

# Characteristics of tumor growth

The growth of tumor cells is characterized by uncontrolled cell division and the impossibility of their wear. Tumor cells also have an increased ability to survive. Tumor cells are characterized by the acquisition of resistance to apoptosis (their programmed death). In tumor growth, the **regulation of the transition from G1-phase to S-phase** is mainly affected. A characteristic feature of the transformed cell is continued division. Their requirements for the presence of hormones and growth factors are reduced (needed for a normal cell) coming from outside. Some transformed cells have the ability to stimulate autocrine, i.e. after the elimination of a specific substance, it retroactively affects the cell. These are mainly specific growth factors. There is also a loss of the ability to stop growth.

Aberrant regulation of the cell division cycle is one of the critical points of tumor growth. The tumor cell tends to deviate from the physiological mechanism of control of cell division.

Among the factors that contribute to this is EFP (estrogen-responsive RING-finger protein), which controls the breakdown of cell cycle inhibitors by ubiquitination and directs the shifts of breast tumor growth from a hormone-dependent mechanism to a hormone-independent mechanism.

## In vivo proliferation

The conversion of a cell into a tumor cell is caused by mutations in protooncogenes, tumor suppressor genes, and mutator genes. These mutations lead to **uncontrolled proliferation of transformed cells** (the main feature of malignant transformation). This process can affect the cells of all tissues.

## Tumor classification

Exist 3 main types of tumors exist:

1. Sarcomas – from mesenchymal tissue,
2. Carcinomas – from epithelial tissue,
3. Hematopoietic and Lymphoid malignancies – leukemias and lymphomas.

A more accurate classification includes the site of origin, tissue type, clinical degree, and rate of progression.

## Morphological picture

- tumours are formed by **proliferating tumour cells** (parenchyma), **connective non-tumour tissue** (stroma) and the **vascular system**, which they themselves stimulate;
- often altered the shape of the transformed cell;
- malignant reversal is associated with mutations in the DNA of transformed cells;
- the suppressive effect of hormones on cell division is attenuated (cell receptor disorder);
- intercellular communication and the relationship of tumor cells to neighboring cells is disrupted;
- disorder of fixation of tumor cells to a solid cell surface;
- in tumor cells we find so-called tumor neoantigens;
- Cytogenic examination reveals a high number of chromosomal fractures and numerous chromosomal abnormalities;
- mostly diagnosed in the late age of the individual;
- tumors arising from several genetic changes over the years;
- however, there are also types of tumors with a specific occurrence in childhood and younger individuals – e.g. Wilms' kidney tumor, retinoblastoma, leukemia, lymphoma;
- A characteristic feature of malignant tumor growth is its invasive growth - the ability to grow into the surrounding tissue and the ability to metastasize from the primary site to other, distant organs (an aggressive form of tumor tissue growth - conditioned by genetically acquired changes in proteolytic enzymes and cell surface adherence molecules).

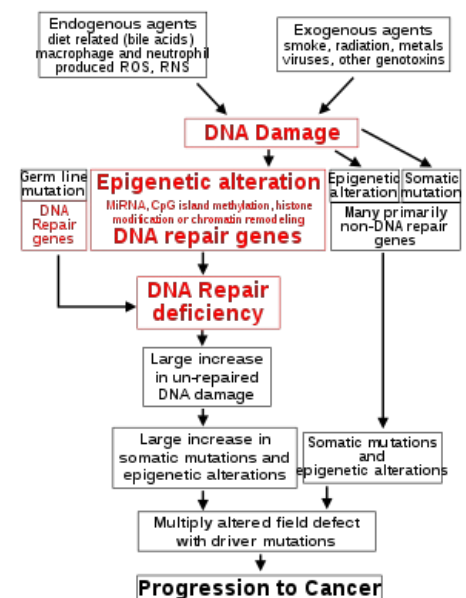


Diagram of tumor progression

## Proliferation in vitro

After developing a tissue culture technique, it allows us to define the differences between normal and malignantly transformed cells.

## Normal cells

- during cultivation, they maintain control of multiplication in the given environment by **regulation - so-called contact inhibition** (cells stop growth after contact with each other, after the formation of a “monolayer”);
- have a limited number of generations - max. 50;
- on the cell surface, they carry typical antigenic determinants corresponding to the antigenic determinants of the tissue from which the cell culture was derived;
- metabolism - mainly aerobic;
- high requirements for the presence of growth factors in the culture medium;
- diploid number of chromosomes;
- retain a specific cell shape.

## Tumor cells

- Tumor cells have different surface antigens;
- in the culture they acquire the ability to grow indefinitely, lose contact inhibition, and transformed cells grow in several layers unorganized;
- culture is immortal, an unlimited number of generations arises;
- increased anaerobic metabolism - a lower requirement for the amount of protein growth factors in the culture medium;
- altered number of chromosomes - heteroploid or pseudodiploid chromosome equipment, chromosomes of transformed cells often show random or non-random numerical or structural aberrations;
- often accompanied by a change in cell shape;
- malignant reversal is encoded in the DNA of transformed cells.

Chromosomes of tumour-transformed cells often show various **chromosomal abnormalities**. These abnormalities can be both numerical and structural. According to their relation to malignant transformation, we then distinguish between **non-random** (primary) and **random** (secondary).

## References

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### Source

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