Full wwPDB NMR Structure Validation Report (i)

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PDB ID	:	2A7U
Title	:	NMR solution structure of the E.coli F-ATPase delta subunit N-terminal domain in complex with alpha subunit N-terminal 22 residues
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Deposited on	:	2005-07-06

This is a Full wwPDB NMR 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/NMRValidationReportHelp
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:

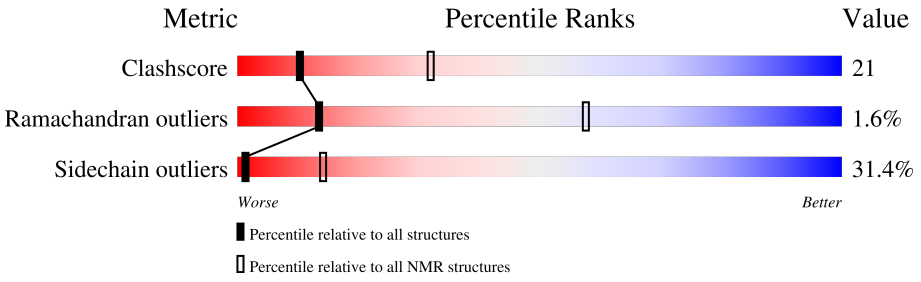
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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%

Mol	Chain	Length	Quality of chain
1	A	22	36% 41% 23%
2	B	134	40% 31% 7% • 22%

2 Ensemble composition and analysis (i)

This entry contains 1 models. Identification of well-defined residues and clustering analysis are not possible.

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 1974 atoms, of which 981 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called ATP synthase alpha chain.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	22	368	112	189	31	35	1	0

- Molecule 2 is a protein called ATP synthase delta chain.

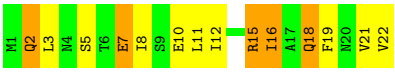
Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
2	B	105	1606	512	792	138	160	4	0

4 Residue-property plots (i)

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

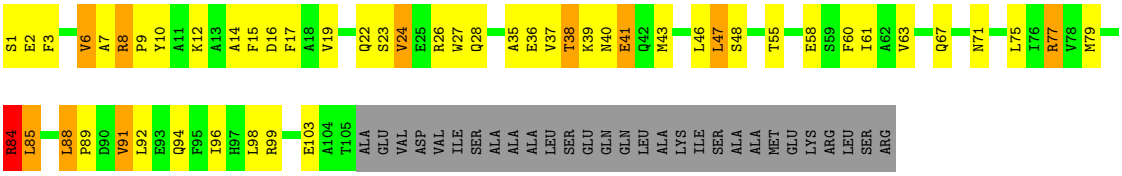
- Molecule 1: ATP synthase alpha chain

Chain A: 36% 41% 23%



- Molecule 2: ATP synthase delta chain

Chain B: 40% 31% 7% • 22%



5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *distance geometry; simulated annealing; molecular dynamics.*

Of the 10 calculated structures, 1 were deposited, based on the following criterion: *averaged minimized structure.*

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
X-PLOR	structure solution	3.8
X-PLOR	refinement	3.8

No chemical shift data was provided.

6 Model quality (i)

6.1 Standard geometry (i)

There are no covalent bond-length or bond-angle outliers.

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	Chirality	Planarity
1	A	0	1
2	B	0	5
All	All	0	6

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

All planar outliers are listed below.

Mol	Chain	Res	Type	Group
1	A	15	ARG	Sidechain
2	B	8	ARG	Sidechain
2	B	26	ARG	Sidechain
2	B	77	ARG	Sidechain
2	B	84	ARG	Sidechain
2	B	99	ARG	Sidechain

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	179	189	189	8
2	B	814	792	792	36
All	All	993	981	981	42

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 21.

All clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)
2:B:38:THR:HG21	2:B:88:LEU:HB2	0.94	1.38
2:B:38:THR:HG23	2:B:60:PHE:HE2	0.69	1.48
2:B:6:VAL:HG22	2:B:10:TYR:CE2	0.68	2.23
2:B:38:THR:HG23	2:B:60:PHE:CE2	0.63	2.29
2:B:47:LEU:HD21	2:B:85:LEU:HD13	0.63	1.69
2:B:79:MET:CB	2:B:85:LEU:HD23	0.62	2.24
2:B:79:MET:HB3	2:B:85:LEU:HD23	0.61	1.73
2:B:88:LEU:N	2:B:89:PRO:HD2	0.59	2.12
2:B:60:PHE:O	2:B:63:VAL:HG12	0.58	1.98
1:A:8:ILE:HG23	1:A:12:ILE:CD1	0.57	2.29
2:B:47:LEU:HD21	2:B:85:LEU:CD1	0.56	2.30
1:A:5:SER:O	1:A:8:ILE:HG22	0.55	2.02
2:B:2:GLU:HG2	2:B:84:ARG:NH1	0.54	2.17
2:B:88:LEU:N	2:B:89:PRO:CD	0.52	2.71
2:B:14:ALA:HB1	2:B:27:TRP:HZ2	0.49	1.66
2:B:79:MET:HE1	2:B:88:LEU:HD22	0.49	1.83
2:B:85:LEU:O	2:B:85:LEU:HD22	0.49	2.07
1:A:8:ILE:HG23	1:A:12:ILE:HD11	0.47	1.84
2:B:7:ALA:CB	2:B:91:VAL:HG12	0.47	2.39
2:B:35:ALA:CB	2:B:92:LEU:HD22	0.46	2.41
2:B:2:GLU:HA	2:B:84:ARG:HD3	0.46	1.86
2:B:12:LYS:HA	2:B:98:LEU:CD2	0.45	2.41
2:B:15:PHE:CG	2:B:98:LEU:HD23	0.45	2.46
2:B:8:ARG:HB3	2:B:9:PRO:HD3	0.45	1.89
1:A:15:ARG:O	1:A:19:PHE:HB2	0.45	2.12
2:B:19:VAL:HG22	2:B:24:VAL:HG21	0.44	1.89
2:B:12:LYS:HG3	2:B:98:LEU:HD21	0.44	1.90
2:B:79:MET:CE	2:B:88:LEU:HD22	0.43	2.44
1:A:12:ILE:HD13	2:B:10:TYR:CD1	0.43	2.48
2:B:40:ASN:O	2:B:41:GLU:C	0.43	2.55
2:B:38:THR:CG2	2:B:88:LEU:HB2	0.43	2.26
2:B:10:TYR:CD2	2:B:79:MET:SD	0.43	3.12
1:A:18:GLN:CG	1:A:21:VAL:HB	0.43	2.44
2:B:8:ARG:N	2:B:9:PRO:HD2	0.42	2.29
2:B:23:SER:O	2:B:24:VAL:C	0.42	2.58
2:B:6:VAL:CG2	2:B:10:TYR:CE2	0.42	2.99
2:B:43:MET:CE	2:B:63:VAL:HG11	0.41	2.45
2:B:14:ALA:HB1	2:B:27:TRP:CZ2	0.40	2.48
2:B:35:ALA:HA	2:B:88:LEU:HB3	0.40	1.93
2:B:58:GLU:O	2:B:61:ILE:HG13	0.40	2.17
1:A:16:ILE:O	2:B:71:ASN:HA	0.40	2.16
1:A:2:GLN:HG3	1:A:7:GLU:HB2	0.40	1.94

6.3 Torsion angles (i)

6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	20/22 (91%)	15 (75%)	4 (20%)	1 (5%)	4 25
2	B	103/134 (77%)	88 (85%)	14 (14%)	1 (1%)	20 68
All	All	123/156 (79%)	103 (84%)	18 (15%)	2 (2%)	13 57

All 2 Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	3	LEU
2	B	24	VAL

6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	21/21 (100%)	14 (67%)	7 (33%)	1 11
2	B	84/106 (79%)	58 (69%)	26 (31%)	1 15
All	All	105/127 (83%)	72 (69%)	33 (31%)	1 14

All 33 residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	2	GLN
1	A	7	GLU
1	A	10	GLU
1	A	11	LEU
1	A	16	ILE

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Mol	Chain	Res	Type
1	A	18	GLN
1	A	22	VAL
2	B	1	SER
2	B	3	PHE
2	B	6	VAL
2	B	16	ASP
2	B	17	PHE
2	B	22	GLN
2	B	28	GLN
2	B	36	GLU
2	B	37	VAL
2	B	38	THR
2	B	39	LYS
2	B	41	GLU
2	B	46	LEU
2	B	47	LEU
2	B	48	SER
2	B	55	THR
2	B	67	GLN
2	B	75	LEU
2	B	77	ARG
2	B	84	ARG
2	B	85	LEU
2	B	88	LEU
2	B	91	VAL
2	B	94	GLN
2	B	96	ILE
2	B	103	GLU

6.3.3 RNA (i)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains (i)

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

6.5 Carbohydrates (i)

There are no monosaccharides in this entry.

6.6 Ligand geometry (i)

There are no ligands in this entry.

6.7 Other polymers (i)

There are no such molecules in this entry.

6.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

7 Chemical shift validation (i)

No chemical shift data were provided