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Nanotheranostics and Pharmacogenomics for the Development of Personalized Medicine

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Nanotheranostics, the integration of diagnostic and therapeutic function in one system using the versatile strategy of nanotechnology, is extremely attractive for personalized medicine. The discovery of genetic, genomic and clinical biomarkers have revolutionized the treatment option in the form of personalized medicine (PM) which allows us to accurately predict a person's susceptibility/progression of disease, the patient's response to therapy, and maximize the therapeutic outcome for a particular patient. It aims to provide right treatment, to the right patient, at the right time, at right cost. "One size does not fit all" is the prime reason for the evolution of PM, which emphasizes on genetic makeup of individuals that can be correlated with difference in drug therapy. Genetic variations in humans are recognized as an important determinant of drug response variability. Different patients respond differently to the same drug, with genetics accounting for 20–95% of the variability. Pharmacogenomics is the study of how human genetic variations affect an individual's response to drugs, considering the drug's pharmacokinetic properties like absorption, distribution and metabolism. It plays an important role in reducing/avoiding the adverse drug reactions (ADRs) and optimizing drug dose by identifying drug responders and non-responders. Recently, the U.S. Food and Drug Administration (FDA) has realized the contribution of pharmacogenomics in better healthcare and advocated the consideration of pharmacogenomic principles in making safer and more effective drug. By predominantly utilizing the unique properties of nanoparticles to achieve biomarker identification and selective/targeted drug delivery, nanotheranostics can be useful for personalized cancer treatment.