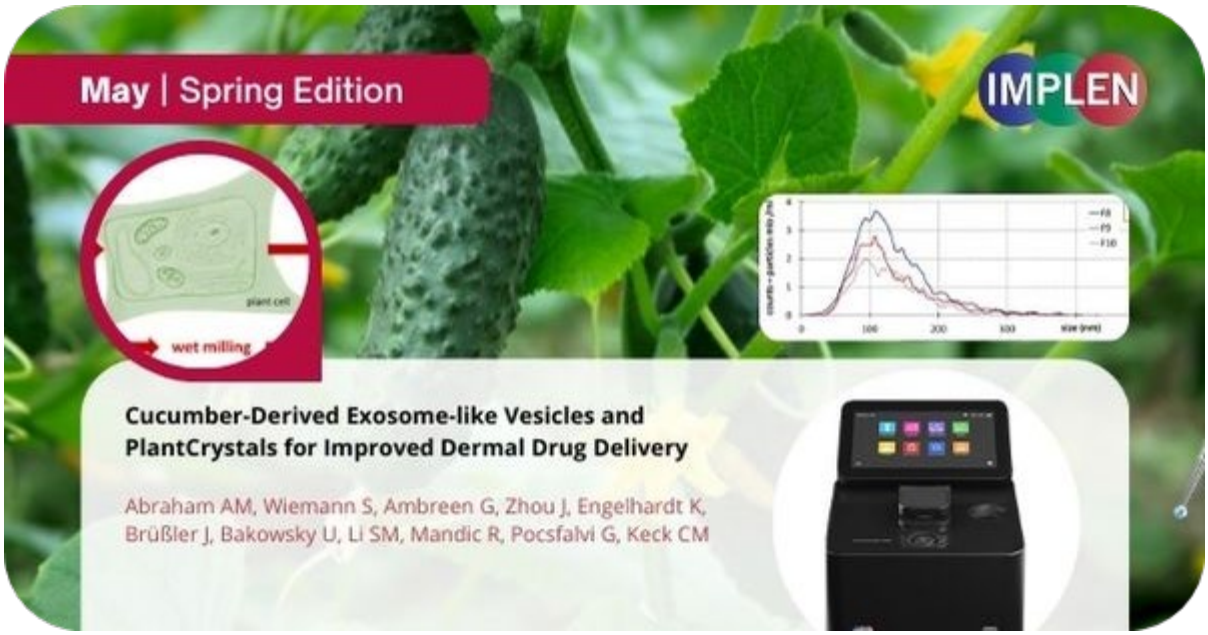
Implen Journal Club | May Issue

Welcome to our May issue of the #Implen #JournalClub in 2022.
Spring Edition



The first issue of the Implen NanoPhotometer® Journal Club: Spring Edition is highlighting the work of Abraham et al. who described for the first time in the Journal of Pharmaceuticals the production and characterization of cucumber-derived extracellular vesicles (EVs) and their ability to improve dermal drug delivery. Extracellular vesicles (EVs) are considered to be efficient nanocarriers for improved drug delivery and can be derived from mammalian or plant cells. Cucumber-derived plant exosome-like vesicles (PEVs) were successfully obtained and characterized, wherein the cucumber-derived PEVs were demonstrated to increase the dermal

penetration efficacy of a lipophilic active ingredient (AI) surrogate to about 200%. Ultimately, this study demonstrated a promising technique for the production of cucumber-derived exosome-like vesicles and PlantCrystals produced in a similar way to drug nanocrystals for improved dermal drug delivery.

The NanoPhotometer® NP80 was used in this study to obtain absorbance values to quantify the protein amounts of the PEVs using the BCA assay with micro BCA kits.

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The second issue of the Implen NanoPhotometer® Journal Club is exploring the concept of novel food, with insects reared under controlled conditions being considered mini livestock. Mass-reared edible insect production is an economically and ecologically beneficial alternative to conventional meat gain. House crickets (Acheta domesticus) and Jamaican field crickets (Gryllus assimilis) are preferred insect species that are used commercially as food. Aleknavičius et al. recently reported in the Journal of Foods that the bacterial community associated with Jamaican field cricket was characterized for the first time and compared to that of a house cricket demonstrating each with significantly different bacterial communities, with some bacteria that are receiving increasing attention for their ability to regulate the gut microbiota performing beneficial probiotic functions and improve host health. The novel information from this study on the edible insect-associated microbiota will contribute to developing strategies for cricket processing to avoid bacteria-caused risks of microbial communities of having detrimental properties and reap the benefits of beneficial microbes. Edible insect-associated microorganisms should gain much attention considering their potential beneficial, health-promoting features.

The NanoPhotometer® P330 was used to assess the quality and quantity of microbial DNA isolated from crickets.

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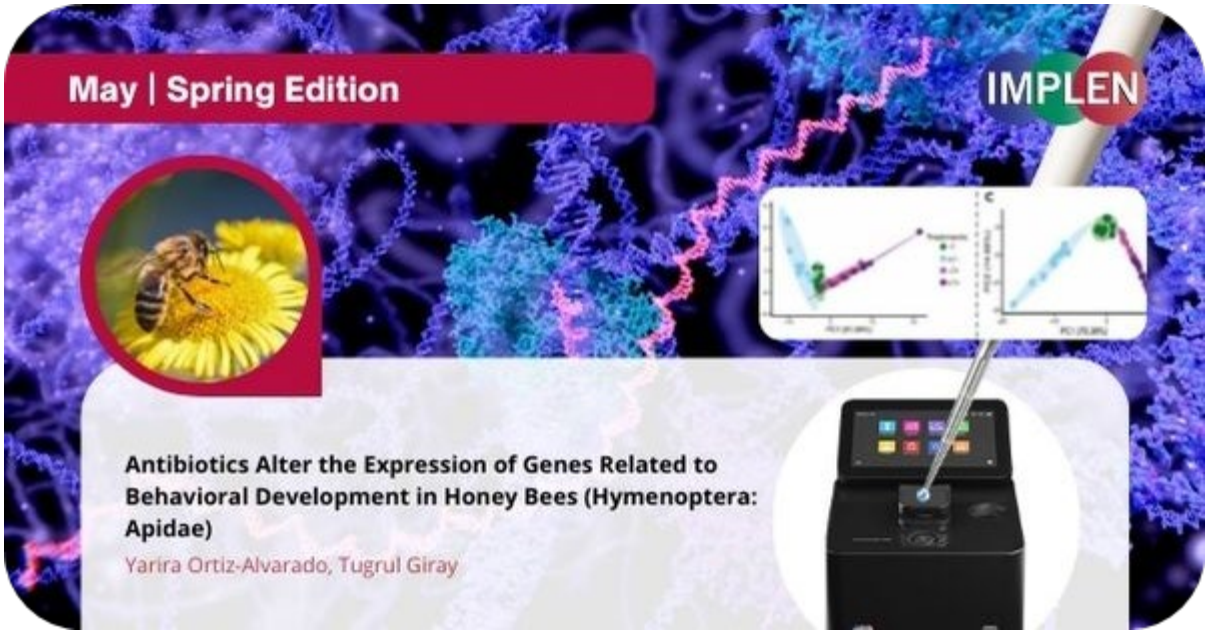

Next issue is revisiting the topic about small, but very important insects whose health should concern us all- honey bees. As many species of social insects display a division of labor among colony members based on behavioral specializations related to age, adult worker honey bees perform a series of tasks in the hive when they are young and with age shift to foraging for nectar and pollen outside the hive. The transition to foraging involves changes in metabolism and neuroendocrine activities. These changes are associated with a suite of developmental genes. Ortiz-Alvarado et al. demonstrated in the Journal of Insect Science that antibiotic treatments, which are often used to treat or prevent infections and to improve honey production, had an effect on the typical expression pattern of regulatory genes and that the immature environment can influence adult development. The exposure of antibiotics during immature stage and adulthood resulted in a delay in the typical changes in the expression of candidate genes known to regulate behavioral development accelerating or delaying the onset of foraging depending on timing of antibiotic exposure. The results of this study illustrate that timing of antibiotic exposure alters the typical regulation of behavioral development by metabolic and neuroendocrine processes. Antibiotic effects on individual behavior highlight the need for further focus on the gut–brain axis and microbiota role on honey bee social organization.

The NanoPhotometer® was used to quantify RNA extracted from the honey bee tissues.

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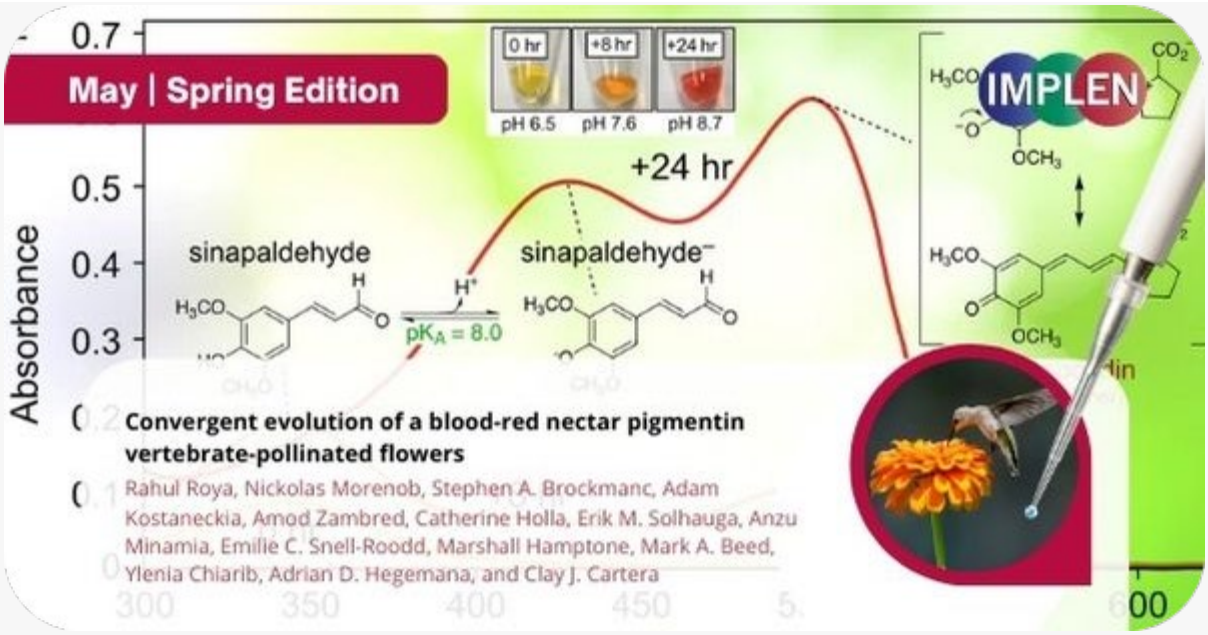

Next, let's highlight the topic of the convergent evolution of vertebrate-pollinated flowers. Nearly 90% of flowering plants depend on animals for reproduction. One of the main rewards plants offer to pollinators for visitation is nectar, with one rare trait among flowering plants is the production of colored nectar, which may function as a visual attractant and guide prospective pollinators. Roya et al. reported in the journal of plant biology findings indicating convergent evolution of a red-colored nectar has occurred across two distantly related plant species. Behavioral data show that the red pigment attracts the likely pollinator of one of these plants. This work cumulatively identifies a convergently evolved trait in two vertebrate-pollinated species, suggesting that the red pigment is selectively favored and that only a limited number of compounds are likely to underlie this type of adaptation. These findings join a growing list of examples of distinct biochemical and molecular mechanisms underlying evolutionary convergence and provide a fascinating system for testing how interactions across species drive the evolution of novel pigments and may serve as a starting point for more in-depth comparative biochemical and behavioral studies on pigment-driven plant–pollinator interactions.

The NanoPhotometer® Pearl was used for all spectrophotometric analysis for this study including: (1) spectrophotometric catalays assay performed by monitoring the breakdown of H2O2 by measuring the absorbance at 250 nm and (2) absorbance wavelength scans performed 8-20 hours following in-situ pharmacological treatments of nectar with carbonic anhydrase inhibitors (acetazolamide, sulfanilamide, or 6-ethoxy-2-benzothiazolesulfonamide) or equivalent amounts of DMSO.

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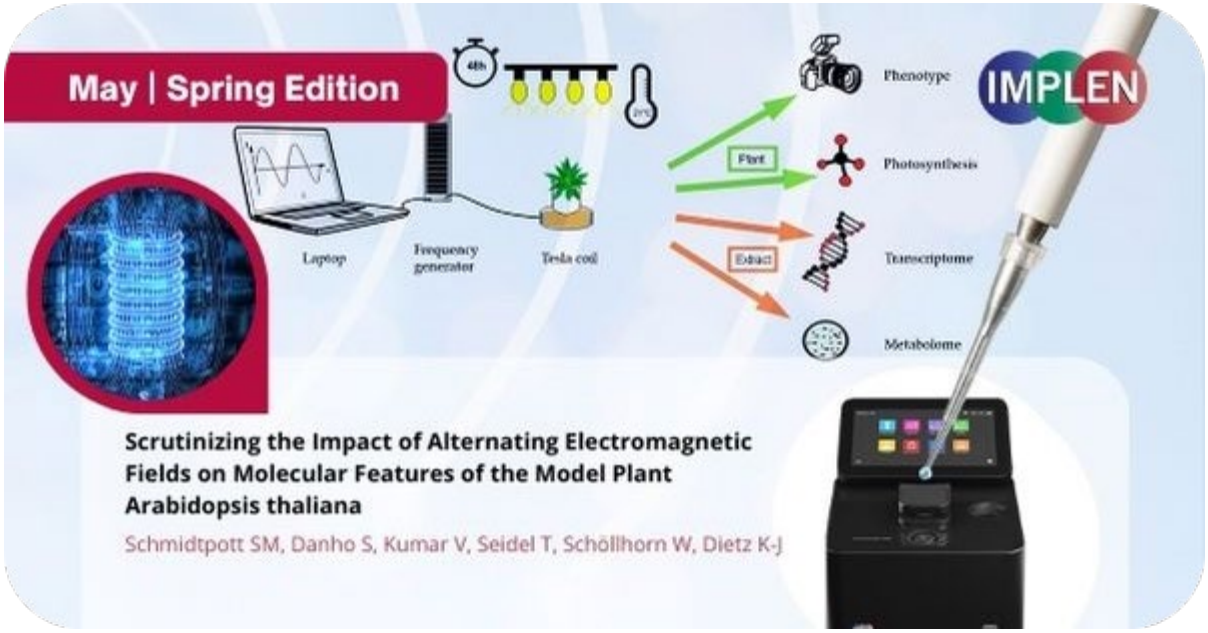

Our last issue is highlighting the topic of the impact of Electromagnetic fields (EMFs) which are ubiquitous in the environment and interfere with all biological organisms including plantlife. The quality and quantity of alternating EMFs are increasing due to the implementation of novel technologies precipitating the need for researching their effects. Schmidtpott et. al. recently reported their work driven by the need to understand EMFs as a stressor on plant physiology in the International Journal of Environmental Research and Public Health with the findings of their exploration of the impact of EMFs (similar to those emitted from battery chargers of electric cars) on plants. The results of this study, in which the model plant Arabidopsis thaliana was exposed to an applied EMF program aimed to mimic a mix of natural and anthropogenic components, show that alternating EMF-exposed plants undergo significant alterations at the levels of photosynthesis, transcriptome, and metabolome. These findings of EMF–plant interaction along with the rapidly changing EMF emissions accentuate the requirement to research the EMF–life and, as conducted here, EMF–plant interaction.

The NanoPhotometer® was used in this study to verify the yield and purity of RNA isolated from the model plants exposed to EMFs for transcriptome analysis by RNA sequencing and quantitative real-time PCR validation.

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