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Cell Hydration as the Primary Factor in Carcinogenesis: A Unifying Concept

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Abstract

The paper discusses the unifying concept that cell hydration is the primary factor in the mechanism of carcinogenesis. The concept includes the following hypotheses: (1) Increased cell hydration causes cancer not only by promoting cell division and oncogene expression, but also by inactivating genes inducing cell differentiation, and by preventing apoptosis. Conversely, factors that reduce cell hydration prevent cancer by inhibiting cell division and oncogene expression, while activating genes inducing cell differentiation, and by promoting apoptosis. The unique ability of cell hydration to have these opposite effects on cell behavior and gene expression can account for its postulated role as the primary factor in both the promotion and prevention of cancer. (2) A progressive increase in cell hydration, induced by successive mutations and/or epigenetic changes, is the basic mechanism of multi-step carcinogenesis, the degree of malignancy increasing with the degree of cell hydration. (3) The increased hydration of cancer cells accelerates their respiration rate, thereby enhancing their ability to compete for nutrients with their normal counterparts. This effect may play a major role in promoting tumor growth and in the postulated mechanism of multi-step carcinogenesis. (4) Increased cell hydration is also proposed as an alternative or additional explanation of the carcinogenetic effect of inflammatory agents and of hormones. A survey of the literature provides evidence consistent with these hypotheses, but suggestions are included for further investigations to test their validity and their implications. From a clinical perspective, the abnormally high water content of cancer cells permits the use of microwave technology for tumor detection and treatment. Also of considerable therapeutic significance is the increased sensitivity of cancer cells to desiccation, postulated to result from genetic changes induced by increased hydration. This may well be the achilles heel of cancer, and recent investigations indicate that it may be exploited very effectively in the treatment of the disease. In conclusion, I suggest that the need for studies on the molecular biology of cancer to be supplemented by more information on environmental effects on gene expression and on the biochemical and physiological factors that mediate genetic effects at the cellular level. This approach might also be used to assess the validity of the postulated role of cell hydration as a factor of particular significance.

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