

Grade 12 NTI Day #10 Anatomy

Assignment: Please read the excerpt below as an independent reading assignment. Then read and answer the questions below the excerpt.



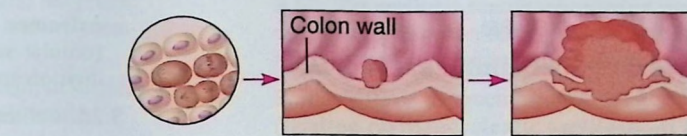
## Cancer—An Intimate Enemy

When controls of cell division malfunction, an abnormal cell mass called a **neoplasm** (“new growth”) or **tumor** develops. Not all neoplasms are cancerous. **Benign** (be-nīn’; “kindly”) neoplasms are usually surrounded by a capsule, grow slowly, and seldom kill their hosts. In contrast, **malignant** (“bad”) neoplasms (cancers) are not encapsulated. They grow more relentlessly and may become killers. Normal cells die when they lose contact with the surrounding matrix, but malignant cells tend to break away from the parent mass and spread via the blood to distant parts of the body. The formation of new masses at other body sites is called **metastasis** (mē-tas’tā-sis).

What causes *transformation*—the changes that convert a normal cell into a cancerous one? Radiation, mechanical trauma, certain viral infections, and many chemicals (tobacco tars, organic solvents such as mineral spirits) can all act as **carcinogens** (cancer-causers). What all of these factors have in common is that they cause *mutations*—changes in DNA that alter the expression of certain genes. Transformation requires several genetic changes.

Proto-oncogenes code for proteins that are needed for normal cell division and growth. However, many have fragile sites that break when they are exposed to carcinogens, which converts them into oncogenes. Another group of genes, the tumor-suppressor genes (such as *p53* and *p16*) put the “brakes” on cell division, so inactivation of these genes leads to uncontrolled growth, allowing oncogenes to “do their thing.”

Consider colorectal cancer (see the figure). One of its first signs is a polyp (a small, benign growth of apparently nor-



	①	②	③
<b>Cellular changes:</b>	Increased cell division	Growth of polyp	Growth of malignant tumor (cancerous)
<b>DNA changes:</b>	Oncogene activated	Tumor-suppressor gene inactivated	Second tumor-suppressor gene inactivated

### Stepwise development of a typical colon cancer

mal mucosa cells. As cell division continues, the polyp enlarges and may become a malignant neoplasm. In most cases, these changes parallel cellular changes at the DNA level and include the activation of oncogenes and the inactivation of tumor-suppressor genes. The seeds of cancer appear to be in our own genes—an intimate enemy indeed.

Screening procedures aid early detection. Unfortunately, most cancers are diagnosed after symptoms have already appeared. Increasingly, diagnosis includes genetic or chemical analysis of tissue samples to determine which genes are switched on or off, and which drugs may be most effective. MRI and CT scans can detect large cancers or the degree of metastasis.

Most neoplasms are removed surgically if possible. Radiation and drugs (*chemotherapy*) may also be used. Current cancer treatments—“cut, burn, and poison”—are recognized as crude and painful. Promising new treatments include:

- Delivering radiation or anticancer drugs precisely to the cancer.
- Strengthening the immune system by using “hand-picked” immune cells from the patient.

- Starving tumors by cutting off their blood supply.
- Destroying cancer cells with viruses.
- Testing the tumor for genetic markers to customize treatment plans.

Today, about half of cancer cases are cured, and patients’ quality of life has improved.

### The Essentials

- Tumors are the result of uncontrolled cell growth and can be benign or malignant. Malignant tumors are cancerous and can spread, or metastasize, to other areas of the body.
- Tumor-suppressor genes turned off by exposure to DNA-damaging agents no longer regulate cell division, and uncontrolled growth results.
- Oncogenes turned on by exposure to DNA-damaging agents, such as carcinogens, allow uncontrolled growth and metastasis to occur.

## Anatomy NTI Day #10 Questions

Here are the questions and answer key based on the passage about **cancer and neoplasms**:

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### Multiple Choice Questions

- 1. What is the primary difference between benign and malignant neoplasms?**
    - a) Benign neoplasms grow quickly, while malignant neoplasms grow slowly.
    - b) Benign neoplasms are encapsulated, while malignant neoplasms are not.
    - c) Benign neoplasms can spread to other parts of the body, while malignant neoplasms cannot.
    - d) Benign neoplasms cause DNA mutations, while malignant neoplasms do not.
  - 2. What is the term for the spread of cancerous cells to distant parts of the body?**
    - a) Transformation
    - b) Carcinogenesis
    - c) Metastasis
    - d) Hyperplasia
  - 3. Which type of gene, when inactivated, leads to uncontrolled cell growth?**
    - a) Proto-oncogenes
    - b) Tumor-suppressor genes
    - c) Oncogenes
    - d) Carcinogens
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### Short Answer Question

- 4. Explain how carcinogens can lead to the development of cancer. Provide an example of a carcinogen mentioned in the passage.**
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