
PhD project title:

Live imaging and genetic testing of tissue integrity and dynamics during development

Principal Supervisor:

Dr Kristen Panfilio (School of Life Sciences)

Where will the student be based? Warwick School of Life Sciences

Project description:

Epithelial tissues are essential structures in animals, creating compartments and barriers such as the skin and lining of the gut. They accomplish this through their organisation as cellular sheets, where cells form strong connections with their neighbours and with the surrounding environment. During embryogenesis, epithelial sheets must first form and then dynamically remodel in precise ways that contribute to organismal development [1]. Impaired tissue integrity (tearing or rupture) or impaired morphogenesis – the process of remodelling – can result in profound birth defects or even lethality.

This 'biological origami' is best visualised and examined through live cell imaging microscopy approaches, to clarify these dynamics at several scales of biological organisation, ranging from genetic regulation, to cellular structure, to tissue topography and interactions.

Key approaches to the investigation of epithelial dynamics include experimental investigation, multi-dimensional imaging acquisition, and computational processing and quantitative analysis. What are the genetic and mechanical requirements of epithelia to ensure tissue integrity, correct morphogenesis, and healthy tissue function? We use the red flour beetle, *Tribolium castaneum*, as an excellent research model for epithelial morphogenesis, with a rich experimental toolkit and embryonic tissues that are readily imaged with a range of high throughput and high resolution microscope systems [e.g., 2, 3]. This project will use these resources to investigate the roles of key genes in the formation and maintenance of epithelia, including the use of sophisticated bioimaging analysis techniques for improving our understanding of animal tissue structure.

Key experimental skills involved:

- Fluorescent live imaging microscopy
- Molecular biological techniques including RNAi and *in vivo* gene expression analyses (in situ hybridization, immunohistochemistry)
- Bioinformatics: Multi-dimensional, bioimaging data computation and analyses

References:

1. St Johnston, D., and Sanson, B. (2011). Epithelial polarity and morphogenesis. *Curr. Op. Cell Biol.* 23, 540-546.
2. Hilbrant, M., Horn, T., Koelzer, S., and Panfilio, K.A. (2016). The beetle amnion and serosa functionally interact as apposed epithelia. *eLife* 5, e13834.
3. Horn, T., and Panfilio, K.A. (2016). Novel functions for *Dorsocross* in epithelial morphogenesis in the beetle *Tribolium castaneum*. *Development* 143, 3002-3011.

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