Radiation safety

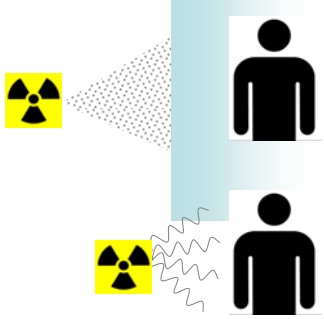
Virologie Heidelberg

Radiation safety = protection from ionizing radiation

Radioactive material emits ionizing radiation
This radiation transmits its energy upon contact with matter (e.g. your body)
This can lead to damage (e.g. by inducing mutations)

Particle radiation

- α-rays
- β-rays
- neutron rays



Electromagnetic radiation

- γ-rays (from)
- X-rays (aus Atomhülle)

Radiation safety areas in the department

Only in these areas radiocative material is permitted

Überwachungsbereiche: 4.floor, whole S2 area including cold room research; S3-Lab
only low amounts of radioactivity (gel samples),
no storage of radioactive samples or waste

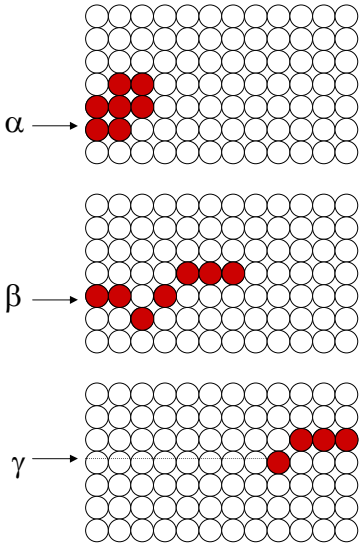
Kontrollbereich: at the first floor
Only permitted for persons
- who are listed officially as users (Barbara)
- who carry a dosimeter badge
- who have received a special instruction (instruction by other lab members is NOT sufficient)

use of β-rays (^{32}P, ^{35}S, ^{3}H)

Nuclides used in the department of Virology

	^{32}P	^{35}S	^{3}H
radaition	β	β	β
Half life	14.3 d	87.5 d	**12.3 years**
Max. energy	**1700 keV**	167 keV	18 keV
Effective range (air)	**several m**	< 1 m	< 10 cm
Effective range (body)	**10 mm**	< 1mm	6 µm
Detection	counter	Counter/Wipe test	**Wipe test**

Ionizing effects of rays (red: Ionisation)



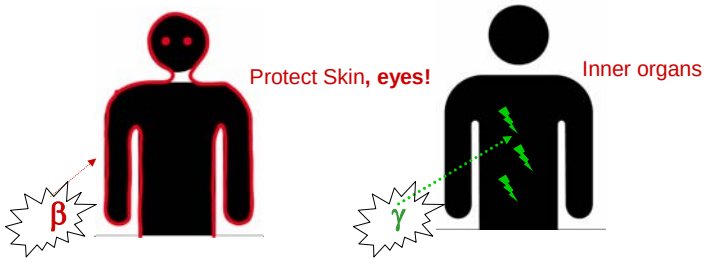
Low effective range (10µm in Wasser)
High density of ionisation

Higher effective range
Lower density of ionisation

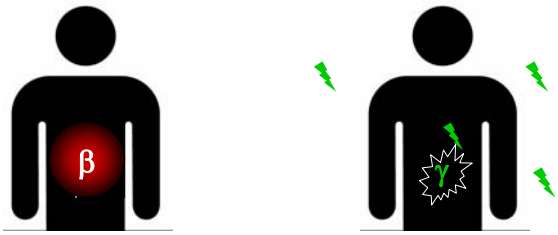
‚indefinite' effective range
Indirect ionisiation, stochastic

How can you endanger yourself?

A. exposition from outside



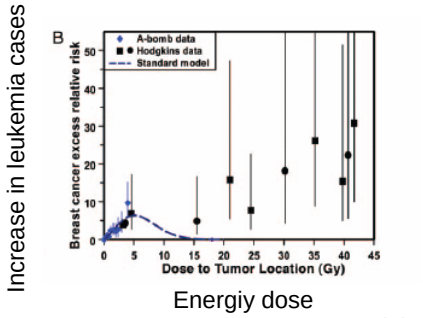
B. Incorporation



How is potential damage estimated?
Effective Dose

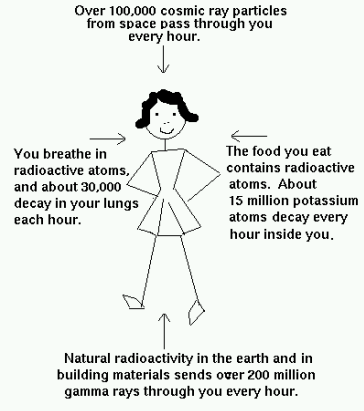
Ionizing rays transmit energy to tissue, which can cause damage

dose = amount of transmitted energy
Energy dose: measures physical effect (Gray, Gy)
Effektive dose: measures biological effects on humans (**Sievert**, **Sv**)



PNAS Sept. 2005

Persons exposed to radioactivity through their job
= **everyone** working in the Virology lab



natural + ‚civilization caused' (e.g. airline traffic)
Radiation exposure:
~ 4mSv/year in Germany

+ job related exposure:

<1 mSv/year = no job related exposure

>1 mSv /Jahr possible = Category B

> 6 mSv/year possible = Category A

(legal limit: 20 mSv/year)

Our dosimeters measure effective doses in 10 mm depth (= mainly bremsstrahlung)

Protection from incorporation

Open radioactive materials are handled in the department:

No eating, drinking or smoking in the lab!



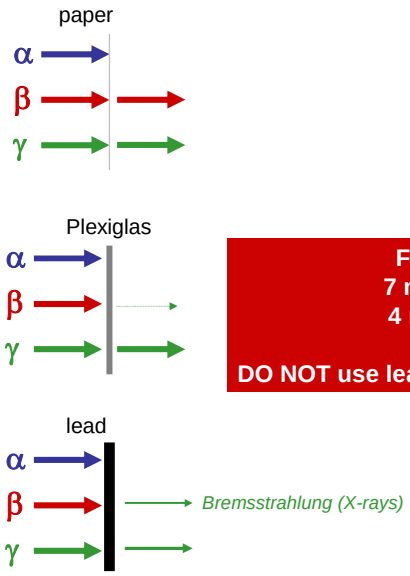

Decrease exposition from without

Increase distance
(quadratic relation to dosis)

Plan experiment - decrease exposition time

Use appropriate screen

Screening from ionizing radiation



For ^{35}S and ^{32}P:
7 mm Plexiglas or
4 mm Aluminum;

DO NOT use lead (causes bremsstrahlung)!

Do not forget:

Mandatory before starting to work with radioactivity:

- instructions including:
  - use of radioactive material
  - screens
  - use of conters
  - Decontamination
  - storage of samples
  - waste disposal
- physical exam at the Betriebsarzt (written attestation to Barbara)

Protect others:

•in the S2-area, radioactive working area has to be clearly labelled (**name of nuclide**) and protected by plexiglas screen
• as soon as work is finished: check area for contamination (including yourself),
•Decontaminate immediately if necessary
•Deposit waste in the Kontrollbereich

Documentation:

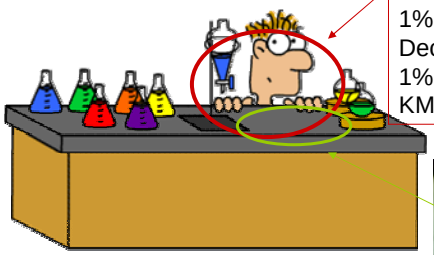
All radioakctive experiments (including those in S2-labs!!) must be documented in the log books provided

At end of experiment: **waste disposal**, check area and yourself for contamination

In case of contamination:

label area, close off in cases of high contamination
Decontaminate; waste water has to be disposed in radioactive waste
Problems, incorporation of radioactivity or significant contaminations: report to radiation safety officer

Persons (intact skin):
Water and soap
1% EDTA
Deconex
1% citric acid
KMnO4-solution



Rotores, Pipetts:
Dishwashing liquid

surfaces:
Scheuermilch

!

Special radiation regulations for pregnant women!

- notify radiation safety officer in case of pregnancy

Radiation safety officers

Barbara Müller, Paul Schnitzler

- Report problems related to radioactivity
- working with radioactivity is only legally permitted, if radiation safety officer can be reached (not on the weekend)



- radioactive material must be recaeived by a radiation safety officer or Oliver Fackler (Lieferscheine an Barbara)
- it must be brought to the Kontrollbereich immediately

PhD students office