



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 27, 2026 – 05:10 PM EDT

PDB ID : 1GY9 / pdb_00001gy9
Title : Taurine/alpha-ketoglutarate Dioxygenase from Escherichia coli
Authors : Elkins, J.M.; Burzlaff, N.I.; Ryle, M.J.; Lloyd, J.S.; Clifton, I.J.; Baldwin, J.E.; Hausinger, R.P.; Roach, P.L.
Deposited on : 2002-04-22
Resolution : 2.50 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
Mogul : 2022.3.0, CSD as543be (2022)
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

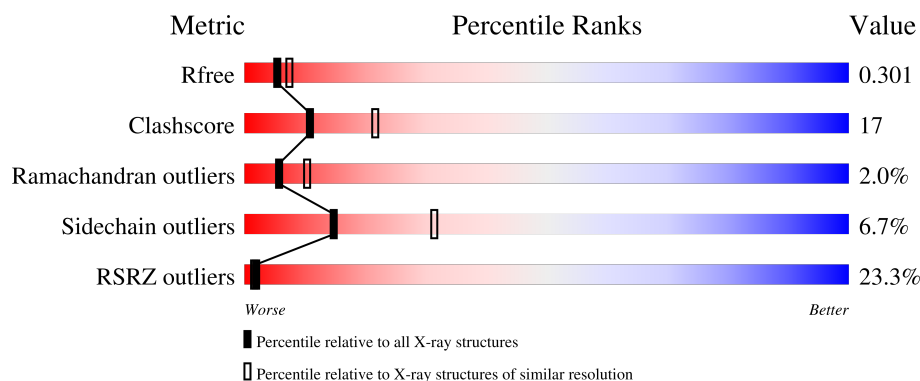
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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 ≥ 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	283	29% 60% 29% 9% ..
1	B	283	17% 65% 27% ..

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4416 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.

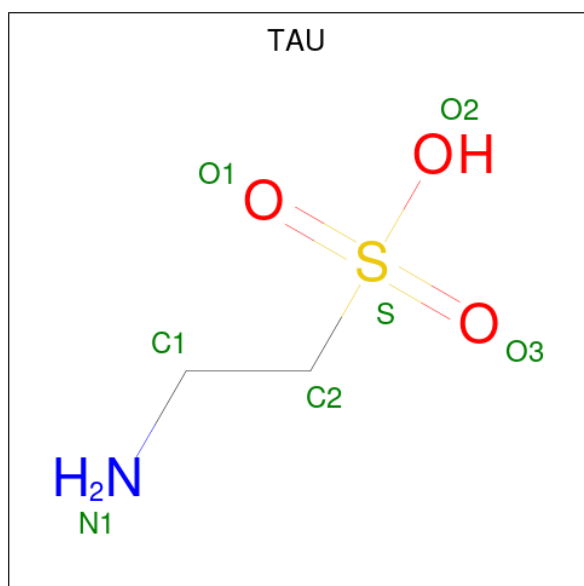
- Molecule 1 is a protein called ALPHA-KETOGLUTARATE-DEPENDENT TAURINE DIOXYGENASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	279	Total	C	N	O	S	0	0	0
			2197	1409	389	398	1			
1	B	275	Total	C	N	O	S	0	0	0
			2160	1383	382	394	1			

- Molecule 2 is FE (III) ION (CCD ID: FE) (formula: Fe).

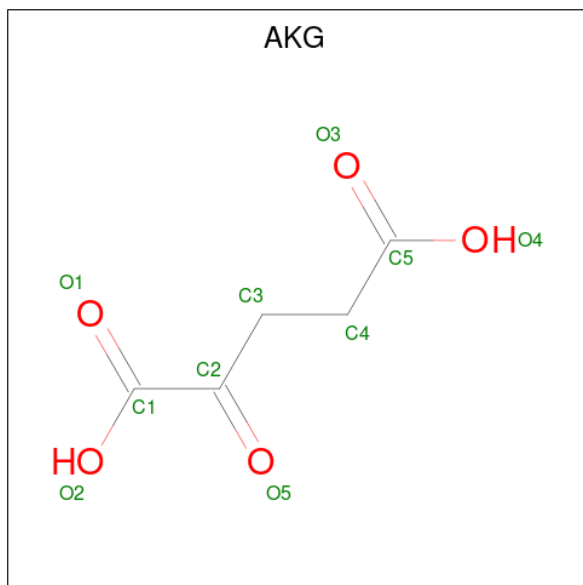
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Fe	0	0
			2	2		
2	B	1	Total	Fe	0	0
			1	1		

- Molecule 3 is 2-AMINOETHANESULFONIC ACID (CCD ID: TAU) (formula: C₂H₇NO₃S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	S	0	0
			7	2	1	3	1		
3	B	1	Total	C	N	O	S	0	0
			7	2	1	3	1		

- Molecule 4 is 2-OXOGLUTARIC ACID (CCD ID: AKG) (formula: $C_5H_6O_5$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			10	5	5		
4	B	1	Total	C	O	0	0
			10	5	5		

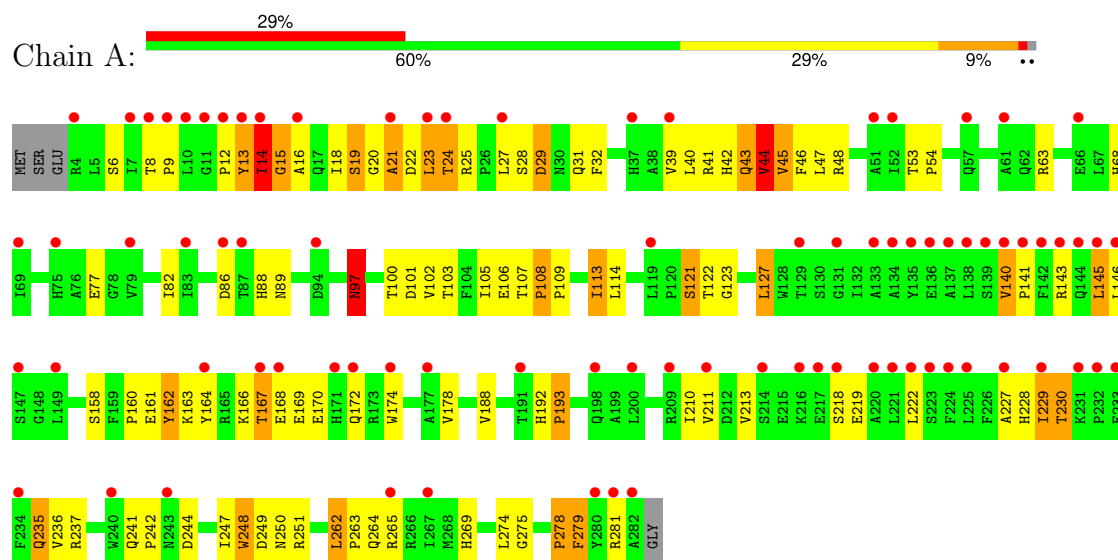
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	18	Total	O	0	2
			18	18		
5	B	4	Total	O	0	0
			4	4		

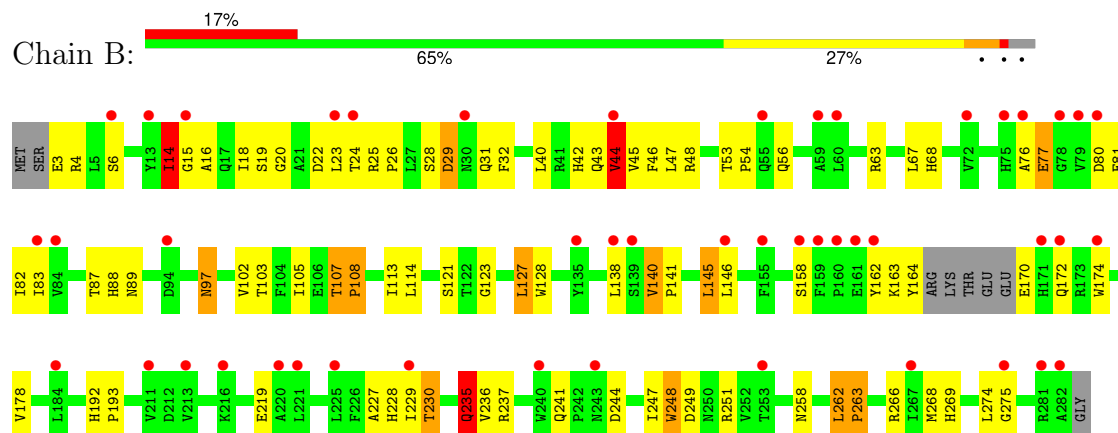
3 Residue-property plots [i](#)

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: ALPHA-KETOGLUTARATE-DEPENDENT TAURINE DIOXYGENASE



• Molecule 1: ALPHA-KETOGLUTARATE-DEPENDENT TAURINE DIOXYGENASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 62 2 2	Depositor
Cell constants a, b, c, α , β , γ	116.79Å 116.79Å 201.94Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.18 – 2.50 45.18 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.3 (45.18-2.50) 98.8 (45.18-2.50)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.51 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.0	Depositor
R, R_{free}	0.261 , 0.293 0.276 , 0.301	Depositor DCC
R_{free} test set	2865 reflections (9.95%)	wwPDB-VP
Wilson B-factor (Å ²)	58.5	Xtriage
Anisotropy	0.469	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 58.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.53$, $\langle L^2 \rangle = 0.37$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.87	EDS
Total number of atoms	4416	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.30% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: TAU, FE, AKG

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	1.46	22/2264 (1.0%)	1.46	23/3100 (0.7%)
1	B	0.98	1/2225 (0.0%)	1.22	11/3048 (0.4%)
All	All	1.25	23/4489 (0.5%)	1.35	34/6148 (0.6%)

All (23) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	21	ALA	CA-CB	-7.59	1.41	1.53
1	A	123	GLY	C-O	-6.35	1.17	1.24
1	A	39	VAL	C-O	-6.35	1.15	1.24
1	A	8	THR	CA-CB	6.14	1.61	1.53
1	A	213	VAL	CA-CB	-6.09	1.45	1.54
1	A	143	ARG	CA-C	-5.86	1.45	1.52
1	A	97	ASN	CB-CG	-5.83	1.37	1.52
1	A	211	VAL	CB-CG2	-5.79	1.33	1.52
1	A	14	ILE	N-CA	5.77	1.53	1.46
1	A	113	ILE	CA-CB	-5.73	1.46	1.54
1	A	21	ALA	CA-C	-5.60	1.45	1.52
1	A	279	PHE	C-O	-5.59	1.16	1.23
1	B	97	ASN	CB-CG	-5.45	1.38	1.52
1	A	45	VAL	CA-CB	-5.44	1.45	1.55
1	A	97	ASN	N-CA	-5.44	1.39	1.46
1	A	188	VAL	CA-C	-5.42	1.44	1.52
1	A	210	ILE	CA-CB	-5.33	1.47	1.53
1	A	281	ARG	CA-CB	-5.18	1.45	1.53
1	A	101	ASP	CA-C	-5.14	1.46	1.52
1	A	222	LEU	CA-C	-5.08	1.46	1.52
1	A	43	GLN	N-CA	5.06	1.52	1.45
1	A	12	PRO	CA-C	5.03	1.59	1.52
1	A	278	PRO	C-O	-5.02	1.18	1.23

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	14	ILE	N-CA-C	12.85	136.06	109.34
1	A	24	THR	N-CA-C	-9.99	99.23	111.33
1	B	14	ILE	N-CA-C	9.63	129.37	109.34
1	A	44	VAL	CB-CA-C	-9.18	96.00	110.69
1	A	42	HIS	N-CA-C	-9.02	98.89	110.53
1	A	23	LEU	N-CA-C	8.85	124.32	113.17
1	A	235	GLN	N-CA-C	8.77	121.63	109.18
1	B	235	GLN	N-CA-C	8.34	122.09	109.41
1	A	13	TYR	N-CA-C	-8.31	97.24	109.63
1	A	108	PRO	O-C-N	8.23	125.10	121.31
1	B	44	VAL	CB-CA-C	-8.03	97.85	110.69
1	A	123	GLY	N-CA-C	-7.96	101.03	112.17
1	B	42	HIS	N-CA-C	-7.83	98.93	110.52
1	B	108	PRO	O-C-N	7.49	124.76	121.31
1	B	248	TRP	N-CA-C	7.22	120.14	109.24
1	A	42	HIS	CA-C-N	-7.04	110.57	122.11
1	A	42	HIS	C-N-CA	-7.04	110.57	122.11
1	A	43	GLN	N-CA-C	-6.64	105.47	113.97
1	A	15	GLY	N-CA-C	6.51	120.35	112.48
1	A	248	TRP	N-CA-C	6.46	119.53	109.52
1	A	193	PRO	CA-C-N	-6.29	116.72	123.08
1	A	193	PRO	C-N-CA	-6.29	116.72	123.08
1	B	123	GLY	N-CA-C	-6.28	102.72	112.45
1	B	140	VAL	CB-CA-C	-6.21	107.80	113.70
1	A	9	PRO	CA-C-O	-5.91	114.71	121.56
1	A	41	ARG	N-CA-C	-5.69	104.77	110.97
1	A	218	SER	CA-C-O	5.57	126.45	120.55
1	A	19	SER	CB-CA-C	-5.56	102.51	110.62
1	A	100	THR	N-CA-C	-5.52	100.41	109.40
1	A	123	GLY	CA-C-O	-5.48	116.91	122.56
1	A	140	VAL	CB-CA-C	-5.41	106.92	114.00
1	B	258	ASN	N-CA-C	5.37	117.81	110.24
1	B	83	ILE	CB-CA-C	-5.33	103.77	111.34
1	B	4	ARG	N-CA-C	5.16	118.04	110.30

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	2197	0	2084	78	0
1	B	2160	0	2044	69	0
2	A	2	0	0	0	0
2	B	1	0	0	0	0
3	A	7	0	6	0	0
3	B	7	0	7	0	0
4	A	10	0	4	1	0
4	B	10	0	4	0	0
5	A	18	0	0	2	0
5	B	4	0	0	1	0
All	All	4416	0	4149	142	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 17.

All (142) 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:B:89:ASN:HD21	1:B:263:PRO:CB	1.88	0.86
1:A:23:LEU:HD21	1:A:27:LEU:HD21	1.56	0.86
1:A:21:ALA:HB1	1:A:23:LEU:HD21	1.58	0.84
1:B:89:ASN:HD21	1:B:263:PRO:HB2	1.43	0.84
1:A:279:PHE:HB3	1:B:26:PRO:HG2	1.64	0.79
1:B:262:LEU:HD12	1:B:263:PRO:HA	1.66	0.78
1:B:14:ILE:HG23	1:B:236:VAL:HG23	1.66	0.78
1:A:168:GLU:C	1:A:170:GLU:H	1.90	0.77
1:A:89:ASN:HD21	1:A:263:PRO:CB	1.96	0.76
1:B:44:VAL:HG13	1:B:248:TRP:HB3	1.71	0.71
1:B:53:THR:HG23	1:B:56:GLN:OE1	1.91	0.71
1:B:3:GLU:HG2	1:B:31:GLN:NE2	2.07	0.70
1:A:262:LEU:HD12	1:A:263:PRO:HA	1.75	0.68
1:A:54:PRO:O	1:A:82:ILE:CD1	2.42	0.68
1:B:249:ASP:OD1	1:B:251:ARG:HG2	1.94	0.68
1:A:89:ASN:HD21	1:A:263:PRO:HB2	1.57	0.67
1:A:227:ALA:O	1:A:230:THR:HB	1.93	0.67

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:242:PRO:O	5:A:2016:HOH:O	2.12	0.67
1:A:249:ASP:OD1	1:A:251:ARG:HG2	1.93	0.67
1:B:229:ILE:C	1:B:229:ILE:HD12	2.20	0.67
1:A:162:TYR:CE1	1:A:163:LYS:HG3	2.30	0.67
1:A:44:VAL:HG13	1:A:248:TRP:HB3	1.77	0.66
1:A:127:LEU:HD22	1:A:237:ARG:HG3	1.77	0.66
1:B:18:ILE:HB	1:B:47:LEU:CD2	2.25	0.66
1:A:18:ILE:HB	1:A:47:LEU:CD2	2.26	0.64
1:B:54:PRO:O	1:B:82:ILE:CD1	2.46	0.64
1:A:48:ARG:NH2	1:A:241:GLN:HB2	2.13	0.64
1:A:229:ILE:C	1:A:229:ILE:HD12	2.23	0.63
1:A:21:ALA:HB1	1:A:23:LEU:CD2	2.27	0.63
1:A:162:TYR:C	1:A:162:TYR:CD1	2.77	0.62
1:A:14:ILE:HG23	1:A:236:VAL:HG23	1.82	0.61
1:A:168:GLU:C	1:A:170:GLU:N	2.58	0.61
1:B:28:SER:O	1:B:29:ASP:C	2.43	0.61
1:B:127:LEU:HD22	1:B:237:ARG:HG3	1.80	0.61
1:A:54:PRO:O	1:A:82:ILE:HD12	2.00	0.61
1:B:48:ARG:NH2	1:B:241:GLN:HB2	2.16	0.60
1:B:227:ALA:O	1:B:230:THR:HB	2.02	0.60
1:B:3:GLU:CG	1:B:31:GLN:NE2	2.64	0.60
1:B:174:TRP:O	1:B:178:VAL:HG23	2.03	0.59
1:A:97:ASN:ND2	1:A:97:ASN:C	2.59	0.59
1:A:113:ILE:HG12	1:A:247:ILE:HG12	1.87	0.57
1:A:22:ASP:C	1:A:23:LEU:HD23	2.29	0.57
1:A:23:LEU:CD2	1:A:27:LEU:HD21	2.31	0.57
1:B:105:ILE:O	1:B:108:PRO:HD3	2.05	0.56
1:A:166:LYS:O	1:A:167:THR:CB	2.53	0.56
1:B:88:HIS:C	1:B:262:LEU:HD11	2.30	0.56
1:A:89:ASN:HD21	1:A:263:PRO:HB3	1.69	0.55
1:A:6:SER:O	1:A:18:ILE:HA	2.07	0.55
1:A:28:SER:O	1:A:29:ASP:C	2.49	0.55
1:B:102:VAL:O	1:B:102:VAL:HG12	2.05	0.55
1:A:168:GLU:O	1:A:170:GLU:N	2.40	0.55
1:A:163:LYS:C	1:A:164:TYR:CD1	2.85	0.54
1:B:46:PHE:O	1:B:47:LEU:HD23	2.08	0.54
1:B:113:ILE:HG12	1:B:247:ILE:HG12	1.88	0.54
1:B:68:HIS:HB2	1:B:274:LEU:HG	1.90	0.54
1:A:18:ILE:HB	1:A:47:LEU:HD22	1.90	0.53
1:B:162:TYR:C	1:B:162:TYR:CD1	2.86	0.53
1:A:106:GLU:CG	1:B:29:ASP:OD1	2.57	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:86:ASP:OD2	1:A:265:ARG:NH2	2.33	0.52
1:B:103:THR:HA	1:B:108:PRO:HB3	1.91	0.52
1:A:102:VAL:HG12	1:A:102:VAL:O	2.09	0.52
1:B:24:THR:HA	1:B:56:GLN:HE22	1.75	0.52
1:A:121:SER:OG	1:A:264:GLN:NE2	2.43	0.52
1:A:22:ASP:O	1:A:23:LEU:HD23	2.10	0.51
1:B:18:ILE:HB	1:B:47:LEU:HD22	1.93	0.50
1:A:145:LEU:HD13	1:A:146:LEU:HD23	1.93	0.50
1:A:88:HIS:C	1:A:262:LEU:HD11	2.37	0.50
1:A:167:THR:O	1:A:170:GLU:N	2.44	0.50
1:B:89:ASN:HD21	1:B:263:PRO:HB3	1.72	0.49
1:B:145:LEU:HD13	1:B:146:LEU:HD23	1.94	0.49
1:A:15:GLY:HA3	1:A:236:VAL:HG21	1.94	0.49
1:A:23:LEU:C	1:A:25:ARG:N	2.66	0.49
1:B:89:ASN:ND2	1:B:263:PRO:HB2	2.21	0.48
1:B:53:THR:OG1	1:B:56:GLN:HG3	2.14	0.48
1:A:174:TRP:O	1:A:178:VAL:HG23	2.14	0.48
1:A:32:PHE:CE2	1:A:63:ARG:HB3	2.49	0.48
1:A:161:GLU:HG2	1:A:174:TRP:CH2	2.48	0.48
1:A:13:TYR:CD1	1:A:13:TYR:N	2.80	0.47
1:B:229:ILE:C	1:B:229:ILE:CD1	2.87	0.47
1:B:23:LEU:O	1:B:24:THR:C	2.58	0.47
1:B:54:PRO:O	1:B:82:ILE:HD12	2.13	0.47
1:B:15:GLY:HA3	1:B:236:VAL:HG21	1.96	0.47
1:B:18:ILE:HB	1:B:47:LEU:HD21	1.97	0.47
1:B:140:VAL:HB	1:B:141:PRO:HD3	1.95	0.47
1:B:97:ASN:OD1	1:B:97:ASN:C	2.58	0.47
1:B:266:ARG:NH2	1:B:268:MET:HE2	2.30	0.47
1:B:6:SER:O	1:B:18:ILE:HA	2.15	0.47
1:B:163:LYS:C	1:B:164:TYR:CD1	2.93	0.47
1:A:16:ALA:O	1:A:45:VAL:HA	2.15	0.46
1:B:192:HIS:ND1	1:B:193:PRO:HD2	2.30	0.46
1:A:279:PHE:HB3	1:B:26:PRO:CG	2.39	0.46
1:A:106:GLU:HG2	1:B:29:ASP:OD1	2.16	0.45
1:B:127:LEU:N	1:B:127:LEU:HD23	2.32	0.45
1:A:46:PHE:O	1:A:47:LEU:HD23	2.17	0.45
1:A:105:ILE:O	1:A:108:PRO:HD3	2.17	0.45
1:A:192:HIS:ND1	1:A:193:PRO:HD2	2.32	0.45
1:A:23:LEU:HD21	1:A:27:LEU:CD2	2.37	0.44
1:A:106:GLU:OE2	1:B:29:ASP:OD1	2.35	0.44
1:B:16:ALA:O	1:B:45:VAL:HA	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:140:VAL:HB	1:A:141:PRO:HD3	1.99	0.44
1:B:138:LEU:HD13	1:B:146:LEU:HD12	2.00	0.44
1:A:114:LEU:HD21	4:A:351:AKG:H41	2.00	0.44
1:A:229:ILE:C	1:A:229:ILE:CD1	2.89	0.44
1:A:174:TRP:CH2	1:A:178:VAL:HG21	2.52	0.44
1:A:46:PHE:C	1:A:47:LEU:HD23	2.43	0.43
1:A:68:HIS:HB2	1:A:274:LEU:HG	1.99	0.43
1:A:103:THR:HA	1:A:108:PRO:HB3	2.00	0.43
1:B:76:ALA:O	1:B:77:GLU:C	2.60	0.43
1:B:3:GLU:HG3	1:B:31:GLN:HE21	1.84	0.43
1:B:53:THR:HB	1:B:54:PRO:HD2	2.00	0.43
1:A:28:SER:O	1:A:31:GLN:N	2.51	0.43
1:B:23:LEU:C	1:B:25:ARG:N	2.76	0.43
1:B:170:GLU:C	1:B:172:GLN:N	2.74	0.43
1:B:114:LEU:HD12	1:B:269:HIS:O	2.18	0.42
1:B:3:GLU:CG	1:B:31:GLN:HE21	2.33	0.42
1:A:114:LEU:HD12	1:A:269:HIS:O	2.19	0.42
1:B:236:VAL:HG22	5:B:2001:HOH:O	2.19	0.42
1:A:48:ARG:NH2	1:A:244:ASP:OD2	2.50	0.42
1:B:22:ASP:O	1:B:25:ARG:N	2.38	0.42
1:B:67:LEU:HD12	1:B:81:GLU:HG2	2.00	0.42
1:B:48:ARG:HH21	1:B:241:GLN:HB2	1.82	0.42
1:A:97:ASN:O	1:A:97:ASN:CG	2.58	0.42
1:B:128:TRP:O	1:B:235:GLN:HB3	2.20	0.42
1:A:107:THR:OG1	1:A:275:GLY:O	2.38	0.41
1:A:170:GLU:C	1:A:172:GLN:N	2.78	0.41
1:B:228:HIS:C	1:B:230:THR:H	2.28	0.41
1:A:127:LEU:HD23	1:A:127:LEU:N	2.36	0.41
1:A:228:HIS:C	1:A:230:THR:H	2.27	0.41
1:B:28:SER:O	1:B:31:GLN:N	2.53	0.41
1:B:32:PHE:CE2	1:B:63:ARG:HB3	2.56	0.41
1:A:160:PRO:O	1:A:161:GLU:C	2.64	0.41
1:A:174:TRP:CZ2	1:A:178:VAL:HG21	2.55	0.41
1:B:48:ARG:NH2	1:B:244:ASP:OD2	2.49	0.41
1:A:53:THR:HB	1:A:54:PRO:HD2	2.03	0.41
1:A:161:GLU:CG	1:A:174:TRP:CH2	3.04	0.41
1:B:80:ASP:OD1	1:B:80:ASP:N	2.53	0.41
1:A:170:GLU:O	1:A:174:TRP:N	2.52	0.41
1:B:81:GLU:N	1:B:81:GLU:CD	2.79	0.40
1:A:109:PRO:O	1:A:250:ASN:HB3	2.21	0.40
1:B:107:THR:OG1	1:B:275:GLY:O	2.40	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:23:LEU:O	1:A:24:THR:C	2.59	0.40
1:A:278:PRO:HA	5:A:2018:HOH:O	2.20	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	277/283 (98%)	252 (91%)	18 (6%)	7 (2%)	4	7
1	B	271/283 (96%)	255 (94%)	12 (4%)	4 (2%)	8	16
All	All	548/566 (97%)	507 (92%)	30 (6%)	11 (2%)	6	10

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	14	ILE
1	A	77	GLU
1	B	14	ILE
1	B	77	GLU
1	A	169	GLU
1	B	29	ASP
1	A	29	ASP
1	A	162	TYR
1	A	167	THR
1	B	20	GLY
1	A	20	GLY

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	224/244 (92%)	209 (93%)	15 (7%)	15	31
1	B	221/244 (91%)	206 (93%)	15 (7%)	14	31
All	All	445/488 (91%)	415 (93%)	30 (7%)	15	31

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	19	SER
1	A	40	LEU
1	A	43	GLN
1	A	44	VAL
1	A	97	ASN
1	A	121	SER
1	A	122	THR
1	A	127	LEU
1	A	145	LEU
1	A	158	SER
1	A	219	GLU
1	A	229	ILE
1	A	230	THR
1	A	235	GLN
1	A	262	LEU
1	B	19	SER
1	B	40	LEU
1	B	43	GLN
1	B	44	VAL
1	B	87	THR
1	B	107	THR
1	B	121	SER
1	B	127	LEU
1	B	145	LEU
1	B	158	SER
1	B	219	GLU
1	B	230	THR

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Mol	Chain	Res	Type
1	B	235	GLN
1	B	262	LEU
1	B	263	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	89	ASN
1	A	97	ASN
1	A	144	GLN
1	A	269	HIS
1	B	31	GLN
1	B	37	HIS
1	B	89	ASN
1	B	144	GLN
1	B	254	GLN
1	B	269	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 7 ligands modelled in this entry, 3 are monoatomic - leaving 4 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# $ Z > 2$	Counts	RMSZ	# $ Z > 2$
3	TAU	A	350	-	6,6,6	0.56	0	7,8,8	2.82	4 (57%)
4	AKG	B	351	2	9,9,9	1.39	2 (22%)	11,11,11	2.31	6 (54%)
3	TAU	B	350	-	6,6,6	1.61	1 (16%)	7,8,8	2.36	3 (42%)
4	AKG	A	351	2	9,9,9	1.71	1 (11%)	11,11,11	1.60	2 (18%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	TAU	A	350	-	-	1/4/4/4	-
4	AKG	B	351	2	-	1/9/9/9	-
3	TAU	B	350	-	-	1/4/4/4	-
4	AKG	A	351	2	-	1/9/9/9	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	351	AKG	C2-C1	-4.08	1.47	1.53
3	B	350	TAU	C2-S	3.26	1.82	1.77
4	B	351	AKG	C2-C1	-2.64	1.49	1.53
4	B	351	AKG	O5-C2	-2.30	1.18	1.23

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	351	AKG	O1-C1-C2	-4.53	116.17	121.81
3	A	350	TAU	O1-S-C2	4.44	113.44	106.73
3	A	350	TAU	O3-S-O1	-4.19	100.19	113.82
3	A	350	TAU	O3-S-C2	3.57	112.12	106.73
3	B	350	TAU	O3-S-O1	-3.41	102.75	113.82
3	B	350	TAU	O1-S-C2	3.38	111.84	106.73
3	B	350	TAU	O2-S-C2	3.33	112.52	106.00
4	A	351	AKG	C4-C3-C2	-3.17	106.96	112.91
4	B	351	AKG	C3-C4-C5	-2.73	106.42	113.67
4	B	351	AKG	O4-C5-C4	2.60	122.23	114.00
4	B	351	AKG	O5-C2-C3	2.38	126.28	121.17

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	351	AKG	O5-C2-C3	2.37	126.24	121.17
4	B	351	AKG	O2-C1-C2	2.32	120.01	113.59
3	A	350	TAU	O2-S-C2	2.24	110.39	106.00
4	B	351	AKG	C4-C3-C2	-2.14	108.90	112.91

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	351	AKG	C1-C2-C3-C4
4	B	351	AKG	C1-C2-C3-C4
3	A	350	TAU	N1-C1-C2-S
3	B	350	TAU	N1-C1-C2-S

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	351	AKG	1	0

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, 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	279/283 (98%)	1.62	82 (29%)  	23, 30, 37, 43	0
1	B	275/283 (97%)	1.17	47 (17%)  	23, 30, 37, 43	0
All	All	554/566 (97%)	1.40	129 (23%)  	23, 30, 37, 43	0

All (129) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	66	GLU	6.1
1	A	172	GLN	6.1
1	A	139	SER	6.1
1	A	171	HIS	5.6
1	B	282	ALA	5.4
1	A	137	ALA	5.1
1	A	12	PRO	5.0
1	B	75	HIS	4.7
1	A	13	TYR	4.7
1	B	275	GLY	4.6
1	A	218	SER	4.6
1	B	30	ASN	4.5
1	A	94	ASP	4.5
1	B	80	ASP	4.4
1	A	138	LEU	4.2
1	A	135	TYR	4.1
1	A	141	PRO	3.9
1	B	158	SER	3.8
1	A	233	GLU	3.8
1	A	221	LEU	3.7
1	A	280	TYR	3.7
1	A	133	ALA	3.6
1	A	24	THR	3.5
1	A	214	SER	3.5

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Mol	Chain	Res	Type	RSRZ
1	A	225	LEU	3.5
1	A	243	ASN	3.5
1	A	83	ILE	3.4
1	A	11	GLY	3.4
1	B	60	LEU	3.4
1	A	222	LEU	3.4
1	B	76	ALA	3.3
1	B	135	TYR	3.3
1	B	172	GLN	3.3
1	B	211	VAL	3.3
1	A	27	LEU	3.3
1	A	267	ILE	3.3
1	A	140	VAL	3.2
1	A	52	ILE	3.2
1	A	79	VAL	3.2
1	B	78	GLY	3.2
1	B	94	ASP	3.2
1	A	146	LEU	3.2
1	B	139	SER	3.2
1	A	136	GLU	3.2
1	A	142	PHE	3.1
1	B	23	LEU	3.1
1	A	51	ALA	3.0
1	B	171	HIS	3.0
1	B	146	LEU	3.0
1	B	6	SER	3.0
1	A	229	ILE	3.0
1	A	174	TRP	2.9
1	B	221	LEU	2.9
1	A	234	PHE	2.9
1	B	15	GLY	2.9
1	A	281	ARG	2.9
1	A	23	LEU	2.9
1	A	57	GLN	2.9
1	A	282	ALA	2.9
1	A	149	LEU	2.8
1	A	69	ILE	2.8
1	A	143	ARG	2.8
1	B	138	LEU	2.7
1	A	227	ALA	2.7
1	B	220	ALA	2.7
1	B	55	GLN	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	86	ASP	2.7
1	B	155	PHE	2.7
1	A	134	ALA	2.7
1	A	220	ALA	2.7
1	A	217	GLU	2.7
1	A	216	LYS	2.6
1	A	14	ILE	2.6
1	B	83	ILE	2.6
1	B	161	GLU	2.6
1	B	59	ALA	2.6
1	B	253	THR	2.6
1	B	281	ARG	2.5
1	B	240	TRP	2.5
1	A	9	PRO	2.5
1	A	231	LYS	2.5
1	A	200	LEU	2.5
1	A	8	THR	2.5
1	B	225	LEU	2.4
1	A	144	GLN	2.4
1	B	13	TYR	2.4
1	B	216	LYS	2.4
1	A	198	GLN	2.4
1	A	223	SER	2.4
1	B	79	VAL	2.4
1	B	24	THR	2.3
1	B	213	VAL	2.3
1	A	61	ALA	2.3
1	A	7	ILE	2.3
1	B	84	VAL	2.3
1	A	4	ARG	2.3
1	A	265	ARG	2.3
1	A	37	HIS	2.3
1	A	75	HIS	2.3
1	B	44	VAL	2.3
1	B	72	VAL	2.3
1	A	209	ARG	2.3
1	A	224	PHE	2.3
1	A	21	ALA	2.2
1	B	162	TYR	2.3
1	A	131	GLY	2.2
1	A	232	PRO	2.2
1	A	87	THR	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	10	LEU	2.2
1	B	184	LEU	2.2
1	B	160	PRO	2.2
1	B	267	ILE	2.2
1	A	147	SER	2.2
1	A	145	LEU	2.1
1	A	168	GLU	2.1
1	A	39	VAL	2.1
1	A	211	VAL	2.1
1	A	16	ALA	2.1
1	A	177	ALA	2.1
1	A	240	TRP	2.1
1	A	129	THR	2.1
1	B	174	TRP	2.1
1	B	159	PHE	2.0
1	A	119	LEU	2.0
1	A	191	THR	2.0
1	B	229	ILE	2.0
1	B	243	ASN	2.0
1	A	167	THR	2.0
1	A	164	TYR	2.0

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 oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	AKG	B	351	10/10	0.82	0.25	23,25,28,29	0
4	AKG	A	351	10/10	0.89	0.18	22,25,30,30	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	TAU	B	350	7/7	0.89	0.28	24,30,30,34	0
3	TAU	A	350	7/7	0.94	0.17	24,29,30,34	0
2	FE	A	310	1/1	0.96	0.15	46,46,46,46	1
2	FE	B	300	1/1	0.96	0.29	27,27,27,27	0
2	FE	A	300	1/1	0.97	0.13	25,25,25,25	0

6.5 Other polymers [i](#)

There are no such residues in this entry.