

IV

CELLULAR PROTEINS

The following table is a summary of cellular proteins known or hypothesized to interact with or be affected by papillomaviruses. If we have overlooked any protein, we ask that this be brought to our attention. For simplicity, compendium references that discuss these involvements are given whenever possible. In some cases, a sequence is not known for the protein; in other cases, a sequence from an animal species is provided. In the table below, the page number and year columns refer to the page and the year of these HPV compendia on which the sequence appears.

Common Name	GenBank Acc. No.	Interaction	Page No.	Year	Ref.
16E1-BP		Protein that binds E1.			1
16K ATPase	J03835	16 kDa subunit of vacuolar ATPase binds to E5 of BVP-1 and some HPVs.	IV-4	95	2
AMF1		Cell protein that interacts with E2.			3
AP-1		Transcriptional regulator of HPV LCR. Interacts with E7.			4,5
bcl-2	M13994	Increased expression of this apoptotic protein in HPV persistent infection.	IV-2	95	6
b-myb		Gene expression activated by E7.			4
c-fos	K00650	Transcription factor upregulated in cells transfected with HPV16 E5. Enhanced by E7.			2,5
c-jun	X51346	Transcription factor upregulated by E5.			2
CKII	X70251	Protein kinase that phosphorylates E7 and E1 proteins. See also PKA, PKC, CKI, p34cdc2, DNA-dependent protein kinase.			1,5
c-myc	J00120	HPV sequences can integrate near the myc locus and disrupt the gene or its control. E7 abrogates TGF-beta repression of c-myc promoter.	IV-47	94	5
c-raf	U01337	Growth factor (Ser/Thr kinase) upregulated by E5.			2
cyclinA	M96390	Cyclin A and E2F form a complex with which E7 associates in S phase. Cyclin A gene is activated by E7.	IV-51	94	5
DCC	X76132	The DCC tumor suppressor gene has been found to be deleted or mutated in nude mice tumors derived from HPV-18 transformed cells.	IV-9	94	7
E6AP	L07557	Forms a complex (ubiquitin ligase) with E6 that then targets p53 degradation.	IV-5	95	8

Common Name	GenBank Acc. No.	Interaction	Page No.	Year	Ref.
E6BP	X78669	C-terminal portion of ERC-55 which binds to E6 in the absence of p53.	IV-6	95	8
E2F1	M96577	Cellular transcription factor that forms a complex with pRb. E7 proteins from high-risk viruses disrupt this complex. See also cyclin A.	IV-11	94	5
EGFR	X00588	Epidermal growth factor receptor activated by BPV E5.	IV-13	94	2
EPOC1	L14677	Transcriptional activator of E6 and E7 in high-risk viruses.	IV-2	96	4
erbB2	X03363	Increased expression in HPV-positive endometrial carcinomas. Forms a complex <i>in vitro</i> with E5.	IV-16	94	2
GR	M32284	Glucocorticoid receptor response elements (GRE) are found in the LCR of HPVs.	IV-52	94	4
hUBC9	U66818	Ubiquitin-conjugating enzyme that interacts with E1.			1
IGFR	X04434	A specific requirement for IGF-1R (insulin-like growth factor receptor) in E7-mediated transformation.	IV-8	95	9
junB	M29039	JunB binds AP-1 sites within the HPV LCR.	IV-54	94	10
keratin	J00124	Keratin filaments associate with E4 protein in some epithelial cells.			11
KGF	S81661	Keratinocyte growth factor reported to down-regulate HPV early genes.	IV-5	96	12
MAP kinase	L35253	Growth factor upregulated by E5.			2
MAP kinase kinase	L36870	Enzyme upregulated by E5.			2
MCP1	D26087	Monocyte chemoattractant protein repressed in HPV-18 positive cervical carcinoma cells; expression directly correlated with HPV-18 repression?	IV-22	94	13
MDM2	X58876	Interacts with p53.	IV-10	95	14
NF1	M57732	Nuclear factor 1 (transcription factor) binds HPV LCR.	IV-24	94	4
OCT1	L20433	Transcriptional regulator of HPV LCR.	IV-26	94	4
P12 ¹	L08432	An HTLV protein that resembles and cooperates with E5.	IV-6	96	2
p21cip1	U22398	Modulator of p53-mediated growth arrest. Binds to E7.			5

Common Name	GenBank Acc. No.	Interaction	Page No.	Year	Ref.
p27kip1	U10906	Cyclin-dependent kinase inhibitor binds to E7.			5
p34cdc2	X05360	Protein kinase that phosphorylates E1. See also PKA, PKC, CKI, CKII and DNA-dependent protein kinase.			1
p53	X02469	A tumor suppressor protein whose transcription and degradation are affected by E6. Transcription affected by E7.	IV-3	94	5,8
p107	L14812	An Rb-related pocket protein bound by E7. P107 is reported to regulate b-myb.	IV-56	94	5
p125	D21089	Protein that binds to E5 (repair protein?).			2
paxillin	U14588	Couples signal transduction to the cytoskeleton, interacts with E6.			3
PDGFR	J03278	Platelet derived growth factor receptor forms a complex <i>in vitro</i> with E5. See also erb-B2 and EGF.	IV-28	94	2
PEPB2	D26531	Transcription factor reported to bind second consensus E2 binding site in BPV4 LCR.	IV-7	96	15
pol α -primase	D17384	Attracted to the origin of replication by E1 helicase function.			1
PP2A	M60483,	Protein phosphatase 2A appears to be inactivated by HPV LCR expression.	IV-33	94	16
pRb	M26460	Retinoblastoma protein, an important "pocket protein" bound by E7.	IV-6	94	5
ras	M54968	Signal transducer that cooperates with RhPV1 E5 to transform rodent epithelial cells. C-ras expression upregulated by E5.			2
SP1	J03133	Transcriptional factor/enhancer. Binding sites in the LCR.			4
TBP	D30051	TATA binding protein interacts with E7 and with E2.			5,17
TEF	M63896	Transcriptional enhancer factor binds to LCR.	IV-39	94	4
telomerase	U86137	Stimulated by E6.			3
TGF β	X14149	Transforming growth factor beta, a growth suppressor inhibited by HPV.	IV-41	94	5
TNF α	M16441	Tumor necrosis factor alpha is transcriptional repressor of HPV LCR in weakly tumorigenic cell lines.	IV-42	94	18
YY1	M77698	"Yin and yang" 1, a transcriptional factor that interacts with the HPV LCR.	IV-45	94	4

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