A new field called nanomedicine has recently emerged. Nanomedicine uses ultra-small objects called “nano-carriers”, which are 10,000 times smaller than the diameter of a human hair, to deliver drugs and imaging agents to human cells. Chemotherapy uses anti-cancer drugs to kill tumour cells, but it is associated with serious side effects because it can't tell cancerous cells apart from normal, healthy ones. This project will investigate a new, more effective way to treat prostate cancer using nanomedicine to deliver chemotherapy directly to cancerous cells. Nanoparticles will not only target the primary tumour (original tumour in the prostate region), but also the metastatic prostate cancer cells (cancer cells spread outside the primary tumour).

Prostate specific antigen (PSA) is a protein found at high levels in cancerous prostate cells. There is a type of drug (called a prodrug) that only becomes active when it comes into contact with a specific target, in this case PSA protein. This means the drug will cause no damage to healthy cells but will result in the specific death of prostate cancer cells. This approach greatly reduces side effects. The major problem with prodrugs is that they are rapidly cleared from the body and don’t accumulate to high enough amounts in sites of metastatic cancer.

The current project aims to wrap up PSA-prodrugs inside nano-carriers called “liposomes”, which can be targeted specifically to prostate cancer cells. Liposomes are made of natural fat molecules called lipids and are considered the safest nano-carrier systems developed so far. Encapsulation of prodrugs into liposomes is expected to increase the amount of time the drugs stay in the body. To increase the amount of the drug that reaches cancer cells that have left the main tumour, the liposomes will have a molecule on their surface that lets them recognise cancerous prostate cells, wherever they are in the body. This molecule will recognise a protein that is found at high levels in cancerous prostate cells called PSMA. This approach should increase the effectiveness of prodrugs, and create a treatment with reduced side effects by only targeting the cancerous cells.
**How long will it take?**

5 years

**What are the expected outcomes?**

As an outcome of this project it is expected that more effective and safer targeted nanomedicines will emerge to treat metastatic prostate cancer so that chemotherapy side effects are hugely reduced.

**How could it make a difference to the lives of men affected by prostate cancer?**

Using “targeted nanomedicine” approach is expected to save lives of many prostate cancer patients by tackling the problem of bone metastasis. Treatments that can get access to the bone and efficiently eradicate the tumour are considered as a huge success. Moreover, the therapy is expected to have much lower side effects thus the quality of patient's life is expected to improve.

**Please write a summary of the project in one sentence only**

Using targeted nanomedicine to treat metastatic prostate cancer is totally novel with expected breakthrough findings that are likely to transform the life of prostate cancer patients.