WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB EM Validation Summary Report (i)

Jul 16, 2025 – 02:34 AM JST

PDB ID	:	9IVG / pdb_00009ivg
EMDB ID	:	EMD-60927
Title	:	Cryo-EM structure of the GLP-1(9-36)-bound human GLP-1R-Gs complex
Authors	:	Li, J.; Li, G.; Mai, Y.; Liu, X.; Yang, D.; Zhou, Q.; Wang, M.-W.
Deposited on	:	2024-07-23
Resolution	:	3.00 Å(reported)

This is a wwPDB EM 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/EMValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

|		
EMDB validation analysis	:	FAILED
MolProbity	:	4-5-2 with Phenix2.0rc1
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	FAILED
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 3.00 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	Percentile Ranks	Value
Clashscore		8
Ramachandran outliers		0.2%
Sidechain outliers		4.0%

Worse *Better*

▌ Percentile relative to all structures

⫾ Percentile relative to all EM structures
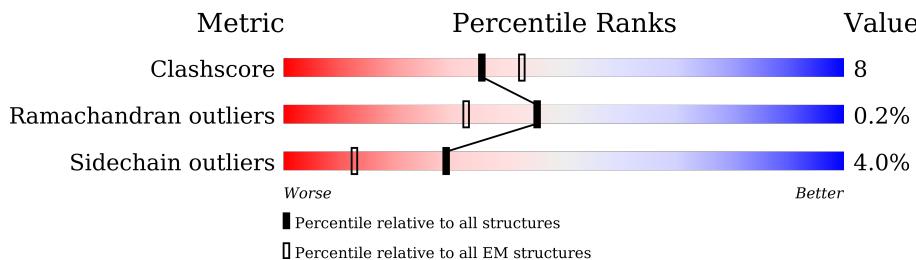
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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%

Mol	Chain	Length	Quality of chain
1	P	28	61% 14% 25%
2	R	440	67% 20% • 13%
3	A	361	52% 15% • 32%
4	B	345	75% 22% •
5	G	70	76% • 20%
6	N	140	74% 14% • 10%

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 9325 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 GLP-1(9-36).

Mol	Chain	Residues	Atoms				AltConf	Trace
1	P	21	Total 160	C 101	N 23	O 36	0	0

- Molecule 2 is a protein called Glucagon-like peptide 1 receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	R	384	Total 3161	C 2086	N 517	O 540	S 18	0	0

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(i) subunit alpha-1,Guanine nucleotide-binding protein G(s) subunit alpha isoforms short.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	A	245	Total 2014	C 1271	N 361	O 374	S 8	0	0

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	49	ASP	GLY	conflict	UNP P63092
A	50	ASN	GLU	conflict	UNP P63092
A	63	TYR	LEU	conflict	UNP P63092
A	226	ALA	GLY	conflict	UNP P63092
A	249	ASP	ALA	conflict	UNP P63092
A	252	ASP	SER	conflict	UNP P63092
A	272	ASP	LEU	conflict	UNP P63092
A	366	SER	ALA	conflict	UNP P63092
A	372	ALA	ILE	conflict	UNP P63092
A	375	ILE	VAL	conflict	UNP P63092

- Molecule 4 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	B	338	Total 2600	C 1604	N 467	O 508	S 21	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	MET	-	initiating methionine	UNP P62873
B	-3	GLY	-	expression tag	UNP P62873
B	-2	SER	-	expression tag	UNP P62873
B	-1	LEU	-	expression tag	UNP P62873
B	0	LEU	-	expression tag	UNP P62873
B	1	GLN	-	expression tag	UNP P62873

- Molecule 5 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	G	56	Total 429	C 269	N 76	O 81	S 3	0	0

- Molecule 6 is a protein called Nanobody-35.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	N	126	Total 961	C 599	N 168	O 188	S 6	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. 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.

- Molecule 1: GLP-1(9-36)

Chain P:

- Molecule 2: Glucagon-like peptide 1 receptor

Chain R:

- Molecule 3: Guanine nucleotide-binding protein G(i) subunit alpha-1,Guanine nucleotide-binding protein G(s) subunit alpha isoforms short
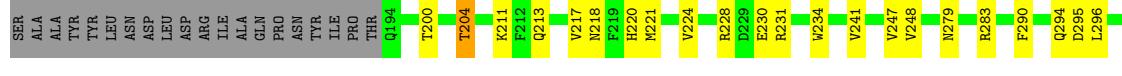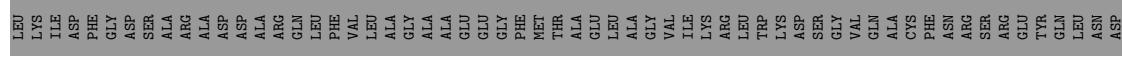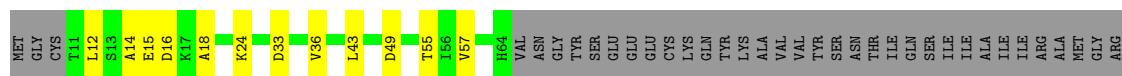
Chain A:

• Molecule 4: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1

Chain B:

75% 22% ·

MET GLY SER LEU GLN SER E3 L4 K15 R22 D27 T34 Q44 R48 H54 Y59 A60 M61 R68 L69 L70 V71 S72 L79 I80 I81 W82 D83 S84 H91 R96 C114 L117 T128 N132 R137 E138 H142 T143 L146

L152 N155 T159 S160 S161 G162 D163 D170 D186 S189 L190 S191 L192 F199 D212 V213 R214 E215 G216 M217 C218 R219 H225 E226 S227 N237 G238 N239 S245 D246 D247 A248 R251 L252 F253 D254 L255 D258 Q259 E260 T263 D267 N268 I269

T274 S275 V276 S279 L284 L285 D290 C294 L300 L308 V315 V320 V327 S331 W332 L336 N340

• Molecule 5: Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2

Chain G:

76% · 20%

ALA SER ASN ASN THR A7 A33 M38 T52 R62 GLU LYS LYS PHE PHE CYS ALA ILE LEU

• Molecule 6: Nanobody-35

Chain N:

74% 14% · 10%

MET ALA Q1 V2 Q3 S17 L20 D50 I51 S52 Q53 S59 R72 L81 Q82 M83 T91 Y94 C99 P100 T104 R105 D106 C107 F108 T111 S112 T113 G121 T125 V126 SER SER HIS HIS HIS HIS HIS HIS GLU PRO GLU ALA

4 Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	99120	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{Å}^2)$	80	Depositor
Minimum defocus (nm)	1500	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

5   Model quality (i)

5.1   Standard geometry (i)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#|Z|>5$	RMSZ	$\#|Z|>5$
1	P	0.10	0/162	0.24	0/217
2	R	0.13	0/3257	0.31	0/4437
3	A	0.22	0/2053	0.39	0/2769
4	B	0.16	0/2647	0.32	0/3589
5	G	0.10	0/435	0.24	0/587
6	N	0.12	0/981	0.28	0/1329
All	All	0.16	0/9535	0.33	0/12928

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	P	160	0	145	3	0
2	R	3161	0	3116	61	0
3	A	2014	0	1971	33	0
4	B	2600	0	2505	42	0
5	G	429	0	441	3	0
6	N	961	0	928	13	0
All	All	9325	0	9106	142	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 8.

The worst 5 of 142 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)
4:B:54:HIS:HE2	4:B:72:SER:HG	1.31	0.79
2:R:113:LYS:HG2	2:R:120:TRP:HA	1.70	0.72
2:R:118:LEU:HD22	2:R:119:PRO:HD2	1.73	0.70
3:A:228:ARG:NH1	4:B:186:ASP:OD1	2.26	0.69
2:R:82:ASN:ND2	2:R:99:HIS:ND1	2.37	0.69

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	P	19/28 (68%)	19 (100%)	0	0	100	100
2	R	378/440 (86%)	348 (92%)	28 (7%)	2 (0%)	25	61
3	A	241/361 (67%)	224 (93%)	17 (7%)	0	100	100
4	B	336/345 (97%)	324 (96%)	12 (4%)	0	100	100
5	G	54/70 (77%)	52 (96%)	2 (4%)	0	100	100
6	N	124/140 (89%)	124 (100%)	0	0	100	100
All	All	1152/1384 (83%)	1091 (95%)	59 (5%)	2 (0%)	45	77

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	R	120	TRP
2	R	118	LEU

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	P	17/22 (77%)	17 (100%)	0	100	100
2	R	341/392 (87%)	332 (97%)	9 (3%)	41	72
3	A	217/315 (69%)	202 (93%)	15 (7%)	13	42
4	B	281/287 (98%)	271 (96%)	10 (4%)	30	64
5	G	45/57 (79%)	45 (100%)	0	100	100
6	N	104/116 (90%)	98 (94%)	6 (6%)	17	48
All	All	1005/1189 (84%)	965 (96%)	40 (4%)	29	61

5 of 40 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	B	70	LEU
6	N	99	CYS
4	B	146	LEU
4	B	275	SER
6	N	106	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
3	A	278	ASN
4	B	9	GLN
6	N	82	GLN
4	B	237	ASN
4	B	239	ASN

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 ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.