Editorial

Nanotechnology Opens the Landscape of Personalized Medicine

Modern medicine requires new developments in disease prevention and treatment towards a personalized medical approach of diseases [1]. Personalized medicine is being developed to predict response or risk of disease from individual patients. However, nanotechnology can open this landscape by designing new tools to obtain and integrate biological information (e.g., biomarkers, bioimaging, environment) and to design advanced materials to respond according to the information obtained [2]. This can be used to personalize the clinical strategy of individual patients. Nanomaterials to be used for disease profiling (e.g., morphological diagnosis, biosensing), local and on demand therapeutics (e.g., protein, drug or gene control release) or drug response monitoring can be designed to perform these functionalities alone or in parallel [3-6]. Theranostics is a medical strategy combining diagnostics with therapeutics [7]. Based on the results of diagnostic tests on patients, a targeted drug therapy is created; thus, giving rise to a more specialized medicine. In molecular theranostics, a tool of information (ion homeostasis, proteins, genes, among others) is required for the design of the most adequate therapy for a patient to avoid unnecessary treatment. By monitoring the response to the treatment, drug selection and efficacy can also be optimized. Despite the great advantages that such a therapy can offer to patients and clinicians, such strategies are still not adopted in routine health care activities. The reasons are the lack of cost-effectiveness studies and appropriate diagnostic/monitoring and drug releasing tools. To provide new treatment/diagnostic [8] possibilities that complement current strategies for the different pathophysiological states, novel pharmaceutical platforms must be designed and characterized. The requirements that such a theranostic tool must have are within others, (i) to be bio-compatible [9] and small enough to ensure outstanding biodistribution, (ii) to entrap a payload and protect it from the physiological milieu (also healthy tissue from the drug), (iii) to give a feedback from the treatment response or to detect analytes imbalances, among others [10]. Nowadays, there is no single material capable of performing all these actions and therefore, composite materials are required. By integrating various materials with different properties within a single matrix, all required functionalities can be combined in one single structure. Nanotechnology allows us playing Lego using nanoparticle building blocks with different physicochemical properties that are combined to create a multifunctional, composite material intelligent enough to perform and fulfill the requirements mentioned above. By using nanomaterials with defined, tunable and reproducible physicochemical properties [11], a correlation with their biological responses can be established [12]. Such a correlation will provide us with the necessary information to rationally design a nanoparticle based on the requirements of the biomedical applications so that the capabilities of the nanomaterial to perform a cellular action are highly optimized.

REFERENCES


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