General tissue response model

The purpose of the presented work is to develop a general biological model of tissue response to radiation. In respect to their response to radiation three different types of behavior have been observed in the radiation practice, namely tumor, critical element and critical volume ones. Based on the idea that an organ is comprised of *functional subunits* several investigators have developed models describing these behaviors for an individual. It is clear from these works that actually there is only one general model of tissue response at individual level. However the only observable quantity is the population response. Bearing in mind that:

- the population response is an average over the response of all individuals comprising the population
- the individual response of an organ is based on FSU survival binomial statistics

we explore in a series of numerical experiments the behavior of the population response (multi-parametric multi-dimensional integral) for different values of the model parameters

It is shown that :

- the population multi-dimentional integral could be reduced to simpler forms. However in the process of simplification the biological meaning of the parameters is often lost
- in the case of single partial or whole organ homogeneous irradiation a two parametric $\Phi(D_{50}, \sigma_{50})$ function approximates sufficiently well the population integral
- in the case of heterogeneous irradiation the Lyman model is a good 3-parametric approximation of the population integral