Nanomaterials in Diagnostic Pathology

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Nanotechnology offers novel materials with new possessions and function for a variety of biomedical fields such as therapy, diagnostics, drug delivery, tissue engineering and biosensors. In nanotechnology field, big things are probable from really small things. The small size of nanomaterials helps them to interact with biomolecules to entree in different areas of the body by passing through intracellular spaces. Identifying DNA changes associated with cancer using nanotechnology and nanomaterials has been recently attained more attention from scientists [1-4].

Nanopores, fine pores that permit DNA to pass over one strand at a time, will lead to more effective DNA sequencing. The shape and other possessions of each base, or letter, on the strand can be detected as DNA passes using a nanopore [5]. Nanotubes, carbon rods in nanometric range, can sense the existence of altered genes. They also may assistance to identify the exact site of those changes [6]. Dendrimers, synthetic polymeric macromolecules with a branching shape, show the ability to attach drugs or other active agents [7]. Magnetic nanoparticles (MNPs), consist of magnetic element, are multipurpose diagnostic means as they can be manipulated using external magnetic field. Intrinsic penetrability of magnetic field into human tissue enables their monitoring in vivo by means of magnetic resonance imaging (MRI) [8]. Quantum dots (QDs), ultrafine crystals with ability to glow in stimulating by ultraviolet light, can be used to bind to specific DNA sequences. When the QDs combine with a single bead, they can be used as probes. Once this combination is stimulated by UV light, each bead emits light that serves as a sort of spectral bar code, detecting a particular region of DNA [9]. Gold nanoparticles (AuNPs) are most attractive and broadly used nanomaterials in biomedical area for analytical purposes like medical diagnosis labeling and biosensing, due to its outstanding properties such as simple preparation, high biocompatibility and non-cytotoxicity [10]. The silver (Ag) nanomaterials especially nanorods can be used in a diagnostic device to distinct viruses, bacteria and other microscopic components of blood samples [11].

It has been demonstrated that nanomaterials are promising materials that provide specified diagnostic, therapeutic, and imaging functions. However, the reports showed that smaller particles are more bioactive and may show the toxic effects. They may interact with other living systems due to their easily crossing from the skin, lung as well as the blood/brain barriers [12]. Then, more studies are needed in this regards.

Conflict of interests

The authors declare that there are no conflicts of interest associated with this work.

References

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