

For other uses, see [Twin \(disambiguation\)](#) and [Twins \(disambiguation\)](#).



[Marian and Vivian Brown](#), identical twins, photographed by [Christopher Michel](#)

Twins are two [offspring](#) produced by the same [pregnancy](#).^[1] Twins can be either *monozygotic* ("identical"), meaning that they develop from one [zygote](#), which splits and forms two [embryos](#), or *dizygotic* ("fraternal"), meaning that they develop from two different eggs. In fraternal twins, each twin is fertilized by its own sperm cell.^[2]

In contrast, a [fetus](#) that develops alone in the womb is called a *singleton*, and the general term for one offspring of a [multiple birth](#) is *multiple*.^[3]

Statistics

The human twin birth rate in the United States rose 76% from 1980 through 2009, from 18.9 to 33.3 per 1,000 births.^[4] The [Yoruba](#) have the highest rate of twinning in the world, at 45–50 twin sets (or 90–100 twins) per 1,000 live births,^{[5][6][7]} possibly because of high consumption of a specific type of [yam](#) containing a natural [phytoestrogen](#) which may stimulate the [ovaries](#) to release an egg from each side.^{[8][9]}

In [Central Africa](#) there are 18–30 twin sets (or 36–60 twins) per 1,000 live births.^[10] In [Latin America](#), [South Asia](#), and [Southeast Asia](#), the lowest rates are found; only 6 to 9 twin sets per 1,000 live births. North America and Europe have intermediate rates of 9 to 16 twin sets per 1,000 live births.^[10]

Multiple pregnancies are much less likely to carry to full term than single births, with twin pregnancies lasting on average 37 weeks, three weeks less than full term.^[11]

Women who have a family history of fraternal twins have a higher chance of producing fraternal twins themselves, as there is a genetically linked tendency to hyper-[ovulate](#). There is no known

genetic link for identical twinning.^[12] Other factors that increase the odds of having fraternal twins include maternal age, fertility drugs and other fertility treatments, nutrition, and prior births.^[13]

Types of Twins & Zygosity

The vast majority of twins are either dizygotic (fraternal) or monozygotic (identical). Less common variants are discussed further down the article.

Twins can be:

- Female-female -- sometimes called sororal twins
- Male-male twins -- no special name
- Male-female twins -- most common pairing; half of all fraternal (dizygotic) twins are male-female

Among non-twin births, male singletons are slightly (about five percent) more common than female singletons. The rates for singletons vary slightly by country. For example, the sex ratio of birth in the US is 1.05 males/female,^[14] while it is 1.07 males/female in Italy.^[15] However, males are also more susceptible than females to die in utero, and since the death rate in utero is higher for twins, it leads to female twins being more common than male twins.

Zygosity is the degree of identity in the **genome** of twins.

common name	scientific name	zygosity	Development	Occurrence	Identification	Health
identical	monozygotic	x	x	x	x	x
fraternal	dizygotic	x	x	x	x	x
half-identical	x	x	x	x	x	x
mirror image	x	x	x	x	x	x
mixed chromosome	x	x	x	x	x	x
superfecundation	x	x	eggs are fertilized during different acts of intercourse	x	x	x
superfetation	x	x	a woman gets pregnant again while already pregnant, resulting in multiple	x	x	x

			fetuses at differing developmental stages			
parasitic twin	x	x	x	x	x	by definition only healthy fully formed fetus
vanishing twin	fetal resorption, twin embolisation syndrome	x	x	up to 1 of every 8 multifetus pregnancies	x	by definition only healthy fully formed fetus
polar body	x	x	x	x	x	x
conjoined twin	x	x	x	x	x	ranges from normal to compromised

Dizygotic (fraternal) twins



Eight-month-old sororal twins napping

Dizygotic (DZ) or fraternal twins (also referred to as "non-identical twins", "dissimilar twins", "biovular twins", and, informally in the case of females, "sororal twins") usually occur when two **fertilized** eggs are implanted in the uterus wall at the same time. When two eggs are independently fertilized by two different **sperm** cells, fraternal twins result. The two eggs, or ova, form two **zygotes**, hence the terms *dizygotic* and *biovular*. Fraternal twins are, essentially, two ordinary siblings who happen to be born at the same time, since they arise from two separate eggs fertilized by two separate sperm, just like ordinary siblings.

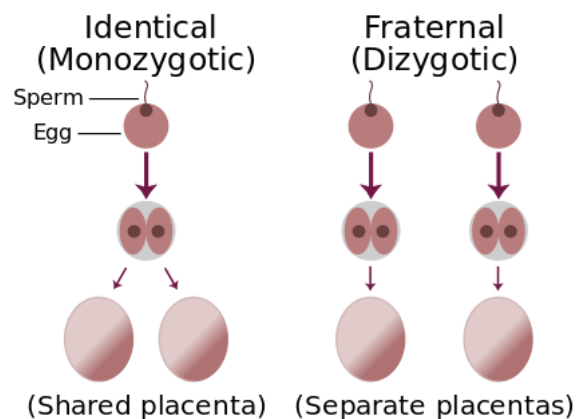
This is the most common type of twin.^[16]

Dizygotic twins, like any other siblings, have an extremely small chance of having the same chromosome profile. Even if they happen to have the same chromosome profile, they will always have different genetic material on each chromosome, due to [chromosomal crossover](#) during [meiosis](#). Like any other [siblings](#), dizygotic twins may look similar, particularly given that they are the same age. However, dizygotic twins may also look very different from each other.

Studies show that there is a genetic proclivity for dizygotic twinning. However, it is only the mother who has any effect on the chances of having such twins; there is no known mechanism for a father to cause the release of more than one [ovum](#). Dizygotic twinning ranges from six per thousand births in Japan (similar to the rate of monozygotic twins) to 14 and more per thousand in some African countries.^[17]

Dizygotic twins are also more common for older mothers, with twinning rates doubling in mothers over the age of 35.^[18] With the advent of technologies and techniques to assist women in getting pregnant, the rate of fraternal twins has increased markedly.

Monozygotic (identical) twins



Comparison of zygote development in monozygotic and dizygotic twins. In the uterus, a majority of monozygotic twins (60–70%) share the same [placenta](#) but have separate [amniotic sacs](#). In 18–30% of monozygotic twins each fetus has a separate placenta and a separate amniotic sac. A small number (1–2%) of monozygotic twins share the same placenta and amniotic sac. Fraternal twins each have their own placenta and own amniotic sac.

Monozygotic (MZ) or identical twins occur when a single [egg](#) is fertilized to form one [zygote](#) (hence, "monozygotic") which then divides into two separate [embryos](#).

Mechanism

Regarding spontaneous or *natural* monozygotic twinning, a recent theory proposes that monozygotic twins are formed after a [blastocyst](#) essentially collapses, splitting the progenitor cells (those that contain the body's fundamental genetic material) in half, leaving the same genetic material divided in two on opposite sides of the embryo. Eventually, two separate fetuses develop.^[19] Spontaneous division of the zygote into two embryos is not considered to be a hereditary trait, but rather a spontaneous and random event.^[18]

Monozygotic twins may also be created artificially by embryo splitting. It can be used as an expansion of [in vitro fertilization](#) (IVF) to increase the number of available embryos for [embryo transfer](#).^[20]

Incidence

Monozygotic twinning occurs in birthing at a rate of about 3 in every 1000 deliveries worldwide.^[21]

The likelihood of a single fertilization resulting in monozygotic twins is uniformly distributed in all populations around the world.^[18] This is in marked contrast to dizygotic twinning, which ranges from about six per thousand births in Japan (almost similar to the rate of identical twins, which is around 4–5) to 15 and more per thousand in some parts of India^[22] and up to over 20 in some Central African countries.^[10] The exact cause for the splitting of a zygote or embryo is unknown.

IVF techniques are more likely to create dizygotic twins. For IVF deliveries, there are nearly 21 pairs of twins for every 1,000.^[23]

Genetic and epigenetic similarity

Monozygotic twins are genetically nearly identical and they are always the same sex unless there has been a mutation during development. The children of monozygotic twins test genetically as half-siblings (or full siblings, if a pair of monozygotic twins reproduces with another pair or with the same person), rather than first cousins. Identical twins do not have the same fingerprints, due to the fact that even in a small space inside the womb, people have contact with different parts of this environment, which gives small variations in the same digital, making them unique.^[24]

Monozygotic twins always have different [phenotypes](#). Normally due to an environmental factor or the deactivation of different X chromosomes in female monozygotic twins, and in some extremely rare cases, due to [aneuploidy](#), twins may express different sexual [phenotypes](#), normally from an XXY [Klinefelter syndrome](#) zygote splitting unevenly.^{[25][26][27]}

Monozygotic twins, although genetically very similar, are not genetically exactly the same. The DNA in white blood cells of 66 pairs of monozygotic twins was analyzed for 506,786 [single nucleotide](#)

[polymorphisms](#) known to occur in human populations. Polymorphisms appeared in 2 of the 33 million comparisons, leading the researchers to extrapolate that the blood cells of monozygotic twins may have on the order of one DNA-sequence difference for every 1.2×10^7 nucleotides, which would imply hundreds of differences across the entire genome.^[28] The mutations producing the differences detected in this study would have occurred during embryonic cell-division (after the point of fertilization). If they occur early in fetal development, they will be present in a very large proportion of body cells.

Another cause of difference between monozygotic twins is [epigenetic modification](#), caused by differing environmental influences throughout their lives. Epigenetics refers to the level of activity of any particular gene. A gene may become switched on, switched off, or could become partially switched on or off in an individual. This epigenetic modification is triggered by environmental events. Monozygotic twins can have markedly different epigenetic profiles. A study of 80 pairs of monozygotic twins ranging in age from three to 74 showed that the youngest twins have relatively few [epigenetic](#) differences. The number of epigenetic differences increases with age. Fifty-year-old twins had over three times the epigenetic difference of three-year-old twins. Twins who had spent their lives apart (such as those adopted by two different sets of parents at birth) had the greatest difference.^[29] However, certain characteristics become more alike as twins age, such as IQ and personality.^{[30][31][32]}

Polar Body & Semi-Identical Twin

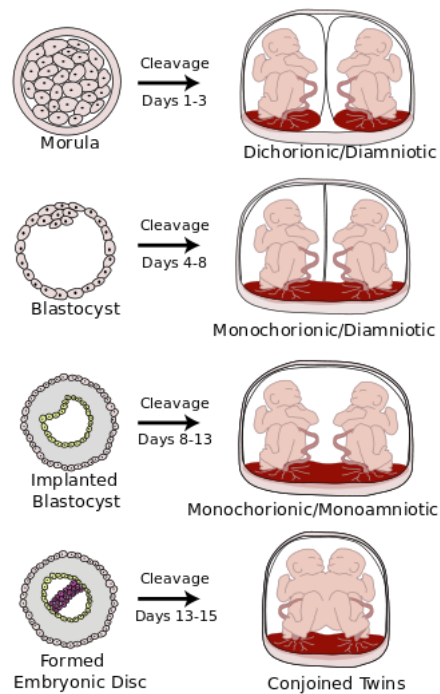
A 1981 study of a deceased [triploid XXX](#) twin fetus [without a heart](#) showed that although its fetal development suggested that it was an identical twin, as it shared a placenta with its healthy twin, tests revealed that it was probably a [polar body](#) twin. The authors were unable to predict whether a healthy fetus could result from a polar body twinning.^[33]

In 2003, a study argued that many cases of triploidy arise from semi-identical twinning.^[34]

Unknown Twin Type

In 2007, a study reported a case of a pair of living twins, one [intersex](#) and one a [phenotypical](#) male. The twins were both found to be [chimeras](#) and to share all of their maternal DNA but only half of their father's DNA. The exact mechanism of fertilization could not be determined but the study stated that it was unlikely to be a case of polar body twinning.^[35]

Degree of separation



Various types of chorionicity and amniosity (how the baby's sac looks) in monozygotic (one egg/identical) twins as a result of when the fertilized egg divides

The degree of separation of the twins in utero depends on if and when they split into two zygotes. Dizygotic twins were always two zygotes. Monozygotic twins split into two zygotes at some time very early in the pregnancy. The timing of this separation determines the chorionicity (the number of placentae) and amniocity (the number of sacs) of the pregnancy. Dichorionic twins either never divided (i.e.: were dizygotic) or they divided within the first 4 days. Monoamniotic twins divide after the first week.

In very rare cases, twins become [conjoined twins](#). Non-conjoined monozygotic twins form up to day 14 of embryonic development, but when twinning occurs after 14 days, the twins will likely be conjoined.^[36] Furthermore, there can be various degrees of shared environment of twins in the womb, potentially leading to [pregnancy complications](#).

It is a common misconception that two [placentas](#) means twins are dizygotic. But if monozygotic twins separate early enough, the arrangement of sacs and placentas in utero is indistinguishable from dizygotic twins.

Type	Description	Day
Dichorionic-Diamniotic	<p>Normally, twins have two separate (di- being a numerical prefix for two) chorions and amniotic sacs, termed Dichorionic-Diamniotic or "DiDi". It occurs in almost all cases of dizygotic twins (except in very rare cases of fusion between their blastocysts^[37]) and in 18–36%^[38] (or around 25%^[37]) of monozygotic (identical) twins.</p> <p>DiDi twins have the lowest mortality risk at about 9 percent, although that is still significantly higher than that of singletons.^[39]</p>	Dichorionic-Diamniotic twins form when splitting takes place by the third day after fertilization . ^[37]
Monochorionic-Diamniotic	<p>Monochorionic twins share the same placenta.</p> <p>Monochorionic twins generally have two amniotic sacs (called Monochorionic-Diamniotic "MoDi"), which occurs in 60–70% of the pregnancies with monozygotic twins,^[38] and in 0.3% of all pregnancies.^[40] Monochorionic-Diamniotic twins are <i>almost always</i> monozygotic, with a few exceptions where the blastocysts have fused.^[37]</p> <p>Monochorionic twins share the same placenta, and thus have a risk of twin-to-twin transfusion syndrome.</p>	Days 4-8
Monochorionic-Monoamniotic	<p>Monochorionic twins share the same amnion in 1–2% of monozygotic twin pregnancies.^[38]</p> <p>Monoamniotic twins are <i>always</i> monozygotic.^[41]</p> <p>The survival rate for monoamniotic twins is somewhere between 50%^[41] to 60%.^[42]</p> <p>Monoamniotic twins, as with diamniotic monochorionic twins, have a risk of twin-to-twin transfusion syndrome. Also, the two umbilical cords have an increased chance of being tangled around the babies. Because of this, there is an increased chance that the newborns may be miscarried or suffer from cerebral palsy due to lack of oxygen.</p>	Monoamniotic twins occur when the split takes place after the ninth day after fertilization. ^[37]
		If the division of

Conjoined twins

When the division of the developing [zygote](#) into 2 embryos occurs, 99% of the time it is within 8 days of fertilization.

Mortality is highest for conjoined twins due to the many complications resulting from shared organs.

the zygote occurs later than the 12 days then [conjoined twins](#) are usually the result.



Dichorionic-diamniotic twins at 8 weeks and 5 days since [co-incubation](#) as part of IVF. The twin at left in the image is shown in the [sagittal plane](#) with the head pointing towards upper left. The twin at right in the image is shown in the [coronal plane](#) with the head pointing rightwards.



[Abdominal ultrasonography](#) of monoamniotic twins at a [gestational age](#) of 15 weeks. There is no sign of any membrane between the fetuses. A [coronal plane](#) is shown of the twin at left, and a [sagittal plane](#) of parts of the upper thorax and head is shown of the twin at right.

Demographics

A 2006 study has found that [insulin-like growth factor](#) present in dairy products may increase the chance of dizygotic twinning. Specifically, the study found that [vegan](#) mothers (who exclude dairy from their diets) are one-fifth as likely to have twins as vegetarian or omnivore mothers, and concluded that "Genotypes favoring elevated IGF and diets including dairy products, especially in

areas where [growth hormone](#) is given to cattle, appear to enhance the chances of multiple pregnancies due to ovarian stimulation."^[43]

From 1980 to 1997, the number of twin births in the United States rose 52%.^[44] This rise can at least partly be attributed to the increasing popularity of [fertility drugs](#) and procedures such as IVF, which result in multiple births more frequently than unassisted fertilizations do. It may also be linked to the increase of [growth hormones](#) in food.^[43]

Ethnicity



A pair of female [ere ibeji](#) twin figures (early 20th-century) in the permanent collection of [The Children's Museum of Indianapolis](#). [Yoruba people](#) have the highest twinning rate in the world.

About 1 in 90 human births (1.1%) results from a twin pregnancy.^[45] The rate of *dizygotic* twinning varies greatly among [ethnic groups](#), ranging as high as about 45 per 1000 births (4.5%) for the [Yoruba](#) to 10% for Linha São Pedro, a tiny Brazilian settlement which belongs to the city of [Cândido Godói](#).^[46] In Cândido Godói, one in five pregnancies has resulted in twins.^[47] The Argentine historian [Jorge Camarasa](#) has put forward a theory that experiments of the [Nazi](#) doctor [Josef Mengele](#) could be responsible for the high ratio of twins in the area.^[48] His theory was rejected by Brazilian scientists who had studied twins living in Linha São Pedro; they suggested genetic factors within that community as a more likely explanation.^[49] A high twinning rate has also been observed in other places of the world, including :

- [Igbo-Ora](#) in [Nigeria](#)^[50]

- [Kodinji](#), located in [Kerala, India](#)^[51]
- [Mohammadpur Umri](#), located in [Uttar Pradesh, India](#)^{[52][53][54]}

The widespread use of fertility drugs causing hyperovulation (stimulated release of multiple eggs by the mother) has caused what some call an "epidemic of [multiple births](#)". In 2001, for the first time ever in the [US](#), the twinning rate exceeded 3% of all births. Nevertheless, the rate of *monozygotic* twins remains at about 1 in 333 across the globe.

In a study on the maternity records of 5750 [Hausa](#) women living in the Savannah zone of [Nigeria](#), there were 40 twins and 2 triplets per 1000 births. Twenty-six percent of twins were monozygotic. The incidence of multiple births, which was about five times higher than that observed in any western population, was significantly lower than that of other ethnic groups, who live in the hot and humid climate of the southern part of the country. The incidence of multiple births was related to maternal age but did not bear any association to the climate or prevalence of [malaria](#).^{[55][56]}

Predisposing factors

The predisposing factors of monozygotic twinning are unknown.

Dizygotic twin pregnancies are slightly more likely when the following factors are present in the woman:

- She is of [West African](#) descent (especially [Yoruba](#))
- She is between the age of 30 and 40 years
- She is greater than average height and weight
- She has had several previous pregnancies.

Women undergoing certain fertility treatments may have a greater chance of dizygotic multiple births. In the United States it has been estimated that by 2011 36% of twin births resulted from conception by [assisted reproductive technology](#).^[57]

The risk of twin birth can vary depending on what types of fertility treatments are used. With [in vitro fertilisation](#) (IVF), this is primarily due to the insertion of multiple embryos into the uterus. [Ovarian hyperstimulation](#) without IVF has a very high risk of multiple birth. Reversal of [anovulation](#) with [clomifene](#) (trade names including *Clomid*) has a relatively less but yet significant risk of multiple pregnancy.

Delivery interval

A 15-year German study^[58] of 8,220 vaginally delivered twins (that is, 4,110 pregnancies) in [Hesse](#) yielded a mean delivery time interval of 13.5 minutes.^[59] The delivery interval between the twins was measured as follows:

- Within 15 minutes: 75.8%
- 16-30 minutes: 16.4%
- 31-45 minutes: 4.3%
- 46-60 minutes: 1.7%
- Over 60 minutes: 1.8% (72 instances)

The study stated that the occurrence of complications "was found to be more likely with increasing twin-to-twin delivery time interval" and suggested that the interval be kept short, though it noted that the study did not examine causes of complications and did not control for factors such as the level of experience of the obstetrician, the wish of the women giving birth, or the "management strategies" of the procedure of delivering the second twin.

Complications during pregnancy

Vanishing twins

Main article: [Vanishing twin](#)

Researchers suspect that as many as 1 in 8 pregnancies start out as multiples, but only a single fetus is brought to full term, because the other fetus has died very early in the pregnancy and has not been detected or recorded.^[60] Early [obstetric ultrasonography](#) exams sometimes reveal an "extra" fetus, which fails to develop and instead disintegrates and vanishes in the uterus. There are several reasons for the "vanishing" fetus, including it being embodied or absorbed by the other fetus, placenta or the mother. This is known as [vanishing twin](#) syndrome. Also, in an unknown proportion of cases, two zygotes may fuse soon after fertilization, resulting in a single [chimeric](#) embryo, and, later, fetus.



[Chang and Eng Bunker](#), born in Siam (now [Thailand](#)) in 1811, were the origin of the term "Siamese twins".

Conjoined twins

Main article: [Conjoined twins](#)

Conjoined twins (or the once-commonly used term "siamese") are monozygotic twins whose bodies are joined together during pregnancy. This occurs when the zygote starts to split after day 12^[37] following fertilization and fails to separate completely. This condition occurs in about 1 in 50,000 human pregnancies. Most conjoined twins are now evaluated for surgery to attempt to separate them into separate functional bodies. The degree of difficulty rises if a vital organ or structure is shared between twins, such as the [brain](#), [heart](#) or [liver](#).

Chimerism

Main article: [Chimera \(genetics\)](#)

A chimera is an ordinary person or animal except that some of their parts actually came from their twin or from the mother. A chimera may arise either from monozygotic twin fetuses (where it would be impossible to detect), or from dizygotic fetuses, which can be identified by chromosomal comparisons from various parts of the body. The number of cells derived from each fetus can vary from one part of the body to another, and often leads to characteristic [mosaicism](#) skin coloration in human chimeras. A chimera may be [intersex](#), composed of cells from a male twin and a female twin. In one case [DNA tests](#) determined that a woman, mystifyingly, was not the mother of two of her three children; she was found to be a chimera, and the two children were conceived from eggs derived from cells of their mother's twin.^[61]

Parasitic twins

Main article: [Parasitic twin](#)

Sometimes one twin fetus will fail to develop completely and continue to cause problems for its surviving twin. One fetus acts as a [parasite](#) towards the other. Sometimes the parasitic twin becomes an almost indistinguishable part of the other, and sometimes this needs to be treated medically.

Partial molar twins

A very rare type of parasitic twinning is one where a single viable twin is endangered when the other zygote becomes cancerous, or molar. This means that the molar zygote's cellular division continues unchecked, resulting in a cancerous growth that overtakes the viable fetus. Typically, this results when one twin has either [triploidy](#) or complete paternal [uniparental disomy](#), resulting in little or no fetus and a cancerous, overgrown placenta, resembling a bunch of grapes.

Miscarried twin

Occasionally, a woman will suffer a [miscarriage](#) early in pregnancy, yet the pregnancy will continue; one twin was miscarried but the other was able to be carried to term. This occurrence is similar to the [vanishing twin](#) syndrome, but typically occurs later, as the twin is not reabsorbed.

Low birth weight

It is very common for twins to be born at a low [birth weight](#). More than half of twins are born weighing less than 5.5 pounds, while the average birth weight of a healthy baby should be around 6-8 pounds.^[62] This is largely due to the fact that twins are typically born [premature](#). Premature birth and low birth weights, especially when under 3.5 pounds, can increase the risk of several health-related issues, such as vision and hearing loss, mental disabilities, and [cerebral palsy](#).^[63] There is an increased possibility of potential complications as the birth weight of the baby decreases.

Twin-to-twin transfusion syndrome

Main article: [Twin-to-twin transfusion syndrome](#)

Monozygotic twins who share a placenta can develop twin-to-twin transfusion syndrome. This condition means that blood from one twin is being diverted into the other twin. One twin, the 'donor' twin, is small and [anemic](#), the other, the 'recipient' twin, is large and [polycythemic](#). The lives of both twins are endangered by this condition.

Stillbirths

Stillbirths occurs when a fetus dies after 20 weeks of gestation. There are two types of stillbirth, including intrauterine death and intrapartum death. Intrauterine death occurs when a baby dies during late pregnancy. Intrapartum death, which is more common, occurs when a baby dies while the mother is giving birth. The cause of stillbirth is often unknown, but the rate of babies who are stillborn is higher in twins and multiple births. Caesareans or inductions are advised after 38 weeks of pregnancy, because the risk of stillbirth increases after this time.^[64]

Management of birth

For otherwise healthy twin pregnancies where both twins are head down a trial of **vaginal delivery** is recommended at between 37 and 38 weeks.^{[65][66]} Vaginal delivery in this case does not worsen the outcome for the infant as compared with **Caesarean section**.^[65] There is controversy on the best method of delivery where the first twin is head first and the second is not.^[65] When the first twin is not head down a C-section is often recommended.^[65] It is estimated that 75% of twin pregnancies in the United States were delivered by Cesarean section in 2008.^[67] In comparison, the rate of Cesarean section for all pregnancies in the general population varies between 14% and 40%.^[68] In twins that share the same placenta delivery may be considered at 36 weeks.^[69]

Human twin studies

Main article: [Twin study](#)

Twin studies are utilized in an attempt to determine how much of a particular trait is attributable to either genetics or environmental influence. These studies compare monozygotic and dizygotic twins for **medical**, **genetic**, or **psychological** characteristics to try to isolate genetic influence from epigenetic and **environmental** influence. Twins that have been separated early in life and raised in separate households are especially sought-after for these studies, which have been used widely in the exploration of **human nature**. Classical twin studies are now being supplemented with molecular genetic studies which identify individual genes.

Unusual twinnings

Among dizygotic twins, in rare cases, the eggs are fertilized at different times with two or more acts of sexual intercourse, either within one menstrual cycle (**superfecundation**) or, even more rarely, later on in the pregnancy (**superfetation**). This can lead to the possibility of a woman carrying fraternal twins with different fathers (that is, **half-siblings**). This phenomenon is known as

heteropaternal superfecundation. One 1992 study estimates that the frequency of heteropaternal superfecundation among dizygotic twins, whose parents were involved in paternity suits, was approximately 2.4%; see the references section, below, for more details.

Dizygotic twins from [biracial](#) couples can sometimes be [mixed twins](#), which exhibit differing ethnic and racial features. One such pairing was born in [Germany](#) in 2008 to a white father from Germany and a black mother from Ghana.^{[70][71]}

[Heterotopic pregnancy](#) is an exceedingly rare type of dizygotic twinning in which one twin implants in the uterus as normal and the other remains in the fallopian tube as an [ectopic pregnancy](#). Ectopic pregnancies must be resolved because they can be life-threatening to the mother. However, in most cases, the intrauterine pregnancy can be salvaged.

Among monozygotic twins, in extremely rare cases, twins have been born with different sexes (one male, one female).^[72] When monozygotic twins are born with different sexes it is because of chromosomal defects. There can be monozygotic boy/girl twins if the sex gene of the embryo has an extra x chromosome (the fertilized egg would be an xxy) then when the egg splits, one can have xx (girl) genes and one can have xy (boy) genes. This is rare, but possible. Records show there are only 10 known cases of these type twins. The probability of this is so small that multiples having different sexes is universally accepted as a sound basis for *in utero* clinical determination that the multiples are not monozygotic. Another abnormality that can result in monozygotic twins of different genders is if the egg is fertilized by a male sperm but during cell division only the X chromosome is duplicated. This results in one normal male (XY) and one female with [Turner syndrome](#) (45,X).^[73] In these cases, although the twins did form from the same fertilized egg, it is incorrect to refer to them as genetically identical, since they have different [karyotypes](#).

Semi-identical twins

[Monozygotic](#) twins can develop differently, due to different genes being activated.^[74] More unusual are "semi-identical twins". These "half-identical twins" are hypothesized to occur when an unfertilized egg cleaves into two identical attached ova and which are viable for fertilization. Both cloned ova are then fertilized by different sperm and the coalesced eggs undergo further cell duplications developing as a chimeric [blastomere](#). If this blastomere then undergoes a twinning event, two embryos will be formed, each of which have different paternal genes and identical maternal genes.

This results in a set of twins with identical genes from the mother's side, but different genes from the father's side. Cells in each fetus carry genes from either sperm, resulting in [chimeras](#). This form had been speculated until only recently being recorded in western medicine.^{[75][76][77]}



Twin calves of the [Hereford](#) breed
in [Miles City, Montana](#)

Mirror image twins

Mirror image twins result when a fertilized egg splits later in the embryonic stage than normal timing, around day 9-12. This type of twinning could exhibit characteristics with reversed asymmetry, such as opposite dominant handedness, dental structure, or even organs ([situs inversus](#)).^[78] If the split occurs later than this time period, the twins risk being conjoined. There is no DNA-based zygosity test that can determine if twins are indeed mirror image.^[79]

Language development

There have been many studies highlighting the [development of language](#) in twins compared to single-born children. These studies have converged on the notion that there is a greater rate of delay in language development in twins compared to their single-born counterparts.^[80] The reasons for this phenomenon are still in question; however, [idioglossia](#) or was thought to be the major cause.^[81] Idioglossia is defined as a private language that is invented usually by young children, specifically twins. Another term to describe as what some people call "twin talk" is [cryptophasia](#) where a language is developed by twins that only they can understand. The increased focused communication between two twins may isolate them from the social environment surrounding them. Idioglossia has been found to be a rare occurrence and the attention of scientists has shifted away from this idea. However, there are researchers and scientists that say cryptophasia or idioglossia is not a rare phenomenon. Current research is looking into the impacts of a richer social environment for these twins to stimulate their development of language.^[82]


Other animals

Twins are common in many animal species, including [cats](#), [sheep](#), [ferrets](#), [giant pandas](#), [dogs](#), [deer](#), [marmosets](#), and [tamarins](#). The incidence of twinning among [cattle](#) is about 1–4%, and research is under way to improve the odds of twinning, which can be more profitable for the breeder if

complications can be sidestepped or managed. A female calf that is the twin of a bull becomes partially masculinized and is known as a **freemartin**.

See also


- [Multiple birth](#)
- [Litter \(animal\)](#)
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