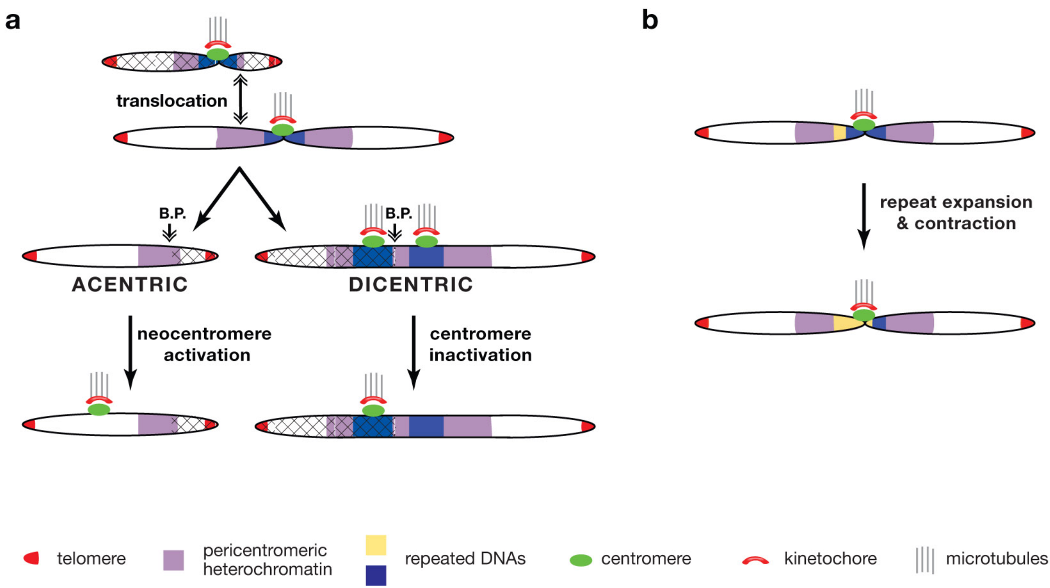

Figure 8. Chromosome Evolution and Epigenetic Regulation of Centromere Identity

Centromere plasticity with respect to association with specific DNA sequences may be necessary to accommodate the sequence changes and chromosome rearrangements that occur during evolution. (*a*) Translocations frequently observed during evolution can produce acentric and dicentric chromosomes, both of which are normally lost during mitotic or meiotic divisions. Epigenetic regulation and plasticity allow acentric fragments to acquire neocentromere function, as well as inactivation of one centromere on dicentric chromosomes, leading to normal inheritance of both translocation products. (B.P. = translocation breakpoints.) (*b*) Centromeres in most eukaryotes are embedded in heterochromatin and repeated DNAs, especially highly repeated satellite arrays. These sequences change at a dramatic rate during evolution and undergo frequent base changes and array expansions and contractions. Strict dependence of centromere identity on specific DNA sequences would result in loss of centromere and kinetochore functions, and detrimental chromosome loss. In contrast, epigenetic regulation of centromere identity and position provides a mechanism for maintaining centromeres despite sequence changes.