WORLDWIDE PDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

May 29, 2020 – 06:52 am BST

PDB ID	:	5FWW
Title	:	Wnt modulator Kremen in complex with DKK1 (CRD2) and LRP6 (PE3PE4)
Authors	:	Zebisch, M.; Jackson, V.A.; Jones, E.Y.
Deposited on	:	2016-02-21
Resolution	:	3.50 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 (i) symbol.

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The following versions of software and data (see references (i)) were used in the production of this report:

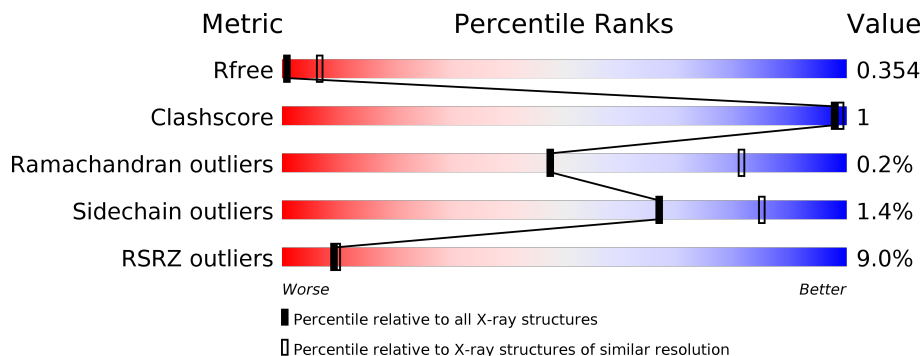|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 3.50 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	Percentile Ranks	Value
Rfree		0.354
Clashscore		1
Ramachandran outliers		0.2%
Sidechain outliers		1.4%
RSRZ outliers		9.0%

Worse　　　　　　　　　　　　　　　　　*Better*

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1659 (3.60-3.40)
Clashscore	141614	1036 (3.58-3.42)
Ramachandran outliers	138981	1005 (3.58-3.42)
Sidechain outliers	138945	1006 (3.58-3.42)
RSRZ outliers	127900	1559 (3.60-3.40)

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 on 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 <=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	619	11% / 96%
2	B	293	4% / 95%
3	C	85	8% / 87% / 11%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 7730 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 LOW-DENSITY LIPOPROTEIN RECEPTOR-RELATED PROTEIN 6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	612	Total 4873	C 3057	N 862	O 929	S 25	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	628	ALA	-	expression tag	UNP O75581
A	629	ASP	-	expression tag	UNP O75581
A	1062	ILE	VAL	conflict	UNP O75581

- Molecule 2 is a protein called KREMEN PROTEIN 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	288	Total 2260	C 1438	N 384	O 418	S 20	0	0	0

- Molecule 3 is a protein called DICKKOPF-RELATED PROTEIN 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	76	Total 596	C 362	N 123	O 101	S 10	0	0	0

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total 1	Ca 1	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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.
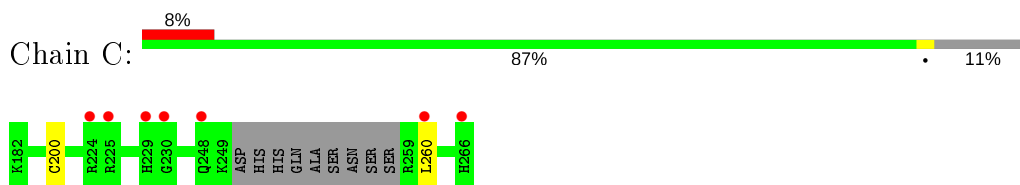
- Molecule 1: LOW-DENSITY LIPOPROTEIN RECEPTOR-RELATED PROTEIN 6
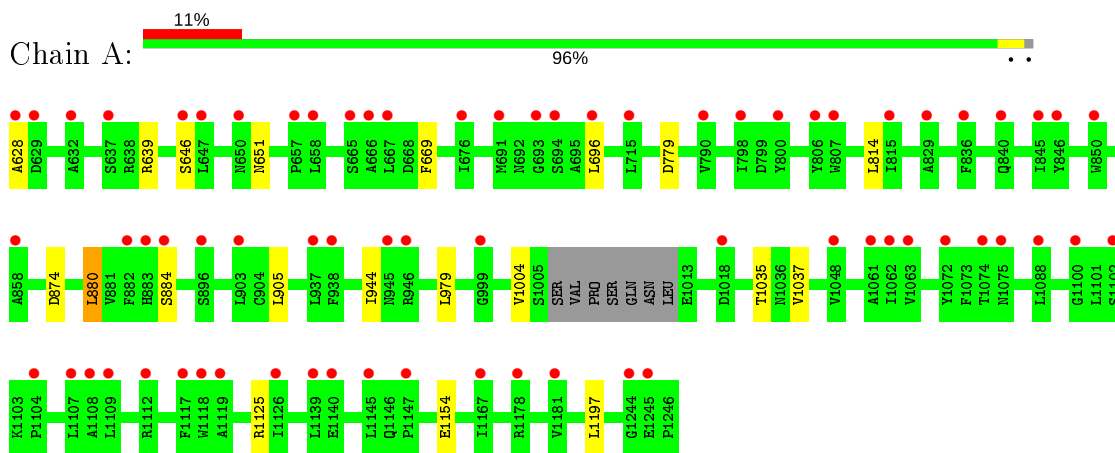
- Molecule 2: KREMEN PROTEIN 1
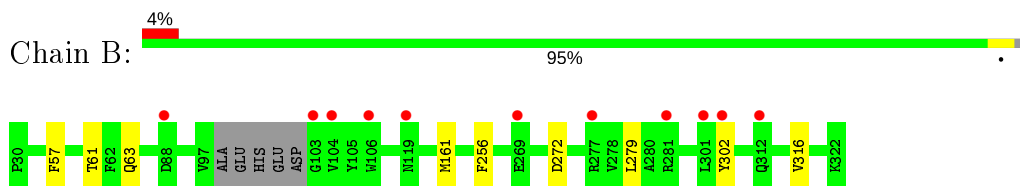
- Molecule 3: DICKKOPF-RELATED PROTEIN 1

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	86.93Å 100.08Å 270.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	135.36 – 3.50	Depositor
	65.63 – 3.50	EDS
% Data completeness	52.7 (135.36-3.50)	Depositor
(in resolution range)	52.7 (65.63-3.50)	EDS
R_{merge}	0.37	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.03 (at 3.49Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.321 , 0.355	Depositor
	0.325 , 0.354	DCC
R_{free} test set	388 reflections (4.83%)	wwPDB-VP
Wilson B-factor (Å^2)	113.4	Xtriage
Anisotropy	0.456	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 24.2	EDS
L-test for twinning[2]	$< |L| > = 0.39$, $< L^2 > = 0.22$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.79	EDS
Total number of atoms	7730	wwPDB-VP
Average B, all atoms (Å^2)	59.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.68% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: CA

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	0.35	0/4976	0.56	0/6753
2	B	0.36	0/2334	0.53	0/3174
3	C	0.34	0/605	0.60	0/801
All	All	0.35	0/7915	0.56	0/10728

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	4873	0	4748	7	0
2	B	2260	0	2082	3	0
3	C	596	0	589	0	0
4	B	1	0	0	0	0
All	All	7730	0	7419	10	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 1.

All (10) 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:628:ALA:N	1:A:884:SER:HG	1.95	0.64
1:A:1035:THR:HG23	1:A:1037:VAL:HG22	1.85	0.59
1:A:944:ILE:HG21	1:A:979:LEU:HD21	1.93	0.50
2:B:272:ASP:HB2	2:B:279:LEU:HD21	1.96	0.46
1:A:646:SER:HB2	1:A:651:ASN:HD22	1.81	0.46
1:A:669:PHE:CD1	1:A:880:LEU:HD11	2.52	0.45
2:B:256:PHE:CE2	2:B:316:VAL:HG22	2.53	0.43
1:A:669:PHE:HD1	1:A:880:LEU:HD11	1.83	0.42
2:B:57:PHE:O	2:B:61:THR:HG23	2.21	0.40
1:A:779:ASP:HA	1:A:905:LEU:HD13	2.03	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	608/619 (98%)	560 (92%)	46 (8%)	2 (0%)	41	75
2	B	284/293 (97%)	265 (93%)	19 (7%)	0	100	100
3	C	72/85 (85%)	69 (96%)	3 (4%)	0	100	100
All	All	964/997 (97%)	894 (93%)	68 (7%)	2 (0%)	47	81

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	639	ARG
1	A	1154	GLU

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	533/540 (99%)	526 (99%)	7 (1%)	69	86
2	B	241/245 (98%)	238 (99%)	3 (1%)	71	87
3	C	66/74 (89%)	64 (97%)	2 (3%)	41	71
All	All	840/859 (98%)	828 (99%)	12 (1%)	67	85

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	696	LEU
1	A	814	LEU
1	A	874	ASP
1	A	880	LEU
1	A	1004	VAL
1	A	1125	ARG
1	A	1197	LEU
2	B	63	GLN
2	B	161	MET
2	B	302	TYR
3	C	200	CYS
3	C	260	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1204	GLN
2	B	140	ASN

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 carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 1 ligands modelled in this entry, 1 is 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 (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(Å²)	Q<0.9
1	A	612/619 (98%)	0.72	70 (11%)	5	6	37, 61, 96, 120	0
2	B	288/293 (98%)	0.29	11 (3%)	40	36	25, 41, 75, 101	0
3	C	76/85 (89%)	0.61	7 (9%)	9	9	47, 63, 96, 105	0
All	All	976/997 (97%)	0.59	88 (9%)	9	10	25, 55, 95, 120	0

All (88) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	628	ALA	8.2
1	A	629	ASP	6.6
1	A	1119	ALA	6.2
1	A	715	LEU	4.5
1	A	1139	LEU	4.4
1	A	882	PHE	4.0
2	B	103	GLY	4.0
1	A	858	ALA	3.9
1	A	836	PHE	3.8
1	A	1108	ALA	3.8
1	A	1140	GLU	3.7
1	A	646	SER	3.7
1	A	693	GLY	3.5
3	C	230	GLY	3.5
1	A	665	SER	3.4
1	A	696	LEU	3.4
1	A	1178	ARG	3.4
1	A	1245	GLU	3.3
1	A	938	PHE	3.3
1	A	1118	TRP	3.3
1	A	1075	ASN	3.3
1	A	657	PRO	3.2
2	B	301	LEU	3.2

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Mol	Chain	Res	Type	RSRZ
2	B	312	GLN	3.1
1	A	1147	PRO	3.1
1	A	1117	PHE	3.1
1	A	798	ILE	3.1
1	A	937	LEU	3.1
1	A	1061	ALA	3.0
1	A	807	TRP	3.0
1	A	896	SER	3.0
3	C	225	ARG	2.9
1	A	800	TYR	2.9
1	A	815	ILE	2.9
1	A	790	VAL	2.9
2	B	119	ASN	2.9
1	A	691	MET	2.9
1	A	1167	ILE	2.8
1	A	666	ALA	2.8
1	A	829	ALA	2.8
1	A	632	ALA	2.7
1	A	1112	ARG	2.7
1	A	1244	GLY	2.7
2	B	106	TRP	2.6
1	A	1104	PRO	2.6
1	A	1126	ILE	2.6
1	A	658	LEU	2.6
3	C	260	LEU	2.6
1	A	1107	LEU	2.5
1	A	1145	LEU	2.5
3	C	229	HIS	2.5
1	A	1109	LEU	2.5
1	A	1072	TYR	2.5
1	A	1063	VAL	2.5
1	A	806	TYR	2.5
1	A	1181	VAL	2.4
1	A	846	TYR	2.4
1	A	647	LEU	2.4
1	A	1088	LEU	2.3
1	A	676	ILE	2.3
1	A	903	LEU	2.3
2	B	269	GLU	2.3
1	A	884	SER	2.3
1	A	667	LEU	2.3
1	A	945	ASN	2.3

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Mol	Chain	Res	Type	RSRZ
2	B	281	ARG	2.3
1	A	999	GLY	2.3
1	A	850	TRP	2.3
1	A	694	SER	2.2
1	A	637	SER	2.2
2	B	104	VAL	2.2
1	A	946	ARG	2.2
1	A	1102	SER	2.2
1	A	1100	GLY	2.1
1	A	1074	THR	2.1
1	A	845	ILE	2.1
1	A	650	ASN	2.1
3	C	224	ARG	2.1
1	A	883	HIS	2.1
1	A	1018	ASP	2.1
1	A	1062	ILE	2.1
1	A	1048	VAL	2.1
2	B	88	ASP	2.1
3	C	248	GLN	2.1
2	B	302	TYR	2.1
3	C	266	HIS	2.1
2	B	277	ARG	2.0
1	A	840	GLN	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 carbohydrates 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.

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å²)	Q<0.9

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å²)	Q<0.9
4	CA	B	1323	1/1	0.46	0.10	88,88,88,88	0

6.5 Other polymers (i)

There are no such residues in this entry.