Nanomedicine & Biotherapeutic Discovery

Extended Abstract

Design of nanorobotics based on flexible FePd nanohelix for cancer treatment

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Abstract

Recently, we successfully processed the FePd Nano-Robots (NRs) by using electrochemistry route and post annealing process. The actuation mechanism of the proposed FePd NRs is based on two scientific mechanisms associated with ferromagnetic shape memory alloy Fe70Pd30: (1) Hybrid mechanism of chain reaction events; applied magnetic field gradient, magnetic force, stress-induced martensite phase transformation of Fe70Pd30 from stiff austenite to soft martensite, resulting in larger displacement at very high speed that we discovered and (2) magnetic interactions coupled with stress-induced martensite phase transformation under constant magnetic field, resulting in large displacement. This phase transformation of FePd nano-helix is considered different from that of its bulk sized FePd. It is found that the Martensite start temperature (Ms) of the FePd nanomaterial is shifted towards lower temperature as compared with that Ms of the bulk sized FeP and also the FePd nanohelix NR can exhibits nanomotions under applied constant magnetic field. There are many applications we can apply above FePd NRs, one of which is a new treatment of cancers by applying mechanical stress loading on live cancers, inducing Mechanical Stress Induced Cell Death (MSICD) on target cancer cells. We performed a biocompatibility testing on Fe7Pd3 nanoparticles to find that the use of modest amount of the FePd nanoactuators would not be cytotoxic to BT-474 breast cancer cells. Here we report some preliminary results of in vitro experiment of MSICD using macroscopic mechanical loading set up which apply mainly dynamic compression loading to live target cells via agarose gel layer. The preliminary results of MSIC indicated that the live breast cancer cells under dominant compressive stress loading area exhibit a mixture of apoptosis and necrosis cell death modes while those under dominant shear stress loading area shows strongly necrosis cell mode.

Nanorobotics is Associate in Nursing rising technology field making machines or robots whose parts are at or close to the size of a nanometre (10−9 meters). additional specifically, nanorobotics (as opposition microrobotics) refers to the applied science engineering discipline of coming up with and building nanorobots, with devices locomote in size from zero.1 to one0 micrometres and made of nanoscale or molecular parts. The terms nanobot, nanoid, nanite, nanomachine, or nanomite have conjointly been accustomed describe such devices presently underneath analysis and development. Nanomachines are mostly within the analysis and development part, however some primitive molecular machines and nanomotors are tested. Associate in Nursing example could be a detector having a switch close to one.5 nanometers across, able to count specific molecules within the chemical sample. the primary helpful applications of nanomachines is also in nanomedicine. as an example, biological machines may be accustomed determine and destroy cancer cells. Another potential application is that the detection of venomous chemicals, and also the measuring of their concentrations, within the surroundings. Rice University has incontestible a single-molecule automotive developed by a natural action and together with Buckminsterfullerenes (buckyballs) for wheels. it's motivated by dominant the environmental temperature and by positioning a scanning tunneling magnifier tip.

Cancer will be treated by surgery, therapy, actinotherapy, secretion medical care, targeted medical care (including therapy like antibody therapy) and artificial deadliness, most ordinarily as a series of separate treatments (e.g. therapy before surgery). the selection of medical care depends upon the placement and grade of the growth and also the stage of the sickness, furthermore because the general state of the patient (performance status). Cancer ordering sequencing helps in

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decisive that cancer the patient specifically has for decisive the simplest medical care for the cancer. variety of experimental cancer treatments are underneath development. underneath current estimates, 2 in 5 folks can have cancer at some purpose in their period of time. Complete removal of the cancer while not injury to the remainder of the body (that is, achieving cure with near-zero adverse effects) is that the ideal, if seldom achieved, goal of treatment and is commonly the goal in follow. typically this may be accomplished by surgery, however the propensity of willcers to invade adjacent tissue or to unfold to distant sites by microscopic metastasis usually limits its impactiveness; and therapy and radiation therapy can have a negative effect on traditional cells. Therefore, cure with nonnegligible adverse effects is also accepted as a sensible goal in some cases; and besides curative intent, sensible goals of medical care may embody (1) suppressing the cancer to a subclinical state and maintaining that state for years of excellent quality of life (that is, treating the cancer as a chronic disease), and (2) palliative care while not curative intent (for advanced-stage pathologic process cancers). Hyper–Rayleigh scattering Optical Activity (/ˈreɪli/ RAY-lee), could be a nonlinear optical physical impact whereby chiral scatterers (such as nanoparticles or molecules) convert light-weight (or different magnetic force radiation) to higher frequencies via harmonic generation processes, during a approach that the intensity of generated light-weight depends on the chirality of the scatterers. "Hyper–Rayleigh scattering" could be a nonlinear optical counterpart to Rayleigh scattering. "Optical activity" refers to any changes in light-weight properties (such as intensity or polarization) that are thanks to chirality.

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