

Reviewer #2: I agree with the author that the links between cancer, natural selection, and long-term evolution are important ones, and I believe that they should be encouraged. However, those links must be justified using our knowledge of evolutionary theory.

1. It is certainly interesting if jellyfish etc do not get cancer, but I am not sure the data exist that would lend any scientific weight to this statement. There are many groups of animals where we have no evidence of cancer. This would certainly be the case for almost all insects - the only reason that tumours are known in *Drosophila* is that mutants have been exhaustively studied. I suspect that finding tumors in a natural population would be close to impossible. I would also add that tumors are very common in angiosperm plants; the only reason that they do not get cancer is that the cells cannot migrate due to their cell wall - a morphology that could be viewed as an anti-cancer mechanism.

But beyond the problem of establishing (at least to a reasonable degree) that cancer is restricted to bilaterians, there is the more important problem of establishing the nature of the natural selection that would spread the tendency of "imperfect" individuals to get cancer. The author argues that cancer acts as a "quality control" mechanism; however, as presented, it relies on a classic group selection argument, i.e. that there is a benefit to the group/clade in the absence of a benefit to the individual. Such arguments need to be very carefully justified and that is not done.

Regarding the falsifications mentioned, I suspect that the well founded view that telomerase suppression is a mechanism that evolved to prevent cancer contravenes #3. In this context, the statement (line 89) that "Because carcinogens are mutagens anti-cancer mechanisms are also anti

mutation mechanisms" is false. Anti-cancer mechanism (such as tumour suppressors) may be inactivated by mutation, but they are typically cell-cycle regulators not involved in activities like DNA repair.