

01. Biotechnology-Derived Drugs

Biotechnology-derived drugs (biopharmaceuticals) are complex therapeutic products made from genetically modified living cells (bacteria, yeast, animal cells). Unlike chemical drugs, they target serious diseases (cancers, autoimmune diseases, rare diseases) using recombinant proteins, monoclonal antibodies, vaccines, or hormones.

Main Types and Examples of Biotechnology Drugs:

- **Monoclonal Antibodies:** Used in oncology (cancers) and inflammatory diseases (e.g., anti-TNF for rheumatoid arthritis).
- **Recombinant Proteins and Hormones:** Insulin for diabetes, growth hormone, antihemophilic factors.
- **Growth Factors and Cytokines:** Erythropoietin (EPO) for anemia, interferons.
- **Vaccines and gene therapies:** Modern (mRNA) or viral vaccines.

Key characteristics:

- **Production:** Requires bioreactors and a complex cell culture process (bioproduction).
- **Administration:** Generally injected or infused to avoid gastrointestinal degradation.
- **Biosimilars:** Similar versions of reference biologics, developed after patent expiration, often more affordable.

These therapies allow for more targeted and personalized medicine, sometimes limiting side effects compared to conventional treatments.

2. Chemically Synthesized Drugs

Chemically synthesized drugs are active ingredients created in laboratories through industrial processes from simpler compounds, representing approximately half of the drugs on the market. Unlike natural or biological products, they allow for mass production of pure and controlled products for cardiovascular, infectious, or cancerous diseases (e.g., paracetamol, aspirin, antibiotics).

Here are the key points regarding these drugs:

- **Manufacturing Process:** Chemical synthesis makes it possible to reproduce natural molecules (at a lower cost) or to create entirely new molecules (total synthesis) that do not exist in nature.
- **Common Examples:** Paracetamol (fever/pain), aspirin (acetylsalicylic acid), ibuprofen, and many antibiotics.

- Advantages: Large-scale production at any time of year, high purity, and the ability to modify structures to improve efficacy.

Semi-synthesis: Sometimes, a natural product is extracted and then chemically modified (e.g., artemisinin for malaria).

- Areas of application: Nearly 90% of new anticancer drugs approved since 2000 are produced through chemical synthesis or semi-synthesis.

These drugs differ from biopharmaceuticals, which are produced by living cells, because their structure is too complex to be chemically synthesized.