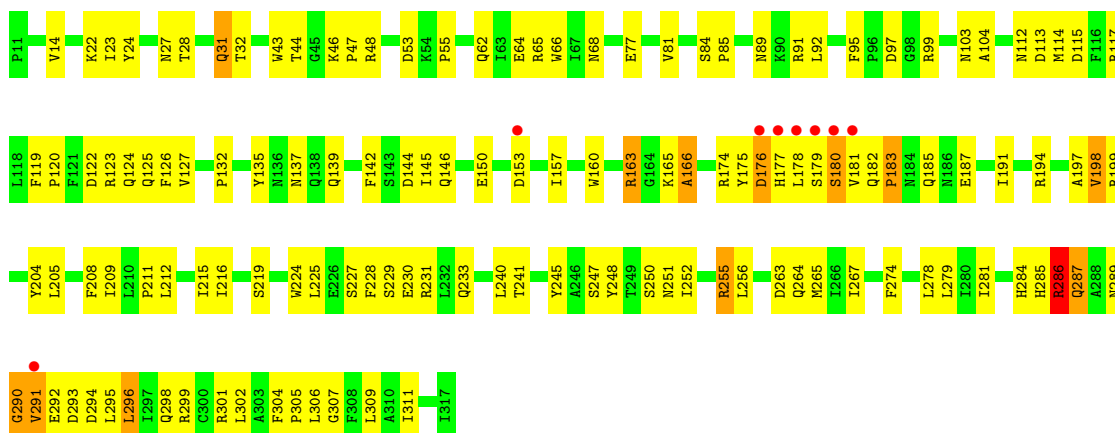


- Molecule 1: Cys-loop ligand-gated ion channel

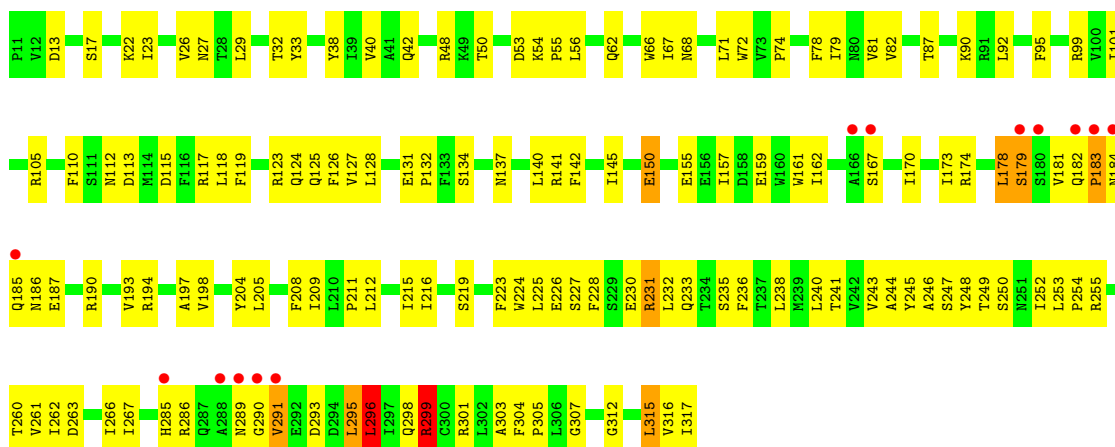




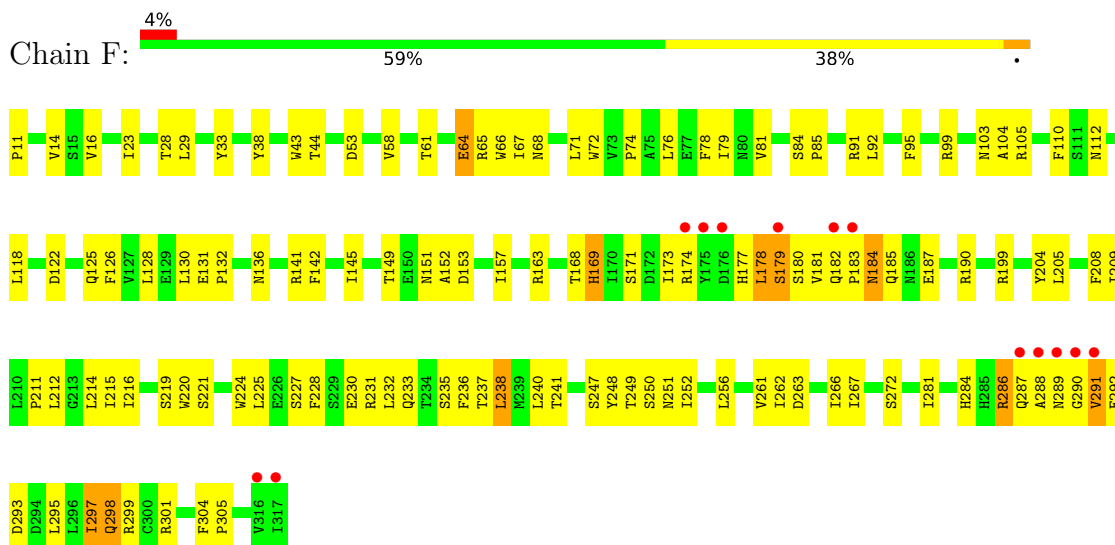
• Molecule 1: Cys-loop ligand-gated ion channel



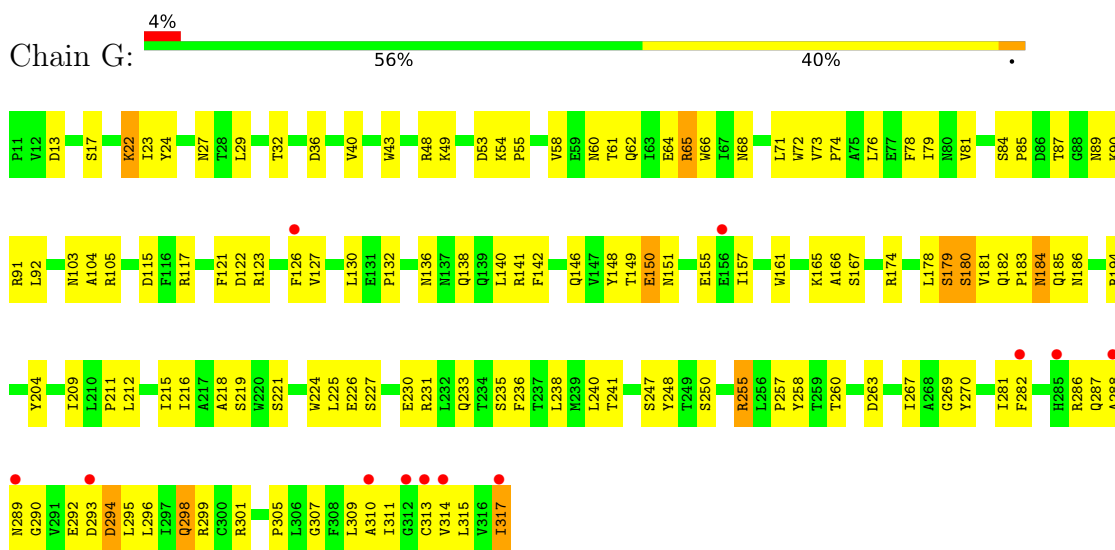
• Molecule 1: Cys-loop ligand-gated ion channel



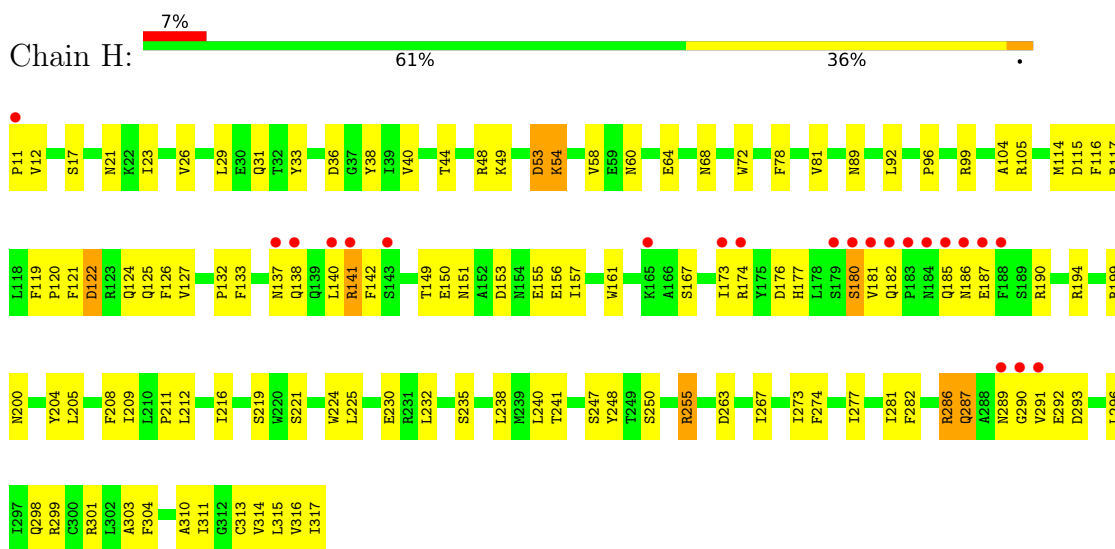
• Molecule 1: Cys-loop ligand-gated ion channel



- Molecule 1: Cys-loop ligand-gated ion channel

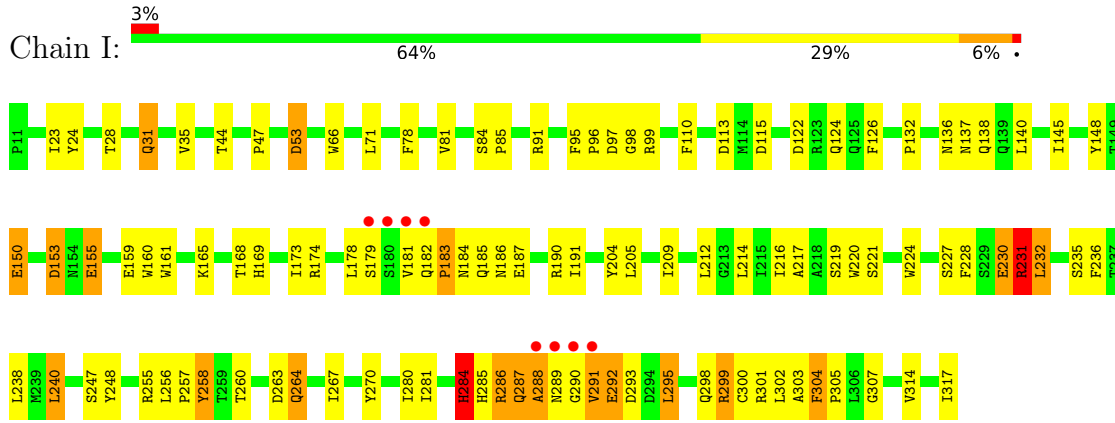


- Molecule 1: Cys-loop ligand-gated ion channel

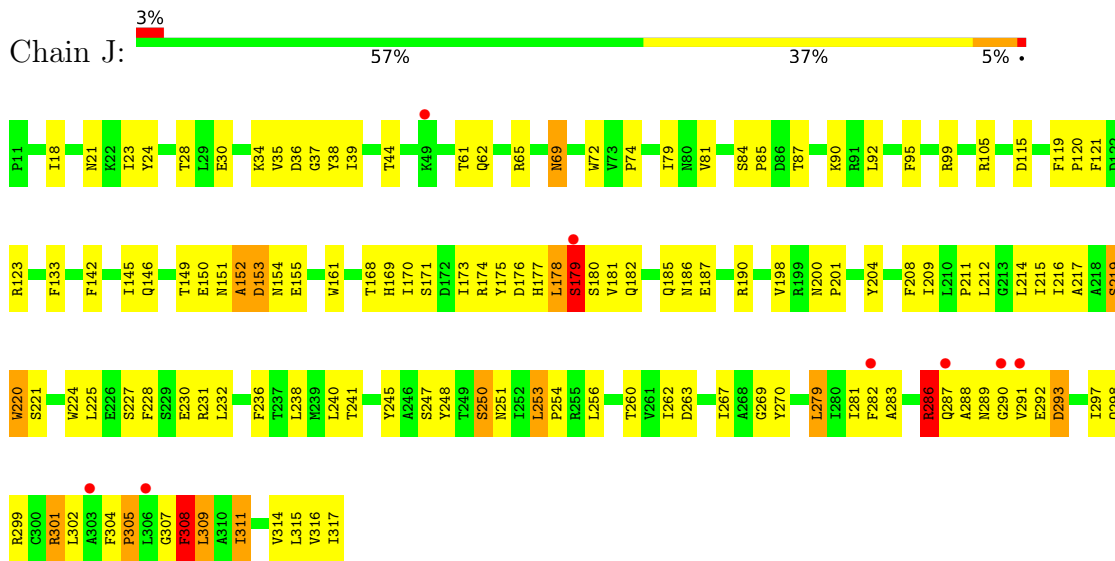




- Molecule 1: Cys-loop ligand-gated ion channel



- Molecule 1: Cys-loop ligand-gated ion channel



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	105.90Å 264.97Å 111.33Å 90.00° 108.82° 90.00°	Depositor
Resolution (Å)	48.62 – 3.60 48.62 – 3.60	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.62-3.60) 90.3 (48.62-3.60)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.30 (at 3.57Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.4_1496)	Depositor
R, $R_{free}$	0.220 , 0.263 0.225 , 0.264	Depositor DCC
$R_{free}$ test set	3361 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	91.3	Xtriage
Anisotropy	0.306	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.26 , 53.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.46$ , $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.88	EDS
Total number of atoms	24970	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	118.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.11% 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	0.44	0/2564	0.77	2/3495 (0.1%)
1	B	0.48	1/2564 (0.0%)	0.82	5/3495 (0.1%)
1	C	0.42	0/2564	0.75	1/3495 (0.0%)
1	D	0.46	0/2564	0.81	4/3495 (0.1%)
1	E	0.44	0/2564	0.79	5/3495 (0.1%)
1	F	0.39	0/2564	0.72	3/3495 (0.1%)
1	G	0.41	0/2564	0.72	1/3495 (0.0%)
1	H	0.40	0/2564	0.73	1/3495 (0.0%)
1	I	0.50	1/2564 (0.0%)	0.82	7/3495 (0.2%)
1	J	0.47	0/2564	0.83	6/3495 (0.2%)
All	All	0.44	2/25640 (0.0%)	0.78	35/34950 (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	2
1	B	0	4
1	C	0	1
1	D	0	1
1	E	0	2
1	F	0	3
1	G	0	2
1	I	0	3
1	J	0	5
All	All	0	23

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	I	258	TYR	CD1-CE1	-6.01	1.30	1.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	292	GLU	CG-CD	-5.18	1.44	1.51

The worst 5 of 35 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	178	LEU	CA-CB-CG	7.19	131.84	115.30
1	D	198	VAL	CB-CA-C	-6.94	98.21	111.40
1	B	293	ASP	CB-CG-OD2	6.56	124.20	118.30
1	B	293	ASP	CB-CG-OD1	-6.48	112.47	118.30
1	J	308	PHE	CB-CA-C	-6.23	97.93	110.40

There are no chirality outliers.

5 of 23 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	181	VAL	Peptide
1	A	286	ARG	Peptide
1	B	177	HIS	Peptide
1	B	286	ARG	Peptide
1	B	288	ALA	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	2497	0	2468	125	0
1	B	2497	0	2468	136	0
1	C	2497	0	2468	141	0
1	D	2497	0	2468	140	0
1	E	2497	0	2468	121	0
1	F	2497	0	2468	116	0
1	G	2497	0	2468	112	0
1	H	2497	0	2468	105	0
1	I	2497	0	2468	114	0
1	J	2497	0	2468	140	0
All	All	24970	0	24680	1130	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 23.

The worst 5 of 1130 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:C:299:ARG:O	1:C:299:ARG:NH1	1.82	1.13
1:C:286:ARG:NH1	1:C:294:ASP:OD2	1.90	1.04
1:F:174:ARG:NH1	1:F:187:GLU:OE2	1.89	1.03
1:J:224:TRP:HE1	1:J:301:ARG:HG2	1.22	1.02
1:D:252:ILE:O	1:E:255:ARG:NH1	1.97	0.97

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	305/307 (99%)	274 (90%)	24 (8%)	7 (2%)	6	38
1	B	305/307 (99%)	272 (89%)	27 (9%)	6 (2%)	7	41
1	C	305/307 (99%)	275 (90%)	23 (8%)	7 (2%)	6	38
1	D	305/307 (99%)	276 (90%)	20 (7%)	9 (3%)	4	33
1	E	305/307 (99%)	280 (92%)	22 (7%)	3 (1%)	15	55
1	F	305/307 (99%)	277 (91%)	25 (8%)	3 (1%)	15	55
1	G	305/307 (99%)	278 (91%)	19 (6%)	8 (3%)	5	35
1	H	305/307 (99%)	277 (91%)	19 (6%)	9 (3%)	4	33
1	I	305/307 (99%)	276 (90%)	18 (6%)	11 (4%)	3	29
1	J	305/307 (99%)	271 (89%)	27 (9%)	7 (2%)	6	38
All	All	3050/3070 (99%)	2756 (90%)	224 (7%)	70 (2%)	6	38

5 of 70 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	183	PRO
1	A	185	GLN
1	B	166	ALA
1	B	183	PRO
1	B	298	GLN

### 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	274/274 (100%)	271 (99%)	3 (1%)	73	88
1	B	274/274 (100%)	267 (97%)	7 (3%)	46	74
1	C	274/274 (100%)	268 (98%)	6 (2%)	52	77
1	D	274/274 (100%)	267 (97%)	7 (3%)	46	74
1	E	274/274 (100%)	263 (96%)	11 (4%)	31	65
1	F	274/274 (100%)	266 (97%)	8 (3%)	42	72
1	G	274/274 (100%)	266 (97%)	8 (3%)	42	72
1	H	274/274 (100%)	268 (98%)	6 (2%)	52	77
1	I	274/274 (100%)	264 (96%)	10 (4%)	35	67
1	J	274/274 (100%)	264 (96%)	10 (4%)	35	67
All	All	2740/2740 (100%)	2664 (97%)	76 (3%)	43	72

5 of 76 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	I	150	GLU
1	J	301	ARG
1	I	169	HIS
1	I	299	ARG
1	J	316	VAL

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

Mol	Chain	Res	Type
1	E	298	GLN
1	J	182	GLN
1	G	136	ASN
1	J	298	GLN
1	I	284	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](#)

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

### 5.5 Carbohydrates [i](#)

There are no monosaccharides 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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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	307/307 (100%)	-0.25	9 (2%)	51	35	69, 114, 205, 266	0
1	B	307/307 (100%)	-0.17	9 (2%)	51	35	67, 100, 210, 287	0
1	C	307/307 (100%)	-0.17	9 (2%)	51	35	64, 99, 199, 276	0
1	D	307/307 (100%)	-0.16	8 (2%)	56	40	71, 102, 210, 290	0
1	E	307/307 (100%)	-0.13	13 (4%)	36	23	70, 109, 203, 258	0
1	F	307/307 (100%)	-0.15	13 (4%)	36	23	70, 110, 211, 306	0
1	G	307/307 (100%)	-0.09	12 (3%)	39	25	70, 101, 201, 258	0
1	H	307/307 (100%)	-0.09	22 (7%)	15	9	67, 108, 206, 301	0
1	I	307/307 (100%)	-0.25	8 (2%)	56	40	62, 103, 206, 335	0
1	J	307/307 (100%)	-0.26	8 (2%)	56	40	75, 111, 230, 307	0
All	All	3070/3070 (100%)	-0.17	111 (3%)	42	28	62, 106, 208, 335	0

The worst 5 of 111 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	288	ALA	10.4
1	D	180	SER	8.1
1	H	184	ASN	6.9
1	D	179	SER	6.4
1	E	290	GLY	6.0

### 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 monosaccharides 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.