TECNOLOGIA SETUBAL

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Nanotechnologies for Lung Cancer Treatment

Gold nanoparticles

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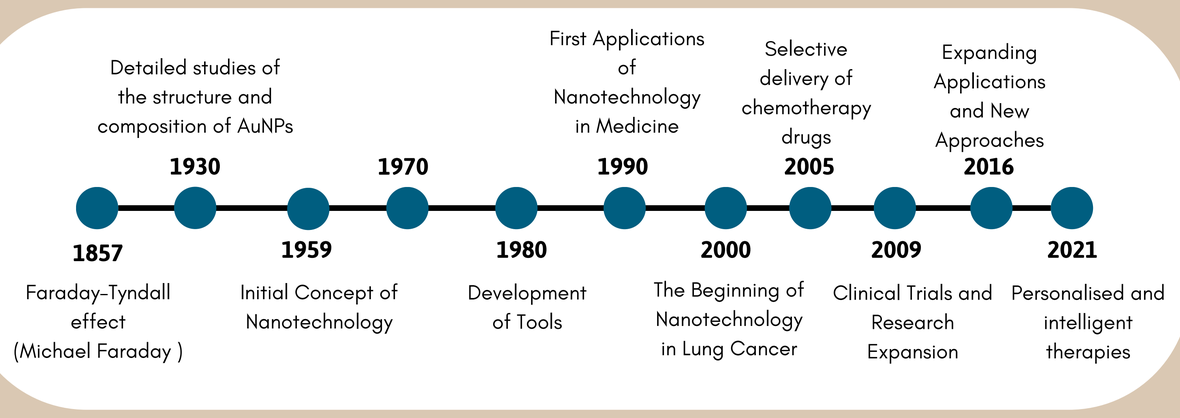
SCAN ME!

INTRODUCTION

Nanotechnologies are transforming the treatment of lung cancer, enabling precise therapies that directly attack tumours while minimising side effects. With faster and more effective diagnosis, these innovations offer new hope in the fight against one of the most aggressive forms of cancer, lung cancer. [1]



Lung cancer is one of the most prevalent and devastating forms of cancer, and one of the leading causes of death worldwide. In 2020, studies revealed that, as well as being one of the most common neoplasms (exaggerated and incorrect growth of any type of cell in the body), it has an alarmingly low survival rate of just 18 per cent, highlighting its aggressiveness and high mortality. Early diagnosis and innovative therapeutic intervention are crucial to improving patients' prognosis and quality of life. [1],[4]

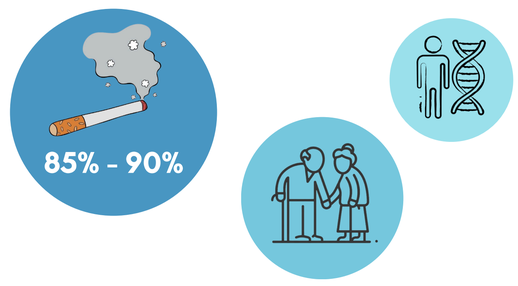
Statistical data

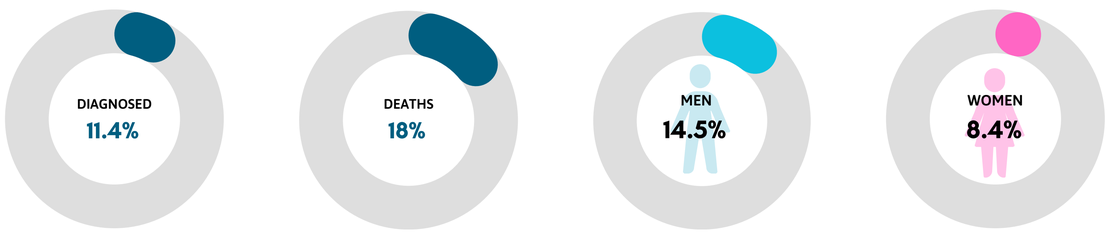
According to the Portuguese Society of Pneumology - 2020 [8]

2.2M New patients diagnosed with lung cancer in 2020

1.8M Lung cancer deaths

Main causes of lung cancer





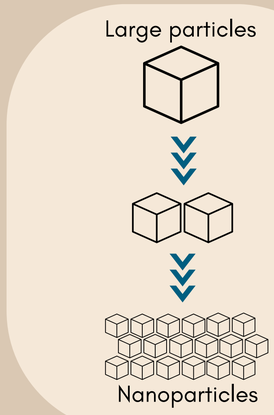
BIOMEDICAL APPLICATIONS

Nanotechnologies have revolutionised the treatment of lung cancer through remarkable advances in the development of targeted pharmaceuticals administration systems.
These systems, using nanoparticles, allow chemotherapy pharmaceuticals to be transported directly to cancer cells, reducing the impact on healthy tissues. This minimises the side effects of conventional treatments and increases efficacy by improving the absorption of drugs by tumour cells. [1], [2]

One of the most promising approaches is the use of lipid and polymer nanoparticles, which encapsulate the pharmaceuticals, allowing for controlled release at the tumour site. Gold nanoparticles, for example, have also been used not only as pharmaceuticals vehicles, but in photothermal therapies, where, after being accumulated in the tumour, they are heated with a laser to destroy the cancer cells. [1], [2]

NANOMATERIAL PRODUCTION

TOP-DOWN METHOD



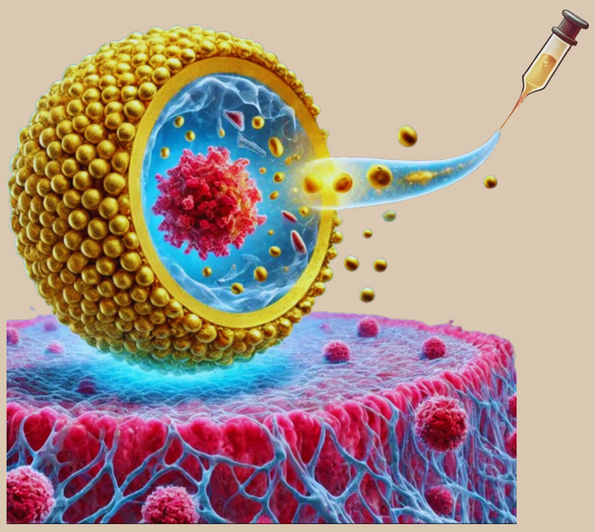
The Top-Down method consists of transforming large particles into nanoparticles through physical or chemical processes. [5], [6]
This method is subdivided into 5 phases:

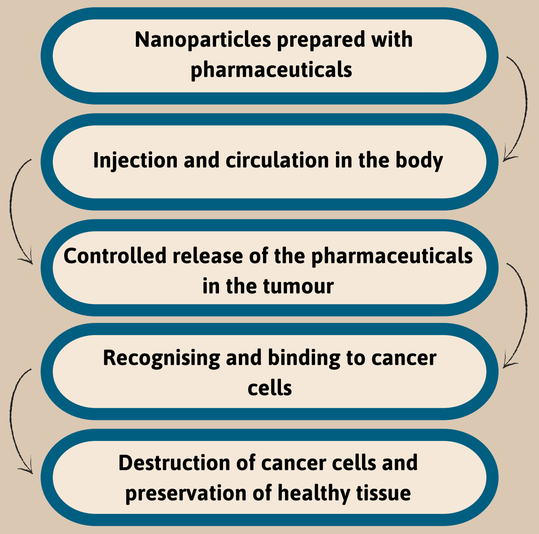
Milling >>> Focussed ion beam >>> Refining and Treatment >>> Purification >>> Characterisation

ACTION MECHANISMS

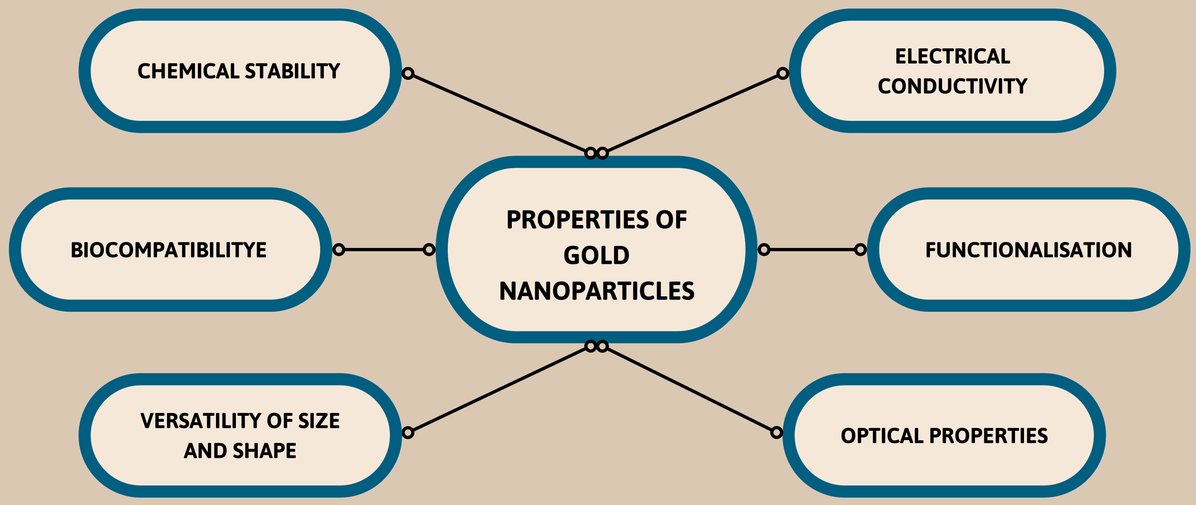
CONTROLLED PHARMACEUTICALS ADMINISTRATION

Nanoparticles allow for a gradual and sustained release of chemotherapy pharmaceuticals directly into the tumour, improving treatment efficacy and minimising side effects on healthy tissues. Gold nanoparticles can be modified to transport pharmaceuticals directly to cancer cells. [5], [6]



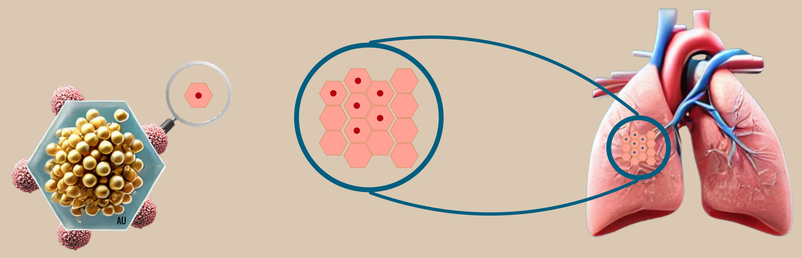


PROPERTIES



FUNCTIONALISATION / BIOCONJUGATION

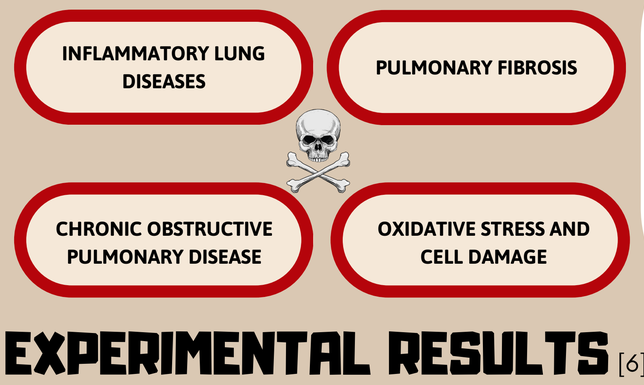
Functionalisation consists of modifying the surface of nanoparticles with bioactive molecules (compounds that have an effect on biological processes in living organisms), such as antibodies or peptides, to target them specifically to cancer cells.

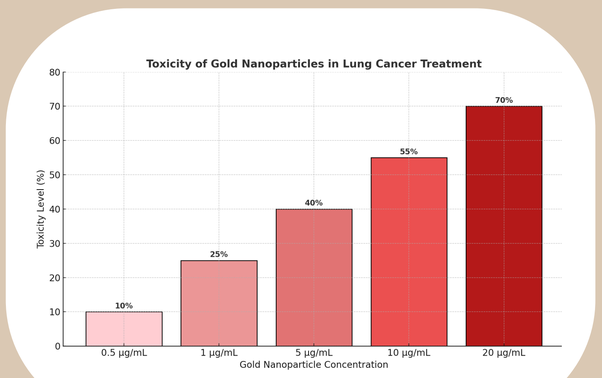


This facilitates selective binding to tumour cells, allowing targeted delivery of pharmaceuticals or use in photothermal therapies, where light-induced heat destroys cancer cells. [1], [4]

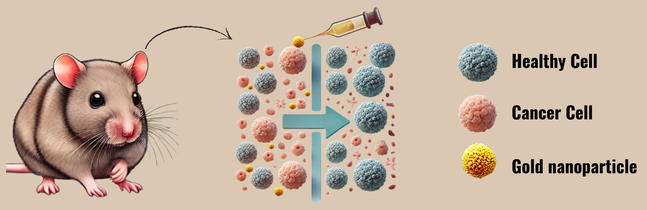
TOXICITY

When used incorrectly: [5]





EXPERIMENTAL RESULTS [6]



In vivo studies on hamsters with oral carcinoma showed that treatment with VC@ GDNDs significantly reduced the tumour. The combination with NIR irradiation increased the anti-tumour effects, highlighting the formulation's selective efficacy and reduced side effects.

CONCLUSION

Gold nanoparticles represent a promising advancement in lung cancer treatment, enabling targeted drug delivery with reduced systemic toxicity. Their unique properties allow for more effective and personalized treatments, offering new perspectives in oncology.

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