

HSP90 INTERACTORS

Chaperones and relatives

- Aha1 and its homolog Hch1
- Cdc37 (p50) and its relative Harc (= Cdc37L1)
- p23 (=Sba1)
- proteins with TPR motifs: Hop (=Sti1), FKBP52 (and high MW plant homologs), FKBP51, FKBP8 (=FKBP38), FKBP36 (=FKBP6), Plasmodium FKBP35, cyclophilin-40 (Cpr6 and Cpr7), PP5 (and yeast Ppt1), Tom70, probably also related Tom71=Tom72, XAP-2 (=AIP=ARA9), Cns1 and its Drosophila and human relatives Dpit47 and TTC4, CHIP, UNC45A (GC-UNC45) and UNC45B, She4, DnaJC7 (=Tpr2=mDj11=CCRP), CRN, WISp39 (=FKBPL), Tah1 (=Spaghetti=RPAP3), NASP, Toc64 and OM64, TPR1 (=Ttc1), SGT (=αSGT=SGTA), DYX1C1, AtTPR1, AtTPR2, AtTPR7, AIPL1, Tom34, Tetrahymena Coi12p
- CS-containing p23 relatives AARSD1, SGT1 (=SUGT1), RAR1, Siah-1-interacting protein (SIP), Chp1/CHORDC1/Morgana, B-ind1, melusin, NudC and NudCL2 (=Nudcd2)
- FNIP1, FNIP2
- Hsc70/Hsp70/Hsp72/DnaK
- Hsp60
- Human DnaJ homolog Hsj1b, cyanobacterial DnaJ2
- PhLP2A
- Pih1 (=Nop17) (mostly through Tah1)
- S100A1
- Sse1, Sse2
- Tel2-Tti1-Tti2 complex
- Toxoplasma Sis1-like

- valosin-containing protein (VCP)/p97
- GIGANTEA

Transcription factors

- 12(S)-HETE receptor
- AF9/MLLT3
- all vertebrate steroid receptors (GR, MR, ERα, ERβ, PR, AR)
- AGL24
- ATF3
- BBX
- BCL-6
- BES1
- BrZ7
- BZR1
- C20orf194
- CAR
- CEBPE
- CXXC1
- cytoplasmic v-erbA
- DLX6
- DMRTA1
- EcR
- FOXD4L6
- FOXM1
- FOXP2
- GTF2IRD2
- Hap1
- HMGA1, HMGA2
- HNF4A
- HP1BP3
- HSF-1
- HsfA1, HsfA2, HsfB1
- IRF2
- IRF3
- ISX
- LFY
- MAFG
- Mal63
- MAX
- Met1
- MKX
- mod(mdg4)
- Nanog
- NFIC
- NFRKB
- Notch1 (ICN1)
- NR1H3
- NR1I2

- Oct4
- p53
- p73
- PAS family members: Dioxin receptor (=AhR), Sim, HIF-1α, HIF-2α, HIF-3α
- PCGF6
- POGK
- PPARα, PPARβ, PPARγ
- PRDM1
- PREB
- PXR
- REV-ERBα
- SETDB1
- SIM2
- SLFN11
- SOC1
- Sp1
- SREBF1
- SREBP1
- SREBP2
- Stat2
- Stat3 (also in caveolin-1 complexes in rafts)
- Stat5
- SUP
- TADA2A
- TBX22
- TCF25
- TDP-43
- TEAD2
- TFDP3
- THAP4
- TonEBP/OREBP
- TRIM32
- Tup1
- Ure2
- USP1
- VDR
- water mold *Achlya* steroid (antheridiol) receptor
- WT1
- ZBED4
- ZBTB17
- ZBTB20
- ZC3H7B
- ZNF215
- ZNF509
- ZNF74

Kinases

- ACVR1B	- Death-associated kinases DAPK, DAPK2, DAPK3	- Lkb1
- ACVR1C	- DMPK	- LRRK2
- ACVR2B	- DYRK1B	- LYN
- Akt/PKB	- DYRK2	- MAP2K5
- AKT2	- DYRK4	- MAP2K7
- ALK	- eEF-2 kinase	- MAP3K12
- ALK1, ALK5	- EGF receptor (mutant and wt)	- MAP3K15
- ALPK1	- eIF2- α kinases HRI, Gcn2, Perk, PKR	- MAP3K2
- AMHR2	- Eml4-Alk	- MAP3K6
- AMPK α , AMPK γ	- EPHA1	- MAP3K9
- ASK1	- EphA2	- MAP4K1
- ATM	- EPHA4	- MAP4K2
- AURKC	- EPHB1	- MAP4K4
- Aurora B	- EPHB6	- MAPK15
- AXL	- ErbB2	- MAPK4
- Bcr-Abl	- ERBB3	- MAPK6
- BGLF4 of EBV	- ERBB4	- MAPK7
- BLK	- ERK5	- MAST2
- BMPR1A	- FASTK	- MATK
- BMX	- FGFR1	- MEK
- BTK	- FGFR3 and FGFR4	- MEKK1 and MEKK3
- c-Abl	- Flt3	- MERTK
- c-Kit	- FLT4	- MET
- c-Mos	- FOP2-FGFR1	- Mik1
- CAMK1G	- FRK	- MINK1
- CAMK2A	- Fused	- MLK3
- CAMK2B	- FYN	- MLKL
- CAMK2D	- Gal1	- MOK, MAK, MRK
- CAMK2G	- GRK2 and GRK6	- Mps1
- CAMK4	- GRK4	- mTOR
- CAMKK1	- GRK7	- MUSK
- CAMKK2	- GSK3A	- MYLK2
- CAMKV	- GSK3 β	- MYLK3
- casein kinase II α catalytic subunit	- HCK	- MYLK4
- Cdc2 (=Cdk1)	- HER3	- NEK11
- CDK11B	- HIPK4	- NEK8
- CDK14	- ICK	- NEK9
- CDK15	- INSRR	- NIK
- CDK18	- Insulin receptor	- NPM-AIk
- Cdk2, Cdk4, Cdk6, Cdk9, Cdk11	- Insulin-like growth factor 1 receptor	- NPR2
- CDK3	- Integrin-linked kinase	- NTRK1
- CheA (E. coli)	- IP6K2	- NTRK2
- Chk1	- IRAK-1	- NTRK3
- Cla4	- IRAK2	- NUAK2
- CLK2	- IRAK3	- Nucleophosmin-Anaplastic Lymphoma Kinase
- CLK3	- Irel α	- p38
- Cot = Tpl-2	- ITK	- p90RSK
- CSF1R	- I κ B kinases α , β , γ , ϵ	- PAK6
- CSNK1A1	- JAK1	- PASK
- DCLK2	- JNK	- PDGFRB
- DDR1	- KSR	- PDIK1L
- DDR2	- LATS1, LATS2	- PDK1
	- LCK	- PGK1
	- LIMK1	- PI4KII β
	- LIMK2	- Pim-1
		- PIM2
		- PIM3
		- Pink1

- PKC λ , PKC ϵ and other PKCs	- STK32C	- Axin 1
- PKM2	- STK38	- BALF5 of EBV
- PKN1	- STK38L	- Bcl-2
- PKN2	- STYK1	- Bcl-xL
- platelet-derived growth factor receptor α	- SYK	- Beclin 1
- PIk1	- TAK1	- Bid
- Pnck	- TAOK3	- BIN2
- pp60v-src, c-src	- TBK1	- BLM helicase
- PRKAA2	- TESK1	- Bms1
- PRKACB	- TESK2	- BPIFB4
- PRKCA	- TGF β receptors I and II	- BRAT1
- PRKCB	- TIE1	- BRCA1
- PRKCG	- TNK1	- BRCA2
- PRKCH	- TNK2	- BRMS1
- PRKCI	- TNNI3K	- BTRC
- PRKCQ	- TP53RK	- c-IAP1
- PRKCZ	- TrkA I and III	- calcineurin (Cna2; catalytic subunit)
- PRKD1	- TrkB	- calmodulin
- PRKD2	- TSSK1B	- calmodulin methyltransferase
- PRKDC	- TSSK2	- calpain-1
- PRKG2	- TSSK3	- calponin
- PRKX	- TSSK4	- CARM1
- PRKY	- TSSK6	- β -catenin
- PSKH1	- Tyk2	- CB2 cannabinoid receptor
- PSKH2	- TYRO3	- Ccp1
- PTK2	- Uik1	- CCDC117
- PTK2B	- VEGFR1, VEGFR2	- Cdc13
- PTK6	- Wee1, Swe1	- Cdc14
- PTK6	- WNK4	- Cdc25a and Cdc25c
- Raf-1, B-Raf, Ste11	- ZAP-70	- Cdk5 activator p35
- RET		- CFTR (nascent and mutant polypeptide)
- RET/PTC1		- CheZ (E. coli)
- RIP1		- Chronophin
- RIP3		- Cineole synthase 1
- Ron		- CLC-1 chloride channel
- ROR2		- CLC-2 chloride channel
- RPS6KA1		- Clostridium toxin CDT
- RPS6KA2		- Clostridium toxin iota
- RPS6KA3		- COG complex
- RPS6KA5		- CTA1
- RPS6KA6		- Ctf13/Skp1 component of
- RPS6KB1		- CBF3
- RPS6KC1		- CUL1
- RPS6KL1		- CUL2
- Ryk		- CUL3
- SGK-1		- CUL4A
- SGK2		- CUL4B
- SGK223		- Cup
- SGK3		- cyclin B
- Sit2		- cyclophilin D (mitochondrial)
- src related tyrosine kinases: fer, fes, fgr, fps, lck, yes		- Cyr1
- SRPK1		- cytoskeletal proteins: actin, tubulin (including ciliary β 4-tubulin), myosin (including Myo3B)
- SRPK3		
- SSCMK1		
- STK32B		
	Others	
	- Act1 (=TRAF3IP2)	
	- Adenosine A _{2A} receptor	
	- α _{2C} adrenergic receptor	
	- AID	
	- Aldo-keto reductase 1B10	
	- ANAPC2	
	- ANKMY2	
	- Annexin II	
	- ANP receptor	
	- ANP32C/D	
	- Apaf-1	
	- apoB	
	- APOBEC-3B, -3C, -3G	
	- ARD1	
	- Argonaute-1 (Ago1)	
	- Argonaute-2 (=Ago2=GERp95)	
	- Argonaute-4 (Ago4)	
	- ARMC5	
	- ASB17	
	- ASB2	
	- ASB3	
	- ASB4	
	- ASB6	
	- ATG8 (GABARAP) proteins	

- DBC2
- DEDD
- Dengue virus protein E
- DET1
- Diphtheria toxin A
- DNA helicase Ssl2
- DNA polymerase α
- DNA polymerase λ
- DNA polymerase η
- DnaA (E. coli)
- DNMT1
- Dsn1
- DTX4
- E6^AE7
- EBAX-1
- ENC1
- eNOS, nNOS (?)
- ether-a-gogo-related potassium channel (ERG = HERG = KCNH2)
- EZH2
- F1F0-ATP synthase
- FANCA
- FBXL12
- FBXL13
- FBXL14
- FBXL15
- FBXL18
- FBXL2
- FBXL3
- FBXL8
- FBXO10
- FBXO17
- FBXO18
- FBXO24
- FBXO25
- FBXO27
- FBXO28
- FBXO3
- FBXO34
- FBXO38
- FBXO4
- FBXO40
- FBXO6
- FBXO9
- FBXW11
- FBXW2
- FBXW5
- FBXW7
- FGAMS
- Fibronectin
- FliN, FliI (E. coli)
- FLIP_S and FLIP_L
- Folliculin
- free $\beta\gamma$ subunit of G protein
- G2E3
- GAN
- GLT-1
- glutathione S-transferase subunit 3 (KS type)
- Guanylate cyclase, soluble
- G α_0 , G α_{12}
- Glucocerebrosidase
- HAX-1
- HDAC1
- HDAC6
- HECTD3
- Hepatitis B virus core protein
- Hepatitis C virus protein NS3
- Hepatitis E virus capsid protein
- HERC4
- HERC6
- Histones H1, H2A, H2B, H3 and H4
- Hsp27
- Huntingtin
- Importin 4 (IPO4)
- Importin β 1
- Importin- α 6 (KPNA5)
- Inositol 1,4,5-trisphosphate receptor 3
- Integrin α 2
- Integrin α L
- IRS-2
- Japanese encephalitis virus E protein
- JlpA
- KAP1
- KAT5
- KBTBD4
- KBTBD7
- KCNA5
- KCNA6
- KCNG1
- KCNS3
- KCNQ4
- KCTD8
- KDM3A/JMJD1A
- KDM4B/JMJD2B
- KEAP1
- KIAA0317
- Kir6.2
- KLHL1
- KLHL10
- KLHL13
- KLHL14
- KLHL15
- KLHL22
- KLHL23
- KLHL25
- KLHL26
- KLHL29
- KLHL32
- KLHL34
- KLHL36
- KLHL38
- KLHL6
- knob complexes (in the membrane of Plasmodium-infected erythrocytes)
- KSHV K1
- KSR1
- KSR2
- L protein of HRSV
- LAMP-2A
- LANA of KS-HSV
- LAP
- LARP4B
- Legumain
- LGALS3BP
- LIS1
- LNX1
- LOC440248
- LOX1 (OLR1)
- LOXL2
- LRP1 (=CD91)
- LRSAM1
- macromolecular aminoacyl-tRNA synthetase complex
- Macrophage scavenger receptor
- MARCH9
- Mdm2
- MDM4
- Mg²⁺-dependent phosphatidate phosphohydrolase
- MIF
- misfolded VHL
- MMP2, MMP3, MMP9
- MRE11/Rad50/NBS1 (MRN) complex
- MRP1
- Msps/XMAP215/ch-TOG
- MTA1
- MTG8
- MUC1
- N-myc downstream-regulated gene 1 (NRDG1)
- N-WASP
- Na⁺-K⁺-Cl⁻ cotransporter 1
- NadA
- NB-LRR proteins: RPM1 and RPS2, Nod1, Nod2, NALP2, NALP3, NALP4, NALP12, IPAF, RPP4
- NCC
- NELF-E
- Neuropeptide Y
- NHE1
- NHLRC1
- Nibrin

- NMNAT2
- Norovirus capsid protein VP1
- Nox1, Nox2, Nox3, Nox5
- NS1
- Nsl1
- NSP3
- nsP3 and nsP4 of Chikungunya virus
- Nup62
- OGT
- OsCERK1
- P protein (rabies virus)
- P1 (picornaviral capsid precursor protein P1)
- p14ARF
- P2X₇ purinergic receptor p300
- P450 CYP2E1
- PARK2
- PARK7 (DJ-1)
- PB1 and PB2 subunits of influenza RNA pol.
- PCGF1
- PCGF3
- PCNA
- perilipin
- PfCRT
- PIDD
- Piwi
- PIWIL2
- PLN
- polysomal ribonuclease 1 (PMR1)
- PRMT5
- pro-Dcp1
- prolactin receptor
- prostacyclin synthase
- proteasome
- PRPF8
- PRPF19
- R-protein I-2
- R2TP complex through Pih1
- Rab-αGDI
- Rab3a
- Rab11a
- RAB40A
- Rac/Rop GTPase Rac1 (rice)
- Rac1
- Rad51
- Rad52
- RAG1
- Ral-binding protein 1 (RalBP1)
- RanBP9
- Rapsyn
- Raptor
- RCBTB1
- RCBTB2
- reovirus protein σ1
- REV1
- reverse transcriptase of hepatitis B virus
- RFWD3
- RGS11
- RGS6
- RGS7
- RGS9
- RHOBTB1
- ribosomal protein L2 (E. coli)
- ribosomal proteins S3 and S6
- ricin catalytic A chain
- RIG-I
- RNA-dep. RNA polymerase (of Bamboo mosaic virus)
- RNF10
- RNF111
- RNF19B
- RNF40
- Rnr4
- Rpb1
- SCAP
- SDF2
- SENP3
- SERCA2a
- SERT (SLC6A4)
- SF3B3
- SH3RF2
- Sicily
- SIR2 (SIR2RP1 in Leishmania)
- SKP2
- SKP2 complexes
- SMYD1, SMYD2, SMYD3
- snoRNP complexes
- SNRNP200
- SOCS6
- SPSB1
- SPSB3
- SREC-I
- SUR1 (subunit of β-cell ATP-sensitive potassium channel)
- survivin
- SV40 large T-antigen
- α-synuclein
- Tab2/3
- Tau protein
- Tax
- telomerase
- TFR1
- thiopurine S-methyltransferase
- thrombin receptor (PAR-1)
- thromboxane synthase
- TiIS
- TIR1
- Tissue plasminogen activator (tPA)
- Titin
- TLR4/MD-2 complex
- TLR7
- TLR9
- TNFAIP3
- TOM40
- TRIM10
- TRIM17
- TRIM2
- TRIM36
- TRIM37
- TRIM41
- TRIM49
- TRIM56
- TRIM7
- TRIM73
- TRIM74
- TRIM8
- Triosephosphate isomerase
- Trithorax (and ortholog MLL)
- Trx1
- TrxR
- Tyrosine hydroxylase
- UCH-L1
- UHRF1
- uPA
- Ura2
- URI complex
- Uroporphyrinogen decarboxylase (HemE) [in cyanobacteria]
- USP19
- Utp21
- Vaccinia core protein 4a vFLIP (of KSHV)
- Vimentin
- VIP1
- VPS18
- VPS41
- WASF3
- WSB2
- WWP1
- XPO1
- XPORT
- XRCC1
- ZEITLUPE

Notes:

- Only the cytosolic form of Hsp90 is considered.
- Clients from different species are all mixed together and the protein names are typically those of the original publication (i.e. not necessarily the official protein name).
- Only proteins are listed for which biochemical evidence for an interaction is available (i.e. geldanamycin effects alone are not considered as sufficient).
- more candidate interactors can be found in reports about proteomic approaches (Falsone et al. [2005] FEBS Lett. 579, 6350; Te et al. [2007] J. Proteome Res. 6, 1963; Caldas-Lopes et al. [2009] PNAS 106, 8368; Tsaytler et al. [2009] Cell Stress Chaperones 14, 629; Gong et al. [2009] Mol. Syst. Biol. 5, 275; Gano and Simon [2010] Mol. Cell. Proteomics 9, 255; Behrends et al. [2010] Nature 466, 68; Wang et al. [2010] Cancer Invest. 28, 635; Garcia-Descalzo et al. [2011] Cell Stress Chaperones 16, 203; Skarra et al. [2011] Proteomics 11, 1508, Moulik et al. [2011] Nat. Chem. Biol. 7, 818; Wu et al. [2012] Mol. Cell. Proteomics 11, M111 016675; Taipale et al. [2012] Cell 150, 987; Taipale et al. [2014] Cell 158, 434; Truman et al. [2015] J. Proteomics 112, 285), global analyses (e.g. Zhao et al. [2005] Cell 120, 715; Millson et al. [2005] Euk. Cell 4, 849; McClellan et al. [2007] Cell 131, 121; Franzosa et al. [2011] PLoS One 6, e28211; Sharma et al. [2012] Mol. Cell. Proteomics 11, M111 014654; Rizzolo et al. [2017] Cell Rep. 20, 2735), and in a pharmacological survey of kinases (Citri et al. [2006] J. Biol. Chem. 281, 14361; Haupt et al. [2012] BMC Cancer 12, 38).
- See **Hsp90Int.db** for the comprehensive (notably human) interactome built with data from public protein-protein interaction databases and the literature (Echeverría et al. [2011] PLoS One 6, e26044; and its associated database at <http://www.picard.ch/Hsp90Int>). Hsp90Int.db also uses exclusively the official NCBI names.
- Looking for references? See <https://www.picard.ch/downloads/Hsp90facts.pdf>.