

TECH CARE

HEALTH AND TECHNOLOGIES

ENGLISH CLASS:
ERICA ROITERO

MEDICAL DISCOVERIES
L2SPS



**SPECIAL EDITION :
CANCER IN OUR LIVES**

ALZHEIMER

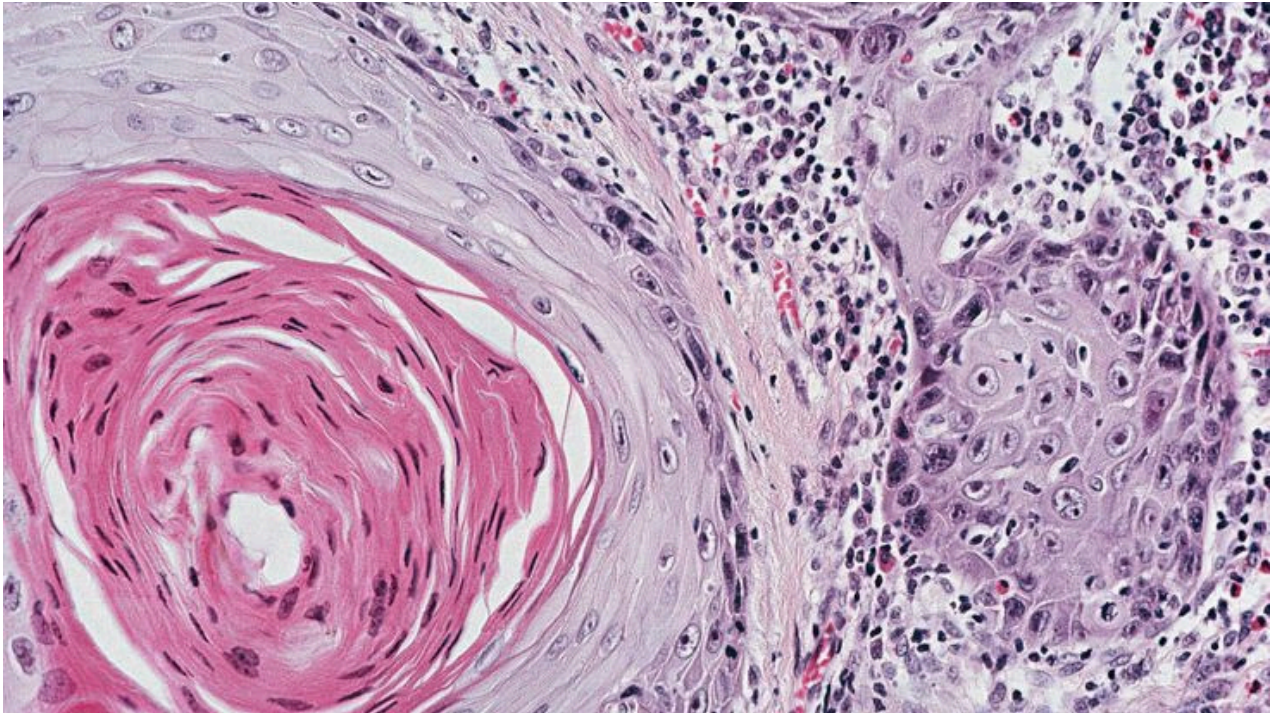
**NOVEL TECHNOLOGIES
FOR HEALTHCARE**

MICROBIOTE

**GENETIC-RELATED
DISEASES**

ARTIFICIAL ORGANS

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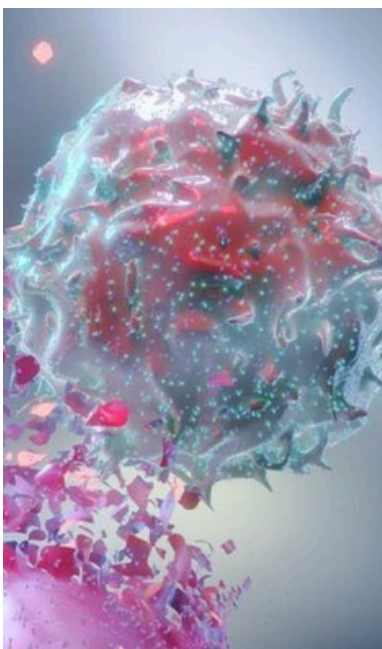
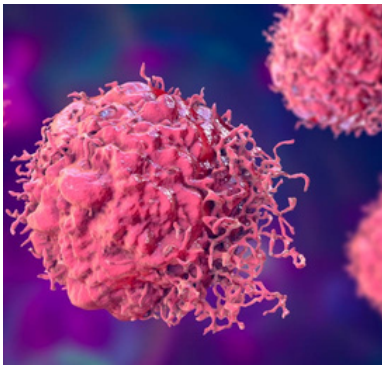
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Cancer becomes an important part of everyone's life. Indeed, one in five men and one in six women will develop cancer during their lifetime.



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INNOVATION AND TECHNOLOGY IN CANCER



Cancer, this disease which destroys us from the inside following the proliferation of cells whose program has been modified randomly...

From simple benign tumors to generalized cancer, it is a vicious disease because it is recognized as our own cells our immune system does not do what is necessary to get rid of them.

This is why scientists around the world are working together to find cures and solutions to this scourge.

What solutions are being developed?

Several solutions are observed:

- Immunotherapy to help our immune system defend itself
- Two kinds of immunotherapy
- The use of new technologies such as AI for prevention and prediction assistance or nanotechnology as a remedy.

All of these approaches are difficult to develop and have limits, but that is the challenge of current cancer research.

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE IN CANCER



Cancer is a significant public health issue with 37 new diagnosis of cancer and 19 deaths by cancer per minute in the world. Using new technologies can be very important to get early diagnosis and avoid complications from late diagnosis.



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As a reminder, Artificial Intelligence (AI) is commonly defined as a set of computer-coded programs or algorithms that use data analysis and pre-programmed instructions to make predictions and decisions about various aspects of a disease.

Machine Learning (ML) is a specialized field within AI that refers to a group of algorithms designed to automatically learn and improve from experience.

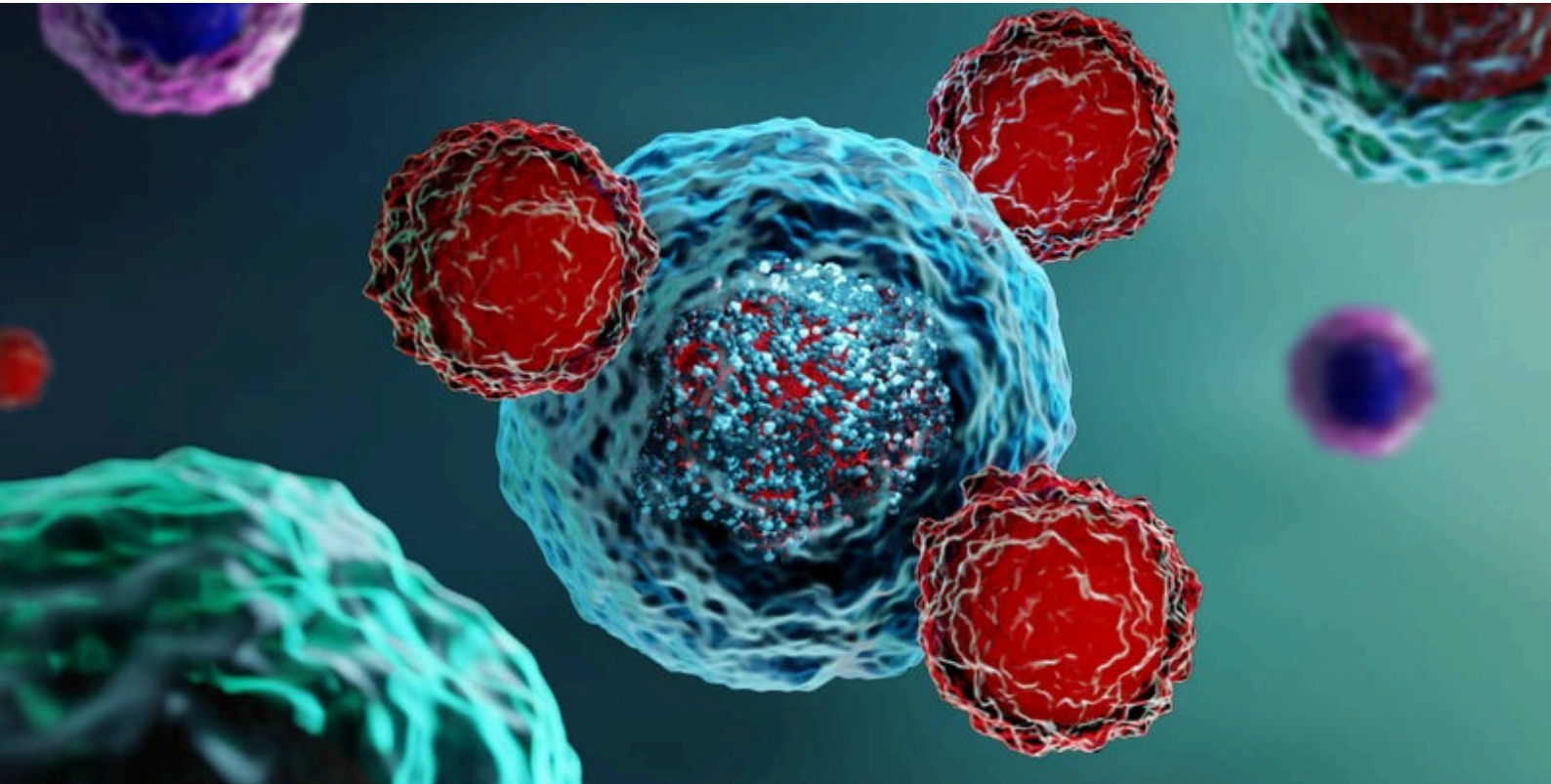
Those two technologies are used for real-time detection and diagnosis of brain tumors, differentiate malignant and normal tissue, classification of cancer, predict the timing and site of cancer recurrence, predict which treatment are best suited for each patient and provide more precise informations about the survival, prognosis, and disease progression.

AI and ML can offer more effective therapy when patients get more accurate prognoses with treatment options including personalised and individualised care.

These technologies have good potentials in every aspect of cancer research, and notably to improve the quality of hospital environments. It may one day result in a more effective treatment for cancer, but it requires additional studies for it.

Machine Learning and AI in Cancer Prognosis, Prediction, and Treatment Selection: A Critical Approach
Bo Zhang, Huiping Shi, Hongtao Wang

Immunotherapy for cancer



Immunotherapy is a treatment that uses a person's own immune system to fight cancer. It can boost or change how the immune system works so it can find and attack cancer cells.

Immunotherapy can have toxic effects on good cells so it's important to control dose and time of prescription.

In the functioning of cancer, the immune T cells will present the PDL1 (=protein program cell death) to the tumor cells to induce their death except that they are capable of destroying these PDL 1 and therefore do not die but multiply.

So the goal of immunotherapy is to destroy the functioning of anti PDL1 to induce the death of tumor cells.

About side effects; we know that they are in another part of the body, it's a normal consequence of immunotherapy, they could be very different on the body : pneumonitis, dermatitis...

If it's too severe, the cessation of therapy and steroids are used to treat them, but it's necessary to control administration of steroids because they have immunosuppressive effects.



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2 TYPES OF IMMUNOTHERAPY

Like we said before, immunotherapy consists of stimulating this system with the goal to strengthen its own defenses against cancer cells.

There are two types of immunotherapy: the monoclonal antibody and the immune checkpoint inhibitors.



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1. Monoclonal antibody

The monoclonal antibody is intended to cause an immune reaction just like a virus does in a normal way for example. This targeted treatment targets a specific part of the cancer cell like a certain protein of the cancer. It blocks the growth of tumor cells

2. Immune checkpoint inhibitors

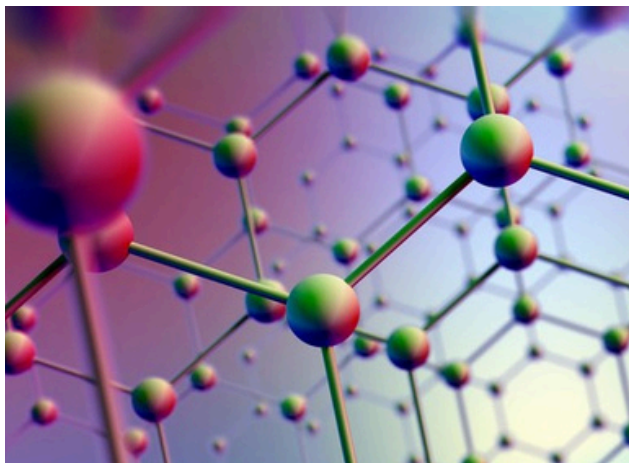
On the surface of each cell of our body are checkpoints. These checkpoints are receptors. Their goal is to ensure that the body does not attack its own cells.

The white blood cells of our immune system are responsible for destroying foreign organisms in our body. When our white blood cells meet the control points of the cells of our own organism, they receive the signal not to destroy them. The same goes for cancer cells that are not foreign cells, but our own defective cells. They are not automatically eliminated by white blood cells. The active substances of immune checkpoint inhibitors suppress this blockage. White blood cells then better recognize cancer cells as abnormal and eliminate them.

NANOTECHNOLOGY

Nanotechnology has revolutionized cancer treatment with its innovative applications in drug delivery, gene therapy, and molecular imaging. Through the development of nanomaterials such as gold nanoparticles and quantum dots, precise diagnosis at the molecular level has become achievable.

Nanotechnology-driven treatments, like nanoscale drug delivery, ensure targeted therapy with minimal side effects by effectively crossing cell barriers. The review that we chose explores the remarkable advancements in cancer treatment facilitated by nanotechnology, focusing on its potential to enhance therapeutic efficacy while minimizing adverse effects.



In lung cancer, for instance, immune superparamagnetic iron oxide nanoparticles (SPIONs) used in Magnetic Resonance Imaging (MRI) imaging have shown high specificity and minimal side effects.



Magnetic powder imaging techniques offer high-resolution and sensitivity to cancer tissues, with magnetic nanoparticles (MNPs) targeting proteins like Epidermal Growth Factor Receptor (EGFR) in non-small cell lung cancer (NSCLC).

Additionally, nanosystems for Positron Emission Tomography (PET)

Nanotechnology plays a pivotal role in cancer therapy, utilizing various tools like liposomes, carbon nanotubes, polymeric micelles, dendrimers, and quantum dots for drug delivery.

- Liposomes, composed of phospholipid bilayers, efficiently transport hydrophilic and hydrophobic drugs to target tumors, exploiting the enhanced permeability and retention (EPR) effect.
- Carbon nanotubes exhibit excellent properties for drug delivery, particularly in non-invasive penetration and targeted therapy through near-infrared (NIR) light absorption.

Nanotechnology has emerged as a promising avenue for cancer treatment, offering improved drug delivery and reduced systemic toxicity. While nanomaterials enhance targeted therapy, they still pose challenges such as systemic and organ-specific toxicities. Overcoming these limitations requires further research to refine drug delivery and minimize adverse effects.

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