

Melatonin-Depleted Blood from Premenopausal Women Exposed to Light at Night Stimulates Growth of Human Breast Cancer Xenografts in Nude Rats

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Abstract

The increased breast cancer risk in female night shift workers has been postulated to result from the suppression of pineal melatonin production by exposure to light at night. Exposure of rats bearing rat hepatomas or human breast cancer xenografts to increasing intensities of white fluorescent light during each 12-hour dark phase (0-345 $\mu\text{W}/\text{cm}^2$) resulted in a dose-dependent suppression of nocturnal melatonin blood levels and a stimulation of tumor growth and linoleic acid uptake/metabolism to the mitogenic molecule 13-hydroxyoctadecadienoic acid. Venous blood samples were collected from healthy, premenopausal female volunteers during either the daytime, nighttime, or nighttime following 90 minutes of ocular bright, white fluorescent light exposure at 580 $\mu\text{W}/\text{cm}^2$ (i.e., 2,800 lx). Compared with tumors perfused with daytime collected melatonin-deficient blood, human breast cancer xenografts and rat hepatomas perfused *in situ*, with nocturnal, physiologically melatonin-rich blood collected during the night, exhibited markedly suppressed proliferative activity and linoleic acid uptake/metabolism. Tumors perfused with melatonin-deficient blood collected following ocular exposure to light at night exhibited the daytime pattern of high tumor proliferative activity. These results are the first to show that the tumor growth response to exposure to light during darkness is intensity dependent and that the human nocturnal, circadian melatonin signal not only inhibits human breast cancer growth but that this effect is extinguished by short-term ocular exposure to bright, white light at night. These mechanistic studies are the first to provide a rational biological explanation for the increased breast cancer risk in female night shift workers.

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