



**Figure 2. Distinct Outer Repeat Heterochromatin and Central Kinetochore Domains at Fission Yeast Centromeres**

(a) Representation of a fission yeast centromere. The central domain (*pink*, kinetochore) is composed of *imr* and *cnt* elements, the outer repeats contain transcribed *dg* and *dh* repeats (*green*, heterochromatin). All three centromeres have a similar overall arrangement; however, the number of outer repeats differs: *cen1* (40 kb) has two, *cen2* (65 kb) has three, and *cen3* (110 kb) has approximately thirteen. Clusters of tRNA genes (*double arrowheads*) occur in the *imr* region and at the extremities of all three centromeres. Transcription of marker genes placed within the outer repeats or central domain is silenced. (b) *Heterochromatin*: Outer repeats are packaged in nucleosomes which are methylated on H3K9me2, allowing binding of the chromodomain proteins Chp1, Chp2, and Swi6. Central “kinetochore” chromatin: CENP-A is found in the central domain where it probably replaces the majority of H3 to form specialized nucleosomes (*pink squares*). In addition to CENP-A, several kinetochore proteins (those indicated) have been shown to associate with central domain sequences but not the outer repeats. Kinetochore assembly within the central domain mediates attachment to microtubules upon spindle formation and chromosome segregation. Mutation of heterochromatin components alleviates silencing of marker genes in the outer repeats but not the central domain. Defects in some kinetochore components allow expression of marker genes in the central domain but not the outer repeats.