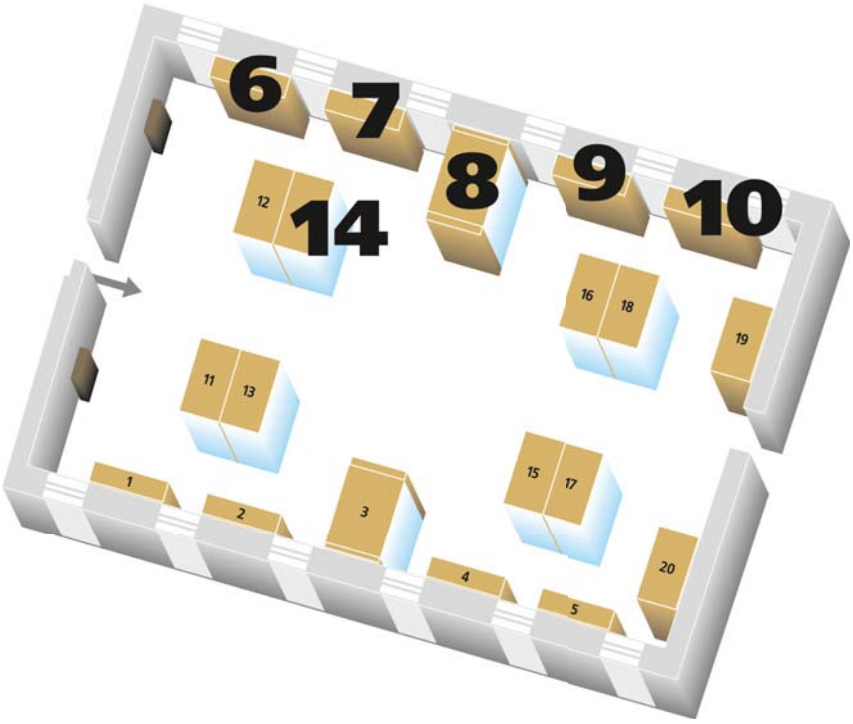
TERATOLOGY



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TERATOLOGY. THE HISTORY OF SCIENCE

The birth of deformed babies has always stricken people and frightened them by its suddenness and inexplicability. Such events were long remembered and accompanied with legends. People tried not only to remember the appearance of a strange child, but also to make an image of it that could be preserved. In Australia, rock paintings have been discovered made several thousand years ago depicting accretes twins. In Egypt there is an image of a man with abnormally short arms made five thousand years ago. Cuneiforms of ancient Babylon defined sixty-two types of congenital malformations, and the Talmud lists over a hundred anomalies. Later, people began to collect everything unusual and abnormal, including monsters.

The word monster determines an organism with gross abnormalities in appearance as well as in functions. People not only collected monsters, but also tried to describe them.

▲ *Specimen of asymmetric twins*

Such twins are different in their constitution and development, as one of them is only partially developed and parasitizes on the other.

▲ *The same specimen was studied in 1806 by a Russian anatomist named P.A. Zagorsky. He illustrated his article about this 'rarest, uncommon human fetus' with this drawing.*

In the 16th century people in different countries began to study monsters. A French surgeon named Ambroise Paré (about 1510—1590) was the first researcher to study accretes twins. He also described the phenomenon of cyclops and assumed that in Ancient Greece children with this abnormality were exiled to faraway islands, so Odyssey's encounter with Cyclops Polyphemus described by Homer may not have been a fiction.

One of the first books dedicated to monsters were *De conceptu et Generatione Hominis* by Jacob Rueff (1578) and *De monstris causis, natura et differentiis* by Lisetus (1616). The latter contains a great number of descriptions and images of real and fictional anomalies. Ulisse Aldrovandi (1522—1605), Professor of natural sciences and Director of the botanic garden of Bologna, who wanted to describe the diversity of nature, dedicated a separate volume to monsters.

In 1651 an English physiologist named William Harvey, whose name is usually associated with the discovery of blood circulation, started a purposeful research of monsters. He defined malformations as deviations from normal embryonic development. But only as late as in the 1820s science got close to understanding of the reasons for congenital malformations. A French scientist named Étienne Geoffroy Saint-Hilaire (1772—1844) became famous as the first researcher to achieve malformation through experiment. He locked eggshells in wax while eggs were sat, which prevented the supply of air to the embryos and led to brain and spinal cord anomalies of the chickens.

In our exposition you can see various malformations of humans and animals, including the Janus-faced malformations and accrete twins, whose development is so uneven, that one of them can only exist on the other's account, being a parasite on its body. Often, such parasite is much smaller and sometimes has no heart or head of its own (like the one on display in this showcase). Sometimes, amorphous lumps deprived of a normal embryo's features are born together with a normally developed twin (showcases #6 and 8).

HUMAN AND ANIMAL EMBRYOS

Deviations from normal development are found both in flora and fauna. Structural anatomical defects that lead to disfigurement or functional disorders are referred to as monstrosities. The term "anomaly" or "malformation" defines a wider notion and means that there are some deviations from the norm, but not as strong as a monstrosity. For example, the location of the heart on the right, or a sixth finger is an anomaly, but not a monstrosity, while all monstrosities are anomalies.

It is undoubtly that a mother's illnesses have an injurious effect on the prenatal foetus development. However, it is not always possible to determine direct influence of the mother's illness on the foetus. Often, it is the consequences, and not the disease itself, that is teratogen or toxic. The disturbing factors are most dangerous during the early stage of an embryo's development: from the 16th day and until the end of the eighth week. In this period different anomalies may develop. German measles is the most dangerous virus to affect foetus development. The science that deals with diagnostics

and prevention of congenital malformations is called teratology.

People and animals can have the same monstrosities.

For example, there is a monstrosity referred to as cyclops, when during an embryo's development its eyes join into one blind eye with a dermal wart above it. This leads not only to an outward malformation, but also to functional disorders affecting the brain and the visual nerves. As a rule, human and animal babies born with this abnormality are blind and often nonviable. In this showcase, you can see samples of this monstrosity represented by a human foetus and a piglet.

▲ *Specimen of a two-faced human fetus*

▲ *Specimen of a two-muzzle sheep*

Another wide spread anomaly is the so-called congenital amputation, when a baby lacks one or two upper or lower extremities. Babies born with this malformation are usually viable.

Occasionally, babies are born with different degrees of head duplication. Sometimes this is shown in the duplication of facial features: the mouth, the nose or the forehead. But sometimes the skull and the brain are also duplicated. The use of the term "twins" seems to be incorrect with regard to such individuals. In our collection, you can see a small lamb with two muzzles and a human foetus with a duplicated face. Duplication of organs is found among both animals and humans. For example, there is a calf with a duplicated hindquarter, and a human embryo with two heads. Such anomalies are also found among plants.

CROCODILE [showcase #8]. Chemists in many countries for centuries decorated their pharmacies with stuffed crocodiles, as they were symbols of longevity (crocodiles' life span can reach up to 100 years). Chemists may also have used their glands that discharge an excretion with a strong smell of musk. Crocodiles' bodies are protected with a shell formed by large corneous crusts that cover the extremities and the tail.

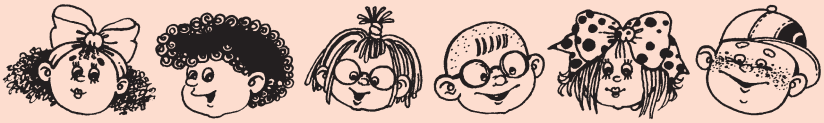
▲ *Cuban crocodile. Stuffed animal on loan from the Zoological museum collections*

Crocodiles are found in the fresh waters of Central and South America, Central Africa, India, Indonesia and Australia. In Ancient Egypt crocodiles were worshiped as sacred animals. According to scientists, crocodiles are closer relatives of extinct dinosaurs and modern birds than other reptiles. People hunt crocodiles mostly for their skins. Some tribes eat young crocodiles' meat.

A "Dried crocodile" was one of the first rarities that Peter acquired during his travel abroad.

SPINY LOBSTER [showcase #8]. Spiny lobsters look a lot like crawfish, but they are much bigger. Both belong to the ten-legged crustaceans, as well as prawns, true lobsters and crabs. Crawfish, the most popular representative of this order, often acts as a character of fairy-tales and fables. Also, it is one of the zodiac signs. In the winter, crawfish hide in holes that they dig in riverbanks with their pincers. Many ten-legged crustaceans, such as spiny lobsters, true lobsters and crabs find shelter between stones and mollusc shells, or in rock crevasses. Due to their size and delicious taste, lobsters have always been hunted for food.

STARFISH [showcase #6]. Starfish are erinaceous animals, which have an ancient origin. They have been found even in the deepest sediments that formed the bottom of the sea about 400 million years ago. Today, they are found near the coasts of the seas with normal salinity level. People have known



starfish since long ago. On frescoes found on the Greek island of Crete that date back to 4000 years ago, there are images of starfish. The ancient Greek gave the name to these creatures. Aristotle, the famous ancient Greek philosopher and scholar, included them over two thousand years ago into his classification of animals and wrote: “they attack many shells and suck them out”.

ECHIDNA [showcase #6]. This animal that reminds of a hedgehog, as well as the duckbill, for many centuries had been a mystery for zoologists and made them wonder if it was a mistake of nature, a monster. No wonder! This animal, found in Australia, does not bear babies like other mammals, but lays eggs. But it does not sit them in a nest like a bird, nor does it dig them in the sand like a tortoise. Instead, it carries them in a pouch on its body. Zoologists still do not know how eggs get into the pouch, where after some time baby echidnas hatch from them. This small animal with a narrow black cylinder-shaped muzzle feeds mostly on ants that it hunts with the help of a long tongue covered with sticky saliva that it thrusts forward.

▲ *Echidna.*
Stuffed animal on loan from the Zoological museum collections

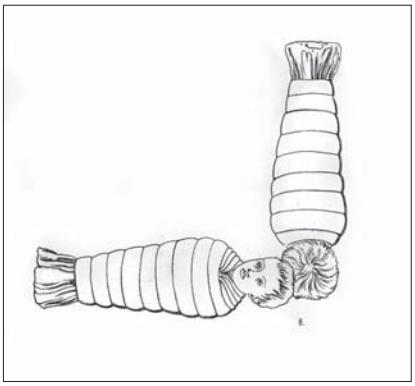
Echidnas protect themselves from enemies with the help of quills. If endangered, they roll up in balls like hedgehogs, or dig into the ground with the help of their powerful claws.

PIKE [showcase #7]. The pike is not an exotic fish. It is widespread in fresh waters. Its long arrow-shaped body and its large head with stretched-out flattened jaws tell us that this is a predator. Its lower teeth are different in size and are used to seize prey. A Russian proverb rightfully says: “A pike in the sea does not let crucian carp doze”. There’s only one mistake: neither the pike, nor the crucian carp live in the sea. However, in Russia locals often referred to a large lake as the sea. A pike can be up to 1.5 meters long and weigh up to 35 kilos. There is a record that dates to June 3rd, 1737 saying that a huge black pike was delivered to the Kunstkamera for examination.

TWIN MONSTROSITIES

Monozygotic twins are not always fully separated in the course of intrauterine development, and sometimes they remain accrete. This is a rare case, and the chances of having such twins are once per 65-80 thousand normal births. It is impossible to count how many of them die on the early stages of pregnancy.

The most famous accrete twins are brothers Chang and Eng born in 1811 in Siam (the old name for Thailand) and died in Philadelphia (USA). They lived quite a long life (63 years) and due to them the term "Siamese twins" appeared that denotes a number of malformations referred to as twin monstrosities. Undoubtedly, such malformations had been known before Chang and Eng's birth. The famous brothers were linked to each other in the lower part of their chests, and in their childhood they were facing one another other, but gradually the dermal commissura that held them together became more flexible and stretched, so they could move, walk and sit more freely. Their arms that moved to their backs were weak and undeveloped, but their front arms were quite strong and capable of all basic functions. When the brothers turned 17, a visiting American bought them from their parents and was going to demonstrate Chang and Eng for money. It must have been then that they got their last name: Bunker. Soon they left this American man and began to tour independently performing with circuses and on fairs all over the world. They earned quite a lot, and soon married two sisters. One of them had twelve children, and the other had ten. At present, there are over a thousand descendants of these Siamese twins living in America.



▲ *Egyptian mummies of children with accrete heads*

▲ *Twins Chang and Eng born in Thailand in 1811*

There is evidence that as early as in the 17th century there was a successful attempt to divide twins with accrete chests. The commissura connecting them was tied with a bandage that was tightened gradually. Eventually, the commissura was successfully cut. It is obvious,

that such operation can only be successful in the case of a superficial junction. Most probably, brothers Chang and Eng could also have been divided using the same method, but, according to some evidence, they did not want this.

Even today, operations aimed at dividing accrete twins are very complex and hazardous. They require serious preparations, the surgeons' high competence and expertise, and often raise complicated ethical questions, since the viability chances of the two babies after the surgery can be very different.

Accrete twins can be linked to each other to different degrees: sometimes they are almost independent, and sometimes only their heads or legs are divided.

Among twin monstrosities there are cases when one of the individuals is much larger or developed than the other. In such cases, one of the embryos becomes a sort of a parasite on the other twin's body. One of them can be quite normal, and the other is only partially developed. The parasitizing individual often has no heart or head of its own and can exist only on the other twin's account.

In showcase #7 you can see twins accrete with their chests, bellies, sacral bone, pelvis and heads.

► *Specimen of twins with accrete pelvis*

SINGLE MONSTROSITIES

Isidore Saint-Hilaire (son of Étienne Geoffroy Saint-Hilaire, a famous French zoologist who is often referred to as Charles Darwin's predecessor) continued the study of monsters started by his father. In 1822 he introduced the

▲ *Specimen of human fetus with cerebral hernia: membranes and sometimes even parts of the brain protrude through the open cranium seams*

term teratololgy (from Greek *teratos*, the same as *monstrum*) used to refer to a science dedicated to studying anomalies. Isidore Saint-Hilaire, Member of the Parisian Academy of Sciences and the correspondent-member of the St. Petersburg Academy of Sciences, studied, summarized and systematized all materials on monstrosities available at that time and accumulated mostly in late 17th—early 18th centuries when the religious ban for the study of dead bodies loosened.

All congenital malformations can be divided into two groups. The first group includes monozygotic or identical twins, which do not divide during their intrauterine development and are born accreted (united or fused) to each other. The second, much larger group includes malformations that only affect one individual. The most serious malformations that are usually fatal are inborn brain defects, such as anencephaly, large cerebral hernias, and cyclopia when two eyes are joined into one blind eye, which usually leads to the baby's death right after it is born due to the respiratory impairment.

Cleft palate is a less serious deformity. If a baby is born with this defect, breast milk and other food gets from its mouth to its nose and respiratory tracts, which leads to the development of pneumonia which once used to be fatal. Today, babies born with this defect are operated. Cleft hare lip, extra or missing fingers, etc. are considered to be "light" anomalies.

Today scientists know that anomalies are formed on the early stage of embryonic development, and can be a result of a fertilized egg's mal development. It is a known fact that foetus development is closely related to the environment, and if its conditions are unfavourable, this can lead to malformations. For example, the level of alcohol in an embryo's blood reaches up to 80—100% of its level in the blood of the mother. But since the embryo has not yet developed the systems that neutralize alcohol in its mother's body, its injurious effect on the embryo is much harder and more prolonged. The type of defect depends primarily on the stage of intrauterine development when the disturbing factor occurred, and is less dependent on the nature of this factor itself. In late 19th—early 20th centuries scientists

discovered that abnormalities can be caused by different reasons: mutant genes, unfavourable environmental conditions (for example, high radiation level), some infectious diseases (German measles), and some medications that a mother takes while she is pregnant.

The term "teratology" is used to define a medical-biological science that focuses on the conditions and regularity of abnormalities of human organs and functional systems.

You can see some 18th—century exhibits showing "single monstrosities" in showcase #14.

In the first decade after Peter I had issued his famous decree, monsters were regularly delivered to the Kunstkamera. Local governors sent them to Moscow, to the Medical Office, whose purpose was to pay for them and deliver them to the Kunstkamera. An inventory has preserved that dates to March, 8th 1725, which lists the exhibits to be sent to the Museum:

▲ *Specimen of human fetus with cerebral hernia*

A fatal malformation.

— "One lamb with 8 legs; one lamb with three eyes, two bodies and six legs. Sent from Tobolsk from Duke Kozlovsky.

— Baby with three legs. From Nizhny Novgorod, from Governor Rzhevsky.

— Calf, with "monstrous" front legs. From Ufa, from Commandant Bakhmetov.

— Baby with two heads, from the same Bakhmetov.

— One baby with eyes under the nose and ears under the neck. From Nezhin.

— Two babies accreted with their chests and bellies. Legs and heads are normal.

— Baby with a fish tail. Born in Moscow, on Tverskaya Street."

These descriptions tell us that a cyclopean baby was sent from Nezhin. This type of abnormality is shown in showcases #6, 9 and 12. The seventh item in the list tells about a siren-like baby. Although this abnormality is extremely rare, you can see several examples on our display (showcases #8, 12, and 14).

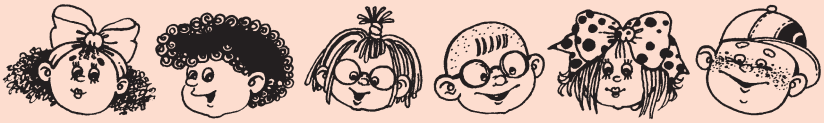
Quite often, the so-called "single monstrosities" are very serious, fatal malformations. Among such defects we can mention anencephaly (which

means the embryo has no vault of the skull and no cerebral hemispheres), deformations of the spinal cord, the backbone, cerebral hernias, and sirenes (a defect when the lower extremities are joined into one and the urino-genital organs are undeveloped). There are also minor defect that do not threaten the baby's life, such as polydactylia, cleft palate, cleft lip and syndactylia (a defect when the second and the third finger are accrete).

Anatomist P.A. Zagorsky, who started to work in the Kunstkamera in 1805, studied different types of monstrosities. He wrote: "The anatomy of monsters not only helps prove scientific physiological hypotheses, but also leads to the discovery of new rare phenomena that can be surprising and enrapturing. And, vice versa, usual, familiar objects sometimes do not attract our attention".

◀ *According to ancient Greek myths, Cyclops were one-eyed giants, sons of Uranus and Gaea*

Cyclopia is an inborn anomaly, when two eye-sockets merge into one that contains the eyeball. Cyclopia is usually accompanied with a cylindrical trunk-like nose.



PELED FISH [showcase #9]. A peled is a whitefish with a darker colouring than other fishes of this type. It can be 45-55 cm long and weigh up to 2.5—3.5 kilos. It is found in the lakes and rivers of Eurasia. This peled was caught in a Siberian river.

CAPUCHIN [showcase #14]. Capuchins are small monkeys found in Central and South America. They got their name because their "hairdos" resemble the hoods of the Capuchin monks. The monkeys with a "hairdo" are usually brownish, and the smooth-headed monkeys have white muzzles and shoulders.

The American monkeys are usually referred to as inferior compared with the monkeys of the Old World. Capuchin monkeys, however, are the smartest on the continent. For example, they can use stones to crack nuts, which not all anthropoid apes are capable of.

► *White-fronted capuchin. Stuffed animal on loan from the Zoological museum collections*

Those who believe in chiromancy may be upset at the fact that the same lines of life, heart and mind used by chirognomists to tell human fate, are found on the palms of these inferior American monkeys. Hardly anyone could predict that this capuchin will be brought to another continent, and its stuffed body will be on display in a museum.

OPOSSUM [showcase #14]. Opossums, as well as all other marsupials, originated from South America. Gradually, opossums spread in the northern regions. They are not fastidious and feed on everything they come across: juicy leaves, beetles, mice and lizards.

Opossums have no sharp claws or strong teeth to protect themselves. So if it fails to run away from its enemy, it pretends to be dead. There's even an idiom in American English "to play possum" which means to fake something, to pretend. In fact, opossums are wonderful actors: they roll up their eyes, spreads its paws as if they were stiff and remains motionless for a long time. If you kick such "dead" opossum or grab its tail and throw it aside, it won't give itself away.

◀ *Northern opossum. Stuffed animal on loan from the Zoological museum collections*

TORTOISES [showcase #10]. Even a small child can tell a tortoise from other animals by its main feature: the shell that protects it from enemies.

There are only two species of fresh-water tortoises: European and American tortoises. The European tortoise is wide spread across Western Europe up to the southern coast of the Baltic Sea, in the Aral Sea region, in the Caucasus, Turkey and Northern Iran. It is found in swamps, pools, lakes, river backwaters with slimy bottoms and flat banks. It feeds on terrestrial and water animals: worms, snails, dragonfly larva, mosquitoes and diving beetles.

In the Middle Ages people in West Europe ate fresh-water tortoises, especially during religious fasts, as the Church considered tortoise meat a Lenten fare, just like fish.

LIMB DEFECTS

The hardest deviation from limb development is a malformation referred to as sirenomelia. It is considered that there's one baby with accrete legs per 60 thousand normal babies. This anomaly is called sirenomelia because they resemble sirens: herbivorous sea animals with front limbs turned into fins and atrophied lower limbs. During embryogenesis, the lower limbs of such babies grow together, as a result of which they look like a fish tail. Accretion concerns soft tissues and some long tubular bones. Sometimes one rudimentary foot is formed with a single toe. Usually, this monstrosity is combined with undeveloped pelvis organs and the absence of an excretory system, which makes life impossible for such baby outside its mother's body.

Less serious limb abnormalities lead to the birth of children with missing legs or arms. Sometimes it looks as if the child underwent an amputation. Sometimes, babies with rudimental limbs are born, for example arms that look like seal flippers.

It is well known that after Peter I had issued his decree, not only dead but also live monsters were delivered to the Kunstkamera. One of them was a dwarf named Foma Ignatiev, who was 126 cm tall, had two toes on each foot, two ugly fingers on his right hand that looked like crawfish pincers, and two pairs of "pincers" on his left hand. All this did not stop him from walking around and taking money from people for the fun. When Peter I came to the Kunstkamera, he always shook his hand. A drawing has preserved that depicts Foma (showcase #18).

▲ *Specimen of a fetus with sirenomelia*

Sirenomelia is an abnormality when fetus lower extremities accrete, as a result of which the lower part of the body reminds of a fishtail. In Greek mythology birds with women's heads were referred to as sirens. In the Middle Ages, this word was used to refer to mythical female beings that looked like mermaids. Herbivorous sea mammals are also referred to as sirens.

Comparatively often, babies are born with extra fingers or toes. The famous Rafael in his painting called the "Sistine Madonna", depicted this phenomenon. If you take a close look at Saint Sixtus's hand, you will see that he has six fingers.

Much more rarely babies are born with three legs. They are quite viable and can even make a successful career, like the famous circus actor named Francesco Lentini who lived quite a long life (1889—1966).

▲ *Foma Ignatiev. Drawing. 1740—1760s. From the collection of the St. Petersburg Branch of the Archive of the Academy of Sciences*
Foma Ignatiev was a live exhibit of the Kunstkamera in the early 18th century. He was 126 cm tall, had two "monstrous" toes on each of his feet and two "monstrous" fingers on each of his hands, which did not stop him from walking around and taking money from people for the fun.

▲ *Specimen of a newborn with an abnormality of the upper extremities*

▲ *Specimen of a newborn with an inborn amputation of the lower extremities and three-fingered left palm*