Implen Journal Club | December Issue

Welcome to our December issue of the #Implen #JournalClub in 2021.

This month's issue of Implen's NanoPhotometer Journal Club we are covering the work of Hannah Yejin Kim et al. who successfully validated an assay using non-invasive saliva sampling to measure linezolid in saliva samples using the NanoPhotometer® NP80 as a mobile UV-Vis

spectrophotometer.

Often, in tuberculosis (TB) endemic settings therapeutic drug monitoring (TDM), which has been recommended for linezolid due to its narrow therapeutic index and drug exposure-related outcomes, is not an option. In addition to non-invasive saliva sampling, the highly affordable, mobile UV-Vis spectrophotometer will allow drug measurement at local healthcare facilities without the need to transport samples to central laboratories. There will be a significant reduction in the long turnaround time and clinicians can make prompt dose adjustment based on drug exposure. Importantly, the mobile UV-Vis spectrophotometer could be used in remote and regional settings and is a great benefit that could enable TDM of linezolid in remote settings. The mobile assay can help to establish a framework for TDM, not only for linezolid but for other drugs as well.

The saliva assay was developed using NanoPhotometer® NP80 and linezolid concentrations were quantified using second-order derivative spectroscopy. Linezolid saliva samples spiked at clinically relevant concentrations of 3.0 to 25 mg/L showed absorbance spectra with increasing magnitudes of absorbance at λmax of 250 nm correlative to linezolid concentration using second-order derivative spectra.

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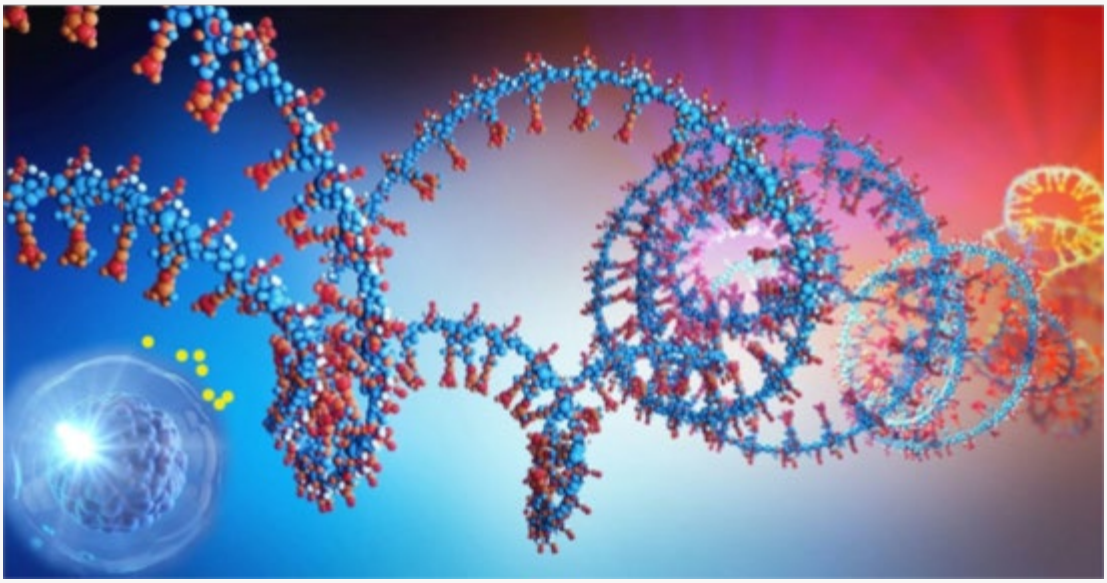

The second issue of Implen's NanoPhotometer Journal club we are exploring a topic of senescent cells, which have gained relevance in recent years as potential targets in the treatment for an ever-expanding range of diseases. Accumulation of these cells has been shown to play a significant role in a plethora of pathologies has sparked an interest in devising anti-senescence strategies, which could have a strong clinical impact, especially in age-related conditions. Poblocka et al. demonstrated in Nature's Scientific Reports that antibodies could be an efficient system to bring toxic drugs into specific types of senescent cells in humans with minimal side effects, following up on the success of similar approaches in cancer treatment. This is the first evidence that the senescent surfaceome, the specific profile of membrane proteins differentially upregulated in senescent cells, can be used to design targeted senolytics. The NanoPhotometer® was used to measure the concentration and purity of extracted RNA.

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In this week's issue of Implen's NanoPhotometer Journal club we are covering a problem that is becoming more and more urgent every year of pharmaceuticals and their metabolites increasingly being found in the environment creating the need to develop a method for purifying domestic and hospital wastewater. The search for new potent adsorbents for these three wide-spread pharmaceuticals is important not only for wastewater decontamination but also for designing detoxification agents to treat medicine overdoses. Clay adsorbents have been repeatedly proposed as adsorbents for treatment purposes, but natural clays are hydrophilic and can be inefficient for catching hydrophobic pharmaceuticals.

Kryuchkova et. al. reported in the International Journal of Molecular Sciences on the efficiency of removing carbamazepine, ibuprofen, and paracetamol from water using pristine and hydrophobic (trimethyl stearyl ammonium-modified) montmorillonite as adsorbents. Montmorillonite (MMT) is a layered aluminum silicate. The layered structure of MMT allows the adsorption of various substances both on the surfaces and in the interlayer spaces, and other MMT-related adsorbents with desired properties can be obtained by chemical modifications of the natural clay. The adsorption capacity of hydrophobic montmorillonite to pharmaceuticals decreased in the following order: carbamazepine (97%) > ibuprofen (95%) > paracetamol (63–67%). Adsorption isotherms were best described by Freundlich model.

The NanoPhotometer® NP80 was used to identify the absorption peak of each pharmaceutical. The calibration curves were plotted in the concentration range of 10–70 µg/mL and used to assess the Pharmaceutical Products (PP) concentration in the supernatant after adsorption. All experiments were performed in triplicate. The removal efficiency by adsorption (R) was calculated according to Equation (1): $R=Co - CeCo \times 100\%$ where Co is the initial PP concentration in the solution, µg/mL, and Ce is equilibrium concentration of PP in solution, µg/mL.

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The last issue of Implen's NanoPhotometer Journal Club highlights the work done by Spanov et al. who reported an important observation that there was no change in binding properties of trastuzumab, the humanized monoclonal antibody (mAb) directed against the human epidermal growth factor receptor-2 (HER2) for the treatment of HER2-positive breast cancer patients, which like several therapeutic antibodies has been shown to be heterogeneous. Heterogeneity may arise due to the susceptibility of monoclonal antibodies to undergo chemical modifications and may adversely affect the potency of the drug, induce immunogenicity or affect pharmacokinetics. In this work it was shown that the binding of HER2 for a range of Fcγ receptors between non-stressed and stressed trastuzumab remained unchanged- an important observation, since triggering ADCC through FcγRIIIa receptor activation is one of the main mechanisms of anti-tumor action. This is an important finding as it is known that clinical grade trastuzumab. The NanoPhotometer® N120 was used to determine the protein concentration in the stock samples using absorbance at 280 nm.

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