wwPDB X-ray Structure Validation Summary Report (i)

Jun 12, 2024 – 05:57 PM EDT

PDB ID	:	1ICV
Title	:	THE STRUCTURE OF ESCHERICHIA COLI NITROREDUCTASE COMPLEXED WITH NICOTINIC ACID
Authors	:	Lovering, A.L.; Hyde, E.I.; Searle, P.F.; White, S.A.
Deposited on	:	2001-04-02
Resolution	:	2.40 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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:

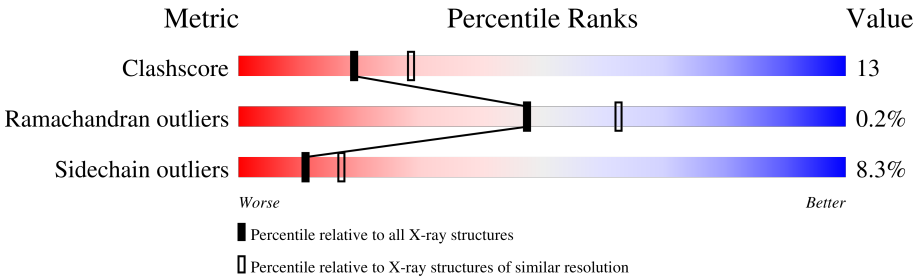
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, 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:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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))
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)

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 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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	217	75% 19% 5%
1	B	217	71% 24% .
1	C	217	77% 20% .
1	D	217	72% 23% 5%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	FMN	A	701	-	X	-	-
2	FMN	B	703	X	X	-	-
2	FMN	C	705	X	X	-	-
2	FMN	D	707	X	X	-	-

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 7511 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.

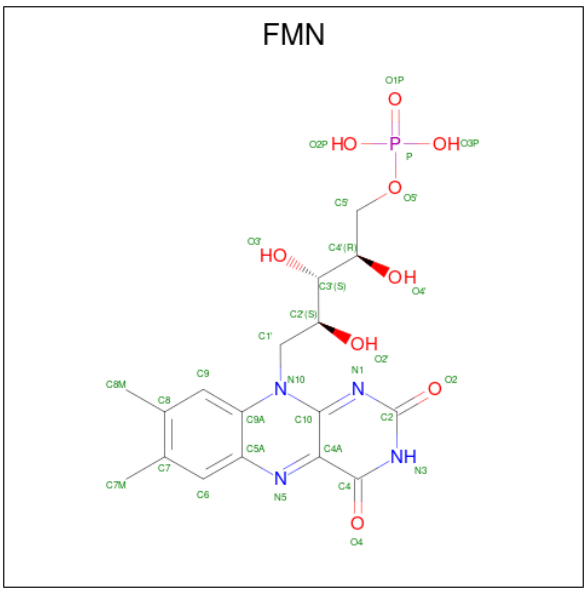
- Molecule 1 is a protein called OXYGEN-INSENSITIVE NAD(P)H NITROREDUCTASE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	216	Total	C	N	O	S	Se	0	0	0
			1677	1065	287	320	1	4			
1	B	216	Total	C	N	O	S	Se	0	0	0
			1677	1065	287	320	1	4			
1	C	216	Total	C	N	O	S	Se	0	0	0
			1677	1065	287	320	1	4			
1	D	216	Total	C	N	O	S	Se	0	0	0
			1677	1065	287	320	1	4			

There are 20 discrepancies between the modelled and reference sequences:

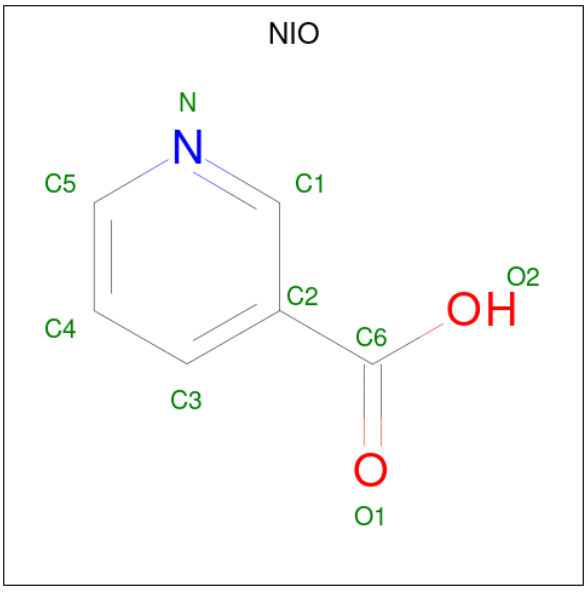
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MSE	MET	MODIFIED RESIDUE	UNP P38489
A	75	MSE	MET	MODIFIED RESIDUE	UNP P38489
A	90	MSE	MET	MODIFIED RESIDUE	UNP P38489
A	127	MSE	MET	MODIFIED RESIDUE	UNP P38489
A	139	MSE	MET	MODIFIED RESIDUE	UNP P38489
B	1	MSE	MET	MODIFIED RESIDUE	UNP P38489
B	75	MSE	MET	MODIFIED RESIDUE	UNP P38489
B	90	MSE	MET	MODIFIED RESIDUE	UNP P38489
B	127	MSE	MET	MODIFIED RESIDUE	UNP P38489
B	139	MSE	MET	MODIFIED RESIDUE	UNP P38489
C	1	MSE	MET	MODIFIED RESIDUE	UNP P38489
C	75	MSE	MET	MODIFIED RESIDUE	UNP P38489
C	90	MSE	MET	MODIFIED RESIDUE	UNP P38489
C	127	MSE	MET	MODIFIED RESIDUE	UNP P38489
C	139	MSE	MET	MODIFIED RESIDUE	UNP P38489
D	1	MSE	MET	MODIFIED RESIDUE	UNP P38489
D	75	MSE	MET	MODIFIED RESIDUE	UNP P38489
D	90	MSE	MET	MODIFIED RESIDUE	UNP P38489
D	127	MSE	MET	MODIFIED RESIDUE	UNP P38489
D	139	MSE	MET	MODIFIED RESIDUE	UNP P38489

- Molecule 2 is FLAVIN MONONUCLEOTIDE (three-letter code: FMN) (formula: $C_{17}H_{21}N_4O_9P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			31	17	4	9	1		
2	B	1	Total	C	N	O	P	0	0
			31	17	4	9	1		
2	C	1	Total	C	N	O	P	0	0
			31	17	4	9	1		
2	D	1	Total	C	N	O	P	0	0
			31	17	4	9	1		

- Molecule 3 is NICOTINIC ACID (three-letter code: NIO) (formula: $C_6H_5NO_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C N O 9 6 1 2	0	0
3	B	1	Total C N O 9 6 1 2	0	0
3	C	1	Total C N O 9 6 1 2	0	0
3	D	1	Total C N O 9 6 1 2	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	164	Total O 164 164	0	0
4	B	179	Total O 179 179	0	0
4	C	157	Total O 157 157	0	0
4	D	143	Total O 143 143	0	0

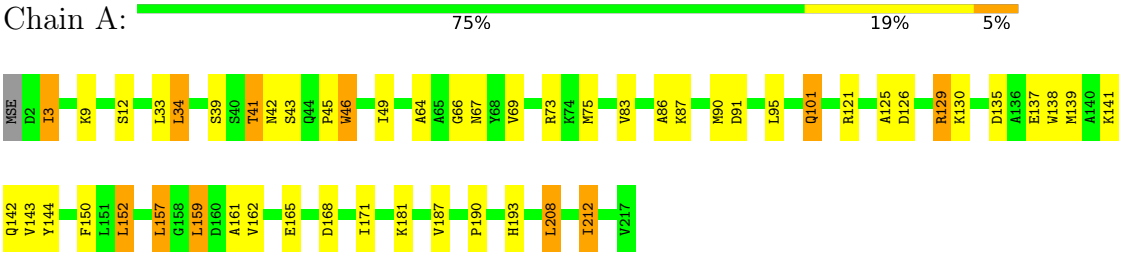
3 Residue-property plots (i)

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. 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. 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.

Note EDS was not executed.

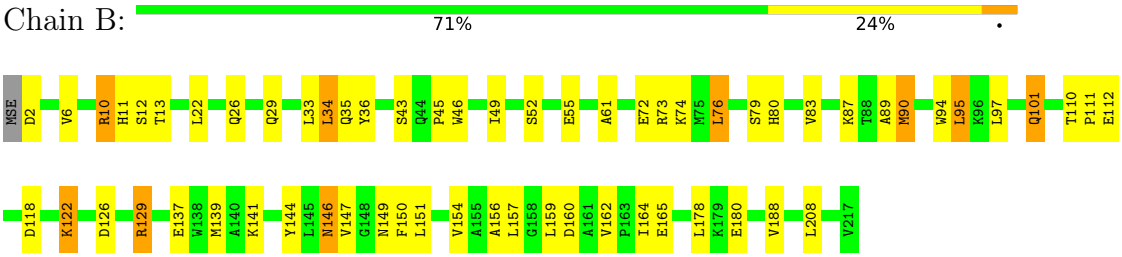
- Molecule 1: OXYGEN-INSENSITIVE NAD(P)H NITROREDUCTASE

Chain A:



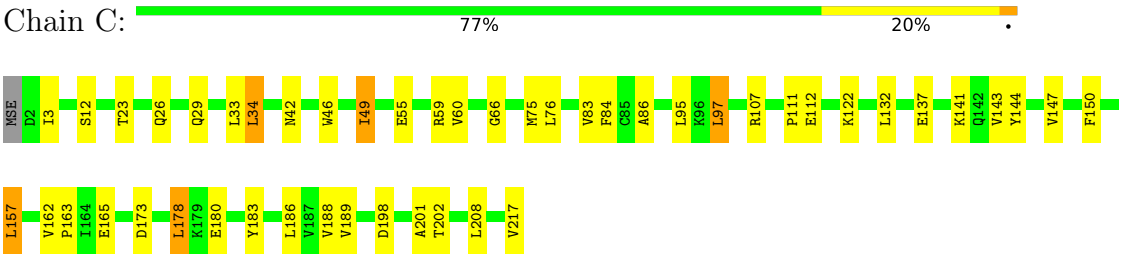
- Molecule 1: OXYGEN-INSENSITIVE NAD(P)H NITROREDUCTASE

Chain B:



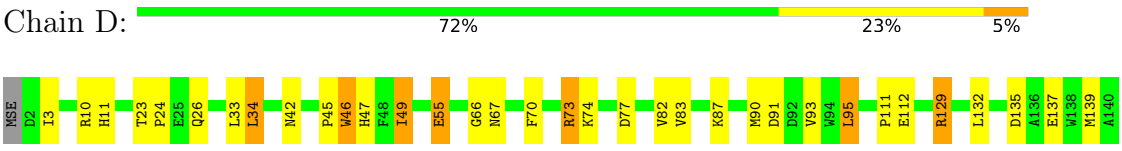
- Molecule 1: OXYGEN-INSENSITIVE NAD(P)H NITROREDUCTASE

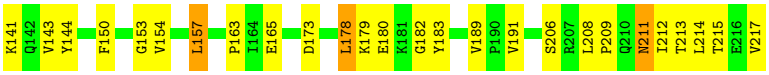
Chain C:



- Molecule 1: OXYGEN-INSENSITIVE NAD(P)H NITROREDUCTASE

Chain D:




K141
Q142
V143
Y144
F150
G153
V154
L157
P163
I164
E165
D173
L178
K179
E180
K181
G182
Y183
V189
P190
V191
S206
R207
L208
P209
Q210
M211
I212
T213
L214
T215
E216
V217

4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	57.74Å 119.57Å 143.61Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	100.00 – 2.40	Depositor
% Data completeness (in resolution range)	(Not available) (100.00-2.40)	Depositor
R_{merge}	0.05	Depositor
R_{sym}	4.90	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.198 , 0.242	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	7511	wwPDB-VP
Average B, all atoms (Å^2)	20.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FMN, NIO

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	0/1708	0.56	0/2306
1	B	0.38	0/1708	0.57	0/2306
1	C	0.36	0/1708	0.58	0/2306
1	D	0.36	0/1708	0.57	0/2306
All	All	0.36	0/6832	0.57	0/9224

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

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	1677	0	1661	53	0
1	B	1677	0	1661	48	0
1	C	1677	0	1661	42	0
1	D	1677	0	1661	55	0
2	A	31	0	18	1	0
2	B	31	0	19	2	0
2	C	31	0	16	3	0
2	D	31	0	16	4	0
3	A	9	0	5	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	9	0	5	0	0
3	C	9	0	5	0	0
3	D	9	0	5	0	0
4	A	164	0	0	5	0
4	B	179	0	0	2	0
4	C	157	0	0	3	0
4	D	143	0	0	4	0
All	All	7511	0	6733	177	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 13.

The worst 5 of 177 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:C:49:ILE:HG23	1:C:83:VAL:HB	1.23	1.15
1:C:75:MSE:HE3	1:C:188:VAL:HG11	1.46	0.97
1:D:49:ILE:CG2	1:D:83:VAL:HB	1.95	0.94
1:C:60:VAL:HG12	1:C:75:MSE:HE1	1.51	0.92
1:C:60:VAL:HG12	1:C:75:MSE:CE	2.05	0.86

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	214/217 (99%)	212 (99%)	2 (1%)	0	100	100
1	B	214/217 (99%)	209 (98%)	5 (2%)	0	100	100
1	C	214/217 (99%)	210 (98%)	3 (1%)	1 (0%)	29	41
1	D	214/217 (99%)	208 (97%)	5 (2%)	1 (0%)	29	41

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	856/868 (99%)	839 (98%)	15 (2%)	2 (0%)	47 62

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	66	GLY
1	D	66	GLY

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	178/174 (102%)	164 (92%)	14 (8%)	12 19
1	B	178/174 (102%)	164 (92%)	14 (8%)	12 19
1	C	178/174 (102%)	165 (93%)	13 (7%)	14 22
1	D	178/174 (102%)	160 (90%)	18 (10%)	7 11
All	All	712/696 (102%)	653 (92%)	59 (8%)	11 17

5 of 59 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	3	ILE
1	D	178	LEU
1	C	132	LEU
1	D	157	LEU
1	D	73	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	35	GLN
1	C	149	ASN
1	D	211	ASN

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Mol	Chain	Res	Type
1	D	29	GLN
1	B	29	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)

8 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	FMN	B	703	-	33,33,33	2.58	16 (48%)	48,50,50	5.83	32 (66%)
2	FMN	C	705	-	33,33,33	2.64	14 (42%)	48,50,50	5.96	35 (72%)
3	NIO	D	706	-	9,9,9	3.09	4 (44%)	11,11,11	1.57	2 (18%)
2	FMN	A	701	-	33,33,33	2.51	14 (42%)	48,50,50	4.37	26 (54%)
3	NIO	A	704	-	9,9,9	3.06	4 (44%)	11,11,11	1.52	2 (18%)
2	FMN	D	707	-	33,33,33	2.53	13 (39%)	48,50,50	7.67	31 (64%)
3	NIO	B	702	-	9,9,9	3.12	4 (44%)	11,11,11	1.51	2 (18%)
3	NIO	C	708	-	9,9,9	3.10	4 (44%)	11,11,11	1.57	2 (18%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral

centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FMN	B	703	-	3/3/4/4	7/18/18/18	0/3/3/3
2	FMN	C	705	-	3/3/4/4	6/18/18/18	0/3/3/3
3	NIO	D	706	-	-	0/4/4/4	0/1/1/1
2	FMN	A	701	-	-	5/18/18/18	0/3/3/3
3	NIO	A	704	-	-	0/4/4/4	0/1/1/1
2	FMN	D	707	-	2/2/4/4	8/18/18/18	0/3/3/3
3	NIO	B	702	-	-	0/4/4/4	0/1/1/1
3	NIO	C	708	-	-	0/4/4/4	0/1/1/1

The worst 5 of 73 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	705	FMN	C9A-C5A	7.53	1.53	1.41
2	B	703	FMN	C9A-C5A	7.46	1.53	1.41
2	D	707	FMN	C9A-C5A	7.13	1.53	1.41
2	A	701	FMN	C9A-C5A	7.02	1.52	1.41
3	C	708	NIO	C3-C2	5.82	1.49	1.39

The worst 5 of 132 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	707	FMN	C4'-C3'-C2'	26.33	168.13	113.36
2	D	707	FMN	C5'-C4'-C3'	20.57	151.94	112.20
2	D	707	FMN	C5A-N5-C4A	17.51	147.19	118.07
2	D	707	FMN	C9A-C5A-N5	-16.79	104.19	122.43
2	B	703	FMN	C5A-N5-C4A	16.33	145.22	118.07

5 of 8 chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	B	703	FMN	C4'
2	B	703	FMN	C2'
2	B	703	FMN	C3'
2	C	705	FMN	C4'
2	C	705	FMN	C2'

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	701	FMN	N10-C1'-C2'-C3'
2	A	701	FMN	O2'-C2'-C3'-O3'
2	A	701	FMN	O2'-C2'-C3'-C4'
2	B	703	FMN	C2'-C1'-N10-C10
2	B	703	FMN	N10-C1'-C2'-C3'

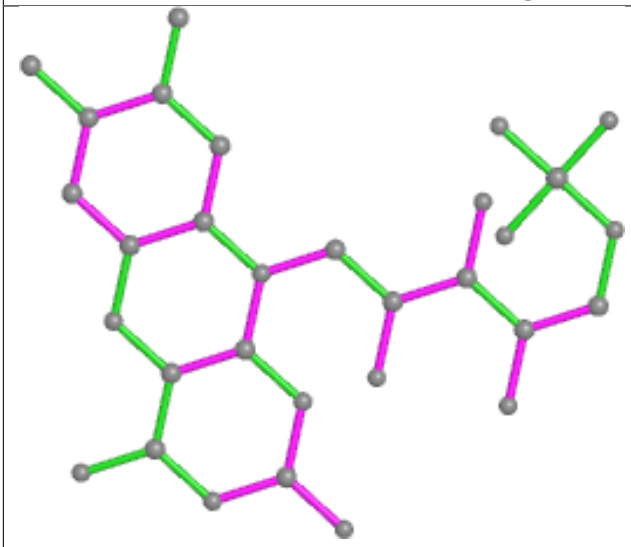
There are no ring outliers.

4 monomers are involved in 10 short contacts:

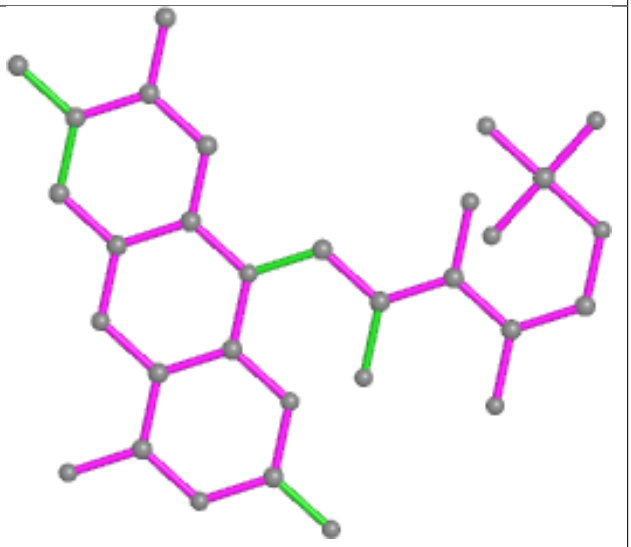
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	703	FMN	2	0
2	C	705	FMN	3	0
2	A	701	FMN	1	0
2	D	707	FMN	4	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

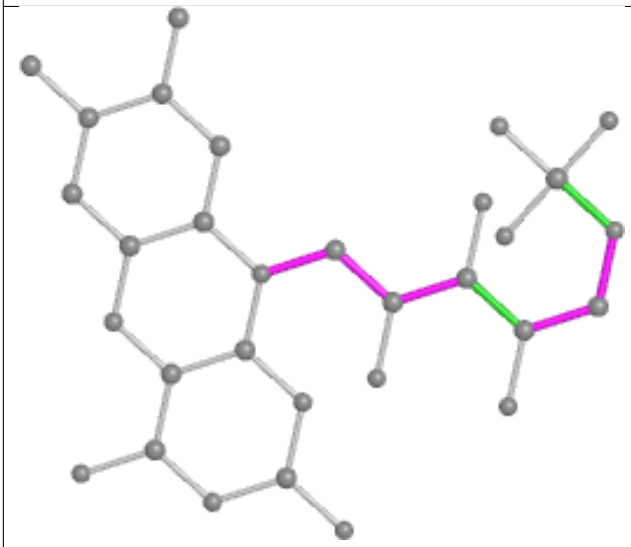
Ligand FMN B 703



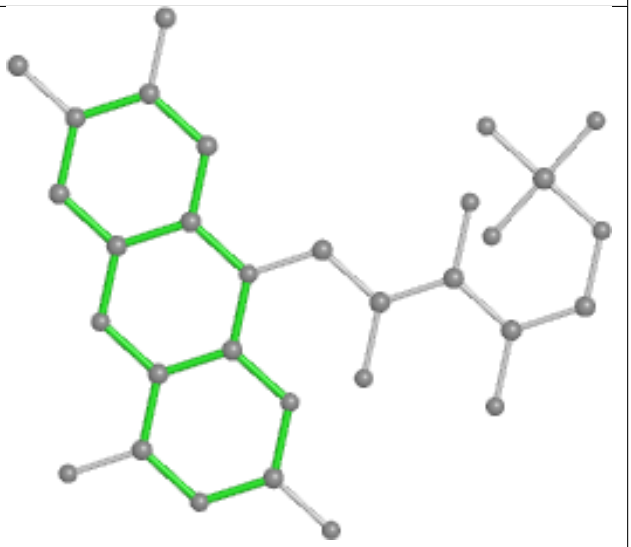
Bond lengths



Bond angles

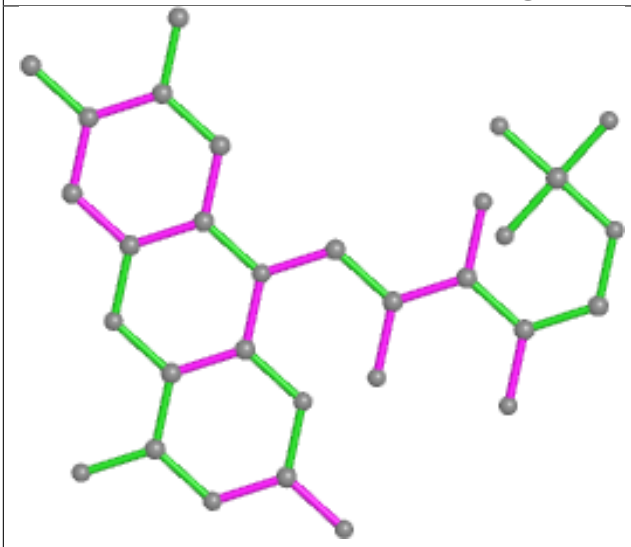


Torsions

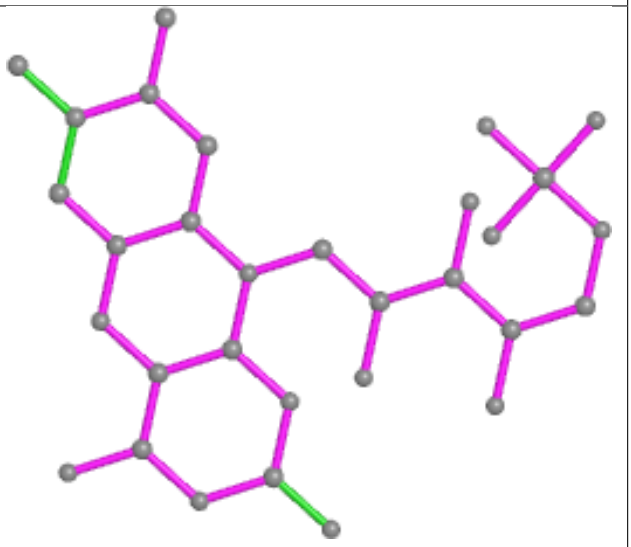


Rings

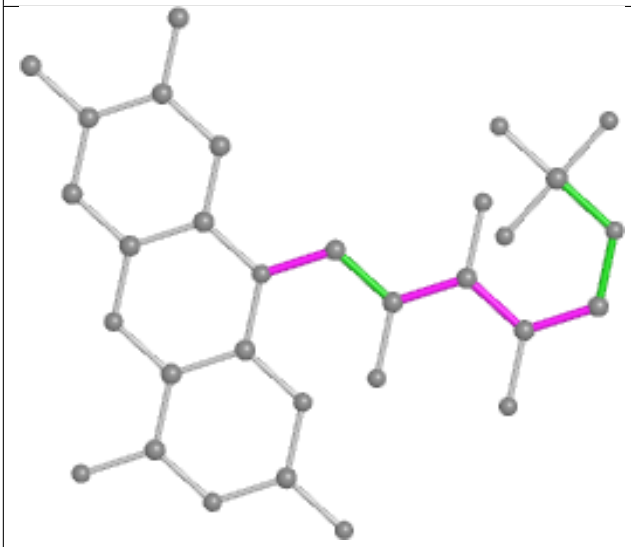
Ligand FMN C 705



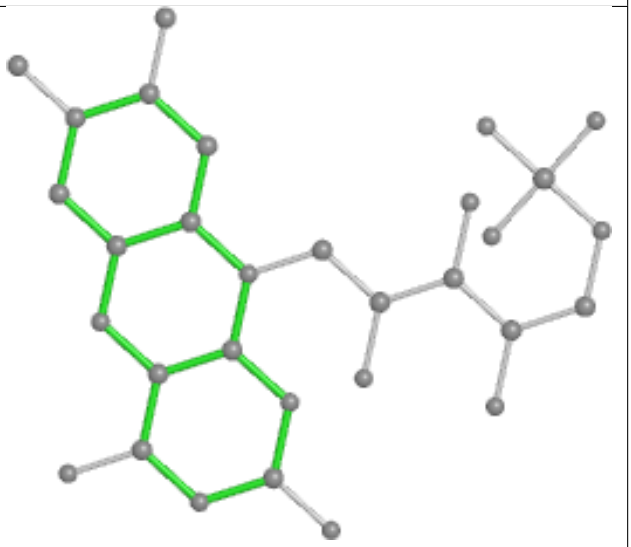
Bond lengths



Bond angles

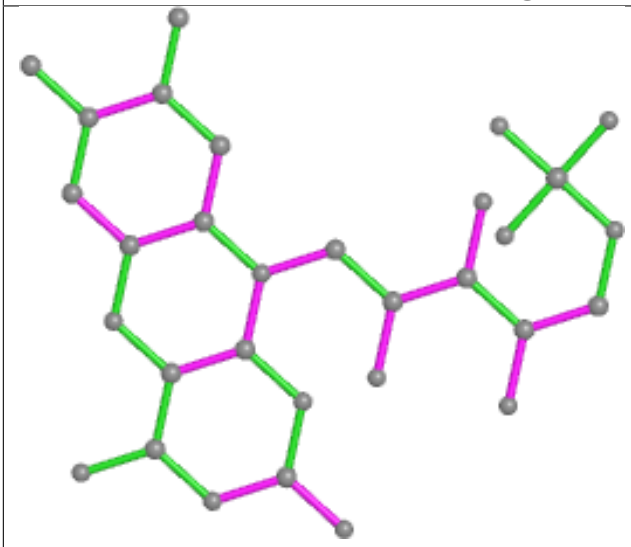


Torsions

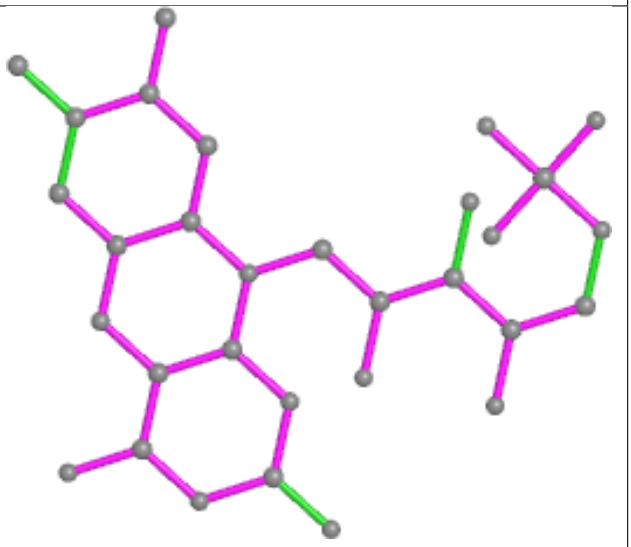


Rings

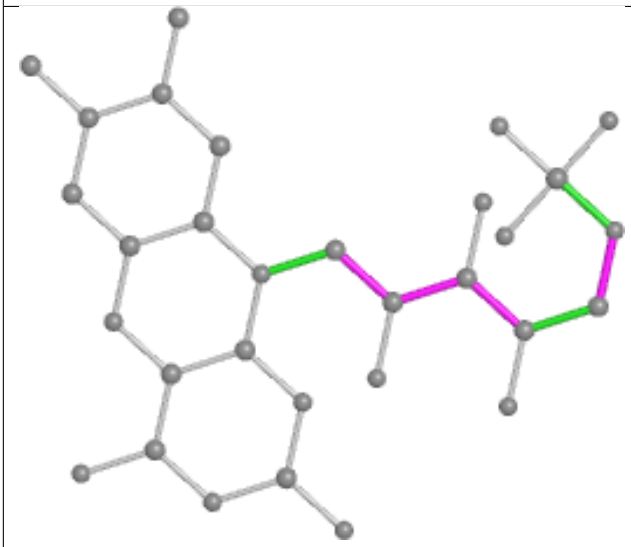
Ligand FMN A 701



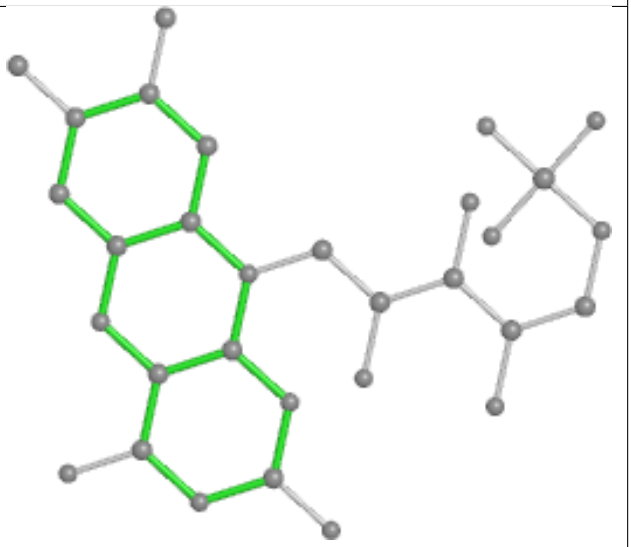
Bond lengths



Bond angles

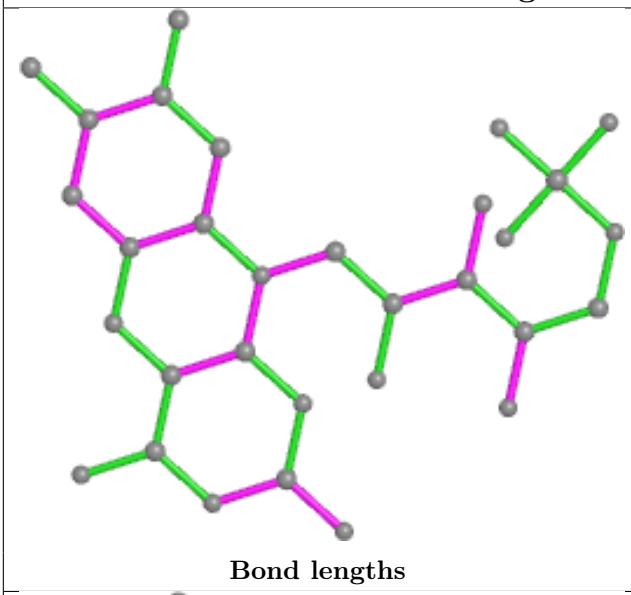


Torsions

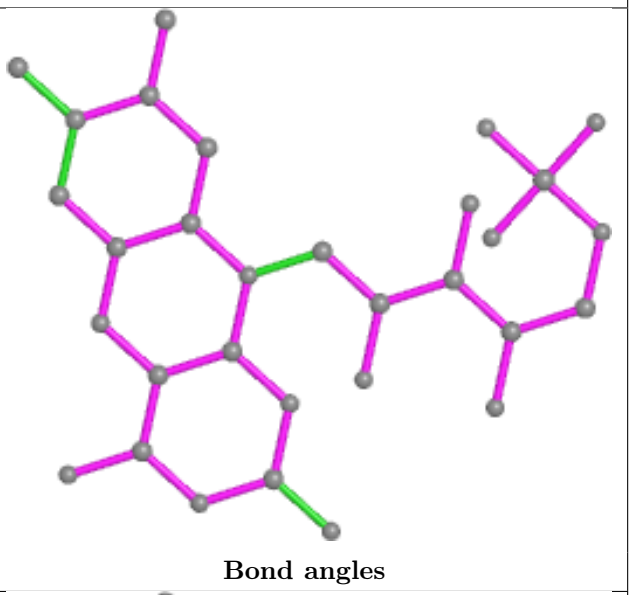


Rings

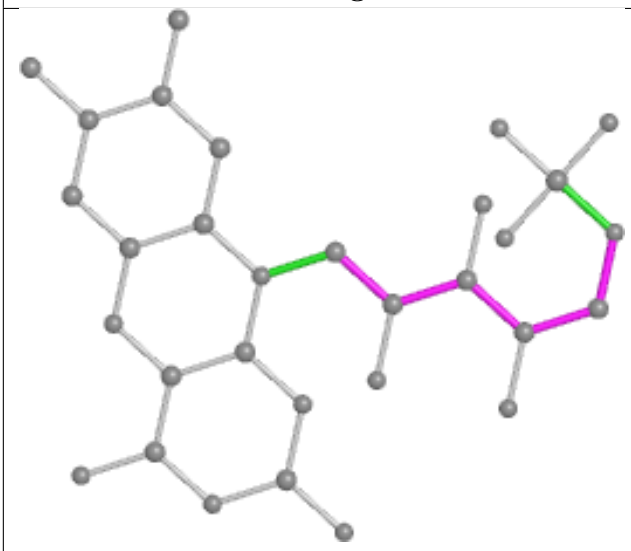
Ligand FMN D 707



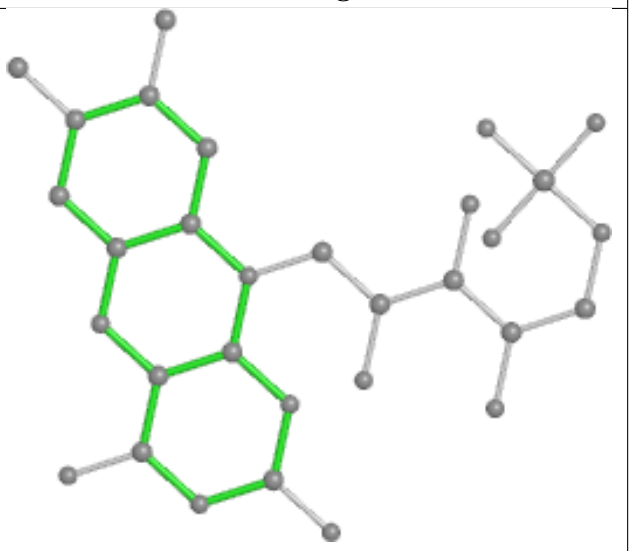
Bond lengths



Bond angles



Torsions



Rings

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

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.