In this study, immunocytogenetics has been used in combination with the subtelomere-specific multiplex-fluorescent in-situ hybridization (stM-FISH) assay to identify 4681 autosomal synaptonemal complexes (SCs) of two fertile men. Comparisons of crossover maps for each individual SC between two men with extremely different meiotic crossover frequencies show that a low crossover frequency results in (i) a higher frequency of XY pairs and of small SCs without MLH1 foci and (ii) lower frequency of crossovers in the proximity of centromeres. In both cases, the bivalents which most frequently lacked MLH1 foci were the XY pair and the SC21. Analysis of SC length showed that SC arms can be longer or shorter than the corresponding mitotic one. Moreover, for a given SC, the variation in length found in one arm was independent of the variation observed in the other one (e.g. SC1p arms are longer than SC1q arms). The results confirmed that reduction in the crossover frequency may increase the risk of achiasmate small bivalents and that interindividual differences in crossover frequency could explain the variability in the frequencies of aneuploidy in human sperm. How MLH1 foci are positioned within the SC is discussed based on detailed MLH1 foci distributions and interfoci distances. Finally, evidence that the variation of the SC arm length may reflect the abundance of open
and of compact chromatin fibers in the arm is shown.