



Food Irradiation Challenges and limits

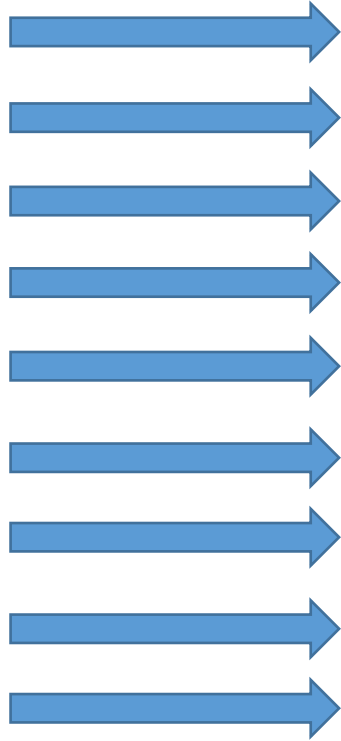
Alain Strasser - Aerial





Food irradiation

Radiation
(Gamma rays, X-rays, Electron Beams)



What is the principle ?





Lethal effect of radiation on living organisms

Direct effect of radiation

Indirect effect : through water radiolysis

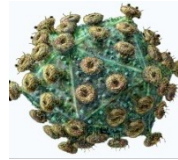


DNA is a very radiosensitive molecule



Resistance to radiation of microorganisms contaminating food

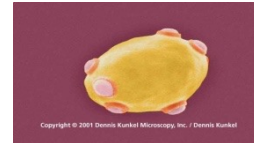
Viruses



Bacteria



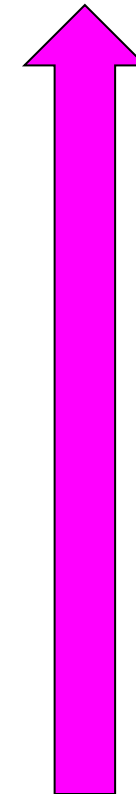
Yeasts



Molds



Insects/Parasites



Resistance to radiation



How to characterize radiation treatment ?



A key parameter : **Dose**

■ Unit : **Gray** (Gy)

$$1 \text{ Gy} = 1 \text{ J.kg}^{-1}$$



Different Radiations (Gamma rays, X-rays, Electron Beams)



Different processes of interaction with matter

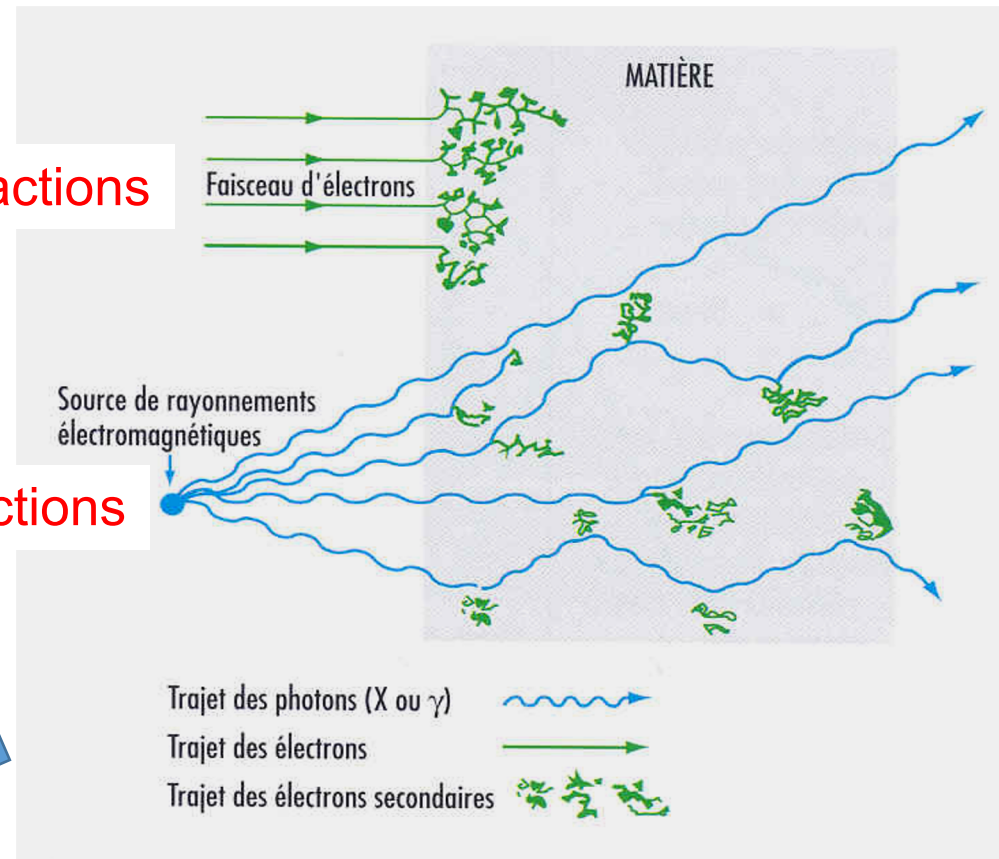


Different non-uniform dose distribution
patterns in products



Electron interactions

Photon interactions





Desired effects



Sprouting inhibition



Extension of shelf life
Microbial decontamination (pathogens)



Disinfestation



Delayed ripening



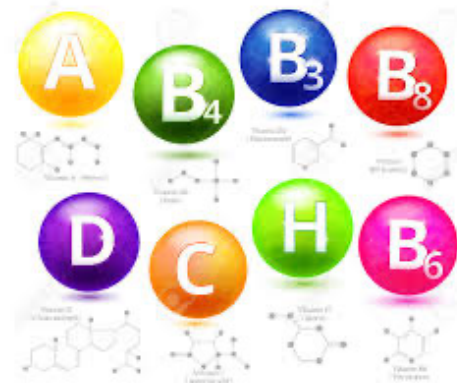
Sterilization



Possible negative effects on the intrinsic properties of the food



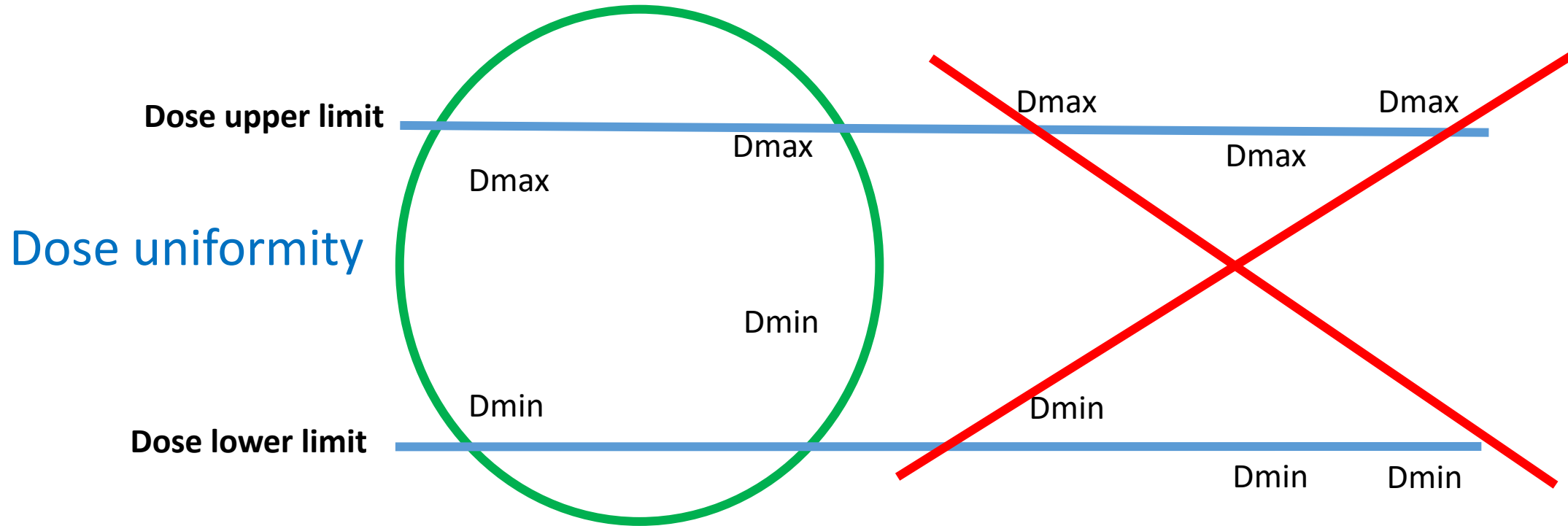
Possible sensory changes, immediate or during storage (odour, flavour, texture, colour, ...)



Possible degradation of nutrients (proteins, vitamins, lipids, ...)



What is the key to successful treatment ?



DUR (Dose Uniformity Ratio) : D_{max} / D_{min}



Specificity of food irradiation

**Food products have different tolerance to radiation
(high water or fat content unfavorable)**



Required DUR generally lower than for other applications (polymers, etc...)



Meeting the required DUR is a key design criteria for irradiation facilities / processes



Next presentations



Anuradha Prakash
(Chapman University - USA)

Effect of phytosanitary irradiation of fresh fruit and vegetable quality



Suresh Pillai
Texas A&M University - USA



Barbora Dubovcova
Bühler group - Switzerland

Emerging research areas related to high-energy electron beam (HEEB) treatment in food processing

Microbial validation of low-energy electron beam (LEEB) treatment



Next presentations



Celina Horak (IAEA)

Overview of some of the approaches used to obtain low microbial or sterile meals and their impact in the society, with a focus on prepared meals dedicated to immunocompromised persons



Monique Lacroix

CIC /INRS Armand-Frappier - Canada

Summary of the different opportunities that irradiation can bring for the development of active polymers or new combined treatments to assure food safety