Full wwPDB X-ray Structure Validation Report (i)

Aug 17, 2022 – 08:15 PM EDT

PDB ID	:	4O5S
Title	:	Crystal structure of Diels-Alderase CE11
Authors	:	Beck, T.; Preiswerk, N.; Mayer, C.; Hilvert, D.
Deposited on	:	2013-12-20
Resolution	:	1.80 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 (1)) were used in the production of this report:

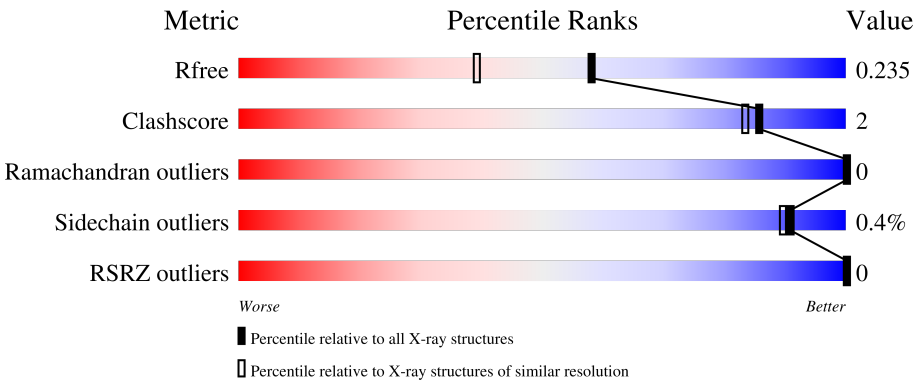
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.29
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.29

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 1.80 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	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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	337	91% . .
1	B	337	85% 7% 7%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 4858 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 Diisopropyl-fluorophosphatase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	323	2407	1540	401	449	17	0	0	0
1	B	312	2316	1486	387	424	19	0	2	0

There are 116 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	13	MET	VAL	engineered mutation	UNP Q7SIG4
A	21	THR	GLU	engineered mutation	UNP Q7SIG4
A	33	VAL	ILE	engineered mutation	UNP Q7SIG4
A	36	SER	PRO	SEE REMARK 999	UNP Q7SIG4
A	37	PRO	GLU	SEE REMARK 999	UNP Q7SIG4
A	38	LEU	VAL	SEE REMARK 999	UNP Q7SIG4
A	39	SER	GLU	SEE REMARK 999	UNP Q7SIG4
A	40	GLU	VAL	SEE REMARK 999	UNP Q7SIG4
A	41	ALA	ASN	SEE REMARK 999	UNP Q7SIG4
A	42	LEU	GLY	SEE REMARK 999	UNP Q7SIG4
A	43	THR	LYS	SEE REMARK 999	UNP Q7SIG4
A	44	LYS	PRO	SEE REMARK 999	UNP Q7SIG4
A	45	ALA	ALA	SEE REMARK 999	UNP Q7SIG4
A	46	ASN	-	SEE REMARK 999	UNP Q7SIG4
A	47	SER	-	SEE REMARK 999	UNP Q7SIG4
A	48	PRO	-	SEE REMARK 999	UNP Q7SIG4
A	49	ALA	-	SEE REMARK 999	UNP Q7SIG4
A	50	GLU	-	SEE REMARK 999	UNP Q7SIG4
A	51	ALA	-	SEE REMARK 999	UNP Q7SIG4
A	52	TYR	-	SEE REMARK 999	UNP Q7SIG4
A	53	LYS	-	SEE REMARK 999	UNP Q7SIG4
A	54	ALA	-	SEE REMARK 999	UNP Q7SIG4
A	55	SER	-	SEE REMARK 999	UNP Q7SIG4
A	56	ARG	-	SEE REMARK 999	UNP Q7SIG4
A	57	GLY	-	SEE REMARK 999	UNP Q7SIG4

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Chain	Residue	Modelled	Actual	Comment	Reference
A	58	ALA	-	SEE REMARK 999	UNP Q7SIG4
A	63	HIS	ARG	engineered mutation	UNP Q7SIG4
A	85	SER	ILE	engineered mutation	UNP Q7SIG4
A	87	ILE	ALA	engineered mutation	UNP Q7SIG4
A	113	GLU	ASP	engineered mutation	UNP Q7SIG4
A	128	CYS	ARG	engineered mutation	UNP Q7SIG4
A	133	ALA	ASN	engineered mutation	UNP Q7SIG4
A	134	TYR	ASP	engineered mutation	UNP Q7SIG4
A	151	GLY	GLU	engineered mutation	UNP Q7SIG4
A	157	PHE	TYR	engineered mutation	UNP Q7SIG4
A	159	ILE	ARG	engineered mutation	UNP Q7SIG4
A	161	LEU	MET	engineered mutation	UNP Q7SIG4
A	162	ARG	GLN	engineered mutation	UNP Q7SIG4
A	186	CYS	PHE	engineered mutation	UNP Q7SIG4
A	188	ALA	ASN	engineered mutation	UNP Q7SIG4
A	208	GLN	THR	engineered mutation	UNP Q7SIG4
A	223	ASN	LYS	engineered mutation	UNP Q7SIG4
A	238	LYS	GLU	engineered mutation	UNP Q7SIG4
A	242	ALA	ASP	engineered mutation	UNP Q7SIG4
A	245	VAL	ASP	engineered mutation	UNP Q7SIG4
A	284	ALA	SER	engineered mutation	UNP Q7SIG4
A	301	ASP	GLU	engineered mutation	UNP Q7SIG4
A	322	SER	LEU	engineered mutation	UNP Q7SIG4
A	328	GLY	-	expression tag	UNP Q7SIG4
A	329	SER	-	expression tag	UNP Q7SIG4
A	330	LEU	-	expression tag	UNP Q7SIG4
A	331	GLU	-	expression tag	UNP Q7SIG4
A	332	HIS	-	expression tag	UNP Q7SIG4
A	333	HIS	-	expression tag	UNP Q7SIG4
A	334	HIS	-	expression tag	UNP Q7SIG4
A	335	HIS	-	expression tag	UNP Q7SIG4
A	336	HIS	-	expression tag	UNP Q7SIG4
A	337	HIS	-	expression tag	UNP Q7SIG4
B	13	MET	VAL	engineered mutation	UNP Q7SIG4
B	21	THR	GLU	engineered mutation	UNP Q7SIG4
B	33	VAL	ILE	engineered mutation	UNP Q7SIG4
B	36	SER	PRO	SEE REMARK 999	UNP Q7SIG4
B	37	PRO	GLU	SEE REMARK 999	UNP Q7SIG4
B	38	LEU	VAL	SEE REMARK 999	UNP Q7SIG4
B	39	SER	GLU	SEE REMARK 999	UNP Q7SIG4
B	40	GLU	VAL	SEE REMARK 999	UNP Q7SIG4
B	41	ALA	ASN	SEE REMARK 999	UNP Q7SIG4

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Chain	Residue	Modelled	Actual	Comment	Reference
B	42	LEU	GLY	SEE REMARK 999	UNP Q7SIG4
B	43	THR	LYS	SEE REMARK 999	UNP Q7SIG4
B	44	LYS	PRO	SEE REMARK 999	UNP Q7SIG4
B	45	ALA	ALA	SEE REMARK 999	UNP Q7SIG4
B	46	ASN	-	SEE REMARK 999	UNP Q7SIG4
B	47	SER	-	SEE REMARK 999	UNP Q7SIG4
B	48	PRO	-	SEE REMARK 999	UNP Q7SIG4
B	49	ALA	-	SEE REMARK 999	UNP Q7SIG4
B	50	GLU	-	SEE REMARK 999	UNP Q7SIG4
B	51	ALA	-	SEE REMARK 999	UNP Q7SIG4
B	52	TYR	-	SEE REMARK 999	UNP Q7SIG4
B	53	LYS	-	SEE REMARK 999	UNP Q7SIG4
B	54	ALA	-	SEE REMARK 999	UNP Q7SIG4
B	55	SER	-	SEE REMARK 999	UNP Q7SIG4
B	56	ARG	-	SEE REMARK 999	UNP Q7SIG4
B	57	GLY	-	SEE REMARK 999	UNP Q7SIG4
B	58	ALA	-	SEE REMARK 999	UNP Q7SIG4
B	63	HIS	ARG	engineered mutation	UNP Q7SIG4
B	85	SER	ILE	engineered mutation	UNP Q7SIG4
B	87	ILE	ALA	engineered mutation	UNP Q7SIG4
B	113	GLU	ASP	engineered mutation	UNP Q7SIG4
B	128	CYS	ARG	engineered mutation	UNP Q7SIG4
B	133	ALA	ASN	engineered mutation	UNP Q7SIG4
B	134	TYR	ASP	engineered mutation	UNP Q7SIG4
B	151	GLY	GLU	engineered mutation	UNP Q7SIG4
B	157	PHE	TYR	engineered mutation	UNP Q7SIG4
B	159	ILE	ARG	engineered mutation	UNP Q7SIG4
B	161	LEU	MET	engineered mutation	UNP Q7SIG4
B	162	ARG	GLN	engineered mutation	UNP Q7SIG4
B	186	CYS	PHE	engineered mutation	UNP Q7SIG4
B	188	ALA	ASN	engineered mutation	UNP Q7SIG4
B	208	GLN	THR	engineered mutation	UNP Q7SIG4
B	223	ASN	LYS	engineered mutation	UNP Q7SIG4
B	238	LYS	GLU	engineered mutation	UNP Q7SIG4
B	242	ALA	ASP	engineered mutation	UNP Q7SIG4
B	245	VAL	ASP	engineered mutation	UNP Q7SIG4
B	284	ALA	SER	engineered mutation	UNP Q7SIG4
B	301	ASP	GLU	engineered mutation	UNP Q7SIG4
B	322	SER	LEU	engineered mutation	UNP Q7SIG4
B	328	GLY	-	expression tag	UNP Q7SIG4
B	329	SER	-	expression tag	UNP Q7SIG4
B	330	LEU	-	expression tag	UNP Q7SIG4

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Chain	Residue	Modelled	Actual	Comment	Reference
B	331	GLU	-	expression tag	UNP Q7SIG4
B	332	HIS	-	expression tag	UNP Q7SIG4
B	333	HIS	-	expression tag	UNP Q7SIG4
B	334	HIS	-	expression tag	UNP Q7SIG4
B	335	HIS	-	expression tag	UNP Q7SIG4
B	336	HIS	-	expression tag	UNP Q7SIG4
B	337	HIS	-	expression tag	UNP Q7SIG4

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	75	75	75	0	0
			Total	O		
2	B	60	60	60	0	0

3 Residue-property plots (i)

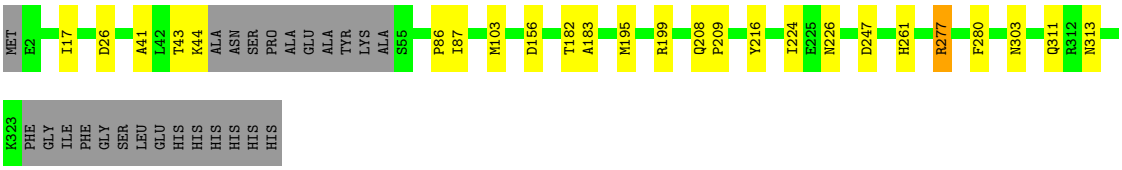
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Diisopropyl-fluorophosphatase

Chain A:

- Molecule 1: Diisopropyl-fluorophosphatase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	43.04Å 46.15Å 76.91Å 84.12° 83.01° 66.18°	Depositor
Resolution (Å)	42.15 – 1.80 42.15 – 1.80	Depositor EDS
% Data completeness (in resolution range)	96.0 (42.15-1.80) 96.0 (42.15-1.80)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.32 (at 1.79Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.185 , 0.233 0.187 , 0.235	Depositor DCC
R_{free} test set	2389 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	26.2	Xtriage
Anisotropy	0.037	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 46.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	4858	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 8.10% 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	0.75	0/2471	0.86	3/3364 (0.1%)
1	B	0.71	0/2382	0.87	4/3241 (0.1%)
All	All	0.73	0/4853	0.87	7/6605 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	277	ARG	NE-CZ-NH1	8.15	124.38	120.30
1	A	247	ASP	CB-CG-OD2	-6.15	112.77	118.30
1	B	26	ASP	CB-CG-OD2	-5.85	113.03	118.30
1	A	104	ARG	NE-CZ-NH1	5.78	123.19	120.30
1	B	247	ASP	CB-CG-OD1	5.66	123.40	118.30
1	A	26	ASP	CB-CG-OD2	-5.13	113.69	118.30
1	B	247	ASP	CB-CG-OD2	-5.04	113.76	118.30

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	2407	0	2264	7	0
1	B	2316	0	2166	13	0
2	A	75	0	0	0	0
2	B	60	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	4858	0	4430	20	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 2.

All (20) 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:195[B]:MET:SD	1:B:199:ARG:NH2	2.46	0.88
1:B:156:ASP:CB	2:B:450:HOH:O	2.27	0.82
1:B:41:ALA:O	1:B:43:THR:O	1.99	0.80
1:B:226:ASN:CB	2:B:435:HOH:O	2.45	0.63
1:B:261:HIS:NE2	1:B:277:ARG:HD3	2.15	0.61
1:B:313:ASN:CB	2:B:415:HOH:O	2.49	0.60
1:B:17:ILE:O	1:B:303:ASN:HB3	2.05	0.57
1:B:182:THR:O	1:B:183:ALA:HB3	2.09	0.52
1:A:193:ARG:HB3	1:A:202:GLN:HB3	1.96	0.48
1:A:186:CYS:HB3	1:A:209:PRO:HD2	1.97	0.47
1:B:103[B]:MET:HE2	1:B:103[B]:MET:HB3	1.73	0.47
1:A:12:LYS:HD3	1:A:306:TRP:CZ2	2.51	0.46
1:B:208:GLN:HB3	1:B:209:PRO:CD	2.46	0.46
1:A:193:ARG:HG2	1:A:201:TYR:CE1	2.52	0.45
1:B:86:PRO:O	1:B:87:ILE:HD13	2.18	0.44
1:A:286:LEU:HD23	1:A:286:LEU:N	2.33	0.44
1:B:216:TYR:CD2	1:B:224:ILE:HD12	2.54	0.42
1:A:216:TYR:CD2	1:A:224:ILE:HD12	2.56	0.41
1:A:33:VAL:HG12	1:A:34:VAL:N	2.36	0.41
1:B:43:THR:HG22	1:B:44:LYS:H	1.86	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	321/337 (95%)	306 (95%)	15 (5%)	0	100	100
1	B	310/337 (92%)	296 (96%)	14 (4%)	0	100	100
All	All	631/674 (94%)	602 (95%)	29 (5%)	0	100	100

There are no Ramachandran outliers to report.

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	239/276 (87%)	239 (100%)	0	100	100
1	B	224/276 (81%)	222 (99%)	2 (1%)	78	75
All	All	463/552 (84%)	461 (100%)	2 (0%)	91	89

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	280	PHE
1	B	311	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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	323/337 (95%)	-0.45	0	100	100	16, 28, 47, 56	0
1	B	312/337 (92%)	-0.45	0	100	100	18, 29, 44, 65	0
All	All	635/674 (94%)	-0.45	0	100	100	16, 29, 46, 65	0

There are no RSRZ outliers to report.

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.