



# AN OLD ANTI-ALCOHOLISM DRUG GIVES LUNG CANCER PATIENTS NEW HOPE

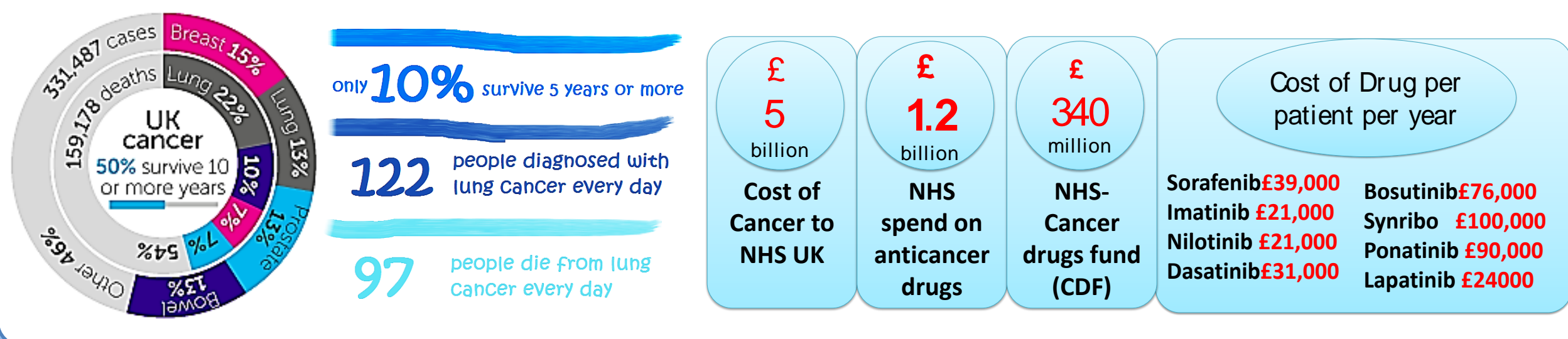
Kate Butcher, Vinodh Kannappan, Zhipeng Wang and Weiguang Wang

Research Institute in Healthcare Science, Faculty of Science and Engineering, University of Wolverhampton, Wolverhampton WV1 1LY



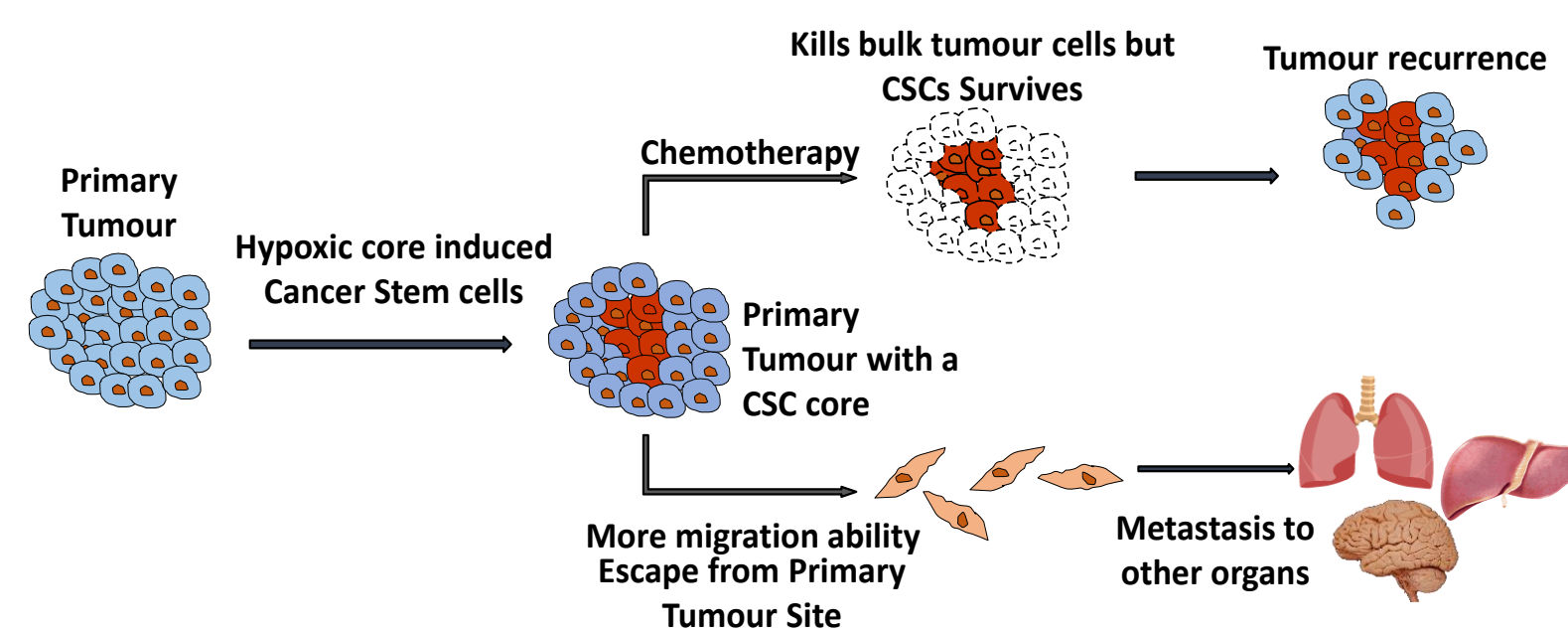
## Pressing need for new anticancer drugs

- Lung cancer is the most common cancer in the world – 1.8 million new cases.
- Lung cancer is the leading cause of cancer death worldwide – 1.6 million deaths.
- UK - 44,500 new cases of lung cancer diagnosed and 35,500 people died in 2012.
- The average price of anticancer drugs increased 15-fold over the last 10 years.
- Most anticancer drugs have severe side effects. **Moreover, they often do not cure cancer.**



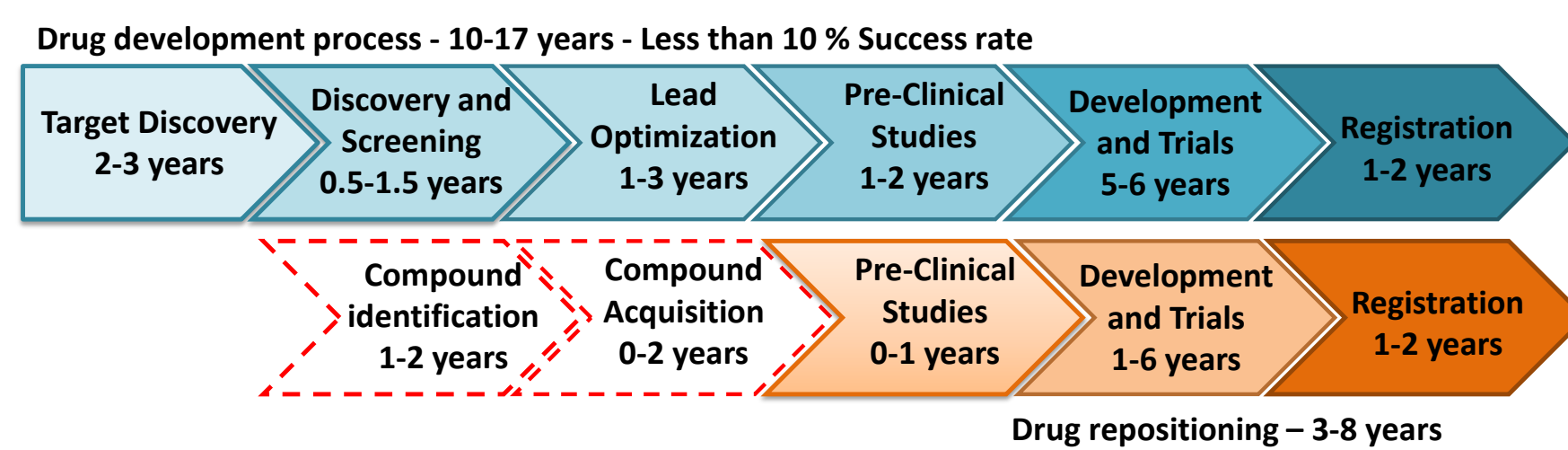
## Cancer Stem Cells - Prime Targets in Cancer

- Cancers contain a small population of cancer stem cells (CSCs) that are highly resistant to anticancer drugs. CSCs result in tumour metastasis, recurrence and poor prognosis.

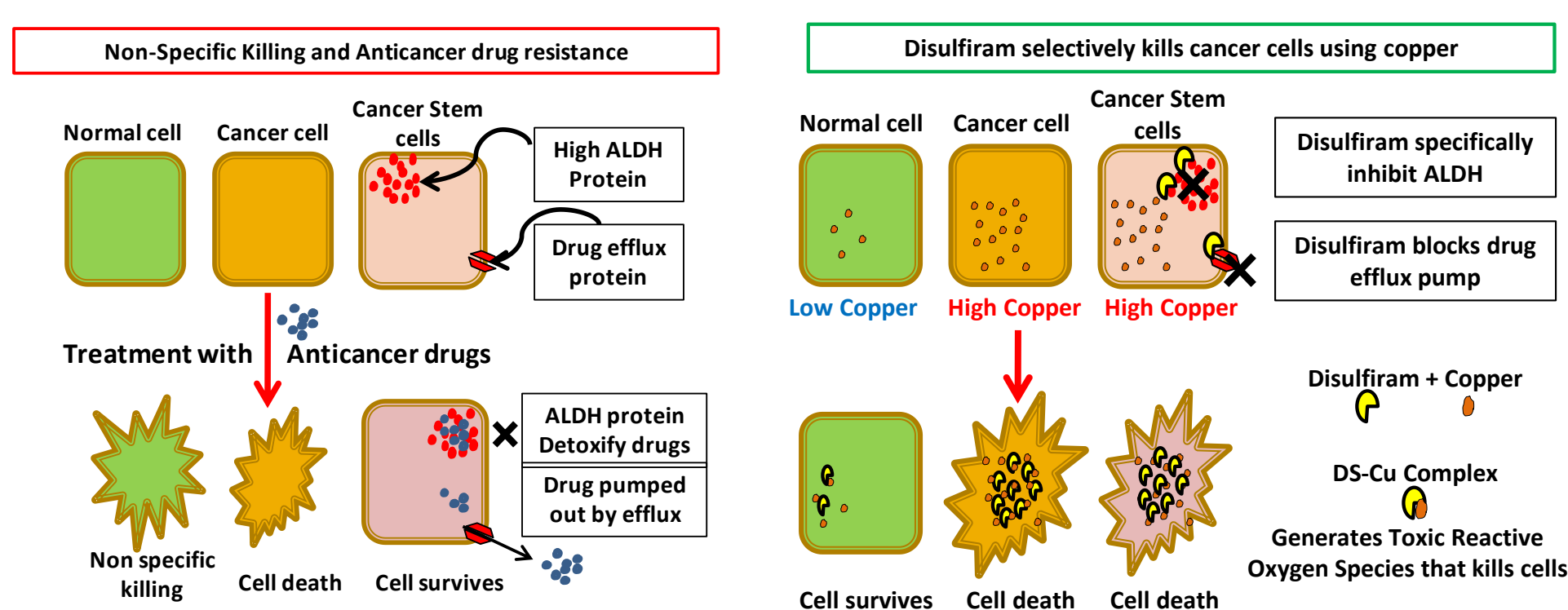


## Drug repositioning and Disulfiram

- Development of a new drug takes an average of 15 years and costs £1.15 billion.
- Repurposing FDA approved drugs for new uses is an established shortcut between the lab and clinics - An attractive strategy for anticancer drug development.



- Disulfiram (DS) is an anti-alcoholism drug that has been used for over 60 years.
- DS forms a complex with Copper (Cu) that kills cancer cells through generation of reactive oxygen species.



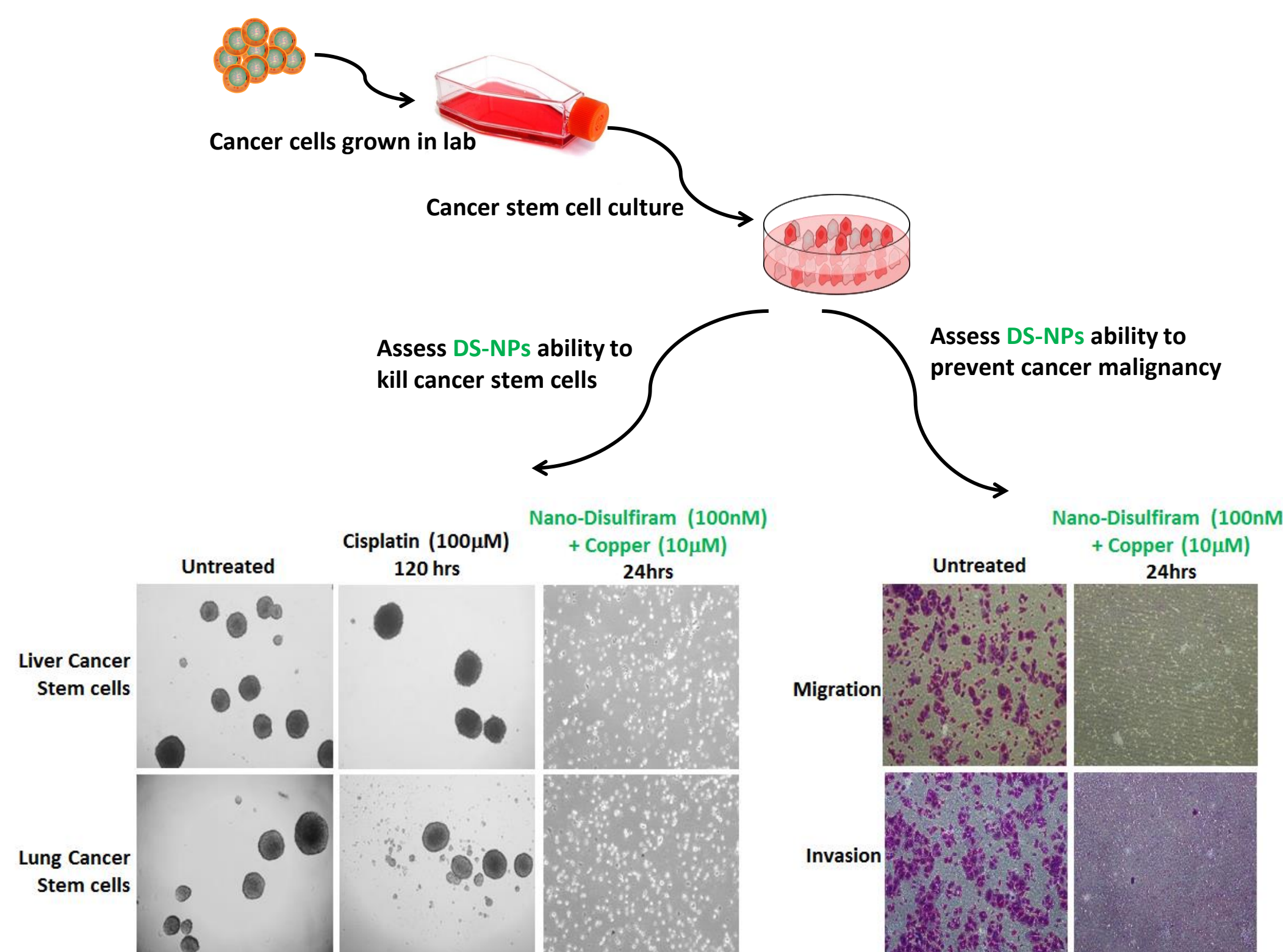
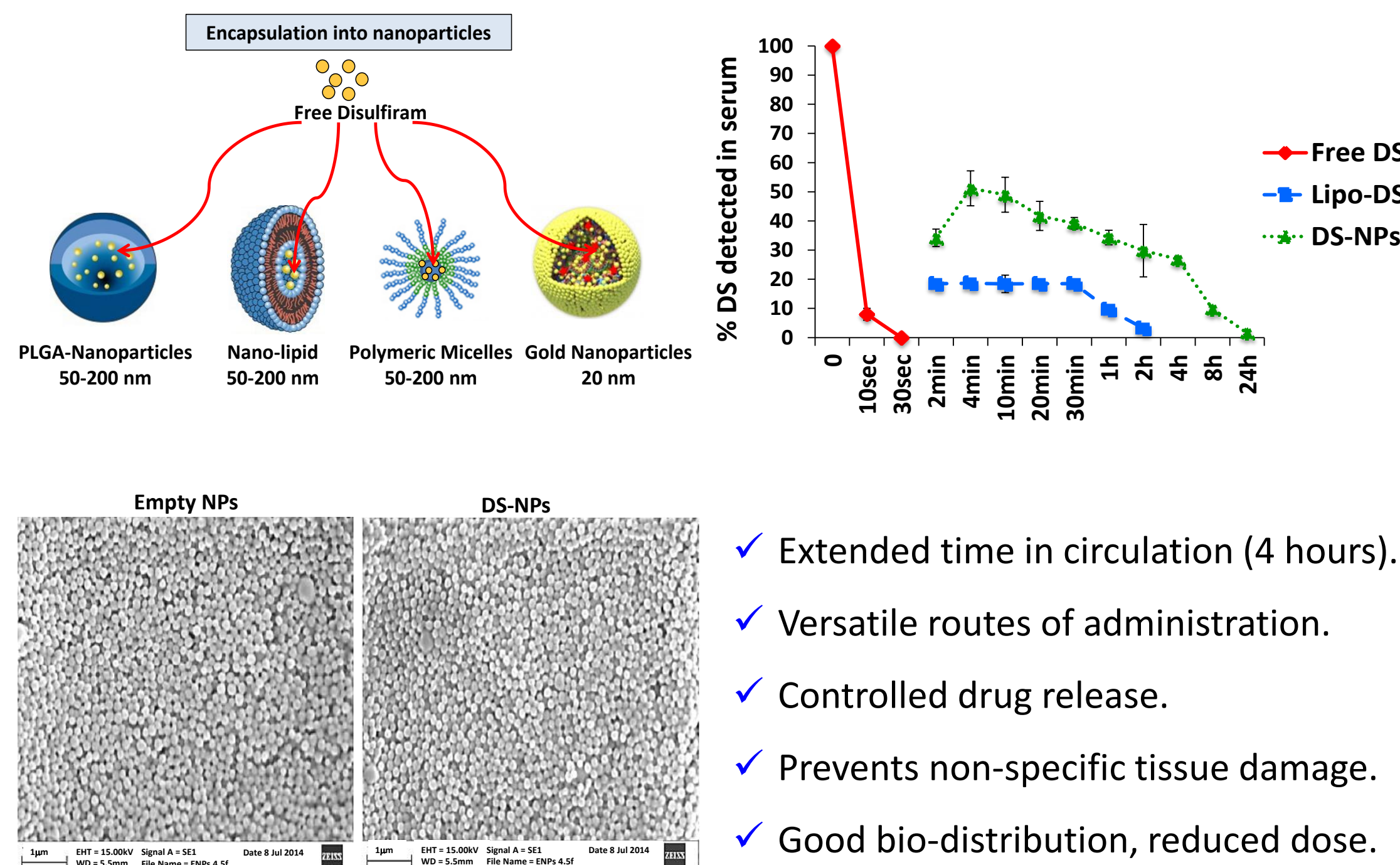
Compared with normal tissues, cancer tissues often possess higher levels of intracellular Cu which enables DS to selectively target cancer cells.

## Problems for using Disulfiram in cancer treatment

- The potential clinical application of DS in cancer treatment is hampered by its very short half-life in the bloodstream (less than 2 min).
- New formulations of DS with longer half-life in the bloodstream are required to establish the true efficacy of DS in cancer.
- Nano-drug-delivery is a cutting edge technology that enables us to protect and deliver vulnerable drugs in the bloodstream.

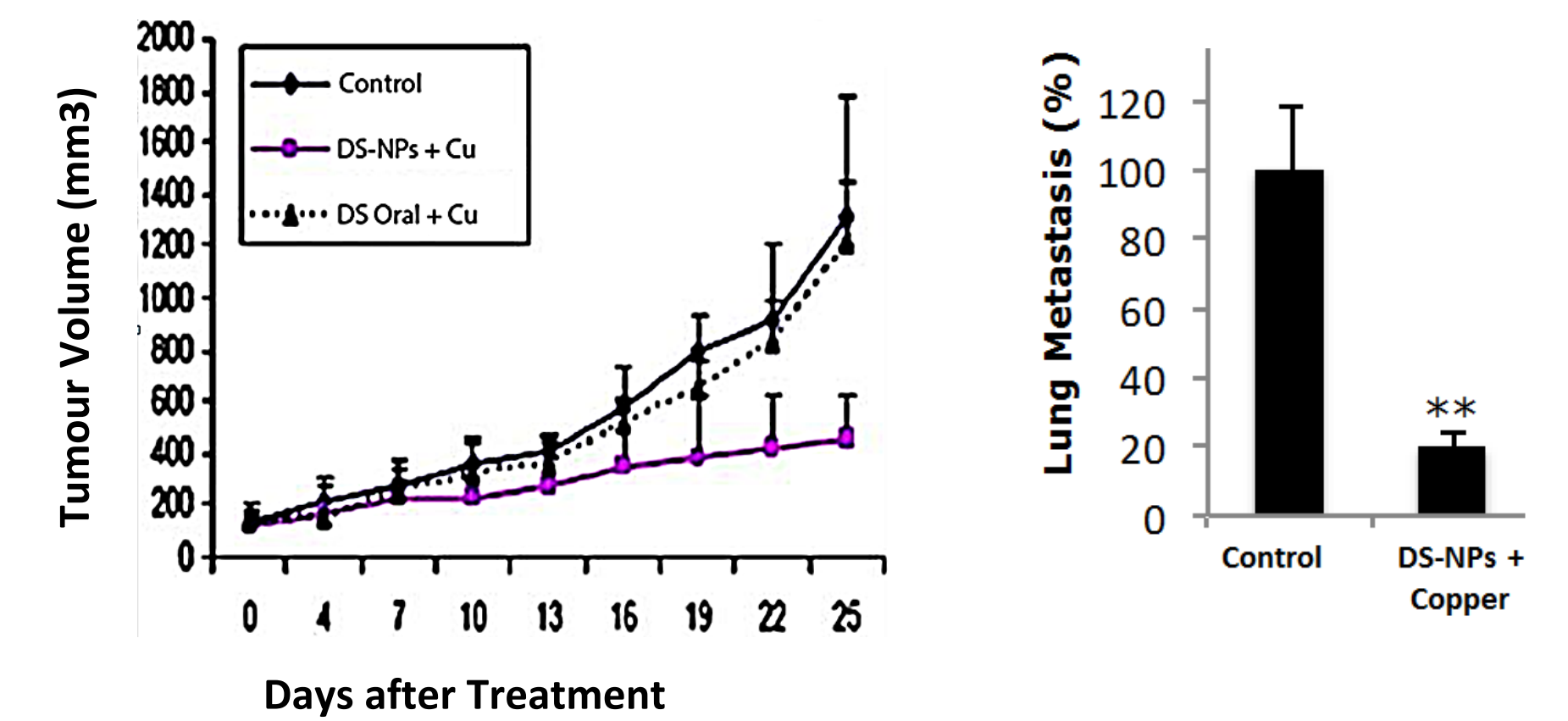
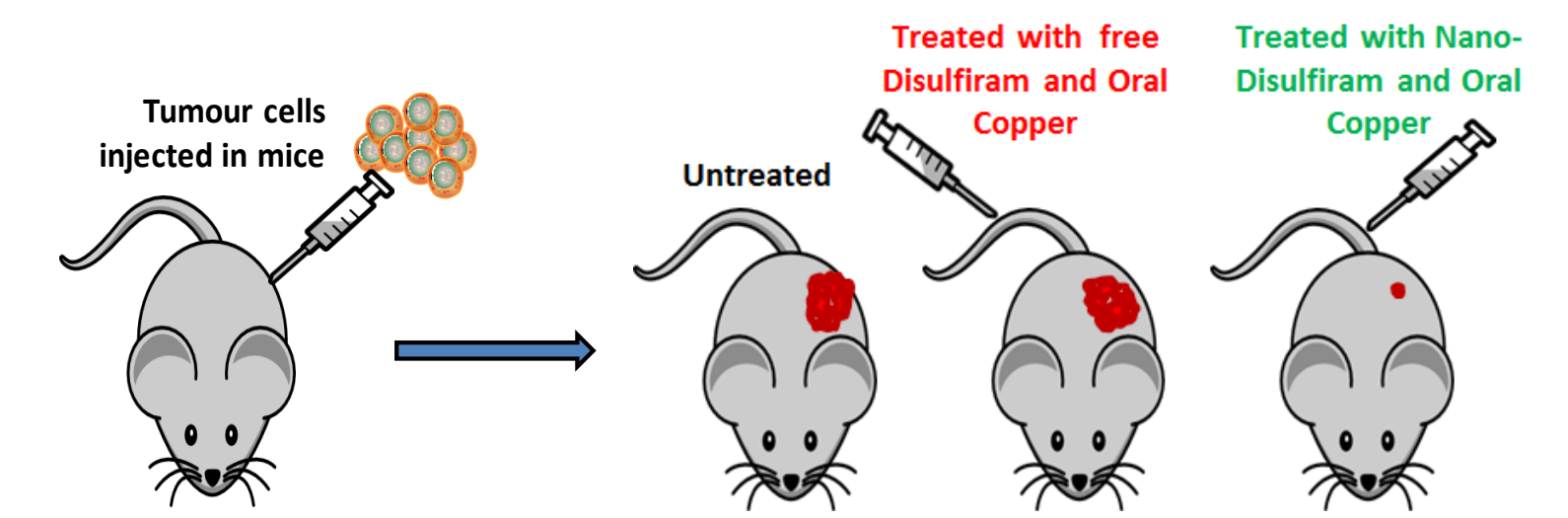
## Nanotechnology improves the efficacy of Disulfiram

We recently developed and characterized novel formulations of DS such as Liposomal DS (**Lipo-DS**), Poly (lactic-co-glycolic acid)-DS, DS-Gold nanoparticles and polymeric micelle-DS (**DS-NPs**).

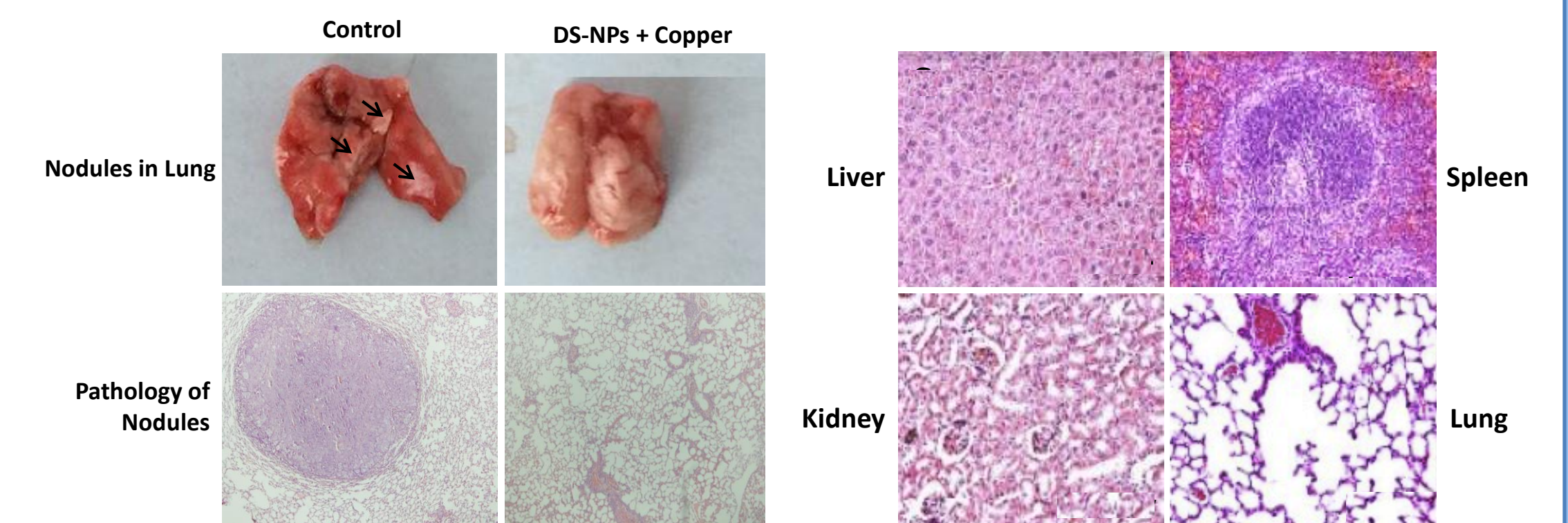


DS-Nano particles eradicates cancer stem cells and stop their migration and invasion capacity in cell culture conditions.

## Nano-Disulfiram eradicates lung cancer in mice



DS-Nano particles can suppress tumour growth in animal models and prevents cancer spreading to other organs.



Treatment with DS-NPs and copper completely blocked metastasis of liver cancer to the lung

No Toxic effect was observed in the vital organs of mice treated with DS-NPs and copper gluconate

A very low dose of nano- DS along with oral Copper supplement showed a remarkable tumour inhibiting effect in xenograft models of lung cancer and inhibited metastasis of liver cancer to lung, without any adverse side effects or toxicity to normal tissues.

## Conclusions

- DS is an FDA approved drug which is available for less than a £1 for a 500mg tablet.
- Nano-encapsulated DS in combination with Cu eradicates multiple cancers by targeting CSCs.
- Nano-encapsulated DS may be translated quickly into clinical use.
- Development of DS based anticancer therapeutics will provide millions of patients with affordable anticancer drug.

**ACKNOWLEDGEMENTS:** We would thank British Lung Foundation (RG14-8) for supporting this project. We also thank Dr. Mark Morris, University of Wolverhampton, for reviewing and providing valuable suggestions for this poster.