Las levaduras: en la intersección entre la Biología de sistemas y la Biomedicina
En memoria del Profesor Julio Rodríguez Villanueva

Yeasts: at the cross-roads of Systems biology and Biomedicine

In memory of Professor Julio Rodríguez Villanueva

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Budding yeast as a powerful model to decipher meiotic quality controls preventing reproductive disorders

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Meiosis is the specialized cell division that produces haploid gametes from diploid parental cells (gametogenesis). After fertilization, the normal chromosome complement is restored; therefore, the accuracy in the distribution of chromosomes to the gametes is critical for a healthy offspring and species survival. Meiotic errors result in aneuploidy and, in humans, they are the main cause of reproductive disorders, including infertility, spontaneous abortions or genetic birth defects, such as, for example, Down's syndrome.

During meioisis, a complex series of events (pairing, synapsis and recombination) leads to the establishment of physical connections between homologous chromosomes that orchestrate their segregation during the first meiotic division. Meiotic cells have developed surveillance mechanisms (checkpoints) that monitor proper distribution of genetic material to the progeny.

This meiotic checkpoint network blocks cell cycle progression in response to defects in recombination and/or chromosome synapsis, thus preventing aberrant chromosome segregation and the formation of aneuploid gametes. Importantly, the incidence of aneuploidy in humans is higher than in other organisms displaying a significant increase with maternal age. Although several factors are involved, a weaker checkpoint response to face meiotic errors is one of the causes contributing to this high frequency of human aneuploidy.

Therefore, investigating the molecular mechanisms underlying the control of meiotic chromosome dynamics by checkpoints is fundamental to unveil the causes of pregnancy losses, infertility and genetic birth diseases.

Historically, the budding yeast *Saccharomyces cerevisiae* has been widely used in meiotic studies providing a myriad of crucial contributions to our current meiosis knowledge. In particular, *S. cerevisiae* possesses robust meiotic quality control systems. The evolutionary conservation of checkpoint pathways, as well as the ample array of research tools available, enables budding yeast as a powerful system to understand the molecular basis of fertility problems. We will present our advances in understanding the checkpoint mechanisms employed by yeast meiotic cells to respond to recombination and chromosome synapsis defects.