**Title**

**Epigenetic programming in male germ cells**

**Abstract  
Germline is the only heritable lineage that ensures continuity of life. A unique feature of germline is the plasticity of its epigenetic state that is supported by the cycles of programming and reprogramming that lead to acquisition of totipotency in the next generation. Of note, the male germline transcriptome changes dramatically during the mitosis-to-meiosis transition to activate male reproduction-specific genes and to transiently suppress somatic genes. These changes reflect epigenetic regulation. Induction of male reproduction genes during spermatogenesis is facilitated by poised chromatin established in the stem cell phases of spermatogonia, whereas silencing of somatic genes during meiosis and postmeiosis is associated with formation of bivalent domains which also allows the recovery of the somatic program after fertilization. Importantly, during spermatogenesis mechanisms of epigenetic regulation on sex chromosomes are different from autosomes: X-linked somatic genes are suppressed by meiotic sex chromosome inactivation without deposition of H3K27me3. Our results suggest that bivalent H3K27me3 and H3K4me2/3 domains are not limited to developmental promoters (which maintain bivalent domains that are silent throughout the reproductive cycle), but also underlie reversible silencing of somatic genes during the mitosis-to-meiosis transition in late spermatogenesis.**