



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 09:09 PM UTC

PDB ID : 1EER / pdb_00001eer
Title : CRYSTAL STRUCTURE OF HUMAN ERYTHROPOIETIN COMPLEXED
TO ITS RECEPTOR AT 1.9 ANGSTROMS
Authors : Syed, R.S.; Li, C.
Deposited on : 1998-07-24
Resolution : 1.90 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

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	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

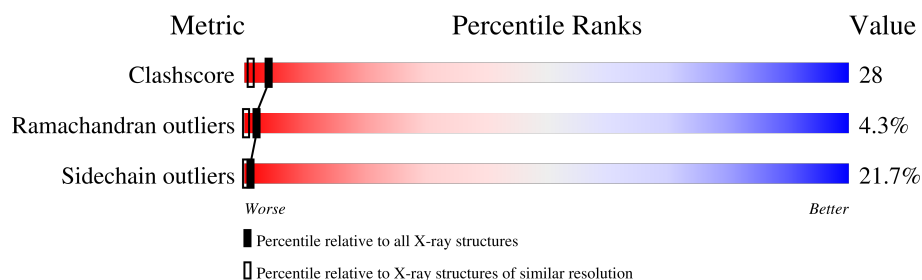
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.90 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	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)

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 ≥ 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	A	166	 56% 31% 10% •
2	B	227	 37% 41% 15% 6%
2	C	227	 48% 33% 11% • 6%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4917 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 ERYTHROPOIETIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	166	Total	C	N	O	S	0	0	0
			1291	815	231	240	5			

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	24	LYS	ASN	engineered mutation	UNP P01588
A	38	LYS	ASN	engineered mutation	UNP P01588
A	83	LYS	ASN	engineered mutation	UNP P01588
A	121	ASN	PRO	engineered mutation	UNP P01588
A	122	SER	PRO	engineered mutation	UNP P01588

- Molecule 2 is a protein called ERYTHROPOIETIN RECEPTOR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	213	Total	C	N	O	S	0	0	0
			1664	1057	293	307	7			
2	C	213	Total	C	N	O	S	0	0	0
			1664	1057	293	307	7			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	52	GLN	ASN	engineered mutation	UNP P19235
B	164	GLN	ASN	engineered mutation	UNP P19235
B	211	GLU	ALA	engineered mutation	UNP P19235
C	52	GLN	ASN	engineered mutation	UNP P19235
C	164	GLN	ASN	engineered mutation	UNP P19235
C	211	GLU	ALA	engineered mutation	UNP P19235

- Molecule 3 is water.

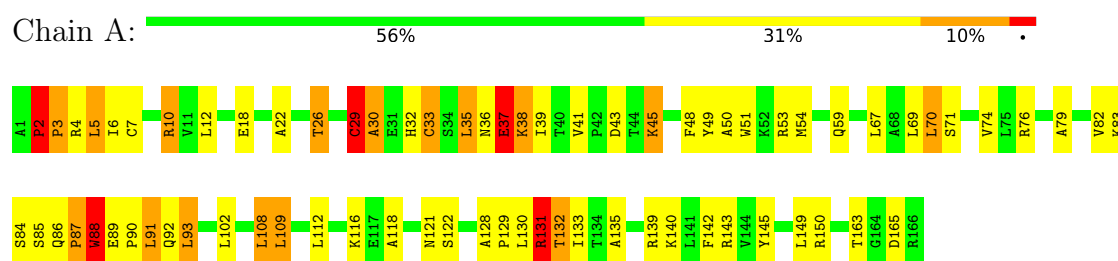
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	118	Total 118	O 118	0	0
3	B	74	Total 74	O 74	0	0
3	C	106	Total 106	O 106	0	0

3 Residue-property plots [i](#)

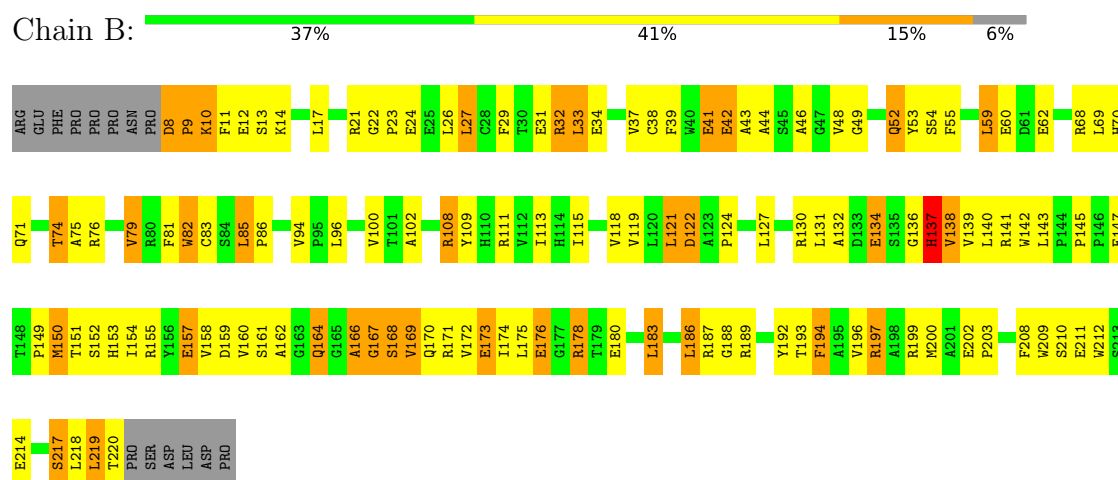
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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.

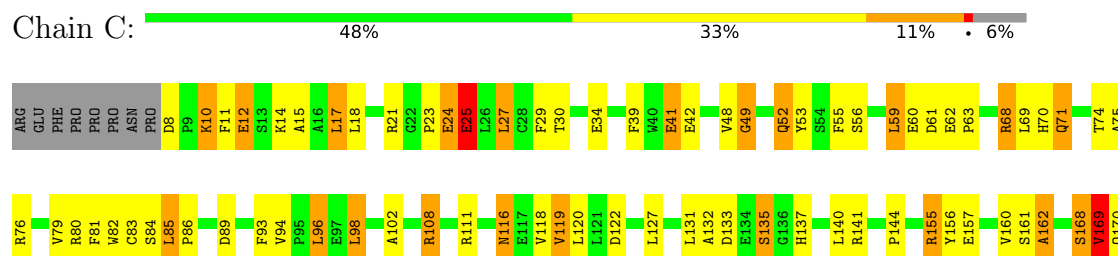
• Molecule 1: ERYTHROPOIETIN



• Molecule 2: ERYTHROPOIETIN RECEPTOR



• Molecule 2: ERYTHROPOIETIN RECEPTOR



E173	E176	E180	S184	N185	L186	R187	G188	R189	T190	R191	Y192	T193	F194	A195	V196	R197	A198	R199	M200	A201	E202	P203	S204	F205	G206	G207	F208	W209	S210	E211	W212	V216	S217	L218	L219	T220	PRO	SER	ASP	LEU	ASP	PRO
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4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	58.40 Å 79.30 Å 136.50 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 1.90	Depositor
% Data completeness (in resolution range)	93.3 (50.00-1.90)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.04	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.242 , 0.318	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4917	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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	0.43	0/1312	0.96	13/1774 (0.7%)
2	B	0.41	0/1709	0.92	6/2330 (0.3%)
2	C	0.44	0/1709	0.92	5/2330 (0.2%)
All	All	0.43	0/4730	0.93	24/6434 (0.4%)

There are no bond length outliers.

The worst 5 of 24 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
2	B	43	ALA	N-CA-C	-11.37	100.91	112.97
2	C	122	ASP	N-CA-C	-7.41	100.54	110.55
2	C	24	GLU	N-CA-C	-7.40	104.38	113.19
2	B	211	GLU	N-CA-C	-6.70	101.50	110.55
2	C	169	VAL	N-CA-C	6.52	122.90	109.34

There are no chirality outliers.

There are no planarity outliers.

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	1291	0	1323	60	0
2	B	1664	0	1622	107	0
2	C	1664	0	1622	92	0
3	A	118	0	0	4	0
3	B	74	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	106	0	0	4	0
All	All	4917	0	4567	257	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 28.

The worst 5 of 257 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:B:48:VAL:HA	2:B:52:GLN:HG3	1.35	1.06
2:B:41:GLU:HG2	2:B:74:THR:HG21	1.34	1.03
2:C:162:ALA:HB2	2:C:192:TYR:HA	1.47	0.94
2:B:197:ARG:HD2	2:B:209:TRP:HB3	1.53	0.89
2:B:160:VAL:HB	2:B:170:GLN:HB3	1.57	0.87

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	164/166 (99%)	150 (92%)	5 (3%)	9 (6%)	1	0
2	B	211/227 (93%)	181 (86%)	21 (10%)	9 (4%)	2	0
2	C	211/227 (93%)	186 (88%)	18 (8%)	7 (3%)	3	0
All	All	586/620 (94%)	517 (88%)	44 (8%)	25 (4%)	2	0

5 of 25 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	5	LEU
1	A	131	ARG

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Mol	Chain	Res	Type
2	B	46	ALA
2	B	137	HIS
2	B	164	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	137/138 (99%)	119 (87%)	18 (13%)	4	1
2	B	176/190 (93%)	125 (71%)	51 (29%)	0	0
2	C	176/190 (93%)	139 (79%)	37 (21%)	1	0
All	All	489/518 (94%)	383 (78%)	106 (22%)	1	0

5 of 106 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	175	LEU
2	C	17	LEU
2	C	190	THR
2	B	178	ARG
2	B	202	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	153	HIS
2	B	170	GLN
2	C	116	ASN
2	C	71	GLN
2	B	52	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 oligosaccharides 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

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.