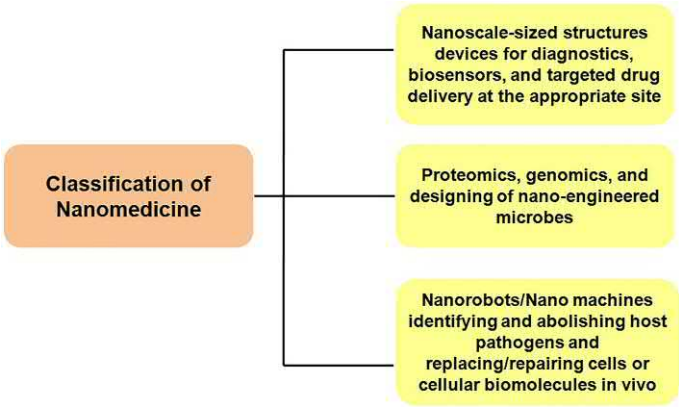

FIG. 1 Classification of nanomedicine application.

patient-compliance, risks of toxicity, and decreasing the cost of health care [18,19]. The encapsulation of medicinal drugs increases the specificity, efficacy, tolerability, and therapeutic index of subsequent drugs [20–25]. Nanomedicines have several advantages for the protection of premature degradation of drug and interaction with the biological component, enhancement of absorption into a selected tissue, bioavailability, retention time, and improvement of control delivery [26–29]. Some nanomedicines are used in different trial phase of testing for the diseases such as diabetes [30], cancer [31], AIDS [32], malaria [33], prion disease [34], and tuberculosis [35]. Furthermore, nanochips, magnetic nanoparticles for chemotherapy attached to the specific antibody, and nanorobotics are new dimensions of their use in drug delivery.

Nanoparticle delivery systems are engineered technologies that are designed and tested for the use of nanoparticles for developing clinically useful therapeutic agents for the targeted delivery and controlled release [36]. Nanoparticles include a variety of materials such as lipids (liposomes), viruses (viral nanoparticles), polymers (polymeric nanoparticles, dendrimers, or micelles), and metallic nanoparticles. The advancement of nanodevices which are synthesized by the incorporation of biocompatible/biodegradable polymers has therefore rapidly emerged with the discoveries of albumin [37], polyalkylcyanoacrylate [38], polylactate-*co*-glycolate [39], and afterward, solid lipid [40] or chitosan [41] nanoparticles. The other advantageous property of nanoparticles is to improve the solubility of orally taken poorly soluble drugs [42]. There are several anticancerous drugs that are used in chemotherapy treatment are poorly water soluble such as paclitaxel, doxorubicin. The nanoparticle formulations of these drug increases the bioavailability without using undesirable excipients, such as polysorbate or Cremophor EL which are used in Taxoteres and Taxols formulations, respectively [36].

2. BACKGROUND OF NANOPARTICLES IN HUMAN HISTORY AND DRUG DEVELOPMENT

Humans are always surrounded by nanoparticles and their existence in the environment for a long time and are not necessarily produced by modern techniques. The Ancient Egyptians were using lead sulfide (PbS) nanoparticles (NPs) (≈5-nm diameter) for hair dye around more than 4000 years ago [43]. Similarly, in the 3rd century BC, "Egyptian blue" synthetic pigment was first prepared by Egyptians by using a mixture of nanometer-sized glass and quartz [44]. Metallic nanoparticles were also used in ancient times as color pigments in luster and glass technology [45,46]. During the 9th century, metallic luster decorations of glazed earthenware were found in Mesopotamia [47].

At late 1960s Peter Paul Speiser synthesized the first nanoparticles which can be used for targeted drug therapy [48] and the first research paper on nanoparticles "a pioneer in the conception of nanoparticles" was published by Speiser (1976) which focused on the advancement of nanoparticles for vaccination purposes, targeting for a slow release of the antigen, leading to a better immunity [19,49]. Georges Jean Franz Köhler and César Milstein in the 1970s succeeded in constructing monoclonal antibodies [50]. The first nanoparticles were modified as a carrier for the transport of fragments and genes and were reached into cells with the help of antibodies at the beginning of the 1990s [48,51]. Paul Ehrlich in the starting of the 20th century attempted