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|  | Introduction    When we think of a disease, most of us imagine a nasty virus or bacterium, something that is an outside force. But in fact, one of the most frightening diseases is caused within our own cells. Cancer is a terrifying disease because, essentially, it is a disease of the body attacking itself. It is mysterious, insidious, and can strike seemingly randomly at any time. The human genome controls the cellular make-up of our bodies, and the genome has the answer to what causes cancer.    According to The National Cancer Institute, "all cancer arises from the accumulation of genetic changes within a cell." In the fight against cancer, the ability to study the genetic profile of a cell during cancer development is a key step to advances in cancer prevention, early detection, diagnosis, and finding new drugs to cure cancer. The goal is to identify precisely what is different between a normal cell and a cancer cell and to follow the genetic changes that make a normal cell turn into a cancerous one. Eventually, by knowing the molecular differences among tumors, we can determine which tumors will respond to therapy, and if so, which therapies they respond to, and whether a tumor will metastasize or not. The National Cancer Institute (NCI) has established the Cancer Genome Anatomy Project (CGAP), a program with a goal to "achieve the comprehensive molecular characterization of normal, precancerous, and malignant cells." In order to accomplish this, CGAP is establishing an index of all genes that are expressed in tumors (In Silico Analysis of cancer through the Cancer Genome Anatomy Project, by Strausberg).    CGAP has made sure that all project resources, data, informatics tools, and technology would be immediately accessible to the entire research community. This has helped me greatly in finding resources and information for my project. My research project studies the source of cancer: the genes that are involved with the formation of cancer cells. Using CGAP, I am researching genes that play an important role in breast cancer. The question of my project is: Do chromosome aberrations give rise to differentially expressed genes in cancer?  For such a difficult question to be answered, a basic understanding of cancer is needed. Certain genes regulate cell growth and division, and if one of these genes is mutated, the cell will not be able to regulate its growth and division, leading to cancer. A gene mutation may be spontaneous, or caused by environmental influences such as, X-rays, viruses or chemical carcinogens.    Here is an example of how cancer may start from a carcinogen. Carcinogenic substances are breathed into lungs usually. They also can enter in food and by absorption through the skin. Carcinogens, however, do not in their original form cause cancer. They must undergo a molecular modification inside a human cell before acquiring cancer causing ability. This process is called activation. A set of enzymes that use cells to detoxify alien substances converts them to a form that can be excreted in urine. Harry Gelboin of the National Cancer Institute has found, however, that some people have enzymes that change carcinogenic molecules the wrong way. The carcinogens are altered so that they can easily enter the cell’s nucleus and bind to DNA. This is the first step to a cancer causing mutation. The cells still have a natural line of defense – a DNA repair mechanism. Special molecules in the nucleus are able to detect abnormalities such as alien molecules attached to the DNA. The enzymes cut out the damaged DNA and allow the DNA to be repaired with new nucleotides. The double helix of DNA allows one strand to serve as a template for the damaged strand. If DNA repair occurs before the cell undergoes its next division into daughter cells, there will be no cancer. If the cell does divides before it is repaired, the portion of the genetic message that is bound to by a carcinogen may be copied abnormally. The daughter cells inherit a gene with a mutation, which cannot be repaired because now the genetic message is hidden within the molecularly normal DNA. There are 30,000 genes in a cell, so it is very likely that a bound carcinogen will bind to a gene that has nothing to do with cancer. However, if the carcinogen has bonded to a gene that controls cell division, cell growth, or any important characteristic that protects tissue from tumors, then cancer is likely to occur. These genes are called proto-oncogenes, which mean that if they are mutated they have the potential to cause cancer. (Cancer: The New Synthesis, by Boyce Resberger)  <[Next](http://docs.google.com/intro2.html)> |
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