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**NANOTECHNOLOGIES WORK FOR MEDICAL CHALLENGES**

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RICHARD P. Feynman, the Father of Nanotechnology, mentioned in his famous lecture “There is plenty of room at the bottom” the idea of swallowing a surgeon. This “nano-surgeon” would recognize infected cells and remove those brick-by-brick, rather than demolishing an entire wall. It would leave neighbouring normal cells intact, thus neither the toxicities of “chemo” drugs nor surgically produced deformities would result. Nanomedicine is a new branch of science that tries to find nanotechnology solutions for medical challenges.

1. Cantilevers: These are tiny lever sanchored at one end. They can be designed such that they bind to molecules that represent a deviation from normality ,such as altered DNA sequences or proteins present in infected cell. When these molecules bind to the cantilevers, surfacetension changes causing the cantilever to bend. By monitoring this bending, scientist scan identify the type of molecule that has caused the bending. This may help in identifying infected cells even if they are present in very low concentrations.

2. Nanopores: These are tiny holes that allow the DNA molecule to pass through one strand at a time. By monitoring the shape and electrical properties of each base or letter on the strand of DNA, scientist scan decipher the encoded information on DNA. This is possible because shape and electrical properties are unique foreach of the four bases that make up thegenetic code. Errors in the genetic code associated with a particular disease can also be located.

3. Nanotubes: Carbon rods, about half the diameter of a molecule of DNA, can detect the presence of altered genes and also pinpoint the exact location of those changes (mutations).

4. Quantum Dots: Nanoparticles of cadmium selenide (quantum dots) glow when exposed to ultraviolet light. The wavelength or the colour of the light depends on the size of the dot. injected, they seep into cancer tumours. The surgeon can see the glowing tumour, and use it as a guide for more precise cutting of tumours .Quantum dots demonstrate the nanoscale property that colour is size dependent. By combining different sized quantum dots within a single bead, scientists can create probes that release distinct colours and intensities of light. When the crystals are hit by UV light, each latex bead emits light that serves as a sort of spectral bar code, identifying a particular region of DNA, which is associated with a particular type of cancer. We know that most cancers arise from multiple mutations within DNA. Thus several quantum dots can be designed to show several cancer associated regions of DNA simultaneously. This can potentially eliminate the need for surgical biopsy (removal of tissue for histo pathological examination under microscope).

5. Nanoshells: These are miniscule beads coated with gold that absorb specific wavelengths of light. These shells then get heated up and kill the surrounding cell. By engineering the nanoshells to selectively link with the antibodies associated with a diseased cell, we can ensure that the nanoshells seep only into the tumour and destroy it, leaving the neighbouring normal cells intact. This has already been done using near-infrared light on animal cancer cell line cultures.