



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:01 PM UTC

PDB ID : 1DBV / pdb_00001dbv
Title : GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE MUTANT
WITH ASP 32 REPLACED BY GLY, LEU 187 REPLACED BY ALA, AND
PRO 188 REPLACED BY SER COMPLEXED WITH NAD+
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Aubry, A.
Deposited on : 1996-12-20
Resolution : 2.50 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 ⓘ 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtrriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

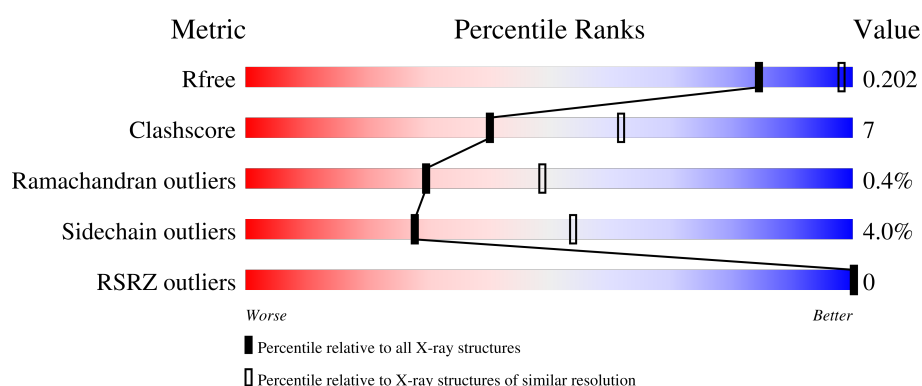
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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 $\leq 5\%$. 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	O	334	81% 17% .
1	P	334	81% 17% .
1	Q	334	80% 19% .
1	R	334	79% 19% .

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 10668 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 GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	O	334	Total	C	N	O	S	0	0	0
			2517	1575	445	488	9			
1	P	334	Total	C	N	O	S	0	0	0
			2517	1575	445	488	9			
1	Q	334	Total	C	N	O	S	0	0	0
			2517	1575	445	488	9			
1	R	334	Total	C	N	O	S	0	0	0
			2517	1575	445	488	9			

There are 12 discrepancies between the modelled and reference sequences:

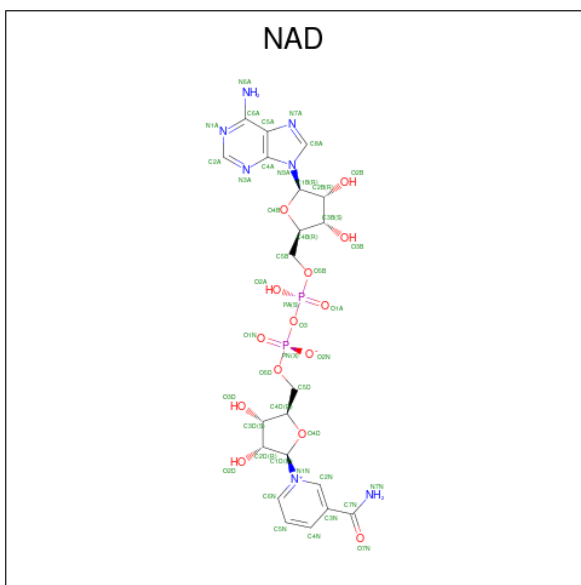
Chain	Residue	Modelled	Actual	Comment	Reference
O	32	GLY	ASP	engineered mutation	UNP P00362
O	187	ALA	LEU	engineered mutation	UNP P00362
O	188	SER	PRO	engineered mutation	UNP P00362
P	32	GLY	ASP	engineered mutation	UNP P00362
P	187	ALA	LEU	engineered mutation	UNP P00362
P	188	SER	PRO	engineered mutation	UNP P00362
Q	32	GLY	ASP	engineered mutation	UNP P00362
Q	187	ALA	LEU	engineered mutation	UNP P00362
Q	188	SER	PRO	engineered mutation	UNP P00362
R	32	GLY	ASP	engineered mutation	UNP P00362
R	187	ALA	LEU	engineered mutation	UNP P00362
R	188	SER	PRO	engineered mutation	UNP P00362

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	O	1	Total	O	S	0	0
			5	4	1		
2	O	1	Total	O	S	0	0
			5	4	1		
2	P	1	Total	O	S	0	0
			5	4	1		
2	P	1	Total	O	S	0	0
			5	4	1		
2	Q	1	Total	O	S	0	0
			5	4	1		
2	Q	1	Total	O	S	0	0
			5	4	1		
2	R	1	Total	O	S	0	0
			5	4	1		
2	R	1	Total	O	S	0	0
			5	4	1		

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



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	O	1	Total 44	C 21	N 7	O 14	P 2	0	0
3	P	1	Total 44	C 21	N 7	O 14	P 2	0	0
3	Q	1	Total 44	C 21	N 7	O 14	P 2	0	0
3	R	1	Total 44	C 21	N 7	O 14	P 2	0	0

- Molecule 4 is water.

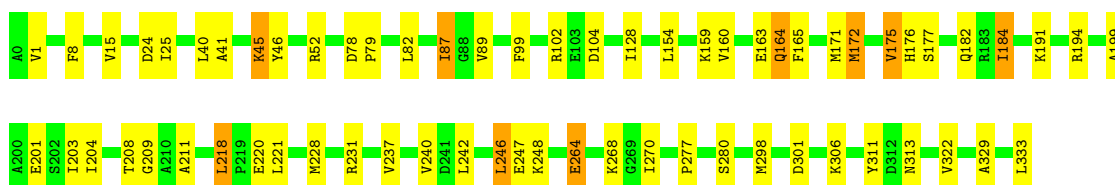
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	O	101	Total O 101 101	0	0
4	P	91	Total O 91 91	0	0
4	Q	102	Total O 102 102	0	0
4	R	90	Total O 90 90	0	0

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.

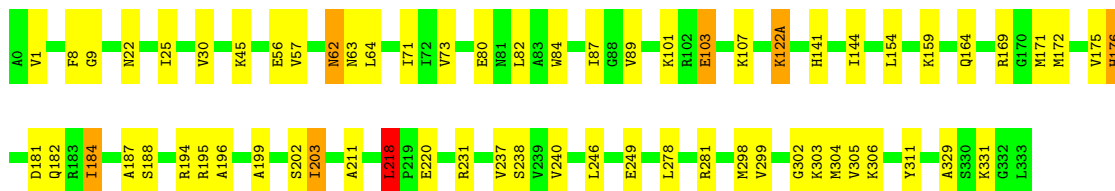
• Molecule 1: GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE

Chain O: 



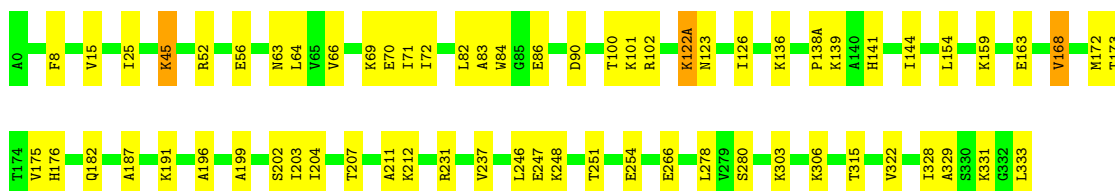
• Molecule 1: GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE

Chain P: 



• Molecule 1: GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE

Chain Q: 



• Molecule 1: GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE

Chain R: 





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	82.95Å 124.68Å 82.87Å 90.00° 108.63° 90.00°	Depositor
Resolution (Å)	8.00 – 2.50 8.00 – 2.50	Depositor EDS
% Data completeness (in resolution range)	80.6 (8.00-2.50) 83.3 (8.00-2.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.57 (at 2.30Å)	Xtriage
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.140 , 0.214 0.138 , 0.202	Depositor DCC
R_{free} test set	5939 reflections (10.19%)	wwPDB-VP
Wilson B-factor (Å ²)	25.9	Xtriage
Anisotropy	0.276	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 26.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.239 for l,-k,h	Xtriage
F_o, F_c correlation	0.99	EDS
Total number of atoms	10668	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.20% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, 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	O	0.62	1/2552 (0.0%)	1.04	15/3460 (0.4%)
1	P	0.59	0/2552	1.02	11/3460 (0.3%)
1	Q	0.62	0/2552	1.04	12/3460 (0.3%)
1	R	0.62	0/2552	1.04	14/3460 (0.4%)
All	All	0.61	1/10208 (0.0%)	1.04	52/13840 (0.4%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	O	270	ILE	CA-CB	6.62	1.61	1.55

All (52) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	Q	204	ILE	N-CA-C	8.15	116.22	108.15
1	O	203	ILE	N-CA-C	-7.72	96.42	108.23
1	P	203	ILE	N-CA-C	-7.43	96.86	108.23
1	R	199	ALA	N-CA-C	7.43	119.02	111.07
1	P	154	LEU	N-CA-C	7.16	119.16	111.36
1	O	199	ALA	N-CA-C	7.12	119.95	111.33
1	Q	15	VAL	N-CA-C	-7.07	103.58	110.72
1	O	204	ILE	N-CA-C	6.92	115.00	107.60
1	R	218	LEU	CA-C-N	6.75	127.02	119.32
1	R	218	LEU	C-N-CA	6.75	127.02	119.32
1	P	141	HIS	N-CA-C	6.54	119.39	108.73
1	O	218	LEU	CA-C-N	6.51	127.02	119.47
1	O	218	LEU	C-N-CA	6.51	127.02	119.47
1	P	199	ALA	N-CA-C	6.49	118.89	111.11
1	O	175	VAL	N-CA-C	-6.36	97.81	107.73
1	O	154	LEU	N-CA-C	6.34	118.27	111.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	R	175	VAL	N-CA-C	-6.33	97.26	106.88
1	O	128	ILE	N-CA-C	6.30	117.19	108.12
1	R	203	ILE	N-CA-C	-6.23	98.02	107.73
1	Q	280	SER	N-CA-C	6.20	118.83	111.33
1	O	24	ASP	N-CA-C	6.11	118.02	111.36
1	Q	203	ILE	N-CA-C	-6.06	98.96	108.23
1	O	78	ASP	CA-C-N	6.00	125.70	119.05
1	O	78	ASP	C-N-CA	6.00	125.70	119.05
1	Q	154	LEU	N-CA-C	5.91	117.59	111.03
1	Q	202	SER	N-CA-C	5.85	117.68	108.96
1	O	87	ILE	N-CA-C	5.72	117.72	111.77
1	O	15	VAL	N-CA-C	-5.71	104.95	110.72
1	Q	175	VAL	N-CA-C	-5.69	98.85	107.73
1	Q	199	ALA	N-CA-C	5.66	118.18	111.33
1	R	110	GLU	N-CA-C	-5.64	105.03	111.07
1	R	197	ARG	N-CA-C	5.57	119.32	109.96
1	R	315	THR	N-CA-C	5.56	117.02	111.07
1	Q	168	VAL	N-CA-C	-5.53	105.72	111.58
1	P	218	LEU	CA-C-N	5.51	125.86	119.47
1	P	218	LEU	C-N-CA	5.51	125.86	119.47
1	O	280	SER	N-CA-C	5.47	117.95	111.33
1	Q	141	HIS	N-CA-C	5.43	117.59	108.96
1	P	22	ASN	CA-C-N	5.34	125.03	119.64
1	P	22	ASN	C-N-CA	5.34	125.03	119.64
1	R	82	LEU	N-CA-C	5.31	118.86	112.38
1	P	202	SER	N-CA-C	5.27	116.81	108.96
1	R	312	ASP	N-CA-C	-5.26	100.52	108.67
1	P	175	VAL	N-CA-C	-5.24	99.13	107.15
1	Q	266	GLU	N-CA-C	5.22	116.66	111.07
1	R	280	SER	N-CA-C	5.21	117.36	111.11
1	R	50	HIS	N-CA-C	5.14	119.65	113.17
1	R	188	SER	N-CA-C	5.14	117.49	110.24
1	Q	315	THR	N-CA-C	5.11	116.65	111.14
1	O	209	GLY	N-CA-C	-5.09	106.94	115.80
1	P	176	HIS	N-CA-C	5.05	117.72	109.59
1	R	112	GLY	N-CA-C	5.01	121.65	114.64

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	O	2517	0	2563	41	0
1	P	2517	0	2563	39	0
1	Q	2517	0	2563	34	0
1	R	2517	0	2563	38	0
2	O	10	0	0	0	0
2	P	10	0	0	0	0
2	Q	10	0	0	0	0
2	R	10	0	0	0	0
3	O	44	0	26	0	0
3	P	44	0	26	1	0
3	Q	44	0	26	0	0
3	R	44	0	26	0	0
4	O	101	0	0	4	0
4	P	91	0	0	3	0
4	Q	102	0	0	3	0
4	R	90	0	0	2	0
All	All	10668	0	10356	136	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 7.

All (136) 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:O:1:VAL:HG21	1:O:329:ALA:HB1	1.63	0.80
1:R:329:ALA:HA	1:R:333:LEU:HD23	1.65	0.75
1:R:17:ARG:HG2	1:R:53:LEU:HD13	1.70	0.73
1:R:214:VAL:HG11	1:R:225:LEU:HD12	1.71	0.72
1:Q:126:ILE:HG23	1:Q:144:ILE:HG23	1.73	0.71
1:R:211:ALA:O	1:R:214:VAL:HG12	1.91	0.71
1:O:1:VAL:HG21	1:O:329:ALA:CB	2.24	0.67
1:R:99:PHE:HD1	1:R:104:ASP:HB3	1.58	0.66
1:R:31:ASN:ND2	1:R:82:LEU:HD21	2.11	0.65
1:P:82:LEU:HD13	1:P:84:TRP:CZ2	2.31	0.65
1:O:191:LYS:HD3	4:O:399:HOH:O	1.96	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:O:8:PHE:HD2	1:O:40:LEU:HD22	1.62	0.63
1:P:184:ILE:HD11	1:Q:182:GLN:O	2.00	0.62
1:P:159:LYS:HB2	1:P:218:LEU:HD11	1.82	0.62
1:O:79:PRO:HA	1:O:82:LEU:HD12	1.82	0.61
1:Q:329:ALA:HA	1:Q:333:LEU:HD13	1.81	0.61
1:P:101:LYS:HG2	1:P:122(A):LYS:HD2	1.83	0.60
1:R:172:MET:HG3	1:R:227:GLY:HA3	1.84	0.59
1:Q:63:ASN:HD22	1:Q:72:ILE:HA	1.68	0.59
1:O:182:GLN:O	1:R:184:ILE:HD11	2.03	0.58
1:O:160:VAL:O	1:O:164:GLN:HB2	2.04	0.57
1:R:62:ASN:O	1:R:73:VAL:HB	2.04	0.57
1:R:165:PHE:HB2	1:R:246:LEU:HG	1.84	0.57
1:Q:122(A):LYS:HB2	1:Q:122(A):LYS:NZ	2.21	0.56
1:O:240:VAL:HG23	1:O:311:TYR:CE1	2.40	0.55
1:Q:187:ALA:O	1:Q:196:ALA:HB1	2.07	0.55
1:R:245:GLU:OE2	1:R:304:MET:HE3	2.07	0.55
1:R:82:LEU:HD13	1:R:84:TRP:CZ2	2.40	0.55
1:R:25:ILE:CD1	1:R:322:VAL:HG13	2.38	0.54
1:P:103:GLU:H	1:P:103:GLU:CD	2.14	0.54
1:P:240:VAL:HG23	1:P:311:TYR:CE1	2.42	0.54
1:Q:83:ALA:HB1	1:Q:86:GLU:HG3	1.90	0.54
1:O:25:ILE:HD11	1:O:322:VAL:HG13	1.89	0.53
1:O:159:LYS:O	1:O:163:GLU:HG3	2.09	0.52
1:Q:102:ARG:HB2	1:Q:123:ASN:O	2.08	0.52
1:O:176:HIS:ND1	1:O:177:SER:O	2.42	0.52
1:O:99:PHE:HD1	1:O:104:ASP:HB3	1.75	0.51
1:R:305:VAL:HG22	1:R:306:LYS:N	2.25	0.51
1:O:201:GLU:O	1:P:281:ARG:HD3	2.11	0.51
1:O:41:ALA:O	1:O:45:LYS:HE3	2.11	0.51
1:P:45:LYS:HE2	1:P:57:VAL:HB	1.92	0.50
1:R:25:ILE:HD13	1:R:322:VAL:HG13	1.94	0.50
1:O:218:LEU:HD13	1:O:221:LEU:HD12	1.93	0.50
1:O:182:GLN:HB3	4:O:362:HOH:O	2.11	0.50
1:Q:144:ILE:HD13	1:Q:328:ILE:HD11	1.93	0.50
1:P:62:ASN:O	1:P:73:VAL:HB	2.12	0.50
1:Q:306:LYS:HB2	1:R:171:MET:HE3	1.93	0.50
1:R:17:ARG:NH2	1:R:47:ASP:HB2	2.26	0.50
1:O:46:TYR:HE1	1:O:52:ARG:HE	1.60	0.50
1:P:278:LEU:HD13	1:R:52:ARG:HH21	1.77	0.49
1:Q:251:THR:OG1	1:Q:254:GLU:HG3	2.12	0.49
1:O:242:LEU:O	1:O:306:LYS:HA	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:Q:211:ALA:HB3	4:Q:354:HOH:O	2.11	0.49
1:R:10:ARG:O	1:R:14:ASN:ND2	2.46	0.49
1:Q:173:THR:OG1	1:R:306:LYS:NZ	2.46	0.49
1:O:8:PHE:CD2	1:O:40:LEU:HD22	2.45	0.48
1:O:228:MET:HB3	1:P:298:MET:HE1	1.94	0.48
1:R:82:LEU:HD13	1:R:84:TRP:HZ2	1.79	0.48
1:R:211:ALA:HB3	4:R:351:HOH:O	2.14	0.47
1:P:1:VAL:HG21	1:P:329:ALA:CB	2.43	0.47
1:O:176:HIS:HB3	1:O:231:ARG:HD3	1.97	0.47
1:Q:25:ILE:HD13	1:Q:322:VAL:HG13	1.97	0.47
1:Q:182:GLN:HB3	4:Q:371:HOH:O	2.14	0.47
1:P:181:ASP:OD2	1:P:195:ARG:NH1	2.46	0.47
1:Q:144:ILE:HD13	1:Q:328:ILE:CD1	2.44	0.47
1:R:206:THR:HG23	1:R:229:ALA:HB3	1.97	0.47
1:P:305:VAL:HG22	1:P:306:LYS:N	2.30	0.47
1:R:160:VAL:O	1:R:164:GLN:HG2	2.13	0.47
1:P:87:ILE:HG23	4:P:404:HOH:O	2.14	0.46
1:O:264:GLU:O	1:O:268:LYS:HE2	2.15	0.46
1:Q:82:LEU:HD13	1:Q:84:TRP:CZ2	2.50	0.46
1:R:191:LYS:HB3	1:R:191:LYS:NZ	2.31	0.46
1:R:240:VAL:HG23	1:R:311:TYR:CE1	2.51	0.46
1:O:171:MET:HE3	1:P:306:LYS:HB2	1.97	0.45
1:O:182:GLN:O	1:R:184:ILE:CD1	2.65	0.45
1:P:249:GLU:HG3	1:P:302:GLY:HA3	1.98	0.45
1:P:176:HIS:HB3	1:P:231:ARG:HD3	1.99	0.45
1:O:248:LYS:HE3	1:O:248:LYS:HB2	1.83	0.45
1:P:9:GLY:HA3	3:P:336:NAD:O5B	2.17	0.45
1:Q:168:VAL:CG2	1:Q:247:GLU:HG3	2.47	0.44
1:O:298:MET:HB3	1:P:171:MET:HE1	1.98	0.44
1:P:64:LEU:HB2	1:P:71:ILE:HB	1.98	0.44
1:P:187:ALA:O	1:P:196:ALA:HB1	2.18	0.44
1:P:299:VAL:HA	1:P:304:MET:O	2.16	0.44
1:P:331:LYS:HD3	1:P:331:LYS:HA	1.56	0.44
1:R:78:ASP:HA	1:R:79:PRO:HD2	1.82	0.44
1:O:184:ILE:HD13	1:O:184:ILE:HA	1.87	0.44
1:O:211:ALA:HB3	4:O:343:HOH:O	2.17	0.44
1:Q:207:THR:HG22	4:R:398:HOH:O	2.18	0.44
1:R:76:GLU:HB2	1:R:82:LEU:CD2	2.48	0.44
1:Q:90:ASP:HB3	1:Q:333:LEU:HD23	1.99	0.43
1:O:194:ARG:NH1	1:P:278:LEU:O	2.47	0.43
1:O:172:MET:CE	1:O:208:THR:HG21	2.48	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:Q:248:LYS:O	1:Q:303:LYS:HD3	2.18	0.43
1:O:175:VAL:HG12	1:P:203:ILE:HD13	2.00	0.43
1:P:211:ALA:HB3	4:P:351:HOH:O	2.19	0.43
1:Q:64:LEU:HB2	1:Q:71:ILE:HB	2.00	0.42
1:O:277:PRO:HA	1:P:194:ARG:CZ	2.49	0.42
1:Q:101:LYS:HB2	1:Q:101:LYS:HE3	1.85	0.42
1:Q:138(A):PRO:HG3	1:Q:331:LYS:HB3	2.01	0.42
1:Q:102:ARG:HB3	1:Q:123:ASN:HB2	2.01	0.42
1:P:249:GLU:HA	1:P:303:LYS:HD3	2.02	0.42
1:O:240:VAL:HG23	1:O:311:TYR:HE1	1.83	0.42
1:O:313:ASN:HA	4:O:349:HOH:O	2.19	0.42
1:P:144:ILE:HD12	1:P:144:ILE:N	2.35	0.42
1:P:182:GLN:HB3	4:P:369:HOH:O	2.20	0.42
1:Q:159:LYS:O	1:Q:163:GLU:HG3	2.20	0.42
1:O:165:PHE:HB2	1:O:246:LEU:HG	2.02	0.42
1:O:172:MET:HE2	1:O:208:THR:HG21	2.02	0.42
1:P:238:SER:HB2	1:P:311:TYR:CZ	2.54	0.42
1:P:84:TRP:HB3	1:P:89:VAL:HB	2.02	0.41
1:O:191:LYS:HB2	1:O:191:LYS:HE2	1.87	0.41
1:Q:329:ALA:HA	1:Q:333:LEU:CD1	2.49	0.41
1:O:52:ARG:HH21	1:Q:278:LEU:HD13	1.86	0.41
1:Q:191:LYS:HG3	4:Q:409:HOH:O	2.20	0.41
1:O:25:ILE:CD1	1:O:322:VAL:HG13	2.49	0.41
1:P:82:LEU:HD13	1:P:84:TRP:HZ2	1.79	0.41
1:R:78:ASP:OD1	1:R:80:GLU:HG2	2.20	0.41
1:Q:306:LYS:HE2	1:R:171:MET:HB3	2.02	0.41
1:O:87:ILE:HG13	1:O:89:VAL:HG23	2.02	0.41
1:P:249:GLU:HA	1:P:302:GLY:O	2.21	0.41
1:Q:56:GLU:O	1:Q:66:VAL:HA	2.21	0.41
1:Q:69:LYS:HB2	1:Q:69:LYS:NZ	2.36	0.41
1:R:91:ILE:HG12	1:R:115:LYS:HB2	2.03	0.41
1:P:240:VAL:HG23	1:P:311:TYR:HE1	1.84	0.41
1:R:45:LYS:HE3	1:R:45:LYS:HB2	1.80	0.41
1:R:204:ILE:HA	1:R:205:PRO:HD3	1.89	0.41
1:R:298:MET:HE2	1:R:298:MET:HB3	1.87	0.41
1:Q:45:LYS:O	1:Q:52:ARG:HA	2.22	0.40
1:Q:176:HIS:O	1:Q:231:ARG:HA	2.21	0.40
1:O:301:ASP:HB2	1:P:169:ARG:HD3	2.03	0.40
1:P:63:ASN:ND2	1:P:73:VAL:H	2.19	0.40
1:R:176:HIS:O	1:R:231:ARG:HA	2.21	0.40
1:R:256:ASN:HD22	1:R:256:ASN:HA	1.69	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:P:80:GLU:HG3	1:P:107:LYS:HD3	2.04	0.40
1:R:17:ARG:HG2	1:R:53:LEU:CD1	2.45	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	O	332/334 (99%)	309 (93%)	22 (7%)	1 (0%)	36	55
1	P	332/334 (99%)	317 (96%)	14 (4%)	1 (0%)	36	55
1	Q	332/334 (99%)	314 (95%)	17 (5%)	1 (0%)	36	55
1	R	332/334 (99%)	314 (95%)	16 (5%)	2 (1%)	21	38
All	All	1328/1336 (99%)	1254 (94%)	69 (5%)	5 (0%)	30	49

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	O	237	VAL
1	P	237	VAL
1	Q	237	VAL
1	R	237	VAL
1	R	302	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	O	270/270 (100%)	260 (96%)	10 (4%)	30	57
1	P	270/270 (100%)	256 (95%)	14 (5%)	21	42
1	Q	270/270 (100%)	260 (96%)	10 (4%)	30	57
1	R	270/270 (100%)	261 (97%)	9 (3%)	33	61
All	All	1080/1080 (100%)	1037 (96%)	43 (4%)	28	54

All (43) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	O	45	LYS
1	O	102	ARG
1	O	164	GLN
1	O	172	MET
1	O	184	ILE
1	O	220	GLU
1	O	246	LEU
1	O	247	GLU
1	O	264	GLU
1	O	333	LEU
1	P	8	PHE
1	P	25	ILE
1	P	30	VAL
1	P	56	GLU
1	P	62	ASN
1	P	103	GLU
1	P	122(A)	LYS
1	P	164	GLN
1	P	172	MET
1	P	184	ILE
1	P	188	SER
1	P	218	LEU
1	P	220	GLU
1	P	246	LEU
1	Q	8	PHE
1	Q	45	LYS
1	Q	70	GLU
1	Q	100	THR
1	Q	122(A)	LYS
1	Q	136	LYS
1	Q	139	LYS

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Mol	Chain	Res	Type
1	Q	172	MET
1	Q	212	LYS
1	Q	246	LEU
1	R	8	PHE
1	R	38	ASN
1	R	102	ARG
1	R	172	MET
1	R	191	LYS
1	R	212	LYS
1	R	230	MET
1	R	246	LEU
1	R	333	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (24) such sidechains are listed below:

Mol	Chain	Res	Type
1	O	38	ASN
1	O	81	ASN
1	O	146	ASN
1	O	236	ASN
1	O	256	ASN
1	P	60	ASN
1	P	63	ASN
1	P	146	ASN
1	P	152	ASN
1	P	256	ASN
1	Q	63	ASN
1	Q	81	ASN
1	Q	146	ASN
1	Q	152	ASN
1	Q	256	ASN
1	R	62	ASN
1	R	63	ASN
1	R	81	ASN
1	R	142	HIS
1	R	146	ASN
1	R	236	ASN
1	R	256	ASN
1	R	284	ASN
1	R	319	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

12 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	SO4	O	339	-	4,4,4	0.53	0	6,6,6	0.54	0
2	SO4	Q	338	-	4,4,4	0.71	0	6,6,6	0.32	0
2	SO4	O	338	-	4,4,4	0.58	0	6,6,6	0.30	0
2	SO4	R	338	-	4,4,4	0.61	0	6,6,6	0.33	0
3	NAD	Q	336	-	46,48,48	1.40	5 (10%)	64,73,73	2.09	12 (18%)
2	SO4	Q	339	-	4,4,4	0.79	0	6,6,6	0.27	0
3	NAD	O	336	-	46,48,48	1.39	5 (10%)	64,73,73	1.98	12 (18%)
2	SO4	R	339	-	4,4,4	0.63	0	6,6,6	0.28	0
3	NAD	R	336	-	46,48,48	1.47	6 (13%)	64,73,73	1.89	11 (17%)
2	SO4	P	339	-	4,4,4	0.53	0	6,6,6	0.31	0
3	NAD	P	336	-	46,48,48	1.33	5 (10%)	64,73,73	1.87	18 (28%)
2	SO4	P	338	-	4,4,4	0.80	0	6,6,6	0.38	0

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	O	336	-	-	10/30/62/62	0/5/5/5
3	NAD	Q	336	-	-	9/30/62/62	0/5/5/5
3	NAD	P	336	-	-	6/30/62/62	0/5/5/5
3	NAD	R	336	-	-	11/30/62/62	0/5/5/5

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	R	336	NAD	C2N-N1N	6.98	1.42	1.35
3	O	336	NAD	C2N-N1N	5.97	1.41	1.35
3	P	336	NAD	C2N-N1N	5.51	1.41	1.35
3	Q	336	NAD	C2N-N1N	5.45	1.41	1.35
3	Q	336	NAD	C5A-N7A	-3.37	1.32	1.39
3	O	336	NAD	C5A-N7A	-3.24	1.33	1.39
3	R	336	NAD	C5A-N7A	-3.08	1.33	1.39
3	P	336	NAD	C5A-N7A	-3.07	1.33	1.39
3	Q	336	NAD	C3N-C7N	2.97	1.55	1.50
3	O	336	NAD	O4D-C1D	2.60	1.44	1.40
3	O	336	NAD	C6N-N1N	2.57	1.41	1.35
3	Q	336	NAD	O4D-C1D	2.47	1.44	1.40
3	R	336	NAD	C6N-N1N	2.45	1.40	1.35
3	P	336	NAD	C6N-N1N	2.43	1.40	1.35
3	R	336	NAD	O4D-C1D	2.40	1.44	1.40
3	R	336	NAD	C3N-C7N	2.38	1.54	1.50
3	P	336	NAD	C4A-N9A	-2.35	1.32	1.37
3	P	336	NAD	O4D-C1D	2.19	1.43	1.40
3	Q	336	NAD	C8A-N9A	-2.07	1.34	1.37
3	O	336	NAD	C3N-C7N	2.07	1.53	1.50
3	R	336	NAD	C4A-N9A	-2.05	1.33	1.37

All (53) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	Q	336	NAD	N3A-C4A-N9A	7.10	139.24	127.17
3	Q	336	NAD	C5A-C4A-N3A	-7.09	116.95	126.72
3	O	336	NAD	N3A-C4A-N9A	6.91	138.93	127.17
3	O	336	NAD	C5A-C4A-N3A	-6.89	117.23	126.72
3	R	336	NAD	C5A-C4A-N3A	-6.65	117.56	126.72
3	R	336	NAD	N3A-C4A-N9A	6.17	137.67	127.17
3	P	336	NAD	C5A-C4A-N3A	-5.48	119.18	126.72
3	Q	336	NAD	N3A-C2A-N1A	-5.04	120.95	128.58
3	O	336	NAD	N3A-C2A-N1A	-5.03	120.97	128.58

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	P	336	NAD	N3A-C4A-N9A	5.02	135.71	127.17
3	P	336	NAD	C4D-O4D-C1D	-4.74	105.58	109.92
3	R	336	NAD	C6A-C5A-C4A	4.41	123.21	117.18
3	O	336	NAD	C6A-C5A-N7A	-4.34	123.72	132.09
3	P	336	NAD	N3A-C2A-N1A	-4.30	122.08	128.58
3	Q	336	NAD	C6A-C5A-C4A	4.15	122.84	117.18
3	O	336	NAD	C6A-C5A-C4A	4.06	122.73	117.18
3	R	336	NAD	N3A-C2A-N1A	-4.03	122.48	128.58
3	Q	336	NAD	C2A-N3A-C4A	3.86	121.25	111.83
3	O	336	NAD	C2A-N3A-C4A	3.75	120.98	111.83
3	R	336	NAD	O4B-C1B-N9A	3.70	115.19	108.09
3	R	336	NAD	C6A-C5A-N7A	-3.68	125.00	132.09
3	Q	336	NAD	C6A-C5A-N7A	-3.68	125.00	132.09
3	Q	336	NAD	C4A-N9A-C8A	3.58	109.49	105.74
3	P	336	NAD	C6A-C5A-C4A	3.52	121.98	117.18
3	R	336	NAD	C2A-N3A-C4A	3.30	119.89	111.83
3	P	336	NAD	C6A-C5A-N7A	-3.10	126.11	132.09
3	P	336	NAD	C5N-C4N-C3N	3.05	123.37	120.36
3	Q	336	NAD	N9A-C8A-N7A	-2.92	109.80	113.94
3	P	336	NAD	C2A-N3A-C4A	2.87	118.84	111.83
3	R	336	NAD	C4A-N9A-C8A	2.80	108.68	105.74
3	P	336	NAD	C4B-O4B-C1B	-2.80	103.29	109.47
3	O	336	NAD	C4A-N9A-C8A	2.74	108.62	105.74
3	O	336	NAD	N6A-C6A-N1A	2.65	124.28	118.38
3	R	336	NAD	N9A-C8A-N7A	-2.52	110.37	113.94
3	Q	336	NAD	C5N-C4N-C3N	2.51	122.84	120.36
3	R	336	NAD	C6N-N1N-C2N	-2.51	119.74	121.88
3	P	336	NAD	C4A-N9A-C8A	2.45	108.31	105.74
3	P	336	NAD	O3B-C3B-C2B	-2.43	104.03	111.82
3	Q	336	NAD	C3B-C2B-C1B	-2.38	96.97	101.46
3	P	336	NAD	C2A-N1A-C6A	2.36	122.61	118.73
3	O	336	NAD	C4A-C5A-N7A	2.30	113.21	110.58
3	Q	336	NAD	O4B-C1B-N9A	2.27	112.46	108.09
3	O	336	NAD	O3-PN-O1N	-2.24	103.95	110.70
3	O	336	NAD	O2N-PN-O1N	2.19	122.62	112.44
3	P	336	NAD	C6N-N1N-C1D	-2.18	115.44	119.73
3	Q	336	NAD	O3-PA-O1A	-2.15	104.23	110.70
3	P	336	NAD	N9A-C8A-N7A	-2.12	110.92	113.94
3	O	336	NAD	C2A-N1A-C6A	2.11	122.19	118.73
3	P	336	NAD	O3-PA-O1A	-2.07	104.49	110.70
3	P	336	NAD	O4D-C4D-C5D	-2.04	102.80	109.33
3	P	336	NAD	C4A-N9A-C1B	-2.03	121.89	126.63

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	P	336	NAD	C5B-C4B-C3B	-2.03	107.92	115.21
3	R	336	NAD	N6A-C6A-N1A	2.01	122.85	118.38

There are no chirality outliers.

All (36) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	O	336	NAD	C5B-O5B-PA-O1A
3	O	336	NAD	O4D-C1D-N1N-C2N
3	O	336	NAD	O4D-C1D-N1N-C6N
3	O	336	NAD	C2D-C1D-N1N-C6N
3	P	336	NAD	O4D-C1D-N1N-C2N
3	P	336	NAD	O4D-C1D-N1N-C6N
3	P	336	NAD	C2D-C1D-N1N-C6N
3	Q	336	NAD	C5B-O5B-PA-O1A
3	Q	336	NAD	C5B-O5B-PA-O3
3	Q	336	NAD	O4D-C1D-N1N-C2N
3	Q	336	NAD	O4D-C1D-N1N-C6N
3	Q	336	NAD	C2D-C1D-N1N-C6N
3	R	336	NAD	C5B-O5B-PA-O1A
3	R	336	NAD	C5B-O5B-PA-O3
3	R	336	NAD	O4D-C1D-N1N-C2N
3	R	336	NAD	O4D-C1D-N1N-C6N
3	R	336	NAD	C2D-C1D-N1N-C2N
3	R	336	NAD	C2D-C1D-N1N-C6N
3	R	336	NAD	O4B-C4B-C5B-O5B
3	Q	336	NAD	C3B-C4B-C5B-O5B
3	R	336	NAD	C3B-C4B-C5B-O5B
3	P	336	NAD	C2N-C3N-C7N-O7N
3	O	336	NAD	O4B-C4B-C5B-O5B
3	Q	336	NAD	O4B-C4B-C5B-O5B
3	O	336	NAD	C3B-C4B-C5B-O5B
3	O	336	NAD	PN-O3-PA-O5B
3	O	336	NAD	C5B-O5B-PA-O3
3	Q	336	NAD	C5B-O5B-PA-O2A
3	R	336	NAD	C5B-O5B-PA-O2A
3	O	336	NAD	PA-O3-PN-O2N
3	O	336	NAD	C2D-C1D-N1N-C2N
3	P	336	NAD	C4N-C3N-C7N-O7N
3	Q	336	NAD	PA-O3-PN-O2N
3	R	336	NAD	PA-O3-PN-O1N
3	R	336	NAD	PA-O3-PN-O2N

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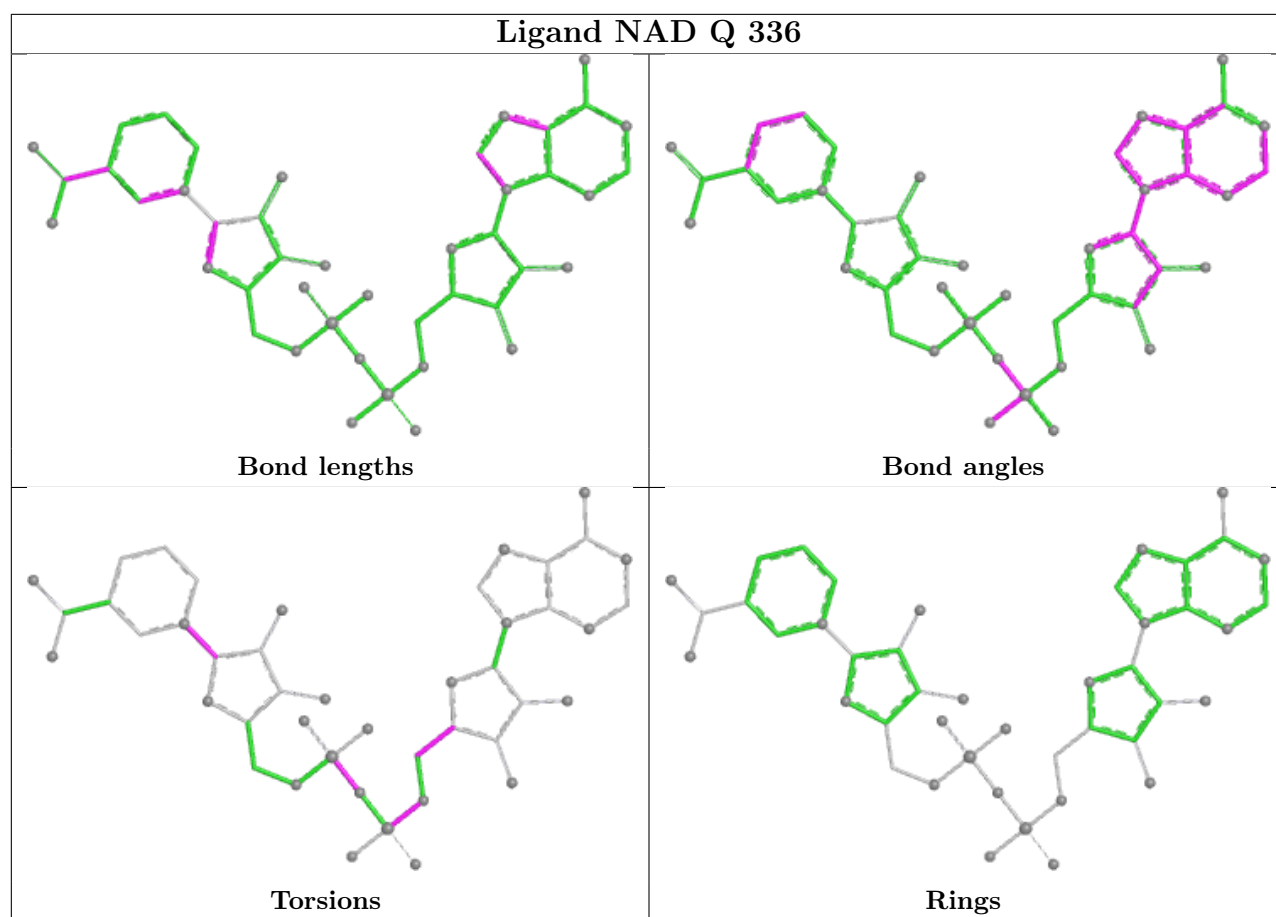
Mol	Chain	Res	Type	Atoms
3	P	336	NAD	O4B-C4B-C5B-O5B

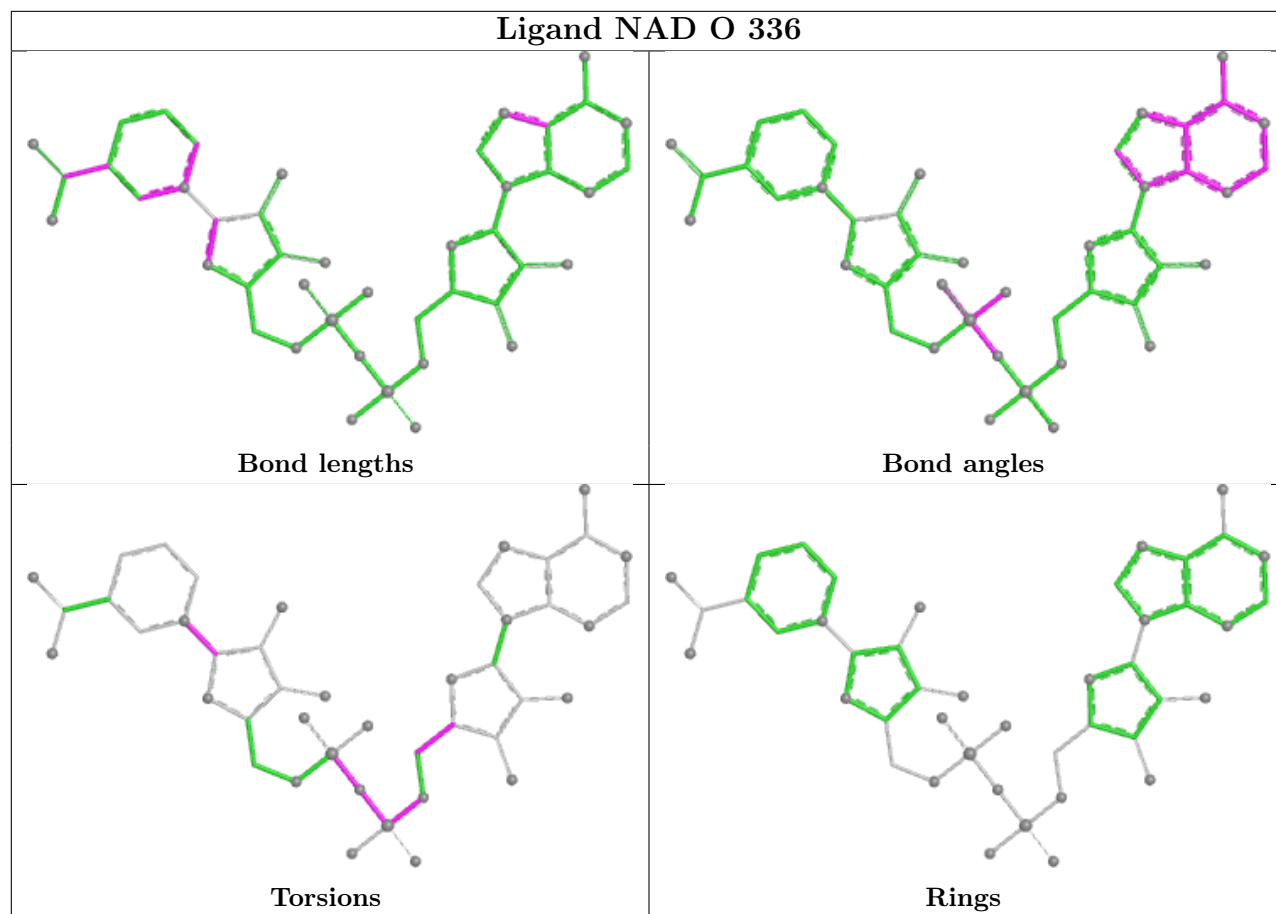
There are no ring outliers.

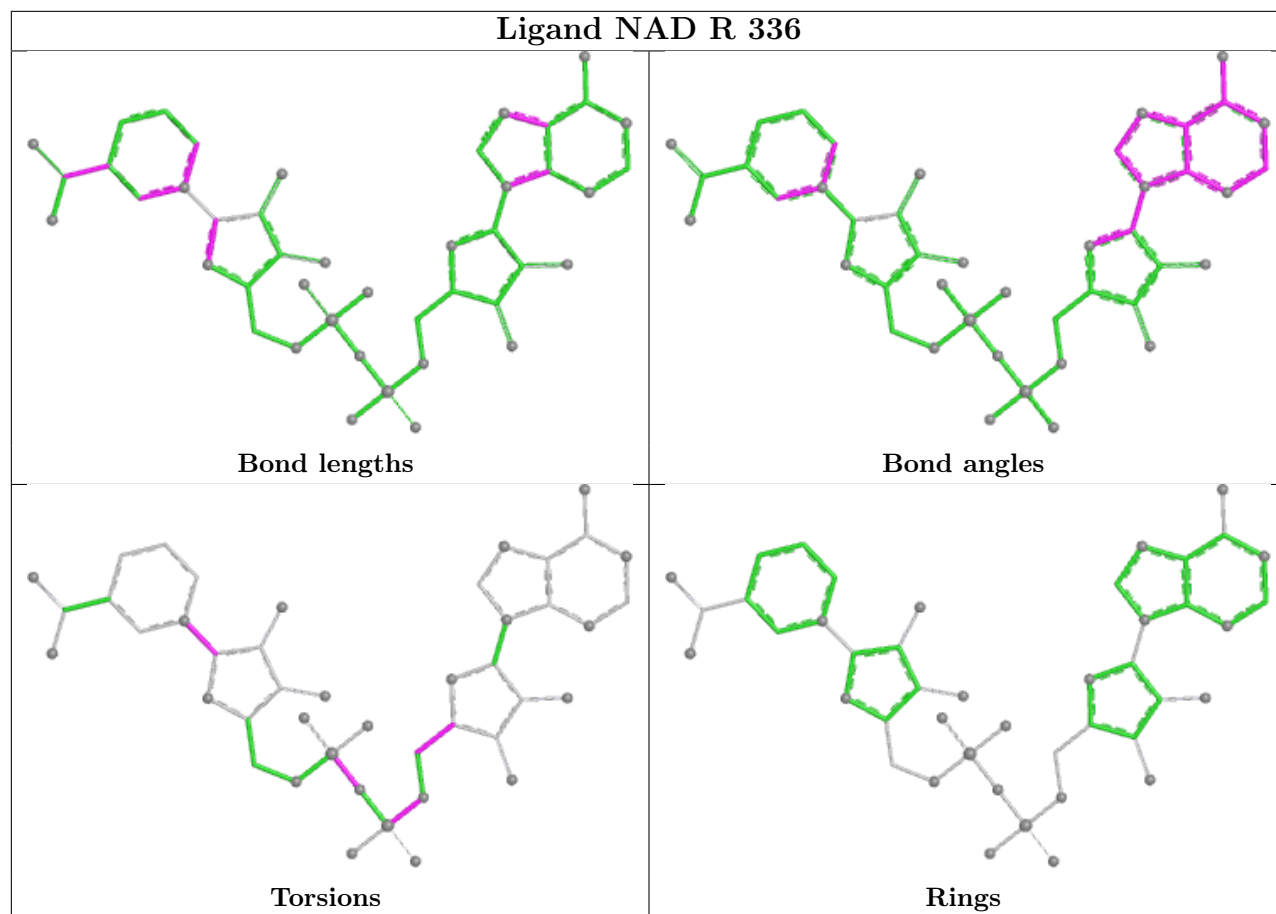
1 monomer is involved in 1 short contact:

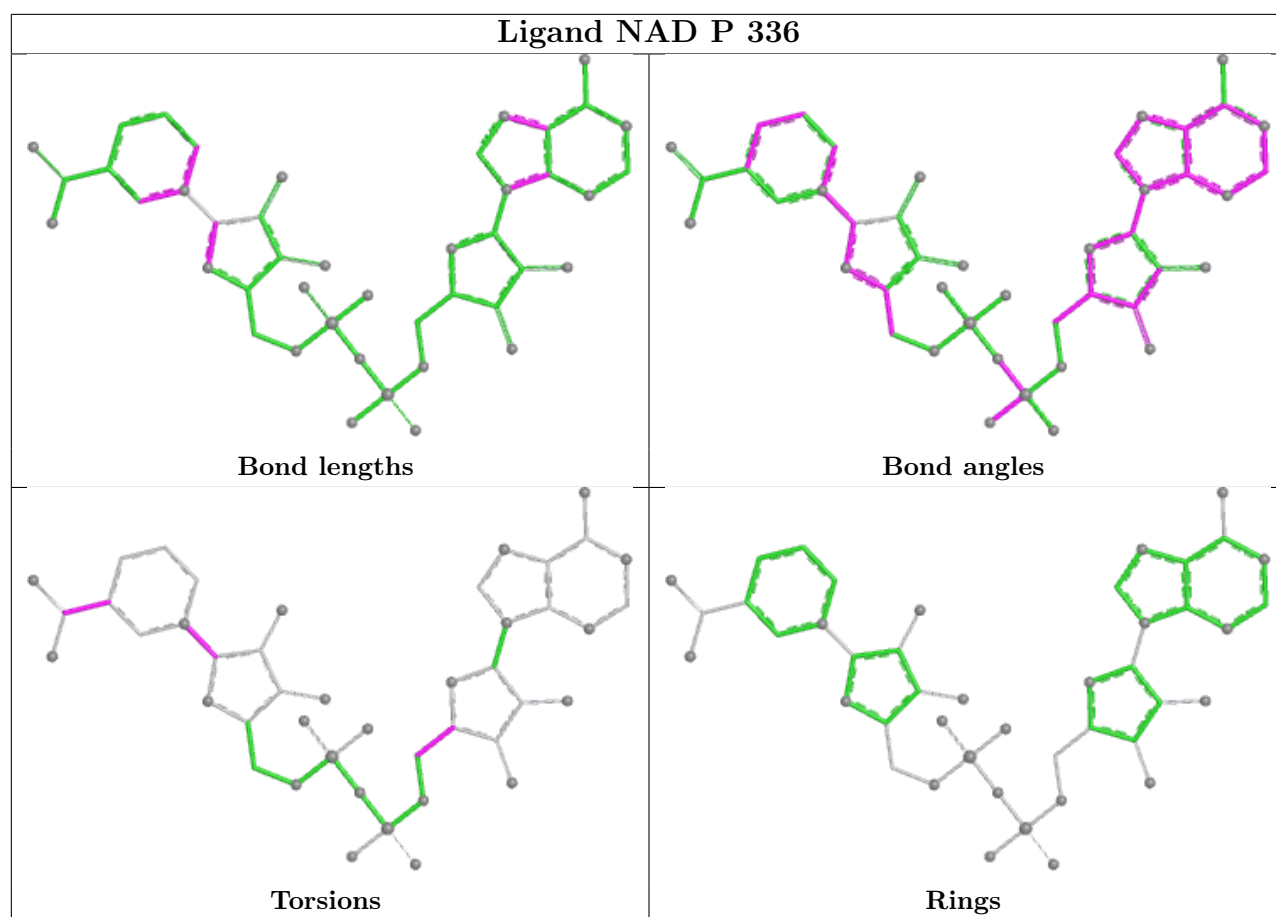
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	P	336	NAD	1	0

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 than 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.









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	O	334/334 (100%)	-1.97	0 100 100	5, 20, 45, 60	0
1	P	334/334 (100%)	-1.97	0 100 100	5, 20, 45, 61	0
1	Q	334/334 (100%)	-1.96	0 100 100	6, 20, 44, 68	0
1	R	334/334 (100%)	-1.97	0 100 100	5, 20, 44, 64	0
All	All	1336/1336 (100%)	-1.97	0 100 100	5, 20, 45, 68	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 oligosaccharides 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.

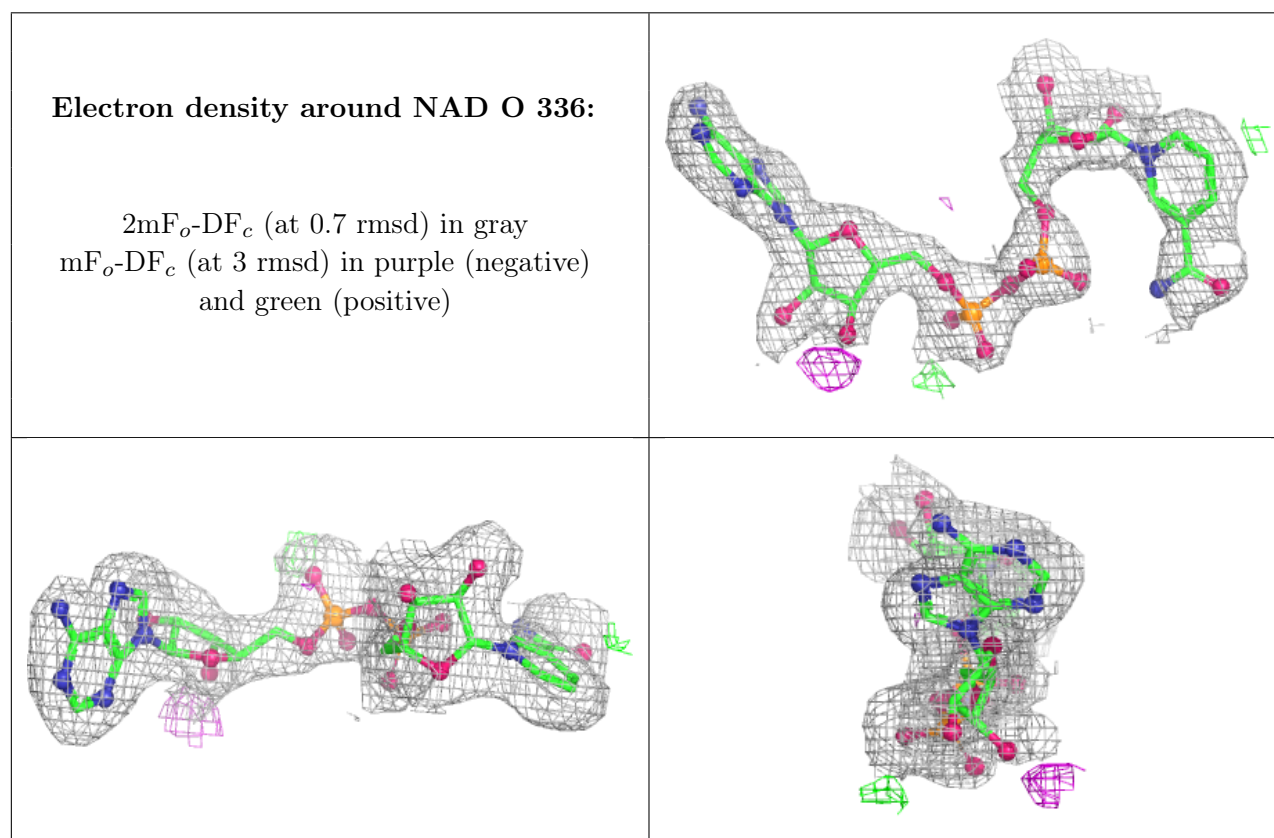
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	SO4	O	338	5/5	1.00	0.01	44,44,49,51	0
2	SO4	O	339	5/5	1.00	0.02	72,73,73,74	0
2	SO4	P	338	5/5	1.00	0.01	39,41,44,45	0
2	SO4	P	339	5/5	1.00	0.02	79,80,81,81	0

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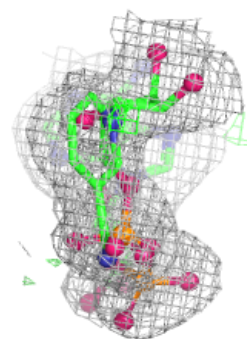
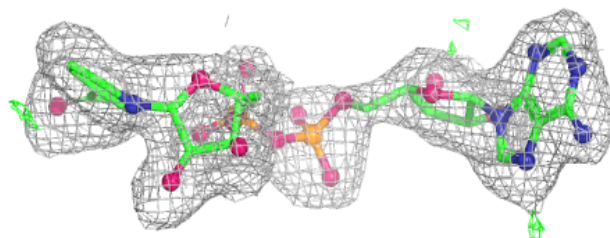
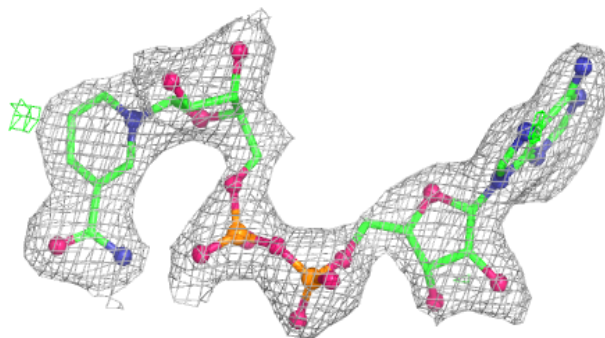
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	SO4	Q	338	5/5	1.00	0.01	34,41,41,42	0
2	SO4	Q	339	5/5	1.00	0.02	69,70,71,72	0
2	SO4	R	338	5/5	1.00	0.02	64,65,68,69	0
2	SO4	R	339	5/5	1.00	0.02	72,72,76,76	0
3	NAD	O	336	44/44	1.00	0.01	16,25,31,33	0
3	NAD	P	336	44/44	1.00	0.01	7,18,27,31	0
3	NAD	Q	336	44/44	1.00	0.01	3,19,27,33	0
3	NAD	R	336	44/44	1.00	0.02	19,30,34,46	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.

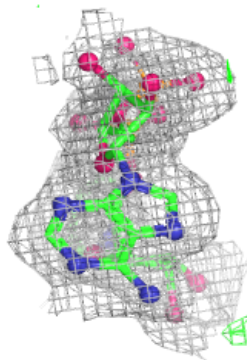
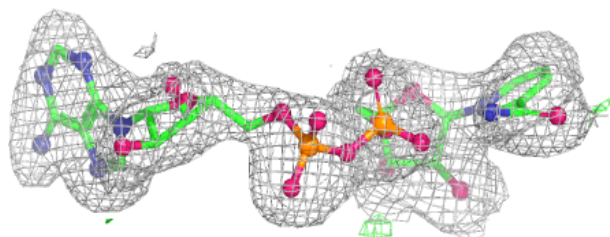
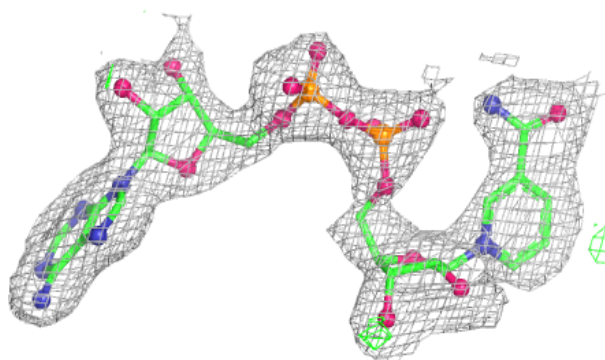


Electron density around NAD P 336:

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

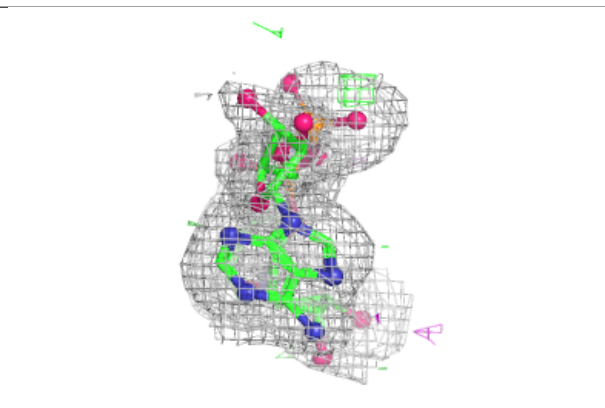
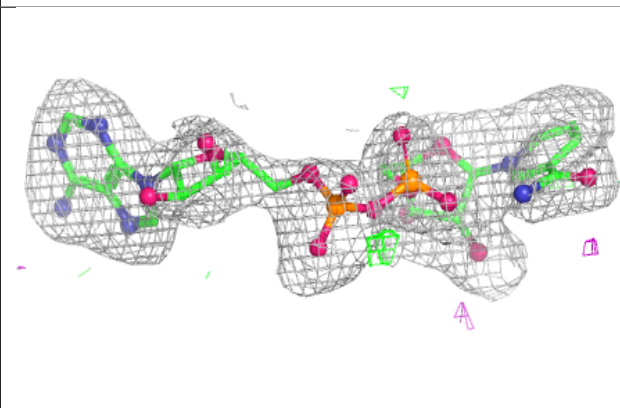
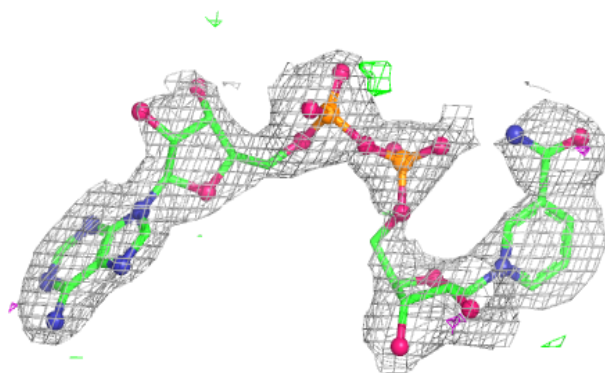
**Electron density around NAD Q 336:**

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



Electron density around NAD R 336:

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



6.5 Other polymers [i](#)

There are no such residues in this entry.