



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:02 PM UTC

PDB ID : 5E3A / pdb_00005e3a
Title : Structure of human DPP3 in complex with opioid peptide leu-enkephalin
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eroux, P.; Gruber, K.
Deposited on : 2015-10-02
Resolution : 2.05 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

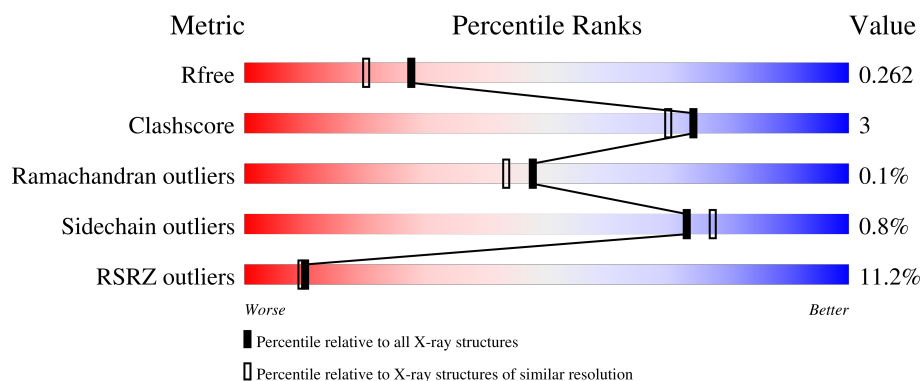
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.05 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	2260 (2.04-2.04)
Clashscore	190562	2333 (2.04-2.04)
Ramachandran outliers	187476	2318 (2.04-2.04)
Sidechain outliers	187428	2318 (2.04-2.04)
RSRZ outliers	180081	2260 (2.04-2.04)

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	726	
2	B	5	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6165 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 Dipeptidyl peptidase 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	725	Total	C	N	O	S	0	1	0
			5758	3670	975	1101	12			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	19	SER	CYS	engineered mutation	UNP Q9NY33
A	207	CYS	GLU	engineered mutation	UNP Q9NY33
A	451	ALA	GLU	engineered mutation	UNP Q9NY33
A	491	CYS	SER	engineered mutation	UNP Q9NY33
A	519	SER	CYS	engineered mutation	UNP Q9NY33
A	654	SER	CYS	engineered mutation	UNP Q9NY33

- Molecule 2 is a protein called Leu-enkephalin.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	5	Total	C	N	O	0	0	0
			40	28	5	7			

- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Zn	0	0
			1	1		

- Molecule 4 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Mg	0	0
			2	2		

- Molecule 5 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 1	K 1	0	0

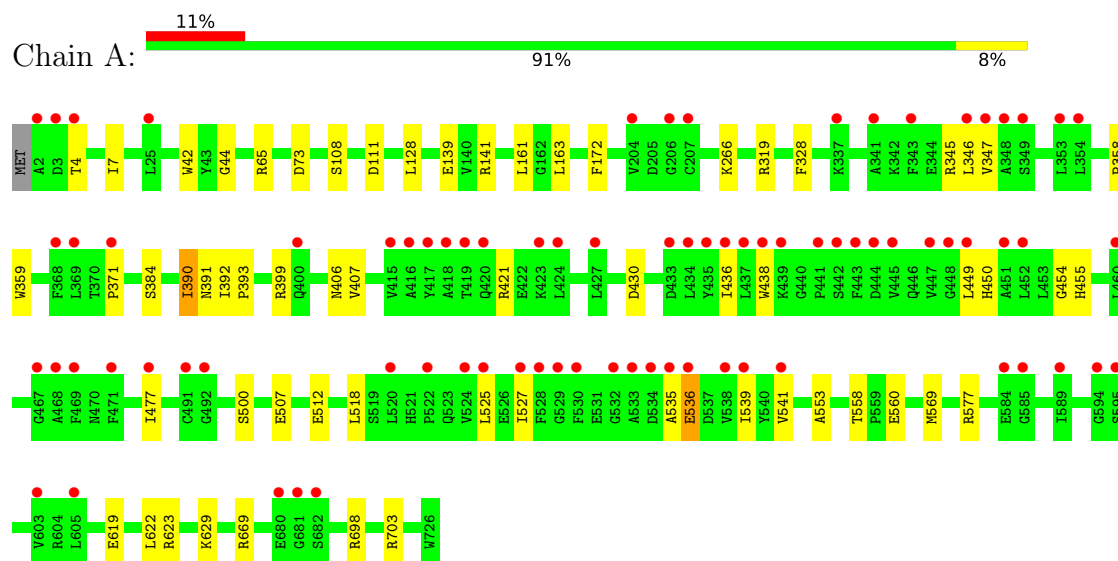
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	363	Total 363	O 363	0	0

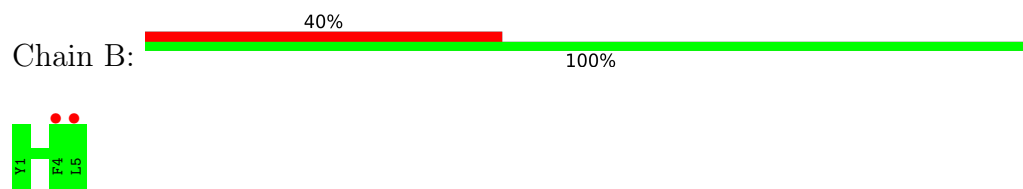
3 Residue-property plots [i](#)

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 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: Dipeptidyl peptidase 3



• Molecule 2: Leu-enkephalin



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	119.56Å 105.76Å 64.99Å 90.00° 93.43° 90.00°	Depositor
Resolution (Å)	39.58 – 2.05 39.58 – 2.05	Depositor EDS
% Data completeness (in resolution range)	94.8 (39.58-2.05) 95.3 (39.58-2.05)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.41 (at 2.05Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.209 , 0.260 0.213 , 0.262	Depositor DCC
R_{free} test set	2414 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	30.8	Xtriage
Anisotropy	0.431	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 35.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	6165	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.98% 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: ZN, K, MG

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	0.28	0/5893	0.69	0/7983
2	B	0.13	0/41	0.40	0/52
All	All	0.28	0/5934	0.69	0/8035

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 [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	5758	0	5635	36	0
2	B	40	0	37	0	0
3	A	1	0	0	0	0
4	A	2	0	0	0	0
5	A	1	0	0	0	0
6	A	363	0	0	5	0
All	All	6165	0	5672	36	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 3.

All (36) 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:A:421:ARG:HB3	1:A:436:ILE:HD11	1.75	0.67
1:A:346:LEU:HA	1:A:527:ILE:HD13	1.77	0.66
1:A:319:ARG:NH1	6:A:902:HOH:O	2.29	0.65
1:A:391:ASN:ND2	1:A:406:ASN:OD1	2.32	0.62
1:A:358:PRO:HB3	1:A:619:GLU:HG3	1.83	0.60
1:A:438:TRP:HB2	1:A:541:VAL:HG21	1.83	0.59
1:A:345:ARG:HG3	1:A:527:ILE:HG23	1.87	0.55
1:A:553:ALA:HA	1:A:569:MET:HE3	1.87	0.55
1:A:391:ASN:OD1	1:A:399:ARG:NH1	2.33	0.55
1:A:141:ARG:NH1	6:A:911:HOH:O	2.39	0.54
1:A:345:ARG:NH1	1:A:527:ILE:O	2.38	0.53
1:A:430:ASP:OD1	1:A:430:ASP:N	2.44	0.50
1:A:669:ARG:NH1	6:A:924:HOH:O	2.44	0.49
1:A:347:VAL:HG22	1:A:371:PRO:HG2	1.94	0.49
1:A:623:ARG:NH1	6:A:905:HOH:O	2.34	0.49
1:A:128:LEU:HD22	1:A:141:ARG:HG2	1.96	0.47
1:A:73:ASP:OD2	1:A:698:ARG:NH2	2.38	0.47
1:A:42:TRP:CD2	1:A:703:ARG:HD3	2.50	0.47
1:A:65:ARG:NH1	1:A:139:GLU:HG2	2.29	0.47
1:A:108:SER:HB3	1:A:384:SER:HB2	1.96	0.47
1:A:577:ARG:NH2	6:A:928:HOH:O	2.47	0.46
1:A:393:PRO:O	1:A:399:ARG:HD3	2.16	0.46
1:A:450:HIS:ND1	1:A:512:GLU:OE1	2.47	0.46
1:A:525:LEU:HD13	1:A:535:ALA:HB1	1.98	0.45
1:A:507:GLU:OE1	1:A:629:LYS:NZ	2.44	0.45
1:A:536:GLU:O	1:A:539:ILE:HB	2.17	0.44
1:A:44:GLY:HA3	1:A:328:PHE:CE1	2.53	0.44
1:A:4:THR:HB	1:A:7:ILE:HG12	1.99	0.43
1:A:449:LEU:HD13	1:A:518:LEU:HB2	2.01	0.43
1:A:359:TRP:HZ3	1:A:622:LEU:HG	1.83	0.43
1:A:558:THR:HG22	1:A:560:GLU:HG2	2.00	0.42
1:A:449:LEU:O	1:A:454:GLY:N	2.53	0.41
1:A:390:ILE:HG13	1:A:407:VAL:HB	2.02	0.41
1:A:399:ARG:HH22	1:A:455:HIS:HB3	1.86	0.41
1:A:163:LEU:HD21	1:A:172:PHE:CG	2.56	0.40
1:A:111:ASP:HB3	1:A:161:LEU:HB2	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	724/726 (100%)	701 (97%)	22 (3%)	1 (0%)	48	43
2	B	3/5 (60%)	2 (67%)	1 (33%)	0	100	100
All	All	727/731 (100%)	703 (97%)	23 (3%)	1 (0%)	48	43

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	500	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	609/609 (100%)	604 (99%)	5 (1%)	73	77
2	B	3/3 (100%)	3 (100%)	0	100	100
All	All	612/612 (100%)	607 (99%)	5 (1%)	73	77

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	266	LYS
1	A	390	ILE
1	A	392	ILE
1	A	477	ILE
1	A	536	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	185	GLN
1	A	420	GLN
1	A	486	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	725/726 (99%)	0.68	80 (11%)	10 10	16, 32, 67, 93	1 (0%)
2	B	5/5 (100%)	1.91	2 (40%)	1 0	37, 38, 49, 67	0
All	All	730/731 (99%)	0.69	82 (11%)	10 9	16, 32, 67, 93	1 (0%)

All (82) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	5	LEU	5.2
1	A	207	CYS	4.8
1	A	417	TYR	4.5
1	A	419	THR	4.3
1	A	435	TYR	4.2
1	A	4	THR	4.0
1	A	424	LEU	3.9
1	A	524	VAL	3.9
1	A	535	ALA	3.9
1	A	443	PHE	3.7
1	A	3	ASP	3.7
1	A	2	ALA	3.7
1	A	522	PRO	3.6
1	A	530	PHE	3.6
1	A	467	GLY	3.5
1	A	436	ILE	3.5
1	A	346	LEU	3.4
1	A	418	ALA	3.4
1	A	532	GLY	3.3
1	A	528	PHE	3.3
1	A	437	LEU	3.2
1	A	438	TRP	3.2
1	A	347	VAL	3.1
1	A	533	ALA	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	434	LEU	3.1
1	A	594	GLY	3.0
1	A	451	ALA	3.0
1	A	349	SER	2.9
1	A	585	GLY	2.9
1	A	527	ILE	2.8
1	A	468	ALA	2.7
1	A	539	ILE	2.7
1	A	371	PRO	2.7
1	A	538	VAL	2.6
1	A	525	LEU	2.6
1	A	534	ASP	2.6
1	A	341	ALA	2.6
1	A	589	ILE	2.5
1	A	353	LEU	2.5
1	A	492	GLY	2.5
1	A	584	GLU	2.4
1	A	354	LEU	2.4
1	A	400	GLN	2.4
1	A	25	LEU	2.4
1	A	343	PHE	2.4
2	B	4	PHE	2.4
1	A	541	VAL	2.4
1	A	439	LYS	2.4
1	A	491	CYS	2.4
1	A	206	GLY	2.4
1	A	416	ALA	2.3
1	A	348	ALA	2.3
1	A	448	GLY	2.3
1	A	681	GLY	2.3
1	A	420	GLN	2.3
1	A	441	PRO	2.3
1	A	536	GLU	2.3
1	A	477	ILE	2.3
1	A	415	VAL	2.3
1	A	603	VAL	2.3
1	A	529	GLY	2.2
1	A	447	VAL	2.2
1	A	452	LEU	2.2
1	A	605	LEU	2.2
1	A	469	PHE	2.1
1	A	680	GLU	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	460	LEU	2.1
1	A	682	SER	2.1
1	A	444	ASP	2.1
1	A	369	LEU	2.1
1	A	423	LYS	2.1
1	A	520	LEU	2.1
1	A	433	ASP	2.1
1	A	337	LYS	2.1
1	A	449	LEU	2.1
1	A	368	PHE	2.1
1	A	471	PHE	2.1
1	A	204	VAL	2.0
1	A	445	VAL	2.0
1	A	442	SER	2.0
1	A	595	SER	2.0
1	A	427	LEU	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
3	ZN	A	801	1/1	0.81	0.11	52,52,52,52	1
4	MG	A	803	1/1	0.97	0.04	19,19,19,19	0
5	K	A	804	1/1	0.97	0.06	29,29,29,29	0
4	MG	A	802	1/1	0.98	0.05	19,19,19,19	0

6.5 Other polymers [i](#)

There are no such residues in this entry.