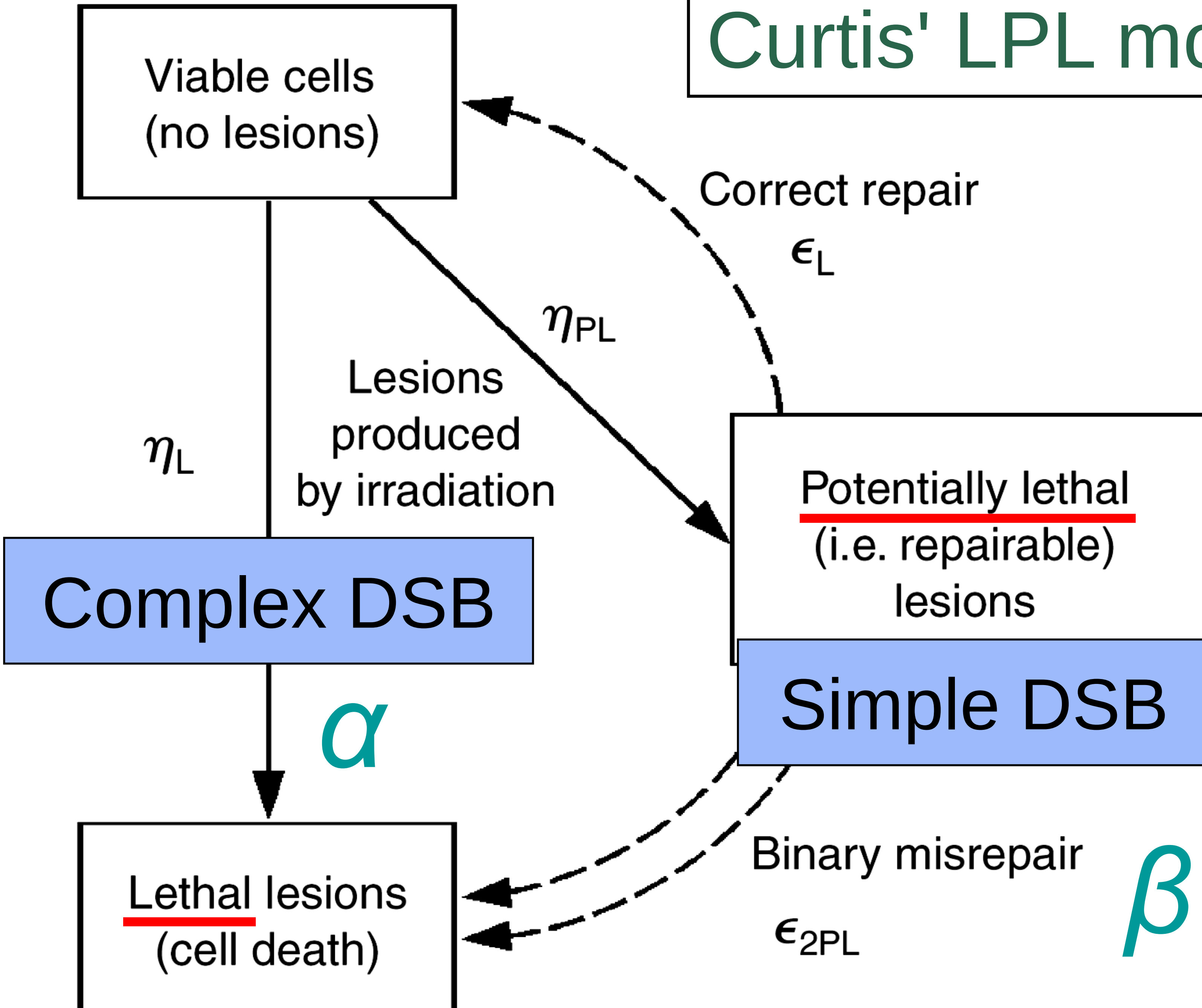
Curtis' LPL model



Curtis SB, *Radiat Res,* **106,** 252, 1986

Dose rate effects

Some tissues and cell lines display the so called “dose rate effects”, in which the rate at which a radiation dose is given influences its biological effect. The Curtis’ Lethal-Potentially lethal (LPL) model postulates that there are two types of lesions, lethal lesions, which involves complex DSBs, presumably unrepairable; and potentially lethal lesions which include simple DSB that are repaired correctly. A dose rate effect could then be achieved, according to the LPL model, if for example low enough rates are used so that 1) DSB are spread far apart and do not interfere with repair of one another and 2) enough time is allowed to elapse to allow simple DSB repair, which is the same principle as in fractionation.

An intriguing phenomena, the inverse dose rate effect has been observed, in which extremely low dose rates actually have a higher biological effect. It is believed that such low doses generate DNA breaks but do not trigger important DNA damage repair proteins such as ATM, which results in lack of activation of cell cycle check points and mitotic catastrophe.

Dose rate effects should be considered when carrying out experiments trying to simulate GCRs, since in space, dose rates are ~5 orders of magnitude smaller than what we use in experiments. However, survival curves from high LET irradiated cells, generally show very little or no shoulder, meaning there is little repair with this kind of radiation, and thus dose rate effects might be less pronounced.

- I like this slide because it shows an important phenomena that I was not completely aware of and is very relevant for space radiation research. Also the slide offers a model of why this phenomena might happen.