Chromosome organisation for meiotic recombination in mice

Mathilde Biot 1 , Attila Toth 2 , Christine Brun 1 , Leon Guichard 1 , Bernard de Massy 3 , Corinne Grey 4

Abstract

In meiotic cells, chromosomes are organized as chromatin loop arrays anchored to a protein axis. This organization is essential to regulate meiotic recombination, from DNA double-strand break (DSB) formation to their repair. In mammals, it is unknown how chromatin loops are organized along the genome and how proteins participating in DSB formation are tethered to the chromosome axes. Here, we identify three categories of axis-associated genomic sites: PRDM9 binding sites, where DSBs form; binding sites of the insulator protein CTCF; and H3K4me3-enriched sites. We demonstrate that PRDM9 promotes the recruitment of MEI4 and IHO1, two proteins essential for DSB formation. In turn, IHO1 anchors DSB sites to the axis components HORMAD1 and SYCP3. We discovered that IHO1, HORMAD1, and SYCP3 are associated at the DSB ends during DSB repair. Our results highlight how interactions of proteins with specific genomic elements shape the meiotic chromosome organization for recombination.

Keywords: ChIP-seq; chromosome structure; genome stability; germline; meiosis; recombination; reproduction.