Pharmacogenomics

Pharmacogenomics is the study of how genes affect a person's response to drugs. This relatively new field combines pharmacology (the science of drugs) and genomics (the study of genes and their functions) to develop effective, safe medications and doses that will be tailored to a person's genetic makeup.

Pharmacogenomics is the study of the role of the genome in drug response. Its name (*pharmaco-* + *genomics*) reflects its combining of pharmacology and genomics. Pharmacogenomics analyzes how the genetic makeup of an individual affects his/her response to drugs. It deals with the influence of acquired and inherited genetic variation on drug response in patients by correlating gene expression or single-nucleotide polymorphisms with pharmacokinetics (drug absorption, distribution, metabolism, and elimination) and pharmacodynamics (effects mediated through a drug's biological targets). The term *pharmacogenomics* is often used interchangeably with *pharmacogenetics*. Although both terms relate to drug response based on genetic influences, pharmacogenetics focuses on single drug-gene interactions, while pharmacogenomics encompasses a more genome-wide association approach, incorporating genomics and epigenetics while dealing with the effects of multiple genes on drug response.

The field of pharmacogenomics is still in its infancy. Its use is currently quite limited, but new approaches are under study in clinical trials. In the future, pharmacogenomics will allow the development of tailored drugs to treat a wide range of health problems, including cardiovascular disease, Alzheimer disease, cancer, HIV/AIDS, and asthma.

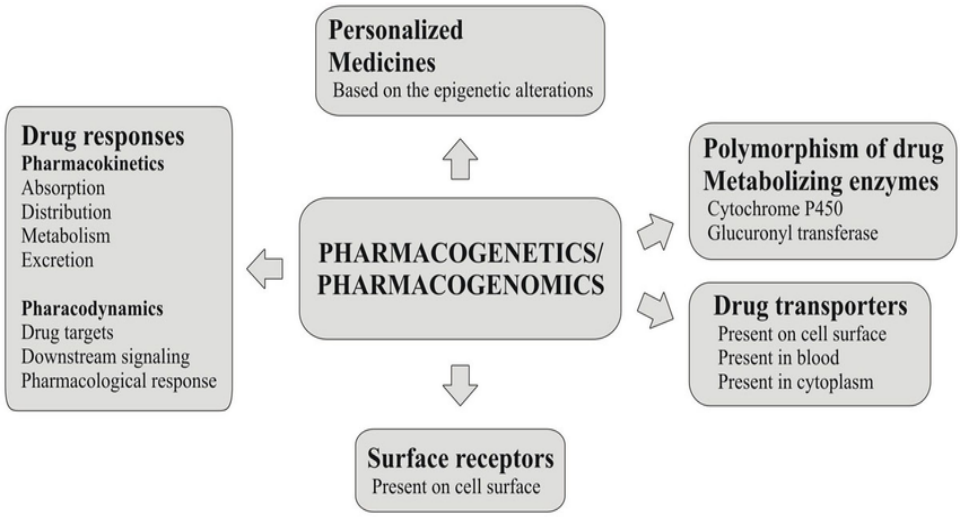
Applications of Pharmacogenomics:

The list below provides a few more commonly known applications of pharmacogenomics:[35]

- Improve drug safety, and reduce ADRs;
- Tailor treatments to meet patients' unique genetic pre-disposition, identifying optimal dosing;
- Improve drug discovery targeted to human disease; and
- Improve proof of principle for efficacy trials.

Pharmacogenomics may be applied to several areas of medicine, including pain management, cardiology, oncology, and psychiatry. A place may also exist in forensic pathology, in which pharmacogenomics can be used to determine the cause of death in drug-related deaths where no findings emerge using autopsy.

In cancer treatment, pharmacogenomics tests are used to identify which patients are most likely to respond to certain cancer drugs. In behavioral health, pharmacogenomic tests provide tools for physicians and care givers to better manage medication selection and side effect amelioration. Beside efficacy, germline pharmacogenetics can help to identify patients likely to undergo severe toxicities when given cytotoxics showing impaired detoxification in relation with genetic polymorphism, such as canonical 5-FU.



Pharmacogenomics in reducing Polypharmacy:

A potential role pharmacogenomics may play would be to reduce the occurrence of polypharmacy. It is theorized that with tailored drug treatments, patients will not have the need to take several medications that are intended to treat the same condition. In doing so, they could potentially minimize the occurrence of ADRs, have improved treatment outcomes, and can save costs by avoiding purchasing extraneous medications. An example of this can be found in psychiatry, where patients tend to be receiving more medications than even age-matched non-psychiatric patients. This has been associated with an increased risk of inappropriate prescribing

Pharmacogenomics in Drug Labelling:

The U.S. Food and Drug Administration (FDA) appears to be very invested in the science of pharmacogenomics as is demonstrated through the 120 and more FDA-approved drugs that include pharmacogenomic biomarkers in their labels. This number increased varies over the years. A study of the labels of FDA-approved drugs as of 20 June 2014 found that there were 140 different drugs with a pharmacogenomic biomarker in their label. Because a drug can have different biomarkers, this corresponded to 158 drug–biomarker pairs. Only 29% stated a requirement or recommendation for genetic biomarker testing but this was higher for oncology drugs (62%). On May 22, 2005, the FDA issued its first *Guidance for Industry: Pharmacogenomic Data Submissions*, which clarified the type of pharmacogenomic data required to be submitted to the FDA and when. Experts recognized the importance of the FDA's acknowledgement that pharmacogenomics experiments will not bring negative regulatory consequences.