Genetic Diseases (Karyotype noticed and more)

Turner Syndrome

Females with this syndrome have normal intelligence, are usually short in stature, and will not go through puberty without hormone therapy so are sexually underdeveloped. They also have Folds of skin on the back of the neck, wide-spaced nipples, a narrow aorta, many pigmented moles, and malformed elbows.

Because their ovaries fail to develop normally, almost all females with Turner syndrome are infertile. Those treated with hormones lead fairly normal lives.
Karyotype for individuals with Turner syndrome is generally 45, XO.
Occurance is 1:2000 females; 97% die before birth.

Klinefelter Syndrome

Occurance is ~1.2 in 1000 males. In Most Klinefelter Syndrome patients the karyotype is a 47, XXY, but in ~ 20% is 48, XXXY. Males with Klinefelter syndrome have low to average intelligence. Most appear normal at birth, but may develop breast tissue and female sexual characteristics. There may be an increased risk of psychotic disorders and adaptabiltiy disorders. Klinefelter males are slow to learn and individuals with additional X's (XXXY) may be intellectually handicapped.

Down Syndrome

This condition is best known as Down syndrome but the name "Trisomy 21" is the most technically correct term. Incidence is between ~1:800 births and 1:1250 births. Many infants with this condition have poor muscle tone, a round flat face, protuding tongue,upward slanting eyes, small ears (perhaps without earlobes), flat nasal bridge, and stubby fingers. The degree of mental retardation varies greatly. For some it is minimal; for others it is substantial. Many also have a congenital heart defect. In 95% of cases, the karyotype is 47, XY,+21 or 47, XX,+21. The remaining 5% are translocaitons, mosaicisms, or partial trisomies. The risk of having a baby with Trisomy 21 depends on the age of the mother when the baby is born. The older the mother, the higher the risk.

Edward Syndrome

Sometimes called "Edwards's syndrome" but the name "Trisomy 18" is preferred. Incidence is ~1:8,000 births. Many infants with this condition have unusually shaped ears, protruding eyes, rocker bottom feet, and die very young (most before 1 year old). If the individual does survive there will be severe mental retardation. In 80% of cases, the karyotype is 47, XY,+18 or 47, XX,+18; 10% are mosaic, and the remaining 10% involve translocations or double aneuploidies like 48, XXY,+18.

Patau Syndrome

This is sometimes referred to as "Patau syndrome" but the name "Tisomy 13" is preferred. Incidence is estimated to be between 1:2,000 to 1:14,000 births. Most infants with this condition have cleft lip and/or cleft palate, extremely small eyes, extra digits, and die very young (most before 1 year old). Heart conditions and defects are common. Those that survive have severe mental retardation and no sense of smell due to missing olfactory bulbs. In 80% of cases, the karotype is 47, XY,+13 or 47, XX,+13. The remaining 20% are either mosaic or trisomy due to a translocation.

Jacobs Syndrome

Occurance is approximately 1 in 800 to 1 in 1000 male births. It is believed that individuals with this karyotype tend to have more volitile/criminalistic behavior, though most appear normal. These males tend to be tall and may have speech and reading problems. The karyotype involves having an extra Y chromosome (47, XYY). There is a normal life expectancy.

Trisomy X

Incidence is 1:1250 female births. Individuals with this karyotype are prone to fertility problems. Studies also have suggested the possibility of increased risk for skizophrenia.

Triple-X individuals are tall and thin and have menstrual irregularities. Their IQ is in the normal range but it is slightly reduced.

Additional X chromosomes are associated with an increased intellectual disability.

Cri-du-chat

Occurence is ~1:216000 births. There is an improperly developed larynx which causes a cat-like cry and a high arched palate. Individuals with this abnormality generally have a normal life expectancy, but will be retarded with IQ's less than 20 (they are intellectually handicapped.) Some never learn to talk with this genetic disorder and have congenital heart disease.

Cri du chat syndrome is due to a deletion of a portion of chromosome 5.

Some Common Genetic Diseases more difficult to see on a Karyotype:

Hemophilia

The word hemophilia derived from two Greek words: haima, meaning blood, and philia, meaning affection. People with hemophilia lack a clotting factor in their blood and as a result, their blood does not form clots normally. He/She does not bleed more profusely or more quickly than other people; however, he/she bleeds for a longer time. External wounds are usually not serious. Far more important is internal bleeding (hemorrhaging). These hemorrhages are in joints, especially knees, ankles and elbows; and into tissues and muscles. When bleeding occurs in a vital organ, especially the brain, a hemophiliac's life is in danger.

Incidence is 1:10,000 for hemophilia A and 1:50,000 for hemophilia B.

Most (75%) have hemophilia A, a lack of clotting factor VIII. Hemophilia B- "Christmas Disease" is a defect in clotting factor IX.

Fragile X

Fragile X Syndrome is the most common form of inherited intellectual disability in boys.

The characteristic long, narrow face becomes more pronounced with age.

The symptoms of fragile-X syndrome appear to be caused by an abnormal number of repeats (CCG) on the X chromosome. Normal DNA has 6 - 54 copies of "CCG" at the locus in question. Carrier males have 55 - 200 copies. This is referred to as a premutation (pre-fragile-X). The full mutation involves more than 200 repeats of CCG.

The chance of being affected increases in successive generations because extra copies of CCG are added during the gamete-formation process.

Females are more likely to add repeats than males.

Intellectual problems are more common if the fragile X is inherited from the mother.

Fragile-X is more common in males because males inherit their only X chromosome from their mother.

The repeats cause the X to have a thread-like portion. It is called a fragile site because it breaks if cultured under certain conditions in the laboratory.

Cystic Fibrosis (CF)

Thick mucous forms in the digestive tract and lungs of people with CF. As a result, they have difficult breathing and are susceptible to lung infections.

The median life expectancy for babies born with cystic fibrosis is 37 years.

The gene that causes the disease is on chromosome 7. One particular mutation of this allele causes 70-75% of the cases.

It is somewhat difficult to detect prenatally.

Cystic fibrosis is the most common lethal genetic disease among Caucasians in the US.

One in 25 is a carrier; one in 2500 is affected.

Tay Sachs

Tay-Sachs is caused by the absence of a vital enzyme called hexosaminidase-A (Hex-A). Without Hex-A, a fatty substance, or lipid, called GM2 ganglioside accumulates abnormally in cells, especially in the nerve cells of the brain.

A baby with Tay-Sachs disease appears normal until about six months of age when its development slows. By about two years of age, most children experience recurrent seizures and diminishing mental function. The infant gradually regresses, and is eventually unable to crawl, turn over, sit or reach out. The child becomes blind, can no longer swallow, becomes cognitively impaired, paralyzed and non-responsive. This leads to death by age 4 or 5, there is no cure.

Treatment involves managing the symptoms of the disease.

It is due to a single defective enzyme which normally digests the fatty material.

Heterozygotes are not affected and are resistant to tuberculosis.

Prenatal diagnosis is available.

It is a common genetic disease among the Jewish population in the US (central and eastern European descent). Up to 11% are carriers. It is also common in people of French-Canadian or Cajun descent.

In the Ashkenazi Jewish population, the incidence of Tay-Sachs disease is 1 in 3,600. The incidence of this disorder in other populations is 1 in 360,000.

PKU - Phenylketonuria

PKU is a recessive genetic disease in which the person does not have the ability to break down the amino acid phenylalanine. The level of phenylalanine in the persons blood builds up and interferes with the development of the nervous system.

Children that are raised on a phenylalanine-restricted diet may develop normally but children that are not raised on a special diet will become severely intellectually handicapped. The diet should be followed for life because high phenylalanine levels affect cognitive functioning.

Genetic screening is the routine testing of individuals for specific genotypes. Newborns in U.S. hospitals are screened for PKU.

The incidence of PKU in the United States is 1 in 13,500 to 1 in 19,000.

Hemochromatosis

Hemochromatosis is a disease that causes the body to absorb more iron from food than normal. High iron levels can lead to organ damage if it is left untreated for many years.

Symptoms include joint pain, fatigue, and abdominal pain.

There are two different mutations of the gene that causes hemochromatosis (the HFE gene) and the severity of symptoms depends on the mutations that are inherited.

One in 200 people in the United States carry the gene and it is the most common genetic disease in people of northern European descent.

There is also a form of this disease that is not due to genetic factors, it is acquired epigenetically.

Huntington’s Disease

The brain cells of Huntington's victims slowly degenerate, producing jerking/twitching muscles, slurred speech, swallowing difficulty, loss of balance, mood swings, reasoning and memory loss, incapacitation, and eventually death (usually from pneumonia or heart failure).

The onset of Huntington’s disease is typically 35 to 45 years. A diagnostic test is available.

It is caused by a repeated DNA sequence (AGC). The normal allele has 11-34 copies; affected people have 42 - 120 copies. People who are most at risk inherit the gene from their father. The severity and time of onset depends on the number of repeats.

The gene is on chromosome 4.

Duchenne Muscular Dystrophy

Duchenne's is the most common and most severe form of muscular dystrophy.

Incidence is: 1 in 5,000 live male births

Muscular deterioration begins between ages 3 to 5.

Affected individuals are confined to a wheelchair by age 12 and rarely survive past age 20.

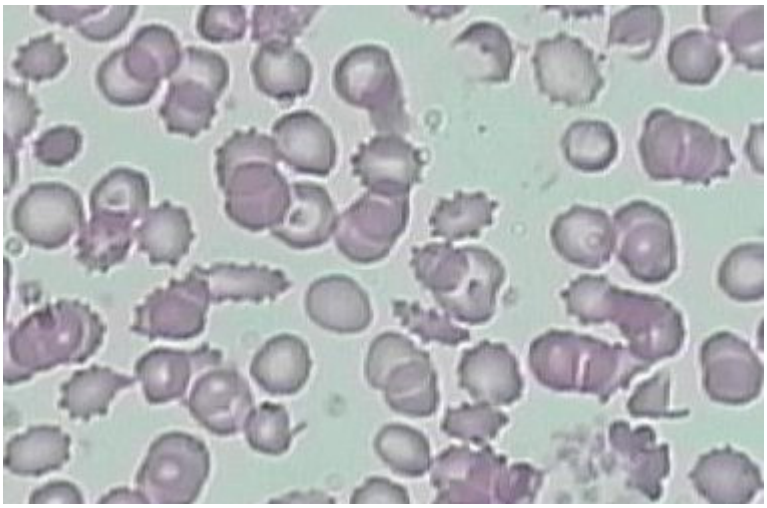
Death is usually due to breathing or heart problems.

It is transmitted primarily by female carriers (males rarely reproduce due to early death age.)

Sickle-Cell Anemia

Sickle-cell anemia is an abnormality of hemoglobin, the molecule that carries oxygen in our blood. Hemoglobin is contained within red blood cells. When the oxygen concentration in the hemoglobin molecules becomes low, the molecules stick together forming long rods that distort the cell (picture below). The cells break down or clog blood vessels causing pain, poor circulation, jaundice, anemia, internal hemorrhaging, low resistance, and damage to internal organs.

Death usually occurs before age 50.



Heterozygotes (carriers) are not affected with anemia and are resistant to malaria.

Eight to ten percent of African Americans carry the allele (have sickle-cell trait).