Implen Journal Club | September Issue, 2022

Welcome to our September issue of the #Implen #JournalClub in 2022.

In the first issue of the Implen NanoPhotometer® Journal Club: Nanomedicine Edition, the work of Wang et. al. recently published in the Chemical Engineering Journal providing an effective new approach for the treatment of malignant bone tumors is being highlighted. Malignant bone tumors are frequent and difficult to cure, which is still a major clinical challenge as the bone microenvironment provides a “barrier” for bone tumors to resist clinical chemoradiotherapy, implying that molecules targeting tumor cells alone cannot effectively target bone tumor cells.

In this study, a novel bone tumor cell-targeting nanosystem for chemo-photothermal synergistic treatment of malignant bone tumors was designed. A bone tumor cell-targeting peptide (BTTP) was covalently attached to the surface of the nanosystem. The nanosystem was constructed by hybridization of a core Mn-Co metal-organic framework and polydopamine as the shell (TM@P). The TM@P/DOX nanosystem could be first targeted to the bone damage interface by the bone-targeting peptide. With Doxorubicin (DOX) loaded onto the TM@P surface (TM@P/DOX), the nanosystem targeted bone tumor cells and effectively inhibited bone tumor growth and osteolysis and also enhanced the contrast of bone tumor (MRI). Collectively, this study suggests that targeted drug delivery for bone tumors is feasible, providing a new and effective strategy for targeted therapy of bone tumors.

For characterization of the nanosystem, of The ultraviolet–visible (UV–Vis) spectra of samples were determined by the Implen NanoPhotometer®.

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The second issue is discussing the topic of cancer recurrence after surgical resection (SR), which is a considerable challenge. Guan et. al. recently published results in Nature communications that demonstrate that the SR creates an immunosuppressive environment characterized by hypoxia and high-influx of myeloid cells, fostering cancer progression and hindering PD-L1 blockade therapy with direct evidence that the local biological consequences of SR can trigger substantial outgrowth of deposited tumor cells at the resection anatomical site. In response, Guan et. al. rationally designed and developed a distinct radio- immunostimulant nanomedicine (IPI549@HMP) with efficient tumor- homing capacity, TME-responsive drug release ability and in situ oxygen production properties that can enhance local X-ray irradiation-initiated cancer cell killing. The enhanced RT-mediated immunogenic effect results in postsurgical TME reprogramming and increased susceptibility to anti-PD-L1 therapy, which can suppress/eradicate locally residual and distant tumors, and elicits strong immune memory effects to resist tumor rechallenge. Our radioimmunotherapy points to a simple and effective therapeutic intervention against postsurgical cancer recurrence and metastasis.

The purity, concentration and integrity of RNA were evaluated with the NanoPhotometer® spectrophotometer.

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Next, the Nanomedicine Edition is covering a novel, easy-to-use, UV-Vis spectroscopy-based method to accurately observe Polyoxometalate nanoparticles (POMs)- a class of compounds made up of multiple transition metals linked together using oxygen atoms, which have an increased interest in use as organo-metallic compounds for cancer therapy. This method was introduced in a recent study published in the International Journal of Molecular Sciences, wherein Petronek et. al. developed two POM preparations shown to have anti-cancer effects on glioblastoma cells. These preliminary results suggest that Mo-POMs (NH4)Mo7O24) and W-POMs (H3PW12O40) may warrant further investigation into their utility as adjunct cancer therapies.

All spectrophotometric measurements were carried out using the NanoPhotometer® microvolume spectrophotometer instead of a normal cuvette spectrophotometer. The Implen NanoPhotometer® works by decreasing the pathlength, and thus introducing an artificial dilution factor so less sample is needed. More importantly, there is a direct measurement of the POM samples, eliminating any interference of any cuvette material.

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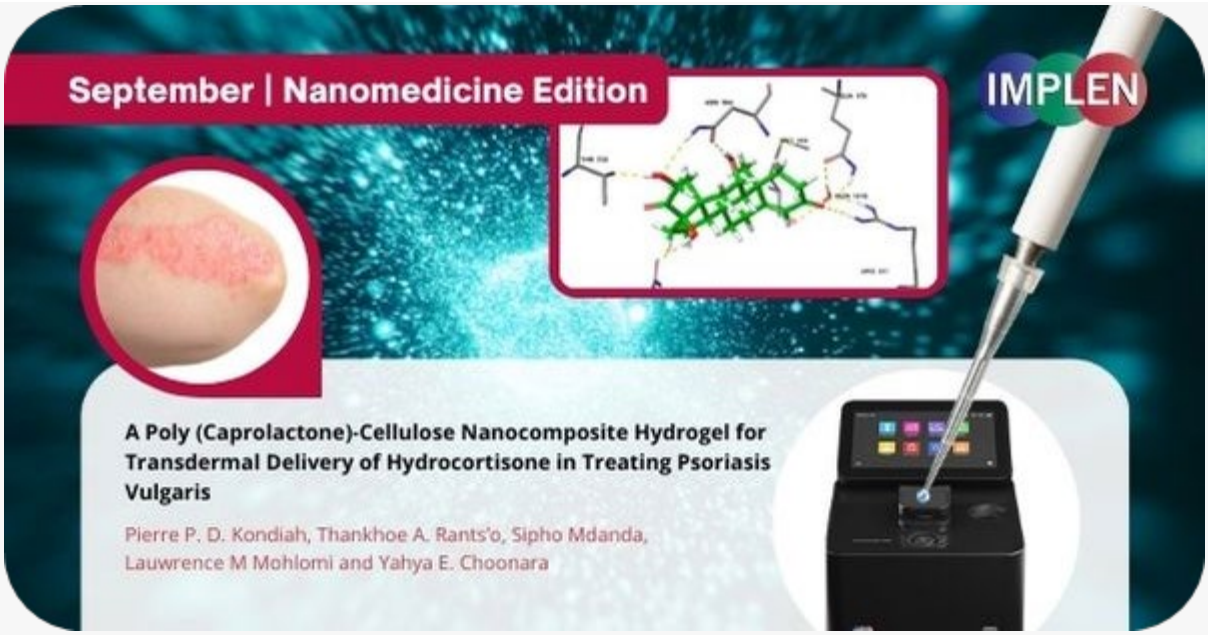

In the last issue, we are discussing the use of a nanocomposite hydrogel for transdermal delivery of hydrocortisone in treating Psoriasis vulgaris (PV), a common chronic, incurable inflammatory skin condition with a severe impact on quality of life affecting much of the population. Kondiah et. al. published their recent work in the polymers journal in which they synthesized a thermo-responsive nano-hydrogel system loaded with an anti-psoriasis drug hydrocortisone (HCT). Results from the formulation of HCT-loaded SMS-PCL nanoparticles encapsulated with CMC showed evidence that this hydrogel can be utilized as a potentially invaluable formulation for transdermal drug delivery of HCT, with less toxicity along with improved efficacy and patient conformity. Further studies with in vivo models should be conducted to assess this as a potential novel therapeutic outlet for the treatment of inflammatory skin disease.

The samples were analyzed from the calibration curve utilizing the NanoPhotometer® NP80 UV/Vis Spectrophotometer at wavelength 245 nm to determine the concentration of HCT as well as the concentration of HCT in the release medium was assayed by UV/Vis spectrophotometry (Implen NanoPhotometer® NP80 UV/Vis Spectrophotometer.)

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