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## REVIEW OF THE EVOLUTION OF DRUG DEVELOPMENT

### ДАРЫ-ДАРМЕКТЕРДИ ИШТЕП ЧЫГУУНУН ЭВОЛЮЦИЯСЫН КАРАП ЧЫГУУ

### ОБЗОР ЭВОЛЮЦИИ РАЗРАБОТКИ ЛЕКАРСТВЕННЫХ СРЕДСТВ

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**Abstract:** *The history of drug discovery is an important part of the history of medicine and public health. From ancient remedies to molecular drugs, drug discovery has come a long way, and the evolutionary process of drug discovery has significantly changed the treatment of diseases worldwide. This article provides a detailed account of the milestones in drug discovery, tracing its historical roots, its significant achievements, and including drug discovery in the present day. Starting from the earliest use of plants and minerals as medicines, it traces the course of drug discovery, highlighting the important therapeutic approaches. The most prominent examples are the discovery of antibiotics, vaccines, and modern biotechnological methods for drug discovery. This article also critically analyzes the stages of drug discovery, physicochemical, analytical, pharmaceutical, screening, acute and chronic toxicity studies on experimental and experimental animals, including pharmacokinetics, pharmacodynamics, anatomical and morphological, clinical trials, and regulatory mechanisms. In addition, it compares the drug discovery processes for different diseases, from infectious to chronic, considering the unique challenges and successes inherent in each. Ultimately, the review considers the future of drug development, which is focused on the development of targeted medicine and targeted therapy. The literature review reflects not only the advances in development but also the ethical and practical issues that affect drug development today.*

**Key words:** *Evolution of drug development, history of medicine, public health, ancient remedies, plants, minerals, drug discovery, treatment methods, modern methods of production, development stage analysis, pharmaceuticals, screening, experimental animals, pharmacokinetics, pharmacodynamics, morphology, clinical trials, infectious diseases, problems, successes, targeted therapy, ethical issues.*

**Аннотация:** дары-дармектерди табуунун тарыхы медицинанын жана коомдук саламаттыктын тарыхынын маанилүү бөлүгү. Байыркы дары-дармектерден молекулалык дары-дармектерге чейин дары-дармектерди табуу узак жолду басып өттү жана дары-дармектерди табуунун эволюциялык процесси дүйнө жүзү боюнча ооруларды дарылоону бир кыйла өзгөрттү. Бул макалада дары-дармектерди табуудагы маанилүү окуялар, анын тарыхый тамыры, маанилүү жетишкендиктери жана азыркы учурдагы дары-дармектерди табуу жөнүндө кеңири баяндалат. Өсүмдүктөр менен минералдарды дары катары алгач колдонгондон тартып, дары-дармектерди табуунун жүрүшүн чагылдырып, маанилүү терапиялык ыкмаларды баса белгилейт. Эң көрүнүктүү мисалдарантибиотиктерди, вакциналарды жана дары-дармектерди табуунун заманбап биотехнологиялык ыкмаларын табуу. Бул макалада ошондой эле дары-дармектерди табуу, физикалык-химиялык, аналитикалык, фармацевтикалык, скрининг, эксперименталдык жана эксперименталдык жаныбарлар боюнча курч жана өнөкөт токсикологиялык изилдөөлөрдүн, анын ичинде фармакокинетика, фармакодинамика, анатомиялык жана морфологиялык, клиникалык сыноолор жана жөнгө салуу механизмдери Сынчыл талдоого алынат. Мындан тышкары, ал ар кандай оорулар үчүн дары-дармектерди табуу процесстерин, жугуштуудан өнөкөтгө чейин, ар бирине мүнөздүү уникалдуу кыйынчылыктарды жана ийгиликтерди эске алуу менен салыштырат. Акыры, кароодо максаттуу медицинаны жана максаттуу терапияны өнүктүрүүгө багытталган дары-дармектерди иштеп чыгуунун келечеги каралат. Адабияттарды карап чыгууда өнүгүүдөгү жетишкендиктер гана эмес, бүгүнкү күндө дары-дармектерди иштеп чыгууга таасир эткен этикалык жана практикалык маселелер да чагылдырылган.

**Негизги сөздөр:** дары-дармектерди иштеп чыгуунун эволюциясы, медицинанын тарыхы, коомдук саламаттык сактоо, байыркы дары-дармектер, өсүмдүктөр, минералдар, дары-дармектерди табуу, дарылоо ыкмалары, өндүрүштүн заманбап ыкмалары, өнүгүү стадиясын талдоо, фармацевтика, скрининг, эксперименталдык жаныбарлар, фармакокинетика, фармакодинамика, морфология, клиникалык сыноолор, жугуштуу оорулар, көйгөйлөр, ийгиликтер, максаттуу терапия, этикалык маселелер.

**Аннотациясы:** История открытия лекарств является важной частью истории медицины и общественного здравоохранения. От древних лекарственных средств до молекулярных лекарств открытие лекарств прошло долгий путь, и эволюционный процесс открытия лекарств значительно изменил методы лечения заболеваний во всем мире. В этой статье подробно рассказывается об основных этапах создания лекарств, прослеживаются их исторические корни, значительные достижения, а также об открытии лекарств в наши дни. Начиная с самого раннего использования растений и минералов в качестве лекарственных средств, в нем прослеживается путь создания лекарств, освещаются важные терапевтические подходы. Наиболее яркими примерами являются открытие антибиотиков, вакцин и современных биотехнологических методов создания лекарств. В этой статье также критически анализируются этапы создания лекарственных средств, физико-химические, аналитические, фармацевтические, скрининговые, исследования острой и хронической токсичности на подопытных животных, включая фармакокинетика, фармакодинамику, анатомо-морфологические, клинические испытания и механизмы регуляции. Кроме того, в нем сравниваются процессы разработки лекарств от различных

*заболеваний, от инфекционных до хронических, с учетом уникальных проблем и успехов, присущих каждому из них. В конечном счете, в обзоре рассматривается будущее разработки лекарств, которое сосредоточено на развитии таргетной медицины и таргетной терапии. Обзор литературы отражает не только достижения в области разработки, но и этические и практические вопросы, которые влияют на разработку лекарств сегодня.*

**Ключевые слова:** *Эволюция разработки лекарств, история медицины, общественное здравоохранение, древние лекарственные средства, растения, минералы, открытие лекарств, методы лечения, современные методы производства, анализ стадии разработки, фармацевтические препараты, скрининг, подопытные животные, фармакокинетика, фармакодинамика, морфология, клинические испытания, инфекционные заболевания, проблемы, успехи, таргетная терапия, этические вопросы.*

**Introduction.** The process of drug development is central to the history of modern medicine. While treatment methods have changed over thousands of years, it is only in recent centuries that the scientific disciplines and techniques of modern drug development have emerged. Progress has been marked by enormous advances, from the discovery of crude natural remedies to the modern era of high-tech drugs and biologics [1].

Drug development is more important than ever. With cancer, diabetes, heart disease, and viral infections spreading around the world, new and improved treatments have never been more needed. Additionally, the COVID-19 pandemic has demonstrated that we must be able to create drugs and vaccines as quickly as possible to meet new challenges. Understanding how drug development has evolved provides great insight into the history of disease treatment and why some challenges still persist [6].

Although there are many reviews of individual drugs or drug classes, few provide an overall history of drug development spanning several centuries and highlighting not only the scientific advances but also the socio-cultural and ethical aspects of drug discovery. This article will fill this gap by providing a comprehensive overview of the history, methodology, and challenges of drug development [8].

The main objective of this article is to provide a historical overview of drug development, its evolution, the drug development process, and its impact on disease treatment. By examining the historical overview, it is revealed how and why certain treatments for various diseases emerged and their impact on public health in general. In this regard, the following tasks need to be addressed:

- Trace the history and landmarks of drug development, from ancient medicine to modern biotechnological advances and genetic engineering.
- Comparison of drug development methodologies such as preclinical trials, clinical trials, and regulatory mechanisms for these processes.
- To conduct a comparative study of developments in the field of drug development for different diseases.
- To discuss the ethical, social, and economic issues associated with drug development.

**Materials and research methods.** The history of pharmacology dates back to ancient times. The Egyptians, Greeks, Chinese, and Indians used natural materials such as plants, minerals, and animal products for medicinal purposes. In ancient Egypt, medicines were made using plants such as aloe vera and myrrh, and the Greek physician Hippocrates established early principles of medical practice [9].

In ancient times, natural remedies and herbal medicine were used, and most of the treatments are still used today, but with modifications. For example, willow bark was used in ancient times to treat pain, and later it was discovered that the bark contains salicin, which is the main component of aspirin.

In China, traditional Chinese medicine has made extensive use of herbal preparations such as ginseng and ephedra. The Ayurvedic tradition in India has also used plants such as turmeric and

ashwagandha for thousands of years, some of which are now gaining acceptance in Western medicine for their anti-inflammatory and antioxidant effects.

The scientific revolution of the 16<sup>th</sup> and 17<sup>th</sup> centuries and the modern foundations witnessed significant advances, especially with the development of scientific methods [4, 6]. One of the most significant people of this time was Paracelsus, a Swiss physician who abandoned the medieval reliance on humors and established the practice of chemistry in medicine. Paracelsus argued that chemicals and minerals, if used correctly, could have therapeutic properties. This laid the foundation for the establishment of pharmacology as a science. During this period, opium and mercury entered mainstream medicine as treatments for disease, although their toxicity was not yet fully appreciated.

The 19<sup>th</sup> century was a revolutionary era of discoveries in the industrialization of drug production, primarily due to the Industrial Revolution and the rise of pharmaceutical companies. The process of isolating morphine from opium and quinine, used to treat malaria, opened up a new world of drug production. Perhaps the most revolutionary moment in drug discovery was in 1928, when Alexander Fleming discovered penicillin, the first true antibiotic. This discovery saved millions of lives and radically changed the course of medical history [2].

In the development of synthetic drugs, the role of chemistry is great and the mass production of drugs laid the foundation for the modern pharmaceutical industry. Drugs such as aspirin and barbiturates were two of the first widely used synthetic drugs [4].

The 20<sup>th</sup> century is the “Golden Age” of pharmaceutical innovation, with the rise of biotechnology and the pharmaceutical industry as a well-organized industry. The production of penicillin and the discovery of many antibiotics, antihistamines, and anesthetics changed the outcome of patient care. The discovery of insulin in the 1920s allowed diabetes to be controlled, saving millions of lives [3].

There was a rise in vaccination and immunology. The development of the polio vaccine, discovered by Jonas Salk in the 1950s, was one of the greatest public health achievements [5]. In the second half of the 20<sup>th</sup> century, attention shifted to gene therapy, immunotherapy, and biologics. This revolutionized the treatment of chronic diseases, cancer, and autoimmune diseases. The 21<sup>st</sup> century has the advantage of being the century of biotechnology and genomics, and their advent has changed the way drugs are developed today. The successful completion of the Human Genome Project in 2003 revealed the secrets of our genetic code, paving the way for personalized medicine. Drugs are now designed based on the genetic makeup of patients, especially in cancer therapy using targeted drugs and immune checkpoint inhibitors [7].

The COVID-19 pandemic has captured the world’s attention, highlighted mRNA vaccine technology, and demonstrated how quickly new treatments can be developed using modern biotechnology techniques [13].

**Research results and their discussion.** The drug development process includes preclinical and clinical phases of drug evaluation. Pharmaceutical development begins with the discovery of a molecule that has the potential to treat a disease. Scientists typically screen thousands of potential drugs to identify those that show the most promise for successful treatment. The substance then undergoes preclinical testing, during which its efficacy and toxicity are determined in test animals [11].

When preclinical results are encouraging, the drug moves on to phase I clinical trials, which focus on safety and dosing in a small group of healthy people. In phase II trials, the volunteer groups are further expanded to include patients, and the efficacy of phase III clinical trials in larger groups of people is established, and the efficacy is again tested with monitoring of drug side effects [12].

After passing clinical trials, the drug receives approval from regulatory agencies such as the FDA or EMA (Emergency Management Agency). Once a drug is on the market, post-marketing surveillance or phase IV trial surveillance is conducted and its effects on a wider population are monitored. Phase V is useful for identifying any long-term effects that were not detected in clinical trials.

The drug has the following advantages. Increasing life expectancy through treatment of diseases such as cancer and HIV that were once considered a death sentence. Complex methods such as targeted

therapy allow drugs to act directly on the mechanisms of disease occurrence and reduce side effects. Use of vaccines with preventative measures has reduced the incidence of infectious diseases worldwide, helping to eradicate diseases such as smallpox. The cost of drug development, as it is an expensive and time-consuming process and only a few drugs make it to market. Despite rigorous testing, some drugs continue to cause serious side effects even after widespread use. Access to medicines: Exorbitant drug prices and unaffordable health care are preventing many people around the world from benefiting from new treatments [10].

**Conclusion.** Thus, in conclusion, it can be noted that drug development is a continuous search that significantly improves human health. From penicillin to today's advances in medicine, drug discovery remains an evolving process tailored to the individual. In the future, advances in genetics, biotechnology, and cost and ethical issues are widely used. Therefore, it is necessary to address the issue of accessibility of drugs that can benefit all of humanity.

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