Full wwPDB X-ray Structure Validation Report (i)

Jun 23, 2024 – 02:00 AM EDT

PDB ID	:	5IP4
Title	:	X-RAY STRUCTURE OF THE C-TERMINAL DOMAIN OF HUMAN DOUBLECORTIN
Authors	:	Ruf, A.; Benz, J.; Burger, D.; D'Arcy, B.; Debulpaep, M.; Di Lello, P.; Fry, D.; Huber, W.; Kremer, T.; Laeremans, T.; Matile, H.; Ross, A.; Rudolph, M.G.; Rufer, A.C.; Sharma, A.; Steinmetz, M.O.; Steyaert, J.; Schoch, G.; Stihle, M.; Thoma, R.
Deposited on	:	2016-03-09
Resolution	:	1.81 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.

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 (i)) were used in the production of this report:

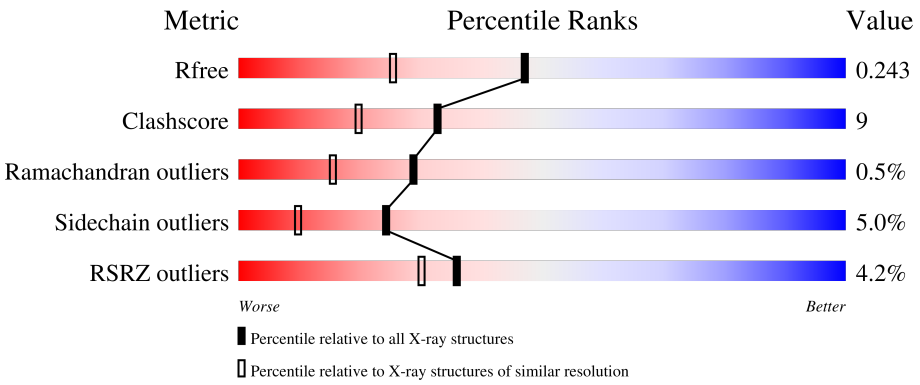
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 1.81 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}	130704	7484 (1.84-1.80)
Clashscore	141614	8401 (1.84-1.80)
Ramachandran outliers	138981	8290 (1.84-1.80)
Sidechain outliers	138945	8290 (1.84-1.80)
RSRZ outliers	127900	7371 (1.84-1.80)

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 <=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	121	4%, 73%, 11%, 6%, •, 10%
1	B	121	79%, 11%, •, 9%
2	D	91	9%, 66%, 18%, •, 12%
2	E	91	3%, 77%, 12%, •, 8%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 3373 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 XA4551 NANOBODY AGAINST C-DCX.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	109	841	524	152	162	3	0	0	0
1	B	110	847	527	153	164	3	0	0	0

- Molecule 2 is a protein called Neuronal migration protein doublecortin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	D	80	631	407	109	113	2	0	0	0
2	E	84	667	432	114	119	2	0	0	0

- Molecule 3 is water.

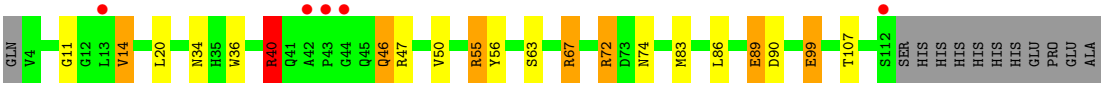
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	128	128	128	0	0
3	B	124	124	124	0	0
3	D	75	75	75	0	0
3	E	60	60	60	0	0

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.

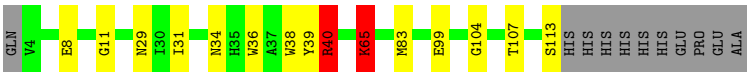
• Molecule 1: XA4551 NANOBODY AGAINST C-DCX

Chain A:



• Molecule 1: XA4551 NANOBODY AGAINST C-DCX

Chain B:

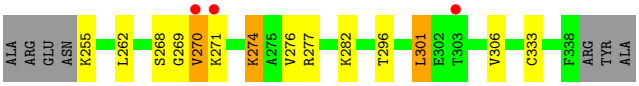


• Molecule 2: Neuronal migration protein doublecortin

Chain D:

• Molecule 2: Neuronal migration protein doublecortin

Chain E:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	89.84Å 86.19Å 73.27Å 90.00° 123.00° 90.00°	Depositor
Resolution (Å)	44.77 – 1.81 43.10 – 1.81	Depositor EDS
% Data completeness (in resolution range)	96.0 (44.77-1.81) 95.9 (43.10-1.81)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$< I/\sigma(I) >$ [1]	1.46 (at 1.81Å)	Xtriage
Refinement program	REFMAC 5.6.0112	Depositor
R, R_{free}	0.194 , 0.246 0.193 , 0.243	Depositor DCC
R_{free} test set	2063 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	26.0	Xtriage
Anisotropy	0.123	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 37.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	3373	wwPDB-VP
Average B, all atoms (Å^2)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.00% of the height of the origin peak. No significant pseudotranslation is detected.*

[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)

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	1.15	4/858 (0.5%)	1.75	11/1164 (0.9%)
1	B	1.04	3/864 (0.3%)	1.11	5/1172 (0.4%)
2	D	0.80	0/640	0.96	2/861 (0.2%)
2	E	0.87	0/678	0.96	0/912
All	All	0.99	7/3040 (0.2%)	1.27	18/4109 (0.4%)

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	67	ARG	CD-NE	-6.89	1.34	1.46
1	B	36	TRP	CD2-CE2	6.43	1.49	1.41
1	B	39	TYR	CE1-CZ	5.66	1.46	1.38
1	A	89	GLU	CD-OE1	5.53	1.31	1.25
1	A	36	TRP	CD2-CE2	5.45	1.47	1.41
1	A	99	GLU	CD-OE2	-5.21	1.20	1.25
1	B	38	TRP	CD2-CE2	5.14	1.47	1.41

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	72	ARG	NE-CZ-NH2	-23.61	108.49	120.30
1	A	67	ARG	NE-CZ-NH2	-20.78	109.91	120.30
1	A	72	ARG	NE-CZ-NH1	19.40	130.00	120.30
1	A	40	ARG	NE-CZ-NH2	-15.48	112.56	120.30
1	A	40	ARG	NE-CZ-NH1	14.74	127.67	120.30
1	A	67	ARG	NE-CZ-NH1	13.74	127.17	120.30
1	B	40	ARG	NE-CZ-NH1	11.59	126.10	120.30
1	B	40	ARG	NE-CZ-NH2	-8.91	115.85	120.30
1	A	72	ARG	CD-NE-CZ	7.72	134.41	123.60
2	D	277	ARG	NE-CZ-NH2	-6.97	116.82	120.30
1	B	40	ARG	CB-CG-CD	6.87	129.46	111.60
1	A	67	ARG	CG-CD-NE	-6.12	98.94	111.80
1	B	83	MET	CG-SD-CE	-5.58	91.26	100.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	65	LYS	CD-CE-NZ	5.56	124.49	111.70
1	A	67	ARG	CD-NE-CZ	5.52	131.33	123.60
1	A	55	ARG	NE-CZ-NH1	5.40	123.00	120.30
1	A	40	ARG	CB-CG-CD	5.25	125.25	111.60
2	D	292	LEU	CB-CG-CD1	-5.24	102.09	111.00

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	841	0	803	15	0
1	B	847	0	808	11	0
2	D	631	0	668	21	0
2	E	667	0	703	8	0
3	A	128	0	0	5	0
3	B	124	0	0	7	0
3	D	75	0	0	4	0
3	E	60	0	0	2	0
All	All	3373	0	2982	52	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 9.

All (52) 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:B:298:HOH:O	2:D:290:GLN:HG2	1.58	1.03
1:B:65:LYS:CE	3:B:218:HOH:O	2.22	0.86
1:B:65:LYS:HE2	3:B:218:HOH:O	1.76	0.86
2:D:302:GLU:HG3	3:D:459:HOH:O	1.76	0.85
1:B:40:ARG:HD3	3:B:304:HOH:O	1.78	0.83
3:B:281:HOH:O	2:D:284:THR:HG23	1.80	0.79
2:E:301:LEU:HD12	2:E:306:VAL:HG22	1.66	0.78

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:40:ARG:HD2	3:A:277:HOH:O	1.86	0.75
1:A:67:ARG:HD2	3:A:307:HOH:O	1.86	0.74
1:A:72:ARG:HD3	1:A:74:ASN:OD1	1.90	0.71
2:E:333:CYS:O	3:E:401:HOH:O	2.12	0.68
1:A:67:ARG:CD	3:A:307:HOH:O	2.43	0.66
2:D:308:LYS:HG2	2:D:316:GLN:NE2	2.13	0.64
1:B:29:ASN:HD22	2:D:277:ARG:H	1.46	0.63
1:B:40:ARG:CD	3:B:304:HOH:O	2.44	0.60
1:B:107:THR:HG23	3:B:264:HOH:O	2.00	0.60
2:D:267:ARG:NE	2:D:270:VAL:HG11	2.18	0.59
2:D:267:ARG:HE	2:D:270:VAL:HG11	1.69	0.58
2:D:308:LYS:HG2	2:D:316:GLN:HE21	1.69	0.57
2:D:308:LYS:CD	2:D:316:GLN:HE21	2.19	0.55
1:A:47:ARG:HG3	3:A:293:HOH:O	2.07	0.55
1:A:34:ASN:HA	1:A:99:GLU:OE2	2.09	0.53
2:D:272:PRO:HA	3:D:455:HOH:O	2.09	0.53
1:A:40:ARG:HG2	1:A:50:VAL:CG2	2.38	0.53
1:A:89:GLU:HG3	3:A:248:HOH:O	2.07	0.53
1:B:29:ASN:ND2	2:D:277:ARG:H	2.07	0.53
2:D:313:ASP:HB2	3:D:429:HOH:O	2.08	0.53
2:E:301:LEU:HD12	2:E:306:VAL:CG2	2.37	0.53
1:A:14:VAL:HG21	1:A:86:LEU:HD13	1.91	0.52
2:E:262:LEU:HD11	2:E:277:ARG:HB3	1.91	0.51
1:A:55:ARG:HD2	1:A:56:TYR:CZ	2.45	0.51
2:D:281:ASN:HB3	2:D:284:THR:HG22	1.93	0.50
2:E:274:LYS:HE2	2:E:276:VAL:CG2	2.42	0.50
2:D:308:LYS:CG	2:D:316:GLN:HE21	2.25	0.49
1:A:20:LEU:HB2	1:A:83:MET:HE3	1.97	0.46
1:B:31:ILE:HB	2:D:294:ASP:HB3	1.98	0.46
1:B:34:ASN:HA	1:B:99:GLU:OE2	2.16	0.46
1:B:8:GLU:OE2	1:B:104:GLY:HA3	2.16	0.46
2:D:317:VAL:HG13	2:D:322:ASP:HB2	1.98	0.46
2:E:296:THR:HG23	2:E:301:LEU:HB3	1.98	0.45
2:E:282:LYS:NZ	3:E:402:HOH:O	2.41	0.45
1:A:11:GLY:HA3	1:A:107:THR:HG22	2.00	0.43
2:D:258:VAL:HG12	2:D:259:ARG:HB3	1.99	0.43
2:E:269:GLY:O	2:E:270:VAL:C	2.58	0.42
2:D:255:LYS:NZ	3:D:405:HOH:O	2.52	0.42
2:D:267:ARG:NH2	2:D:270:VAL:HG11	2.36	0.41
1:A:67:ARG:NH2	1:A:90:ASP:OD2	2.31	0.41
1:B:11:GLY:HA3	1:B:107:THR:HG22	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:308:LYS:HE2	2:D:316:GLN:NE2	2.36	0.41
1:A:11:GLY:HA3	1:A:107:THR:CG2	2.51	0.41
2:D:267:ARG:CZ	2:D:270:VAL:HG11	2.51	0.41
1:A:46:GLN:H	1:A:46:GLN:HG2	1.49	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	107/121 (88%)	103 (96%)	4 (4%)	0	100	100
1	B	108/121 (89%)	105 (97%)	3 (3%)	0	100	100
2	D	78/91 (86%)	75 (96%)	3 (4%)	0	100	100
2	E	82/91 (90%)	77 (94%)	3 (4%)	2 (2%)	6	1
All	All	375/424 (88%)	360 (96%)	13 (4%)	2 (0%)	29	15

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	E	270	VAL
2	E	274	LYS

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	86/97 (89%)	82 (95%)	4 (5%)	26	11
1	B	87/97 (90%)	84 (97%)	3 (3%)	37	22
2	D	71/80 (89%)	66 (93%)	5 (7%)	15	4
2	E	75/80 (94%)	71 (95%)	4 (5%)	22	9
All	All	319/354 (90%)	303 (95%)	16 (5%)	24	10

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

Mol	Chain	Res	Type
1	A	14	VAL
1	A	40	ARG
1	A	46	GLN
1	A	63	SER
1	B	40	ARG
1	B	65	LYS
1	B	113	SER
2	D	259	ARG
2	D	268	SER
2	D	284	THR
2	D	295	ILE
2	D	308	LYS
2	E	255	LYS
2	E	268	SER
2	E	271	LYS
2	E	301	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	29	ASN
1	A	100	ASN
1	B	15	GLN
1	B	29	ASN
1	B	46	GLN
2	D	316	GLN
2	E	290	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 monosaccharides 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	109/121 (90%)	-0.12	5 (4%) 32 27	16, 24, 43, 61	0
1	B	110/121 (90%)	-0.33	0 100 100	16, 24, 42, 59	0
2	D	80/91 (87%)	0.31	8 (10%) 7 5	22, 33, 69, 102	0
2	E	84/91 (92%)	-0.03	3 (3%) 42 37	19, 31, 60, 83	0
All	All	383/424 (90%)	-0.07	16 (4%) 36 30	16, 27, 56, 102	0

All (16) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	272	PRO	7.8
2	D	271	LYS	4.5
2	D	334	GLY	4.3
1	A	44	GLY	4.0
2	D	270	VAL	3.8
2	D	308	LYS	3.4
1	A	13	LEU	3.1
2	D	269	GLY	2.7
2	E	271	LYS	2.6
1	A	43	PRO	2.5
2	D	305	VAL	2.5
1	A	42	ALA	2.4
2	E	303	THR	2.3
2	D	258	VAL	2.3
2	E	270	VAL	2.3
1	A	112	SER	2.1

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 monosaccharides 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.