Pushing the boundaries in personalized healthcare with AFM technology

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There are more than 200 different types of cancers, but they all have the same cause: a random change, or mutation, in a cell's genetic code that trigger cells in the body to grow and divide uncontrollably So far some of these mutations are known and targeted therapies or drugs have been developed for cancer treatments that made the difference in survival for many people.
However since the sequencing of the entire human genome it turns out that we know now what we are made of but we still don't know to a large extent how we work that is that epigenetical changes can eventually alter cancerogenesis and produce different mutations which means that the therapy stops working. Including immunotherapie eliminating cancer by stimulating the immune system treating the malignant tumors as an infection and thereby keeping the system from being 'switched off ' could be a powerful combination in future cancer therapies.
However fast new diagnostic tools are therefore required. Recently Atomic Force Microscopy (AFM) technologies have come of age in various biological applications. Moreover these developments has started to enter the clinic. From this toolkit we use a micro-fabricated silicon cantilevers array platform as a novel biochemical highly sensitive sensor that offers a label-free approach for point of care fast diagnostics where ligand-receptor binding interactions occurring on the sensor generating nanomechanical signals like bending or a change in mass which is optically detected in-situ. It enables the detection of multiple unlabelled biomolecules simultaneously down to picomolar concentrations within minutes in differential measurements including reference cantilevers on an array of eight sensors. The sequence-specific detection of unlabelled DNA in specific gene fragments within a complete genome is shown. In particular the expression of the inducible gene interferon- a within total RNA fragments and unspecific back ground. This gives rise that the method allows monitoring gene regulation, an intrinsic step in shining light on disease progression on a genetic level.
Moreover two types of cancer have been investigated on a genetic level: malignant melanoma BRAF, the deadliest form of skin cancer as well as invasive ductal carcinoma HER2 the most common Breast cancer can be detected with this technology on a single point mutation without amplification and labeling in the background of the total RNA.