VISIONS: THE ART OF SCIENCE

Capturing Chaotic Chromosomes: Pairing in Action†

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Accurate chromosome segregation is critical for the formation of haploid gametes, and therefore healthy offspring. Errors in segregation result in aneuploidy, which increases exponentially with maternal age (Hassold and Hunt, 2001). Maternally aged mouse oocytes were recently found to exhibit premature sister chromatid separation due to reduced levels of Securin, an essential regulator of sister chromatid cohesion (Nabti et al, 2017). This landmark finding was facilitated by using chromosome spreads that allow for the visualization of meiotic processes, such as recombination, synapsis, crossing over, and cohesion. This powerful technique is easy to perform and analyze, and allows for the identification of markers for different processes, including DNA damage and repair.

The synaptonemal complex is a supramolecular structure essential for accurate segregation of homologous chromosomes and efficient crossovers, which together promote genetic diversity. Dysregulation of synaptonemal complex formation is associated with miscarriage and human infertility (Cahoon and Hawley, 2015). We examined homologous chromosome pairing and synapses in mouse spermatocytes and oocytes during prophase I using antibodies against two synaptonemal complex proteins. The top-right panel shows correct pairing in a *spermatocyte* with rabbit anti-SYCP1 (red) (rabbit anti-SYCP1; Abcam) and SYCP3 (green) (mouse anti-SYCP3; Abcam), synapsed along the length of the chromosomes; the middle-right panel shows incorrect *spermatocyte* pairing. The bottom panel shows a pachytene *oocyte* with normal pairing, as indicated by SYCP3 (red), along the chromosomes. These images highlight the importance of studying meiotic chromosome structures using simple spread techniques to generate high-resolution data amenable to detecting chromosome instability and/or rearrangements.

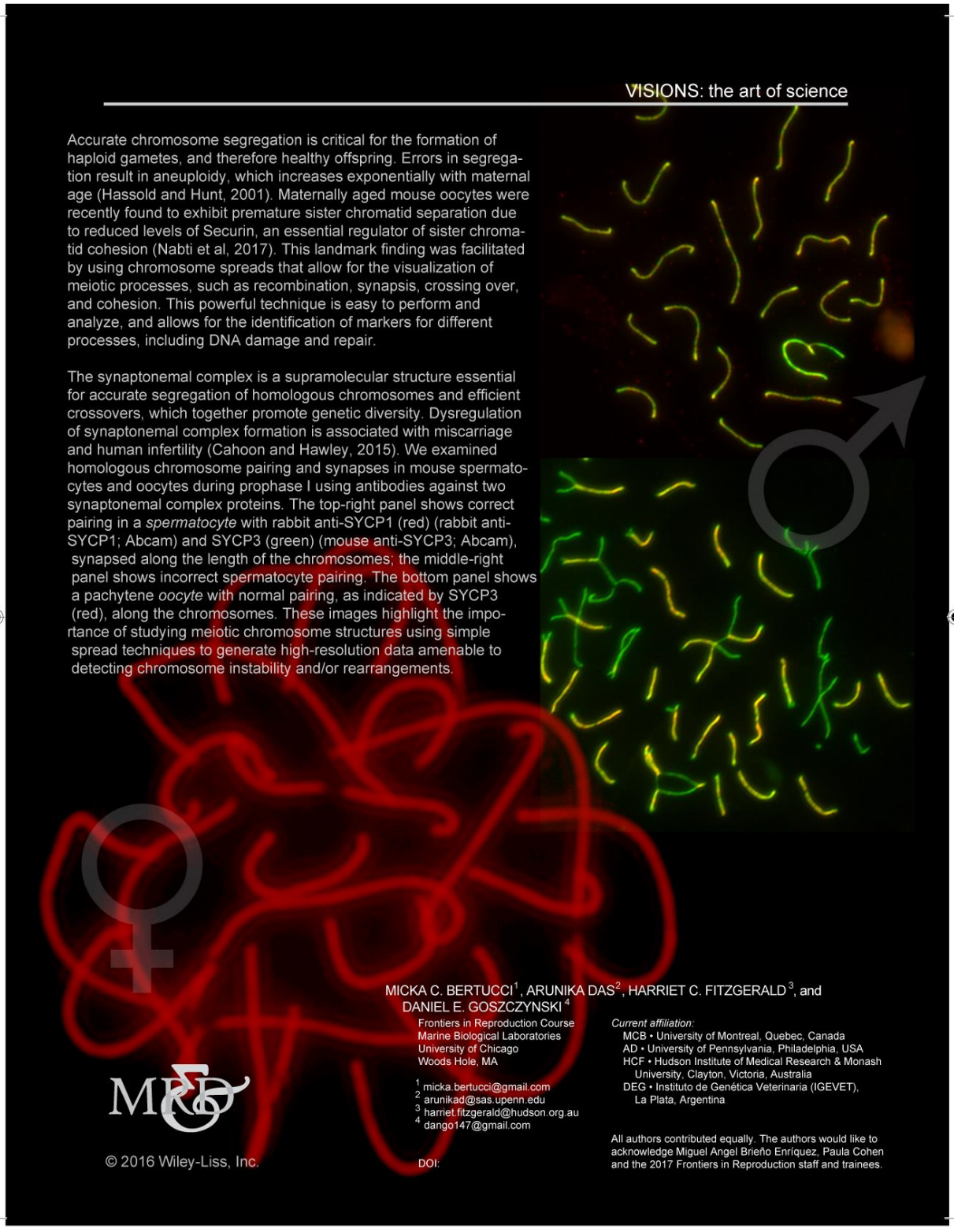

Figure 1