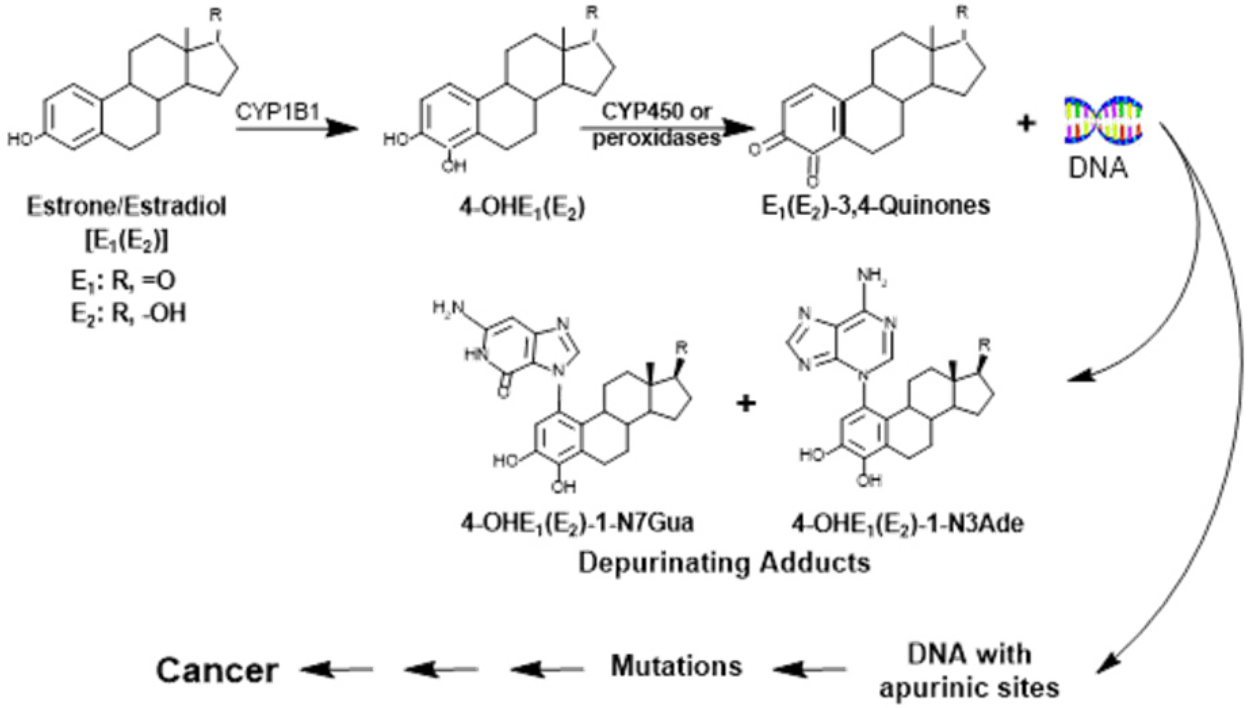
How cancer begins and how to prevent it

Cancer is a problem of chemical carcinogenesis. This means that chemicals are involved in the processes leading to cancer. Knowledge of how certain molecules work is, therefore, essential for understanding how cancer begins. The chemicals that cause much of human cancer are the estrogens, which can cause cancer when dangerous estrogen metabolites are produced.

In over 40 years of research on how cancer begins and how to prevent it, we have found that many prevalent types of cancer start by a common mechanism. All of us, men and women, have estrogens in our body. Cancer begins because of increased formation of dangerous estrogen metabolites called quinones. If the balance of estrogen metabolism tips toward formation of these dangerous estrogen quinones at significant levels, DNA is damaged and cancer-causing mutations occur.



As seen in the figure, the estrogens estrone and estradiol can be converted to the dangerous estrogen quinones that react with DNA, forming estrogen-DNA adducts and leaving gaps, called apurinic sites, in the DNA. The apurinic sites generate the cancer-causing mutations. This is how the cancer process begins. Subsequently, a variety of factors determine which type of cancer develops. Since the first step in many prevalent types of cancer is the same, we can prevent these cancers by inhibiting the initial step.

We have developed an assay for these estrogen-DNA adducts that predicts which people are at high risk for developing cancer. We have demonstrated this so far for five types of cancer – breast, ovarian and thyroid cancer in women, and prostate cancer and non-Hodgkin lymphoma in men. We think that other prevalent types of cancer, such as pancreas, kidney and brain cancer, etc., begin in the same way.

High levels of estrogen-DNA adducts are observed not only in women diagnosed with breast cancer but also in women considered to be at high risk for developing breast cancer. This finding shows that formation of high levels of estrogen-DNA adducts is a critical factor leading to the development of cancer.

In addition, we have discovered a combination of dietary supplements, *N*-acetylcysteine and resveratrol, that reduces formation of estrogen-DNA adducts. Through different chemical and biochemical mechanisms, *N*-acetylcysteine and resveratrol reduce the formation of estrogen quinones and block the reaction of the quinones with DNA, thus inhibiting formation of the estrogen-DNA adducts. Various types of studies have shown that these two supplements inhibit both formation of estrogen-DNA adducts and the transformation of normal cells into cancer cells.

By understanding the role of estrogen-DNA adducts in how cancer begins, we know that minimizing formation of these adducts is the way to prevent cancer. Importantly, our approach to preventing cancer would in short order reduce the number of new people afflicted with this dreaded illness. Thus, cancer prevention is a reality and should be started today.

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