# Priorities in Hadron Therapy Research using Glioma Stem Cells

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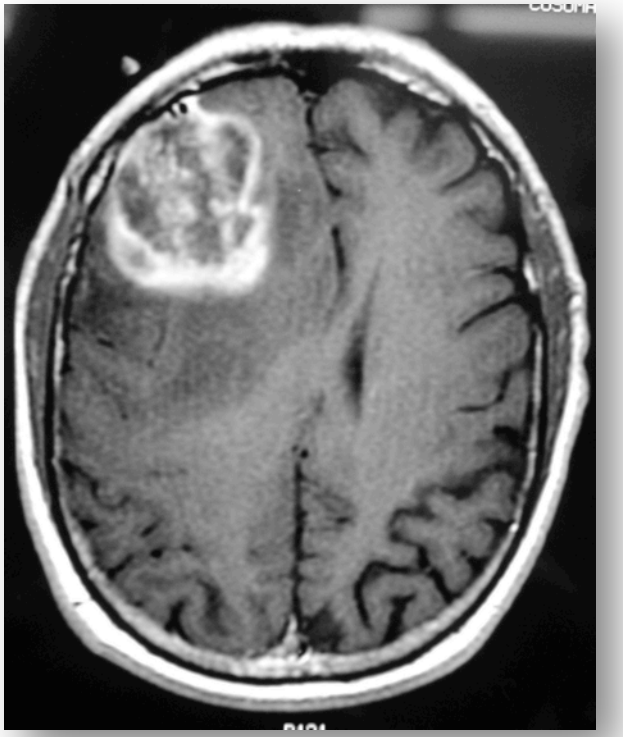
# Background

- Glioblastoma is an aggressive for of primary brain tumour
- Responsible for more years of life lost per patient than any other common adult cancer
- Tumour core is resistant to conventional radiation therapy
- Tumour infiltrates into surrounding tissue



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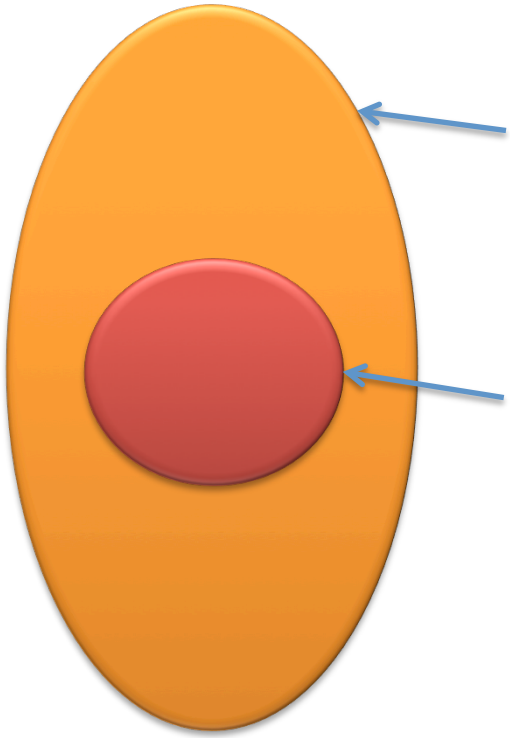
# Treatment targets



Infiltrative zone
- Fluorescence guided surgical resection
- New systemic treatments

Tumour core
- **High LET radiation**
- Nanoparticle delivery of radiosensitiser

Molecular Genetics
- Verhaak / TCGA type classification

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# Research needs

- Combination effects of new drugs and high LET radiation needs to be established
- Efficacy of radiation sensitisers needs to be established
- Establish that studies at **cellular** level can be used to guide treatment at **patient** level

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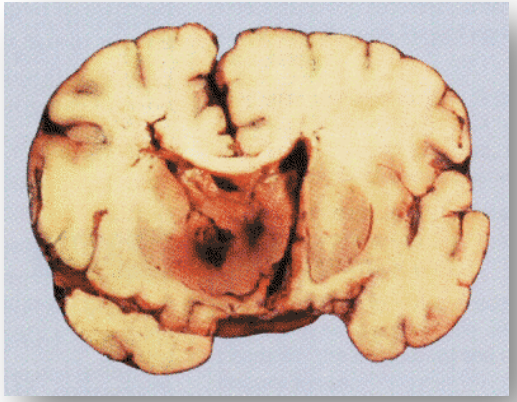
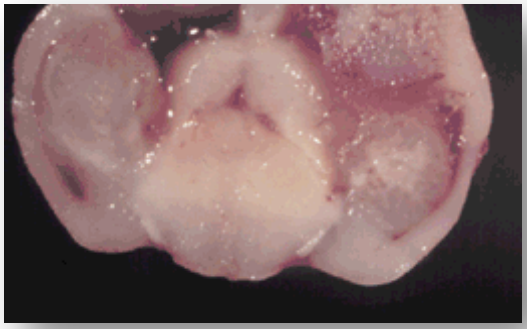
# Innovative approaches

- Tissue scaffolds enhance assessment of tumour response in 3D
  - Chitosan / chondroitin based
  - Nanofilament based
  - Reduce need for animal models (esp as mouse glioma models are suboptimal)
- Won't work for normal tissues





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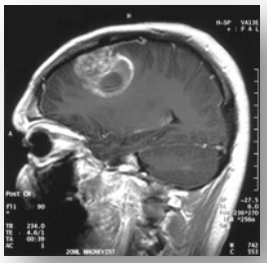
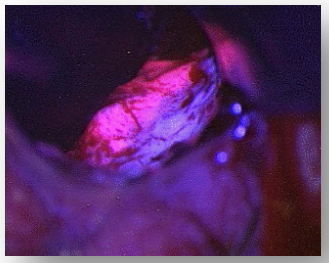
# The Cambridge Glioma Stem Cell Protocol



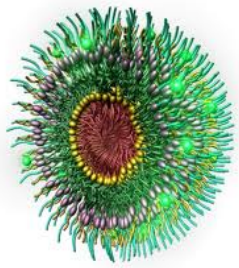
Patient with GBM sent to Glioma Clinic



Fluorescence guided resection

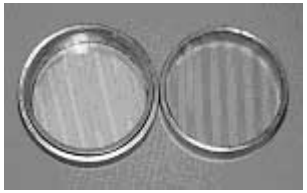
Extraction of patient derived stem cells

Next generation targeted radiation sensitisers



Gold nanoparticle rendered biocompatible via protein coat, loaded with radisensitising drug (Cisplatin)

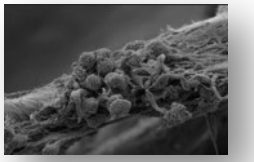
Low energy microbeam @ Surrey



Irradiate 2D cell mases on mylar

High energy beam (Li, C) @ CERNBIO

Irradiate cell suspension in flasks



Irradiate tumour mass on 3d scaffold

**CERNBIO** becomes part of a sophisticated preclinical development platform for new treatments of Glioblastoma

# High energy facilities used in PARTNER

- NIRS
  - \+ IOL. Existing collaboration
  - \- Distance. Transport and MTA for cells. Beam availability at clinical site. Different radiation biology practice

- GSI
  - \+ Within Europe. Strong in Radiobiology
  - \- Beam availability

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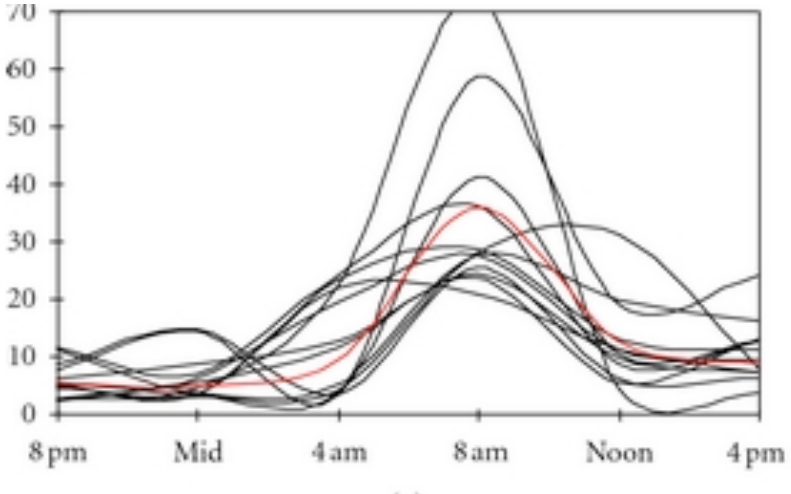
# CERNBIO : Unique Selling Points

- No clinical commitments to contend with, experiments can be be run over longer timescale
- More time for setup / closedown of experiments, especially as move to DNA and molecular assessments

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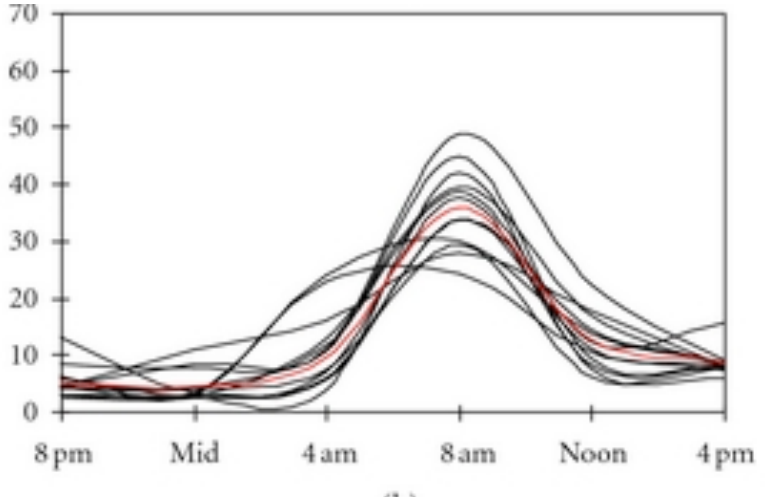


(b)

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# CERNBIO : Unique Selling Points

- Horizontal and vertical beam line
- Beam energy facilitates use of hypoxia chamber
- Bench space
- Mixed beam species & LET, range of dose rates

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# CERNBIO : Unique Selling Points

- CERN experiments can take the long term view
- TNA is in CERN's DNA
- MTA for cells easier within Europe
- Data sharing framework, informatics, modelling

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