wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 25, 2020 – 03:31 PM BST

PDB ID	:	4CQL
Title	:	Crystal structure of heterotetrameric human ketoacyl reductase complexed with NAD
Authors	:	Venkatesan, R.; Sah-Teli, S.K.; Awoniyi, L.O.; Jiang, G.; Prus, P.; Kastaniotis, A.J.; Hiltunen, J.K.; Wierenga, R.K.; Chen, Z.
Deposited on	:	2014-02-19
Resolution	:	2.85 Å(reported)

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

|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.13
buster-report	:	1.1.7 (2018)
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)	:	2.13

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 2.85 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.
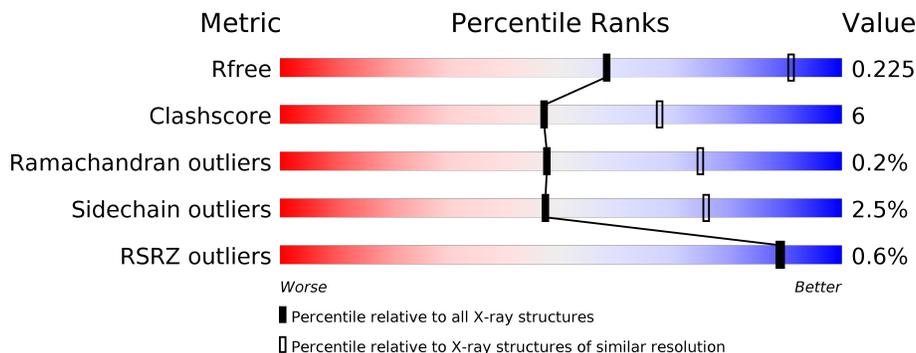
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3168 (2.90-2.82)
Clashscore	141614	3438 (2.90-2.82)
Ramachandran outliers	138981	3348 (2.90-2.82)
Sidechain outliers	138945	3351 (2.90-2.82)
RSRZ outliers	127900	3103 (2.90-2.82)

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	261	82% — 13% — 6%
1	D	261	% / 84% — 10% — 6%
1	E	261	80% — 13% — 7%
1	H	261	82% — 10% — 7%
1	I	261	84% — 12% — •
1	L	261	77% — 14% — • — 8%

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Mol	Chain	Length	Quality of chain
1	M	261	75% 18% 6%
1	P	261	80% 14% 6%
2	B	244	79% 14% 7%
2	C	244	74% 14% 11%
2	F	244	76% 18% 5%
2	G	244	% 70% 16% 13%
2	J	244	% 73% 20% 6%
2	K	244	% 76% 14% 10%
2	N	244	% 77% 16% 6%
2	O	244	2% 74% 17% 8%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 26833 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 ESTRADIOL 17-BETA-DEHYDROGENASE 8.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	246	Total 1756	C 1090	N 313	O 342	S 11	0	0	0
1	D	246	Total 1721	C 1070	N 302	O 339	S 10	0	0	0
1	E	244	Total 1733	C 1075	N 308	O 339	S 11	0	0	0
1	H	242	Total 1710	C 1059	N 306	O 335	S 10	0	0	0
1	I	251	Total 1762	C 1097	N 309	O 345	S 11	0	0	0
1	L	240	Total 1697	C 1053	N 302	O 331	S 11	0	0	0
1	M	245	Total 1755	C 1089	N 315	O 341	S 10	0	0	0
1	P	246	Total 1739	C 1080	N 308	O 341	S 10	0	0	0

- Molecule 2 is a protein called CARBONYL REDUCTASE FAMILY MEMBER 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	227	Total 1593	C 1000	N 293	O 291	S 9	0	0	0
2	C	216	Total 1496	C 942	N 266	O 280	S 8	0	0	0
2	F	231	Total 1623	C 1013	N 297	O 304	S 9	0	0	0
2	G	212	Total 1452	C 905	N 263	O 276	S 8	0	0	0
2	J	229	Total 1609	C 1010	N 292	O 298	S 9	0	0	0
2	K	220	Total 1493	C 934	N 271	O 280	S 8	0	0	0

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	N	229	Total	C	N	O	S	0	0	0
			1616	1014	294	299	9			
2	O	224	Total	C	N	O	S	0	0	0
			1508	946	269	285	8			

There are 56 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-6	MET	-	expression tag	UNP Q8N4T8
B	-5	HIS	-	expression tag	UNP Q8N4T8
B	-4	HIS	-	expression tag	UNP Q8N4T8
B	-3	HIS	-	expression tag	UNP Q8N4T8
B	-2	HIS	-	expression tag	UNP Q8N4T8
B	-1	HIS	-	expression tag	UNP Q8N4T8
B	0	HIS	-	expression tag	UNP Q8N4T8
C	-6	MET	-	expression tag	UNP Q8N4T8
C	-5	HIS	-	expression tag	UNP Q8N4T8
C	-4	HIS	-	expression tag	UNP Q8N4T8
C	-3	HIS	-	expression tag	UNP Q8N4T8
C	-2	HIS	-	expression tag	UNP Q8N4T8
C	-1	HIS	-	expression tag	UNP Q8N4T8
C	0	HIS	-	expression tag	UNP Q8N4T8
F	-6	MET	-	expression tag	UNP Q8N4T8
F	-5	HIS	-	expression tag	UNP Q8N4T8
F	-4	HIS	-	expression tag	UNP Q8N4T8
F	-3	HIS	-	expression tag	UNP Q8N4T8
F	-2	HIS	-	expression tag	UNP Q8N4T8
F	-1	HIS	-	expression tag	UNP Q8N4T8
F	0	HIS	-	expression tag	UNP Q8N4T8
G	-6	MET	-	expression tag	UNP Q8N4T8
G	-5	HIS	-	expression tag	UNP Q8N4T8
G	-4	HIS	-	expression tag	UNP Q8N4T8
G	-3	HIS	-	expression tag	UNP Q8N4T8
G	-2	HIS	-	expression tag	UNP Q8N4T8
G	-1	HIS	-	expression tag	UNP Q8N4T8
G	0	HIS	-	expression tag	UNP Q8N4T8
J	-6	MET	-	expression tag	UNP Q8N4T8
J	-5	HIS	-	expression tag	UNP Q8N4T8
J	-4	HIS	-	expression tag	UNP Q8N4T8
J	-3	HIS	-	expression tag	UNP Q8N4T8
J	-2	HIS	-	expression tag	UNP Q8N4T8
J	-1	HIS	-	expression tag	UNP Q8N4T8

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Chain	Residue	Modelled	Actual	Comment	Reference
J	0	HIS	-	expression tag	UNP Q8N4T8
K	-6	MET	-	expression tag	UNP Q8N4T8
K	-5	HIS	-	expression tag	UNP Q8N4T8
K	-4	HIS	-	expression tag	UNP Q8N4T8
K	-3	HIS	-	expression tag	UNP Q8N4T8
K	-2	HIS	-	expression tag	UNP Q8N4T8
K	-1	HIS	-	expression tag	UNP Q8N4T8
K	0	HIS	-	expression tag	UNP Q8N4T8
N	-6	MET	-	expression tag	UNP Q8N4T8
N	-5	HIS	-	expression tag	UNP Q8N4T8
N	-4	HIS	-	expression tag	UNP Q8N4T8
N	-3	HIS	-	expression tag	UNP Q8N4T8
N	-2	HIS	-	expression tag	UNP Q8N4T8
N	-1	HIS	-	expression tag	UNP Q8N4T8
N	0	HIS	-	expression tag	UNP Q8N4T8
O	-6	MET	-	expression tag	UNP Q8N4T8
O	-5	HIS	-	expression tag	UNP Q8N4T8
O	-4	HIS	-	expression tag	UNP Q8N4T8
O	-3	HIS	-	expression tag	UNP Q8N4T8
O	-2	HIS	-	expression tag	UNP Q8N4T8
O	-1	HIS	-	expression tag	UNP Q8N4T8
O	0	HIS	-	expression tag	UNP Q8N4T8

- Molecule 3 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$).

NAD
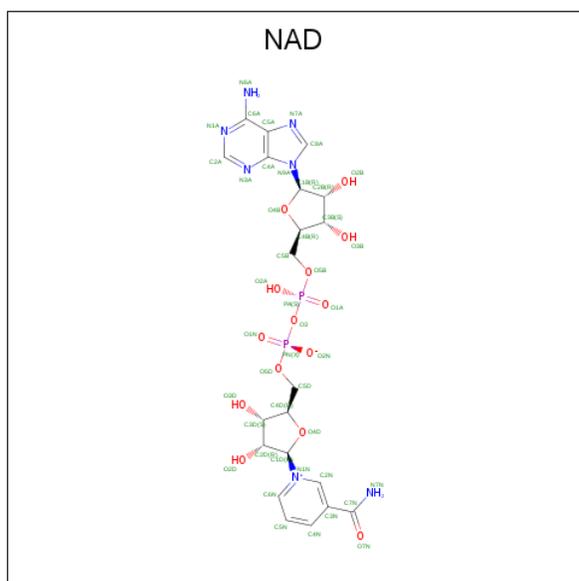
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
3	D	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
3	E	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
3	H	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
3	I	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
3	L	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
3	M	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
3	P	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	24	Total	O	0	0
			24	24		
4	B	7	Total	O	0	0
			7	7		
4	C	10	Total	O	0	0
			10	10		
4	D	4	Total	O	0	0
			4	4		
4	E	25	Total	O	0	0
			25	25		
4	F	8	Total	O	0	0
			8	8		
4	G	4	Total	O	0	0
			4	4		
4	H	9	Total	O	0	0
			9	9		
4	I	14	Total	O	0	0
			14	14		
4	J	8	Total	O	0	0
			8	8		
4	K	7	Total	O	0	0
			7	7		
4	L	20	Total	O	0	0
			20	20		

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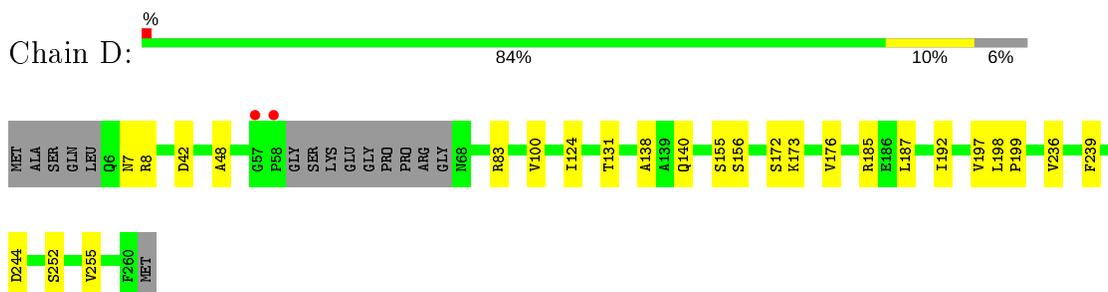| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	M	38	Total 38	O 38	0	0
4	N	24	Total 24	O 24	0	0
4	O	6	Total 6	O 6	0	0
4	P	10	Total 10	O 10	0	0

3 Residue-property plots ⓘ

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: ESTRADIOL 17-BETA-DEHYDROGENASE 8
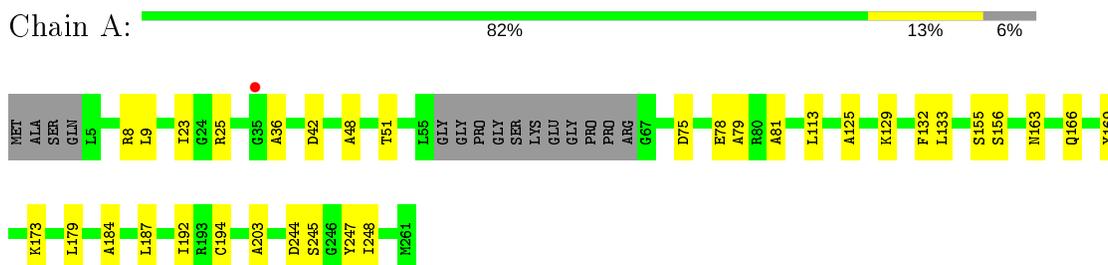
Chain A:

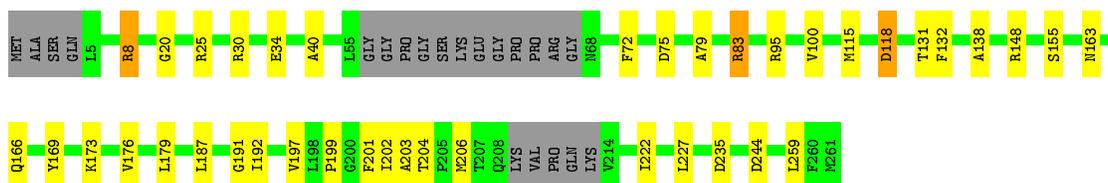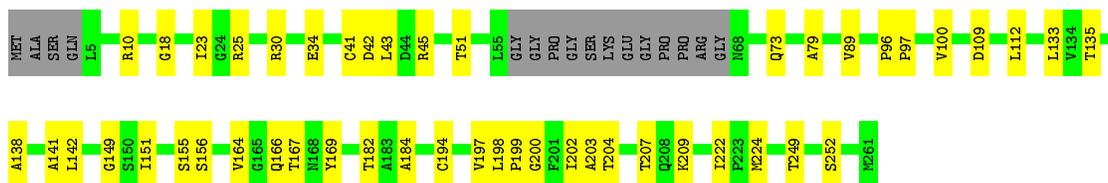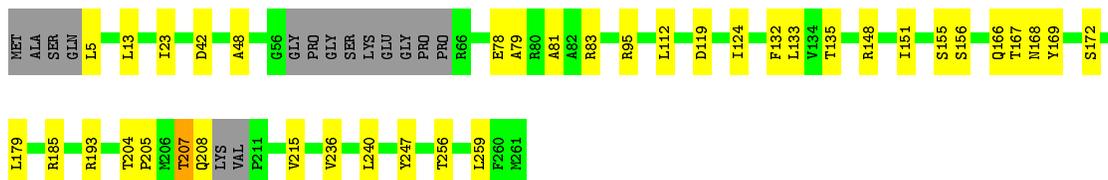- Molecule 1: ESTRADIOL 17-BETA-DEHYDROGENASE 8

Chain D:

- Molecule 1: ESTRADIOL 17-BETA-DEHYDROGENASE 8

Chain E:

- Molecule 1: ESTRADIOL 17-BETA-DEHYDROGENASE 8

Chain H:

L198 P199 I202 P205 MET THR GLN LYS VAL PRO Q212 V253 M261
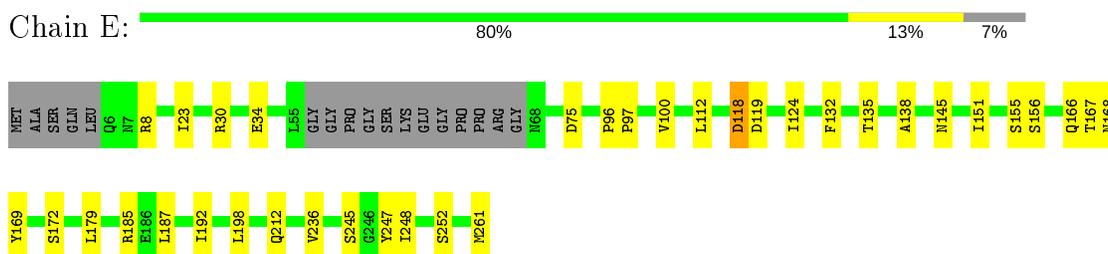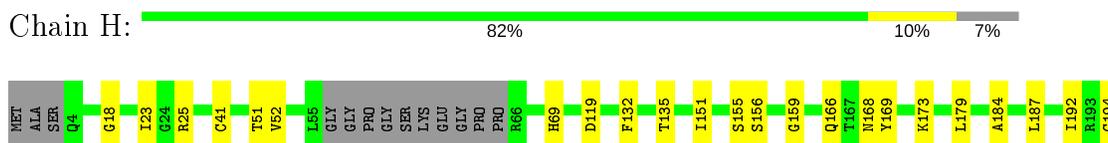
• Molecule 1: ESTRADIOL 17-BETA-DEHYDROGENASE 8

Chain I: 84% 12% ·

MET ALA SER Q4 R8 E34 D42 A48 R53 L54 L55 S60 LYS GLU GLY PRO PRO ARG GLY N68 E78 A81 L112 D119 I124 T135 Q136 I151 S155 Q166 T167 N168 Y169 S172 K173 L187 I192 L198 A203 T204

T207 T219 H226 D229 V236 Y247 T251 M261

• Molecule 1: ESTRADIOL 17-BETA-DEHYDROGENASE 8

Chain L: 77% 14% · 8%

MET ALA SER GLN L5 R8 G20 R25 R30 E34 A40 L55 GLY GLY PRO GLY SER LYS GLU GLY PRO PRO ARG GLY N68 F72 D75 A79 R83 R95 V100 M115 D118 T131 F132 A138 R148 S155 N163

Q166 Y169 K173 V176 L179 L187 G191 I192 V197 L198 P199 G200 F201 I202 A203 T204 P205 M206 T207 Q208 LYS VAL PRO GLN LYS V214 I222 L227 D235 D244 L259 F260 M261

• Molecule 1: ESTRADIOL 17-BETA-DEHYDROGENASE 8

Chain M: 75% 18% 6%

MET ALA SER GLN L5 R10 G18 I23 G24 R25 R30 E34 C41 D42 L43 D44 R45 T51 L55 GLY GLY PRO GLY SER LYS GLU GLY PRO PRO ARG GLY N68 Q73 A79 V89 P96 P97 V100 D109 L112 L133 V134 T135

A138 A141 L142 G149 S150 I151 S155 S156 V164 G165 Q166 T167 N168 Y169 T182 A183 A184 C194 V197 L198 P199 G200 F201 I202 A203 T204 T207 Q208 K209 I222 P223 M224 T249 S252 M261

• Molecule 1: ESTRADIOL 17-BETA-DEHYDROGENASE 8

Chain P: 80% 14% 6%

MET ALA SER GLN L5 L13 I23 D42 A48 G56 GLY PRO GLY SER LYS GLU GLY PRO PRO R66 E78 A79 R80 A81 A82 R83 R95 L112 D119 I124 F132 L133 V134 T135 R148 I151 S155 S156 Q166 T167 N168 Y169 S172

L179 R185 R193 T204 P205 M206 T207 Q208 LYS VAL P211 V215 V236 L240 Y247 T256 L259 F260 M261

• Molecule 2: CARBONYL REDUCTASE FAMILY MEMBER 4

Chain B: 79% 14% 7%

MET HIS HIS HIS HIS H-1 R12 K25 I32 K40 F53 E60 H61 D62 G75 N78 F79 L80 V81 N82 H105 L109 I130 V131 N132 L139 K140 A150 F158 L162 V166 A167 R168 V176 A177 P178 V181 H182 THR ASP MET THR

LYS ASP LEU LYS GLU GLU HIS LEU K195 G204 V213 V226 V229 D230 L233 Q234 L237

• Molecule 2: CARBONYL REDUCTASE FAMILY MEMBER 4

Chain C:

74% 14% 11%

MET HIS HIS HIS HIS HIS MET ASP K3 S11 I14 E37 GLY ALA LYS ALA ALA GLY ASP LEU GLY ASP HIS LEU A52 V57 N78 F79 I80 A83 D89 GLY LEU L92 T97 H105 T106 N107 L108 L109 T114 K140 A150 S151 F158 L162 A163 A167 V173 V176 F180 T183 ASP MET THR K187 D188 L189 K190 E191 K195 P199 R202 F203 V213 V214 F215 I222 D230 G231 G232 L233 Q234 L237
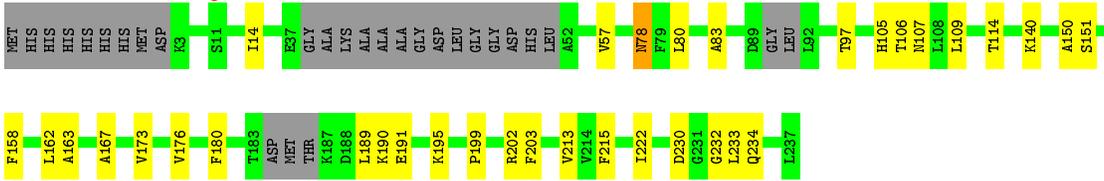
• Molecule 2: CARBONYL REDUCTASE FAMILY MEMBER 4

Chain F:

76% 18% 5%

MET HIS H-4 F8 G9 R12 R16 A19 Q20 L21 M22 L29 A30 V31 I32 L36 A42 D45 LEU GLY GLY D49 S54 C55 E60 E71 L80 N87 ARG ASP GLY L91 Q103 L104 H105 T106 L109 G110 T114 N132 V133 G134 K140 A150 S151 K152 L155 F158 N174 D184 MET THR LYS ASP LEU K190 N197 I198 P199 R202 E208 F215 L216 L217 V228 V229 D230 G231 G232 L233 Q234 L235 I236 L237
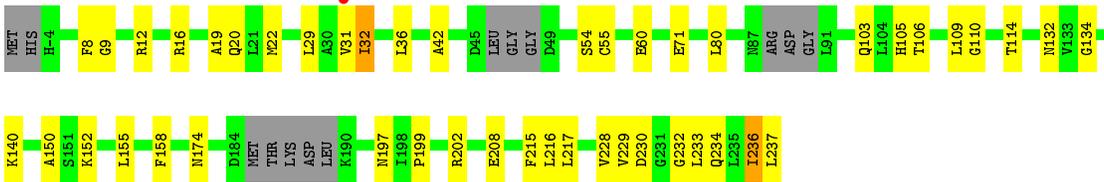
• Molecule 2: CARBONYL REDUCTASE FAMILY MEMBER 4

Chain G:

%

70% 16% 13%

MET HIS HIS HIS HIS HIS MET ASP LYS VAL CYS ALA V7 G13 R16 A23 R24 K25 GLY TYR ARG LEU A30 A33 R34 N35 L36 GLU GLY A39 D45 L46 G47 G48 ASP HIS LEU ALA F53 S54 A58 K59 E60 K72 G75 ARG V77 A84 R94 T97 E98 D99 H105 T106 N107 L108 L109 M119 R120 T121 M122 I123 GLN GLN GLY G128 S129 I130 G134 K140 A150 S151 K152 F158 R168 K169 V173 M174 V175 F180 D184 K187 ASP LEU LYS GLU E192 F203 V209 S219 I222 V226 V229 D230 Q234 L235 I236 L237

• Molecule 2: CARBONYL REDUCTASE FAMILY MEMBER 4

Chain J:

%

73% 20% 6%
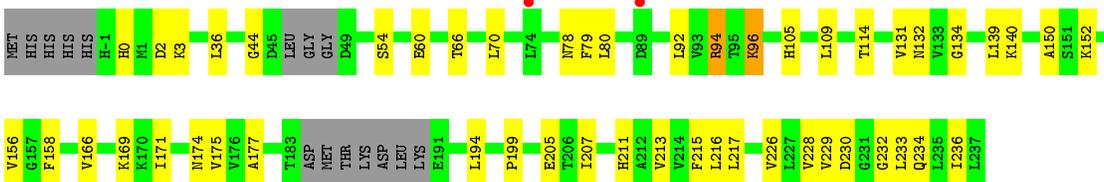
MET HIS HIS HIS H-1 H0 M1 D2 K3 L36 G44 D45 LEU GLY GLY D49 S54 E60 T66 L70 L74 N78 F79 I80 D89 L92 V93 R94 T95 K96 H105 L109 T114 V131 N132 V133 G134 L139 K140 A150 S151 K152 V156 G157 F158 V166 K169 K170 I171 N174 V175 V176 A177 T183 ASP MET THR LYS ASP LYS E191 L194 P199 E205 T206 I207 H211 A212 V213 V214 F215 L216 L217 V226 L227 V228 V229 D230 G231 G232 L233 Q234 L235 I236 L237
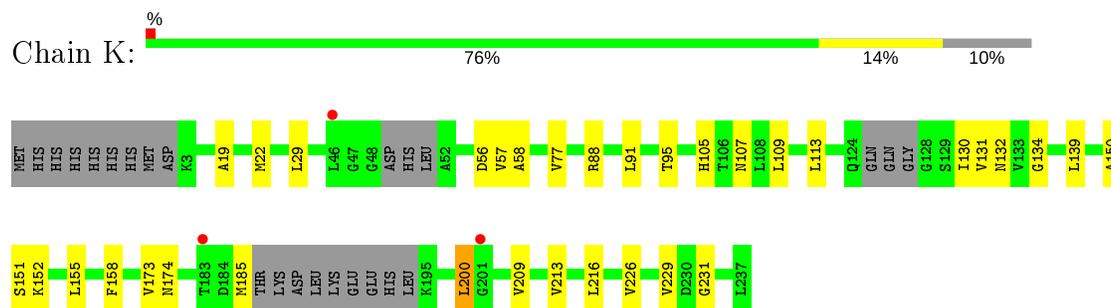
• Molecule 2: CARBONYL REDUCTASE FAMILY MEMBER 4

Chain K:

● Molecule 2: CARBONYL REDUCTASE FAMILY MEMBER 4

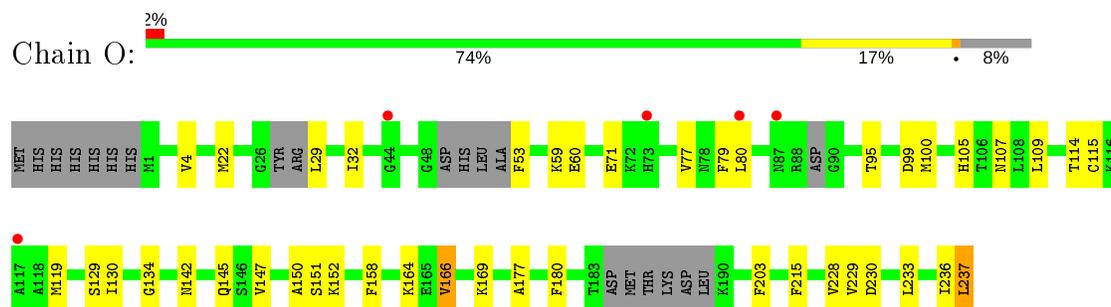Chain N:

● Molecule 2: CARBONYL REDUCTASE FAMILY MEMBER 4

Chain O:
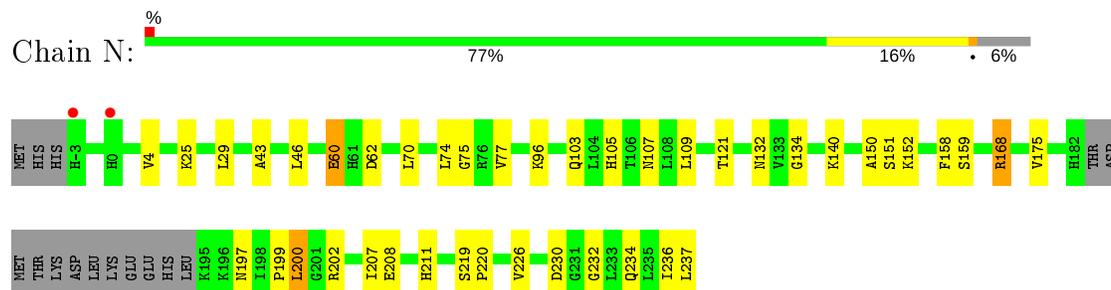
4   Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	87.15Å 237.11Å 87.35Å 90.00° 94.52° 90.00°	Depositor
Resolution (Å)	49.78 – 2.85 49.78 – 2.85	Depositor EDS
% Data completeness (in resolution range)	91.7 (49.78-2.85) 87.2 (49.78-2.85)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	1.85 (at 2.86Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, R_{free}	0.183 , 0.236 0.182 , 0.225	Depositor DCC
R_{free} test set	3673 reflections (4.88%)	wwPDB-VP
Wilson B-factor (Å^2)	38.9	Xtriage
Anisotropy	0.696	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 33.3	EDS
L-test for twinning[2]	$<|L|> = 0.43, <L^2> = 0.26$	Xtriage
Estimated twinning fraction	0.308 for l,-k,h	Xtriage
Reported twinning fraction	0.320 for L,-K,H	Depositor
Outliers	0 of 75315 reflections	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	26833	wwPDB-VP
Average B, all atoms (Å^2)	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.22% 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: NAD

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	0.20	0/1776	0.36	0/2412
1	D	0.20	0/1742	0.35	0/2373
1	E	0.20	0/1753	0.36	0/2383
1	H	0.19	0/1728	0.35	0/2346
1	I	0.20	0/1783	0.37	0/2427
1	L	0.20	0/1715	0.36	0/2330
1	M	0.20	0/1775	0.36	0/2412
1	P	0.20	0/1758	0.37	0/2387
2	B	0.20	0/1614	0.35	0/2183
2	C	0.20	0/1511	0.34	0/2045
2	F	0.20	0/1639	0.35	0/2216
2	G	0.20	0/1461	0.35	0/1971
2	J	0.20	0/1626	0.36	0/2198
2	K	0.20	0/1507	0.36	0/2040
2	N	0.20	0/1633	0.35	0/2207
2	O	0.20	0/1520	0.34	0/2057
All	All	0.20	0/26541	0.35	0/35987

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	1756	0	1741	21	0
1	D	1721	0	1673	16	0
1	E	1733	0	1707	22	0
1	H	1710	0	1669	15	0
1	I	1762	0	1721	20	0
1	L	1697	0	1662	23	0
1	M	1755	0	1739	29	0
1	P	1739	0	1706	20	0
2	B	1593	0	1549	22	0
2	C	1496	0	1427	22	0
2	F	1623	0	1562	28	0
2	G	1452	0	1375	21	0
2	J	1609	0	1568	32	0
2	K	1493	0	1410	18	0
2	N	1616	0	1591	25	0
2	O	1508	0	1429	23	0
3	A	44	0	26	3	0
3	D	44	0	26	0	0
3	E	44	0	26	3	0
3	H	44	0	26	2	0
3	I	44	0	26	1	0
3	L	44	0	26	3	0
3	M	44	0	26	4	0
3	P	44	0	26	1	0
4	A	24	0	0	0	0
4	B	7	0	0	0	0
4	C	10	0	0	0	0
4	D	4	0	0	0	0
4	E	25	0	0	0	0
4	F	8	0	0	0	0
4	G	4	0	0	0	0
4	H	9	0	0	0	0
4	I	14	0	0	0	0
4	J	8	0	0	0	0
4	K	7	0	0	0	0
4	L	20	0	0	1	0
4	M	38	0	0	0	0
4	N	24	0	0	0	0
4	O	6	0	0	0	0
4	P	10	0	0	0	0
All	All	26833	0	25737	325	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 6.

The worst 5 of 325 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)
2:J:158:PHE:HB2	2:K:150:ALA:HB2	1.65	0.77
2:B:158:PHE:HB2	2:C:150:ALA:HB2	1.69	0.72
1:P:132:PHE:HB2	1:P:179:LEU:HD11	1.73	0.71
2:G:130:ILE:HB	2:G:173:VAL:HG12	1.73	0.71
1:L:187:LEU:HB3	1:L:192:ILE:HB	1.73	0.70

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	242/261 (93%)	228 (94%)	13 (5%)	1 (0%)	34	62
1	D	242/261 (93%)	232 (96%)	10 (4%)	0	100	100
1	E	240/261 (92%)	232 (97%)	8 (3%)	0	100	100
1	H	236/261 (90%)	224 (95%)	12 (5%)	0	100	100
1	I	247/261 (95%)	233 (94%)	13 (5%)	1 (0%)	34	62
1	L	234/261 (90%)	224 (96%)	9 (4%)	1 (0%)	34	62
1	M	241/261 (92%)	230 (95%)	10 (4%)	1 (0%)	34	62
1	P	240/261 (92%)	225 (94%)	14 (6%)	1 (0%)	34	62
2	B	223/244 (91%)	215 (96%)	8 (4%)	0	100	100
2	C	208/244 (85%)	197 (95%)	11 (5%)	0	100	100
2	F	223/244 (91%)	208 (93%)	15 (7%)	0	100	100
2	G	198/244 (81%)	181 (91%)	17 (9%)	0	100	100
2	J	223/244 (91%)	211 (95%)	12 (5%)	0	100	100
2	K	212/244 (87%)	200 (94%)	11 (5%)	1 (0%)	29	57

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	N	225/244 (92%)	215 (96%)	10 (4%)	0	100	100
2	O	214/244 (88%)	207 (97%)	7 (3%)	0	100	100
All	All	3648/4040 (90%)	3462 (95%)	180 (5%)	6 (0%)	47	75

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	203	ALA
1	M	203	ALA
1	P	205	PRO
2	K	57	VAL
1	L	203	ALA

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	179/198 (90%)	179 (100%)	0	100	100
1	D	171/198 (86%)	169 (99%)	2 (1%)	71	89
1	E	176/198 (89%)	173 (98%)	3 (2%)	60	83
1	H	170/198 (86%)	170 (100%)	0	100	100
1	I	175/198 (88%)	173 (99%)	2 (1%)	73	90
1	L	170/198 (86%)	166 (98%)	4 (2%)	49	77
1	M	179/198 (90%)	176 (98%)	3 (2%)	60	83
1	P	174/198 (88%)	169 (97%)	5 (3%)	42	72
2	B	151/193 (78%)	148 (98%)	3 (2%)	55	80
2	C	140/193 (72%)	138 (99%)	2 (1%)	67	86
2	F	154/193 (80%)	148 (96%)	6 (4%)	32	63
2	G	134/193 (69%)	126 (94%)	8 (6%)	19	45
2	J	153/193 (79%)	147 (96%)	6 (4%)	32	63
2	K	134/193 (69%)	129 (96%)	5 (4%)	34	65

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	N	155/193 (80%)	146 (94%)	9 (6%)	20	46
2	O	136/193 (70%)	130 (96%)	6 (4%)	28	58
All	All	2551/3128 (82%)	2487 (98%)	64 (2%)	47	76

5 of 64 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	J	94	ARG
2	K	185	MET
1	P	5	LEU
2	J	96	LYS
2	K	77	VAL

Some 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)

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
3	NAD	A	301	-	42,48,48	0.80	1 (2%)	50,73,73	1.23	5 (10%)
3	NAD	E	301	-	42,48,48	0.82	1 (2%)	50,73,73	1.20	5 (10%)
3	NAD	H	301	-	42,48,48	0.82	1 (2%)	50,73,73	1.24	5 (10%)
3	NAD	L	301	-	42,48,48	0.82	1 (2%)	50,73,73	1.23	5 (10%)
3	NAD	D	301	-	42,48,48	0.80	1 (2%)	50,73,73	1.21	5 (10%)
3	NAD	I	301	-	42,48,48	0.85	2 (4%)	50,73,73	1.24	5 (10%)
3	NAD	M	301	-	42,48,48	0.81	1 (2%)	50,73,73	1.22	5 (10%)
3	NAD	P	301	-	42,48,48	0.81	1 (2%)	50,73,73	1.21	5 (10%)

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
3	NAD	A	301	-	-	9/26/62/62	0/5/5/5
3	NAD	E	301	-	-	9/26/62/62	0/5/5/5
3	NAD	H	301	-	-	8/26/62/62	0/5/5/5
3	NAD	L	301	-	-	11/26/62/62	0/5/5/5
3	NAD	D	301	-	-	11/26/62/62	0/5/5/5
3	NAD	I	301	-	-	13/26/62/62	0/5/5/5
3	NAD	M	301	-	-	14/26/62/62	0/5/5/5
3	NAD	P	301	-	-	12/26/62/62	0/5/5/5

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	301	NAD	C5A-C4A	2.52	1.47	1.40
3	H	301	NAD	C5A-C4A	2.51	1.47	1.40
3	M	301	NAD	C5A-C4A	2.51	1.47	1.40
3	E	301	NAD	C5A-C4A	2.49	1.47	1.40
3	L	301	NAD	C5A-C4A	2.49	1.47	1.40

The worst 5 of 40 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	P	301	NAD	PN-O3-PA	-3.46	120.94	132.83
3	I	301	NAD	PN-O3-PA	-3.46	120.96	132.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	H	301	NAD	PN-O3-PA	-3.43	121.05	132.83
3	L	301	NAD	PN-O3-PA	-3.39	121.19	132.83
3	A	301	NAD	PN-O3-PA	-3.39	121.20	132.83

There are no chirality outliers.

5 of 87 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	301	NAD	C5B-O5B-PA-O1A
3	A	301	NAD	O4B-C4B-C5B-O5B
3	A	301	NAD	C3B-C4B-C5B-O5B
3	A	301	NAD	C5D-O5D-PN-O3
3	E	301	NAD	C5B-O5B-PA-O2A

There are no ring outliers.

7 monomers are involved in 17 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	301	NAD	3	0
3	E	301	NAD	3	0
3	H	301	NAD	2	0
3	L	301	NAD	3	0
3	I	301	NAD	1	0
3	M	301	NAD	4	0
3	P	301	NAD	1	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 NAD A 301

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD E 301

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD H 301

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD L 301

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD D 301

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD I 301

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD M 301

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD P 301

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 ⓘ

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	246/261 (94%)	-0.41	1 (0%)	92	92	24, 49, 80, 123	0
1	D	246/261 (94%)	-0.41	2 (0%)	86	85	26, 49, 79, 137	0
1	E	244/261 (93%)	-0.51	0	100	100	23, 45, 70, 120	0
1	H	242/261 (92%)	-0.35	0	100	100	32, 55, 86, 123	0
1	I	251/261 (96%)	-0.44	0	100	100	28, 47, 85, 158	0
1	L	240/261 (91%)	-0.41	0	100	100	28, 49, 88, 156	0
1	M	245/261 (93%)	-0.54	0	100	100	22, 43, 67, 94	0
1	P	246/261 (94%)	-0.41	0	100	100	25, 53, 89, 128	0
2	B	227/244 (93%)	-0.35	1 (0%)	92	92	22, 53, 89, 114	0
2	C	216/244 (88%)	-0.26	1 (0%)	91	90	29, 55, 101, 145	0
2	F	231/244 (94%)	-0.28	1 (0%)	92	92	29, 54, 94, 180	0
2	G	212/244 (86%)	-0.16	3 (1%)	75	74	35, 62, 100, 153	0
2	J	229/244 (93%)	-0.32	2 (0%)	84	84	27, 55, 96, 136	0
2	K	220/244 (90%)	-0.15	3 (1%)	75	74	32, 59, 99, 138	0
2	N	229/244 (93%)	-0.37	2 (0%)	84	84	28, 51, 87, 141	0
2	O	224/244 (91%)	-0.10	5 (2%)	62	59	32, 65, 95, 138	0
All	All	3748/4040 (92%)	-0.35	21 (0%)	89	89	22, 52, 91, 180	0

The worst 5 of 21 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	K	183	THR	4.8
2	N	0	HIS	4.3
2	F	31	VAL	4.0
1	D	58	PRO	3.9
2	J	89	ASP	3.6

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)

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.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	NAD	L	301	44/44	0.84	0.25	76,100,128,220	0
3	NAD	H	301	44/44	0.89	0.22	45,73,108,151	0
3	NAD	P	301	44/44	0.92	0.20	42,74,93,113	0
3	NAD	I	301	44/44	0.95	0.13	7,42,61,87	0
3	NAD	D	301	44/44	0.95	0.14	19,49,82,93	0
3	NAD	M	301	44/44	0.96	0.14	1,45,58,69	0
3	NAD	A	301	44/44	0.96	0.16	29,57,80,99	0
3	NAD	E	301	44/44	0.97	0.14	5,39,58,68	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.
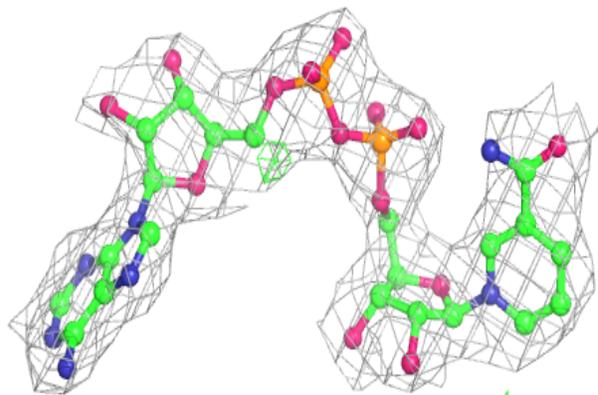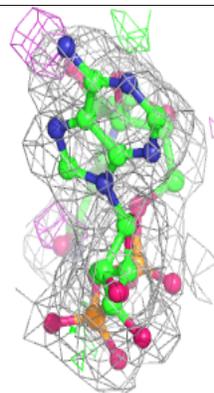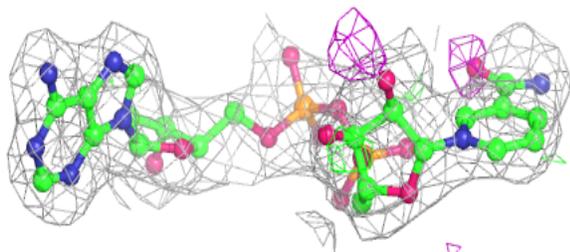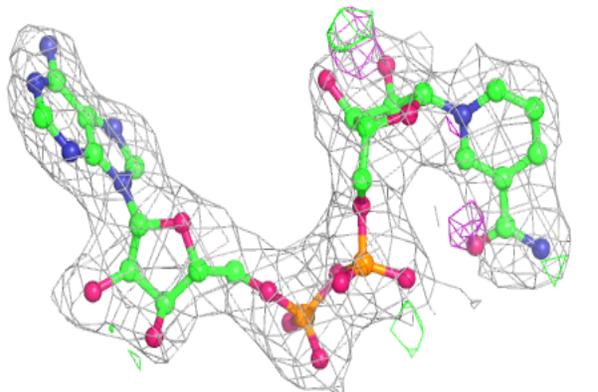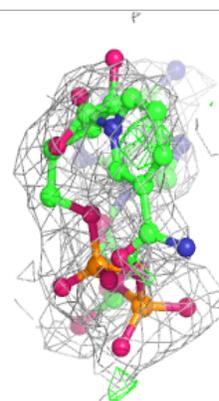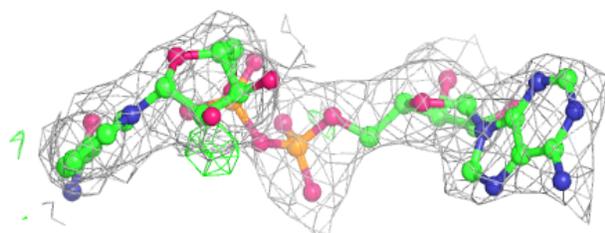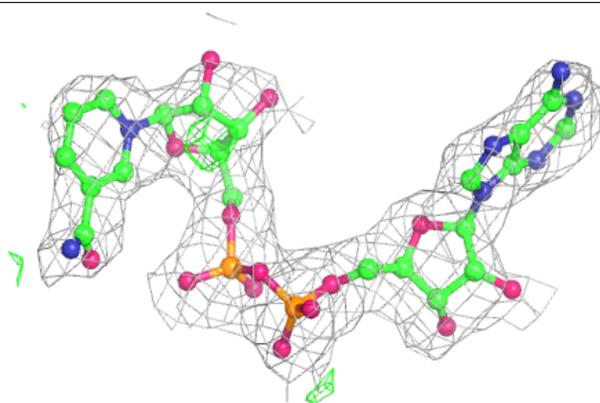
Electron density around NAD L 301:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around NAD H 301:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
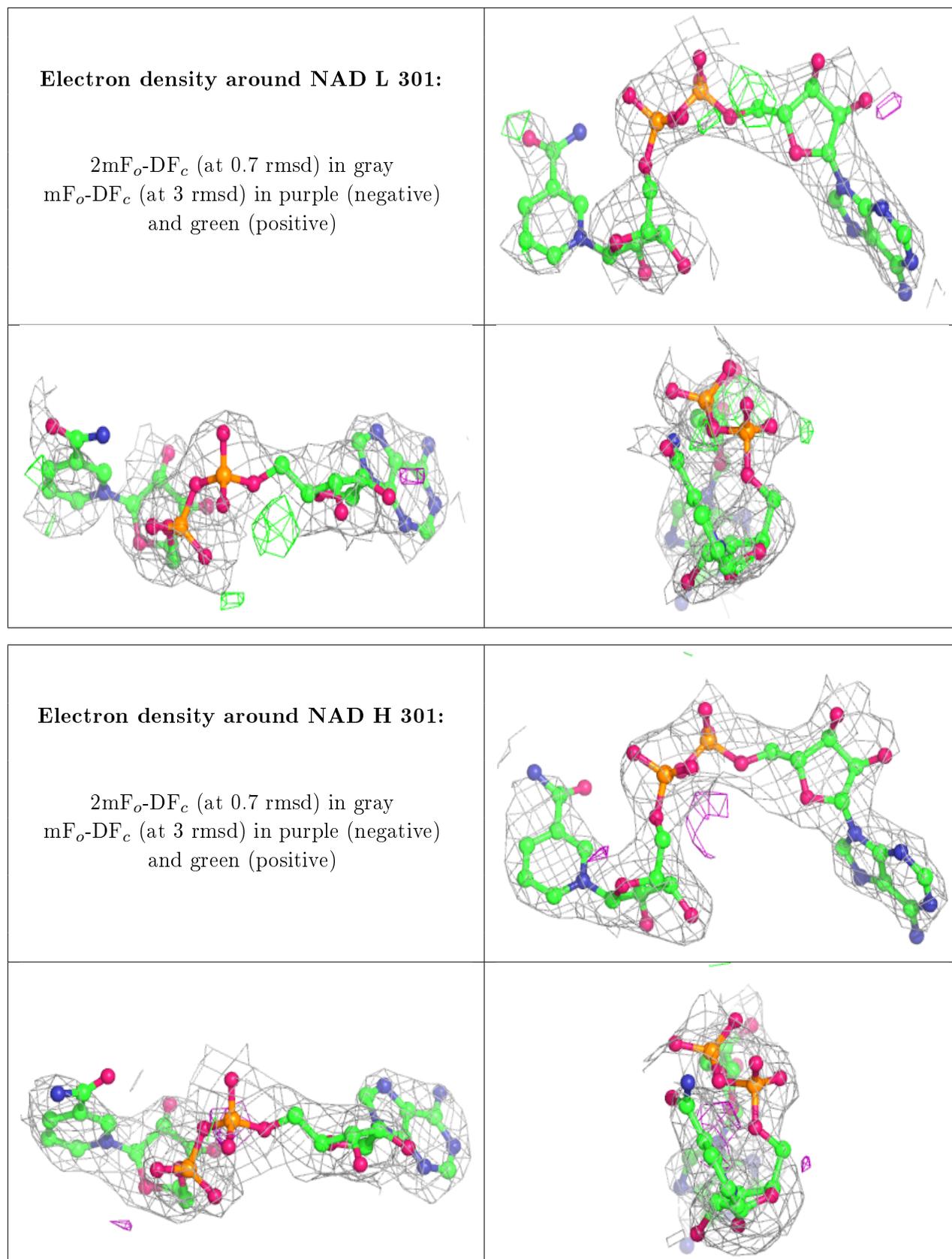
Electron density around NAD P 301:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
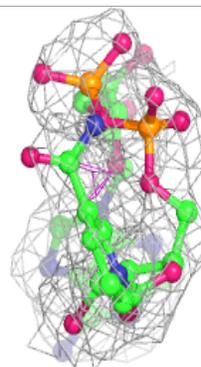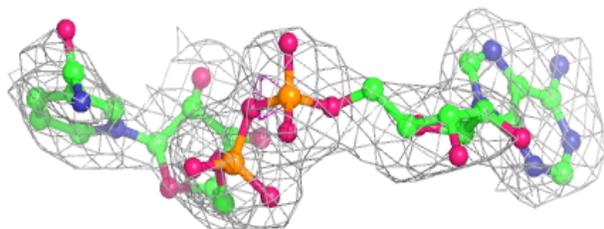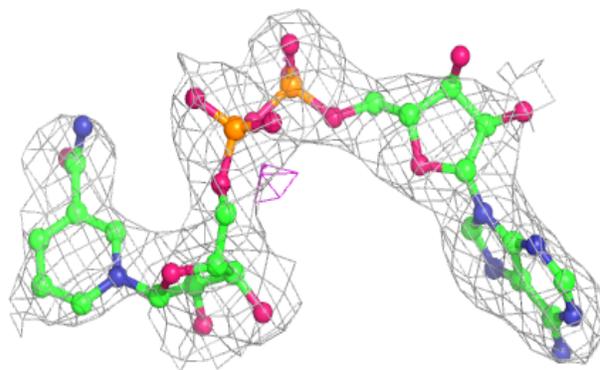
Electron density around NAD I 301:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
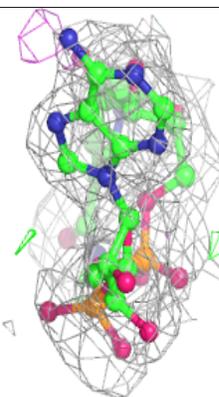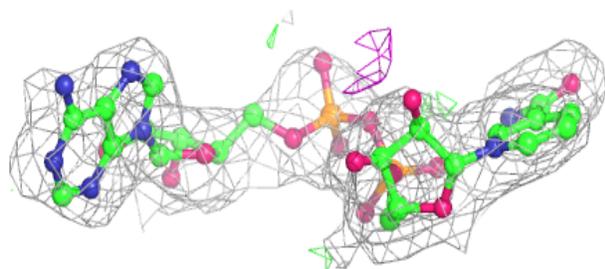$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
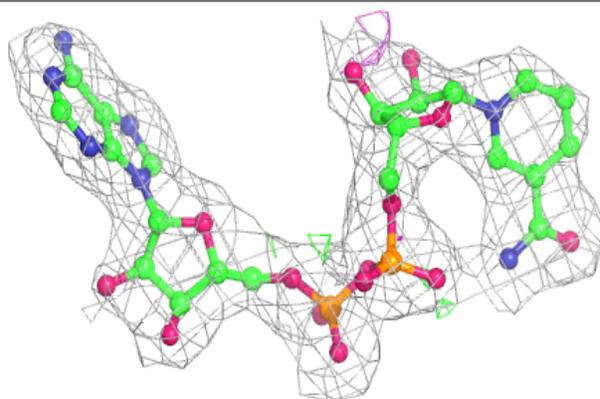and green (positive)
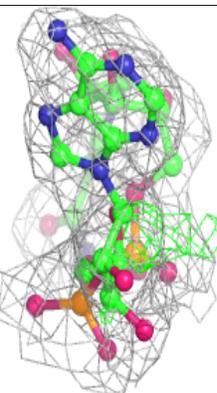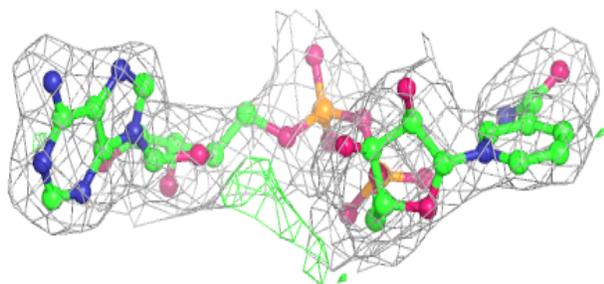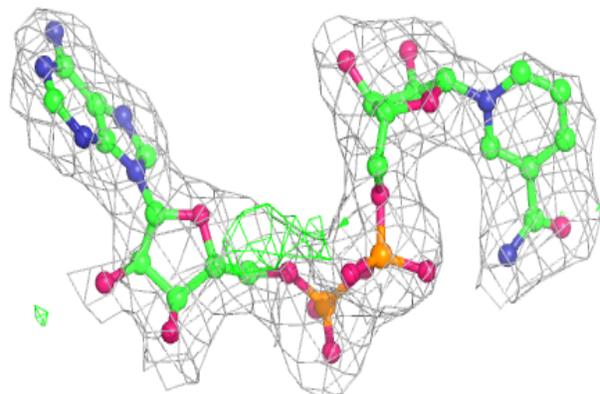
Electron density around NAD D 301:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
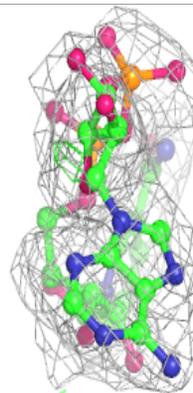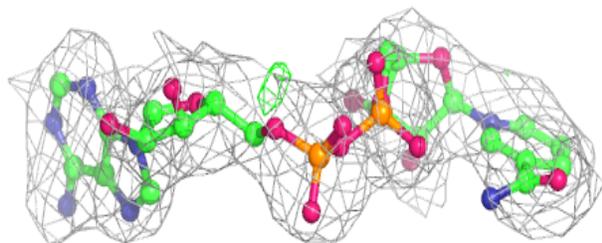
Electron density around NAD M 301:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around NAD A 301:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around NAD E 301:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

6.5 Other polymers (i)

There are no such residues in this entry.