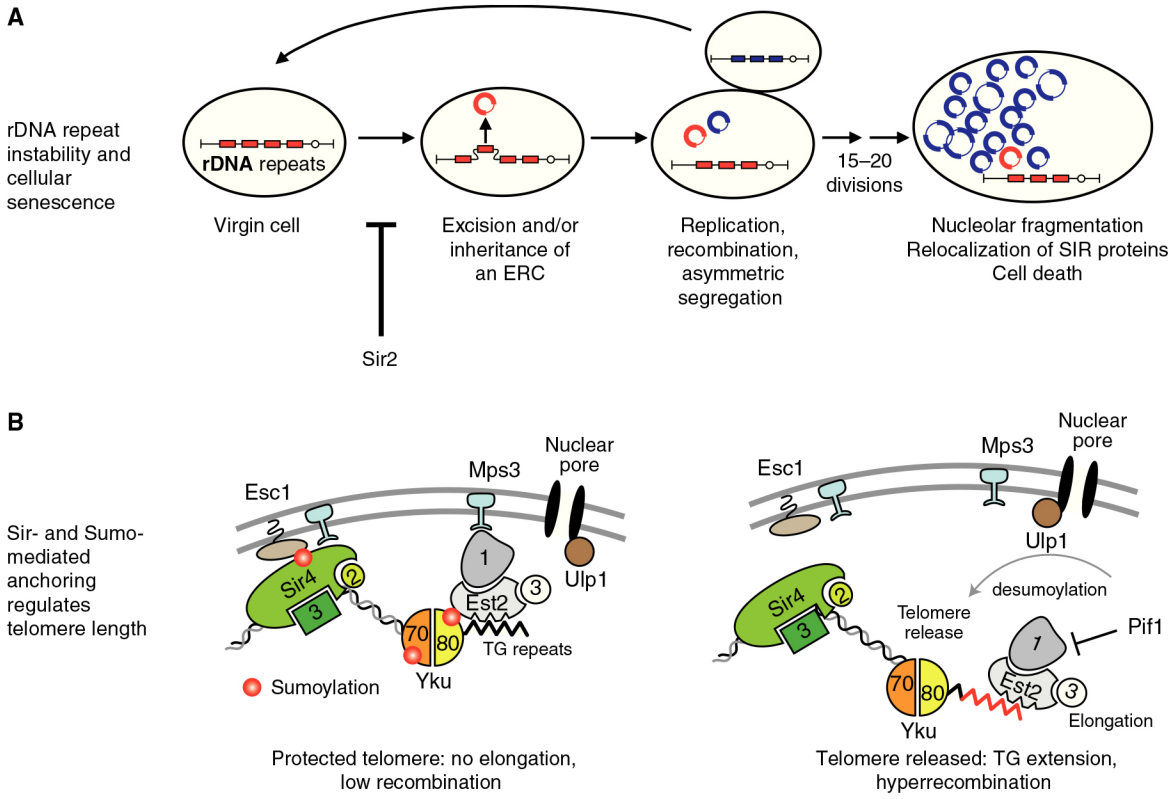

Figure 11. Secondary functions of Sir proteins and silent chromatin. (*A*) rDNA recombination leads to cellular senescence in yeast. The rDNA is organized in an array of 140–200 direct repeats of a 9.1 kb unit (red block). These encode the 18S, 5.8S, 25S, and 5S rRNAs, and contain two Sir2 responsive elements downstream of the 5S gene and within the 18S gene. The rDNA repeats tend to be excised in aging yeast cells, and the circles accumulate in the mother cell (Kaeberlein et al. 1999). This correlates with premature senescence and can be antagonized by Sir2, which helps suppress unequal recombination and ring excision. (*B*) Telomere anchoring and silent chromatin contribute to telomere homeostasis. Redundant pathways that tether yeast telomeres to the nuclear envelope include sumoylation targets, Sir4, yKu70, and yKu80 (Ferreira et al. 2011). The relevant Sumo E3 ligase is Siz2. Loss of Siz2, ablation of the Mps3 amino terminus, or deletion of Sir4 all lead to release of telomeres from the nuclear envelope and longer steady state telomere length. Loss of Mps3 amino terminus or yKu also increases telomere recombination. This suggests that sequestration at the nuclear envelope may limit access for both recombination and telomerase activation mechanisms, and that loss of anchoring increases both pathways. Regulated desumoylation by Ulp1 may play a role in releasing telomeres from the periphery allowing efficient elongation in late S phase. Siz2-mediated sumoylation is indicated by red circles.