

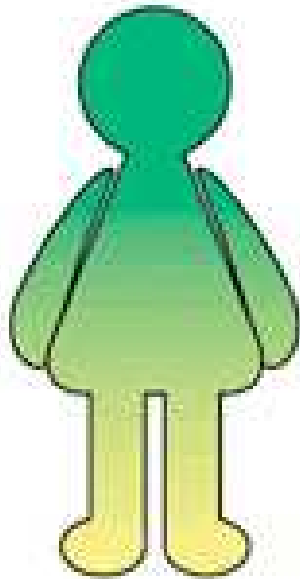
2. Effects of internal and external exposure to radiation

M.Mihara, Ph.D.

Units of radioactivity

Bq indicates the number of collapses per second.
Sv indicates the estimated health effect to the body.

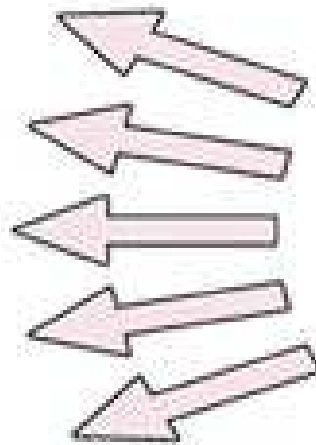
シーベルトSv



放射線によってどれだけ影響あるのかを表わす単位
[シーベルト(Sv)]

ベクレルBq

放射線

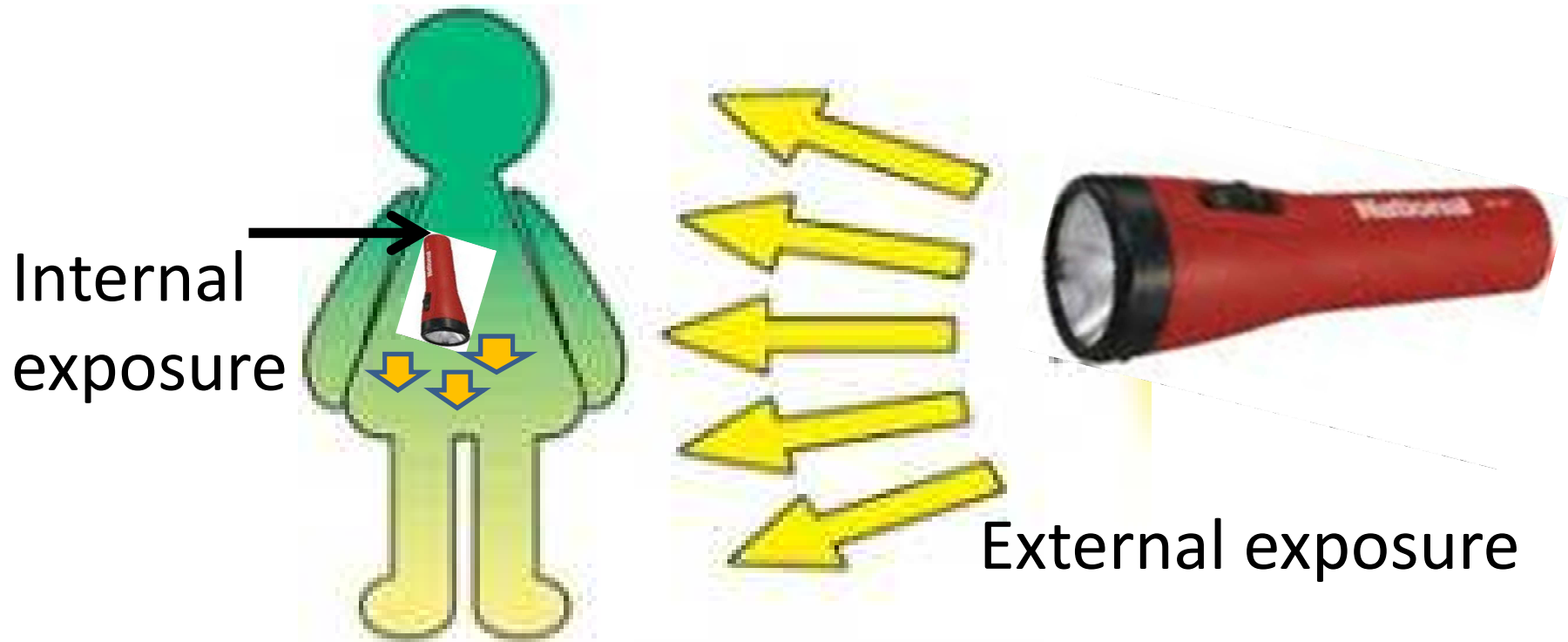


JAEROより引用

Internal and External Exposure

Electromagnetic wave → γ ray, X ray

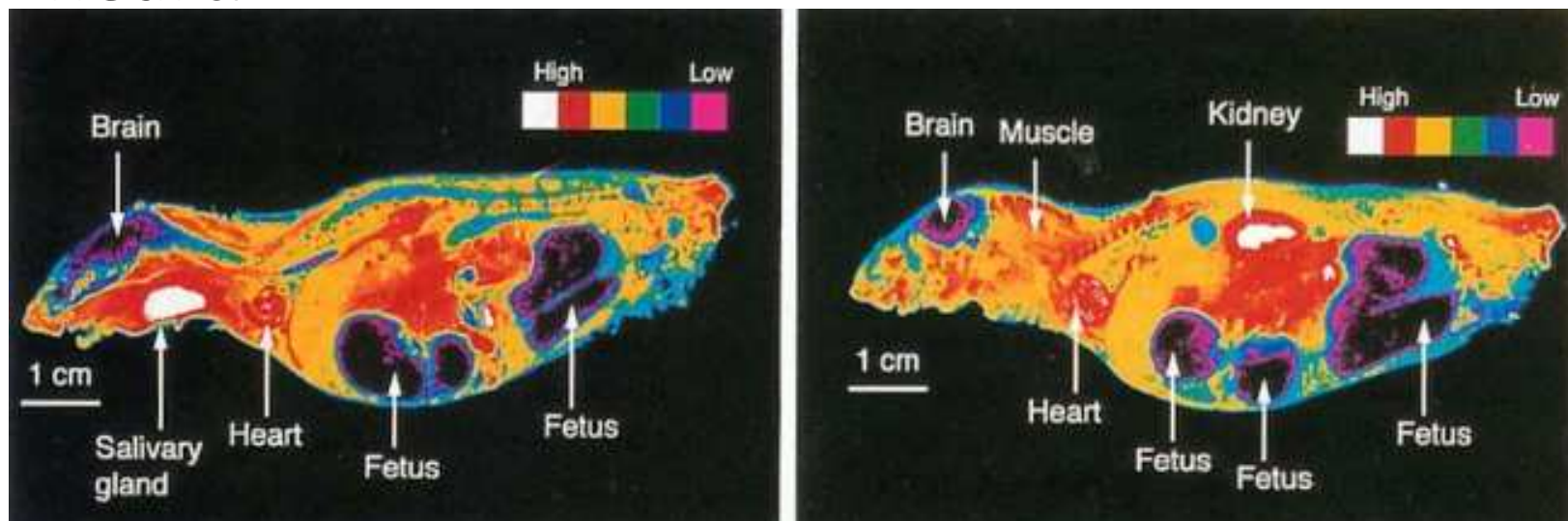
Radiation ↙ Particle beam → α ray, β ray



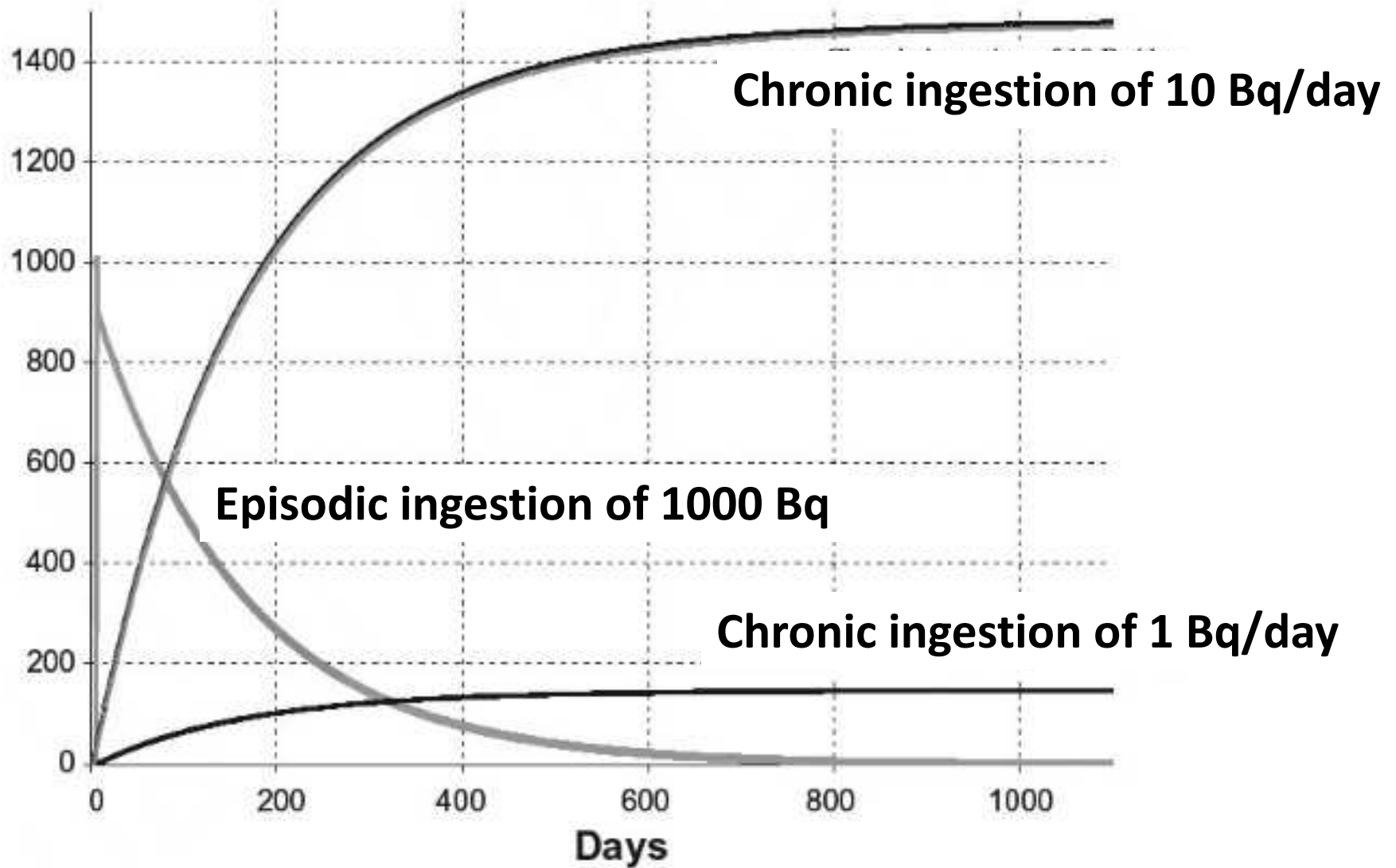
明るさを表わす単位 [ルクス (lx)]

Distribution of Cs137 in mice

- Cs137 is absorbed in a way similar to Potassium (K) .
- But, excretion is slow and Cs137 is accumulated in muscles, kidneys, and the heart.



From ICRP Publication 111



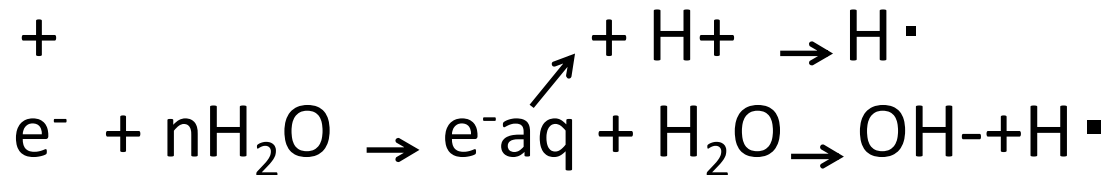
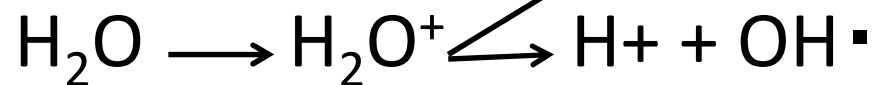
Evolution over a pluri-annual period (1000 days) of whole-body activity(Bq) associated with an episodic intake of 1000Bq and daily intake of 1 and 10Bq of Cs 137.

Ionization and excitation

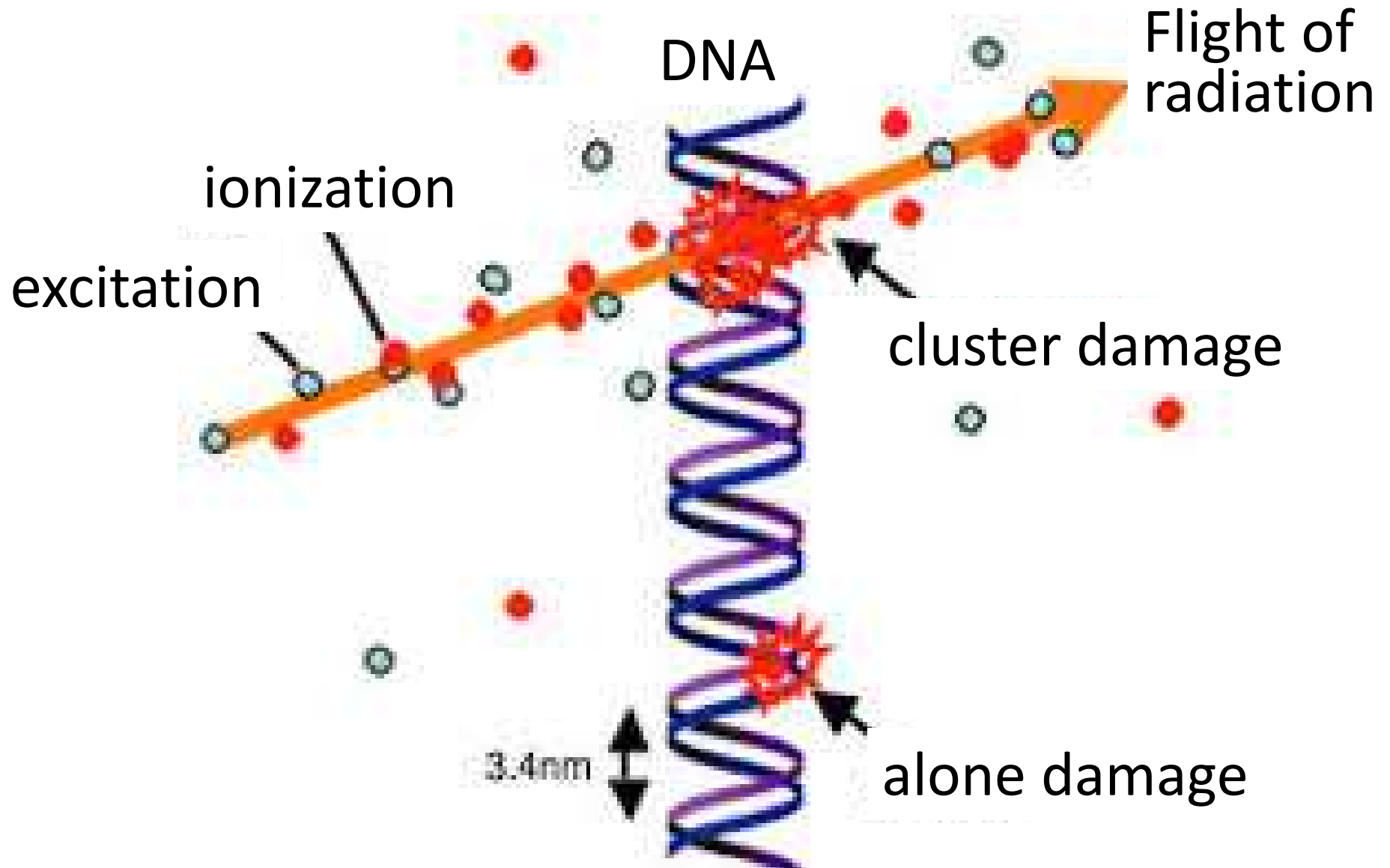
- Our body is consisted of 60 trillion cells and more than 60% of water.
- Intracellular fluid accounts for two-thirds of the water.
- Therefore, a large number of water molecules are ionized and excited as follows.
- Excitation of water



- Ionization of water



Damages on DNA

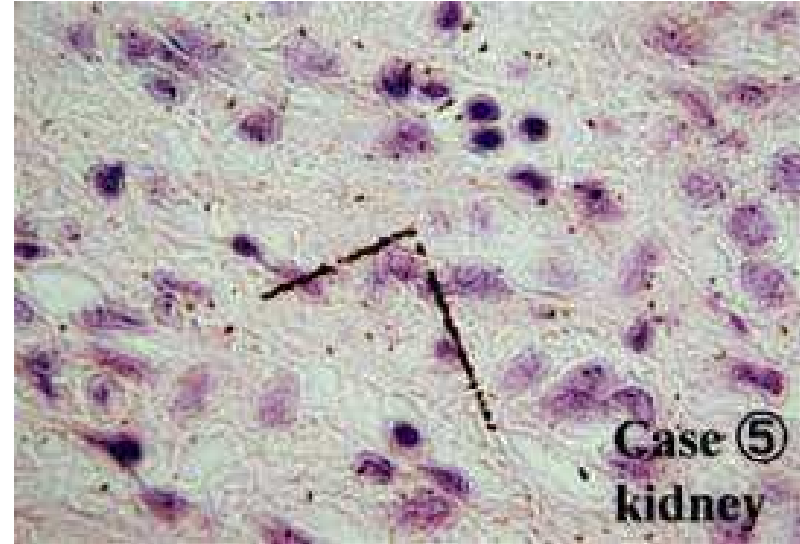


Fear of internal exposure-1

- Cs137, emitting β -rays and γ -rays, has the half-life of 30 years.
- Cs137 behaves like K and accumulates in muscles (especially heart muscles) and kidneys. It increases the risks of heart attacks.
- Sr90, emitting β -rays, has the half-life of 29 years.
- Sr90 behaves like Ca and accumulates in bones, destroying the bone marrow. It increases the risks of blood disorders (such as leukemia, etc.)

Fear of internal exposure-2

- Pu239, emitting α -rays, has the half-life of 24,000 years.
- Pu239 accumulates in lungs through breathing.



Plutonium emission in a kidney of a Nagasaki victim.

- Radiation causes a decline in immune function.
- Radiation causes energy shortage disease (such as general malaise) due to damages to mitochondria.

Conclusion

- Many types of damages are known to be caused by external and internal exposure to radiation.
- Especially, health effects of internal exposure are complicated and difficult to reproduce in animal experiments.
- Experiences in Chernobyl are very important in understanding long-term health effects on individual human body as well as on a whole population.