

CELL POPULATION TYPES: STATIC, GROWING, RENEWING, APOPTOSIS (PROGRAMMED CELL DEATH) AND THE OPPOSITE OF MITOSIS**Nodirov Dostonjon Zokir o'g'li**

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Abstract. This article provides a comprehensive analysis of different types of cell populations, including static, growing, and renewing populations, along with a detailed explanation of apoptosis as a programmed cell death mechanism and its functional opposition to mitosis. The study highlights the biological significance of maintaining cellular balance through controlled proliferation and death. Cellular populations are essential for tissue homeostasis, regeneration, and organismal development.

Keywords: Cell population, static cells, growing cells, renewing cells, apoptosis, mitosis, cell cycle, homeostasis, regeneration, differentiation.

HUJAYRA POPULYATSIYALARINING TURLARI: STATIK, O'SUVCHI, YANGILANUVCHI, APOPTOZ VA MITOZNING AKSI

Annotatsiya. Ushbu maqolada hujayra populyatsiyalarining asosiy turlari — statik, o'suvchi va yangilanuvchi populyatsiyalar chuqur tahlil qilinadi. Shuningdek, apoptoz — dasturlashtirilgan hujayra o'limi jarayoni va uning mitozga qarama-qarshi biologik ahamiyati keng yoritiladi. Hujayra populyatsiyalarining muvozanati organizmning normal faoliyati uchun zarur bo'lib, bu muvozanat buzilganda turli kasalliklar yuzaga kelishi mumkin

INTRODUCTION / KIRISH

All living organisms rely on the dynamic balance between cell proliferation and cell death. This balance ensures proper tissue function, structural integrity, and adaptation to environmental changes. Cells are not static entities; they continuously interact, divide, differentiate, and sometimes undergo programmed death.

Tirik organizmlarda hujayralar doimiy ravishda yangilanib turadi. Ular nafaqat bo'linadi, balki o'z funksiyasiga qarab ixtisoslashadi yoki ma'lum vaqtdan keyin nobud bo'ladi. Shu jarayonlarning muvozanati organizmning sog'lom ishlashini ta'minlaydi. Agar bu muvozanat buzilsa, organizmda jiddiy patologik holatlar yuzaga keladi.

Cell populations are defined as groups of cells that share similar structural and functional characteristics. These populations behave differently depending on their biological role. Some cells rarely divide, while others continuously proliferate. Understanding these differences is crucial in modern medicine, especially in oncology, regenerative medicine, and developmental biology.

Hujayra populyatsiyalari organizmning turli qismlarida turlicha faoliyat yuritadi.

Masalan, ba'zi hujayralar (neyronlar) deyarli bo'linmaydi, boshqalari esa (epiteliy hujayralari) doimiy ravishda yangilanib turadi. Shu sababli hujayra populyatsiyalarini o'rganish tibbiyotda muhim ahamiyatga ega hisoblanadi.

Another important concept is the regulation of cell cycle processes. The cell cycle includes phases such as interphase and mitosis, which ensure cell growth and division.

However, not all cells continuously go through this cycle. Some exit the cycle permanently, while others remain in a reversible resting state.

Hujayra siklining boshqarilishi organizm uchun juda muhim. Bu jarayon qat'iy nazorat qilinadi va maxsus genlar orqali boshqariladi. Agar bu nazorat buzilsa, nazoratsiz hujayra bo'linishi yuzaga keladi, bu esa o'sma kasalliklariga olib kelishi mumkin.

In contrast to cell proliferation, apoptosis plays a critical role in eliminating damaged or unnecessary cells. This mechanism prevents the accumulation of abnormal cells and contributes to tissue remodeling and immune defense.

Apoptoz jarayoni organizmni zararli yoki eskirgan hujayralardan tozalashga yordam beradi. Bu jarayon juda muhim bo'lib, u hujayralarning tartibli ravishda nobud bo'lishini ta'minlaydi va yallig'lanishsiz kechadi.

ASOSIY QISM

Cell populations can be broadly classified into three major types: static, growing, and renewing populations. Each type has distinct biological characteristics and plays a specific role in maintaining the organism's functionality.

Hujayra populyatsiyalarining bu uch turi organizmda turli vazifalarni bajaradi. Ularning har biri o'ziga xos biologik xususiyatlarga ega bo'lib, umumiy muvozanatni saqlashda ishtirok etadi.

Static cell populations consist of highly differentiated cells that have permanently exited the cell cycle. These cells do not divide under normal physiological conditions. Their primary function is to perform specialized tasks that require stability rather than proliferation.

Statik hujayralar yuqori darajada ixtisoslashgan bo'ladi va ular deyarli bo'linmaydi. Bu hujayralar hujayra siklidan chiqib ketgan bo'lib, G0 fazada qoladi. Ularning asosiy vazifasi murakkab fiziologik funksiyalarni bajarishdan iborat.

Examples of static cells include neurons and cardiac muscle cells. These cells are essential for vital functions such as signal transmission and heart contraction. Due to their inability to divide, damage to these cells often leads to irreversible consequences.

Masalan, neyronlar axborotni uzatishda muhim rol o'ynaydi, yurak mushak hujayralari esa yurak qisqarishini ta'minlaydi. Agar bu hujayralar zararlansa, ularning tiklanishi juda qiyin yoki deyarli imkonsiz bo'ladi.

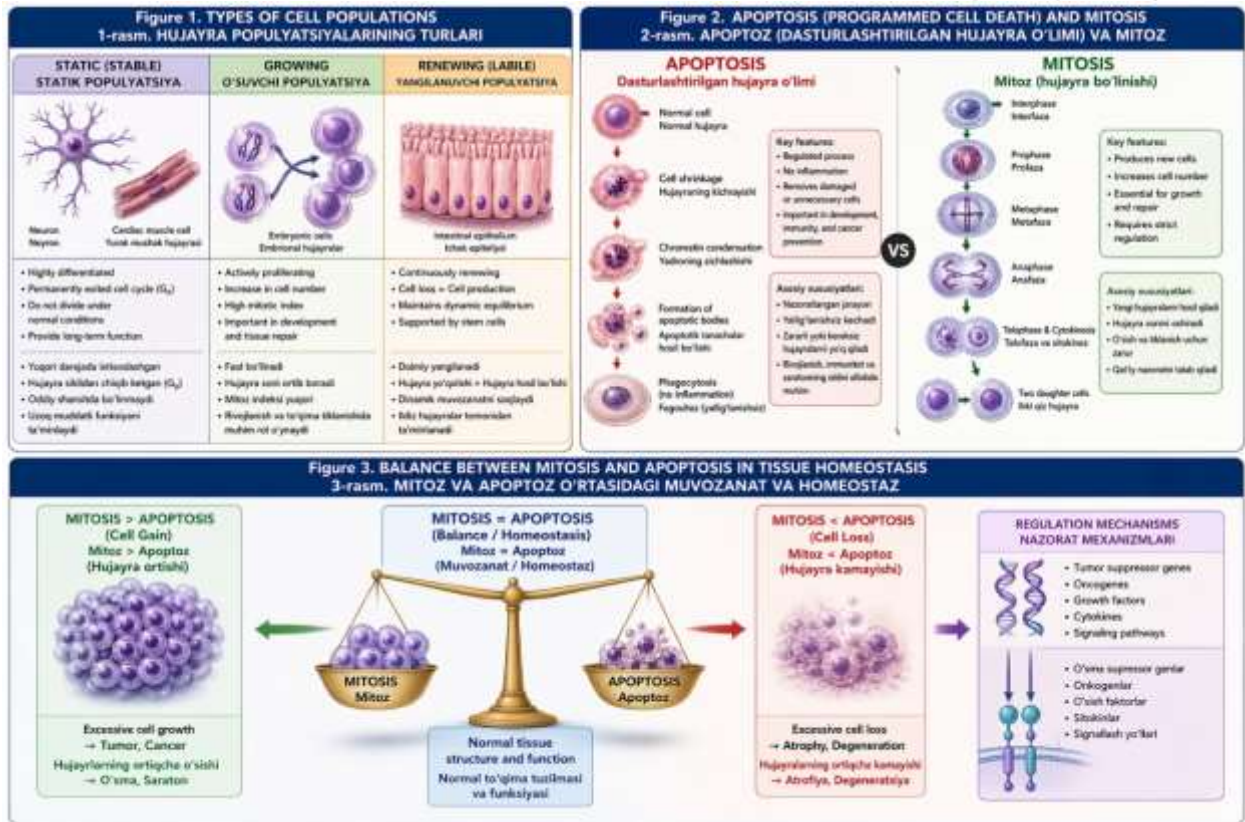
The inability of static cells to regenerate highlights the importance of protective mechanisms in these tissues. For instance, the brain and heart are protected by specialized structures and physiological barriers.

Statik hujayralarning tiklanmasligi sababli organizm ularni himoya qilishga harakat qiladi. Masalan, miya suyak bilan himoyalangan, yurak esa maxsus fiziologik tizimlar bilan qo'llab-quvvatlanadi.

In addition, static populations demonstrate minimal turnover, meaning that cell loss is not easily compensated by new cell formation. This makes them particularly vulnerable to degenerative diseases.

Bu hujayralarda yangilanish darajasi juda past bo'lganligi sababli, ular degenerativ kasalliklarga moyil bo'ladi. Masalan, nerv tizimi kasalliklari aynan shu sabab bilan bog'liq bo'lishi mumkin.

Growing cell populations are characterized by active proliferation and an increase in cell number over time. These populations are especially prominent during embryonic development, tissue growth, and certain regenerative processes.



The defining feature of growing populations is their high mitotic index, meaning a large proportion of cells are actively dividing.

O'suvchi hujayra populyatsiyasi organizm rivojlanishining muhim bosqichlarida kuzatiladi. Bu hujayralar doimiy ravishda bo'linib, son jihatdan ortib boradi. Ayniqsa embrional rivojlanish davrida bu jarayon juda intensiv kechadi, chunki yangi to'qimalar va organlar shakllanadi.

During embryogenesis, nearly all cells belong to the growing population. At this stage, cells rapidly divide, differentiate, and organize into complex tissues and organs. This process is tightly regulated by genetic and molecular signals to ensure proper development.

Embrional davrda hujayralarning tez bo'linishi va differentsiallashuvi organizmning to'g'ri shakllanishini ta'minlaydi. Bu jarayon genetik darajada nazorat qilinadi va har qanday buzilish tug'ma nuqsonlarga olib kelishi mumkin.

In postnatal life, growing populations are less common but still exist in certain conditions, such as wound healing and tissue repair. When injury occurs, cells near the damaged area re-enter the cell cycle and begin proliferating to replace lost tissue.

Tug'ilgandan keyin ham o'suvchi populyatsiyalar butunlay yo'qolmaydi. Masalan, jarohatlanganda hujayralar yana bo'linishni boshlaydi va shikastlangan to'qimalarni tiklashga harakat qiladi. Bu regeneratsiya jarayonining asosiy mexanizmlaridan biridir.

However, uncontrolled growth of such populations can lead to pathological conditions, particularly cancer. In this case, cells lose regulatory control over division and continue proliferating abnormally.

Agar o'suvchi hujayralar ustidan nazorat yo'qolsa, bu xavfli kasalliklarga olib keladi.

Eng mashhur misol — saraton bo'lib, bunda hujayralar nazoratsiz bo'linadi va o'sma hosil qiladi.

Renewing (labile) cell populations are continuously dividing and replacing cells that are lost due to normal physiological processes. These populations maintain a dynamic equilibrium where cell production equals cell loss.

Yangilanuvchi hujayra populyatsiyasi organizmda doimiy ravishda yangilanib turadi. Bu yerda eski hujayralar nobud bo'ladi va ularning o'rniga yangi hujayralar hosil bo'ladi. Bu muvozanat organizmning normal faoliyati uchun zarur.

Typical examples include epithelial cells of the skin, gastrointestinal tract, and hematopoietic cells in the bone marrow. These tissues experience constant wear and tear, requiring continuous renewal.

Masalan, teri hujayralari doimiy ravishda yangilanadi, ichak epiteliysi esa juda tez almashinadi. Qon hujayralari ham suyak iligida muntazam ishlab chiqariladi. Bu jarayonlar organizmni tashqi va ichki ta'sirlardan himoya qiladi.

The regulation of renewing populations involves stem cells, which serve as a source of new cells. Stem cells have the ability to both self-renew and differentiate into specialized cell types.

Yangilanuvchi populyatsiyalarda ildiz hujayralar (stem cells) muhim rol o'ynaydi. Ular yangi hujayralarni hosil qiladi va zaruratga qarab turli hujayra turlariga aylanishi mumkin.

Any disruption in this balance may result in disease. For example, decreased renewal can lead to tissue degeneration, while excessive proliferation may cause hyperplasia or neoplasia.

Agar yangilanish jarayoni buzilsa, turli kasalliklar kelib chiqadi. Kam yangilanish to'qima yemirilishiga olib kelsa, ortiqcha bo'linish o'sma yoki boshqa patologik holatlarni keltirib chiqaradi.

Apoptosis (programmed cell death) is a highly regulated and controlled process that eliminates unnecessary or damaged cells without causing inflammation. Unlike necrosis, which is a form of uncontrolled cell death, apoptosis is an orderly process essential for maintaining tissue homeostasis.

Apoptoz — bu hujayraning dasturlashtirilgan, tartibli o'limi hisoblanadi. Bu jarayon organizm uchun juda muhim bo'lib, zararli yoki eskirgan hujayralarni yo'q qiladi. Eng muhim jihati — bu jarayon yallig'lanishsiz kechadi.

Apoptosis involves a series of biochemical events, including activation of enzymes called caspases. These enzymes break down cellular components, leading to characteristic morphological changes such as cell shrinkage, chromatin condensation, and formation of apoptotic bodies.

Apoptoz jarayonida maxsus fermentlar — kaspazalar faollashadi. Ular hujayra ichidagi strukturalarni parchalab yuboradi. Natijada hujayra kichrayadi, yadrosi zichlashadi va bo'laklarga ajraladi.

These apoptotic bodies are then recognized and engulfed by neighboring cells or macrophages, preventing the release of harmful substances into surrounding tissues.

Hosil bo'lgan apoptotik tanachalar boshqa hujayralar tomonidan yutiladi. Bu esa atrof to'qimalarga zarar yetkazilishini oldini oladi va organizmni himoya qiladi.

Apoptosis plays a crucial role in development, immune system function, and prevention of cancer. For instance, it removes cells with DNA damage that could otherwise become cancerous.

Apoptoz organizm rivojlanishida, immun tizim faoliyatida va saratonning oldini olishda muhim ahamiyatga ega. DNKsi shikastlangan hujayralar aynan shu jarayon orqali yo‘q qilinadi.

Mitosis and its functional opposition to apoptosis represent two fundamental processes that regulate cell population dynamics. Mitosis leads to the production of new cells, while apoptosis removes cells. The balance between these processes determines tissue size and health.

Mitoz va apoptoz bir-biriga qarama-qarshi jarayonlar hisoblanadi. Mitoz orqali yangi hujayralar hosil bo‘ladi, apoptoz orqali esa eski yoki zararli hujayralar yo‘q qilinadi. Bu ikki jarayon o‘rtasidagi muvozanat juda muhim.

When mitosis exceeds apoptosis, there is a net increase in cell number, which may lead to tumor formation. Conversely, excessive apoptosis can result in tissue atrophy and degenerative diseases.

Agar mitoz apoptozdan ustun bo‘lsa, hujayralar ortib ketadi va o‘sma paydo bo‘lishi mumkin. Aksincha, apoptoz haddan tashqari kuchaysa, to‘qimalar kamayib, degenerativ kasalliklar yuzaga keladi.

At the molecular level, this balance is controlled by various genes and signaling pathways, including tumor suppressor genes and oncogenes.

Bu muvozanat genetik darajada boshqariladi. Maxsus genlar hujayraning bo‘linishi yoki nobud bo‘lishini nazorat qiladi. Ushbu tizim buzilganda kasalliklar rivojlanadi.

The dynamic balance between different cell populations is essential for maintaining organismal homeostasis. Each type of cell population—static, growing, and renewing—plays a distinct but interconnected role in ensuring the proper functioning of tissues and organs. Their coordinated activity reflects the complexity of biological regulation at cellular and molecular levels.

Hujayra populyatsiyalari o‘rtasidagi muvozanat organizmning normal faoliyati uchun juda muhim hisoblanadi. Statik, o‘sovchi va yangilanuvchi hujayralar bir-biri bilan bog‘liq holda ishlaydi va umumiy tizimning barqarorligini ta‘minlaydi. Bu jarayonlar organizmning murakkab biologik boshqaruv tizimining bir qismi hisoblanadi.

Static populations provide long-term stability by maintaining specialized functions that are critical for survival. Although they lack regenerative capacity, their structural and functional integrity is preserved through protective mechanisms and limited cellular turnover.

Statik hujayralar uzoq muddatli barqarorlikni ta‘minlaydi. Ular tiklanish qobiliyatiga ega bo‘lmasa ham, organizm ularni maksimal darajada himoya qiladi. Shu sababli bu hujayralar juda muhim hayotiy funksiyalarni bajaradi.

Growing populations contribute significantly to developmental processes and tissue repair. Their ability to rapidly proliferate allows the organism to adapt to physiological demands and recover from injury. However, strict regulation is necessary to prevent abnormal growth.

O‘sovchi hujayralar organizmning rivojlanishi va tiklanish jarayonida muhim rol o‘ynaydi. Ularning tez bo‘linish xususiyati organizmga moslashish imkonini beradi. Lekin bu jarayon qat‘iy nazorat qilinishi kerak, aks holda patologiyalar yuzaga keladi.

Renewing populations ensure continuous replacement of cells in tissues exposed to constant stress and damage. This renewal capacity is vital for maintaining functional efficiency and protecting the organism from environmental challenges.

Yangilanuvchi hujayralar organizmni tashqi ta'sirlardan himoya qiladi. Ular doimiy ravishda yangilanib turadi va to'qimalarning normal ishlashini ta'minlaydi.

Apoptosis serves as a fundamental mechanism for removing damaged, aged, or potentially harmful cells. It plays a key role in development, immune regulation, and prevention of diseases such as cancer.

Apoptoz organizmni zararli hujayralardan tozalaydi. Bu jarayon kasalliklarning oldini olishda, ayniqsa saraton rivojlanishini to'xtatishda muhim rol o'ynaydi.

The interplay between mitosis and apoptosis represents a finely tuned regulatory system.

This balance determines whether tissues grow, shrink, or remain stable. Disruption of this equilibrium can lead to severe pathological conditions, including cancer, degenerative diseases, and immune disorders.

Mitoz va apoptoz o'rtasidagi muvozanat organizm holatini belgilaydi. Agar bu muvozanat buzilsa, turli og'ir kasalliklar rivojlanadi. Shu sababli bu jarayonlarni chuqur o'rganish zamonaviy tibbiyot uchun muhimdir.

CONCLUSION / XULOSA

In conclusion, cell populations are fundamental units that determine the structural and functional integrity of living organisms. The classification into static, growing, and renewing populations provides a framework for understanding how tissues develop, maintain themselves, and respond to damage.

Xulosa qilib aytganda, hujayra populyatsiyalari organizmning asosiy funksional birliklari hisoblanadi. Ularning turlarga ajratilishi biologik jarayonlarni tushunishda muhim ahamiyatga ega.

The balance between cell proliferation and cell death, particularly through mitosis and apoptosis, is essential for maintaining homeostasis. Any disruption in this balance may result in pathological conditions that affect the overall health of the organism.

Hujayralarning bo'linishi va nobud bo'lishi o'rtasidagi muvozanat organizm sog'lig'i uchun zarur. Bu muvozanat buzilganda kasalliklar paydo bo'ladi.

Understanding these processes not only enhances our knowledge of basic biology but also contributes to advancements in medical science, including cancer treatment, regenerative medicine, and tissue engineering.

Ushbu jarayonlarni o'rganish tibbiyot rivoji uchun katta ahamiyatga ega. Ayniqsa, saratonni davolash, regenerativ tibbiyot va yangi davolash usullarini ishlab chiqishda muhim rol o'ynaydi.

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