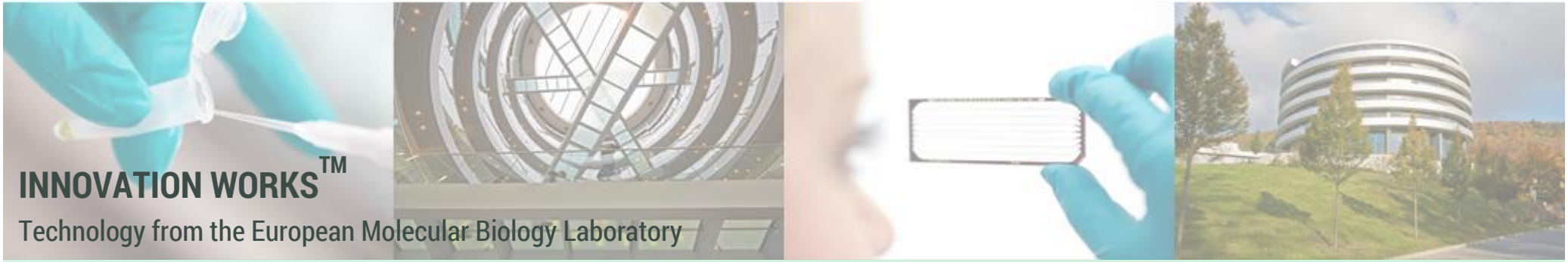

INNOVATION WORKS™

Technology from the European Molecular Biology Laboratory

Novel coating for efficient cellular uptake and retention of small Gold Nanoparticles (GNPs) for radiosensitation

EMBLEM Ref. HDU-16

Challenge

- radiotherapy is an important method in cancer treatment
- sensitivity of tumor cells to radiation can be increased by introducing particles of high atomic number
- clear need for a method that allows efficient internalisation of small GNPs in tumour cells

Commercial Opportunity

- pre-clinical and clinical development of the technology towards a market product in radiotherapy
- opportunity to develop the product for use in drug delivery, imaging and diagnostics

Technology

- surface coating of GNPs to improve cellular uptake
- coating small (5-10nm) spherical GNPs with DNA
- encapsulating the coated GNPs with a standard lipophilic transfection agent
- the procedure showed that GNPs were internalised with significantly increased efficiency in HeLa cells and were located in both the cytoplasm and the nucleus
- the DNA molecules used for the coating can be further modified

Contact

Dr. Birgit Kerber, kerber@embl-em.de

Key Inventors

Dr. Marlson R. Veldwjik, Department of Radiation Oncology, Medical Faculty Mannheim, University of Heidelberg, Germany

Intellectual Property

GB1212908.6, filed 31.08.2012
PCT/EP2013/068002, filed 30.08.2013

EMBLEM TECHNOLOGY TRANSFER

Novel coating for efficient cellular uptake and retention of small Gold Nanoparticles (GNPs) for radiosensitation

EMBLEM Ref. HDU-16

Radiotherapy in combination with surgery is a fundamental part of cancer treatment with about 50% of cancer patients receiving radiotherapy during the course of their disease. In radiotherapy, tumour control correlates with the dose given to the tumour which in turn is limited by the damage to surrounding healthy tissue. The sensitivity of tumour cells to radiation can be increased by introducing particles of high atomic number into tumour cells. Gold nanoparticles (GNPs) are particularly versatile, however, a major obstacle is that with current methods their optimum large size for cellular uptake is limited to 50nm. A higher rate of radiosensitation, and thus improved dose modifying factors, are expected from smaller GNPs, though, and there is a clear need for a method that facilitates efficient internalisation of small GNPs in tumour cells to improve patient outcomes.

Surface coating of GNPs to improve cellular uptake and decrease GNP size is under investigation, though, current methods have yielded mixed results. We have shown that by coating small (5-10nm) spherical GNPs with DNA and encapsulating them with a standard lipophilic transfection agent, GNPs are internalised with significantly increased efficiency in HeLa cells and are located om both the cytoplasm and nucleus. With our method, GNPs significantly decreased clonogenic survival and significant dose modifying factors are obatained in colony forming assays (D_{4Gy} 1.25+/-0.14; D_{6Gy}: 1.11+/-0.06 D_{8Gy} 1.07+/-0.04) in HeLa cells with 6MV X-rays as is frequently used in the clinic.

The DNA molecules used for the coating can be further modified and/or effector molecules can be attached to them.