

# Pharmacogenetics and Pharmacogenomics: A Brief Introduction

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## Introduction

The personalized medicine/individualized medicine putting significant influence on today's drug development process. This concept was first advocated by Hippocrates, the father of modern medicine. According to him clinicians must consider the factors like patient's age, body condition while prescribing medicines, because every individuals did not respond to drug therapies in a uniform and predictable manner [1,2]. Apart from physiological and external environmental and several factors, overall health profile and genetic constitution are responsible for an individual's response to drug therapy [3]. Now a days, it is very much easy to develop a customized and individualized drug regimen, in order to minimize the side effects. This is possible due to availability of advanced technology through advances in molecular biology and genetics, by tracing pathogenesis of many diseases to know the variation in DNA [4,5]. This is helping our physicians to decide the drug therapy with appropriate drug for targeting the disease in the right manner, in the right dose in individual patients to achieve maximum therapeutic benefit with minimal and tolerable side effects. Individualized medicine can increase the value of health care by allowing the physicians to give the right treatment from the very beginning [5]. The study through which a relationship has been established between genetic constitution and disease pathology and its treatment, finally this led to the emergence of pharmacogenetics and pharmacogenomics that describes the genetic reasons for variance in drug response in individual patients [6].

## Pharmacogenetics and Pharmacogenomics

Garrod, an English physiologist was first proposed the possibility of modulation in drug action due to genetic variants [2]. He also suggested that enzymatic defects lead to aggregation of exogenously administered substrates, such as food, toxin and drugs, with clinical concerns. Pharmacogenomics is a science that analyzes individuals' responses to therapeutic agents and their genetic inheritance, and the word 'pharmacogenetics' was first coined by Vogel of Heidelberg, in 1959 [2,7]. Pharmacogenetics can thus be defined as the science of determining the genetic differences on metabolic pathways which can affect individual responses to drugs, both therapeutically and adversely [7].

Differences in the pharmacodynamics, including receptor and transporter polymorphisms are responsible for individual variations in response to a drug. Genetic makeup of an individual patient can cause differences in metabolic pathways of drug action and elimination [8]. To ensure the better therapeutic efficacy, and minimize the incidences of adverse reactions it is essential to tailor the drug to suite the genetic constitution of patient through better understanding the role of genetic polymorphisms in drug responses.

Emergence and development of Human Genome Project and genome science in 1990s, the term 'pharmacogenomics' came into existence. Both the terms pharmacogenetics and pharmacogenomics are often used interchangeably [9], and a unanimous and precise definition of either remains elusive. Whilst pharmacogenetics is generally referred to study or investigation of genetic variations leading to varied responses to pharmaceutical products, pharmacogenomics is a broader

application of genomic technologies for development of new drug and/or further categorization of existing drugs [10]. Pharmacogenomics is a branch of science that deals with the systematic identification of all the human genes, their products, inter-individual and intra-individual variation in expression and function. Pharmacogenomics differs from pharmacogenetics in the level of its application. Whilst the former is for a population, the latter is more individualistic as the difference between the two is the initial approach of the science [11]. Pharmacogenetics starts with an unexpected drug response and evaluates its genetic cause, while pharmacogenomics begins with looking for genetic variations within a population that may explain certain observed responses to a therapeutic drug.

## Conclusion

With the advancement of human genome science now it will be easy for our clinicians to tailor the drug treatment through the specific prescription to the individual patient that target the drug to maximize its therapeutic efficacy and minimize the damage to surrounding healthy cells. The probable adverse reactions could be minimized through decreasing the possible drug dose. The clinical trial studies can be adopted the advanced validated pharmacogenetic markers in order to increase the demonstration of therapeutic benefits without exposing non-receptive subjects. The clinical trial study can also be optimized as a small, fast and economic by undertaking pregenetic screening of those patients taking part in a clinical trial.

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