Magnetic Nanogels For Combined Hyperthermia And Chemotherapy Of Prostate Cancer

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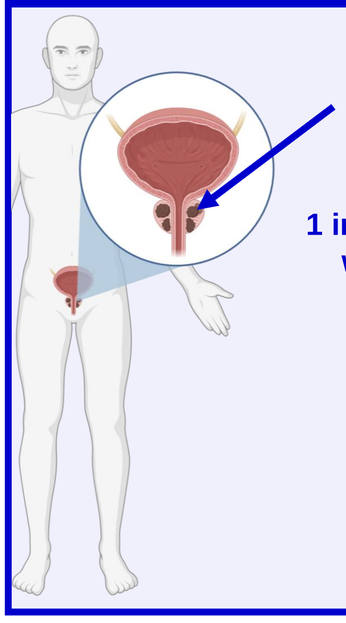
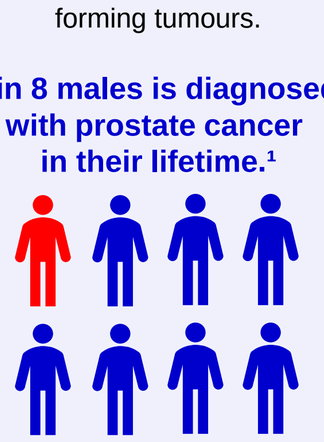
Prostate Cancer: What Is It And How Is It Treated?



Prostate cancer occurs when prostate cells multiply abnormally, forming tumours.

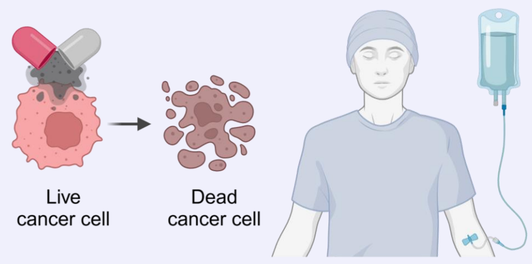
1 in 8 males is diagnosed with prostate cancer in their lifetime.[1]



Prostate cancer is the most commonly diagnosed cancer in males in the UK.[1]

Chemotherapy

High drug dosages are used to kill or slow the growth of cancer cells.[2]

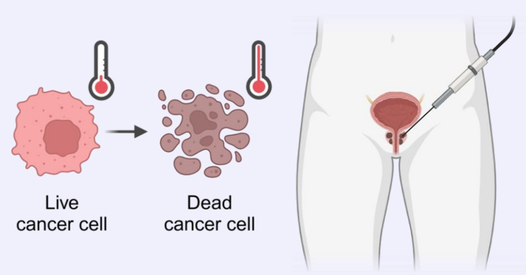


Side effects:

- Hair-loss, nausea, fatigue
- Will kill healthy cells
- Cancer cells can learn to fight off the drugs

Hyperthermia

Controlled heating is used to kill cancer cells (saunas, probes, heated blankets).[2]



Side effects:

- Burns and swelling
- Invasive treatment
- Cancer cells can survive
- Will kill healthy cells

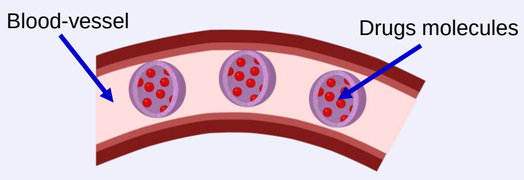
Our work challenges common therapies for prostate cancer

How Can We Kill Cancer Effectively Without Harming The Patient?

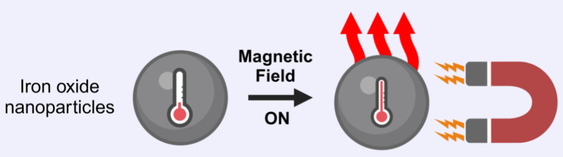
Nanoparticles Improve Cancer Treatment:

Nanoparticles are nanoscale materials, 100,000 times smaller than a grain of sand. Their size gives them unique properties, such as biocompatibility, allowing them to be used in medicine.[3]

1. Nanoparticles make the therapies more specific:



Nanoparticles can be used as containers for chemotherapy drugs, protecting healthy cells as the drugs travel through the body.[3]

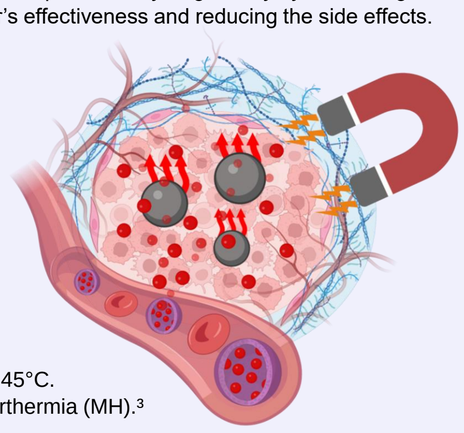


Iron oxide nanoparticles (IONPs) heat up in a magnetic field, up to 45°C. This heat is used to selectively kill cancer cells with magnetic hyperthermia (MH).[3]

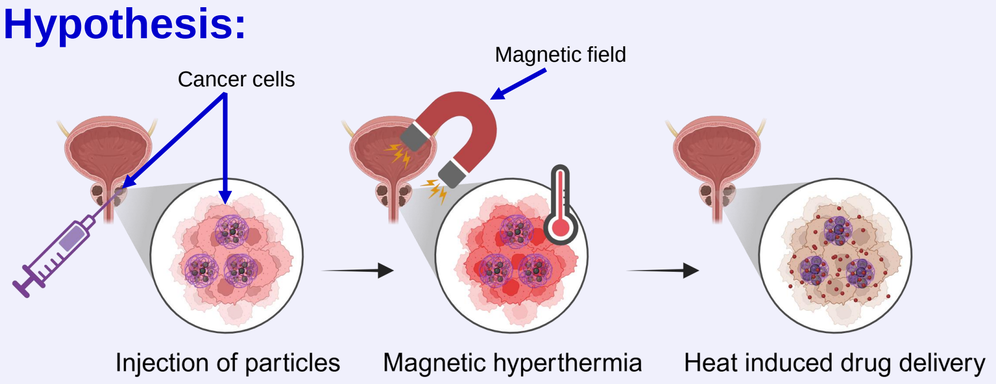
2. Nanoparticles can combine two therapies together:

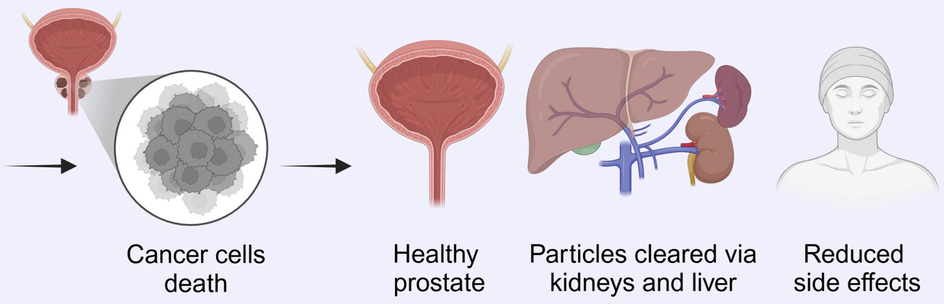
Combinatorial therapies

The therapies work synergistically by enhancing each other's effectiveness and reducing the side effects.



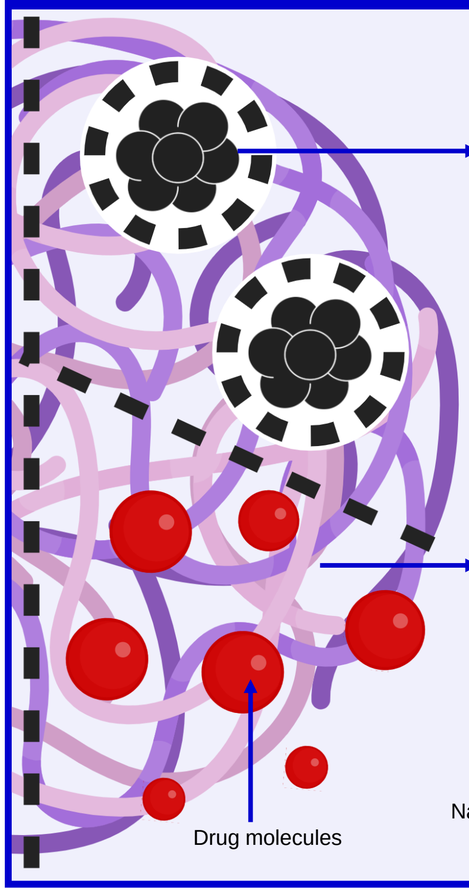
Our Hypothesis:



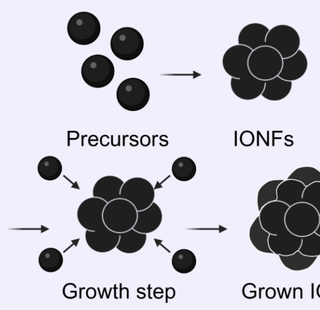


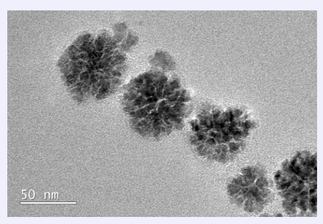
How Can We Achieve This Novel Therapy?

Magnetic Nanogels With Iron Oxide Nanoflowers



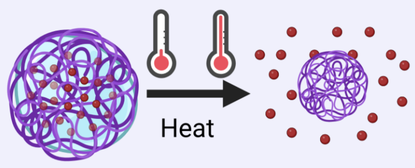
Iron oxide nanoflowers (IONFs) are clusters of IONPs with a flower-like appearance. The clustering enhances the heating abilities of the IONFs, making them highly efficient for MH.[4]

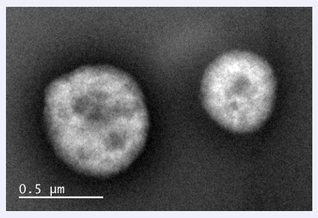




IONFs, TEM, 100k

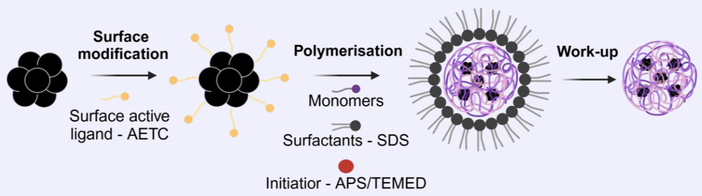
Nanogels are spherical, water-swollen polymeric nanoparticles engineered for drug release, which is triggered by the heat generated from IONFs.[5]

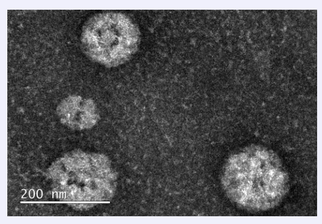




Nanogels TEM, 15k

Magnetic Nanogels (MNG) Synthesis:

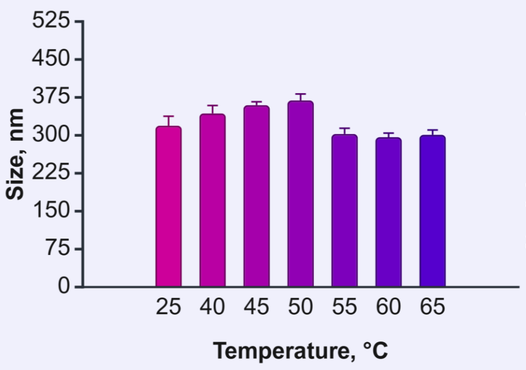




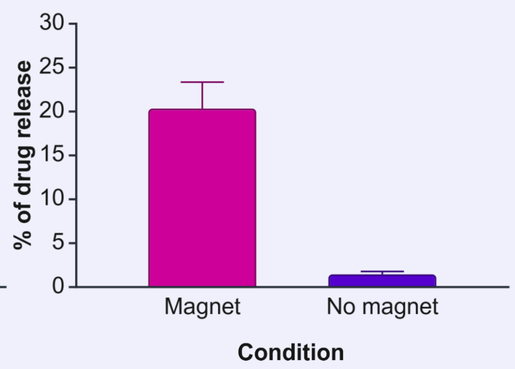
MNG, TEM, 40k

Magnetic Nanogels Properties:

Size changes in MNG with increasing temperature



Drug release with magnetic field



What Does The Future Of Prostate Cancer Treatment Look Like?

Stronger Cancer-Fighting Power

Magnetic nanogels heat up and release drugs exactly where needed, boosting effectiveness compared to separate treatments.[6]

Less Harm to Healthy Cells

This precise targeting means fewer side effects, leading to a safer and more comfortable treatment for patients.[7]

References:
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