

as well as experimental evidence seems to favor the viewpoint that solar radiation accelerates the development of tar and pitch cancers, but is not an essential factor (Büngeler).

Bayet advanced the theory that arsenic in tar was the actual carcinogenic agent. As tar cancers and arsenic cancers of the skin exhibit a different type of local distribution, and as the relative content of arsenic in various types of tar has no relation to the carcinogenic potency, this theory was abandoned. Recently Hammett proposed, in connection with his hypothesis of the sulfhydryl action on the induction of benign and malignant cell proliferation, that carcinogenic action of tars was attributable to their content of mercaptans and sulfides, which were said to promote the regenerative processes beyond repair. Subsequent observations of Hammett and Reimann have demonstrated that sulfhydryl substances neutralize the action of chemical carcinogens. Hueper has pointed out that the factual basis for Hammett's theory was defective, and contrary to well-established, biological observations on the nature of growth-promoting factors. Consequently, this theory has not found any supporters. Bloch has noted already that the carcinogenic constituents of tar do not contain nitrogen, sulfur, or arsenic.

The most recent hypothesis as to the causative mechanism of tar cancer has been elaborated by Rous. He contended that tar papillomas proper produced in rabbits are so different from other responses to tar, that they imply the action of a differing, specific cause (virus), especially since these neoplasms resemble morphologically those produced by the papilloma virus in rabbits.

These conceptions are based upon the following evidence. When the papilloma virus (Shope) was injected intravenously into rabbits whose ears had been tarred previously for 1.5 to 3 months, there developed rapidly a large number of papillomas and a few squamous-cell carcinomas in the tarred area. The tarred ears of control rabbits, which had been tarred only, showed merely warts, which receded spontaneously later. The investigators concluded that the virus activated the tar warts, determined the site of the papillomatous responses, and intensified the neoplastic results of tarring by causing the development of a great variety of benign and malignant tumors.

Rous and Kidd claimed that different types of cellular changes observed are produced by an action of tar upon epidermal cells, and do not reflect differences in the potentialities of the virus. This is because the neoplasms in tarred animals develop from focal or punctate, cellular anomalies, the biological character of which is fixed from the start. Rous has advanced from these and other observations the hypothesis, that tar activates a carcinogenic virus, previously present in a dormant state in the cells with which tar may come in contact. Thus, an ubiquitary virus represents the general, direct cause of tar cancer, while the chemical agent determines only the time and site of the activity of the virus. While such speculations are interesting and thought-