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LETTER TO EDITOR

Nanotechnology, (Nanomedicine)- A Function Based Technology In Cancer Diagnosis

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This is a short educational write up from journals and from other sources.
Use of Nanotechnology in Cancer Research and Diagnosis.
'Nano-technology' consists of separation, consolidation, and deformation of materials by one atom or by one molecule."
1-This technology consists of the application of AFM (Atomic Force Microscopy) to detect cancer cells, by detecting the resistance of the cell membrane, mainly in body fluids, which may look very similar under optical microscopy when fixed and stained samples are used.
More so, cancer cells are present in 70% of cases in body fluids but escape from being detected by optical microscopy in 30% of cases.
2-It can thus personalize patient treatment by Oncologists.
3-It also helps in drug delivery, particularly to cancer cells without harming neighboring normal cells

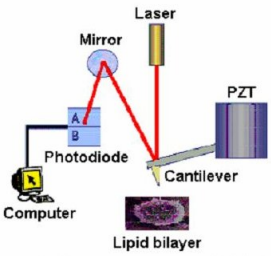
Principle

Nanotechnology refers broadly to a field of applied science and technology, whose unifying theme is the control of matter on the atomic and molecular scale, normally 1 to 100 nanometers, and the fabrication of devices within that size range. It is a highly multidisciplinary field, drawn from fields such as applied physics, materials science, interface and colloid science, device physics, supramolecular chemistry, chemical engineering, mechanical engineering, and electrical engineering.

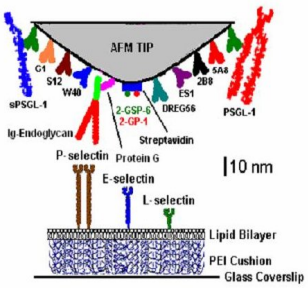
Cancer cells are softer and more flexible than normal cells and thus have different mechanical properties. For example, in the market, two tomatoes may look similar, but one may be rotten and may not be detected unless it is felt by hand, as it is softer than normal ones.

Basic Technique

The AFM uses a minute, sharp tip on a spring to push against the cell surface and to determine the degree of softness. The AFM system was built and calibrated in house [Table/Fig 1],[Table/Fig 2] (Marshall, et al. 2003



(Table/Fig 1) Basic principle of AFM technology.



(Table/Fig 2) Experiment showing cell adhesion by AFM technology.

It consists of a piezoelectric translator (PZT) on which a cantilever {Thermo microscopes} is directly mounted. A laser is focused on the end of the cantilever's back and is deflected onto a photodiode that measures the quasi-static tip inclination that is directly proportional to the quasi-static tip deflection, which is converted to force using the cantilever spring constant. Each cantilever spring constant (4-100 pN/nm) was calibrated during the experiment using thermal fluctuation analysis (Hutter and Bechhoefer 1993). A personal computer with a data acquisition board (National Instruments, Austin, TX) was used to control the movement of the PZT and to collect the signal from the photodiode. After probing a cell, the AFM assigns a value that represents how soft a cell is, based on the resistance encountered. What the team found was, that the cancer cells were much softer than normal cells.

Nano technology will open a new era for function-based tumor cell diagnosis.

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