Chapter-1 Cancer

**Definitions**

Cancers are a large family of diseases that involve abnormal [cell growth](https://en.wikipedia.org/wiki/Cell_growth) with the potential to invade or spread to other parts of the body. They form a subset of [neoplasms](https://en.wikipedia.org/wiki/Neoplasm). A neoplasm or tumor is a group of cells that have undergone unregulated growth and will often form a mass or lump but may be distributed diffusely.

All tumor cells show the [six hallmarks of cancer](https://en.wikipedia.org/wiki/The_Hallmarks_of_Cancer). These characteristics are required to produce a malignant tumor. They include:

* [Cell growth and division](https://en.wikipedia.org/wiki/Cell_growth) absent the proper signals
* Continuous growth and division even given contrary signals
* Avoidance of [programmed cell death](https://en.wikipedia.org/wiki/Apoptosis)
* [Limitless number of cell divisions](https://en.wikipedia.org/wiki/Biological_immortality)
* Promoting [blood vessel construction](https://en.wikipedia.org/wiki/Angiogenesis)
* [Invasion](https://en.wikipedia.org/wiki/Invasion_(cancer)) of tissue and formation of [metastases](https://en.wikipedia.org/wiki/Metastasis)

The progression from normal cells to cells that can form a detectable mass to outright cancer involves multiple steps known as malignant progression.

**Most common types**

* [Breast cancer](https://www.google.com/search?rlz=1C1CHBF_enIN833IN833&q=Breast+cancer&stick=H4sIAAAAAAAAAONgFuLQz9U3KEwuMlACs7IsMlIeMTpyC7z8cU9YymLSmpPXGI24uIIz8std80oySyqFVLjYoCwpLh4puCYNBikuLjiPBwDVkS3dWgAAAA&sa=X&ved=2ahUKEwiZ0_TehoTgAhUZk3AKHXKABlAQ0EAwF3oECAgQFA)-A cancer that forms in the cells of the breasts.
* [Prostate cancer](https://www.google.com/search?rlz=1C1CHBF_enIN833IN833&q=Prostate+cancer&stick=H4sIAAAAAAAAAONgFuLQz9U3KEwuMlACs3KNjTIeMTpyC7z8cU9YymLSmpPXGI24uIIz8std80oySyqFVLjYoCwpLh4puCYNBikuLjiPBwBzb4J4WgAAAA&sa=X&ved=2ahUKEwiZ0_TehoTgAhUZk3AKHXKABlAQ0EAwF3oECAgQFg)-A cancer in a man's prostate, a small walnut-sized gland that produces seminal fluid.
* [Basal cell cancer](https://www.google.com/search?rlz=1C1CHBF_enIN833IN833&q=Basal+cell+cancer&stick=H4sIAAAAAAAAAONgFuLQz9U3KEwuMlDiBLGMjbOySh4xOnMLvPxxT1jKatKak9cYTbi4gjPyy13zSjJLKoXUuNigLBkuXimELg0GKW4uBJcHALjemixdAAAA&sa=X&ved=2ahUKEwiZ0_TehoTgAhUZk3AKHXKABlAQ0EAwF3oECAgQGA)-A type of skin cancer that begins in the basal cells.
* [Melanoma](https://www.google.com/search?rlz=1C1CHBF_enIN833IN833&q=Melanoma&stick=H4sIAAAAAAAAAONgFuLQz9U3KEwuMlDiBLGMTZOM0h8xOnMLvPxxT1jKatKak9cYTbi4gjPyy13zSjJLKoXUuNigLBkuXimELg0GKW4uBJcHAL0a2R9dAAAA&sa=X&ved=2ahUKEwiZ0_TehoTgAhUZk3AKHXKABlAQ0EAwF3oECAgQGg)-The most serious type of skin cancer.
* [Colon cancer](https://www.google.com/search?rlz=1C1CHBF_enIN833IN833&q=Colon+cancer&stick=H4sIAAAAAAAAAONgFuLQz9U3KEwuMlDiBLEMU5ILsx4xOnMLvPxxT1jKatKak9cYTbi4gjPyy13zSjJLKoXUuNigLBkuXimELg0GKW4uBJcHAAGLsdldAAAA&sa=X&ved=2ahUKEwiZ0_TehoTgAhUZk3AKHXKABlAQ0EAwF3oECAgQHA)-A cancer of the colon or rectum, located at the digestive tract's lower end.
* [Lung cancer](https://www.google.com/search?rlz=1C1CHBF_enIN833IN833&q=Lung+cancer&stick=H4sIAAAAAAAAAONgFuLQz9U3KEwuMlACs0wKjMsfMTpyC7z8cU9YymLSmpPXGI24uIIz8std80oySyqFVLjYoCwpLh4puCYNBikuLjiPBwDO-gg7WgAAAA&sa=X&ved=2ahUKEwiZ0_TehoTgAhUZk3AKHXKABlAQ0EAwF3oECAgQHg)-A cancer that begins in the lungs and most often occurs in people who smoke.
* [Leukemia](https://www.google.com/search?rlz=1C1CHBF_enIN833IN833&q=Leukemia&stick=H4sIAAAAAAAAAONgFuLQz9U3KEwuMlACs0wKitMeMTpyC7z8cU9YymLSmpPXGI24uIIz8std80oySyqFVLjYoCwpLh4puCYNBikuLjiPBwDMRDvQWgAAAA&sa=X&ved=2ahUKEwiZ0_TehoTgAhUZk3AKHXKABlAQ0EAwF3oECAgQIA)-A cancer of blood-forming tissues, hindering the body's ability to fight infection.
* [Lymphoma](https://www.google.com/search?rlz=1C1CHBF_enIN833IN833&q=Lymphoma&stick=H4sIAAAAAAAAAONgFuLQz9U3KEwuMlACs7JSsg0eMTpyC7z8cU9YymLSmpPXGI24uIIz8std80oySyqFVLjYoCwpLh4puCYNBikuLjiPBwD5J2F9WgAAAA&sa=X&ved=2ahUKEwiZ0_TehoTgAhUZk3AKHXKABlAQ0EAwF3oECAgQIg)-A cancer of the lymphatic system.

**Diagnosis**

Most cancers are initially recognized either because of the appearance of signs or symptoms or through [screening](https://en.wikipedia.org/wiki/Cancer_screening). Neither of these leads to a definitive diagnosis, which requires the examination of a tissue sample by a [pathologist](https://en.wikipedia.org/wiki/Anatomical_pathology). People with suspected cancer are investigated with [medical tests](https://en.wikipedia.org/wiki/Medical_test). These commonly include [blood tests](https://en.wikipedia.org/wiki/Blood_test), [X-rays](https://en.wikipedia.org/wiki/Projectional_radiography), ([contrast](https://en.wikipedia.org/wiki/Contrast_CT)) [CT scans](https://en.wikipedia.org/wiki/CT_scan) and [endoscopy](https://en.wikipedia.org/wiki/Endoscopy).

The tissue [diagnosis](https://en.wikipedia.org/wiki/Medical_diagnosis) from the biopsy indicates the type of cell that is proliferating, its [histological grade](https://en.wikipedia.org/wiki/Histological_grade), genetic abnormalities and other features. Together, this information is useful to evaluate the [prognosis](https://en.wikipedia.org/wiki/Prognosis) and to choose the best treatment.

[Cytogenetics](https://en.wikipedia.org/wiki/Cytogenetics) and [immunohistochemistry](https://en.wikipedia.org/wiki/Immunohistochemistry) are other types of tissue tests. These tests provide information about molecular changes (such as [mutations](https://en.wikipedia.org/wiki/Mutation), [fusion genes](https://en.wikipedia.org/wiki/Fusion_gene) and numerical [chromosome](https://en.wikipedia.org/wiki/Chromosome) changes) and may thus also indicate the prognosis and best treatment.

Chapter-2 Breast Cancer

Spanhol, F., Oliveira, L. S., Petitjean, C., Heutte, L., **A Dataset for Breast Cancer Histopathological Image Classification,** IEEE Transactions on Biomedical Engineering (TBME), 63(7):1455-1462, 2016. [[pdf](http://www.inf.ufpr.br/lesoliveira/download/TBME-00608-2015-R2-preprint.pdf)]