Swedish National Committee for Radiation Protection Research

Seminar ”Ethics of Radiation Protection”, November, 29, 2012, Stockholm

Discussion and Conclusions

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Development of Applied Ethics

- **Jonas, Hans (1903-1993): Principle of Responsibility, „act that way, that the consequences of your action are tolerable with the permanence of true human life on earth“.**
- **Ethics of Responsibility means that you have to consider the consequences of your actions and to compensate for.**
- **Rational actions are necessary for the development of promising strategies for conflict resolution. After all, the conflict is often caused by following the rules (“morals”) which determine actions within a culture and serve to legitimate the actions of the individual, but which are established differently in different cultures and in their subcultures. The critical analysis of morals and their scope is thus a prominent object of ethics.**

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Consequence & directives of action for radiological protection are:

- **To develop an appropriate level of protection for people and the environment against the detrimental effects of radiation under consideration of ethical and societal aspects without unduly limiting the desirable human actions that may be associated with such exposures.**

Fundamental Principles of Radiological Protection (ICRP 103, 2007)

- **Justification: "Any decision that alters the radiation exposure situation should do more good than harm". (Benefit in a broad sense is necessary. The legislator has to decide.)**
- **Optimisation: "The likelihood of incurring exposures, the number of people exposed, and the magnitude of their individual doses should all be kept as low as reasonably achievable, taking into account economic and societal factors".**
- **Optimisation is an iterative process not only for planning but is also ongoing during practice of a procedure.**

- **These principles apply for all processes where exposures to ionising radiation occur (planning, emergency, existing situations) including medical procedures.**

- **ICRP (2007) Para 219: "Optimisation of protection is not minimisation of dose. Optimised protection is the result of an evaluation, which carefully balances the detriment from the exposure and the resources available for the protection of individuals."**

- **The best option is not necessarily the one with the lowest dose (e.g. X-ray diagnostics). For the judgment of the benefit not only the monetary costs are decisive but also ethical and societal aspects have to be considered.**

- **Dose Limits: "The total dose to any individual from regulated sources in planned exposure situations other than medical exposure of patients should not exceed the appropriate limits".**
- **Dose Constraints: "A source-related restriction on the individual dose, which provides a basic level of protection for the most highly exposed individuals on the dose in optimisation of protection for that source. The dose constraint is a value of individual dose used to limit the range of options considered in the process of optimisation."**

- **Dose constraints allow flexibility below dose limits. It gives some freedom for regulators in cooperation with the operator.**

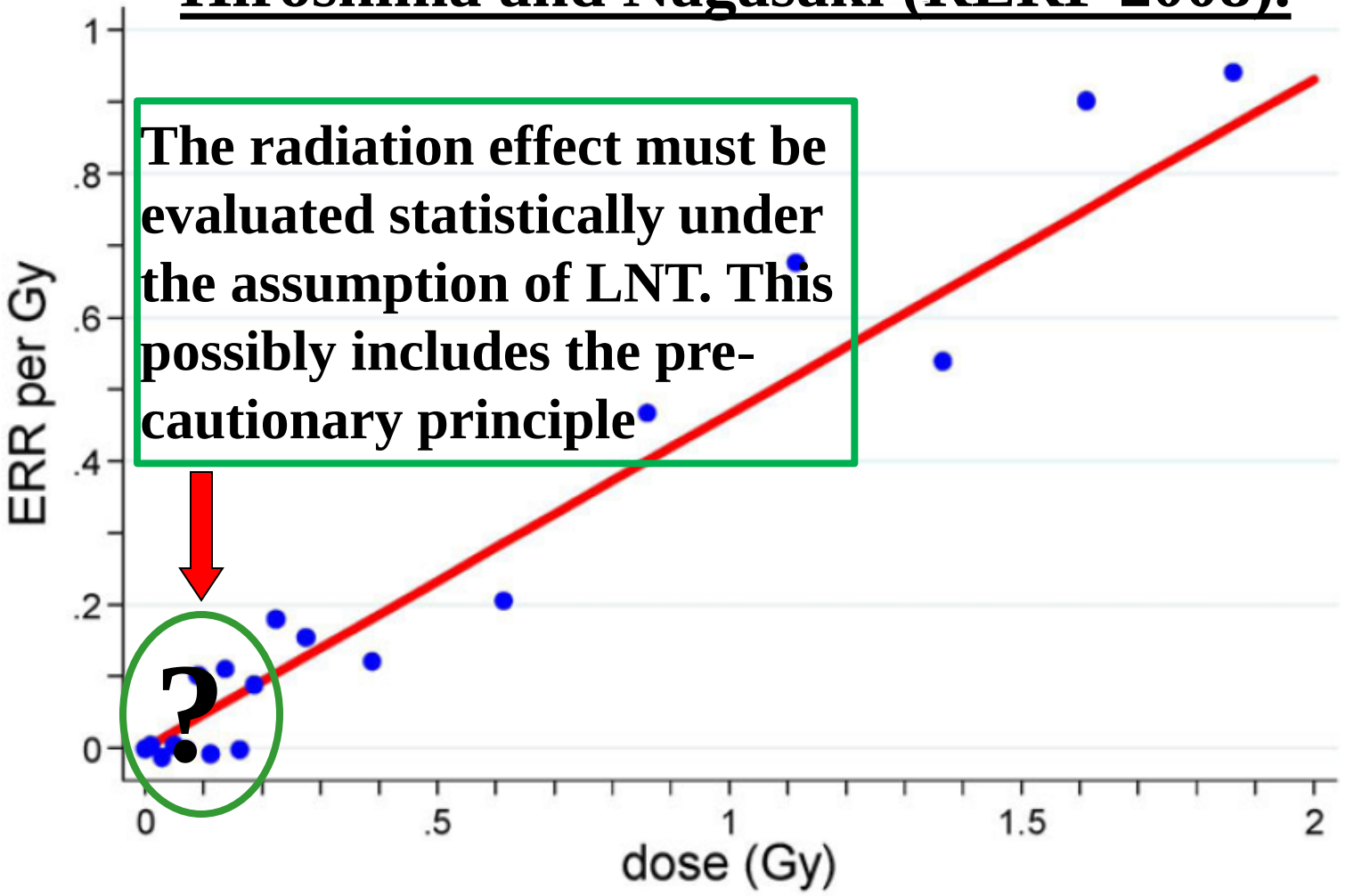
- **The fixation of dose limits includes always a judgement of values: Which risk is tolerable and acceptable under judgement of the usefulness of a radiation exposure?**

- **There is no action without risk, which is usually connected to uncertainties, the lower the dose the higher the uncertainty. The fixation of standards and dose limits requires actions with given risk limits. These limits need the acceptance of the society and a societal consensus.**
- **The consciousness and acceptance for risk differ in different countries, these phenomena also change with time. The development during last decades shows significantly, that the sensibilisation of people has increased with the progressing degree of mechanisation and prosperity.**

Consideration of Precautionary Principle

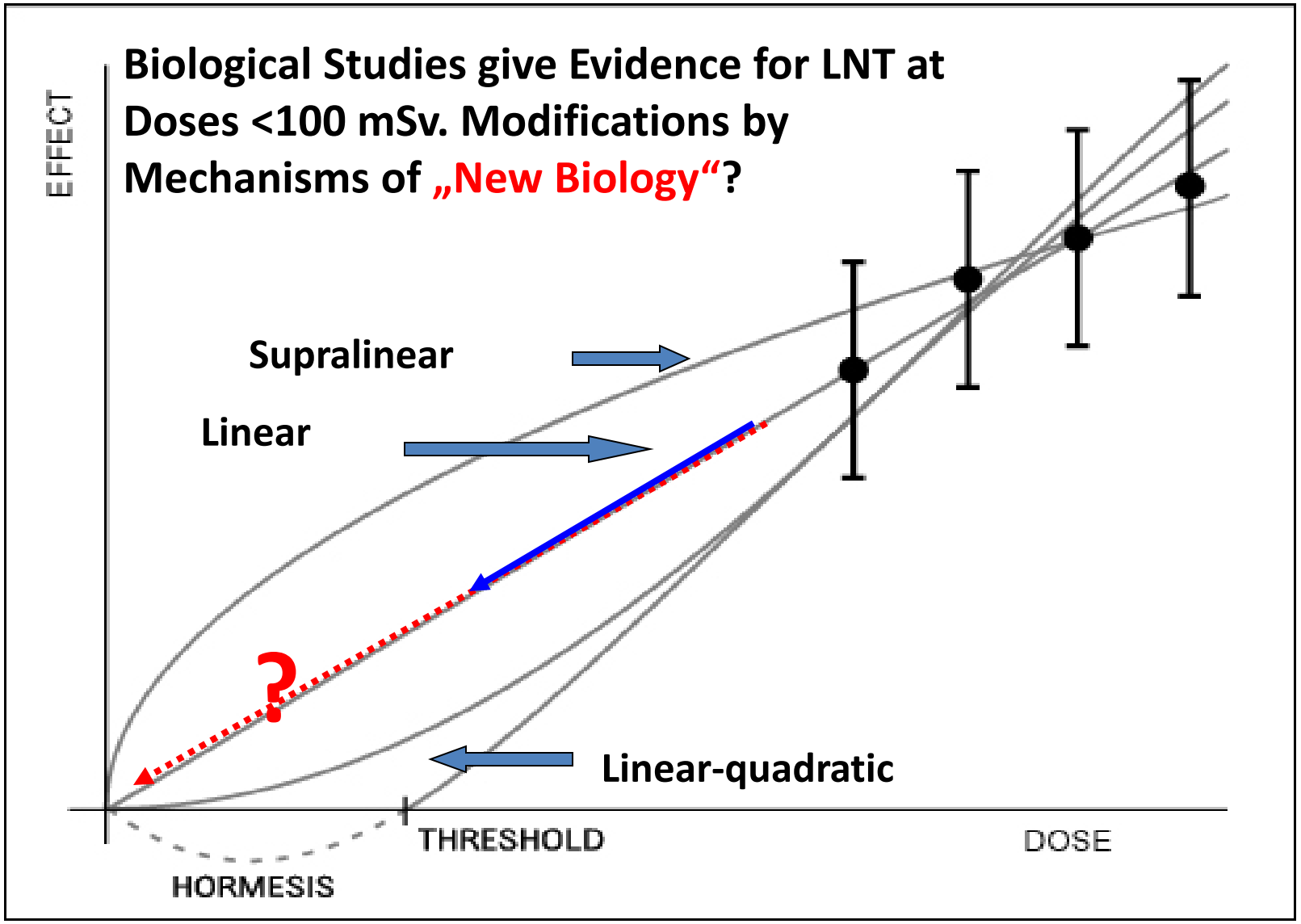
Use of the so-called linear-non-threshold (LNT) model is considered by the Commission to be one of the best practical approaches to manage risk from radiation exposure and commensurate it with the ‘Precautionary Principle’ (UNESCO, 2005). The Commission considers that the LNT model remains a prudent basis for radiological protection at low doses and low dose rates (ICRP, 2005d). (ICRP 103, 2007)

All Solid Cancers Fitted by Linear Dose Response and Dose Category Specific ERR Estimates in Hiroshima and Nagasaki (RERF 2008).



http://www.rerf.or.jp/

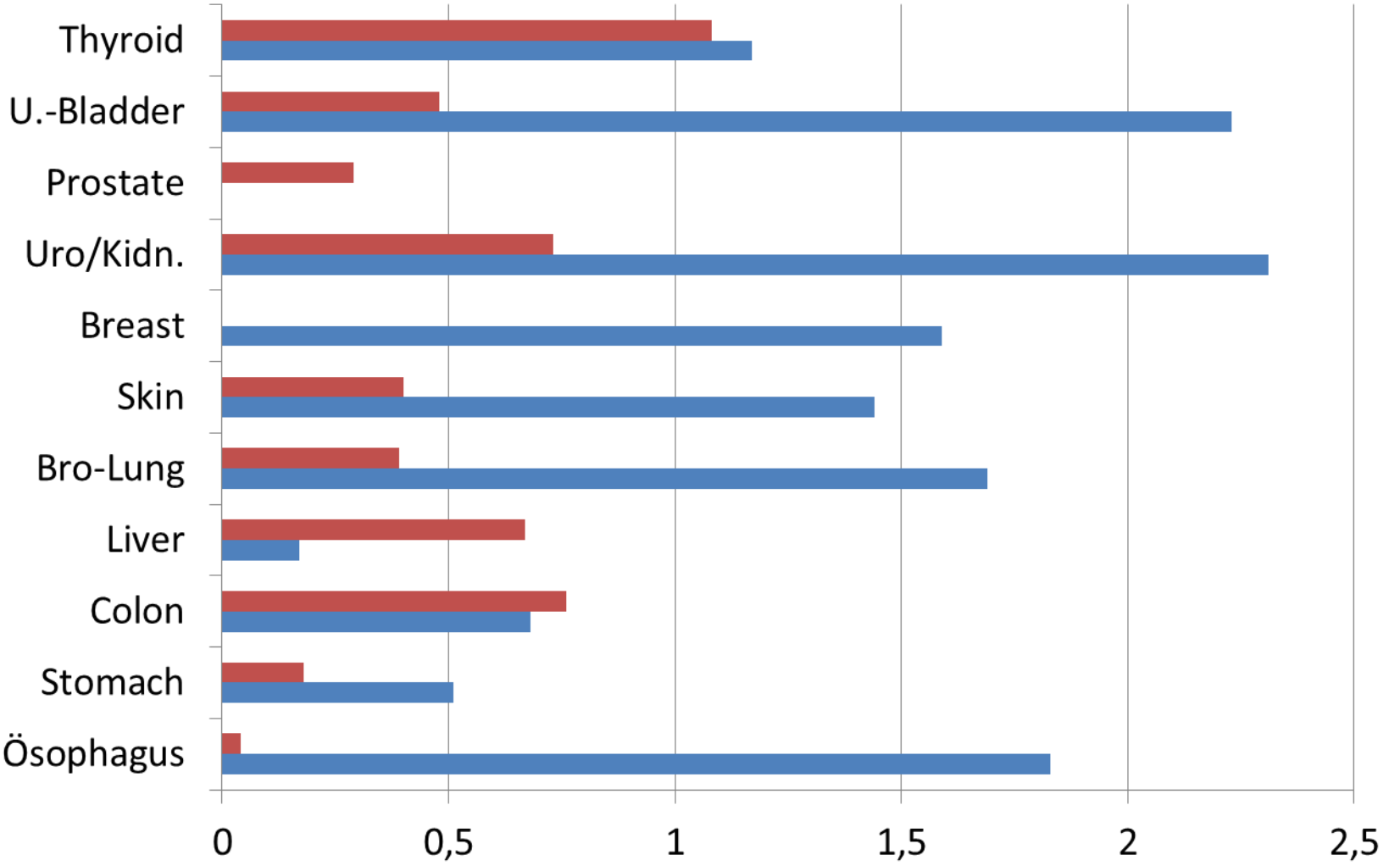
Possibilities of Extrapolation into the lower Dose Range



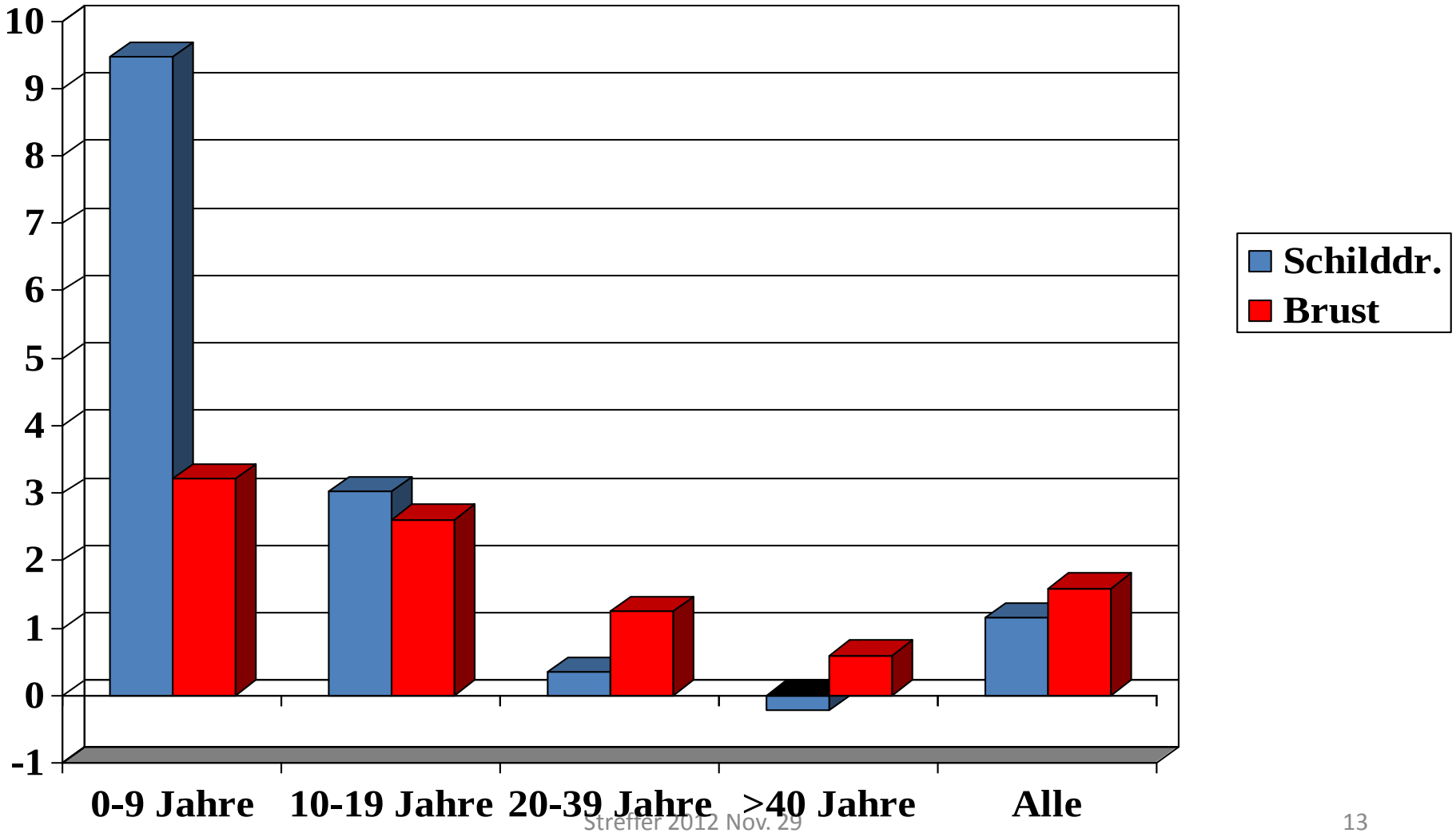
Further aspects for the development of culture and ethics in radiological protection

- **Transparency with respect to fixation of regulations and standards. Communication has to take place in the „scientific community“ and with stakeholder.**
- **Information in a broad sense about knowledge and uncertainties of dose- and risk-estimations has to be given.**
- **Efforts are important to reach acceptability and acceptance,**
- **Individual radiosensitivity (age, gender, genetic disposition has to be considered.**
- **Participation of the public under consideration of legal rules has to take place in a democratic way.**
- **Future generations have to be considered with respect to radiation exposures.**

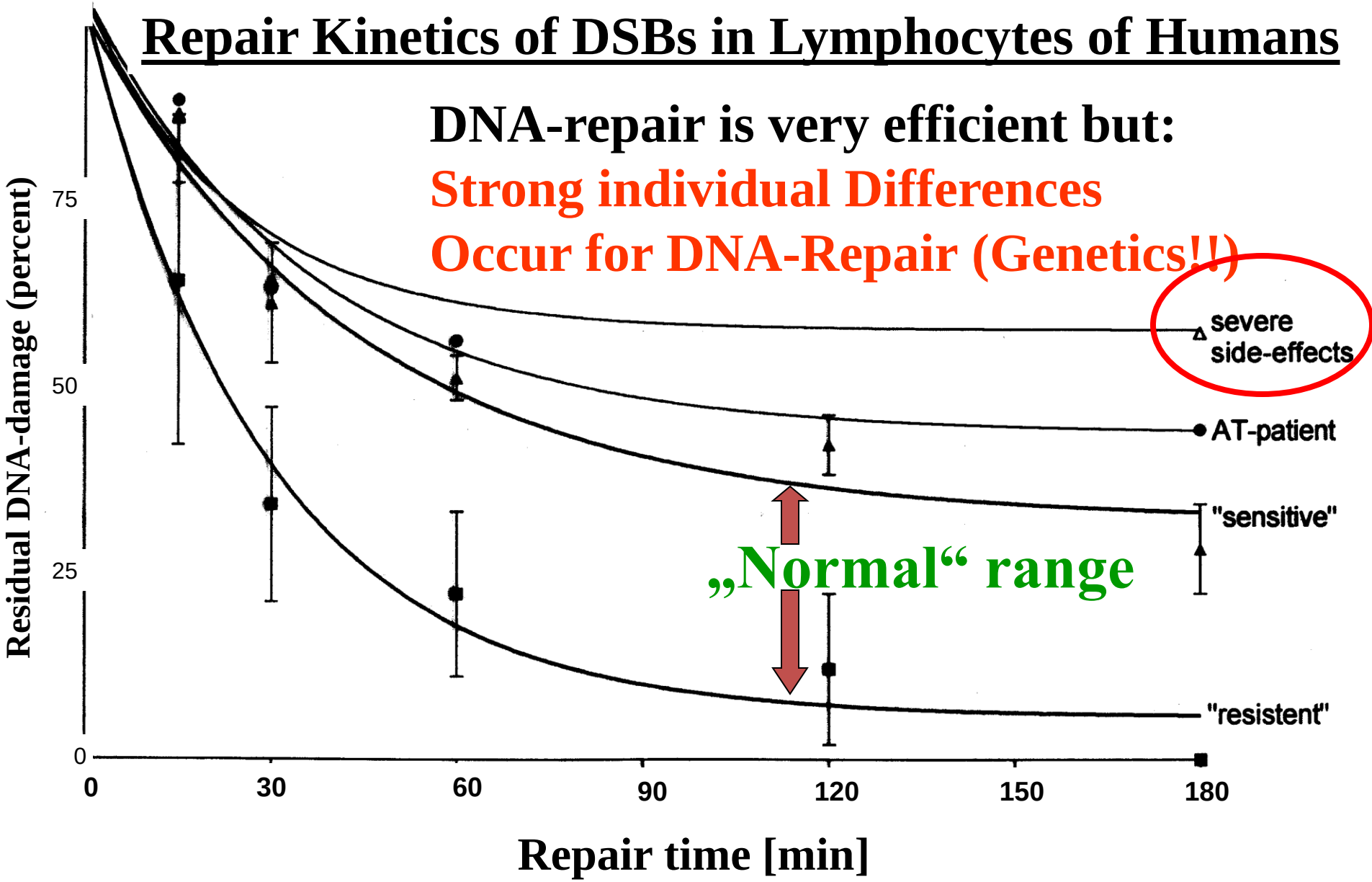
Excess Relative Risk per 1 Sv of Incidence for solid Cancer (1958-87) in Hirosh. & Nagasaki in Males (red) and Females (blue) (Thompson et al. 1994)



Excess Relative Risk per 1 Sv for Incidence of Thyroid and Breast Cancer (1958-87) in Hiroshima & Nagasaki in Dependance on Age Exposure (Thompson et al. 1994)



Repair Kinetics of DSBs in Lymphocytes of Humans



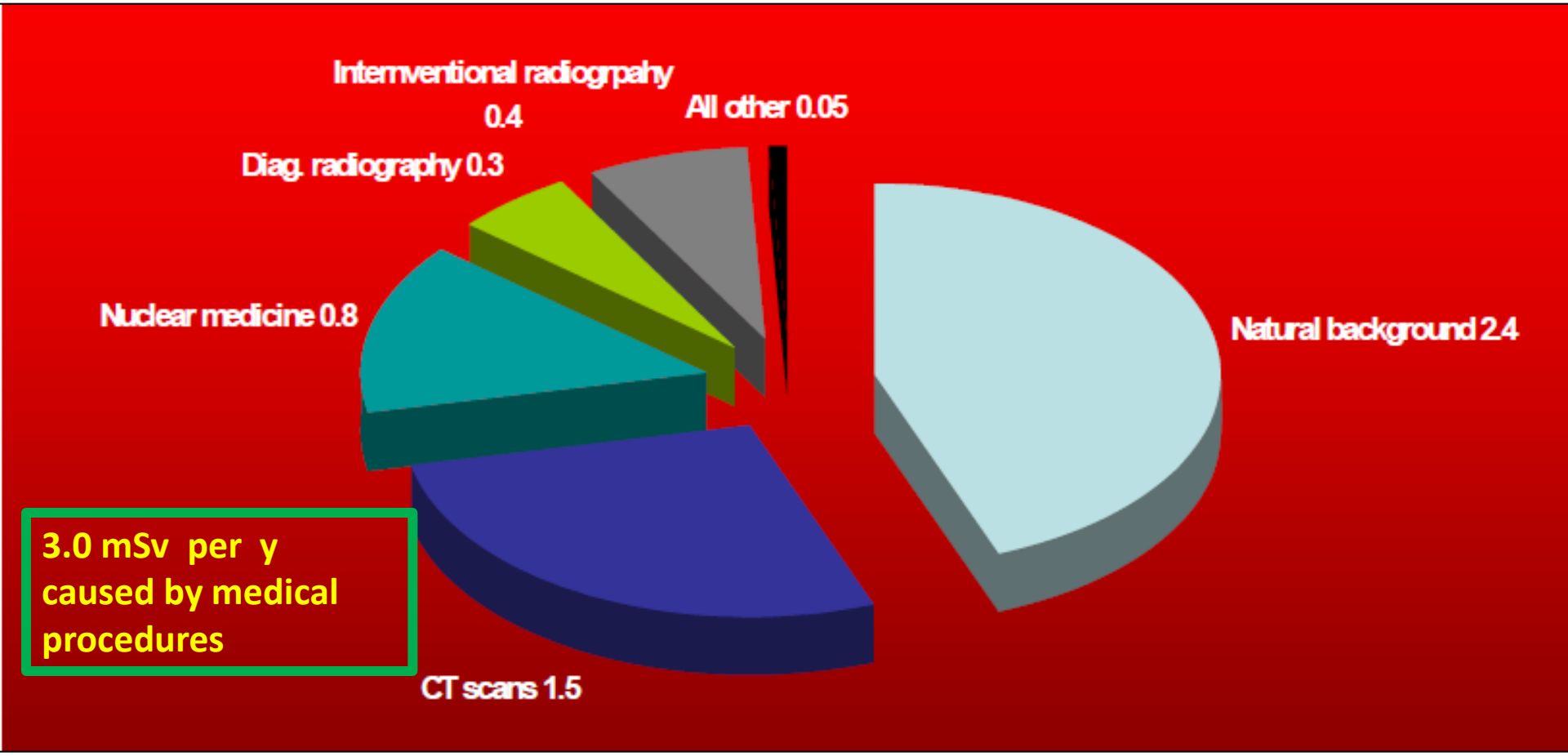
Where are the challenges for radiological protection in medical procedures?

- **Justification and optimisation are mandatory for applying ionising radiation to patients but no dose limitation is recommended for patients by ICRP.**

- **The responsibility for medical exposures to patients lies with the physician, who has to have good knowledge of the risks and benefits of the procedures involved. A profound education and steady learning of new information are necessary.**

- **The highest man-made radiation exposures per caput is caused by the use of ionising radiation & radionuclides in medicine. In many industrialized countries dose levels per caput are about equal to the doses from natural sources. These dose levels from medical use increase steadily.**

Annual per Caput Dose (effective Dose in mSv) in USA 2006 (UNSCEAR 2008)



Further ethical-societal Aspects

Consideration of Precautionary Principle

Acceptability and acceptance of exposure and risk

- Transparency
- Information about knowledge and uncertainties
- Participation and legal regulation

Individual Radiosensitivity

- Age
- Gender
- Genetic disposition

Just Distribution of risk and benefit

- Exposure and compensation
- Future generations

Consequence & directives of action for radiological protection are:

- **To develop an appropriate level of protection for people and the environment against the detrimental effects of radiation without unduly limiting the desirable human actions that may be associated with such exposures. Econimical, ethical and societal aspects have to be considered.**
- **These are prominent principles for radiological protection also for the medical use with very valuable procedures.**

- **Science aims for knowledge searching the truth in a general sense**

- **but it also has the obligation to develop knowledge and technologies in order to improve prosperity and health (in the physiological and psychological sense) for the societies**