HPV31

HPV31 mRNAs were investigated in CIN612 cells grown in monolayer cultures and in organotypic raft cultures treated with TPA or C8 (1-6). CIN612 cells contain extrachromosomal HPV31. Four promoters have been identified by primer extension, RNAse protection, and nuclease S1 and ExoVII analyses. P_{99} is active in both monolayer and organotypic raft cultures; P_{742} is active only in differentiated raft cultures (1). A promoter was also identified upstream of P_{99} with a start site at nt 77 (3). Although this promoter transcribes several late mRNAs, it also transcribes early mRNAs and has therefore been named P_{77} rather than PL (5). Finally, a smaller number of transcripts appear to be transcribed from a promoter at nt 3320 (P_{3320}) (3). No promoter could be identified in the E6 ORF (1).

Early region mRNAs: Species A–E are most likely transcribed from both P_{77} and P_{99}, with P_{99} contributing more mRNA than P_{77}. Species F is transcribed from P_{742}. There is a polyadenylation signal at nt 4138–4143. However, early mRNAs have been shown to be polyadenylated upstream of this signal between nt 4099 and 4125 (1).

HPV31 Late region mRNAs: The structures of the late region mRNAs on the facing page were determined by RT PCR, cloning, and sequencing (2,3). S1 and exoVII analyses demonstrated that mRNAs with the same basic structure were transcribed from at least three different promoters: P_{77} (and possibly P_{99}), P_{742}, and P_{3320}. The reason for the extreme diversity of late region mRNAs is not known. However, it is possible that some species represent nuclear splicing intermediates or the products of aberrant splicing and are not biologically relevant. The exact sites of polyadenylation at the late poly(A) site were not determined in these studies, but a putative polyadenylation signal exists at nt 7227.

1. **Hummel, M., J. B. Hudson, and L. A. Laimins**. 1992. Differentiation-induced and constitutive transcription of human papillomavirus type 31b in cell lines containing viral episomes. J.Virol. **66**:6070-6080.
2. **Hummel, M., H. B. Lim, and L. A. Laimins**. 1995. Human papillomavirus type 31b late gene expression is regulated through protein kinase C-mediated changes in RNA processing. J.Virol. **69**:3381-3388.
3. **Ozbun, M. A. and C. Meyers**. 1997. Characterization of late gene transcripts expressed during vegetative replication of human papillomavirus type 31b. J.Virol. **71**:5161-5172.
4. **Ozbun, M. A. and C. Meyers**. 1998. Human papillomavirus type 31b E1 and E2 transcript expression correlates with vegetative viral genome amplification. Virology **248**:218-230.
5. **Ozbun, M. A. and C. Meyers**. 1998. Temporal usage of multiple promoters during the life cycle of human papillomavirus type 31b. J.Virol. **72**:2715-2722.
6. **Ozbun, M. A. and C. Meyers**. 1999. Two novel promoters in the upstream regulatory region of human papillomavirus type 31b are negatively regulated by epithelial differentiation. J.Virol. **73**:3505-3510.

Extracted from:

Maps of Papillomavirus mRNA Transcripts
1995, 1996 and 1997 LANL Human Papillomavirus Database

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