

(75) in patients with colorectal cancer. On the other hand, lymphocytes infiltrating the gut, on a chronic basis, can cause colorectal cancer. This untoward effect of lymphocytes has been extensively documented in diseases of chronic inflammation, such as Crohn's disease and ulcerative colitis (76,77). Inflammatory bowel disease (Crohn's disease; ulcerative colitis) must exist for at least 7 years before the risk of colorectal cancer increases. Toxic oxygen produced by infiltrating lymphocytes and neutrophils induces the mutations found in cells of the gut, where these mutations occur in oncogenes such as p53, KRAS, and adenomatous polyposis coli (APC) (78,79). The end-result of accumulated mutations in the relevant oncogenes is colorectal cancer (80).

It might also be pointed out that patients with Crohn's disease and ulcerative colitis have elevated C-reactive protein (CRP). About 75% of Crohn's disease patients have elevated CRP, while 30% of ulcerative colitis patients have increased CRP (81). CRP, which is detailed at the end of this chapter, finds use as a biomarker.

## II. MICROARRAYS

Microarrays are a tool for measuring large numbers of different biomarkers, for example about 50 to 5,000 different genes, at the same time. In using a microarray, expression levels of genes can be measured by techniques that employ hybridization.

A DNA microarray takes the form of a solid support, such as a glass slide, silicon chip, or nylon membrane, on which single stranded DNA (ssDNA) is attached (82). Typically, the slide or chip is divided into hundreds or thousands of different regions, where ssDNA, corresponding to a particular gene of interest, is attached to each individual region. The microarray can even contain ssDNA corresponding to every single gene in the human genome, about 50,000 genes. With a tissue biopsy, or with collected lymphocytes, the researchers first isolate the messenger RNA (mRNA), and use standard techniques for generating single stranded cDNA (complementary DNA). The cDNA is modified by attaching a fluorescent dye. This is followed by hybridizing

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