Medical Triage: Code Tags and Triage Terminology

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Triage refers to the evaluation and categorization of the sick or wounded when there are insufficient resources for medical care of everyone at once. Historically, triage is believed to have arisen from systems developed for categorization and transport of wounded soldiers on the battlefield. Triage is used in a number of situations in modern medicine, including:

- In mass casualty situations, triage is used to decide who is most urgently in need of transportation to a hospital for care (generally, those who have a chance of survival but who would die without immediate treatment) and whose injuries are less severe and must wait for medical care.

- Triage is also commonly used in crowded emergency rooms and walk-in clinics to determine which patients should be seen and treated immediately.

- Triage may be used to prioritize the use of space or equipment, such as operating rooms, in a crowded medical facility.

In a walk-in clinic or emergency department, an interview with a triage nurse is a common first step to receiving care. He or she generally takes a brief medical history of the complaint and measures vital signs (heart rate, respiratory rate, temperature, and blood pressure 📷) in order to identify seriously ill persons who must receive immediate care.

In a hospital, triage might prevent an operation for an elective facelift from being performed if there are numerous emergent cases requiring use of operating facilities and surgical nursing staff.

In a disaster or mass casualty situation, different systems for triage have been developed. One system is known as START (Simple Triage and Rapid Treatment). In START, victims are grouped into four categories, depending on the urgency of their need for evacuation. If necessary, START can be

implemented by persons without a high level of training. The categories in START are:

- the deceased, who are beyond help
- the injured who could be helped by immediate transportation
- the injured with less severe injuries whose transport can be delayed
- those with minor injuries not requiring urgent care.

Another system that has been used in mass casualty situations is an example of advanced triage implemented by nurses or other skilled personnel. This advanced triage system involves a color-coding scheme using red, yellow, green, white, and black tags:

- **Red tags** - (immediate) are used to label those who cannot survive without immediate treatment but who have a chance of survival.
- **Yellow tags** - (observation) for those who require observation (and possible later re-triage). Their condition is stable for the moment and, they are not in immediate danger of death. These victims will still need hospital care and would be treated immediately under normal circumstances.
- **Green tags** - (wait) are reserved for the "walking wounded" who will need medical care at some point, after more critical injuries have been treated.
- **White tags** - (dismiss) are given to those with minor injuries for whom a doctor's care is not required.
- **Black tags** - (expectant) are used for the deceased and for those whose injuries are so extensive that they will not be able to survive given the care that is available.

Genetic Diseases

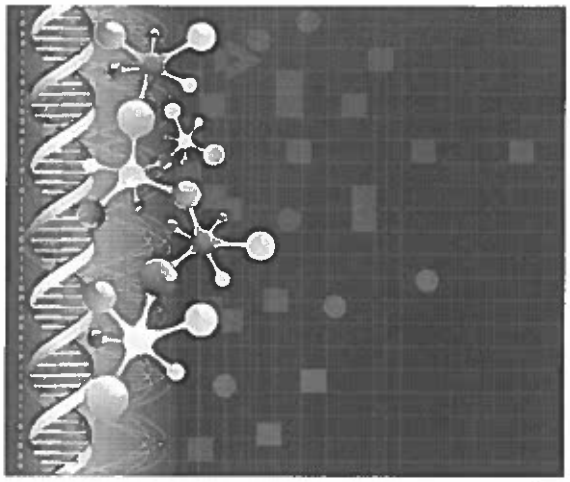


Photo by: Zlatko Guzmic

Genetic diseases are disorders that are inherited by a person from his or her parents or are related to some type of spontaneous genetic change.

KEYWORDS

for searching the Internet and other reference sources

Birth defects

Gene therapy

Genetic counseling

Genetics

Hereditary diseases

Human genome

Prenatal diagnosis

What Is Heredity?

Every person develops under the influence of a mix of genes inherited from his or her mother and father. These genes, or small parts of chromosomes, determine the architecture and activity of the entire body. They determine visible characteristics, such as eye color, skin color, and height, as well as traits that cannot be seen, such as the likelihood of certain diseases, the chemicals made by the body, and the functioning of body systems.

Normally, each cell in the body contains two copies of each gene: one that originally came from the egg of the mother and one from the sperm of the father. In many instances, these two copies are slightly different from each other. The result is a child who has some characteristics from the mother and some from the father, but who is never identical to either parent.

Because there are two copies, a gene that works normally usually can make up for one that has a defect. For example, a gene with a defect that causes a particular disease may be passed through generations of a family without causing illness. That is because the normal gene in the pair may work well enough to mask the defect. However, if a child inherits two genes with the defect, the child will develop the illness. This explains how a child with the disease can be born to parents without it.

What Causes Genetic Diseases?

Genetic disorders can be inherited, in which case people are born with them, even if they are not noticeable at first. Some disorders, however, are not inherited but develop spontaneously when disease-causing mutations * occur during cell division *. These also are genetic disorders, because they involve changes in the genes.

Some inherited genetic disorders, such as cystic fibrosis (/knowledge/Cystic_fibrosis.html) * and phenylketonuria * (PKU), are caused simply by the inheritance of genes that do not work properly. In other disorders, however, genetic and environmental factors seem to work together to cause changes in otherwise normal genes. For example, some forms of radiation or chemicals can cause cancer in people who are prone to be affected because of their genetic makeup.

- **mutations** (mu-TAY-shuns) are changes in a chromosome (/knowledge/Chromosome.html) or a gene.
- **cell division** is the process by which a cell divides to form two daughter cells, each of which contains the same genetic material as the original cell.
- **cystic fibrosis (../Conj-Dys/Cystic-Fibrosis.html)** (SIS-tik fi-BRO-sis) is a genetic disorder of the body's mucus-producing glands. It mainly affects the respiratory and digestive systems of children and young adults.
- **phenylketonuria** (fen-ul-ke-ton-Uree-a), or PKU for short, is a genetic disorder of body chemistry that, if left untreated, causes mental retardation.
- **genetics** is the branch of science that deals with heredity and the ways in which genes control the development and maintenance of organisms.

How Are Diseases Inherited?

The beginning of modern genetics

Gregor Mendel (/knowledge/Gregor_Mendel.html) (1822-1884) is considered the father of modern genetics . Mendel was an Austrian monk. While growing peas in the monastery garden, Mendel noted that certain traits appeared in offspring in predictable patterns, and he began to understand the basic rules of inheritance. These rules are called Mendelian (men-DEL-ee-an) law.

Under Mendelian law, a dominant (DOM-i-nant) trait is one that appears even when the second copy of the gene for that trait is different. For example, for the seeds of Mendel's peas, "smooth" is dominant over "wrinkled." Thus, if a pea plant contains one gene for smooth and one for wrinkled, the seed will be smooth. Wrinkled is a recessive (re-SES-iv) trait, which is one that only appears when two copies of it are present.

Dominant and recessive genes

Normally, each person has two copies of every gene, one from the mother and one from the father. A physical feature or a disorder carried by genes can be either a dominant (G) or a recessive (g) trait. If the affected gene is dominant, a person with one or two copies of the gene will have the disorder. Therefore, a person with the patterns (GG) or (Gg) will be affected, but (gg) will not be affected by the disorder. Two copies of a dominant gene produce a much more serious form of the disorder.

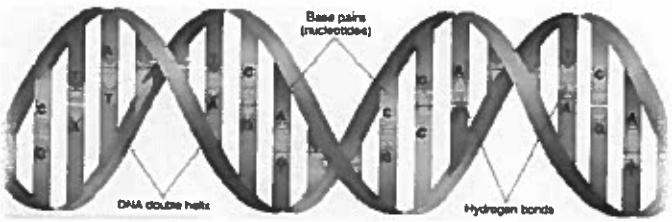
If the affected gene is recessive, only a person with two copies of the gene will have the disorder. Therefore, a person with the pattern (gg) will be affected, but (GG) and (Gg) will not be affected by the disorder.

Autosomal and sex-linked traits

Of the 23 pairs of chromosomes in human cells, 22 are autosomes (AW-to-somes), or non-sex chromosomes. The other pair contains the two sex chromosomes, which determine a person's gender. Females have two X chromosomes (XX), and males have one X and one Y chromosome (/knowledge/Y_chromosome.html) (XY). The reproductive cells, or eggs and sperm, each have only one set of 23 chromosomes. While an egg always carries an X chromosome, a sperm cell can carry either an X or a Y, so it is the sperm that determines gender.

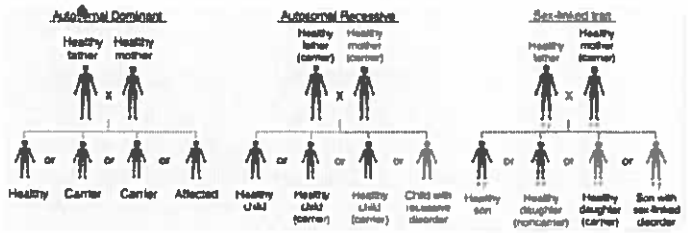
A Genetic Glossary

- **Cells:** The units that comprise living beings. The human body is made of about 60 trillion cells.
- **Nucleus:** A membrane-bound structure inside cells that contains DNA.
- **Chromosomes:** DNA is packaged into units called chromosomes. Humans have 23 pairs of chromosomes, for a total of 46.
- **DNA (deoxyribonucleic acid):** A double-stranded molecule, made of chemical bases called nucleotides, that contains the genetic code necessary to build a living being.
- **Genes:** Segments of DNA located on the chromosomes. Genes are the units of heredity. They help determine a person's characteristics, from eye color to how various chemicals work in the body.
- **Genome:** An animal's entire collection of genes. The human genome contains 50,000 to 100,000 genes.



DNA is a double-stranded molecule that is twisted in a spiral shape, known as a double helix. DNA is made of chemicals called nucleotides that occur in pairs: adenine (A) with thymine (T), and guanine (G) with cytosine (C).

Inherited genetic disorders that are carried on the sex chromosomes are referred to as sex-linked. Disorders carried on the other chromosomes are referred to as autosomal (aw-to-SOME-al). In general, autosomal disorders are likely to affect males and females equally, but sex-linked disorders usually affect males more often than females. This gender difference has to do with the fact that males have only one X chromosome. The X chromosome



Three common inheritance patterns.

carries genes for which there is no second copy on the Y. Therefore, a male has only one copy of these genes. If his copy is damaged or defective, he has no normal copy to override or mask the defective one. Depending on the problem with the gene, the result can be an X-linked disorder.

What Are the Common Inheritance Patterns of Genetic Diseases?

Single-gene autosomal diseases

Most genetic disorders are caused by defective genes on the autosomes. If an autosomal genetic disorder is caused by a problem with a single gene, then the following rules of inheritance usually apply. There are exceptions to these rules, but they are useful guidelines for understanding inheritance. In an autosomal dominant disorder:

- It takes only one copy of the gene to cause the disorder. So if a child inherits the disease, at least one of the parents has the disease as well.
- It is possible for the gene to change by itself in the affected person. This change is called a mutation.
- Unaffected children of a parent with the disorder have unaffected children and grandchildren.

* **carrier** is a person who has one copy of the defective gene for a recessive disorder. Carriers are not affected by the disorder, but they can pass on the defective gene to their children.

In an autosomal recessive disorder:

- If two people without the disorder have a child with the disorder, both parents carry one copy of the abnormal gene.
- If a person with the disorder and a carrier * have a child, there is a fifty-fifty chance that the child will have the disorder. Any child without the disorder will be a carrier.
- If a person with the disorder and a noncarrier have children, all of the children will be carriers but will not have the disorder.
- If two people with the disorder have children, all of the children will have the disorder.

Single-gene sex-linked diseases

More than 150 disease traits are carried on the X chromosome. X-linked dominant disorders are rare. In an X-linked recessive disorder:

- Nearly all people with sex-linked disorders are male. The disorder is transmitted through the female, because a son's X chromosome always comes from his mother. She is unaffected, however, because she has a second X chromosome which usually contains a normal gene for the trait.
- A male with the disorder never transmits it to his sons, because a father passes his X chromosome only to his daughters.
- A son born to a female carrier has a fifty-fifty chance of having the disorder.
- All daughters of an affected male will be carriers.

Multiple-gene diseases

Many disorders are exceptions to the Mendelian laws of inheritance. Genetic disorders caused by a combination of many genes are called multifactorial (mul-tee-fak-TOR-e-al) disorders. In addition, some disorders show reduced penetrance (PEN-e-trance), which means that a gene is not wholly dominant or recessive. For example, a person who has one recessive gene for a disorder might show milder symptoms of the disorder, but someone with two copies will have the full-blown disorder.

Chromosome disorders

Other genetic disorders are caused by extra or missing chromosomes. In Down syndrome *, a person has three copies of chromosome 21, rather than the usual two copies. In a disease called cri du chat *, a piece of chromosome 5 is missing. In Turner syndrome *, which affects only girls, all or part of an X chromosome is missing. In most cases, chromosome disorders are not inherited. Instead, the problems occur for unknown reasons when the egg and sperm meet to form the embryo.

Spontaneous (new) genetic mutations

Particularly in the case of dominantly-inherited disorders, a child may be born with a condition despite the fact that neither parent has the disorder as would be expected. When this happens, it is usually because a spontaneous (or new) mutation in a gene or genes has occurred. The mutation may occur in a parent's egg or sperm cell, or it may occur after the egg has been fertilized and begins to develop into an embryo. This is frequently the case in achondroplasia (/knowledge/Achondroplasia.html) (a-kon-dro-PLAY-zha), a form of dwarfism in which 90 percent of children born with the condition have unaffected parents. When this child grows up, the child will pass the gene on to his or her children according to the autosomal dominant inheritance (/knowledge/Dominance__genetics_.html) pattern described above.

* **Down syndrome** is a genetic disorder that can cause mental retardation, shortness, and distinctive facial characteristics, as well as many other features.

* **criduchat** (kree-doo-SHA), French for "cat's cry," is a genetic disorder that can cause mental retardation, a small head, and a cat-like whine.

* **Turner syndrome** is a genetic disorder that can cause several physical abnormalities, including shortness, and lack of sexual development.

The Past and Future of Genetic Diseases

Mendel figured out the basic concepts of inheritance in the 1800s, before people knew that genes are the units of inheritance. It was not until 1953 that the structure of DNA was described. From the 1980s to the present, scientists' understanding of genes and how they work has grown at an incredibly rapid pace. Many disease-causing genes now have been identified, opening the door to research on ways to fix genetic defects. This field of science is referred to as gene therapy.

Gene therapy

Genetic disorders can be treated in a number of ways. In some disorders, special diets are used to prevent the buildup in the body of compounds that are toxic to patients. In other disorders, the treatment involves blocking or rerouting chemical pathways. A third kind of treatment is new and controversial. It involves actually replacing defective genetic material with normal genetic material inside the cells. Researchers currently are looking for ways to do this. A variety of methods are being considered, including the use of microscopic "bullets" coated with genetic material and viruses to deliver normal genes to cells.

Prenatal testing

A fetus * can be tested for many genetic disorders before it is born. Tests for prenatal (before birth) diagnosis are done on samples taken from the tissue or fluid surrounding a fetus. The fetus's chromosomes then can be studied using a karyotype (KAR-e-o-type), which is a visual display of the chromosomes from cells viewed under a microscope. Newer techniques enable scientists and doctors to look directly at the DNA that makes up the genes contained in the chromosomes. Common prenatal tests include:

- Amniocentesis (am-nee-o-sen-TEE-sis): In amniocentesis, a needle is passed through the mother's belly into her uterus * to collect some of the fluid in which the fetus lives. This fluid, called amniotic fluid, contains cells from the fetus.
- Chorionic villus (kor-e-ON-ik VIL-us) sampling (CVS): CVS also involves collecting cells from the fetus with a needle. In this case, the cells are taken from the chorionic villi, which are structures in the uterus that are part of the placenta.
- Percutaneous umbilical (per-ku-TAY-ne-us um-BIL-i-kal) blood sampling (PUBS): In PUBS, fetal blood is taken from the umbilical cord * .

* **fetus** (FEE-tus) in humans is the developing offspring from nine weeks after conception until birth.

* **uterus** (U-ter-us), also called the womb, is the organ in a woman's body in which a fertilized egg develops into a fetus.

* **umbilical cord** (um-BIL-i-kal cord) is the flexible cord that connects a fetus at the navel with the placenta, the organ that allows for the exchange of oxygen, nutrients, and other substances between mother and fetus.

Inheritance Patterns of Some Genetic Diseases

Autosomal dominant	Autosomal recessive	X-linked dominant	X-linked recessive	Multiple genes
Achondroplasia	Albinism	Diabetes insipidus (one form)	Color blindness	Alzheimer's disease
Huntington's disease	Cystic fibrosis		Hemophilia	Some cancers (breast, colon, lung)
Neurofibromatosis (/knowledge/Neurofibromatosis.html)	Phenylketonuria (PKU)		Hunter's syndrome	
	Sickle-cell anemia		Muscular dystrophy (Duchenne type)	Gout
	Tay-Sachs disease			Rheumatoid arthritis (/knowledge/Rheumatoid_arthritis.html)

Genetic testing and counseling

Geneticists believe that each person probably carries about 5 to 10 defective recessive genes. Thus, both potential parents may be worried about having a child with birth defects. If relatives have genetic disorders—or if ethnic or other background factors increase the risk of certain genetic diseases—parents-to-be may worry even more.

Many medical centers now offer genetic testing and genetic counseling. Parents and relatives can be tested to determine whether they carry genes for a variety of disorders. Using this information, a genetic counselor can help couples calculate genetic risks realistically, and inform them about the options they may have to increase the likelihood of having a healthy child.

Ethical

concerns Increasingly, people will have the option to be tested to find out if they carry genes for genetic disorders. For example, women now can find out if their unborn children have certain genetic defects (/knowledge/Genetic_disorder.html) or if they themselves have genes that make them more likely to develop breast cancer. Already there is controversy about how this information should be used. Genetic testing can have far-reaching social, financial, and

ethical effects. For example, a woman who thinks she will develop breast cancer might opt not to have children, or she might decide to have her breast tissue removed before cancer cells develop, or her insurance company might decide not to insure (/knowledge/Insurance.html) her because she is a high-risk client. With knowledge comes responsibility, and genetic testing surely will be at the forefront of debates about medical ethics in the twenty-first century.

Resources

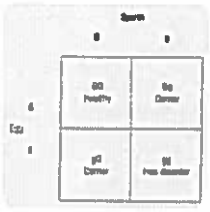
Books

Baker, Catherine. *Your Genes, Your Choices.* Washington, DC: American Association for the Advancement of Science, 1997. A clear introduction to the ethical, legal, and social issues raised by genetic research. The full text of this book can be found on the association's website.
http://www.aaas.org (http://www.aaas.org)

Jackson, John F *Genetics and You.* Totowa, NJ: Humana Press, 1996. This book explains the basic principles of genetics, genetic counseling, and prenatal testing.

Punnett Squares

Punnett squares often are used to visualize the chances of inheriting a particular gene. Using G for a healthy gene and g for an affected recessive gene, the Punnett Square shows which offspring are likely to inherit two healthy genes, which offspring are likely to be carriers of the gene, and which are likely to have the disorder caused by the defective gene.



Organizations

Alliance of Genetic Support Groups, 4301 Connecticut Avenue Northwest, Number 404, Washington, DC 20008-2304. This national organization is an alliance of support groups for people who have or who are at risk for genetic disorders.
Telephone 800-336-GENE
http://www.geneticalliance.org (http://www.geneticalliance.org)

March of Dimes Birth Defects Foundation, 1275 Mamaroneck Avenue, White Plains, NY 10605. This large, national organization provides

information about genetic birth defects.
Telephone 888-MODIMES
http://www.modimes.org (http://www.modimes.org)

U.S. National Human Genome Research Institute, 31 Center Drive, Building 31, Room 4B09, MSC 2152, Bethesda, MD 20892. This government institute is home to the Human Genome Project, an international research effort aimed at mapping the human genome.
http://www.nhgri.nih.gov (http://www.nhgri.nih.gov)

U.S. National Center for Biotechnology Information, National Library of Medicine, Building 38A, Room 8N805, Bethesda, MD 20894. This division of the U.S. National Library of Medicine provides detailed information about genes and genetic diseases.
http://www.ncbi.nlm.nih.gov (http://www.ncbi.nlm.nih.gov)

See also
Albinism
(../A-As/Albinism.html)
Alzheimer's Disease (../A-As/Alzheimer-s-Disease.html)
Birth Defects (../At-Ca/Birth-Defects.html)
Breast Cancer (../At-Ca/Breast-Cancer.html)
Color Blindness (../Cank-Con/Color-Blindness.html)
Colorectal Cancer (../Cank-Con/Colorectal-Cancer.html)
Cystic Fibrosis (../Conj-Dys/Cystic-Fibrosis.html)
Down Syndrome (../Conj-Dys/Down-Syndrome.html)
Dwarfism (../Conj-Dys/Dwarfism.html)
Growth Disorders (../Gas-Hep/Growth-Disorders.html)
Hemophilia (../Gas-Hep/Hemophilia.html)
Huntington's Disease (../Her-Kid/Huntington-s-Disease.html)
Muscular Dystrophy (../Men-Os/Muscular-Dystrophy.html)
Neurofibromatosis (../Men-Os/Neurofibromatosis.html)
Phenylketonuria (../Pan-Pre/Phenylketonuria-PKU.html)
Sickle-Cell Anemia (../Se-Sy/Sickle-cell-Anemia.html)
Tay-Sachs Disease (../T-Ty/Tay-Sachs-Disease.html)
Turner Syndrome (../T-Ty/Turner-Syndrome.html)