

How DNA Microarrays Work

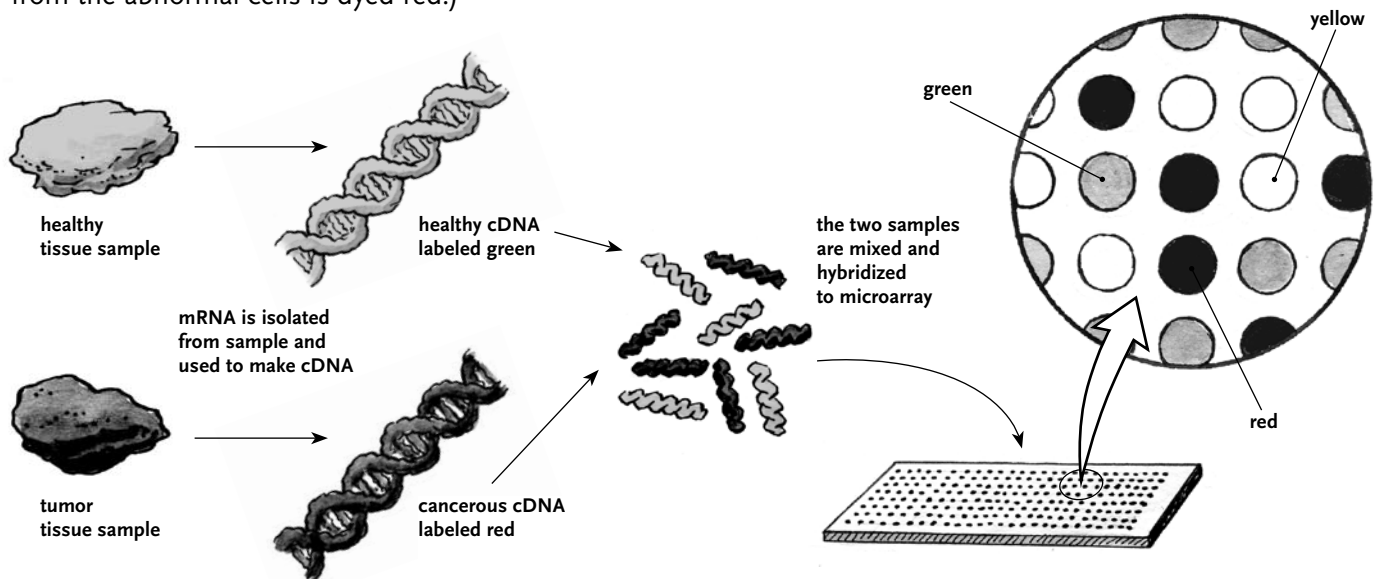
In each type of cell, like a muscle cell or a skin cell, different genes are expressed (turned on) or silenced (turned off). If the cells that are turned on mutate, they could—depending on what role they play in the cell—trigger the cell to become abnormal and divide uncontrollably, causing cancer.

By identifying which genes in the cancer cells are working abnormally, doctors can better diagnose and treat cancer. One way they do this is to use a DNA microarray to determine the expression levels of genes. When a gene is expressed in a cell, it generates messenger RNA (mRNA). Overexpressed genes generate more mRNA than underexpressed genes. This can be detected on the microarray.

The first step in using a microarray is to collect healthy and cancerous tissue samples from the patient. This way, doctors can look at what genes are turned on and off in the healthy cells compared to the cancerous cells. Once the tissues samples are obtained, the messenger RNA (mRNA) is isolated from the samples. The mRNA is color-coded with fluorescent tags and used to make a DNA copy (the mRNA from the healthy cells is dyed green; the mRNA from the abnormal cells is dyed red.)

The DNA copy that is made, called complementary DNA (cDNA), is then applied to the microarray. The cDNA binds to complementary base pairs in each of the spots on the array, a process known as hybridization. Based on how the DNA binds together, each spot will appear red, green, or yellow (a combination of red and green) when scanned with a laser.

- A red spot indicates that that gene was strongly expressed in cancer cells. (In your experiment these spots will be dark pink.)
- A green spot indicates that that gene was strongly repressed in cancer cells. (In your experiment these spots will be light pink.)
- If a spot turns yellow, it means that that gene was neither strongly expressed nor strongly repressed in cancer cells. (In your experiment these spots will be clear.)
- A black spot indicates that none of the patient's cDNA has bonded to the DNA in the gene located in that spot. This indicates that the gene is inactive. (All of the genes in your experiment are active.)



A microarray is an orderly arrangement of rows and columns on a surface like a glass slide. Each of the spots on an array contains single-stranded DNA molecules that correspond to a single gene. An array can contain a few, or thousands, of genes.