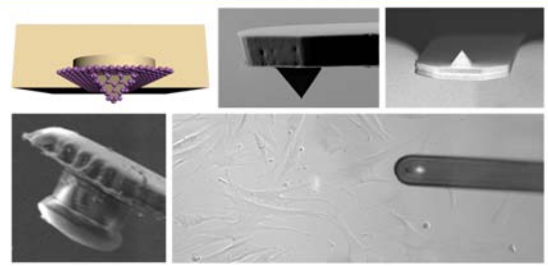
1. FINAL PUBLISHABLE SUMMARY REPORT

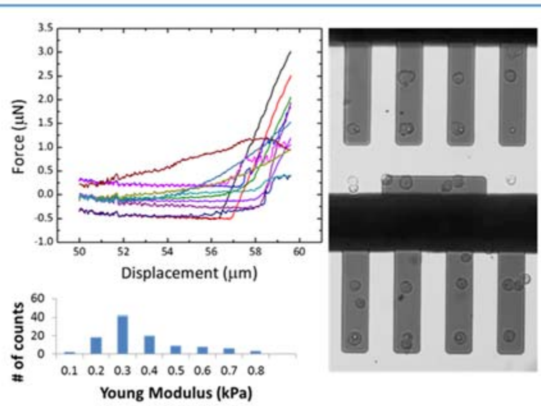
For centuries, medical doctors have used palpation exploration as a part of their examination to detect lumps or masses. This is used to feel the texture of a patient's tissue, gauge its stiffness or reaction to the applied pressure. When parts are detected with a distinct stiffness that is often flagged as an early warning sign for disease. Similarly, many different methods have successfully been used to determine the mechanical properties of cells and even link them to many different diseases.

The measurement of cellular or tissue stiffness consists in essence of two parts: a force that is applied to the cell/tissue and the deformation that such force causes is measured. By relating these two parameters, one can estimate the stiffness. AFM is one of the tools that are typically used to perform these measurements in a very reliable and accurate fashion. Nevertheless, this technique has important drawbacks in terms of complexity, fragility and difficulty together with a very low throughput.



Polymeric AFM probes: Top row – graphene coated AFM probes with improved lifetime and conductivity. Bottom – customized blunt tip to increase signal to noise ratio in cellular nanoindentation experiments.

This project, SCANCER (Specialized cantilevers for cancer research), has aimed to ease AFM spectroscopy technique on single cells by developing specialized SU-8 probes. SU-8 has a low Young's modulus achieving lower spring constants to the levers with thicker structures for better stability in liquid; the tip geometry is easily tunable to be less sharp, beneficial for a more gentle contact with the cells; and SU-8 provides a cost-effective fabrication.



Throughput increase of AFM-based cellular stiffness measurements. Distance curves and statistics over 128 stiffness measurements done with 2D arrays of cantilevers operating in parallel.

SCANCER has also explored the capability of the SU-8 probes coated with graphene for fundamental research on graphene interactions with cells and opening the possibility of new functionalization and electrical measurements together with a longer preservation of the tip geometry.

SCANCER also has aimed to increase throughput by using 2-dimensional (2D) probe arrays on a homemade interferometric AFM system. By performing the measurement of multiple cells in parallel, stronger statistics can be obtained in the same amount of time. This work demonstrates that parallel force spectroscopy is a valid approach to significantly make an improvement in the field of cancer research by means of faster acquisition of elasticity data.