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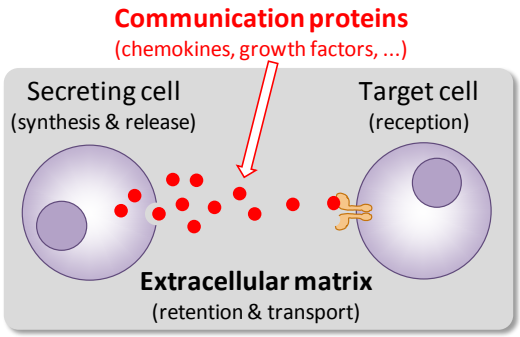
This proposal is representative of the projects on offer in our lab. For more details of active research projects, please visit our webpages at http://www.fbs.leeds.ac.uk/staff/profile.php?tag=Richter_R and http://www.physics.leeds.ac.uk/index.php?id=263&uid=1527).

Nanoscale physics of inter-cellular communication



Small "communication proteins" (chemokines, growth factors, etc) in the extracellular space are essential to inter-cellular communication in higher organisms. They guide the migration of immune cells in inflammation and of stem cells in tissue repair and are key to the function of our organs and tissues. For these proteins to function, they need to be at the right time and concentration at the right place. Polysaccharides of the glycosaminoglycan (GAG) family are abundant in extracellular matrix and bind most communication proteins. They play a decisive role in the retention and diffusion of communication proteins in tissues. However, how the interactions between GAGs and communication proteins are tuned to enable effective protein distribution is not well understood.

In this project, you will seek to reveal the physical mechanisms that define the redistribution of communication proteins in the extracellular space. This question connects soft matter physics with biology, and also involves chemistry and materials sciences. If successful, you will advance our fundamental understanding of how extracellular matrix works, and help develop novel strategies to interfere with diseases such as cancer metastasis or chronic inflammation, or advanced biomaterials with novel functions.

This project requires the development of new biophysical assays capable to analyse the interaction of communication proteins with GAGs at the nanoscale, down to the level of single biomolecules and bonds. You will develop and apply these assays. Key techniques are atomic force microscopy – to probe the nanomechanics of individual bonds – and fluorescence microscopy methods – to probe the dynamics of chemokine protein distribution – but also quartz crystal microbalance and spectroscopic ellipsometry.

References:

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