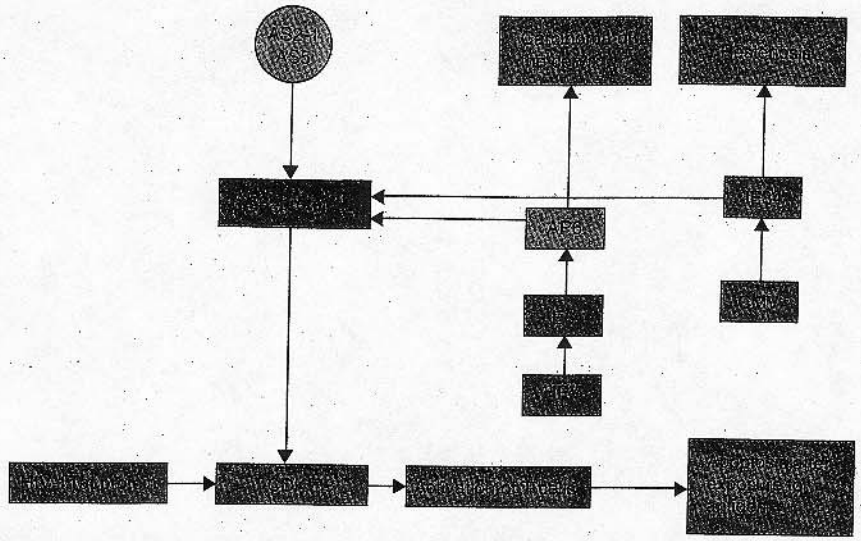

Fig. 3. Antiviral activity of antineoplastons. Tat protein induces T-cell apoptosis through activation of CDK, which is blocked by p53 protein. Protein E6 produced by HPV attaches to AP6 and causes inactivation of p53 leading to carcinoma of the uterine cervix. Inactivation of p53 protein by CMV-IE84 may lead to restenosis. AS2-1 and AS5 may activate the gene for p53 by inhibiting methylation. *Abbreviations:* see Glossary.

tion, healing is promoted through increased epidermisation.[125,126] Patients older than 90 years have taken A10 and AS2-1 without adverse reactions. However, it should be stressed that antineoplastons are investigational agents.

Tissue culture and preliminary clinical data indicate optimistic prospects in the treatment of cancers of the pancreas, ovary, liver and kidneys.[88,105,132,162,163] Antineoplastons currently in development may help patients who failed to respond to treatment with A10, A10-1, and AS2-1. Since the early 1980s, BRI has not used AS5, however, extensive clinical trials are still conducted at the NCI.[119,128] AS5 is rapidly and almost completely metabolised in the liver.[164] AS2-1 offers a better chance of successful treatment, because one of its components inhibits the enzyme which conjugates AS5. Laboratory data coming from a few centres confirm preventive activity of A10 against breast, lung, and liver cancer in animals.[82,83,87,93,165-167] Limited data in the treatment of autoimmune diseases and PD give hope for better therapies for these difficult to treat disorders, but much more extensive clinical experimentation is necessary.

Known antineoplastons have a surprisingly simple structure. As indicated by Broder, Karp and Samid, AS5 has multifunctional activity linking oncology with cardiology.[102,106,108,168] Laboratory testing by the FDA and the Kurume University School of Medicine along with limited clinical trial data indicate the antiviral activity of AS2-1 and AS5 (fig. 3).[169-173] A recent study by the team from the Dana-Farber Cancer Institute, Boston, USA, explains the possible mechanism of action of AS2-1 and AS5 against HIV-1.[174] Two mechanisms of action of antineoplastons; regulation of methylation and detoxification, link this field with 2 important theories of aging.[29,175] It should be realised that in spite of exciting laboratory and clinical results, more extensive research is necessary to determine the place of antineoplastons in the diseases of old age.

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