Eukaryotes' mechanism to repress cell division: Sexual reproduction and unequal cell division

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SUMMARY

Prokaryotes have small and compact genomes so that they can grow rapidly to produce an awful number of cells in a short time. In contrast, eukaryotes with enlarged genomes grow slowly so that they are prone to the risk of mutations. Evolution from prokaryotes to eukaryotes is metaphorically viewed as the transition from the car without brake to one with the brake. Here I propose sexual reproduction (SR) and unequal cell division (UCD) as brake systems to repress cell divisions in eukaryotes. SR initiates ontogeny changing from youth to senescence, and from the totipotent cell to differentiated cells with cellular lifespan. In most advanced SRs, gametes produced by meiosis arrest cell division tentatively or stop it completely, while in less advanced SRs haploid gametes usually undergo cell division. In *Paramecium*, cells committed to SR are unable to undergo cell division. UCD is another way to repress chaotic cell division limiting the ever-lasting cell to one of the daughter cells: for example, stem cells produce ever-lasting and differentiated daughters; budding yeasts produce a rejuvenated daughter and an aging mother cell; *Volvox* produces germ-like and soma-like cells. In both SR and UCD, highly regulated mechanisms to repress futile survival are working.