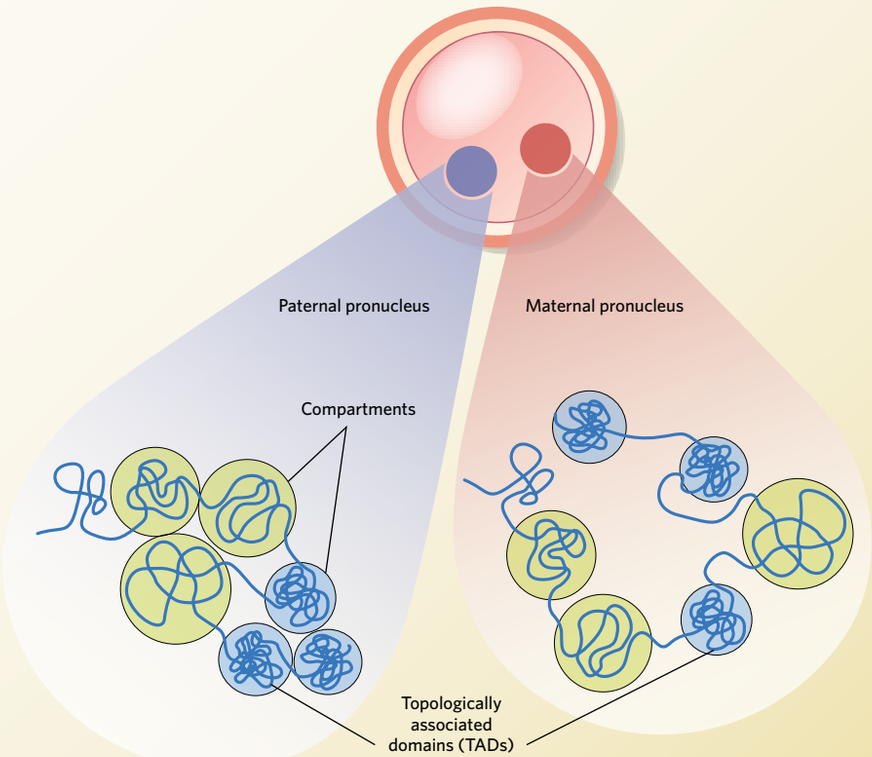
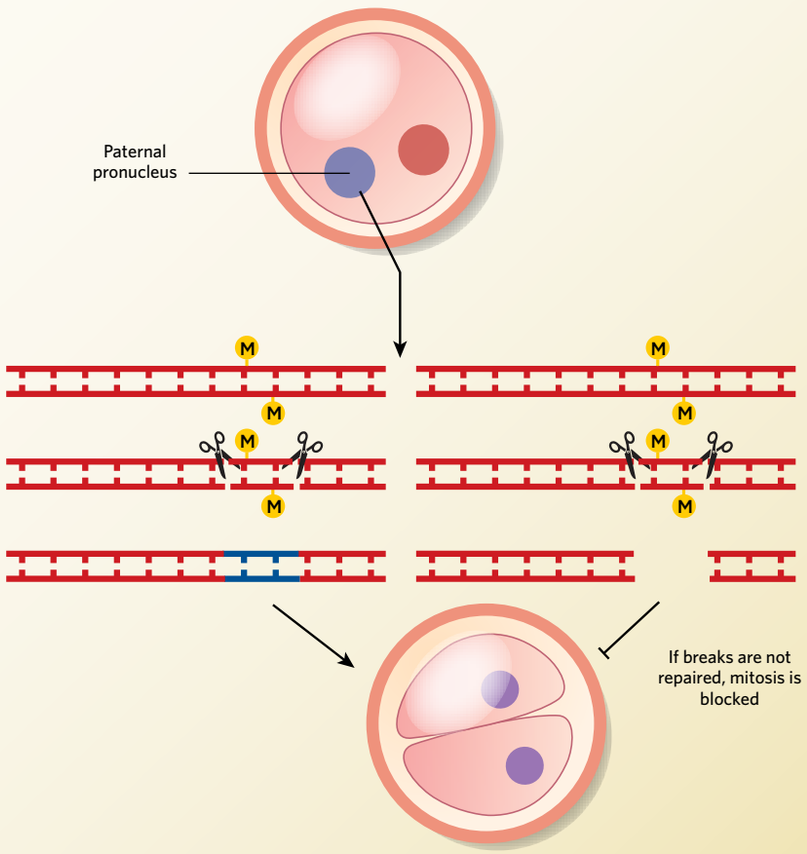
CHROMATIN CHANGES

After fertilization, the genomes donated by the sperm and the egg lose many of the organizational features of their chromatin, which must be reestablished in the early embryo. One recent study showed that the paternal pronucleus of the single-cell zygote contained global features known as compartments, in which more-active regions of the genome associate with other active regions, while less-active regions associate more closely with one another. The maternal pronucleus, however, largely lacked compartments. In this study, both pronuclei had local features known as topologically associated domains (TADs), though other studies have failed to identify these organizational characteristics until later in the first week of development.



DNA DEMETHYLATION

There are likely many mechanisms governing the global demethylation of the zygotic genome following fertilization. One mechanism at play in the paternal pronucleus involves the excision of the methylated DNA by breaking and repairing the double helix. As those breaks are repaired, nonmethylated cytosines are inserted where methyl marks used to reside. One recent study showed that if these breaks are not repaired, the embryo delays the first cell division.



CELL-FATE DETERMINATION

Recent research has shown that cell-fate bias stems from methylation of arginine 26 on histone 3 (H3R26), which lengthens the time certain transcription factors remain on the DNA. Longer binding promotes expression of genes such as *Sox21* that drive cells to become the embryonic lineage (blue) that will form the fetus, while cells with shorter binding form the extraembryonic lineage (green) that becomes the placenta.