



# Full wwPDB X-ray Structure Validation Report

Feb 28, 2014 – 10:47 PM GMT

PDB ID : 1HWG  
Title : 1:2 COMPLEX OF HUMAN GROWTH HORMONE WITH ITS SOLUBLE  
BINDING PROTEIN  
Authors : Sundstrom, S.M.; Lundqvist, T.  
Deposited on : 1996-11-13  
Resolution : 2.50 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

---

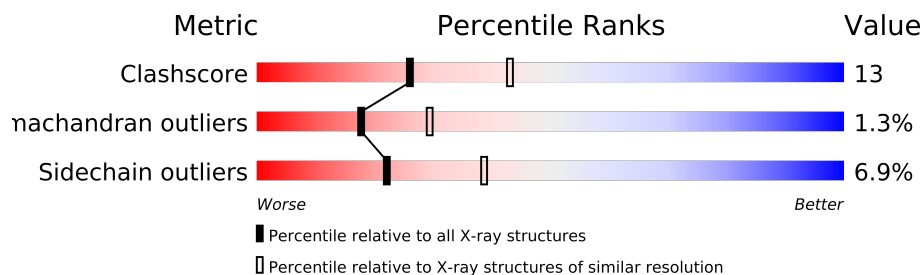
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 21963  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

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))
Clashscore	79885	3562 (2.50-2.50)
Ramachandran outliers	78287	3480 (2.50-2.50)
Sidechain outliers	78261	3482 (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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	191	
2	B	237	
2	C	237	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4718 atoms, of which 0 are hydrogen and 0 are deuterium.

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 GROWTH HORMONE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	184	Total	C	N	O	S	0	0	0
			1457	933	241	276	7			

- Molecule 2 is a protein called GROWTH HORMONE BINDING PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	194	Total	C	N	O	S	0	0	0
			1559	1001	254	295	9			
2	C	191	Total	C	N	O	S	0	0	0
			1527	979	250	288	10			

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	50	Total	O	0	0
			50	50		
3	B	57	Total	O	0	0
			57	57		
3	C	68	Total	O	0	0
			68	68		

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

Note EDS was not executed.

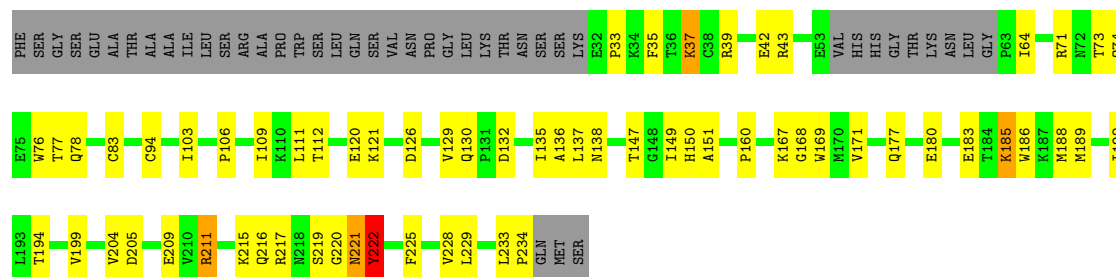
#### • Molecule 1: GROWTH HORMONE

Chain A: 



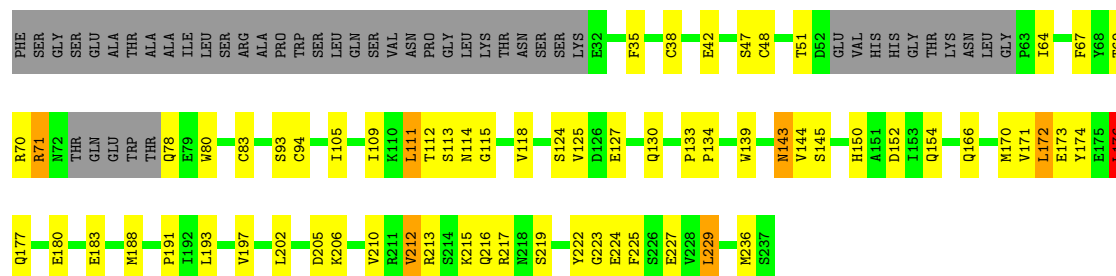
#### • Molecule 2: GROWTH HORMONE BINDING PROTEIN

Chain B: 



#### • Molecule 2: GROWTH HORMONE BINDING PROTEIN

Chain C: 



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	145.61Å 69.02Å 76.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.50	Depositor
% Data completeness (in resolution range)	94.3 (20.00-2.50)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.10	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, $R_{free}$	0.199 , 0.287	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4718	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	31.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

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	0.44	0/1486	0.64	1/2010 (0.0%)
2	B	0.48	0/1603	0.76	2/2186 (0.1%)
2	C	0.51	0/1569	0.72	3/2139 (0.1%)
All	All	0.48	0/4658	0.71	6/6335 (0.1%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	48	PRO	N-CA-CB	6.01	110.51	103.30
2	C	176	LEU	CA-CB-CG	5.88	128.81	115.30
2	B	234	PRO	N-CA-CB	5.32	109.68	103.30
2	C	229	LEU	CA-CB-CG	5.12	127.08	115.30
2	C	173	GLU	N-CA-C	-5.12	97.18	111.00
2	B	222	TYR	N-CA-C	-5.00	97.49	111.00

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1457	0	1396	19	0
2	B	1559	0	1463	53	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	1527	0	1425	47	0
3	A	50	0	0	3	0
3	B	57	0	0	4	0
3	C	68	0	0	2	0
All	All	4718	0	4284	113	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 13.

All (113) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:B:130:GLN:HA	2:B:221:ASN:HB3	1.51	0.91
2:B:216:GLN:HB3	2:B:221:ASN:HD21	1.45	0.82
2:C:134:PRO:HG2	2:C:212:VAL:HG22	1.70	0.73
2:C:144:VAL:HG11	2:C:236:MET:HG3	1.72	0.71
2:B:71:ARG:HB3	2:B:106:PRO:HD2	1.73	0.70
2:C:133:PRO:HB3	2:C:224:GLU:O	1.92	0.69
1:A:64:ARG:O	1:A:68:GLN:HG2	1.93	0.68
2:B:219:SER:HB2	2:B:221:ASN:OD1	1.95	0.67
2:B:221:ASN:O	2:B:222:TYR:HB2	1.96	0.64
2:B:74:GLN:O	2:B:76:TRP:HD1	1.82	0.63
2:B:220:GLY:HA2	3:B:250:HOH:O	1.99	0.62
2:B:186:TRP:CZ3	2:B:211:ARG:HG2	2.37	0.60
2:C:83:CYS:CB	2:C:94:CYS:SG	2.90	0.60
2:C:176:LEU:HD12	2:C:177:GLN:N	2.16	0.60
2:C:35:PHE:CZ	2:C:109:ILE:HD12	2.36	0.60
2:C:193:LEU:HD21	2:C:217:ARG:HD3	1.82	0.60
2:C:171:VAL:HG11	2:C:217:ARG:HG3	1.82	0.60
1:A:4:ILE:O	1:A:127:ARG:NH2	2.35	0.60
2:C:71:ARG:HE	2:C:78:GLN:HE22	1.48	0.60
1:A:11:ASP:O	1:A:15:LEU:HD13	2.02	0.59
2:C:205:ASP:O	2:C:206:LYS:HG3	2.02	0.59
1:A:36:ILE:HD11	1:A:156:LEU:HD21	1.86	0.58
2:B:215:LYS:HB2	2:B:222:TYR:CD1	2.39	0.57
2:B:211:ARG:HD3	2:B:225:PHE:CD1	2.41	0.56
2:B:130:GLN:HA	2:B:221:ASN:CB	2.30	0.56
2:C:193:LEU:CD2	2:C:217:ARG:HD3	2.35	0.56
2:B:168:GLY:HA2	3:B:245:HOH:O	2.05	0.56
2:B:215:LYS:HG3	2:B:221:ASN:OD1	2.06	0.55
2:B:189:MET:HG2	3:B:272:HOH:O	2.06	0.55
2:B:103:ILE:CG2	2:B:126:ASP:HB3	2.36	0.55
2:B:37:LYS:C	2:B:37:LYS:HD2	2.27	0.54

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:B:150:HIS:HD2	2:C:152:ASP:OD2	1.91	0.53
2:C:171:VAL:O	2:C:172:LEU:HB2	2.09	0.53
2:B:64:ILE:HA	2:B:112:THR:O	2.08	0.53
1:A:68:GLN:NE2	3:A:214:HOH:O	2.41	0.53
2:C:64:ILE:CG2	2:C:111:LEU:HD22	2.39	0.52
1:A:1:PHE:HB2	1:A:2:PRO:HD2	1.91	0.52
2:B:171:VAL:HG12	2:B:217:ARG:HG3	1.92	0.52
2:B:83:CYS:CB	2:B:94:CYS:SG	2.99	0.51
2:B:177:GLN:HG2	2:B:188:MET:HB3	1.92	0.50
2:B:130:GLN:CA	2:B:221:ASN:HB3	2.34	0.50
2:C:176:LEU:HD23	2:C:197:VAL:CG1	2.42	0.50
2:C:177:GLN:HG2	2:C:188:MET:HG2	1.94	0.50
1:A:118:GLU:O	1:A:122:GLN:HG3	2.12	0.50
2:B:209:GLU:HB2	2:B:228:VAL:CG1	2.42	0.49
2:C:180:GLU:HB2	2:C:183:GLU:HB2	1.93	0.49
2:C:83:CYS:SG	2:C:94:CYS:CB	3.00	0.49
1:A:64:ARG:HH22	2:B:167:LYS:HD2	1.78	0.49
2:B:37:LYS:O	2:B:37:LYS:HD2	2.12	0.49
2:C:172:LEU:HA	2:C:215:LYS:O	2.12	0.49
2:B:185:LYS:H	2:B:185:LYS:HD3	1.78	0.49
2:C:48:CYS:O	2:C:93:SER:HA	2.12	0.49
1:A:156:LEU:HD23	1:A:157:LEU:N	2.27	0.49
2:C:130:GLN:HG2	2:C:223:GLY:HA2	1.93	0.49
2:B:233:LEU:H	2:B:233:LEU:HD12	1.77	0.48
2:C:176:LEU:HD13	2:C:210:VAL:HG13	1.96	0.48
2:B:76:TRP:O	2:B:78:GLN:N	2.47	0.48
1:A:49:GLN:O	1:A:51:SER:N	2.47	0.48
1:A:88:GLU:HB2	3:A:201:HOH:O	2.13	0.48
1:A:64:ARG:NH2	2:B:167:LYS:HD2	2.28	0.47
2:C:176:LEU:CD1	2:C:210:VAL:HG13	2.45	0.47
2:C:139:TRP:HA	2:C:154:GLN:O	2.15	0.47
2:B:211:ARG:HD3	2:B:225:PHE:CE1	2.50	0.47
2:B:71:ARG:CB	2:B:106:PRO:HD2	2.42	0.47
1:A:169:ASP:O	1:A:173:VAL:HG23	2.15	0.47
1:A:125:MET:HG2	3:A:240:HOH:O	2.15	0.47
2:B:151:ALA:HB3	2:B:233:LEU:HD23	1.95	0.46
2:B:204:VAL:HA	2:B:233:LEU:HD13	1.97	0.46
2:B:73:THR:O	2:B:76:TRP:HB3	2.15	0.46
2:C:113:SER:HB3	2:C:118:VAL:HG11	1.98	0.46
2:B:151:ALA:HB3	2:B:233:LEU:CD2	2.46	0.45
2:B:120:GLU:HG2	2:B:121:LYS:N	2.31	0.45
1:A:132:SER:HA	1:A:133:PRO:HD2	1.86	0.45

*Continued on next page...*



*Continued from previous page...*

Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:C:150:HIS:HA	2:C:202:LEU:O	2.16	0.45
2:B:39:ARG:HG3	2:B:130:GLN:HB3	1.99	0.45
2:C:67:PHE:HB3	2:C:80:TRP:HB3	1.99	0.45
2:C:176:LEU:HD23	2:C:197:VAL:HG11	2.00	0.44
2:B:180:GLU:HB2	2:B:183:GLU:HG3	1.98	0.44
2:C:112:THR:HG22	2:C:112:THR:O	2.18	0.44
2:B:216:GLN:HB3	2:B:221:ASN:ND2	2.22	0.44
2:C:113:SER:HB3	2:C:118:VAL:CG1	2.47	0.44
2:C:38:CYS:HA	2:C:47:SER:O	2.18	0.43
2:B:135:ILE:HG22	2:B:136:ALA:N	2.32	0.43
2:C:174:TYR:O	2:C:191:PRO:HA	2.19	0.43
2:C:150:HIS:HD2	3:C:241:HOH:O	2.01	0.43
2:C:216:GLN:CG	2:C:219:SER:HB3	2.49	0.43
2:B:149:ILE:HD12	2:C:143:ASN:ND2	2.33	0.43
1:A:61:PRO:HD2	1:A:176:PHE:CZ	2.53	0.43
2:C:215:LYS:HB2	2:C:222:TYR:CD1	2.54	0.42
2:C:133:PRO:HA	2:C:134:PRO:HD3	1.86	0.42
2:B:209:GLU:HA	2:B:229:LEU:O	2.19	0.42
2:C:70:ARG:HE	2:C:105:ILE:HD11	1.85	0.42
2:B:35:PHE:CZ	2:B:111:LEU:HB2	2.54	0.42
2:C:124:SER:OG	2:C:127:GLU:HG3	2.20	0.42
2:C:70:ARG:HB3	2:C:105:ILE:HD12	2.00	0.42
2:B:129:VAL:O	2:B:221:ASN:HB3	2.20	0.42
1:A:46:GLN:HA	2:B:76:TRP:HZ2	1.85	0.42
2:B:132:ASP:HB2	2:B:160:PRO:HB3	2.02	0.42
2:C:112:THR:HG23	2:C:115:GLY:C	2.40	0.41
2:B:192:ILE:HG22	2:B:194:THR:H	1.84	0.41
1:A:138:ILE:HA	1:A:138:ILE:HD12	1.83	0.41
2:B:33:PRO:HG2	2:B:64:ILE:CD1	2.50	0.41
2:C:213:ARG:HD3	2:C:225:PHE:CE1	2.55	0.41
2:B:209:GLU:HB2	2:B:228:VAL:HG11	2.03	0.41
2:B:147:THR:HG22	2:C:145:SER:HB3	2.01	0.41
2:B:43:ARG:HB3	2:B:169:TRP:HE1	1.86	0.41
2:B:222:TYR:HA	2:B:222:TYR:HD1	1.66	0.41
2:C:213:ARG:HD3	2:C:225:PHE:CZ	2.56	0.41
1:A:16:ARG:HB2	1:A:117:LEU:HD13	2.02	0.40
2:C:176:LEU:C	2:C:176:LEU:HD12	2.42	0.40
2:C:125:VAL:HG23	3:C:275:HOH:O	2.21	0.40
2:C:171:VAL:CG1	2:C:217:ARG:HG3	2.49	0.40
2:B:135:ILE:HD11	3:B:265:HOH:O	2.21	0.40

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 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	180/191 (94%)	166 (92%)	11 (6%)	3 (2%)	14	22
2	B	190/237 (80%)	167 (88%)	21 (11%)	2 (1%)	21	34
2	C	185/237 (78%)	165 (89%)	18 (10%)	2 (1%)	21	34
All	All	555/665 (84%)	498 (90%)	50 (9%)	7 (1%)	18	29

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	50	THR
2	C	71	ARG
2	B	222	TYR
2	B	77	THR
1	A	49	GLN
2	C	172	LEU
1	A	132	SER

### 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 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	156/176 (89%)	145 (93%)	11 (7%)	21	37
2	B	170/217 (78%)	159 (94%)	11 (6%)	24	42
2	C	166/217 (76%)	154 (93%)	12 (7%)	21	36
All	All	492/610 (81%)	458 (93%)	34 (7%)	22	39

All (34) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	THR
1	A	7	SER
1	A	9	LEU
1	A	11	ASP
1	A	21	HIS
1	A	23	LEU
1	A	87	LEU
1	A	93	LEU
1	A	113	LEU
1	A	127	ARG
1	A	167	ARG
2	B	37	LYS
2	B	42	GLU
2	B	109	ILE
2	B	137	LEU
2	B	138	ASN
2	B	185	LYS
2	B	199	VAL
2	B	205	ASP
2	B	211	ARG
2	B	221	ASN
2	B	222	TYR
2	C	42	GLU
2	C	51	THR
2	C	69	THR
2	C	111	LEU
2	C	114	ASN
2	C	143	ASN
2	C	166	GLN
2	C	170	MET
2	C	176	LEU
2	C	212	VAL
2	C	227	GLU
2	C	229	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	46	GLN
1	A	68	GLN
1	A	181	GLN
2	B	49	HIS
2	C	78	GLN

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
2	C	114	ASN
2	C	143	ASN
2	C	150	HIS

### 5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates 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.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers

EDS was not executed - this section will therefore be empty.