Editorial

Trend of medicine of the 21st century

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Until today, traditional clinical diagnosis and disease management was focused on the individual patient's clinical symptoms and signs, medical and family history, data from laboratory and imaging evaluation that led to diagnose and treatment of illnesses. This is often a reactive approach to treatment, i.e., treatment starts after the symptoms and signs appear. Advances in medical genetics have enabled a more detailed understanding of the impact of genetics in diseases. It was the main reason for developing a so called personalized medicine. Large collaborative research projects (for example, the Human genome project) have laid the groundwork for the understanding of the roles of genes in human development and physiology. Even that revealed single nucleotide polymorphisms that pointed to some of the genetic variabilities between individuals. Important biological functions: growth, death, cellular movement and localization, differentiation, etc. are controlled by a process called signal transduction. This process is nearly entirely epi-genetic and governed by protein enzyme activity. Diseases such as cancer, based on genomic mutations, are functionally manifest as dysfunctional protein signal transduction. Historically, the pharmaceutical industry has developed medications based on empiric observations and more recently, on known disease mechanisms. For example, medications for diabetes aim to improve insulin release from the pancreas and the sensitivity of the muscle cells and fat tissues on the effect of insulin. Drugs for high cholesterol, affect the absorption, metabolism, and generation of cholesterol. It means that medications are developed based on mechanisms of disease that have been extensively studied over the past century. We hope that recent advancements in the genetic etiologies of common diseases will improve pharmaceutical development. Today we discovered that information about a patient's proteomic, genetic and metabolic profile could be used to tailor medical care to that individual's needs. One idea of this medical model is the development of diagnostics, whereby molecular assays that measure levels of proteins, genes or specific mutations are used to provide a specific therapy for an individual's condition by stratifying disease status, selecting the proper medication and tailoring dosages to that patient's specific needs. Besides that, many scientists and practitioners estimate that such methods might be used to assess a patient's risk factor for a number of conditions and tailor individual preventative treatments such as nutritional immunology approaches. Contemporary potential applications of personalized medicine include pharmacogenetics, pharmacometabolomics and cancer management. Examples of pharmacogenetics include: Genotyping for single nucleotide polymorphisms in genes involved in the action and metabolism of warfarin. This medication is used clinically as an anticoagulant but requires periodic monitoring and is associated with adverse side effects. Recently, genetic variants in the gene encoding Cytochrome P450 enzyme CYP2C9, which metabolizes warfarin1, and the Vitamin K epoxide reductase gene (*VKORC1*), a target of coumarins2, have led to commercially-available testing that enables more accurate dosing based on algorithms that take into account the age, gender, weight, and genotype of an individual. Examples of personalized cancer management include: Testing for disease-causing mutations in the *BRCA1* and *BRCA2* genes, which are implicated in familial breast and ovarian cancer syndromes. Discovery of a disease-causing mutation in a family can inform "at-risk" individuals as to whether they are at higher risk for cancer and may prompt individualized prophylactic therapy including mastectomy and removal of the ovaries. More detailed molecular stratification of breast tumors may pave the way for future tailored treatments3. Targeted therapy is used for medications' designing which targets epidermal grow factor receptors (EGFR) in a subset of patients with Non-Small Cell Lung Cancer (NSCLC). For example, Tyrosine kinase inhibitors such as erlotinib and gefitinib have been developed to treat NSCLC, where the mutation of the epidermal growth factor receptor gene (exon 19 - 21) in lung cancer cells was detected. These medications specifically inhibit the intracellular domain of this receptor, this way making blockade of intracellular signal transduction cascade which is responsible for cellular proliferation, invasion, metastasis, angiogenesis and inhibition of apoptosis. In the future, tissue-derived molecular information might be

combined with an individual's personal medical history, family history, data from imaging, and other laboratory tests to develop more effective treatments for a wider variety of conditions.

References

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