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Qualifications

- 1996 B.A. Universidad Complutense de Madrid, Spain
- 2001 Ph.D. Universidad Complutense de Madrid, Spain
- 2002-2003 Marie-Curie Individual Fellowship, University of Birmingham, UK
- 2004-2008 BBSRC Postdoc Research Fellow, University of Birmingham, UK
- 2008 David Phillips Fellowship BBSRC, University of Birmingham, UK

Postgraduate supervision

For a list of possible PhD projects offered by Dr Sanchez-Moran:

www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Sanchez-Moran (http://www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Sanchez-Moran)

Research

Research Theme: Molecular and Cell Biology

Short research description: Organisation and behaviour of chromosomes in plant meiosis

Full research description:

Our research aims to unravel the biological significance that the different levels of DNA compaction structures and components have on chromosome condensation and DNA processes in the nucleus. We believe that this research will contribute to the understanding of different important themes like cell division, cancer, stem cells, chromosome alterations, fertility and, plant and animal, breeding.

WHY DO WE DO IT?

The role of DNA is to store an individual's genetic information such that it can be used during normal growth and development and be accurately copied during the different divisions of the cell. Human cells contain DNA totalling about 2 m in length that has to be packed within the cell nucleus which is only 0.01 mm in diameter. Importantly, the DNA must be organised in such a way that it is readily accessible for a variety of crucial processes. The information it contains must be easily read (transcription) so that the cell can rapidly produce proteins. It must be readily duplicated (DNA replication) and accurately separated during cell division (mitosis) and sexual reproduction (meiosis). Also, it is essential that any break, knot or tangle that might occur can be repaired (DNA repair). DNA associates with different proteins forming a nucleo-protein complex called chromatin. This enables the compaction necessary to fit the naked DNA inside the cell nucleus whilst maintaining access to the genetic information. The chromatin is divided into individual structures constituting chromosomes. During the process of cell division when the individual chromosomes have been duplicated chromosome condensation is necessary to ensure their accurate distribution. Miss-regulation of chromosome condensation can lead to cell death, cancer and improper chromosome segregation during cell cycle or during the production of gametes.

WHAT DO WE KNOW ABOUT IT?

There are different levels of compaction involved in packaging DNA into chromosomes. The basic structure is the nucleosome, formed by wrapping naked DNA around a core of proteins known as histones. The nucleosomes are arranged along the DNA forming a 10nm diameter fibre, likened to beads on a string. Despite the old impression that nucleosomes were static structures, nowadays, a nucleosome is considered as a highly dynamic assemblage. Changes to this organised structure are facilitated through histone modifications, modelling factors and exchange of histone proteins. The nucleosomal fibre is further compacted by winding it into a 30 nm fibre whose structure remains controversial. This fibre is additionally arranged into loops that are attached to a multi-protein axis called the chromosome scaffold. Although the biochemistry of histones and other chromosome-associated proteins has been studied intensively, their interactions to achieve chromosome condensation are still poorly understood.

HOW DO WE DO IT?

The key proteins involved in chromosome condensation are conserved throughout eukaryotic evolution indicating that they are likely to have fundamental roles that are species-independent. We are using Arabidopsis thaliana, a plant model organism for basic research in genetics and molecular biology and a good experimental system without any of the ethical issues related to working with animals. We are also considering to start pilot experiments with other model systems to understand the evolution of chromatin structures. We are using a multidisciplinary approach combining new high-resolution cytogenetic techniques, mutant characterisation, proteomic analysis, and systems biology to resolve the complicated interactions of individual chromatin components that result in accurate chromosome condensation.

WHO IS FUNDING US?

Biotechnology and Biological Sciences Research Council (BBSRC

Publications

Armstrong SJ, Sanchez-Moran E, Franklin FC. Cytological analysis of Arabidopsis thaliana meiotic chromosomes. Methods in Molecular Biology (2009) 558:131-45.

Osman K, Sanchez-Moran E, Mann SC, Jones GH, Franklin FC. Replication protein A (AtRPA1a) is required for class I crossover formation but is dispensable for meiotic DNA break repair. The EMBO Journal (2009) 28(4):394-404.

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Uanschou C, Siwiec T, Pedrosa-Harand A, Kerzendorfer C, Sanchez-Moran E, Novatchkova M, Akimcheva S, Klein F, SchlÃ¶gelhofer P. A novel plant gene essential for meiosis is related to the human CtIP and the yeast COM1/SAE2 gene. The EMBO Journal (2007) 26: 5061-5070.

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