Jurnal Kedokteran dan Kesehatan Indonesia

Indonesian Journal of Medicine and Health

Journal homepage: https://journal.uii.ac.id/JKKI

The art of nanoimmunobiotechnomedicine

Dito Anurogo*[1,2]

[1]International PhD Program for Cell Therapy and Regeneration Medicine (IPCTRM), College of Medicine, Taipei Medical University (TMU), Taiwan

[2]Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Makassar, Indonesia

EDITORIAL

ARTICLE INFO

***Corresponding author:**
dito.anurogo@med.unismuh.ac.id

DOI : 10.20885/JKKI.Vol12.Iss3.art2

Nanoimmunobiotechnomedicine (NiBTM) is a collaboration of various branches of modern science, such as nanotechnology, immunology, bioinformatics, medical, basic technology and applications, and also neuroscience, to solve fundamental problems in basic science. Nanoimmunobiotechnomedicine applications have penetrated in all walks of life. One example is the application of nanotechnology in dentistry. Scientists have developed therapeutic nanomaterials, including poly (ethylene glycol)-poly-(lactic-co-glycolic acid) /PLGA-PEG cisplatin for oral cancer treatment, hydrogel for periodontology, gold nanoparticles and quantum dots for oral cancer management. Experts have also developed antimicrobial nanoparticles, both organic (such as: chitosan, polymer triclosan, and quaternary ammonium compounds) and inorganic. (nanosilver, titanium dioxide, amorphous calcium phosphate/ ACP, zinc or copper-based nanomaterials).

Nanoparticles have numerous applications in everyday life. Humanity can feel the effects of nanoparticles in textiles, biomedicine, health services, food-agriculture, industry, electronics, the environment, and renewable energy. Nanoparticles are used in the health industry for antibacterial, ultraviolet ray protection, nutraceutical (e.g. antioxidants), fungus repellent, and other purposes.[1] Experts in the field of dentistry are additionally creating nanostructures with mechanical support, for example, the assembling of nanocarbon, nanosilica, nanozirconia, polymer nanogels, nanohydroxyapatite, and nanofibrillar silicates. These nanostructures assume a part in endodontics, bioceramics, therapeutic composites, biomineralization, and embed (implant) odontology.[2]

The nanobiotechnology viewpoint sees NiBTM through its own lens. The cell is an amazing self-replicating nanomachine model in which various complete biological processes and other biochemical pathways take place at the nanoscale. The benefits of nanobiotechnology include drug targeting, selective localization, increased permeability, increased drug efficiency, crossing the blood-brain barrier, and accumulation at higher concentrations than conventional drugs.

There is an intriguing viewpoint, which is nanomedicine in bionanotechnology. Nanomedicine research will soon yield useful research tools, advanced drug delivery systems, new ways to treat disease or repair damaged cells and tissues in the body, and solutions to poor bioavailability, particularly in the case of RNA interference therapy.[3] In terms of diagnosis, nanomedicine diagnostics are used, which serve as optical imaging (in cases of cancer, rheumatoid arthritis, and atherosclerosis) and magnetic resonance imaging (MRI, in cases of Alzheimer's and cancer). The two slices are nanoparticles with multiple functions.

The investigation of NiBTM can be viewed through the lens of nanotechnology. Nanomaterials, scaffolds, and stem cells are examples of various nanotechnology approaches in regenerative medicine. Nanomaterials can be used as growth channels, have bioactive properties, and can direct cell differentiation toward specific lineages.[4] Scaffolds are useful for storing growth factors, integrating with neighboring tissues, attaching cells, and promoting cell proliferation. Stem cells can help with chemokine release, integration/implantation support, and differentiation into specific lineages.[5] NiBTM applications in various fields of life, especially health, have been realized thanks to the support of nanotechnology, nanomedicine, and neuroscience. Nanotechnology can be used to treat stroke and spinal cord injury (SCI).[6] Biologically compatible nanofibers or hydrogel scaffolds can serve as permissive bridges for axon regeneration and re-establishment of damaged connections in SCI.

Adult mesenchymal stem cells have shown promising therapeutic potential in human medicine for the therapy of central nervous system cells and have been used in clinical trials for autologous transplantation.[7] Micro circular ribonucleic acid (MiRNAs) show epigenetic regulation in silver nanoparticles treated human embryonic stem cell-derived neural stem/progenitor cells (Ag NP-treated hESC-derived NPCs), providing molecular insight into the development of AgNPs-induced neurotoxicity.[8] At the molecular level, AgNPs cause oxidative stress and dysfunctional neurogenesis in hESC-derived NPCs.[9]

Nanotechnology, immunology, neuroscience, bioinformatics, applied-basic technology, and medicine all have close connections and correlations. This link demonstrates the presence of nanoimmunobiotechnomedicine. The government and stakeholders must always support the most recent research to make better applications in medicine and public health. To create a better world and a brighter civilization, synergy and research collaboration must be constantly developed.

REFERENCES

1. Helal NA, Eassa HA, Amer AM, Eltokhy MA, Edafiogho I, Nounou MI. Nutraceuticals' novel formulations: The good, the bad, the unknown and patents involved. Recent Patents on Drug Delivery & Formulation. 2019;13(2):105–56.
2. Jandt KD, Watts DC. Nanotechnology in dentistry: Present and future perspectives on dental nanomaterials. Dental Materials. 2020;36(11):1365–78.
3. Peng Y, Chen L, Ye S, Kang Y, Liu J, Zeng S, et al. Research and development of drug delivery systems based on drug transporter and nano-formulation. Asian Journal of Pharmaceutical Sciences. 2020;15(2):220–36.
4. Dayem AA, Lee S Bin, Cho SG. The impact of metallic nanoparticles on stem cell proliferation and differentiation. Nanomaterials. 2018;8(10):761
5. Han Y, Li X, Zhang Y, Han Y, Chang F, Ding J. Mesenchymal Stem Cells for Regenerative Medicine. Cells. 2019;8(8):886.
6. Kubinová Š, Syková E. Nanotechnology for treatment of stroke and spinal cord injury. Nanomedicine. 2010;5(1):99–108.
7. Joyce N, Annett G, Wirthlin L, Olson S, Bauer G, Nolta JA. Mesenchymal stem cells for the treatment of neurodegenerative disease. Regenerative Medicine. 2010;5(6):933–46.
8. Brzóska K, Gradzka I, Kruszewski M. Silver, gold, and iron oxide nanoparticles alter miRNA expression but do not affect DNA methylation in HepG2 cells. Materials. 2019;12(7):1038
9. Yamada S, Yamazaki D, Kanda Y. Silver nanoparticles inhibit neural induction in human induced pluripotent stem cells. Nanotoxicology 2018;12(8):836–46.