

Viruses and cancer: papilloma, hepatitis, epstein-barr and rous-sarcoma virus

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Human papilloma virus (HPV)

Human papillomaviruses (HPVs) are small circular, double-stranded DNA viruses infecting epithelial tissues. HPV is a virus from the papillomavirus family that affects human skin and the moist membranes that line the body, such as the throat, mouth, feet, fingers, nails, anus and cervix. The HPV 16 and 18 strains, which are known to cause nearly all cases of cervical cancer, also raise the risk of developing oropharyngeal (throat) cancer. HPV gains access to basal cells through microabrasions or by infecting the transformation zone, an abrupt transition from a columnar to a squamous epithelium¹. Infected cells actively express the early genes E1, E2, E4 and E5. Viral oncoproteins E6 and E7 are expressed in limited amounts due to transcriptional repression exerted by E2. Infected basal cells migrate to the lumen as they differentiate; differentiated epithelial cells express the late capsid genes L1 and L2. (Fig. 1).

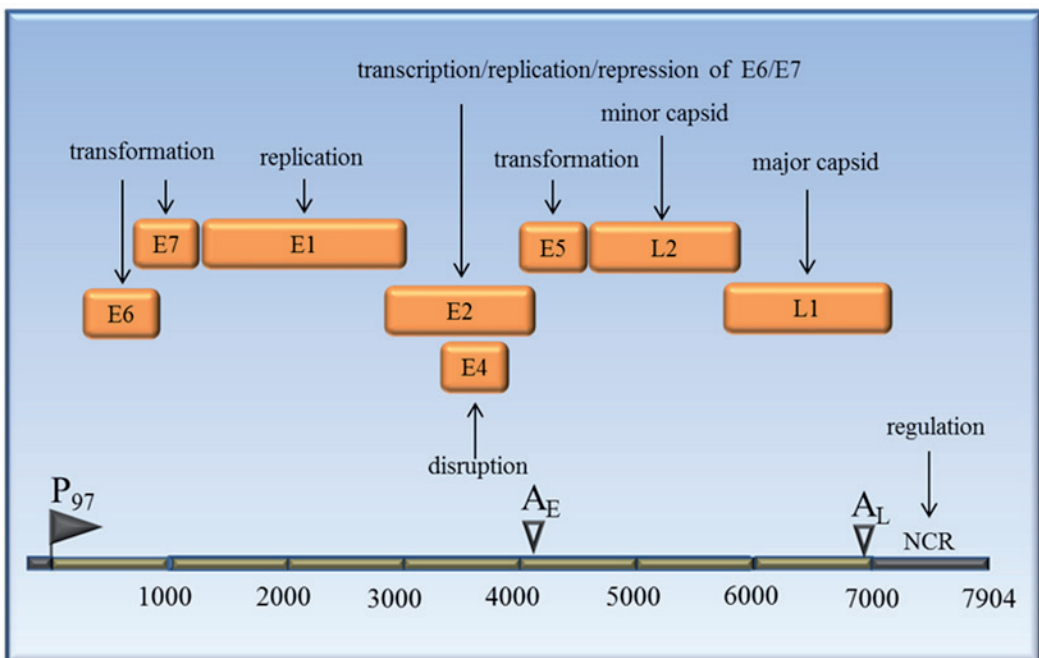


Fig. 1: Genomic organization of the human papillomavirus type 16. ORFs deduced from the DNA sequence are designated E1 to E7, and L1 and L2. The non-coding region (NCR, also known as a long control region) is also shown. A_E and A_L indicate early and late polyadenylation sites²

Hepatitis viruses that cause cancer

Hepatitis B virus (HBV), a member of the hepadnavirus group, double-stranded DNA viruses which replicate, unusually, by reverse transcription. Hepatitis B virus is endemic in the human population and hyperendemic in many parts of the world. A number of variants of this virus have been described. Hepatitis C virus (HCV), is an enveloped single-stranded RNA virus which appears to be distantly related to flaviviruses. Several genotypes have been identified. Infection with this more recently identified virus is common in many countries. Hepatitis C virus is associated with chronic liver disease and also with primary liver cancer in some countries.

Epstein-barr virus (EBV)

The Epstein–Barr virus (EBV), also called human herpesvirus 4 (HHV-4), is a virus of the herpes family, double-stranded DNA virus, and is one of the most common viruses in humans. It is best known as the cause of infectious mononucleosis (glandular fever). It is also associated with particular forms of cancer, such as Hodgkin's lymphoma, Burkitt's lymphoma, nasopharyngeal carcinoma. Infection with EBV occurs by the oral transfer of saliva and genital secretions. EBV infects B cells of the immune system and epithelial cells. Once the virus's initial lytic infection is brought under control, EBV latently persists in the individual's B cells for the rest of the individual's life.

Rous sarcoma virus (RSV)

The RSV is an avian sarcoma leukosis virus. As soon as RSV infects a cell, its reverse transcriptase synthesizes DNA copies of its genome. These enter the nucleus of the cell and insert themselves randomly throughout the DNA of the host's chromosomes. Normal gene transcription within the nucleus now produces an RSV messenger RNA (mRNA) that reenters the cytoplasm. Some copies of this mRNA are then translated by the normal machinery (e.g., ribosomes) of the host cell into protein products. Other copies of the RNA become incorporated into new virus particles. The Rous sarcoma

virus has only 4 genes : gag, which encodes the capsid protein; pol, which encodes the reverse transcriptase; env, which encodes the envelope protein; src, which encodes a tyrosine kinase, an enzyme that attaches phosphate groups to Tyr residues on a variety of host cell proteins. What makes RSV oncogenic? The answer is *src*. The expression of this gene in some way — still only dimly understood — is able to transform cells in culture.

Acknowledgment

Financial support from the project Liga proti rakovine Praha 16002/2013-981 is highly acknowledged.

The authors declare they have no potential conflicts of interests concerning drugs, products, services or another research outputs in this study.

The Editorial Board declares that the manuscript met the ICMJE „uniform requirements“ for biomedical papers.

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