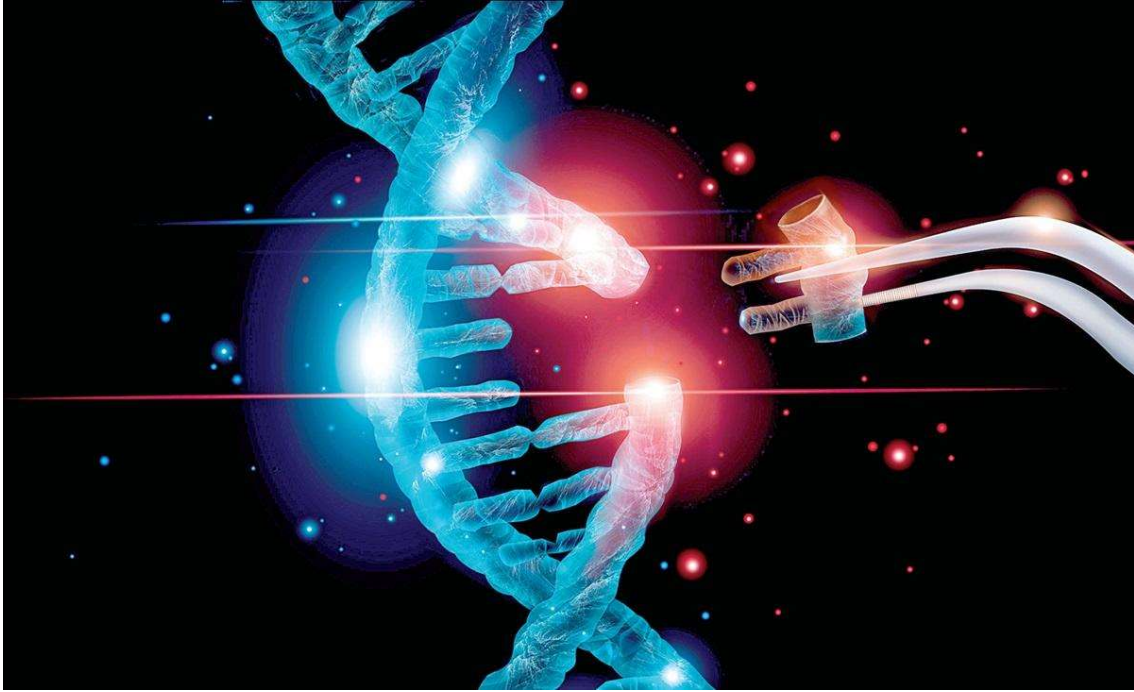


Modern medicine scaling new heights



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In the wake of the covid-19 pandemic, we have been witnessing a lot of drastic changes and fabulous improvements in the medical field globally. In 2023 these changes gained momentum. New diagnostic methods and modern medical facilities have been increasing. As a result, the duration of diagnosis is reduced not only for common diseases but also for many rare diseases and methods of clinical treatment have become easier as well.

Gene therapies' significance

In 2023, an important step forward in modern medicine is related to gene therapy. Many rare diseases are caused by a combination of genetic mutation, auto immunity, metabolism, organ degeneration and so on. Several developments have taken place in resolving these problems. As for genetic diseases, the basic principle of treatment is to remove or replace a faulty or mutated gene in the DNA chain. This is called 'Gene editing'. The technology used for this is 'CRISPR' (clustered regularly interspaced short palindromic repeats).

The process involves correcting errors using synthetic RNA (RNA) and Cas9 enzymes produced in bacteria. RNAs identify for Cas9 enzymes the faulty gene chain that needs correction, just as we identify a leaking water pipe at home for a plumber. The plumber will apply some glue and plug the leaking pipe or replace the pipe. Similarly, Cas9 enzymes remove or replace the faulty gene. In this process the technique called 'Base editing' has been followed, so far.

DNA is like a double stranded chain. Base editing involves modification of both strands of DNA. Sometimes this is not required. While correction in a single strand is enough, the correction done in both strands sets off some undesirable consequences for the user. To overcome this shortcoming, a modern method called 'prime editing' has now been introduced to correct only a single faulty strand. This is similar to fixing only the leaking part of a pipe instead of removing the pipe itself. How is this possible? Instead of showing a leaking pipe as a whole, the leaking part of the pipe is identified. Likewise, RNAs used in prime editing can pinpoint the faulty gene with precision. As a result, the genetic fault is corrected very accurately and a total cure of diseases is possible. Rare diseases such as thalassemia, sickle cell disease, Duchenne Muscular Dystrophy, Inherited Ataxia and so on are cured with the help of this 'prime editing.'

A new way-out for cancer

In the corona times, the mRNA Technology brought about an innovation in the vaccine concept. This technology has made it possible to discover a corona vaccine fast and make it affordable. Using this gene-based technology, scientists have been trying to find new drugs for the most puzzling and challenging diseases, In particular, mRNA is used to cure cancer. When mRNAs are administered via a vaccine, they stimulate normal cells in the body to produce cancer-fighting antibodies. As a result, cancer is cured..

Advanced fetal tests

In order to predict whether a fetus runs the risk of contracting a congenital disease, tests such as amniocentesis and chorionic villus sampling are now recommended. However, these tests are likely to harm the baby in the womb. So, to avert this risk, the Non-Invasive Prenatal DNA Testing (NIPT) technology comes in handy. This is a kind of blood test method that separates the fetal cells circulating in the mother's blood and examines their genes. The comforting feature of this technology is that it does not cause any harm to the fetus.

Innovation in cancer diagnosis

Bio-markers found in the blood of the user or genetic tests are now used to diagnose cancer early. Yet diagnosis of various types of cancer at much earlier stages is now possible, thanks to the new technology called 'Proximity ligation assays - PLA'.

When cancer afflicts a person, it first reacts to the proteins on the surface of cells. Then antibodies appear there. Now a modern diagnostic method is used to predict cancer risk. It is a new lesson learnt that just as a plant's disease is diagnosed by examining its leaves instead of studying its roots, so the cancerous cells' protein is enough for study, not the genes, for diagnosing cancer.

Hopeful neuroimaging

The neuroimaging methods such as EEG, PET, and MRI scans, which have been widely used for diagnosing mental illnesses, have now so progressed that chemical changes in the brain caused by the thought-action-behavior pattern arising from social influence, individual mood, and decision-making in stressful times can be studied. Importantly, the Functional MRI (fMRI) images lead the way, raising hopes that the technology could be used to diagnose and stall suicidal thoughts early.

Transformative Artificial Intelligence

The Artificial Intelligence (AI) technology is revolutionizing the field of medicine, changing paradigms in diagnosis of diseases and drug development. This is borne out by the recent increase in the number of research articles on artificial intelligence in the popular medical journals such as Nature, Science and New England Journal of Medicine.

This year AI-assisted apps such as ChatGPT, Gemini, Claude and so on and the 'Crowdsourcing' diagnostics have taken the medical field to the next level of modernity. On the flip side, there are possibilities of fakes emerging in the domain, posing challenges to the doctors and having the people struggle to differentiate between the real and the fake.

To address this issue, experts should formulate proper guidelines on using the digital platforms to guide the physicians and the public. The government should also systematically monitor the sites used by the community.

After all, the field of medicine is related to human life.

Translated by V. Mariappan.