

Glossary

Acquired mutations: gene changes that arise within individual cells and accumulate throughout a person's lifetime; also called somatic mutations. (See Hereditary mutation.)

Alleles: variant forms of the same gene. Different alleles produce variations in inherited characteristics such as eye color or blood type.

Alzheimer's: a disease that causes memory loss, personality changes, dementia and, ultimately, death. Not all cases are inherited, but genes have been found for familial forms of Alzheimer's disease.

Amino acid: any of a class of 20 molecules that combine to form proteins in living things.

Amniocentesis: prenatal test where a needle is inserted into the womb and into the fluid in which the fetus floats. A few milliliters of fluid is withdrawn for testing.

Anencephaly: severe type of neural tube defect in which the top of the brain fails to develop.

APHIS (Animal and Plant Health Inspection Service): An agency of the U.S. Department of Agriculture responsible for regulating the field testing of genetically engineered plants and certain microorganisms.

Autonomy (as a moral category): the power of self-rule or direction; independence from outside guidance. An autonomous self is one that operates in an integrated, self-determining manner rather than according to outside authority or in response to outside stimuli. A dominant category of Enlightenment thinking.

Autosomal disease: (See Recessive Allele)

Autosomal recessive disorder: disorder where both alleles of an autosomal gene are erroneous.

Autosome: any of the non-sex-determining chromosomes. Human cells have 22 pairs of autosomes.

Base pairs: the two complementary, nitrogen-rich molecules held together by weak chemical bonds. Two strands of DNA are held together in the shape of a double helix by the bonds between their base pairs. (See Chemical base.)

Biosafety Protocol: A treaty being negotiated under the Convention on Biological Diversity to set up a process for the safe movement across countries' boundaries of living genetically engineered organisms.

Biotechnology: Broadly defined, the use of biological processes of microbes and of plants or animal cells for the benefit of humans. When used in conjunction with genetic engineering, it is the genetic modification of an organism's DNA such that the transformed individuals have new traits that enhance survival or modify quality. The actual use of biotechnological methods began centuries ago, when plants and animals were selectively bred and microorganisms were used in the production of beer, wine, cheese, and bread. In addition to genetic engineering biotechnology is concerned with such areas as plant tissue culture, gene splicing, enzyme systems, plant breeding, animal cell culture, immunology, molecular biology, and fermentation. Modern biotechnology is being used in medicine, fuel production, agriculture and food production, and criminal science, as well as in environmental activities.

Bovine Somatotropin (BST/BGH): Known both as BST and BGH (for bovine growth hormone), a naturally occurring protein that has been genetically engineered as a synthetic compound to stimulate milk production in cows.

BRCA1 breast cancer susceptibility gene: a mutated version of BRCA1, which predisposes a person toward developing breast cancer.

BRCA1: a gene that normally helps to restrain cell growth.



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B.t. Corn (Maize): Corn that is genetically engineered to provide protection against the European Corn Borer.

B.t. Cotton: Cotton that is genetically engineered to control tobacco budworms, bollworms, and pink bollworms.

B.t. Crops: Crops that are genetically engineered to carry the gene from the soil bacterium *Bacillus thuringiensis*. The bacterium produces a protein that is toxic when ingested by individual species of insects, thereby providing protection throughout the entire plant.

Carrier testing: testing to identify individuals who carry disease-causing recessive genes that could be inherited by their children. Carrier testing is designed for healthy people who have no symptoms of disease, but who are known to be at high risk because of family history.

Carrier: a person who has a recessive mutated gene, together with its normal allele. Carriers do not usually develop disease but can pass the mutated gene to their children.

Cell: a small, watery, membrane-bound compartment filled with chemicals; the basic subunit of any living thing.

CGIAR (Consultative Group on International Agricultural Research): An informal association of 58 public and private sector members supporting 16 international agricultural research centers. The centers develop advanced breeding material for adoption and use by national agricultural research systems in developing countries.

Chemical base: an essential building block. DNA contains four complementary bases: adenine, which pairs with thymine, and cytosine, which pairs with guanine. In RNA, thymine is replaced by uracil.

Chromosomes: structures found in the nucleus of a cell, which contain the genes. Chromosomes come in pairs and a normal human cell contains 46 chromosomes, 22 pairs of autosomes and two sex chromosomes.

Clone: a group of genetically identical genes, cells, or organisms derived, asexually, from a single ancestor.

Cloning: the process of making genetically identical copies.

Crossing over: a phenomenon, also known as recombination, that sometimes occurs during the formation of sperm and egg cells (meiosis); a pair of chromosomes (one from the mother and the other from the father) break and trade segments with one another.

Cystic fibrosis: an inherited disease in which a thick mucus clogs the lungs and blocks the ducts of the pancreas.

Cytoplasm: the cellular substance outside the nucleus in which the cell's organelles are suspended.

Dementia: severe impairment of mental functioning.

Down's Syndrome: (also known as Trisomy 21) a congenital condition characterized by moderate to severe mental retardation, slanting eyes, a broad short skull and broad hands with short fingers.

DNA (Deoxyribonucleic Acid): The molecule that encodes genetic information. It is constructed of a double helix held together by weak bonds between base pairs of four nucleotides adenine, guanine, cytosine, and thymine.

DNA repair genes: certain genes that are part of a DNA repair pathway; when altered, they permit mutations to pile up throughout the DNA.

DNA sequencing: determining the exact order of the base pairs in a segment of DNA.

DNA: the substance of heredity; a large molecule that carries the genetic information that cells need to replicate and to produce proteins.

Dominant allele: a gene that is expressed, regardless of whether its counterpart allele on the other chromosome is dominant or recessive. Autosomal dominant disorders are produced by a single mutated dominant allele, even though its corresponding allele is normal. (See Recessive allele.)

Edward's Syndrome: (also known as Trisomy 18) a congenital condition characterized by low birth



weight, severe mental retardation, low-set and malformed ears, small jaw, hand abnormalities, congenital heart disease, hernias, and others. Infants who suffer from this condition rarely survive beyond a few months of life.

Enzyme: a protein that facilitates a specific chemical reaction.

EPA (Environmental Protection Agency): A U.S. government agency that issues permits for large-scale testing of herbicides and biotechnology-derived plants containing new pesticidal substances.

Eugenics: literally it means “good genes”; the term can indicate simply the study of hereditary improvement by genetic control. It usually, however, refers to any intentional strategy to direct human evolution through encouraging the transmission of “desired” traits while discouraging the “undesired” ones. Such strategy could include selective mating, prenatal testing, selective abortion, forced sterilization, ethnic cleansing or others.

Expression: (see gene expression)

Expressivity: the degree to which a gene produces an observable effect or characteristic.

FDA (Food and Drug Administration): A U.S. government agency responsible for ensuring that foods derived from new plant varieties are safe to eat. FDA also has legal authority for food labeling.

Gamete: reproductive cell such as sperm or egg containing a half-copy of the genome.

Gene deletion: the total loss or absence of a gene.

Gene expression: the process by which a gene’s coded information is translated into the structures present and operating in the cell (either proteins or others); the action whereby combinations of proteins produce an observable effect or function in a particular individual. the observable effect or characteristic in the individual due to the interaction of various proteins that determines how the individual organism will appear and function.

Gene mapping: determining the relative positions of genes on a chromosome and the distance between them.

Gene Stacking: Combining traits (e.g., herbicide tolerance and insect resistance) in seed.

Gene testing: examining a sample of blood or other body fluid or tissue for biochemical, chromosomal, or genetic markers that indicate the presence or absence of genetic disease.

Gene therapy: treating disease by replacing, manipulating, or supplementing nonfunctional genes.

Gene: a unit of inheritance; a working subunit of DNA. Each of the body’s approximately 50,000 genes contains the code for a specific product, typically, a protein such as an enzyme.

Genetic Engineering: Very broadly, a technique used to alter or move genetic material (genes) of living cells. In the United States, under guidelines issued by Department of Agriculture’s Animal and Plant Health Inspection Service, genetic engineering is defined as the genetic modification of organisms by recombinant technology.

DNA techniques: Definitions used in Europe tend to be broader.

Genetic linkage maps: DNA maps that assign relative chromosomal locations to genetic landmarks—either genes for known traits or distinctive sequences of DNA—on the basis of how frequently they are inherited together. (See Physical maps.)

Genetically Modified Organism (GMO): An organism produced by genetic engineering techniques that allow the transfer of inherited characteristics from one organism to another, often between species. Bacteria, fungi, viruses, plants, insects, fish, and mammals are some examples of genetic material that have been artificially changed or altered in order to change some physical property or capability. Living modified organisms (LMOs), genetically engineered (GE) foods, and transgenic crops are other terms often used in place of GMOs.

Genetics: the scientific study of heredity; how particular qualities or traits are transmitted from parents to offspring; The term often is used broadly to indicate the ethical, social, and legal questions that result from the knowledge of genetic science and its application.

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Genome maps: charts that indicate the ordered arrangement of the genes or other DNA markers within the chromosomes.

Genome: The sum of the genetic material in the chromosomes of a particular organism; a complete set of haploid chromosomes.

Genotype: the actual gene carried by an individual (as distinct from phenotype—that is, the physical characteristics into which genes are translated).

Germ cells: the reproductive cells of the body, either egg or sperm cells.

Germline mutation: (See Hereditary mutation.)

GMO: GMO technically stands for Genetically Modified Organism and refers to any living form that has been modified by recombinant technology. However, the acronym GMO is sometimes loosely used, for instance to indicate plants and foods so modified.

Herbicide-tolerant Crops: Crops developed to survive certain herbicides. These crops previously would have been destroyed along with targeted weeds, but now can be used by farmers as an effective weed control. The most common herbicide tolerant crops (cotton, corn, soybeans, and canola) are marketed under such names as Roundup Ready (RR), resistant to glyphosate, a herbicide effective on many species of grasses, broadleaf weeds, and sedges; Liberty Link (LL) corn, resistant to glufosinate-ammonium; and BXN cotton, resistant to bromoxynil.

Hereditary mutation: a gene change in the body's reproductive cells (egg or sperm) that becomes incorporated in the DNA of every cell in the body; also called germline mutation. (See Acquired mutations.)

Human Genome Project: an international research effort (led in the United States by the National Institutes of Health and the Department of Energy) to sequence the base pairs, identify the genes, and understand the human genome. It includes efforts to address the ethical, legal, and social issues that arise from this knowledge. (See Genome.)

Huntington's disease: an adult-onset disease characterized by progressive mental and physical deterioration; it is caused by an inherited dominant gene mutation that affects brain chemistry.

Hurler-Scheie syndrome: an autosomal recessive disorder caused by inadequate production of an enzyme protein, characterized by facial and dental malformations, dwarfism, blindness from cataracts, and progressive dementia beginning at a few months of age.

Immunology: the study of the immune system which fights infection.

Imprinting: a biochemical phenomenon that determines, for certain genes, which one of the pair of alleles, the mother's or the father's, will be active in that individual.

In vitro fertilization (IVF): any of a number of methods of treating infertility by initially combining sperm and egg outside the body.

Inborn errors of metabolism: inherited diseases resulting from alterations in genes that code for enzymes.

Lesch-Nyhan syndrome: a genetic disorder due to lack of an enzyme, characterized by self-mutilation by biting.

Linkage analysis: a gene-hunting technique that traces patterns of heredity in large, high-risk families, in an attempt to locate a disease-causing gene mutation by identifying traits that are co-inherited with it.

Molecule: a group of atoms arranged to interact in a particular way; one molecule of any substance is the smallest physical unit of that particular substance.

Mutation: a change in the number, arrangement, or molecular sequence of a gene.

Neoplasm: abnormal new growths, either malignant cancers or benign tumors.

Newborn screening: examining blood samples from a newborn infant to detect disease-related abnormalities or deficiencies in gene products.



Norm (as a moral term): a pattern, precept, or rule for decision and action. In this usage the term does not refer to what may be statistically standard or normal practice; it refers instead to a principle for regulating or judging conduct.

Norm: a typical, average, or standard characteristic or behavior.

Nucleotide: A subunit of DNA or RNA, consisting of one chemical base plus a phosphate molecule and a sugar molecule.

Nucleus: the cell structure that houses the chromosomes.

Oncogenes: genes that normally play a role in the growth of cells but when overexpressed or mutated, can foster the growth of cancer.

Penetrance: a term indicating the likelihood that a given gene will actually result in disease.

Pharmacogenetics: the study of genetically-controlled variations in individual responses to drugs or products that use genetic susceptibility as part of the rationale for their use.

Pharmacogenomics: (See Pharmacogenetics.)

Phenotype: the observable characteristics of gene expression. (Compare with genotype.)

Phenylketonuria (PKU): an inborn error of metabolism caused by the lack of an enzyme, resulting in abnormally high levels of the amino acid phenylalanine; untreated, PKU can lead to severe, progressive mental retardation.

Physical maps: DNA maps showing the location of identifiable landmarks either genes or distinctive short sequences of DNA. The lowest resolution physical map shows the banding pattern on the 46 different chromosomes, while the highest resolution map depicts the complete nucleotide sequence of the chromosomes.

PKU: see Phenylketonuria

Plant Breeding: The technique of crossing plants to produce varieties with particular characteristics (traits) that are carried in their genes and passed on to future generations.

Predictive gene test: tests to identify gene abnormalities that may make a person susceptible to certain diseases or disorders.

Prenatal diagnosis: examining fetal cells taken from the amniotic fluid, the primitive placenta (chorion), or the umbilical cord for biochemical, chromosomal, or gene alterations.

Probe: a specific sequence of single-stranded DNA, typically labeled with a radioactive atom, which is designed to bind to, and thereby single out, a particular segment of DNA.

Prostate Specific Antigen (PSA): cell marker measured by blood test that can be used to screen men for prostate cancer.

Protein: a large, complex molecule composed of amino acids. The sequence of the amino acids—and thus the function of the protein—is determined by the sequence of the base pairs in the gene that encodes it. Proteins are essential to the structure, function, and regulation of the body. Examples are hormones, enzymes, and antibodies.

Recessive allele: a gene that is expressed only when its counterpart allele on the matching chromosome is also recessive (not dominant). Autosomal recessive disorders develop in persons who receive two copies of the mutant gene, one from each parent who is a carrier. (See Dominant allele.)

Recombinant DNA (rDNA): DNA produced using genetic engineering techniques. Such techniques involve transferring a DNA segment from one organism and inserting it into the DNA of another, possibly unrelated, organism.

Recombination: (See Crossing over.)

Reproductive cells: egg and sperm cells. Each mature reproductive cell carries a single set of 23 chromosomes.



Restriction enzymes: enzymes that can cut strands of DNA at specific base sequences.

RNA: a chemical similar to DNA. The several classes of RNA molecules play important roles in protein synthesis and other cell activities.

Screening: a medical test used for certain populations to screen for telltale products of genetic material known to cause disorder. The findings of a screen often include false positives and only an additional test can be determinative.

Sequencing: (See DNA sequencing.)

Sex chromosomes: the chromosomes that determine the sex of an organism. Human females have two X chromosomes; males have one X and one Y.

Sickle cell anemia: an inherited, potentially lethal disease in which a defect in hemoglobin, the oxygen-carrying pigment in the blood, causes distortion (sickling) and loss of red blood cells, producing damage to organs throughout the body. As a recessive gene, it can be expressed as either sickle cell trait when derived from only one parent or as a full-blown anemia when inherited from both.

Somatic cells: all body cells except the reproductive cells.

Somatic mutations: (See Acquired mutations.)

Tay-Sachs disease: an inherited disease of infancy characterized by profound mental retardation and early death; it is caused by a recessive gene mutation.

Toxic Knowledge: genetic information about a statistically probable onset of, or disposition to, a disease or disorder for which there is no cure.

Transcription: the process of copying information from DNA into new strands of messenger RNA (mRNA). The mRNA then carries this information to the cytoplasm, where it serves as the blueprint for the manufacture of a specific protein.

Transgenic Plants: Plants that result from the insertion of genetic material from another organism, generally through recombinant DNA techniques, to make the plant exhibit a desired trait.

Translation: the process of turning instructions from mRNA, base by base, into chains of amino acids that then fold into proteins. This process takes place in the cytoplasm, on structures called ribosomes.

Translocation: the swapping of a genetic material from one chromosome to another.

Trisomy: three copies of a chromosome per cell, which causes disease. one example. One example is Trisomy 21 (three copies chromosome 21), commonly known as Down Syndrome. Trisomy 18, or Edwards Syndrome, is another example.

Trisomy 18: see Edwards Syndrome

Trisomy 21: see Down Syndrome

Variable number of tandem repeats (VNTR): some sequences of DNA are repeated many times in a row. The number of repeats may not be identical in offspring. This can lead to disease and can be used in forensics to identify individuals.

X chromosome: a sex chromosome; normal females carry two X chromosomes.

Y chromosome: a sex chromosome; normal males carry one Y and one X chromosome.

Sources: *Understanding Gene Testing* National Institutes of Health, National Cancer Institute; *Genetic Testing and Screening* Division for Church in Society, ELCA; U.S. Department of Agriculture; Organization for Economic Cooperation and Development; U.S. Congress, Office of Technology Assessment.



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- Web sites: (These are included for general reference on the subject of genetic science)
- www.ornl.gov/hgmis/project/info.html;
- www.ornl.gov/TechResources/Human_Genome/home.html
- <http://biology.about.com/science/biology/msub6.htm>
- www.elca.org/dcs/genetics.study.html



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Ordering Information

For ELCA publications noted in the text

ELCA Resources

Genetic Testing & Screening: Critical Engagement at the Intersection of Faith and Science

A multi-authored volume on the issues surrounding genetics from a Christian perspective.

AFP 34-11-2108 (ISBN 1-886513-11-2), \$10.00 (1998)

Human Cloning: Papers from a Church Consultation

This multi-authored volume addresses the challenges posed by cloning from a faith-based perspective.

AFP 69-1550 (ISBN 6-0001-3165-8), \$5.00 (2001)

The Promise of Lutheran Ethics

A multi-authored volume on the Lutheran approach to ethics.

AFP 1-3132 (ISBN 0-8006-3132-3), \$18.00 (1998)

Talking Together as Christians about Tough Social Issues

A six-session introduction on how to begin conversation on tough social issues.

AFP 69-8681 (ISBN 6-0001-1197-5), \$1.00 (1999)

ELCA Social Statements

A Social Statement on Abortion

The ELCA's social statement on abortion.

AFP 69-0062, 15¢ (1991)

A Social Statement on Caring for Creation: Vision, Hope, and Justice

The ELCA's social statement on the environment.

AFP 69-1380, 10¢ (1993)

The Church in Society: A Lutheran Perspective

The ELCA's social statement on church in society.

AFP 69-2102, 10¢ (1991)

A Social Statement on Economic Life: Sufficient, Sustainable Livelihood for All

The ELCA's social statement on economic life.

AFP 69-8615, 35¢ (1999)

ELCA Procedural Documents

Policies and Procedures of the Evangelical Lutheran Church in America for Addressing Social Concerns

Details the manner in which the ELCA chooses a social topic to study and the processes it goes through to make it ELCA policy.

AFP 69-7440, 25¢ (1998)

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Single, complimentary copies of these resources (excluding *Genetic Testing & Screening*) may be ordered by calling the Division for Church in Society's toll-free resource line at 800-638-3522 ext. 2996, or by writing to: Dept. for Studies, Evangelical Lutheran Church in America, 8765 W. Higgins Rd., Chicago, IL 60631-4190.

Multiple copies (and *Genetic Testing & Screening*) may be ordered from Augsburg Fortress, Publishers by calling 800-328-4648.

This publication is available for free download at www.elca.org/dcs/genetics.study.html



