Motivation

The changes in shape and composition of the cell membrane during crucial biological processes, such as cell death, signal transduction or membrane trafficking, are still a mystery [1]. On a simple model of the cell membrane these changes can be studied by two state of the art techniques: atomic force microscopy (AFM) and, our main focus, surface enhanced Raman spectroscopy (SERS).


Models for the cell membrane

Fig.1 shows the shape of a model membrane as 'seen' by the atomic force microscope (AFM), which allows to resolve smaller features than traditional optical microscopy. The dark areas correspond to the holes in the membrane.

Raman spectroscopy: the technique

If Snow White had a laser and Physics degree...

... she would never have tried the poisoned apple.

Fig.2. The Raman set-up. A laser is focused on the sample through a microscope and the signal from the sample collected and analysed. Real samples are cell membranes and not poisoned apple slices.

Raman on the cell membrane: the results

Fig.3. 'Raman spectra' of two model cell membranes (AA1 and AA2). These signals present sharp peaks revealing accurately the composition of the sample under study.

The signal collected from the sample, called the 'Raman spectrum' of the model cell membrane, reveals quantitatively its composition.

Conclusion

Our results demonstrate the potential of using two outstanding techniques combined to study the changes in shape and composition of the cell membrane during crucial biological processes.

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