AbstractID: 7889 Title: Note on some limitations of the Kallman 'relative seriality' Normal Tissue Complication Probability model

In this work we show that the 'relative seriality' model of Kallman et al. (1) is based on several assumptions about the structure of the irradiated organ and the pattern of irradiation which are very specific and should lead to a limited use of the model. The assumptions are as follows: 1) The organ has a special architecture – it consists of (n) parallel structures (fibers) and each of them consists of functional subunits (FSUs). 2) The critical number of FSUs in a fiber is 1 (serial behavior). 3) The critical number of fibers is n (parallel behavior). 4) The organ is irradiated heterogeneously in such a way that all fibers have an equal damage probability.

More importantly, however, there exists an inner inconsistency in the model concerning the way in which the response of the organ to a homogeneous irradiation is described. It is described using a two-parameter dose-response function identical to the Tumor Control Probability function. Thus in the homogeneous case a tumor like behavior is assumed in discrepancy with the initially presumed complex structure of the organ. It should also be pointed out that according to the assumptions of the model the values of the parameter $\boldsymbol{s}$ may vary between zero for a parallel organ and unity for a serial organ. Values of $\boldsymbol{s}$ higher than 1 were reported even in Kallman's original work. Therefore, this model should be considered to be just a phenomenological one having no radiobiological basis.

1. Kallman et al., 1992, IJROBP 62(2): 249-62.