# Personalized Medicine Glossary

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**Analytical Validity.** The accuracy of a test in detecting the specific characteristics that it was designed to detect, often measured by sensitivity and specificity.

**Biomarker.** Characteristics that can be scientifically measured and evaluated as indicators of normal biologic processes, disease, or response to therapeutic intervention. Biomarkers include genes and their protein products and other metabolic intermediates and endpoints. A biomarker is typically measured using a diagnostic test (e.g., an in vitro diagnostic test, imaging diagnostic) or other objective measurement method.

**CISH (Chromogenic In Situ Hybridization).** Uses chromogenic dyes instead of fluorophores to aid in gene amplification analysis.

**Clinical Utility.** The relevance and usefulness of an intervention in patient care; the likelihood of an intervention to improve patient outcomes.

**Clinical Validity.** The accuracy with which a test identifies or predicts a patient's clinical status.

**Combination Product.** A product comprised of two or more regulated components, e.g., drug/device, biologic/device, drug/biologic, or drug/device/biologic.

**Companion Diagnostic.** An *in vitro* diagnostic device or an imaging tool that provides information that is essential for the safe and effective use of a corresponding therapeutic product.

**Cytogenetics.** Refers to the microscopic analysis of chromosomes in individual cells.

*Note:* Cytogenetics and genomics studies can be performed on fresh blood, bone marrow, prenatal specimens, and solid tissue specimens, and on fixed specimens.

**Diagnostic Device.** A device used to improve patient outcomes. There are *in vitro* and *in vivo* diagnostic devices.

***In Vitro* Companion Diagnostic Device.** Provides information that is essential for the safe and effective use of a corresponding therapeutic product, e.g., assays used to measure gene expression.

***In Vitro* Diagnostic (IVD).** A reagent, instrument, or system used to diagnose disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat, or prevent disease or its sequela. Such products are intended for use in the collection, preparation, and examination of specimens taken from the human body.

***In Vitro* Laboratory Developed Test (LDT).** A type of *in vitro* diagnostic test that is designed, manufactured, and used within a single laboratory.

**Enrichment.** The prospective use of any patient characteristic—demographic, pathophysiologic, historical, genetic—to select a study population in which detection of a drug effect is more likely than it would be in an unselected population.

**FISH (Fluorescence In Situ Hybridization).** This test provides researchers a way to visualize and map the genetic material in individual cells, including specific genes or portions of genes. Allows researchers to understand a variety of chromosomal abnormalities and other genetic mutations. Unlike other techniques, FISH does not have to be performed on cells that are actively dividing. FISH tests are commonly used to look for HER2 abnormalities to provide a score of either "positive" or "negative" (some hospitals call a negative test "zero"). If the cancer is FISH positive, it will probably respond well to Herceptin.

**Genetics**. The study of heredity and the variation of inherited characteristics.

**Genetic Test.** A test for DNA, RNA, or protein mutations with a target population composed of those who are suspected of having, or are at risk of developing, a particular disease or condition.

Source: "Paving the Way for Personalized Medicine," Food and Drug Administration, 2013, http://www.fda.gov/downloads/ScienceResearch/SpecialTopics/PersonalizedMedicine/UCM372421.pdf; Oncology Roundtable interviews and analysis.

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**Genomic Biomarker.** A measureable DNA and/or RNA characteristic that is an indicator of normal biologic processes, pathogenic processes, and/or response to therapeutic or other interventions; for example, the expression of a gene, the function of a gene, or the regulation of a gene.

**Genomics.** The study of genes and their functions, and related techniques.

*Note*: Genetics refers to the functioning and composition of a single gene, whereas genomics addresses all genes and their inter-relationships in order to identify their combined influence on the growth and development of the organism.

**Immunogenicity.** The ability to provoke an immune response or the degree to which it provokes a response.

**IHC (Immunohistochemistry).** The process of detecting antigens/proteins in cells of a tissue section through use of antibodies. Using specific tumor markers, physicians use IHC to diagnose a cancer as benign or malignant, determine the stage and grade of a tumor, and identify the cell type and origin of a metastasis to find the site of the primary tumor.

**Laboratory Developed Tests (LDTs).** A subset of *in vitro* diagnostic devices which are designed, manufactured, and offered for clinical use by a single laboratory.

**Metabolomics.** The study of small-molecule metabolites in cells, tissues, and organisms that are present in biofluids, such as plasma and urine.

**Molecular Diagnostics.** Used on blood, tissue, or other biologic samples to identify specific biomarkers. Sample uses: assess the likely efficacy of specific therapeutic agents in specific patients; identify patients who may suffer disproportionately severe adverse effects from a given treatment or dosage; determine optimal dosages for drugs whose therapeutic effect is known to vary widely; assess the extent or progression of disease; and identify patients who can benefit from specific preventive measures.

**Next-Generation Sequencing.** Technology that parallelizes the genetic sequencing process, allowing for the production of thousands or millions of sequences concurrently (also referred to as high-throughput sequencing).

**Oncogene.** A gene that has the potential to cause cancer.

**Oncolytic.** Pertaining to the destruction of tumor cells.

**Panel Testing.** Gene panels are used to sequence a number of genes to identify targeted therapies. They are often used to analyze different types of tumors and use next-generation sequencing technology. This can also be referred to as comprehensive genomic profiling.

**Personalized Medicine.**

"The use of new methods of molecular analysis to better manage a patient's disease or predisposition to disease." – Personalized Medicine Coalition

"Providing the right treatment to the right patient, at the right dose at the right time." – European Union

"The tailoring of medical treatment to the individual characteristics of each patient." – President's Council of Advisors on Science and Technology

"Health care that is informed by each person's unique clinical, genetic, and environmental information." – American Medical Association

"A form of medicine that uses information about a person's genes, proteins, and environment to prevent, diagnose, and treat disease." – National Cancer Institute, NIH

Source: "Paving the Way for Personalized Medicine," Food and Drug Administration, 2013, http://www.fda.gov/downloads/ScienceResearch/SpecialTopics/PersonalizedMedicine/UCM372421.pdf; "WHO Definitions of Genetics and Genomics," World Health Organization, http://www.who.int/genomics/geneticsVSgenomics/en/; "Toward Precision Medicine," National Research Council of the National Academies, http://www.ucsf.edu/sites/default/files/legacy_files/documents/new-taxonomy.pdf; Oncology Roundtable interviews and analysis.

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**Pharmacogenetics (PGt).** The study of variations in DNA sequence as related to drug response. Pharmacogenetics is a subset of pharmacogenomics.

**Pharmacogenomics (PGx).** The study of variations of DNA and RNA characteristics as related to drug response.

**Pharmacodynamics.** Drug response; all of the effects of a drug on any physiologic and pathologic processes, including those related to effectiveness and those related to adverse reactions; "what the drug does to the body."

**Pharmacokinetics.** Drug exposure; a readily measured feature of a drug, including absorption, distribution, metabolism (including formation of active metabolites), and excretion; "what the body does to the drug."

**Precision Medicine.** The use of genomic, epigenomic, exposure, and other data to define individual patterns of disease, potentially leading to better individual treatment.

**Protein Therapeutics.** Proteins used in the treatment of human diseases that are purified from animal or human sources or, increasingly, manufactured by recombinant DNA technology.

**Proteomics.** A large-scale comprehensive study of a specific proteome, including information on protein abundances, their variations and modifications, and their interacting partners and networks, in order to understand cellular processes.

**Pyro Sequencing (PyroSeq).** Detects and quantifies mutations and methylation through sequencing by synthesis.

**Sanger Sequencing.** Examines strands of DNA to identify mutations by analyzing long contiguous sequencing reads.

**Signature Assay.** Genomic test that analyzes the activity of a group of genes to predict how a cancer is likely to behave and respond to treatment; examples include Oncotype DX Breast and MammaPrint.

**Single Nucleotide Polymorphism.** A single nucleotide polymorphism, frequently called SNP, is a variation at a single position in a DNA sequence among individuals. SNPs occur normally throughout DNA and are the most common type of genetic variation among people. They occur once in every 300 nucleotides on average, translating to roughly 10 million SNPs in the human genome. Most of these genetic differences appear to have no effect on health or development, but some may be used to help predict an individual's response to certain drugs, susceptibility to environmental factors such as toxins, and risk of developing particular diseases.

**Stratified Medicine.** Using a biomarker to match a patient to a cohort that has exhibited a differential response to a treatment.

**Stratification.** The division of patients with a particular disease into subgroups based on a specific characteristic who respond more frequently to a particular drug or are at decreased risk of side effects in response to a certain treatment.

**Synonymous SNPs.** Single nucleotide changes that do not result in a change in the amino acid in the translated protein.

**Tumor Tissue Banks.** The storage of leftover human tissue that has been removed during a medical procedure, such as an operation, biopsy, or blood test. This extra tissue is not needed for diagnosis or treatment. With written consent, this tissue is sent to a tissue bank, where it is carefully preserved and protected. Scientists use tissues from these banks to study disease and find better ways to diagnose, prevent, and treat cancer in the future. Human tissue donated for medical research can include pieces of tumor from the lung, breast, kidneys, or other organs; cancerous cells from blood and bone marrow; and excess normal tissue from organs or blood.

**Whole Exome Sequencing.** Sequencing the coding regions, or exons, of DNA; the exome makes up about 1% of the entire genome.

**Whole Genome Sequencing.** Sequencing an individual's complete DNA, including coding and non-coding regions.

Source: "Paving the Way for Personalized Medicine," Food and Drug Administration, 2013, http://www.fda.gov/downloads/ScienceResearch/SpecialTopics/PersonalizedMedicine/UCM372421.pdf; "E15 Definitions for Genomic Biomarkers, Pharmacogenomics, Pharmacogenetics, Genomic Data, and Sample Coding Categories," U.S. Department of Health and Human Services, 2008, http://www.fda.gov/downloads/drugs/guidancecomplianceregulatoryinformation/guidances/ucm073162.pdf; Oncology Roundtable interviews and analysis.