

Name:	Chemistry ♦ Life Science ♦ Earth & Space Science
The Chemistry of Cancer	53

Directions: Read the text below, then answer the text-dependent questions that follow.

Cancer is a disease that affects millions of people around the world. It occurs when cells in the body begin to grow and divide uncontrollably, ignoring the body's natural signals to stop. Normal cells grow, divide, and eventually die in an organized way as part of the body's routine maintenance. Cancer cells, however, do not follow this pattern. Instead, they keep growing and divide more rapidly than normal cells. Over time, they form lumps called tumors. Some tumors are benign, meaning they are harmless and do not spread. However, malignant tumors are dangerous because they invade nearby tissues and can spread to other parts of the body through the blood and lymphatic systems in a process called metastasis. Metastatic cancer is often harder to treat and can affect multiple organs.

At the chemical level, cancer is caused by damage to DNA, the molecule that carries genetic instructions for all living things. DNA is made up of a sequence of chemical bases that form a unique code for each person. When DNA is healthy, it tells cells when to grow, divide, and die. However, when DNA becomes damaged, this code can be altered, leading to errors called mutations. These mutations may occur naturally when cells divide, but they can also be triggered by harmful factors such as smoking, exposure to ultraviolet (UV) radiation from the sun, certain toxic chemicals, or even viruses like human papillomavirus (HPV). Some mutations may have little effect, but others can cause cells to grow uncontrollably, leading to cancer.

One reason cancer is so difficult to treat is that cancer cells are similar to normal cells. Chemotherapy, a common cancer treatment, uses chemicals to kill fast-growing cells. However, chemotherapy can harm healthy cells that also grow quickly, like hair and stomach cells. This is why cancer patients often lose their hair and feel sick during treatment.

Scientists, like Dr. Hadiyah-Nicole Green, are working on new ways to treat cancer with fewer side effects. Dr. Green developed a treatment that uses tiny particles called nanoparticles, which are thousands of times smaller than the width of a human hair. These nanoparticles are specially designed to recognize and attach to cancer cells while avoiding healthy cells. Once attached, the nanoparticles act like tiny heat bombs. When a special laser is shined on the area, the nanoparticles absorb the laser's energy and heat up, reaching temperatures high enough to kill the cancer cells without harming the surrounding healthy tissue. This approach is called photothermal therapy. Unlike chemotherapy, which affects both cancerous and healthy cells, this treatment aims to target only cancer cells, reducing harmful side effects. Dr. Green's innovative work is still in the testing phase, but it represents a promising step toward safer, more precise cancer treatments.

Understanding the chemistry behind cancer helps scientists create better treatments, such as more precise therapies that target cancer cells while sparing healthy ones. This knowledge not only improves patient survival rates but also enhances quality of life during treatment. By uncovering how cancer starts and spreads at the molecular level, researchers can develop innovative approaches, like immunotherapy and targeted drug delivery systems, offering hope to patients and families affected by this disease.

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1. What is cancer, and how do cancer cells behave differently from normal cells?

2. What is DNA, and how do mutations lead to cancer?

3. Name two things that can cause DNA damage.

4. Why does chemotherapy often cause side effects like hair loss?

5. How does Dr. Green’s nanoparticle treatment work to target cancer cells?

6. Why is understanding the chemistry of cancer important for developing better treatments?

7. What is metastasis, and why does it make cancer harder to treat?