Overview of Brain Tumor Treatment: Radiotherapy

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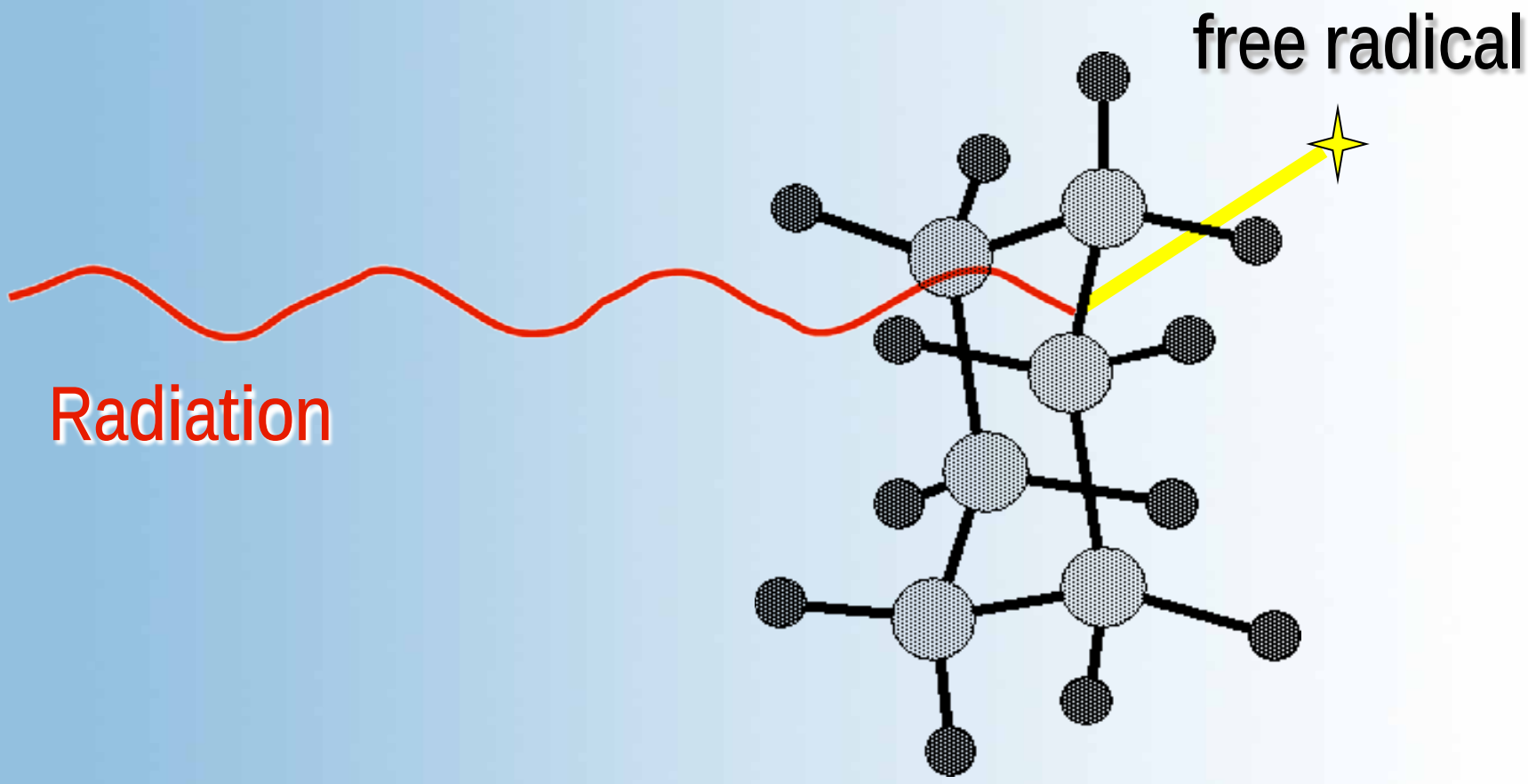
Radiotherapy Can Be Used For

- Astrocytomas
- Glioblastomas
- Meningiomas
- Metastases
- Neuromas
- Glomus tumors
- Pituitary tumors
- Ependymomas
- CNS lymphomas
- Medulloblastomas
- Craniopharyngiomas
- Germ cell tumors
- Pineocytomas
- Neurocytomas

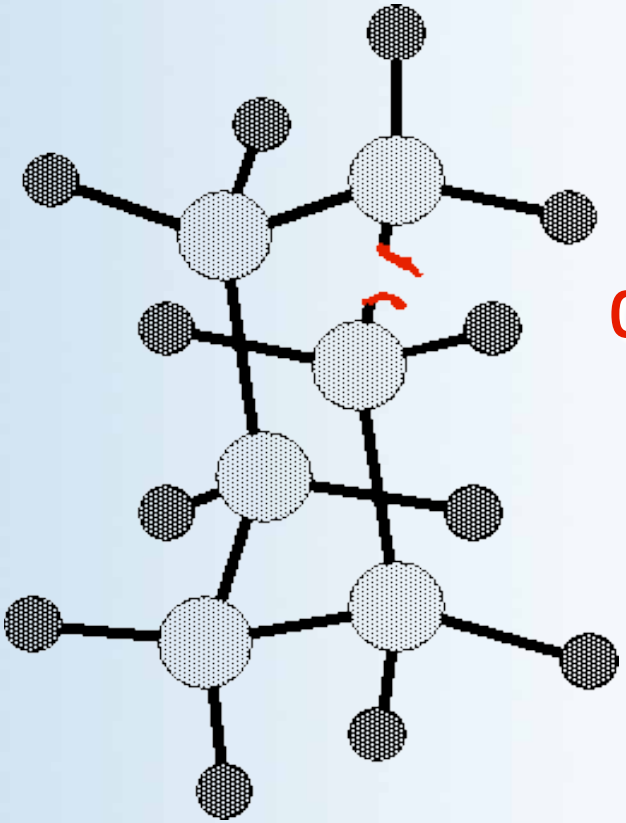
Topics We'll Discuss

- How does radiation therapy work?
- How is radiotherapy administered, and what are the side effects?
- What is the latest technology?

Radiation Creates Free Radicals

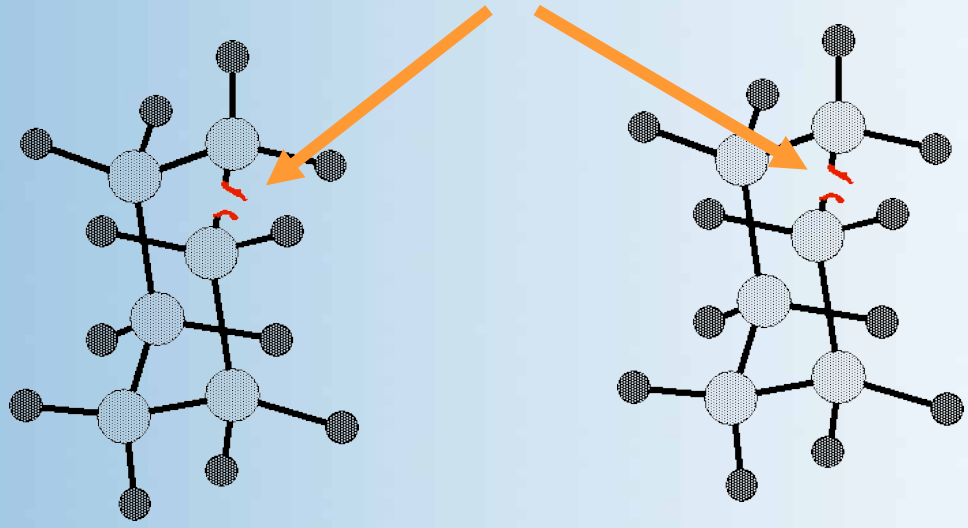


Which Kill the Cells

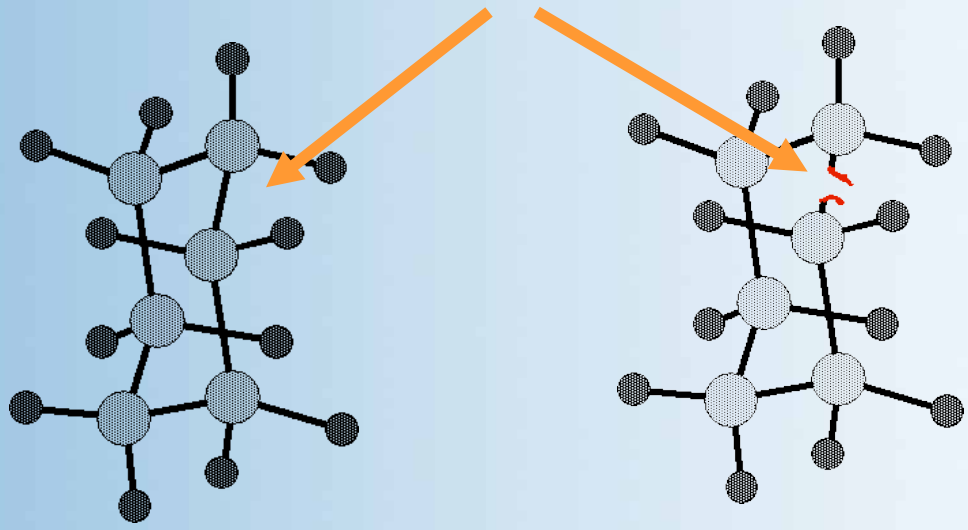


damage

Tumor cells can’t repair themselves like normal cells

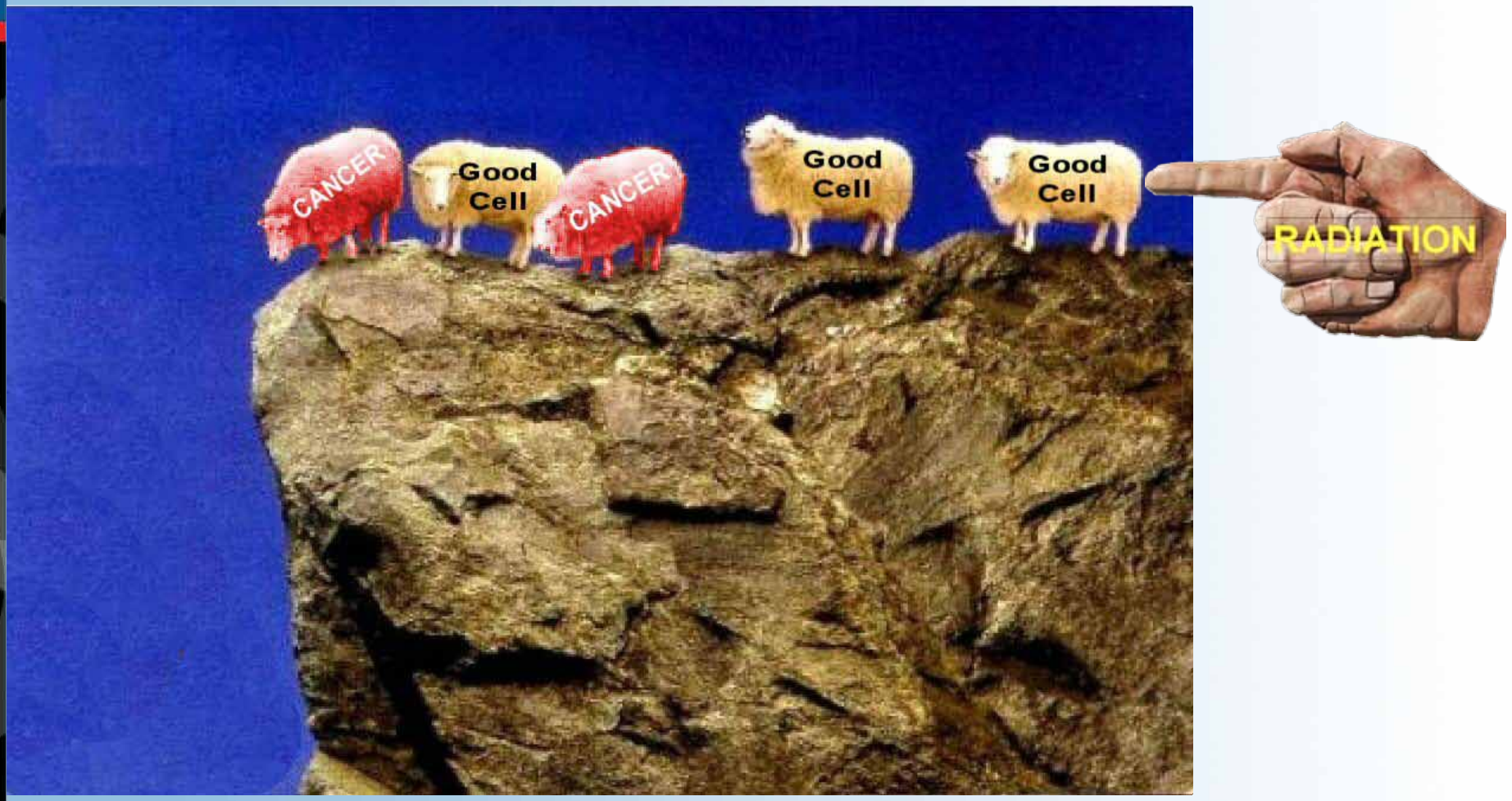


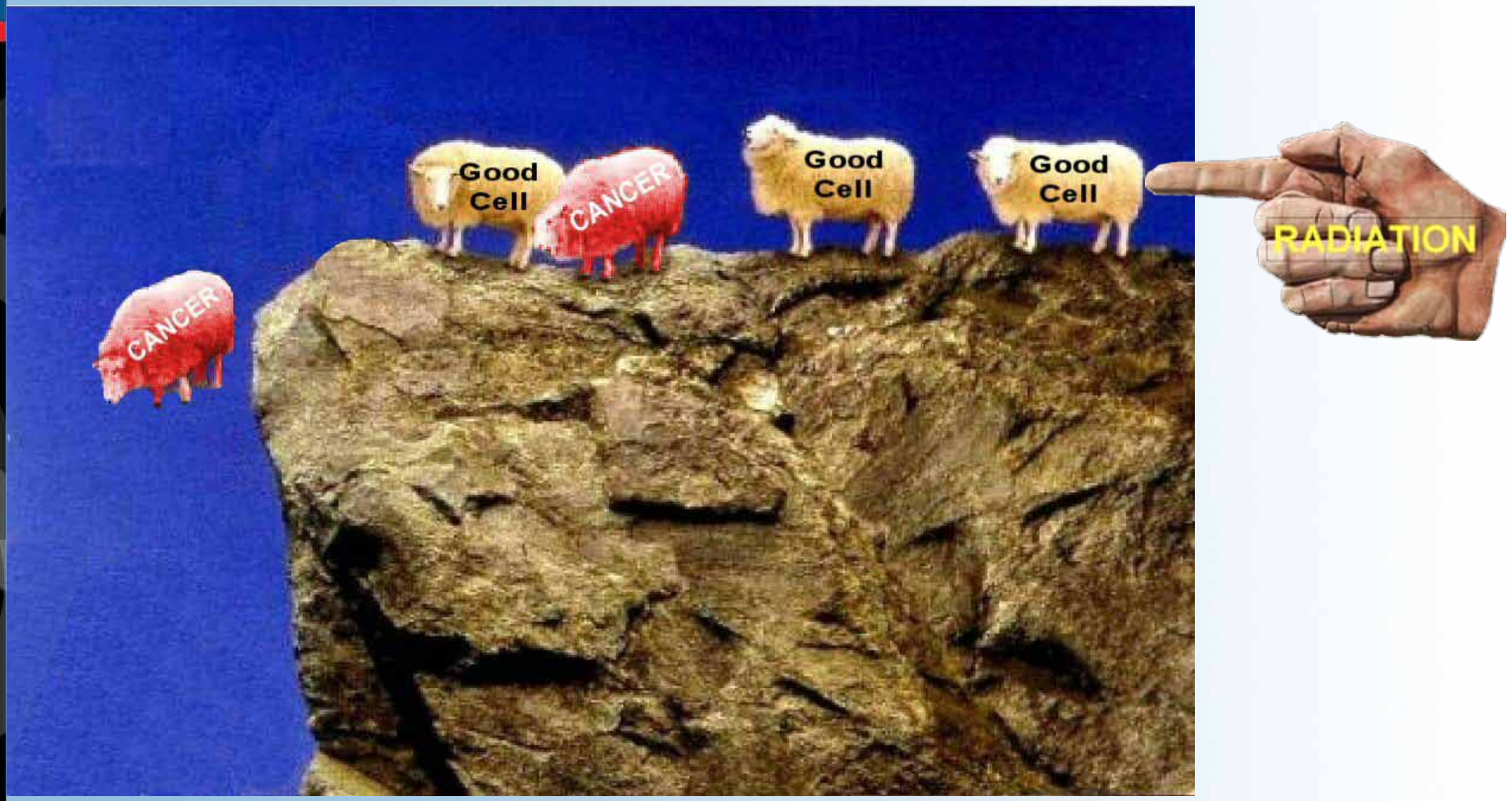
Tumor cells can't repair themselves like normal cells

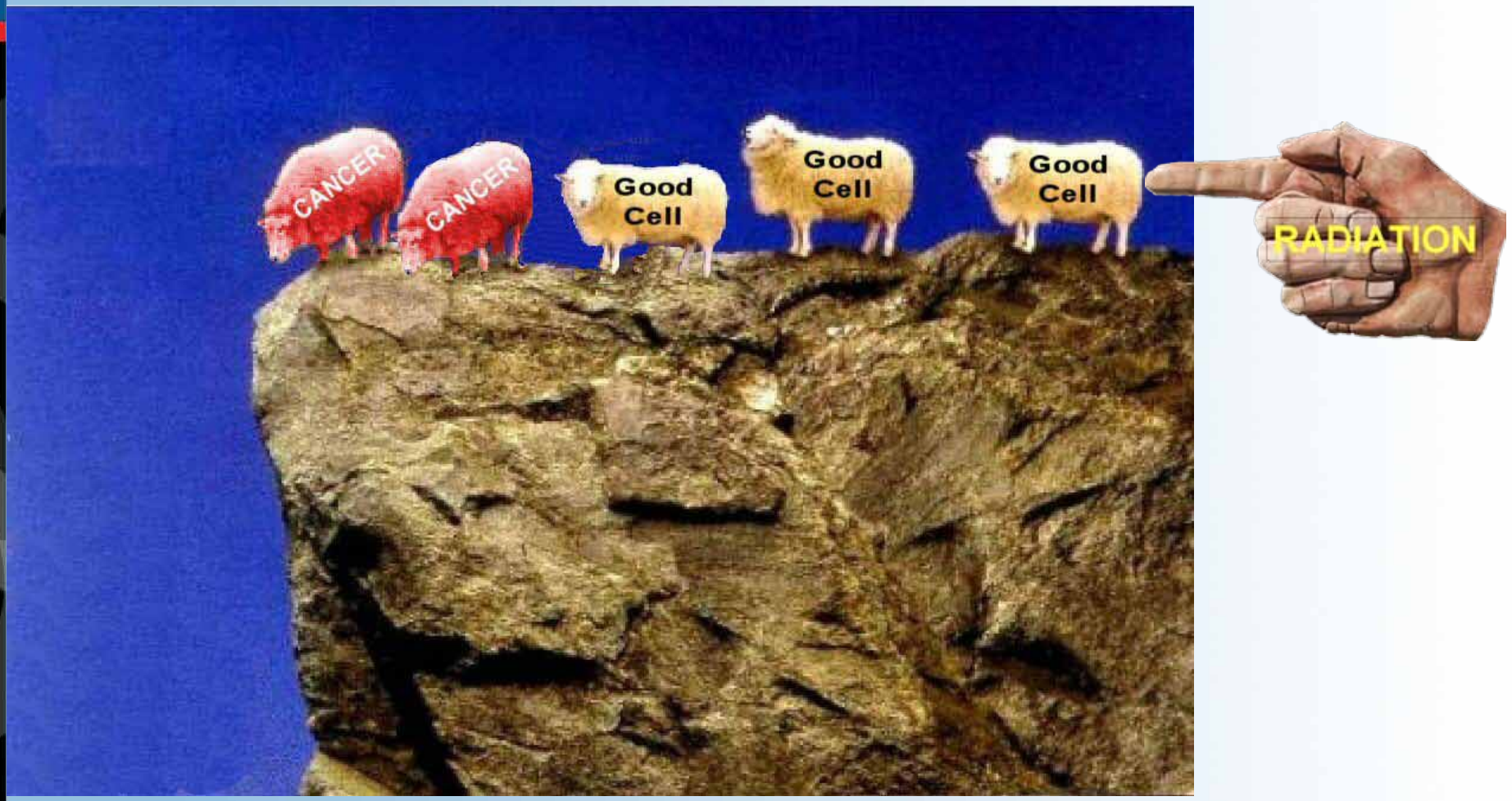


normal cell

tumor cell

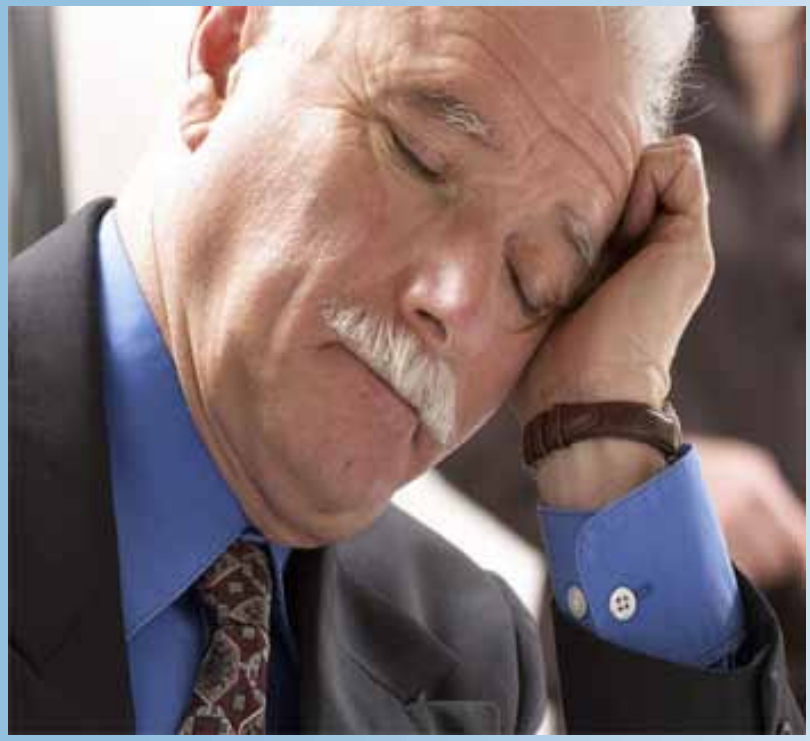

CANCER
Good Cell
CANCER
Good Cell
Good Cell
RADIATION


Good Cell
CANCER
Good Cell
Good Cell
CANCER
RADIATION


CANCER
CANCER
Good Cell
Good Cell
Good Cell
RADIATION

What Happens During Radiotherapy?

Side effects: Frequent…



Fatigue

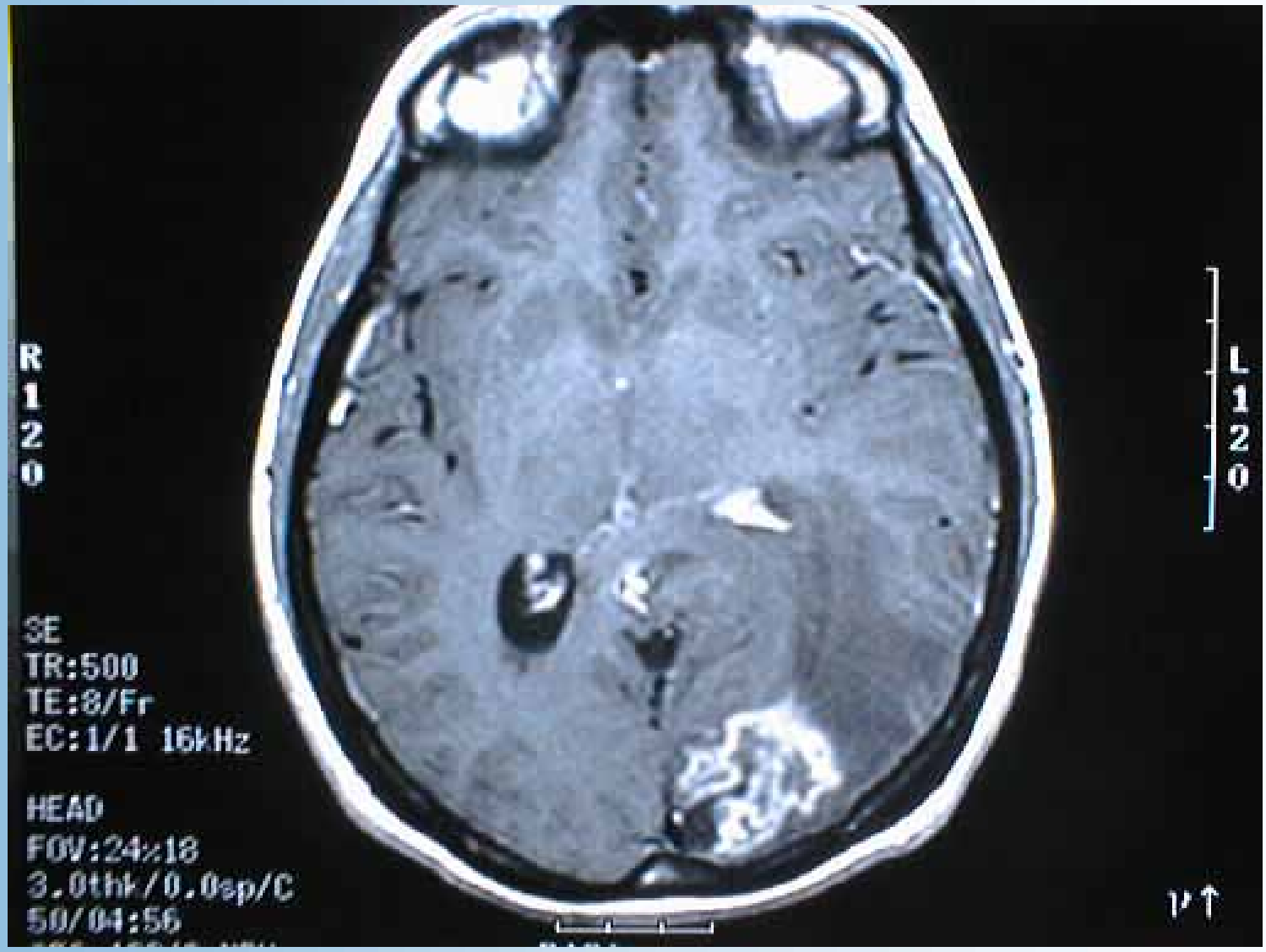
Hair Loss

Occasionally..

- Short term memory difficulty
- Low thyroid hormones
- Decreased hearing

Usually not …

- Headaches
- Nausea

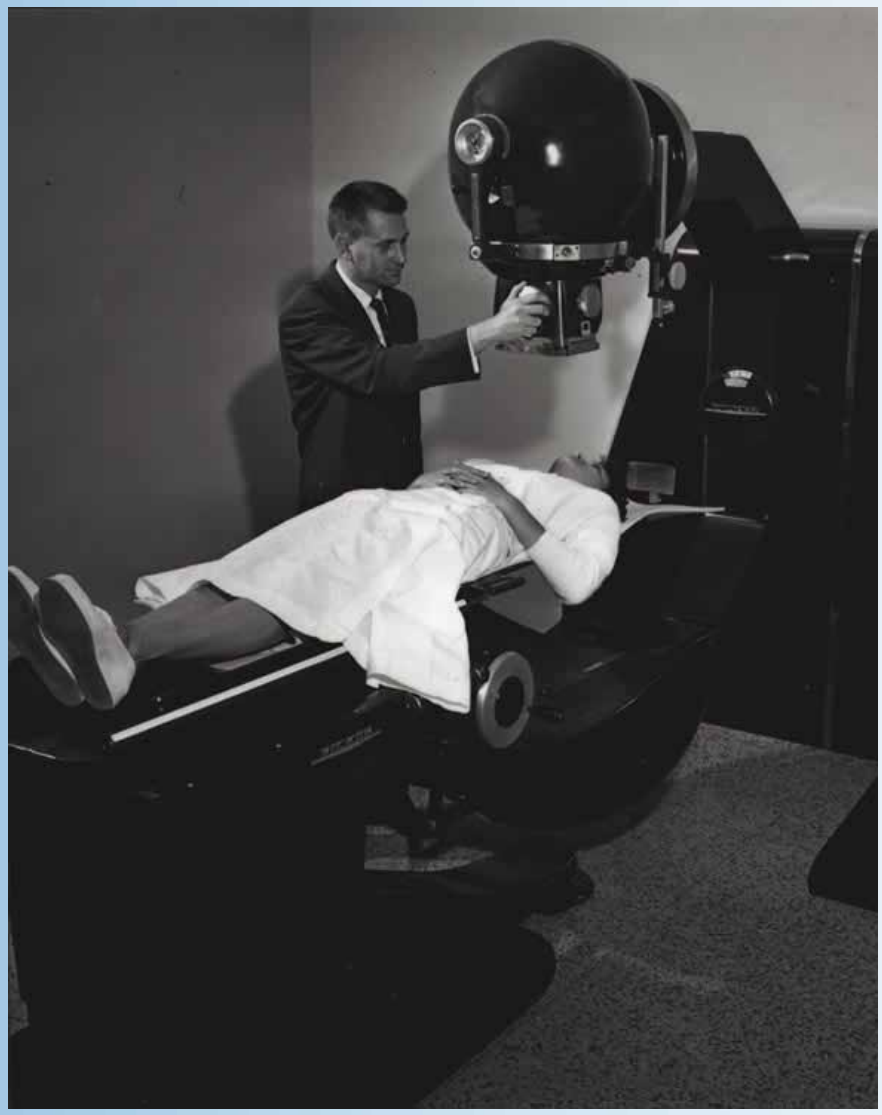

R
120
L
120
SE
TR:500
TE:8/Fr
EC:1/1 16kHz
HEAD
FOV:24x18
3.0thk/0.0sp/C
50/04:56

Necrosis

State-of-the-Art Technology

“Orthovoltage” Radiotherapy

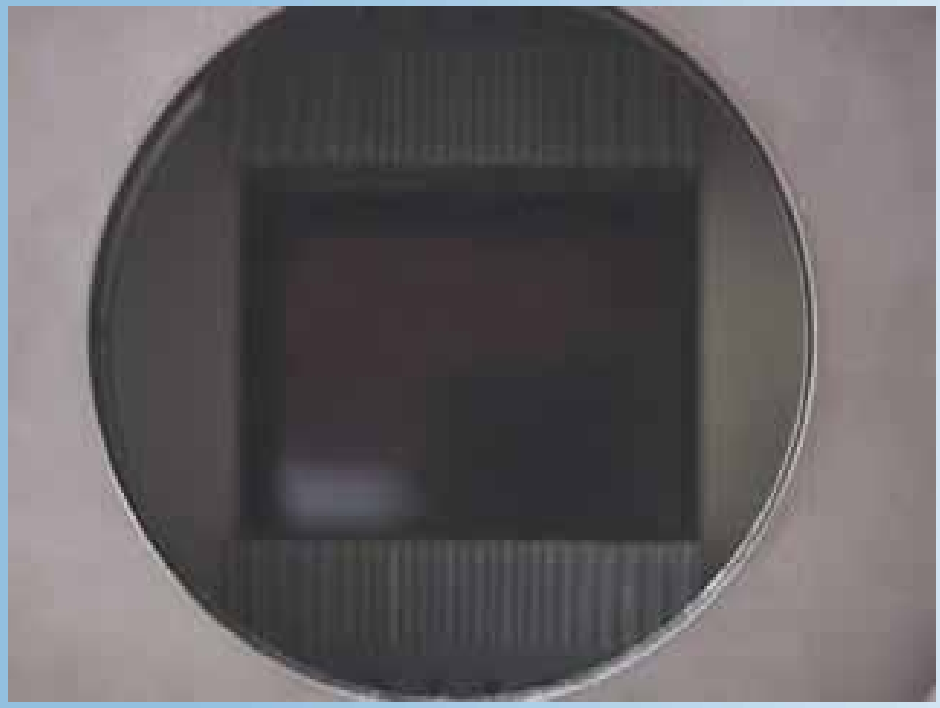
“Cobalt” Treatment



Linear Accelerators


RADIONICS
MMLC


DELL



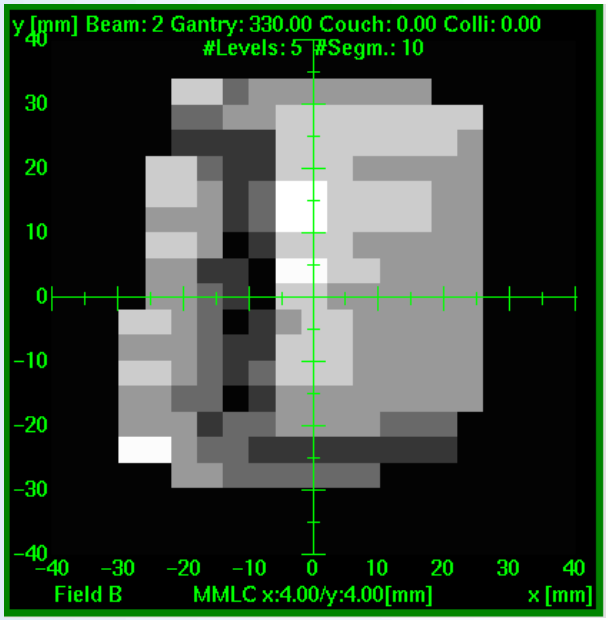
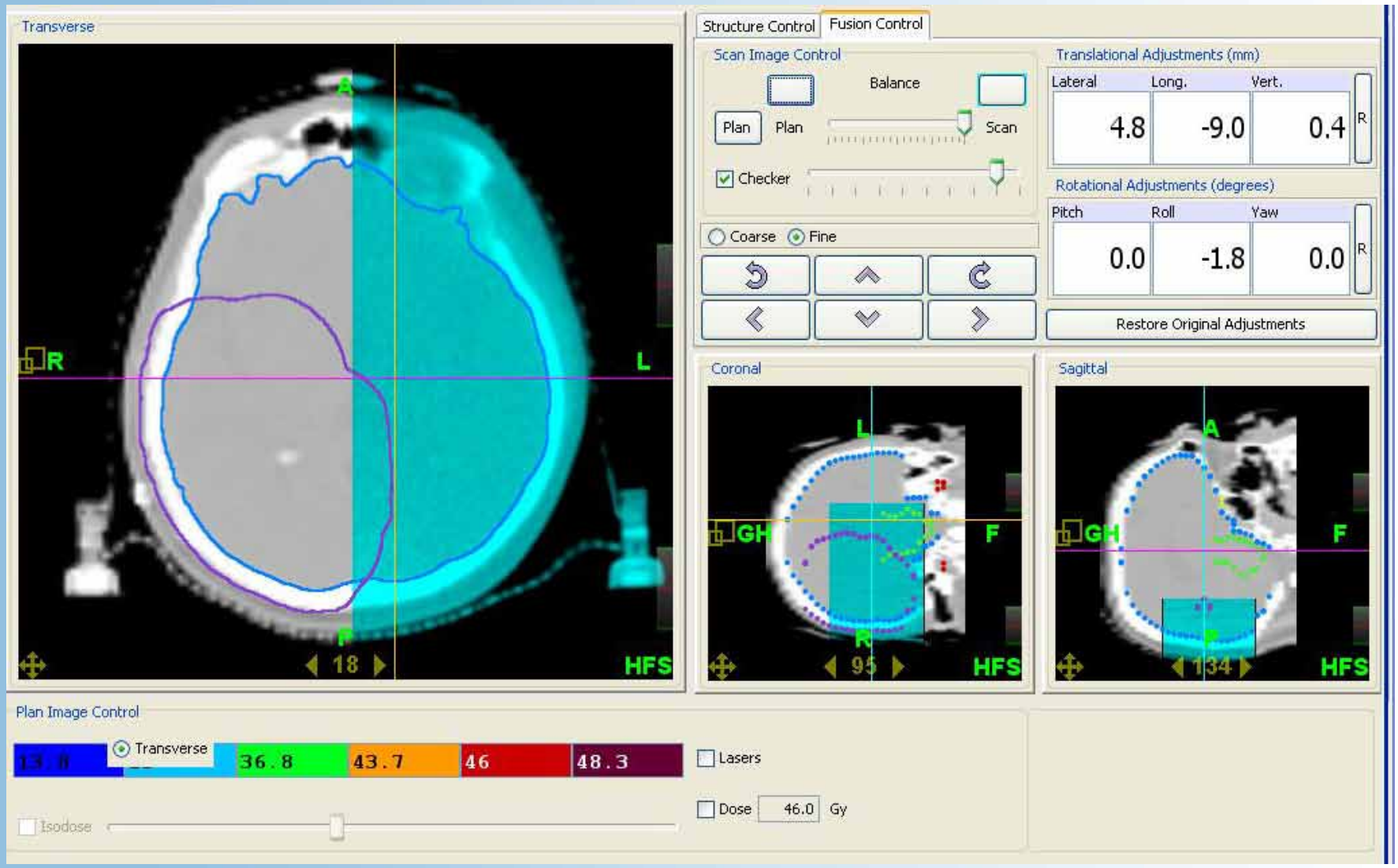

y [mm] Beam: 2 Gantry: 330.00 Couch: 0.00 Colli: 0.00
#Levels: 5 #Segm.: 10
40
30
20
10
0
-10
-20
-30
-40
-40 -30 -20 -10 0 10 20 30 40
Field B
MMLC x:4.00/y:4.00[mm]
x [mm]

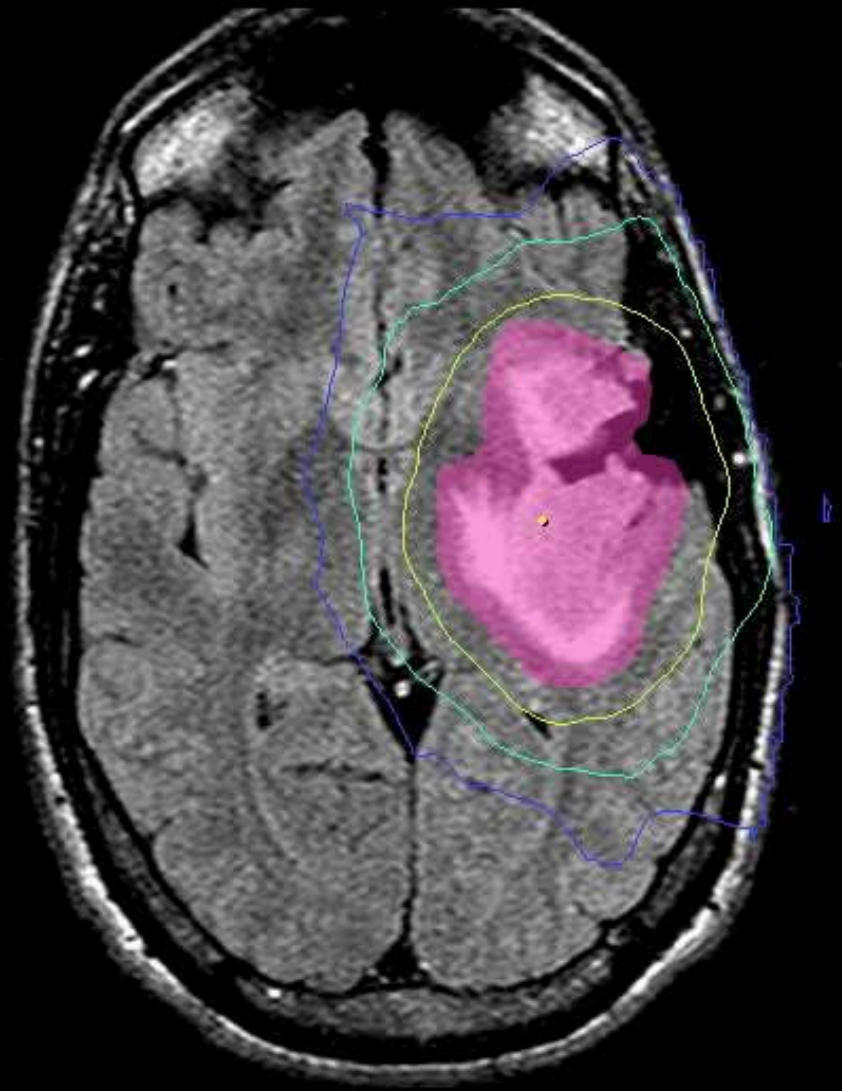
Image Guided Radiotherapy

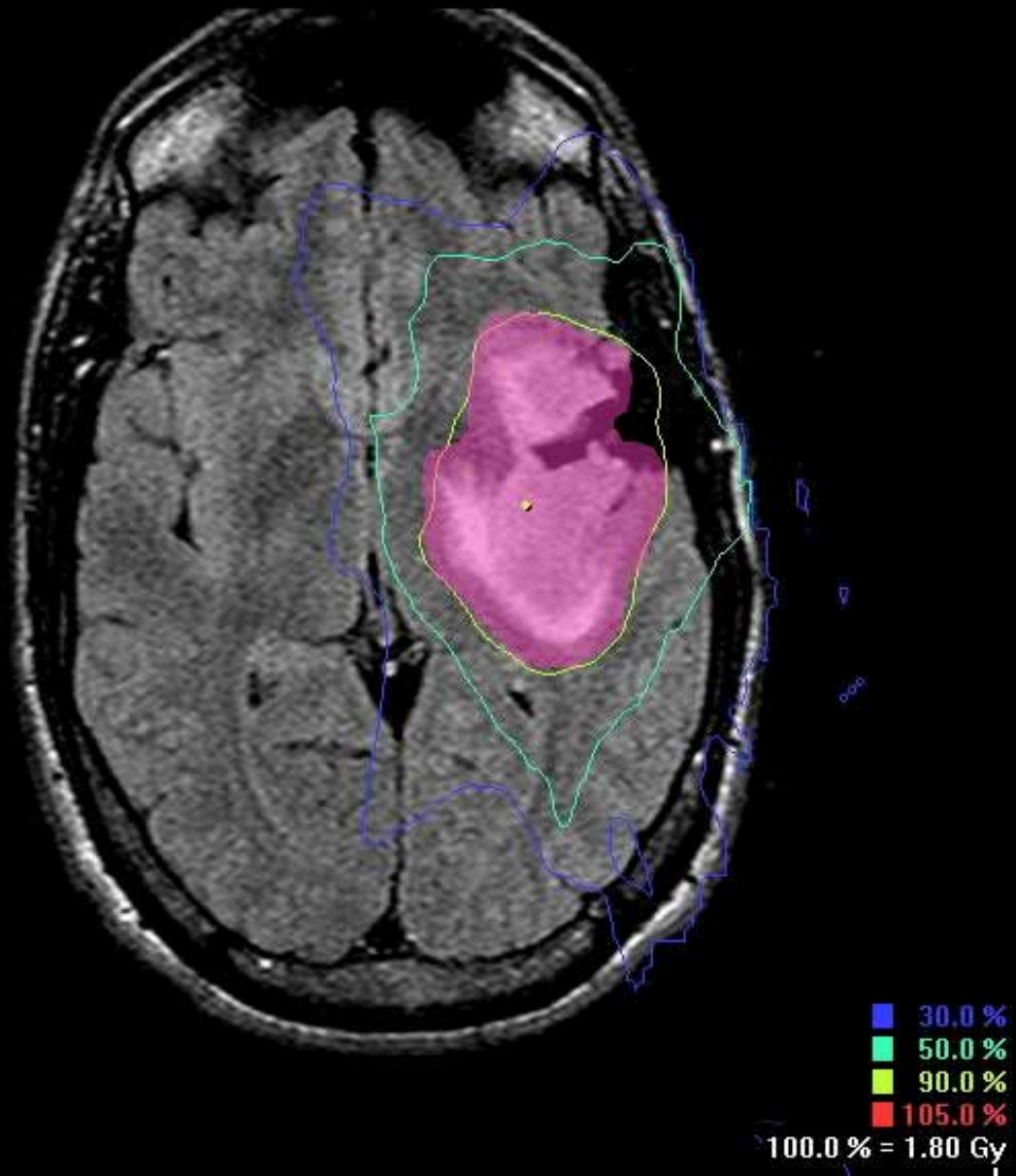

Transverse
A
R
L
P
18
HFS
Structure Control
Fusion Control
Scan Image Control
Balance
Plan
Plan
Scan
Checker
Coarse
Fine
Translational Adjustments (mm)
Lateral
Long.
Vert.
4.8
-9.0
0.4
R
Rotational Adjustments (degrees)
Pitch
Roll
Yaw
0.0
-1.8
0.0
R
Restore Original Adjustments
Coronal
L
GH
F
R
95
HFS
Sagittal
A
GH
F
P
134
HFS
Plan Image Control
Transverse
36.8
43.7
46
48.3
Lasers
Dose
46.0
Gy
Isodose

30.0 %
50.0 %
90.0 %
100.0 % = 1.80 Gy

30.0 %
50.0 %
90.0 %
100.0 % = 1.80 Gy


RADIONICS
MMLC

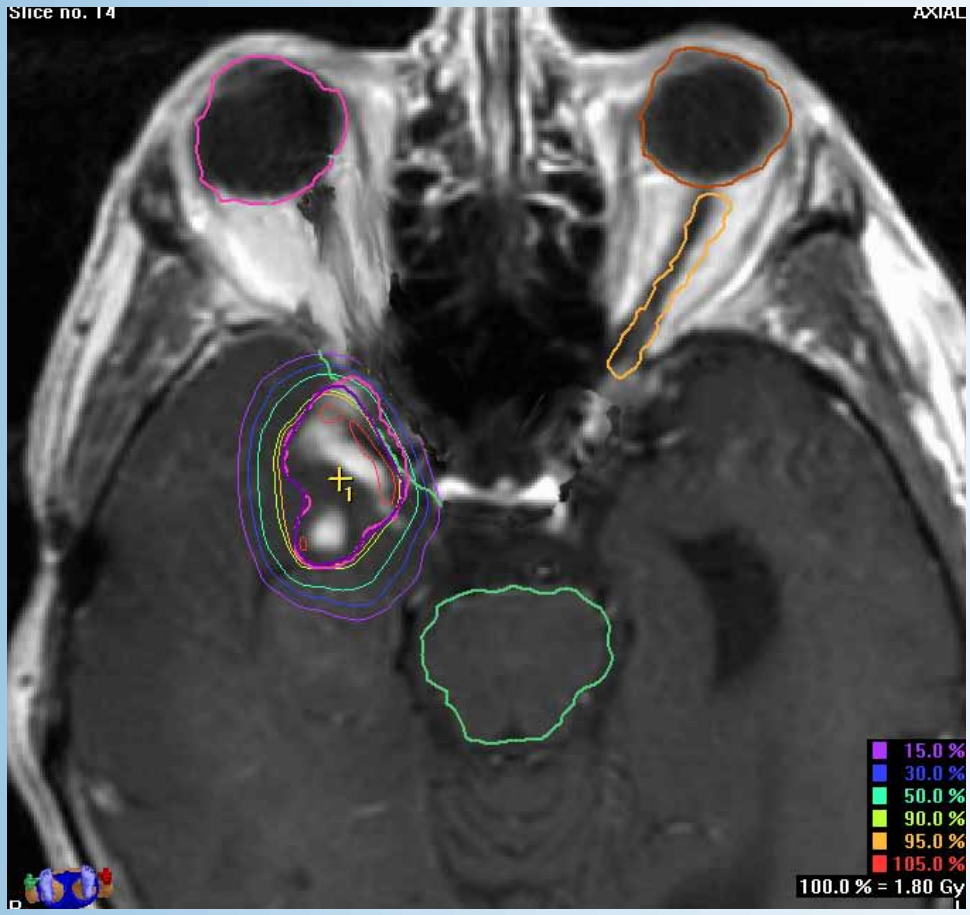

30.0 %
50.0 %
90.0 %
100.0 % = 1.80 Gy


30.0 %
50.0 %
90.0 %
105.0 %
100.0 % = 1.80 Gy

Why This Matters

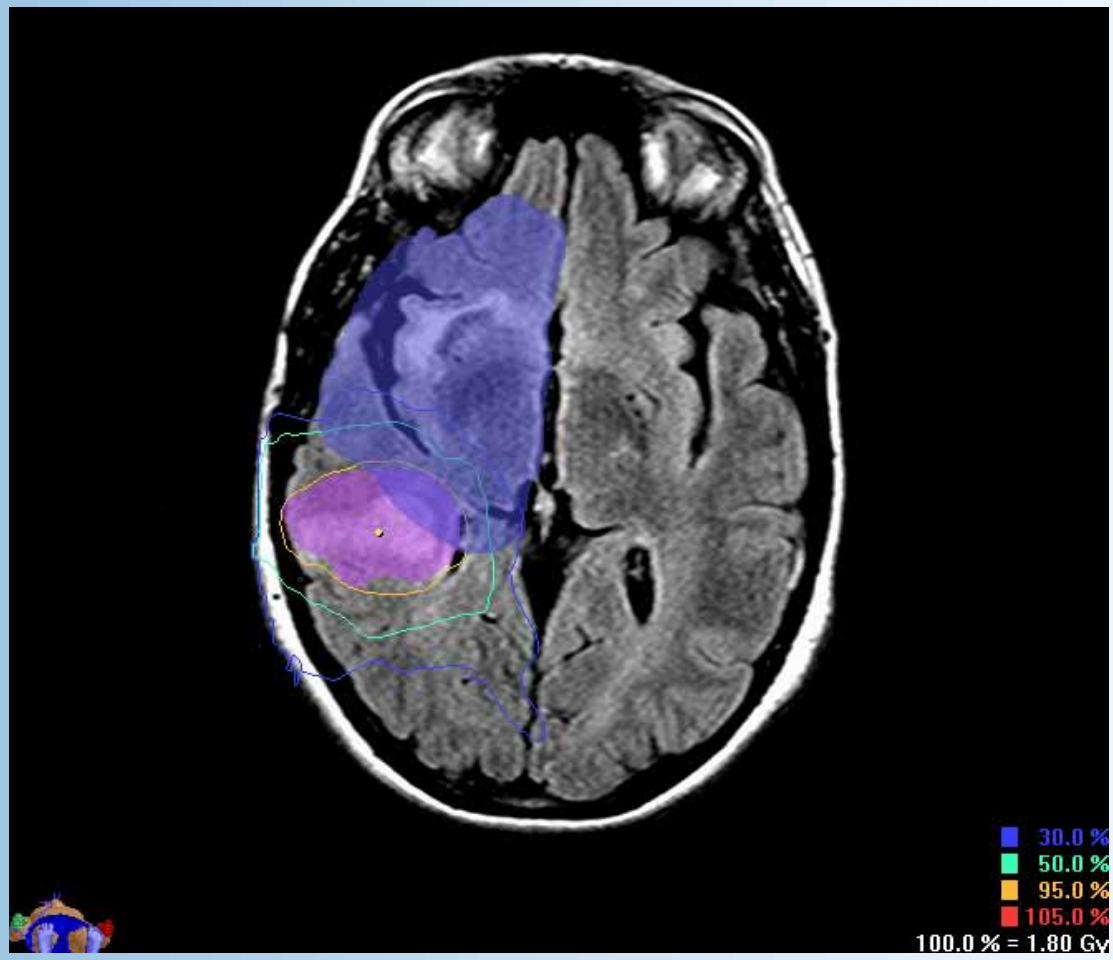
- Fewer side effects

Why This Matters



More Aggressive Treatment for Tumors

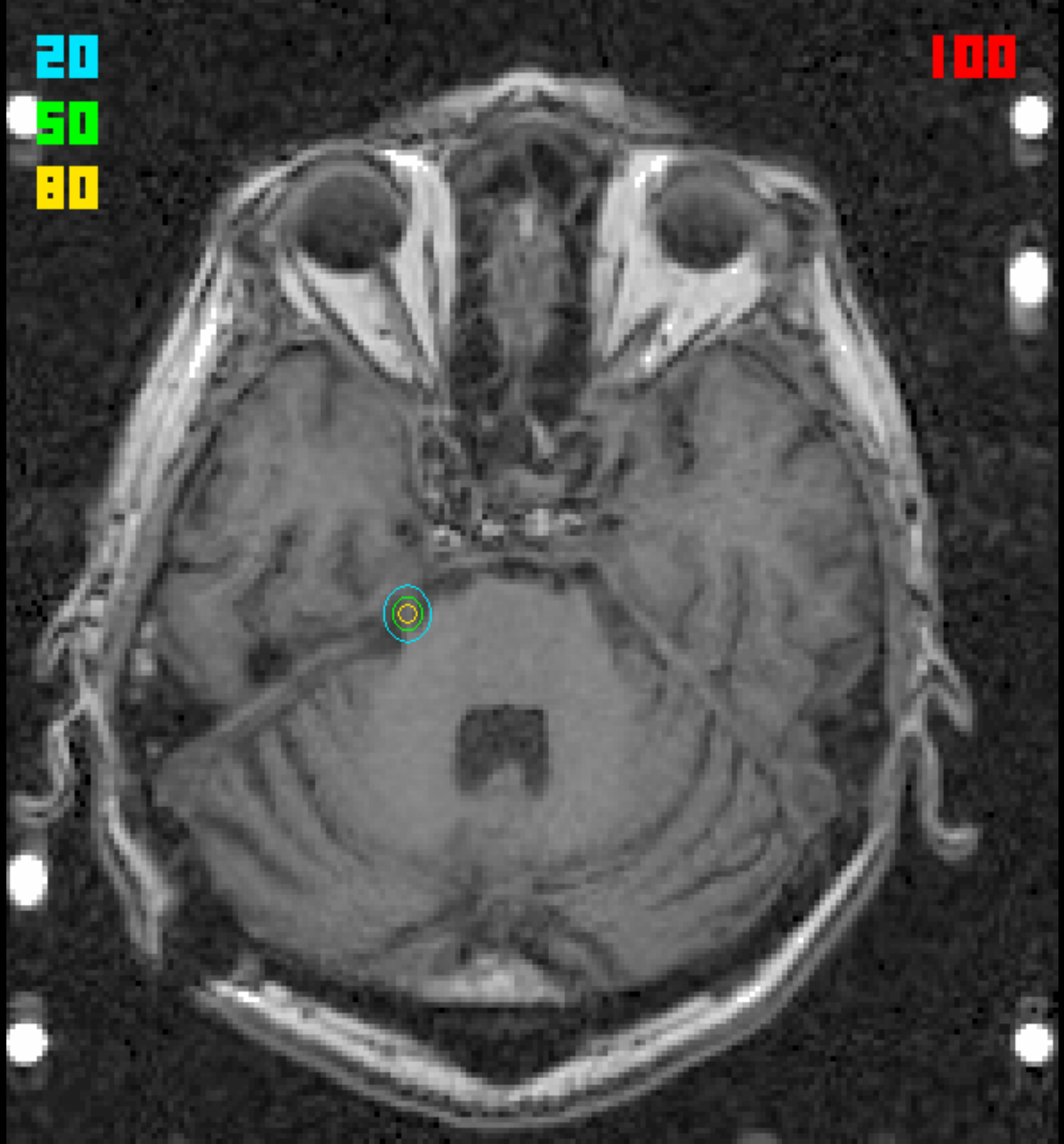
Why This Matters



Re-treatment for Recurrent Tumors

Stereotactic Radiosurgery –

Not surgery, but the application of highly focused, high dose radiation with the intent to kill everything that is targeted

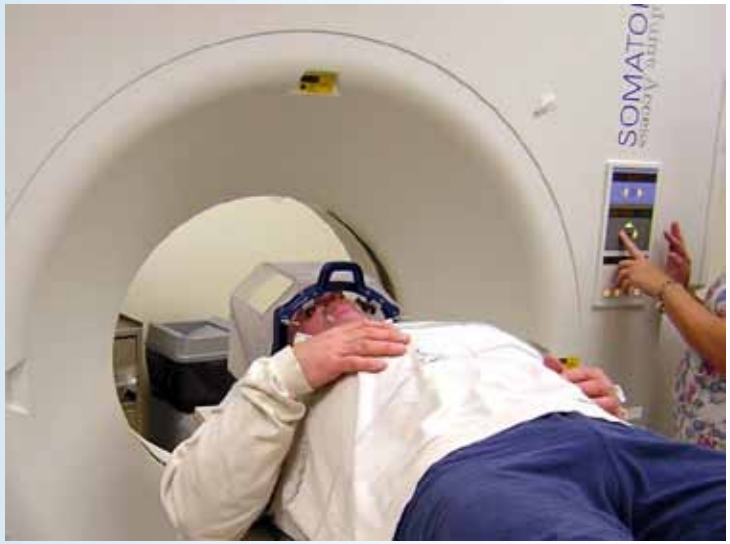

20
50
80
100

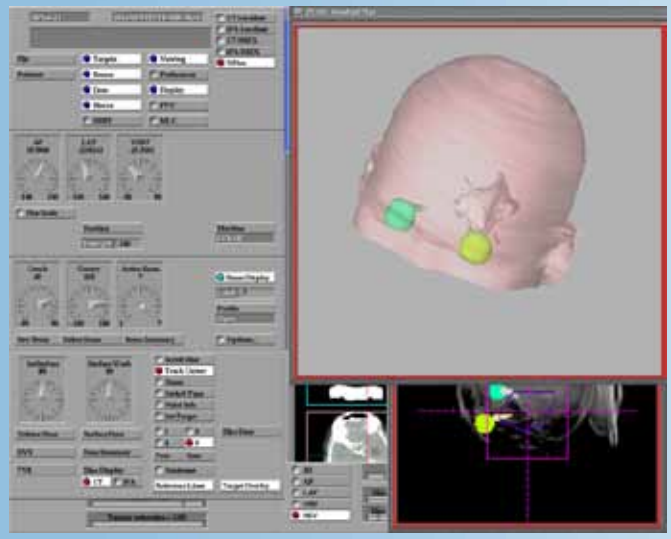
Stereotactic Radiosurgery Devices

Gamma Knife

Linac

Cyberknife





UC Neuroscience Institute

Frameless Radiosurgery

Ring-based

"Frameless"

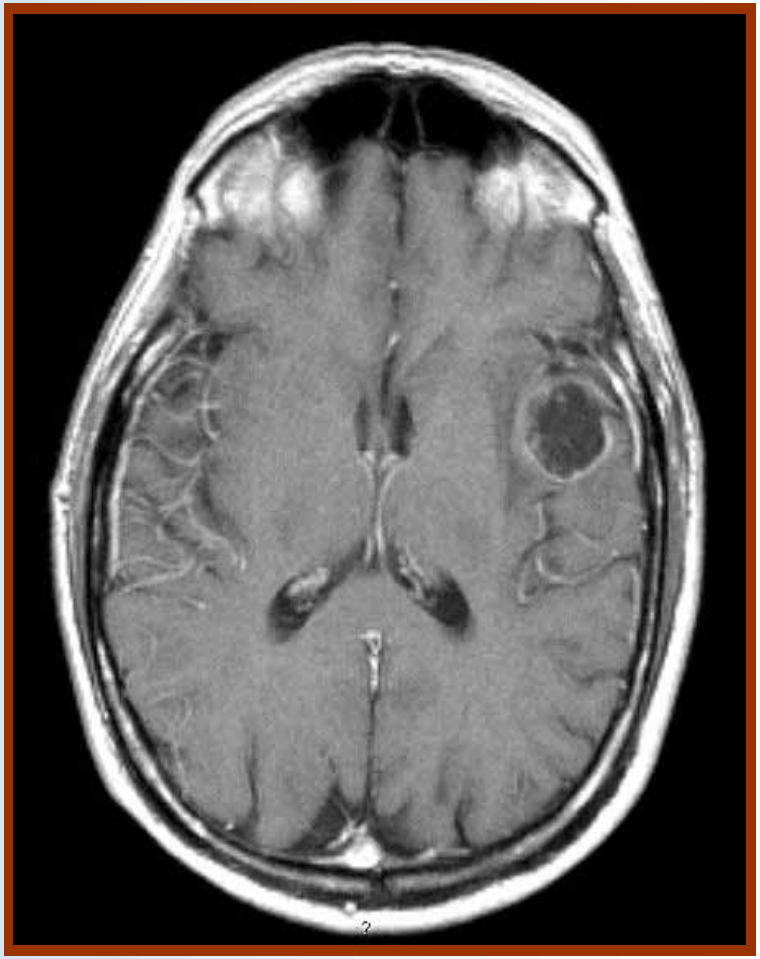
PHYSICS CONTRIBUTION

EVALUATION OF IMAGE-GUIDED POSITIONING FOR FRAMELESS INTRACRANIAL RADIOSURGERY

CLINICAL INVESTIGATION

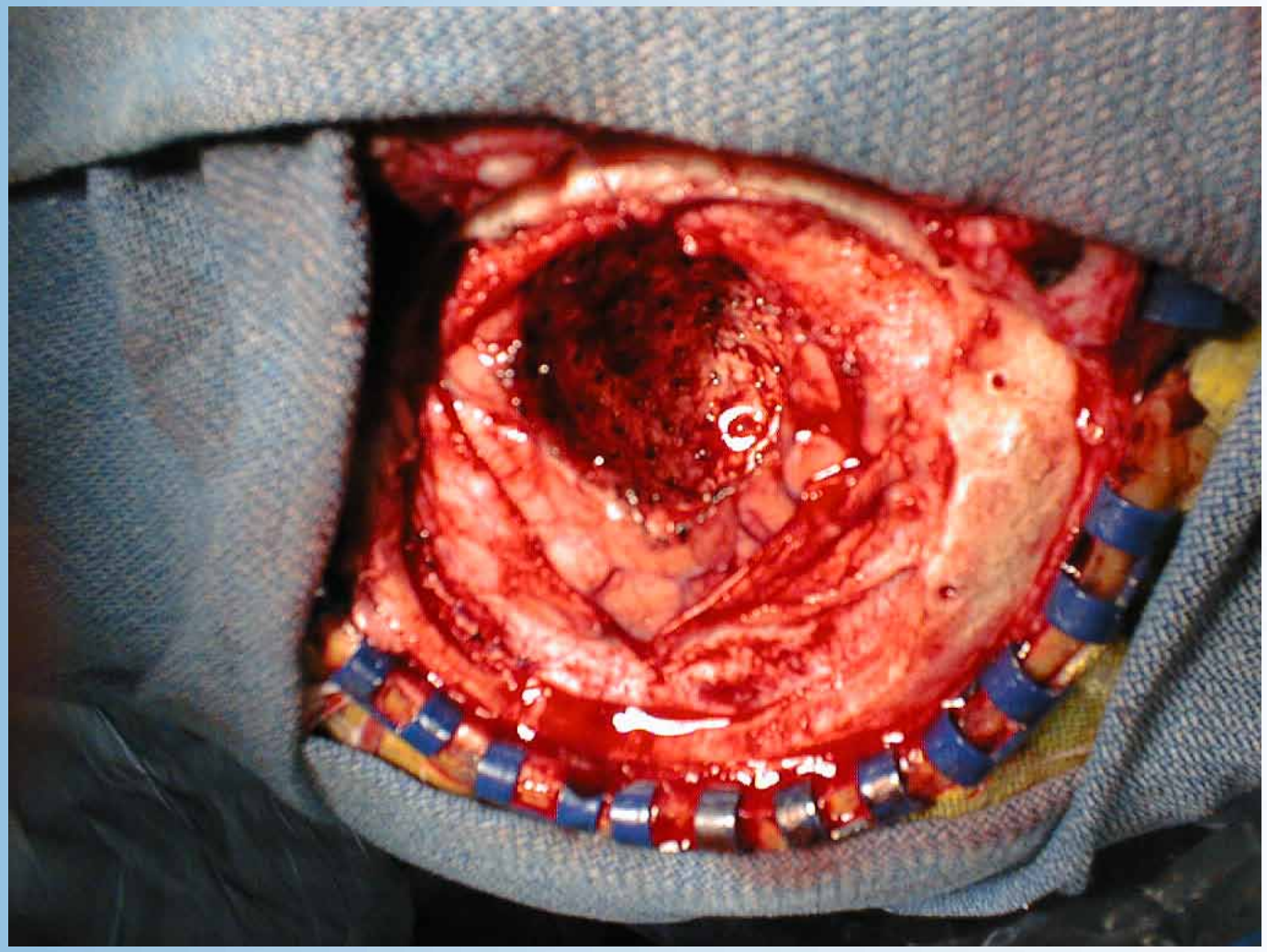
FRAMELESS IMAGE-GUIDED INTRACRANIAL STEREOTACTIC RADIOSURGERY: CLINICAL OUTCOMES FOR BRAIN METASTASES

Pre Radiosurgery

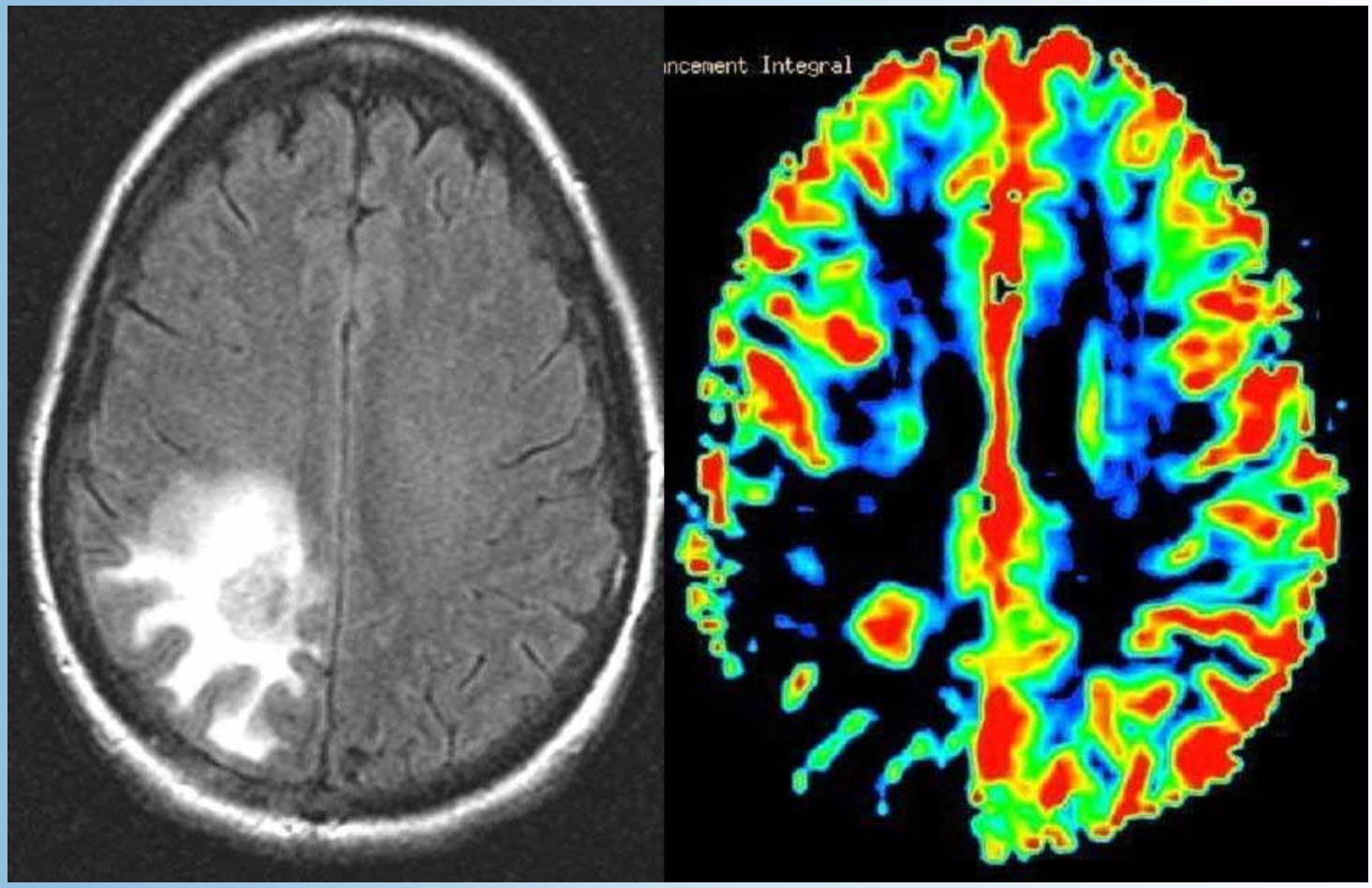


Post Radiosurgery

Brachytherapy



New Developments



Identifying Targets and
Evaluation of Treatment Outcomes

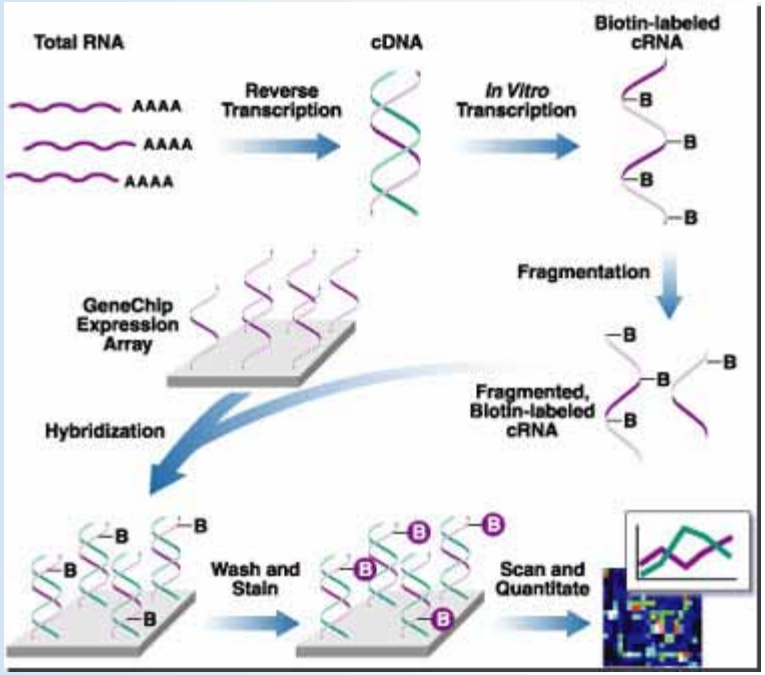
New Developments

Protons

New Developments

Use of Biologic Agents Concurrently with Radiotherapy

New Developments



Individualizing Treatment for Tumors