What is biodosimetry and why is it needed for medical management

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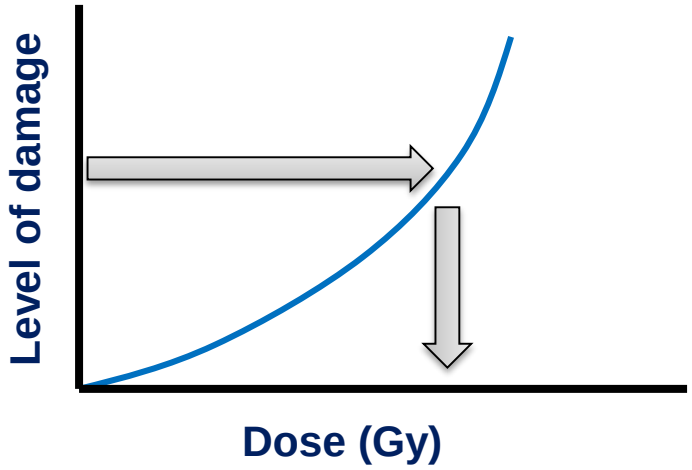
A simple definition of biological dosimetry

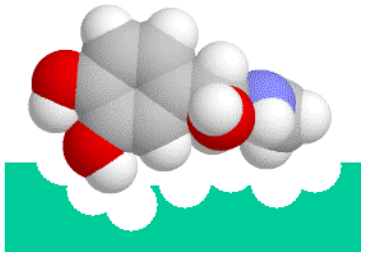
Biological dosimetry is a method of dose assessment based on measuring the level of radiation-induced damage to components of the body and reading off the dose from a calibration curve.



In many radiation accidents this has been the only possible method of retrospective dose assessment!

What are the criteria of a reliable biodosimeter?

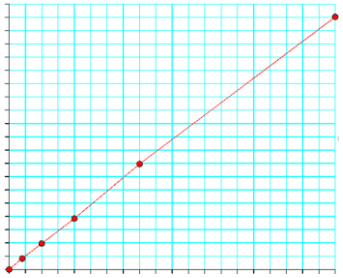
1. Signal must be specific to radiation



2. Signal must not fade with time

3. Signal must be detectable after partial-body exposure even when we do not know the exposure scenario

4. It must be possible to generate a universal in vitro calibration curve which is valid for all people (independent of age, sex, disease, etc)



Available individual retrospective dosimeters

Biodosimeters

DNA damage and response in lymphocytes
Protein changes in blood serum/saliva
EPR (in vivo) of teeth, bones, finger-, and toenails

Fortuitous dosimeters

EPR of mobile phone glass, sugar of chewing gum
OSL of semiconductors, salt of nuts, etc.

Physical dosimeters

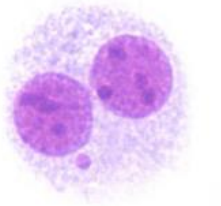
Film dosimeters
TLD dosimeters
Ionisation chambers/semiconductors

Available biodosimeters

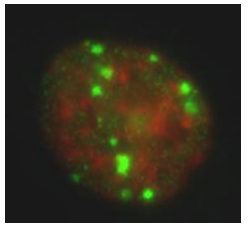
- The dicentric assay
- The micronucleus assay
- The gamma H2AX focus assay
- The PCC assay
- The FISH assay
- The gene expression assay
- The protein expression assay
- EPR of teeth, bones, finger-, and toenails

Underlined: future methods, currently under validation

A - scoring



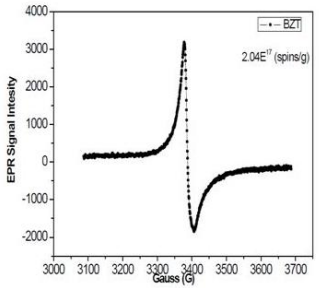
A - scoring



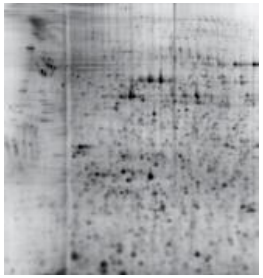
A - scoring

M - scoring

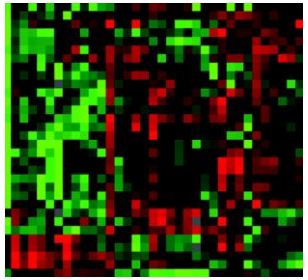
Spectrometer

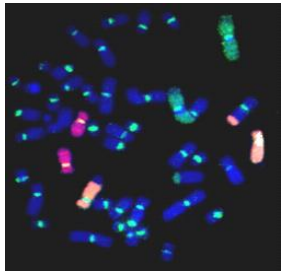


ELISA
Western



MicroArray
qPCR





M - scoring

Non-biological personal dosimeters

Fortuitous dosimeters

EPR of smartphone glass, sugar of chewing gum

OSL of smartphone electronic components, salt

Physical dosimeters

Film dosimeters
TLD dosimeters
Ionisation chambers/semiconductors

Dosimetric information is a very important element of managing radiological incidents

Question 1: Was I exposed???

A major challenge in economic restoration of radiological accidents is **overcoming the stigma attached to radiation**.

Because of fear and misperceptions, many people will have strong feelings of futility, fatalism and hopelessness. These feelings will, in turn, severely impact the **public desire and ability to process and absorb information**. For example, while only about 249 people were found to have some level of ^{137}Cs contamination following the1987 Goiania accident in Brazil, over 120,000 people showed up at monitoring stations to be surveyed for contamination.

Source:

NCRP REPORT No. 175

DECISION MAKING FOR LATE-PHASE RECOVERY FROM MAJOR NUCLEAR OR RADIOLOGICAL INCIDENTS

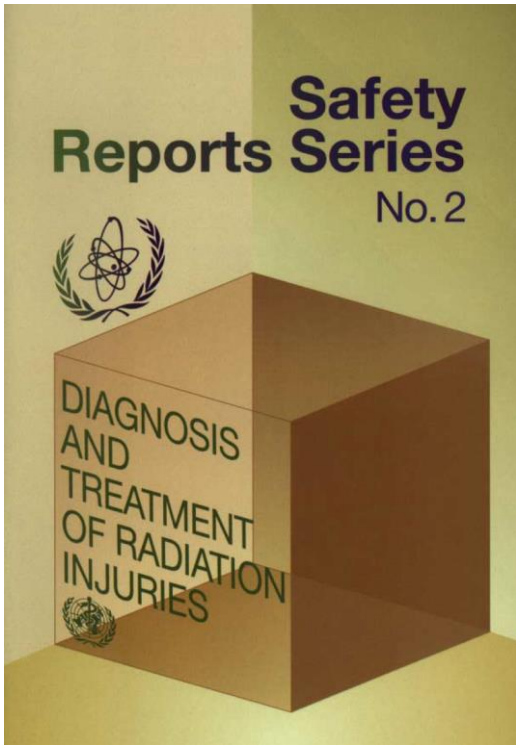
National Council on Radiation Protection and Measurements

Dosimetric information is a very important element of managing radiological incidents

Question 2: What was the dose???

Why is knowledge of the dose so important?

Because severe radiation-induced late effects (that are proportional to the dose) may appear after a long latency period and it is not possible to predict them based on the early, prodromal reactions.




Widening the radiation protection world…