



WHAT IS CANCER **SU2C + AACR**

Cancer is the end result of a series of enduring mistakes, known as mutations, made by cells during the normal process of cell division that continually replaces aging cells.

Normal cells reproduce and die off to make room for new, healthy cells in a process called senescence that happens millions of times a day, often without our notice. But this normal process goes awry in cancer. The first mistake often makes it more likely that there will be a second mistake; that mistake makes the situation even more unstable, increasing the likelihood of a third mistake; and so on.

The body has a defense against this downward slide of accumulating errors: cells have "spellcheckers" that look for these mutations and, if errors are detected, can stop cell division. If the damage cannot be repaired, the cell puts out a signal for the immune system to kill it, or the cell simply commits suicide in a process known as apoptosis.

However, if a cell accumulates enough mutations without being eliminated through apoptosis, then that cell and all of its descendants can become malignant and immortal. These cells continue to grow in an unregulated fashion locally, then spread and invade distant parts of the body, disrupting normal body functions and devastating healthy tissue.

Ironically, cancer cells use normal cellular machinery involved in wound healing, embryonic development, and normal growth to carry out these very abnormal and destructive behaviors. When a normal gene is inappropriately activated by a malignant cell to support cancer cell growth, this gene is called an oncogene. This "hijacking" of normal cell functions by cancer makes targeting and killing cancer cells while sparing healthy ones a difficult challenge. Targeting cancer cells is a major focus of current cancer research.

Cancer develops when the balance between accumulating genetic mutations and the safeguards built into cells to defend against and repair the resulting damage is upset. The genes that a cell activates in this surveillance-and-repair process are called tumor suppressor genes. The workings of this balance are reflected in the epidemiology of cancer in human populations. Things that tip the balance in favor of the wayward cell completing its transformation into malignancy increase one's risk of developing cancer.

For example, hormones increase cell division and growth in some tissues. But the more times a cell divides, the greater the chance for a mistake which can lead to cancer. A recent study showed a sharp decline in breast cancer rates in women from 2002 to 2003, which the researchers attributed to reduced use of hormone supplements to treat the symptoms of menopause.

Smoking, exposure to radiation and exposure to certain chemicals increases the likelihood of the cell making a mistake on the next division. Exposure to these known carcinogens has been associated with increased risk of leukemia, lymphoma (lymph node cancer), lung cancer, melanoma and bladder cancer.

Defects in the immune system - either hereditary, acquired through diseases such as HIV infection, or caused by medical treatments given to suppress immunity - can lead to lymphoma and other cancers.

Lastly, hereditary deficiencies in the genetic machinery involved in mutation repair can lead to cancer. For example, mutations in the BRCA mutation repair gene have been linked to breast and ovarian cancer.

Imagine cancer as a broken light switch, with the light permanently stuck in the "on" position when it should be turned off. This can happen to anyone, anytime, but it is more likely to happen if you repeatedly turn the light switch on and off (as in the hormone supplement example), use a hammer to turn the light on and off (via exposure to a carcinogen), or lose your screwdriver so you can't fix the switch when it breaks (as when the body's immune system or mutation-repair machinery are not working properly).

Simply put, cancer is the uncontrolled growth of cells. Often these cells spread beyond the site in which they initially arose to invade and damage distant organs. Cancer is a group of devastating diseases that are relatively common and share this fundamental property.

What Is Cancer was written with the help of [ACCR](#) the world's oldest and largest professional organization dedicated to advancing cancer research. The membership includes nearly 27,000 basic, translational, and clinical researchers; health care professionals; and cancer survivors and advocates in the United States and more than 70 other countries.

***** www.standup2cancer.org/magazine