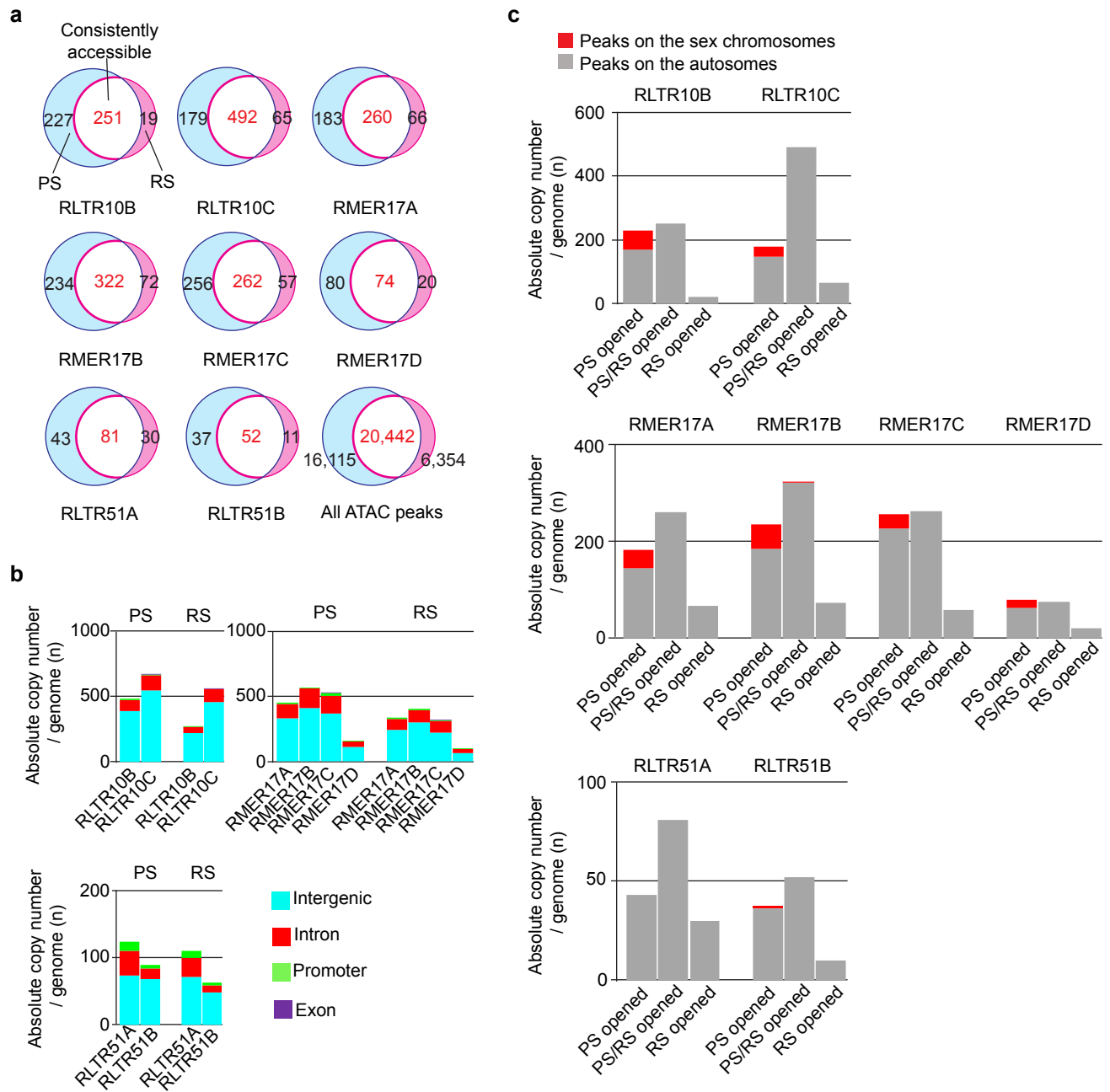


Supplementary Figure 1. ATAC-seq read enrichment at 5,000 randomly selected repetitive element loci.

Heat map depicting RPKM-normalized ATAC-seq reads at 5,000 randomly selected repetitive element loci during spermatogenesis. THY1⁺, undifferentiated spermatogonia; KIT⁺, differentiating spermatogonia; PS, pachytene spermatocyte; RS, round spermatids; Sperm: epididymal spermatozoa.



Supplementary Figure 2. Genomic features of accessible ERVKs in late spermatogenesis.

(a) Venn diagram showing the overlap of young ERVK loci in accessible chromatin between pachytene spermatocytes (PS; blue) and round spermatids (RS; pink). (b) Bar charts depicting genomic distributions of young ERVK loci in accessible chromatin. Distributions are shown with colored bars. (c) Bar charts indicating absolute copy numbers on autosomes (gray) and sex chromosomes (red) of young ERVKs.

a RLTR10B (RepBase consensus)

Similarity: 172/317 (54.26%) by EZBioCloud Pairwise nucleotide sequence alignment for taconomy

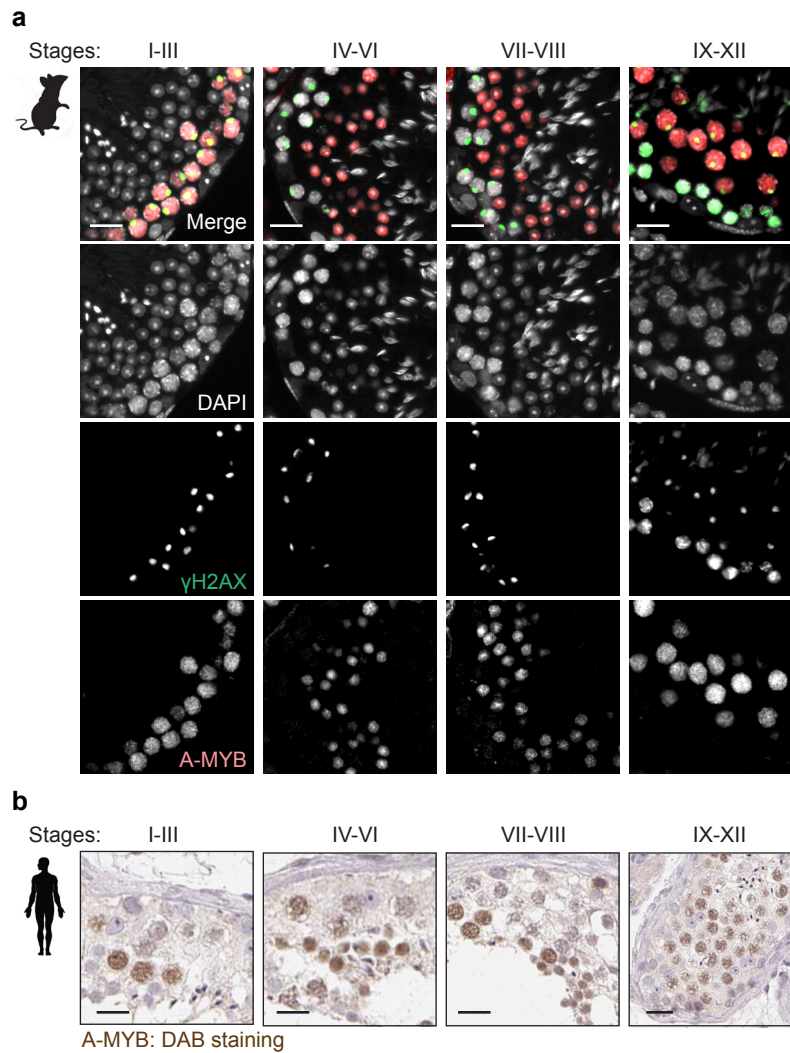
Mouse RLTR10B: TGTGGGAAGC- - - CACATGTGCCGTTGCAGGGTGGCGCTGGCTACCGCTGGCCACCAAGCATACATAGGCA
Rat RLTR10B: TGTGGGAGCGGGTGTAGCGGCAATCCCAAGATGGCGCCGGGACTGCTGCCGA- - - - -
GTAAAGTTTTTTTTGCCAAGATGAGGTTTTGAGAATTAAACAAAATTAACCAATCAGATGAGAGACAAGTTAAACCAATCA- GAT
- - - - - GTCTTACGACTAGCACCTGAAAGTAAGCCA- - - - - CGCCCCATC- - - GTGAGAGCTGCGCAGGCGCACCATGAC
GAGAGACAAGTTAAACCAATCAGATGTGAGGCATGCAAATGAGGTGGTAAAGCATAAACCCATGCATAAACCAATCCGGGTGTGAGAC
GATAGA- - - - - TCAGGCCATGTGACGTGGACCTATGAACGGAGGT- - - TACGCAGA- - - - - CTGGACGGTTGAGCGGAGTTGAG- -
ACGCCCTCCTAGGCCATATTAAG- - - CAGCACCAGTTCTGGGGCTTGGGGTCTCTTCGCCTCTGCAATC- - - AAGCTCTCC
- - - - - GGAGGTTATAAGGGAGTGCCGTCGGGGGCTGGATTGAGAGATTGTTGCTGCTTGCATGCTAAAAGGTTCTT
CAATAAAC- - - - - GTGTGCAGAAAGGATCCTGTTGCAGCTGTGCTTCTTCTGCTGGCGAGTCAGGGCGCGCGCAA
GAATAAACTGCTTTGAGAAGAACG- TCGTGGTGTGCTCCTTTCTGCTGGTTCGGGGTTGAAAGCGACA- -

b RMER17A (RepBase consensus)

Similarity: 189/319 (59.25%) by EZBioCloud Pairwise nucleotide sequence alignment for taconomy

Mouse RMER17A: TGTGGGGAATTCAGGCTGGTCCAGTTGAGCTGAGGTCTGAACCCAGTGGTGATAATTACCTACATGAC
Rat RMER17A: - - - - -
ACGGTAGGCATTCCTCATGCTCCTGGAACCTCTGGCTCCTGCCTAAGTTACCGCCCCCACAGCCCCACAAGAGAAGCAT
- - - - -
GGTTAGTAGTCACGCAGGCAATGTCCCAAGCTTCTGACCTTCAGGCTAGACTCCTCCC- - - CAGTTACCTAGCAACGTTAAAG- -
- - - - - TGTTAGCATTCTGTCTAAGCTCCACCCCCACAGTTACCTGGCAACAGCCAGGT
- - - - - ACCATAAGAGGGGCTGCTCGGCCCTCCTCGCTCTTTACTTGTCTCTTCTTTACTCCTTTGTTCTCTTAACT
ATGCCTGACACTATAAAAAGGGGCTGCTTCCCCCTCCTCACTCTCTTGC- - - TCTTGCTTCTTCTCTTCTTCTTCCCCCTC
TCTCACACTTCTTTCTCCTCTTCCCTTTCTCTTTGTCTTCTCTCCTCTCTCCTTTCTCTACTCTTCTCTCAGCCTTCTCTCT
CTTCCCCCTTTGTCCCTTCTCTCCCAATCCC- - - CTCCCCCTTCCCTCCAGTGTCTCATGGCCGGCCTCT- - - ACTCCTCTCC
CTCTCTCCCTCTCCCTCCCTCTCTCCTCTCTTATACCCCTGCCTTTCTACAATAAAGCTCTAAAACCATAGAGAGTCTCTGCT
TCTTCTACTCTTCTCTCTCTCGTCCCTCTCCCTTGTCTCGTCTTTT- - - CATTAAACCTTTCCA- - - - - - - - CGTGGAAC
CATCAAGATCTGCTGGGCTCACTCTCGTCAGTGTGGAAACCTCTTCCCCATCCTTCTCTCCCATAACCCCTGGTGGCTTTAGA
CATGTTGGCCTGGTGTGGTTTGTCCGGATGCGAGCCGAGATTTCTACCCCAACA- - - - - - - - - - - - - - - - -
AAGTAGCTCTGGGGCCCCAGGTAGGGCTGCCCTTGGCCACCCCCGAAGAGTGGGTGAGAGGCTTAGATGCCACCCAGGG
- - - - -
ATGAGTGGAAGGTAGATAGCAGCCCTCCCACCTGACTGACCAGAGAACAGGTGGAACCTCTGGCGGGGTGTGGGTCTTCCCCCTT
- - - - -
CCCCCTCTTCCCCAGGGCCCCCACCTTTTTGCTCCCAA
- - - - -

Supplementary Figure 3. Sequence similarities of young ERVK elements between mouse and rat.
(a,b) Pairwise alignments of RLTR10B **(a)** and RMER17A **(b)** entire consensus sequences between mouse and rat.



Supplementary Figure 4. A-MYB are highly expressed both in mouse and human spermatocytes.

(a) Immunofluorescence co-staining of 12-week-old mouse testicular cross sections for A-MYB (red) and γ H2AX (green), and counterstaining with DAPI (gray). The Roman numerals indicate cycles of seminiferous epithelium. (b) Representative images of immunohistological staining of 29-to-65-year-old human testicular sections for A-MYB (brown) and counterstaining with hematoxylin (adapted from the Human Protein Atlas (www.proteinatlas.org/ENSG00000185697-MYBL1/tissue/testis#img)). Scale Bars: 20 μ m.