



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 1, 2026 – 05:40 AM UTC

PDB ID : 1A5L / pdb_00001a5l
Title : K217C VARIANT OF KLEBSIELLA AEROGENES UREASE
Authors : Pearson, M.A.; Schaller, R.A.; Michel, L.O.; Karplus, P.A.; Hausinger, R.P.
Deposited on : 1998-02-17
Resolution : 2.20 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

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)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

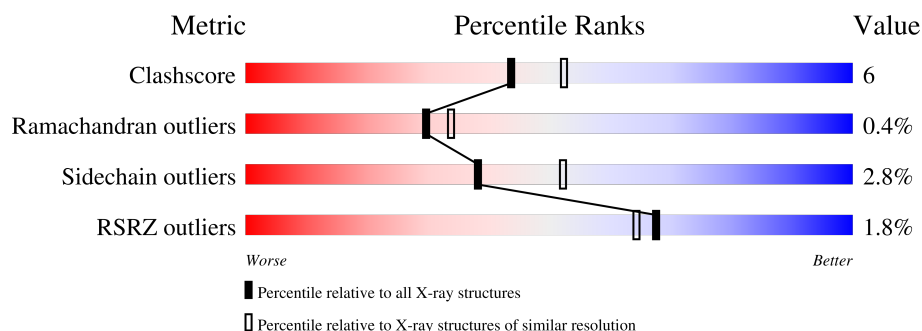
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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 $\leq 5\%$. 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	100	
2	B	101	
3	C	566	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 5731 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 UREASE (GAMMA SUBUNIT).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	100	Total	C	N	O	S	0	0	0
			776	491	134	146	5			

- Molecule 2 is a protein called UREASE (BETA SUBUNIT).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	101	Total	C	N	O	S	0	0	0
			785	496	150	136	3			

- Molecule 3 is a protein called UREASE (ALPHA SUBUNIT).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	536	Total	C	N	O	S	0	1	0
			3987	2502	700	764	21			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	217	CYS	LYS	engineered mutation	UNP P18314

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	17	Total	O	0	0
			17	17		
4	B	12	Total	O	0	0
			12	12		
4	C	154	Total	O	0	0
			154	154		

- Molecule 1: UREASE (GAMMA SUBUNIT)



- | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| M1 | I2 | P3 | G4 | H7 | R19 | K50 | E72 | Q75 | L81 | V82 | A83 | R88 | A89 | V97 | P100 | L101 |
|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|

- | | | | |
|------|------|------|------|
| S493 | E345 | H272 | S2 |
| L507 | D346 | T273 | K20 |
| R508 | L348 | E274 | V21 |
| R518 | H349 | | R22 |
| T519 | S355 | G277 | L293 |
| V520 | L356 | G278 | A24 |
| V526 | S359 | G279 | L36 |
| H527 | D360 | H280 | V50 |
| | S361 | A281 | C85 |
| Y541 | Q362 | P282 | I75 |
| V545 | A363 | L284 | I81 |
| E548 | G365 | L285 | A89 |
| L549 | V370 | S296 | P110 |
| I550 | L371 | T298 | P111 |
| P554 | L372 | N299 | V118 |
| A555 | R373 | T301 | I135 |
| L558 | V377 | L302 | H166 |
| P559 | | P303 | G173 |
| M560 | R380 | T305 | I177 |
| A561 | T392 | L306 | S178 |
| Q562 | N395 | N307 | R179 |
| F567 | K406 | TLE | P188 |
| | Y407 | ASP | N198 |
| | T408 | GLJ | V199 |
| | L409 | HIS | S200 |
| | N410 | LEU | Q201 |
| | P411 | ASP | P202 |
| | H419 | NET | D203 |
| | | LEU | A204 |
| | | NET | L205 |
| | | VAL | V213 |
| | N435 | CYS | I218 |
| | S436 | HIS | W222 |
| | F440 | HIS | A236 |
| | G441 | LEU | V243 |
| | V442 | ASP | H246 |
| | K443 | PRO | S247 |
| | P444 | ASP | T350 |
| | V447 | ILE | |
| | I448 | ALA | |
| | K449 | GLJ | |
| | I455 | VAL | |
| | I465 | ALA | |
| | R474 | PHE | |
| | P475 | ALA | |
| | | GLJ | |
| | | SER | |
| | | ARG | |
| | | ILE | |
| | | ARG | |
| | | R339 | |

4 Data and refinement statistics

Property	Value	Source
Space group	I 21 3	Depositor
Cell constants a, b, c, α , β , γ	170.80Å 170.80Å 170.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 2.20 10.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.0 (10.00-2.20) 88.7 (10.00-2.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.15 (at 2.20Å)	Xtriage
Refinement program	X-PLOR	Depositor
R, R_{free}	0.186 , (Not available) 0.183 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	14.8	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 45.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.037 for -l,-k,-h	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5731	wwPDB-VP
Average B, all atoms (Å ²)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.68% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	0.51	0/787	0.87	0/1061
2	B	0.44	0/805	0.90	1/1087 (0.1%)
3	C	0.50	0/4071	1.02	24/5548 (0.4%)
All	All	0.49	0/5663	0.99	25/7696 (0.3%)

There are no bond length outliers.

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	173	GLY	CA-C-N	9.59	129.21	119.24
3	C	173	GLY	C-N-CA	9.59	129.21	119.24
3	C	247	SER	N-CA-C	8.21	120.93	110.33
3	C	443	LYS	CA-C-N	7.83	127.76	119.85
3	C	443	LYS	C-N-CA	7.83	127.76	119.85
3	C	436	SER	N-CA-C	-7.83	99.94	109.72
3	C	442	VAL	CB-CA-C	-6.91	105.84	111.71
3	C	50	VAL	N-CA-C	6.62	118.22	111.00
3	C	360	ASP	N-CA-C	-6.40	102.41	111.56
3	C	201	GLN	CA-C-N	6.30	125.79	119.24
3	C	201	GLN	C-N-CA	6.30	125.79	119.24
3	C	409	ILE	N-CA-C	6.28	116.45	110.42
3	C	135	ILE	N-CA-C	6.07	117.03	108.36
3	C	306	LEU	N-CA-C	5.83	118.59	111.82
3	C	562	GLN	N-CA-C	5.72	119.36	112.38
3	C	442	VAL	N-CA-C	5.68	116.82	111.48
3	C	173	GLY	N-CA-C	5.65	123.87	112.34
3	C	283	ASP	N-CA-C	5.57	118.87	112.57
3	C	361	SER	N-CA-C	5.41	118.64	110.64
3	C	118	VAL	N-CA-C	5.40	115.89	108.12
3	C	199	VAL	CB-CA-C	-5.39	104.31	111.80
3	C	493	SER	N-CA-C	-5.31	103.38	110.55
2	B	19	ARG	N-CA-C	5.30	118.20	109.72
3	C	299	ASN	N-CA-C	5.21	121.31	109.81

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	355	SER	N-CA-C	5.09	119.77	113.50

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	776	0	807	4	0
2	B	785	0	775	9	0
3	C	3987	0	3944	58	0
4	A	17	0	0	1	0
4	B	12	0	0	1	0
4	C	154	0	0	2	0
All	All	5731	0	5526	68	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 6.

All (68) 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)
3:C:299:ASN:HB2	3:C:373:ARG:HD2	1.56	0.86
3:C:297:SER:HB2	3:C:349:HIS:HE1	1.44	0.82
3:C:300:PRO:HG3	3:C:364:MET:O	1.81	0.81
3:C:302:LEU:HD22	3:C:377:VAL:HG21	1.74	0.70
3:C:359:SER:O	3:C:365:GLY:HA3	1.93	0.68
3:C:274:GLU:HG3	3:C:345:GLU:HB2	1.76	0.67
3:C:299:ASN:HB2	3:C:373:ARG:CD	2.26	0.64
3:C:218:ILE:HD13	3:C:243:VAL:HG13	1.81	0.62
3:C:545:VAL:O	3:C:548:GLU:HG2	2.02	0.60
3:C:188:PRO:O	3:C:449:LYS:HD2	2.04	0.57
3:C:299:ASN:O	3:C:373:ARG:HD3	2.05	0.56
2:B:7:HIS:HB3	3:C:20:LYS:HB2	1.87	0.56
3:C:201:GLN:HE21	3:C:203:ASP:H	1.52	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:285:ILE:HD11	3:C:348:LEU:CD1	2.37	0.55
3:C:303:PRO:O	3:C:305:THR:HG23	2.07	0.54
3:C:380:ARG:NE	3:C:555:ALA:HB2	2.23	0.54
3:C:359:SER:HB3	3:C:370:VAL:CG2	2.37	0.54
2:B:89:ALA:HA	2:B:100:PRO:HA	1.90	0.53
3:C:173:GLY:O	3:C:177:ILE:HG13	2.08	0.53
3:C:395:ASN:C	3:C:395:ASN:HD22	2.17	0.53
3:C:166:HIS:HD2	4:C:688:HOH:O	1.92	0.53
2:B:72:GLU:H	2:B:75:GLN:NE2	2.08	0.52
3:C:363:ALA:O	3:C:364:MET:HB2	2.08	0.52
3:C:236:ALA:O	3:C:518:ARG:HD2	2.11	0.51
2:B:4:GLY:HA2	3:C:22:ARG:O	2.10	0.51
3:C:296:SER:HB3	3:C:356:LEU:HB2	1.92	0.51
2:B:83:ALA:HB1	2:B:88:ARG:HH21	1.76	0.50
3:C:297:SER:HB2	3:C:349:HIS:CE1	2.35	0.50
3:C:298:THR:HG21	3:C:360:ASP:HB2	1.93	0.50
2:B:3:PRO:HA	3:C:24:ALA:O	2.12	0.49
3:C:297:SER:CB	3:C:349:HIS:HE1	2.22	0.49
3:C:440:PHE:O	3:C:560:MET:HE2	2.11	0.49
3:C:285:ILE:HD11	3:C:348:LEU:HD11	1.94	0.49
3:C:435:TRP:CZ3	3:C:444:PRO:HG3	2.47	0.49
3:C:246:HIS:CG	3:C:272[A]:HIS:CE1	3.01	0.48
1:A:72:GLY:O	1:A:76:MET:HG3	2.14	0.48
2:B:50:LYS:HB2	4:B:110:HOH:O	2.14	0.47
3:C:99:ALA:HA	3:C:110:ILE:O	2.15	0.47
1:A:53:VAL:O	1:A:57:MET:HG3	2.15	0.47
3:C:419:HIS:HE1	4:C:628:HOH:O	1.98	0.47
3:C:408:THR:O	3:C:411:PRO:HD2	2.15	0.47
3:C:447:VAL:HB	3:C:455:ILE:HG22	1.96	0.47
1:A:10:LYS:NZ	4:A:113:HOH:O	2.48	0.46
3:C:177:ILE:HD13	3:C:213:VAL:HG13	1.97	0.46
3:C:305:THR:HG21	3:C:558:LEU:HD11	1.96	0.46
3:C:303:PRO:HB3	3:C:377:VAL:HG22	1.97	0.46
3:C:36:LEU:HD12	3:C:36:LEU:N	2.31	0.45
3:C:246:HIS:CG	3:C:272[A]:HIS:HE1	2.34	0.45
3:C:347:VAL:HG11	3:C:550:ILE:HD12	1.99	0.45
2:B:100:PRO:O	2:B:101:LEU:CB	2.65	0.45
3:C:259:THR:OG1	3:C:280:HIS:NE2	2.49	0.45
2:B:72:GLU:HB2	2:B:75:GLN:HE21	1.81	0.44
3:C:349:HIS:HD2	3:C:406:LYS:NZ	2.15	0.44
3:C:198:ASN:CG	3:C:222:TRP:HB2	2.42	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:75:ILE:O	3:C:81:ILE:HA	2.17	0.43
3:C:299:ASN:N	3:C:300:PRO:HD2	2.33	0.43
3:C:65:CYS:HA	3:C:111:PRO:HG2	1.99	0.43
3:C:246:HIS:NE2	3:C:278:GLY:HA3	2.33	0.43
3:C:282:PRO:HG3	3:C:541:TYR:CE1	2.54	0.43
3:C:218:ILE:HD13	3:C:243:VAL:CG1	2.48	0.43
3:C:273:THR:O	3:C:285:ILE:HA	2.20	0.42
3:C:199:VAL:HG23	3:C:205:LEU:HD21	2.01	0.41
3:C:281:ALA:HA	3:C:282:PRO:HA	1.85	0.41
3:C:526:VAL:HG12	3:C:527:HIS:CD2	2.55	0.41
1:A:86:PHE:CE1	1:A:91:LYS:HB2	2.56	0.41
3:C:304:TYR:O	3:C:554:PRO:HA	2.21	0.41
3:C:474:ARG:HA	3:C:475:PRO:HD3	1.92	0.41
3:C:395:ASN:C	3:C:395:ASN:ND2	2.79	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	98/100 (98%)	97 (99%)	1 (1%)	0	100	100
2	B	99/101 (98%)	94 (95%)	5 (5%)	0	100	100
3	C	533/566 (94%)	496 (93%)	34 (6%)	3 (1%)	21	23
All	All	730/767 (95%)	687 (94%)	40 (6%)	3 (0%)	30	34

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	C	364	MET
3	C	481	GLY
3	C	282	PRO

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	85/85 (100%)	84 (99%)	1 (1%)	63	78
2	B	78/78 (100%)	76 (97%)	2 (3%)	40	55
3	C	417/443 (94%)	404 (97%)	13 (3%)	35	48
All	All	580/606 (96%)	564 (97%)	16 (3%)	38	52

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	100	ILE
2	B	81	LEU
2	B	97	VAL
3	C	179	ARG
3	C	199	VAL
3	C	282	PRO
3	C	349	HIS
3	C	372	LEU
3	C	392	THR
3	C	395	ASN
3	C	442	VAL
3	C	449	LYS
3	C	465	ILE
3	C	507	LEU
3	C	508	ARG
3	C	520	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	12	GLN
2	B	16	ASN
2	B	29	HIS
2	B	75	GLN
3	C	3	ASN

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Mol	Chain	Res	Type
3	C	142	GLN
3	C	166	HIS
3	C	201	GLN
3	C	349	HIS
3	C	362	GLN
3	C	376	GLN
3	C	395	ASN
3	C	419	HIS
3	C	469	GLN
3	C	486	HIS
3	C	531	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 [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, 95th 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 ²)	Q<0.9
1	A	100/100 (100%)	-0.74	0	100	100	3, 11, 30, 38	0
2	B	101/101 (100%)	-0.40	0	100	100	7, 18, 37, 46	0
3	C	536/566 (94%)	-0.60	13 (2%)	59	56	2, 10, 48, 85	1 (0%)
All	All	737/767 (96%)	-0.59	13 (1%)	67	64	2, 11, 41, 85	1 (0%)

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	C	307	ASN	4.5
3	C	302	LEU	4.3
3	C	300	PRO	3.9
3	C	299	ASN	3.8
3	C	280	HIS	3.3
3	C	277	GLY	3.1
3	C	306	LEU	3.0
3	C	278	GLY	3.0
3	C	339	ARG	2.7
3	C	308	THR	2.6
3	C	279	GLY	2.5
3	C	301	THR	2.3
3	C	541	TYR	2.2

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 oligosaccharides 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.