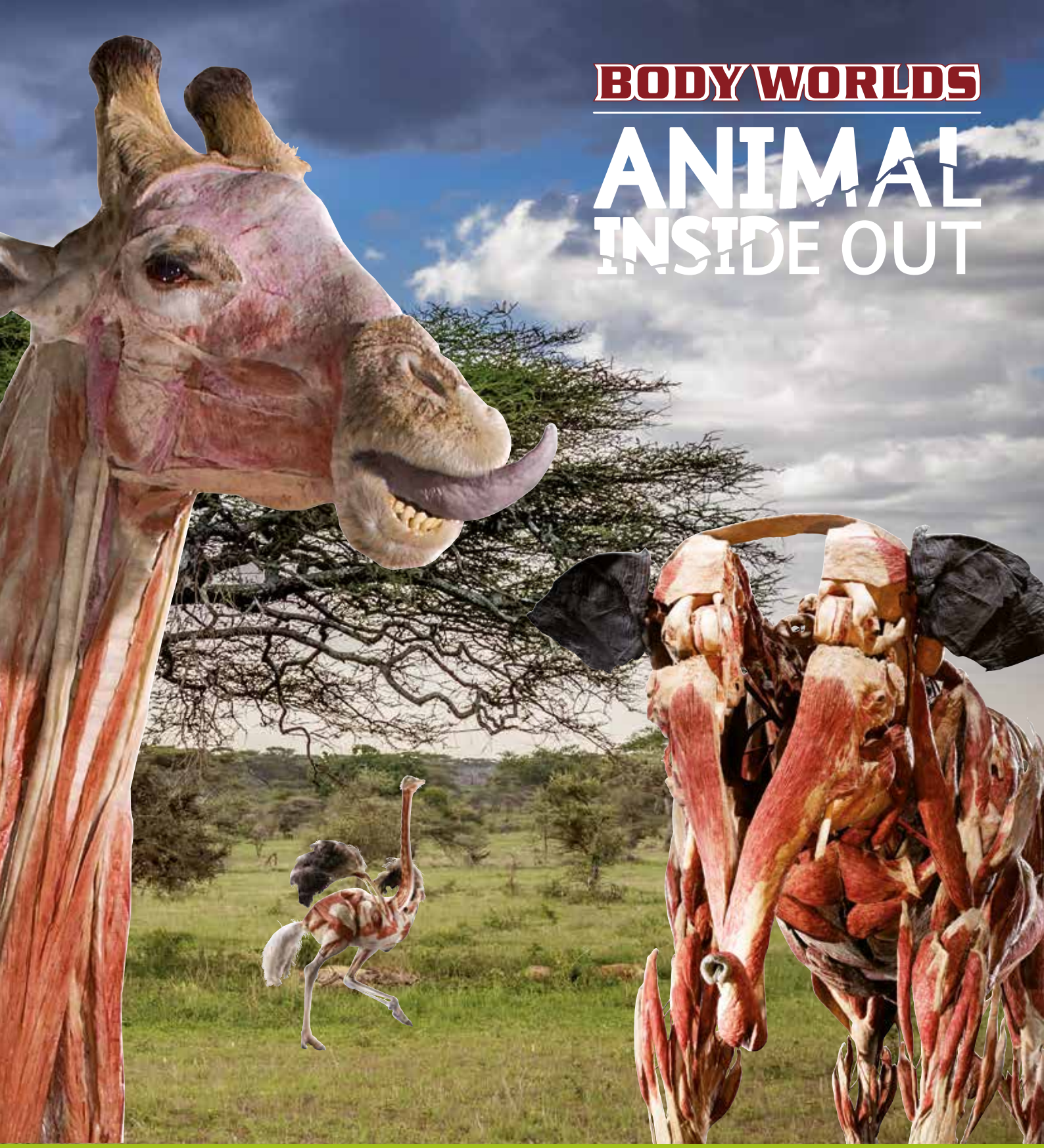

EXHIBITION GUIDE

EU FEB 2016

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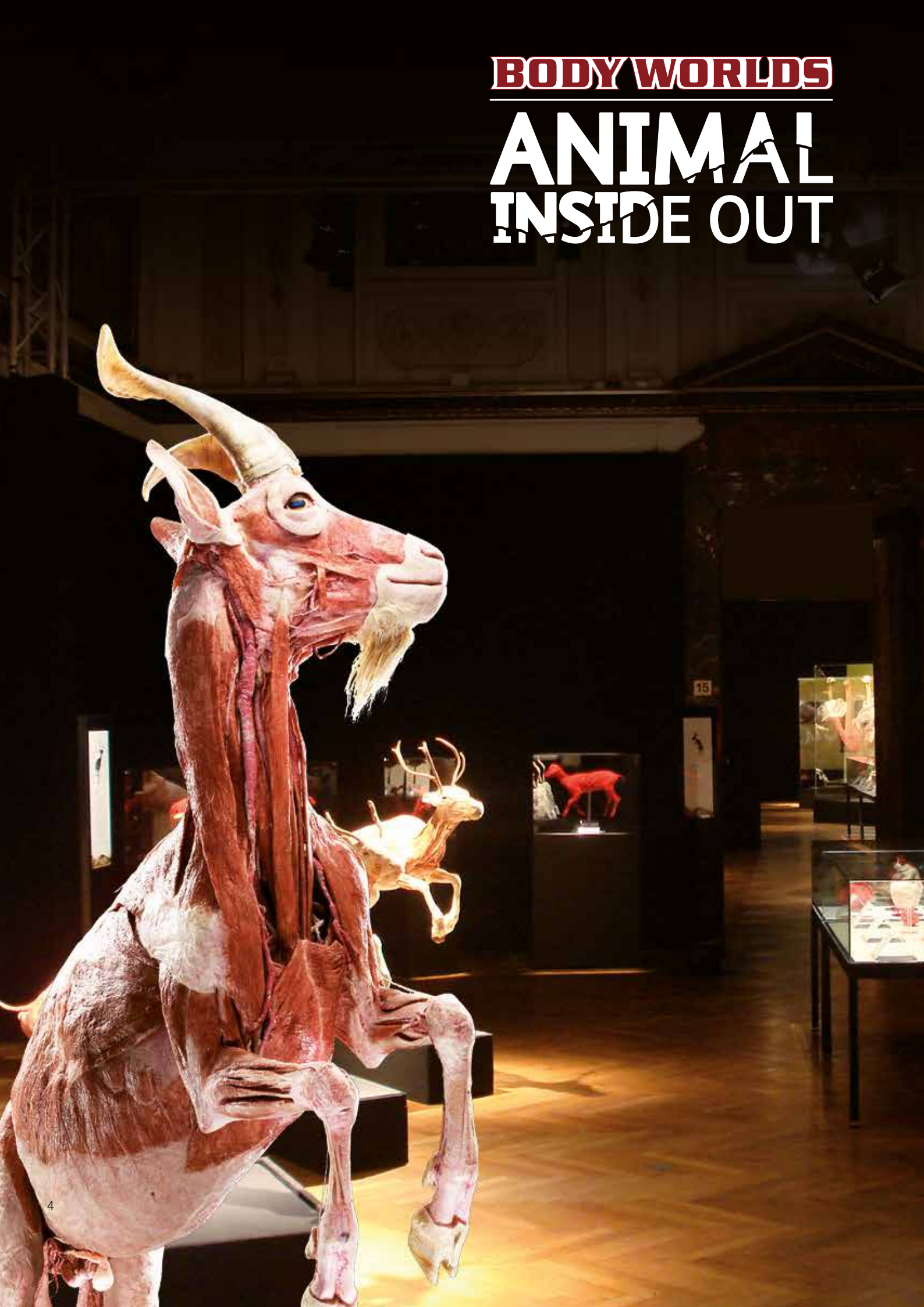
can be downloaded from our website
www.animalinsideout.com


BODY WORLDS
ANIMAL
INSIDE OUT

WELCOME

A letter from ANIMAL INSIDE OUT

Dear Students,

Did you know that giraffes are the tallest mammals on earth, ranging in height from 4 – 6 metres? Can you imagine that the heart of a bull is five times larger than that of a human? While our own bodies are capable of some pretty amazing feats, all animals have their own traits, characteristics and incredible skills that make them unique.

The specimens presented in ANIMAL INSIDE OUT were created by German anatomist, Dr. Gunther von Hagens, inventor of the revolutionary Plastination process. Thanks to the donation of various animals from zoos and other institutions, we began our work on the specimens you will see in this one-of-a-kind exhibition, intended to help people understand more about the animal kingdom through anatomy.

When you visit with your school or family, you will see how intricate the blood vessels of animals are, what the muscular system and various organs of different animals look like and how they compare to other animals, including humans. ANIMAL INSIDE OUT will show you why giraffes have such long necks, reveal why camels have humps and how the hoofs of certain animals make them better equipped to navigate the terrain of their native habitats. Combined with additional educational activities we hope that you will learn more about the anatomy of animals and how each species, large and small, plays an important role on our planet.

Albert Einstein once wrote that we should widen "our circle of compassion to embrace all living creatures and the whole of nature and its beauty." The animals presented in ANIMAL INSIDE OUT – wild, exotic, domestic, previously unknown and even those familiar to us, offer a glimpse into the biology and diversity on our planet. The plastinated specimens are our contribution to the epic on evolutionary biology and the diversity of life on our planet.

It's my sincere hope that you enjoy this anatomical safari!

Dr. Angelina Whalley

Creative & Conceptual Designer
ANIMAL INSIDE OUT and BODY WORLDS Exhibitions

ANIMAL INSIDE OUT – **A MODERN DAY NOAH'S ARK**

It is only natural for humans to be fascinated most by what we have never seen before. And what might be more astonishing to visitors than these giants from the steppes, the jungles, and the deep seas? Plastinator Dr. Gunther von Hagens and curator Dr. Angelina Whalley have created a spectacular exhibition: ANIMAL INSIDE OUT. Thanks to revolutionary plastination technologies, even the largest animals can be aesthetically dissected and preserved for the long term.

This memorable and educational exhibition is dedicated to the animals' insides. A look underneath the skin and fur allows a view of the animals' bone structure, muscles, nervous system and organs at a level of detail never experienced before. "It is fascinating to see the anatomical similarities of the vertebrates on the one hand, and how many different anatomical variations have formed on the other hand, in response to an animal's living conditions – such as the elephant's trunk or the giraffe's long neck," says exhibition curator, Dr. Angelina Whalley.

In addition to a gorilla packing 120 kilograms of muscle, a bear, a giant giraffe and other animals, some of them domestic, ANIMAL INSIDE OUT presents an authentic sensation: "Samba", the first elephant plastinate ever! "Samba," with her mass of 3.2 tons and a size of 6 by 3.5 metres is the largest animal ever plastinated as a whole.

Everyone interested in animals, male or female, young or old, is invited to participate in an easy to understand anatomical safari. In a manner that is more graphic and more detailed than any anatomy textbook could ever be, the exhibition relates interesting facts about all the animals shown.

A visit to the exhibition provides unique insights into the animals' interiors and opens up a 3rd dimension of experience. Thus, the didactic aim of ANIMAL INSIDE OUT becomes apparent: The exhibition illustrates the complexity of the animals' insides, and how different animals have adapted both their anatomy and their organ function to their natural habitats. In doing so, the exhibition also shows how important it is for humans not to endanger the animal world by negligent and selfish destruction. Recognizing this, visitors will develop increased respect for animal life and will become more aware of the necessity of protecting the habitats of endangered animal species.

Didactically, ANIMAL INSIDE OUT has been prepared in a way that makes it suitable for children and adults. Seeing this special exhibition is practically a must – not only as part of biology class.

Curator Dr. Angelina Whalley and Plastinator Dr. Gunther von Hagens

"It is fascinating to see the anatomical similarities between different animal groups. ANIMAL INSIDE OUT shows animal anatomy with far more detail than any textbook."

Dr. Angelina Whalley

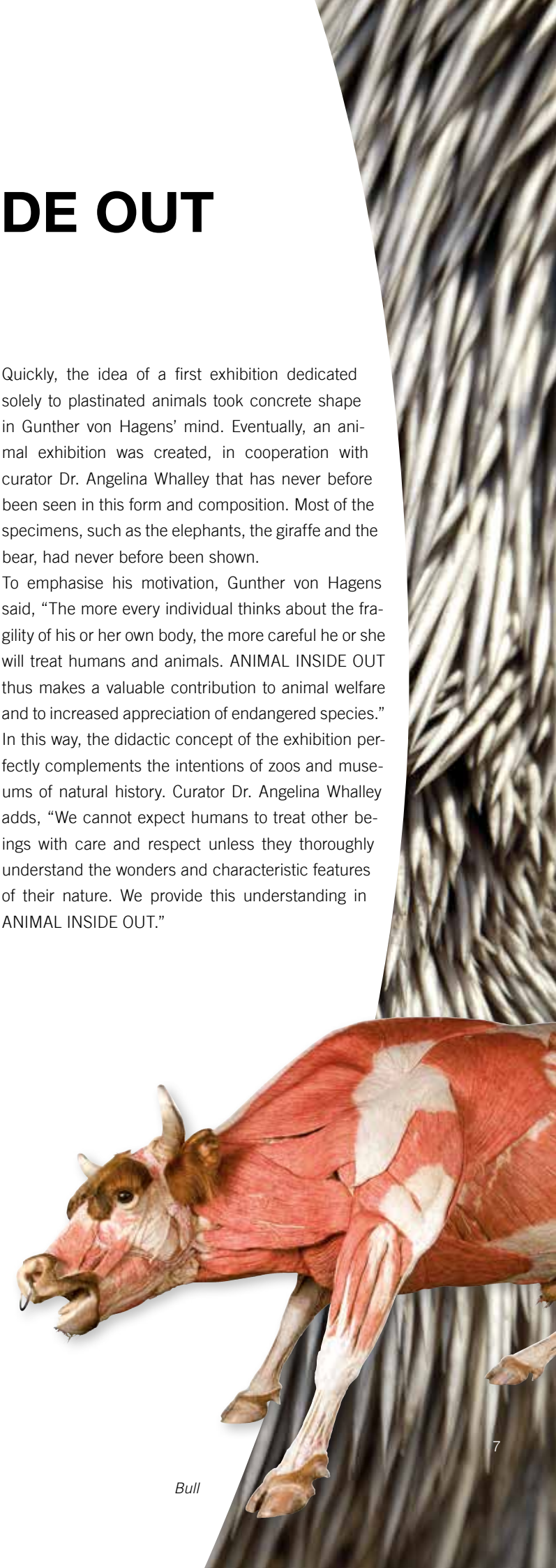
THE GENESIS OF **ANIMAL INSIDE OUT**

Physician and scientist Gunther von Hagens has been particularly fascinated by animals for years now. As early as the year 2000, the professed animal lover has plastinated large animals such as an impressive horse, followed in 2003 by a camel and a gorilla. His fascination with these animals stems from his underlying motives, he explains: “Humans always look for the extraordinary, for that which goes beyond all imagination. Humans want to be amazed! In plastinating animals, what entices me most is the possibility. They challenge my entire creative abilities! The larger they are, the bigger the anatomical and technical challenge they present. With giants, such as the elephant, even I discover much that is new, that I have never seen before. For example, we have been able to visualize that a giraffe’s skin is more vascularized in its dark parts than in its light parts. This has never before been shown so clearly, as no-one else previously has injected an entire giraffe with a resin that penetrates the arteries of the skin, as we have done.”

Thanks to the plastinator’s indefatigable enthusiasm, more and more imposing animals have been collected over time. But it was not until the female elephant, “Samba” died from cardiovascular weakness in February of 2005 and her carcass had been plastinated, that ANIMAL INSIDE OUT was born. In creating the exhibition, Gunther von Hagens followed the wishes of Neunkirchen zoo director Dr. Norbert Fritsch who donated the giant carcass that his zoo would host the exhibition premiere. “We are glad that “Samba” has not been rendered as animal fat and could be saved, literally, at the last minute from the rendering plant,” says Dr. Fritsch.

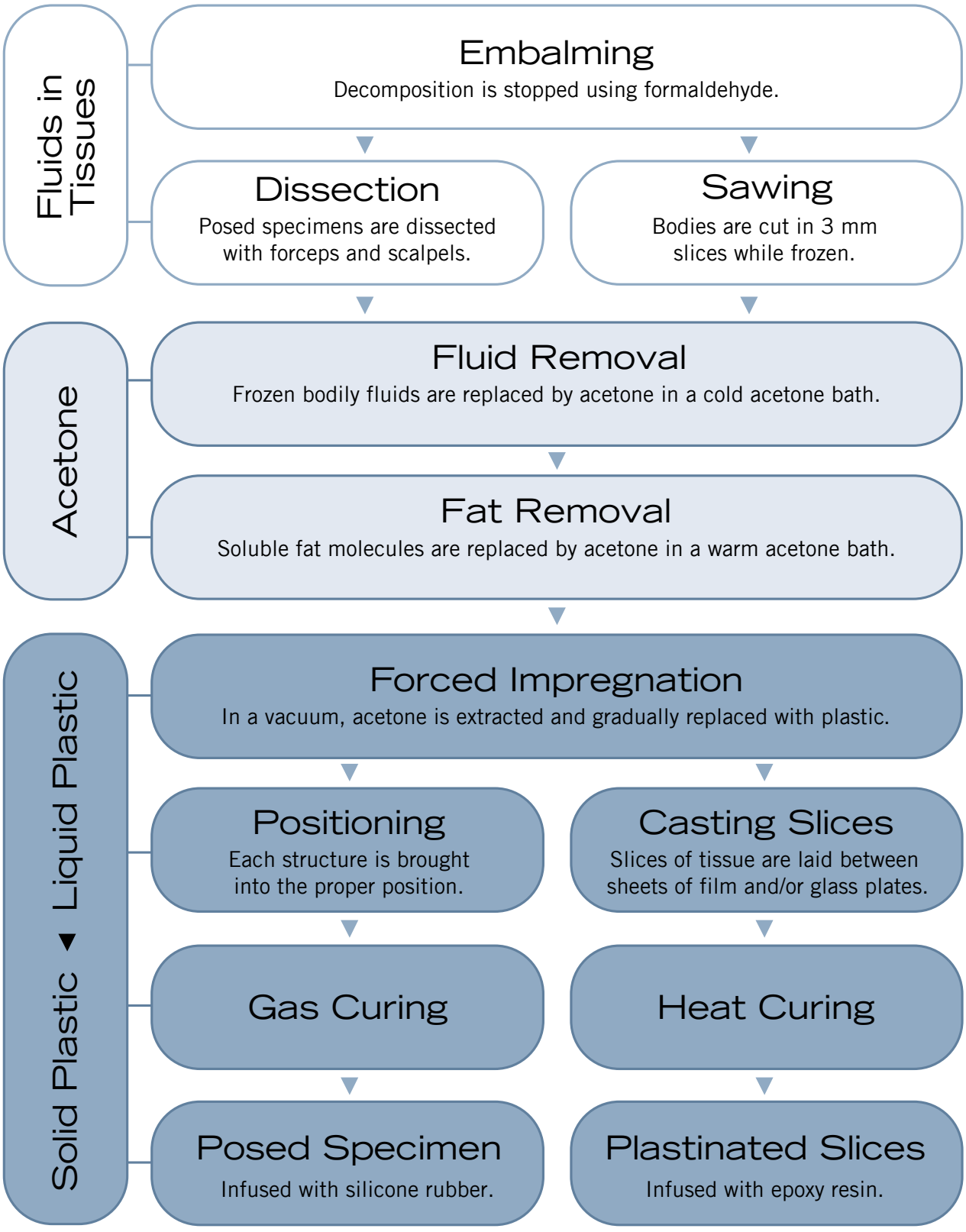
Quickly, the idea of a first exhibition dedicated solely to plastinated animals took concrete shape in Gunther von Hagens’ mind. Eventually, an animal exhibition was created, in cooperation with curator Dr. Angelina Whalley that has never before been seen in this form and composition. Most of the specimens, such as the elephants, the giraffe and the bear, had never before been shown.

To emphasise his motivation, Gunther von Hagens said, “The more every individual thinks about the fragility of his or her own body, the more careful he or she will treat humans and animals. ANIMAL INSIDE OUT thus makes a valuable contribution to animal welfare and to increased appreciation of endangered species.” In this way, the didactic concept of the exhibition perfectly complements the intentions of zoos and museums of natural history. Curator Dr. Angelina Whalley adds, “We cannot expect humans to treat other beings with care and respect unless they thoroughly understand the wonders and characteristic features of their nature. We provide this understanding in ANIMAL INSIDE OUT.”



Bull

THE **PLASTINATION PROCESS**



THE MIND BEHIND **THE EXHIBITION**

Animals have fascinated me all my life.

As a child, I was enthralled by the small animals I encountered in the woods. The first specimens I dissected were beetles, frogs, and other small animal corpses that my friend, Dietrich and I found during our jaunts to the woods. These deaths which were so random and yet so normal must have coloured my view of death and shaped my thoughts on mortality, preparing me psychologically for my career as an anatomist.

My childhood years were filled with a certain awe for nature and the varieties of life that populated it. But in my teenage years, my interest in biology was replaced by an interest in electronics and space. I became the resident expert on all things related to Sputnik, and soon in the gadgets I saw in early James Bond films.

Later as an adult, I renewed my relationship with animals by frequently visiting zoos and aquariums. The larger than life animals I admired – giraffes, elephants, and gorillas – were filled with a controlled grace that I found wondrous.

They lumbered, they sauntered, they ambled, their elegance so surprisingly disproportionate to their size. In the last decade, I have travelled to Africa and Antarctica to see up close the creatures that had captured my childhood imagination.

In an accelerated technological age, when our environments are fashioned from steel and concrete, being in close proximity to animals – both domestic and wild – returns us to authenticity. Outside of the rainforests and flora, they and we are the last remaining pieces of nature. They are our cohabitants on this spinning blue globe. This exhibition, ANIMAL INSIDE OUT, is both a celebration and an homage to animals both familiar and rare.

Dr. Gunther von Hagens

Anatomist, Inventor of Plastination and
Creator of ANIMAL INSIDE OUT & BODY WORLDS Exhibitions

Q&A WITH KIDS

Children Visiting ANIMAL INSIDE OUT – Interview with Dr. Gunther von Hagens Creator of BODY WORLDS & Inventor of Plastination

Were you ever scared to work with dead animals and bodies?

Dr. von Hagens: When I was a child I spent my time in the woods, chasing frogs and listening to the sounds of animals in the forest. Occasionally, I would find small, dead creatures – like beetles and snakes, which I would take with me to dissect. I was always curious to see what they were like on the inside.

When I was about six years old, my jaunts in the woods came to a halt. I became very sick and nearly died. I was in hospital for many months and became very comfortable in that environment of the sick and dying. The doctors and nurses who cared for me became my heroes, and I wanted to become like them. Later when I worked in a hospital as an orderly and then a nurse, (long before I became a doctor), one of my duties was to transport the dead to the morgue. Other workers didn't like this job because it frightened them, but I was never afraid. Being afraid of death is not a good way to live.

What is the largest animal you have ever plastinated?

Dr. von Hagens: For years now, I have been working on plastinating animals. A few years ago, I plastinated not only some smaller animals, but some large ones, such as a horse (2000), a camel, and a gorilla (2003). In particular, these large animals require all of my imagination. The larger they are, the bigger the anatomical and technical challenge they present. When I completed the plastination of these animals I was certain that they would be the largest animals I would ever plastinate, however, to my great surprise and honour I was donated two elephants by the Neunkirchen Zoo in Germany, in 2005. The animals died in captivity – one of old age and the other of heart failure. The whole process to transform the two elephants took four and five years respectively. Through the challenges and obstacles faced to transform them I must admit that they certainly have allowed a view of elephants never seen before. I now presume they are the largest animals I will ever plastinate, but I hesitate to say I'm completely certain.

What have you learned from plastinating animals?

Dr. von Hagens: I have discovered many new aspects of anatomy when working on the plastination of animals giant and small. My team and I dissect animals in a detailed and careful manner that surpasses previous preservation techniques. In doing so, I feel like a researcher on an anatomical journey of discovery. For example, we have been able to show how the underside of a giraffe's skin is more vascularized where it has dark spots, compared to the areas where it has lighter fur. This has never before been shown so clearly, as no one else previously has injected an entire giraffe with a contrast enhancing resin that penetrates even the minute arteries of the skin, as we have done.

Where did the idea for BODY WORLDS and ANIMAL INSIDE OUT come from?

Dr. von Hagens: When I used to teach anatomy to students in medical school in the 1970s, I had to use illustrated anatomy atlases and picture books to show the organs and body systems. I tried to use real human organs and specimens, but at that time the specimens were preserved in blocks of plastic so you could not touch them, or study the placement of the organs properly. I realized one day that if the plastic was inside the body and not outside it, the specimen would be rigid and easy to grasp, and study and work with. I was only trying to solve a problem, I wanted to educate my students so they would become better doctors, as I don't think doctors should be poking around inside your body and operating on you if they don't know important things about it. But something very unusual began to happen after I began to plastinate organs and specimens. The janitors and secretaries and office workers at the university began to stop by the lab; they were fascinated by the plastinates. This was when I began to think of anatomy for lay people, which is what BODY WORLDS is. It is very different from anatomy for medical professionals because it has to be interesting and dynamic and not scary to look at. In the human BODY WORLDS exhibitions, curator Dr. Angelina Whalley and I decided to incorporate some animal specimens. Visitors often found them as fascinating as human specimens. This led us to come up with the concept of ANIMAL INSIDE OUT.

How long does it take to prepare the specimens for display?

Dr. von Hagens: Plastination takes a very long time. A whole-human body can take up to 1,500 working hours to prepare. Larger animals like elephants, giraffes and horses can take three years or more. Smaller specimens and slice specimens take an average of 3-6 months depending on the size and level of dissection.

Bactrian Camel

ESSENTIAL QUESTIONS

1. How are animal groups anatomically similar?

By examining and comparing the anatomy among species, similarities and differences are observed, establishing a relationship between species. When characteristics are shared among a large number of similar species, they are viewed as ancestral. While those limited to one or a few species are viewed as derived. The comparison of a variety of characteristics possessed by similar species allows scientists to differentiate between species that are truly closely related and those illustrate the interconnectedness. ANIMAL INSIDE OUT encourages the visitor to make the connection of how living things are more alike anatomically than what can be seen externally.

2. Do animals in nature have anatomical similarities to humans?

All species are similar at the molecular level. They are made of a cell or cells, surrounded by a plasma membrane and containing DNA and RNA. There are 500 genes common to all species it's the combination of the other thousands of genes that allow for such great diversity present on Earth today. The main goal of ANIMAL INSIDE OUT is to illustrate the interconnectedness of all species when the covering is removed. From the outside, the diversity of life is evident by all of the different and unique life forms on Earth. Through revealing their, and our, internal structures the interconnectedness of life can be better understood. Multicellular organisms consist of body systems, some more complex than others.

As an example, this case can be made by comparing bird wings and primate skeletal structure in the forearms. Each of the organisms possesses a humerus (upper arm in primates), radius and ulna (both comprising the forearm in primates), carpals and metacarpals (primate wrist bones) and phalanges (primate fingers). The main difference between these organisms is the use of the structure and the size and number of certain bones.

Humans tend to identify the most with gorillas and chimpanzees when it comes to likeness. Certainly, there are more similarities in body structure than dissimilarities, such as similar muscle groups, an opposable thumb on the hand to allow for grasping and handling objects, as well as common reproductive strategies. There are specific structures on humans that allow for walking upright on two feet all of the time that are unique to humans and are either not found in apes or are slightly modified.

3. How do animals use specific adaptations to survive in their environments?

ANIMAL INSIDE OUT highlights the unique adaptations in animal groups that allow for survival and proliferation of their species. For example, sharks have adapted to their environment so well they have been present in some form for over 300 million years. Sharks belong to the most numerous and diverse classification of vertebrates on Earth, fish, and are categorized as cartilaginous fish. This means their skeletal structure is made of cartilage not bone, as with other fish. Sharks have extremely well developed sensory organs; this enables them to be considered apex predators in Earth's oceans.

Octopus

The reindeer is another example of an animal that has highly developed adaptations for the extremely cold environment it lives in. Reindeer hair is hollow like a straw. This adaptation allows the reindeer to float when swimming. The hollow hair traps air, which insulates the body. Heat is trapped close to the body by a long, thick winter coat. The reindeer also has the ability to cool down its limbs in the winter in order to conserve body heat. The blood vessels constrict, restricting the flow of warm blood to the limbs and saving heat and energy for the muscles higher up in the animals body since the reindeers lower legs are primarily tendons and ligaments. When the outside temperature warms to above minus 18° C the blood vessels open and allow warm blood to flow to the legs again.

4. Why is understanding anatomy critical to discovering more about the evolution of living organisms and the natural world?

The nature of science is an effort to understand, or better understand, the natural world and how it works. Science asks the questions: What is there? How does it work? How did it come to be this way? The homology of past and present living organisms is revealed by studying the anatomy and cellular similarities and differences of organisms. There are 500 genes that are common to all species. This commonality provides strong evidence that all living things descended from the same ancestor. Comparative anatomy brings to light the concealed similarities to establish a relationship between different species of living organisms. Developmental biology allows scientists to study the embryological development of living things. Developing embryos provide evidence for common ancestry. This provides clues to the evolution of present day organisms. The applicability of evolution in science allows for progress in medical science, agriculture and conservation.

Human *Lizard* *Bird* *Bat* *Whale*

The front limbs of many animals are very similar because they have a common evolutionary origin. This similarity is referred to as homology.

BODY WORLDS
ANIMAL INSIDE OUT

EXHIBITION
OVERVIEW

Travel on an anatomical safari

Explore the intricate biology, zoology and physiology of the world's most spectacular creatures, large and small in this fascinating new exhibition by BODY WORLDS creator, anatomist Dr. Gunther von Hagens.

ANIMAL INSIDE OUT takes visitors on an anatomical safari of more than 100 specimens. Each animal is painstakingly preserved by the remarkable process of Plastination, invented by Dr. von Hagens.

From goats to giraffes, elephants to eels and octopuses to ostriches visitors will discover the form and function of animals both exotic and familiar. Animal biology textbooks spring to life in this unforgettable museum learning experience.

Ostrich

AMAZING **FACTS**

A bull's heart
is around 5 times heavier
than a human heart.

Elephants have a longer pregnancy
than any other mammal – almost 22 months. At birth,
elephants already weigh some 90 kilograms and stand
about 1 metre tall.

Giraffes
are the tallest mammals on earth,
ranging in height from 4-6 metres.

The combination of the cat's inner ear
(vestibular apparatus) and tail
provide the cat with its incredible balance
and acrobatic prowess.

Chickens
can travel up to
14 kilometres
per hour.

An adult bull giraffe
can feed on the leaves of trees over 6 metres
above the ground!

Reindeer

Reindeer
have long, coarse hair with hollow cores,
which keeps them insulated in colder climates.

Frogs don't need to drink
the way humans do:
they absorb water
through their permeable skin!

Giant squid can snatch prey up to 10 metres away by shooting out their two feeding tentacles, which are tipped with hundreds of powerful sharp-toothed suckers.

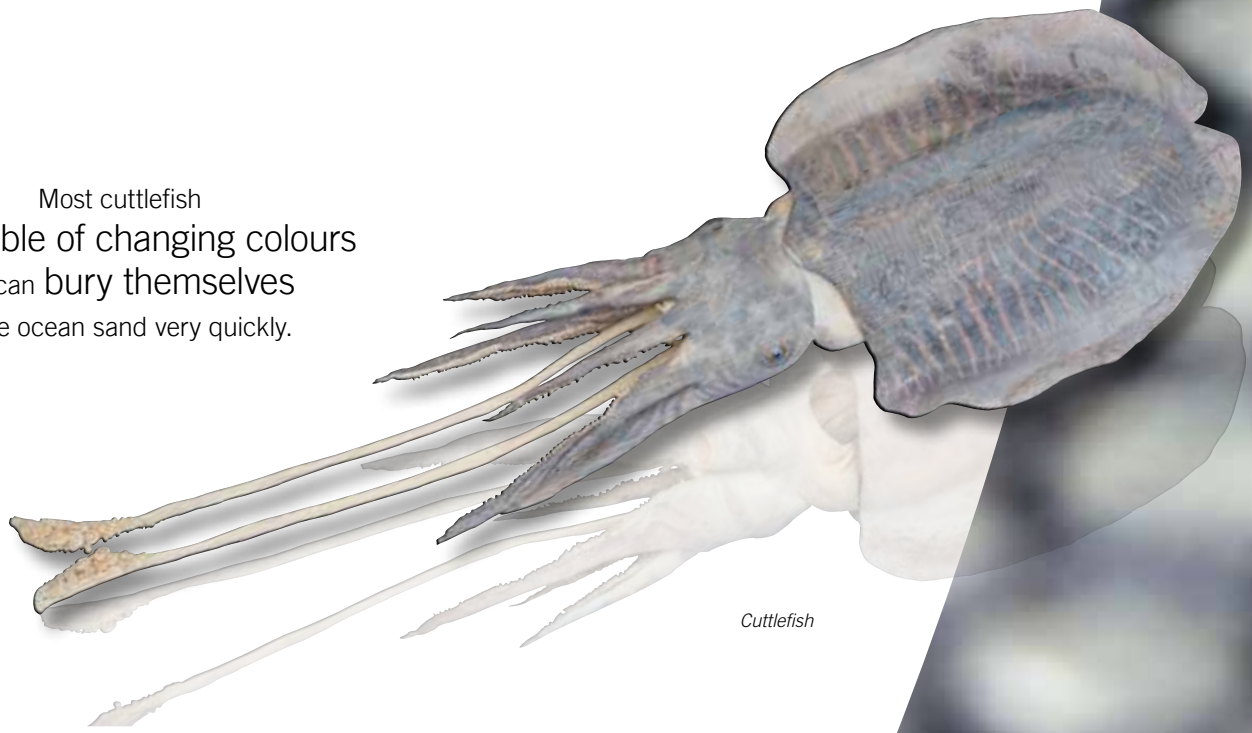
Sharks have been swimming the seas for 400 million years – longer than dinosaurs have been walking the earth.

Sea scallops grow rapidly during the first several years of life. Between the ages of 3 and 5, they commonly increase 50% to 80% in shell height and quadruple their meat weight.

Mackerel, unlike any other species, are likely to die if their incredibly thin and specialized skin is touched by human hands. It is theorized that it may be the oils in human hands.

The maximum speed of a snail is 1.6 kilometres a week or about 10 metres an hour.

Most cuttlefish are capable of changing colours and can bury themselves in the ocean sand very quickly.



Cuttlefish

The **Elephant**

Asian elephants (Elephas maximus) such as “Samba” are the second largest terrestrial animals worldwide, towered only by the African elephants. Asian and African elephants are different in that Asian elephants have much smaller ears and tusks: While male and female African elephants carry large, widely visible tusks, only about half of the male Asian elephants have tusks. Female Asian elephants have only thin and short tusks. However, these tusks often break in fights or when subjected to heavy loads, and they do not re-grow. Another difference is that the highest point of the body of the Asian elephant is its head, and in an African elephant it is its back. But there are also differences on the inside, for example 19 vs. 21 paired ribs and 33 vs. 26 vertebrae in the tail.

Elephants, weighing up to 6 tons and being the heaviest terrestrial mammals, are called pachyderms, meaning thick-skinned. And indeed, their skin is about as thick as a human thumb. Hidden underneath is the gigantic body with its huge skeletal muscles and bones. In the expanded elephant they are clearly shown. The abducted muscles also allow insights into the architecture of the knee and elbow joints.

Among today’s terrestrial animals, elephants hold almost all the records: Their brains weigh about 5 kilograms, their hearts between 15 and 25 kilograms. Although a human heart at 300 grams weighs only a fraction of that of an elephant, at 60 beats per minute it beats about three times as quickly. Their long gestational period also is unique among all animals: It lasts 20 to 22 months. Eventually, an elephant calf is born, weighing 100 kilograms, more than most grown men.

Cool Fact

Saying that elephants are pachyderms is correct only in part. On vulnerable spots like the trunk embouchure, legs and back, skin can in fact be 2.5 to 3 centimetres thick, but behind the ears, by the eye, on the abdomen, chest and shoulders it is as thin as paper. Despite its thickness, an elephant’s skin is also very sensitive to sun burn and bug bites.

Elephant “Samba”

The trunk is the most unusual anatomic structure in the elephant. It represents the elephant's extended organ of smell that in the course of evolution developed out of the upper lip and nose. The trunk is more than one metre long, consists mostly of muscles, and does not contain a single bone. The muscles are intertwined into about 40,000 bundles and make the trunk extraordinarily flexible and a versatile tool. An elephant can use it to suck in up to 10 litres of water and squirt them into its mouth for drinking.

PROFILE

ASIAN ELEPHANT

SCIENTIFIC NAME
Elephas maximus

SIZE
Body length: up to 6.40 m
Shoulder height: up to 3 m

TOP SPEED
43 km/h

WEIGHT
Up to 5 tons

LIFE SPAN
Up to 60 years

DIET
Herbivore; roots, grasses, fruit and bark

PREDATORS
Tiger

DISTRIBUTION
India and Southeast Asia including Sumatra and Borneo

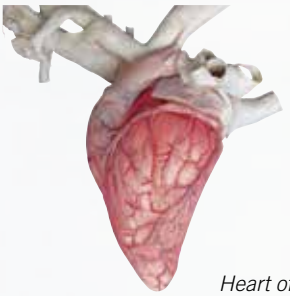
HABITAT
Rainforest and tropical woodland

PROTECTION STATUS
Endangered (IUCN Red List www.iucnredlist.org)

When crossing a river, the elephant uses its trunk with its highly sensitive tactile hairs as a "snorkel" for breathing, and when eating, the trunk becomes a gripping arm that allows the elephant to pick leaves and branches off trees. Elephants are plant eaters and consume about 150 kilograms of grass, bark, branches, roots, and fruit every day. For this reason, elephants' teeth will regrow six times during their lifetime. When it has lost its final set of teeth, an elephant is no longer able to chew its food and its time to die has come. The trunks correspond to the incisors of other mammals, they serve to peel the bark off trees, and, in an emergency, to defend the animal. The large amounts of food are needed because elephants, unlike ruminants, use only about 40% of what they eat. They consume 250,000 calories daily, which is about 100 times as much as humans need in a day.

The **Giraffe**

Most unusual about the expanded giraffe (Giraffa camelopardalis) in ANIMAL INSIDE OUT are its seemingly record dimensions. At up to 6 metres in height, the giraffe is the tallest terrestrial animal worldwide. After “Samba” it is the second largest plastinate to date and was dissected, over a course of 2 years and 20,000 working hours, by Gunther von Hagens and eleven plastinators. A look underneath the mottled skin that uses circular arteries in the subcutaneous tissue to give off heat allows rare insights into the anatomical characteristics of the giraffe, such as its spectacular heart weighing 10 kilograms. Due to the length of the neck that stretches almost two metres, the giraffe’s heart has to work hard to pump blood against gravity all the way up to the brain.



Heart of a giraffe

The head, which was dissected into four parts, shows the dense network of arteries beneath the brain. These arteries have special valves making sure that the giraffe will not suffer from brain damage when suddenly lowering its head, thereby significantly increasing the blood pressure in its neck and brain vessels. The characteristic long neck has, just like the human neck, only seven vertebrae – each of which, in the giraffe, measures up to 40 centimetres. In the course of its evolution this long neck gave the giraffe an advantage over shorter herbivorous (plant eating) animals when hunting for food in the scrubs and steppes of the African savannah. A single strong ligament holds this long neck upright and forms the protuberance at the back of the neck. Because the giraffe’s front legs are much longer than its hind legs, its back is strongly sloped. The extremities appear rather clumsy. However, a galloping giraffe may reach top speeds of up to 60 kilometres per hour.

Characteristic of the giraffe’s head are its antlers, tipped ears and large eyes with their thick lashes. When eating, the giraffe uses its 50 centimetre long, bluish tongue to grasp and pull leaves off trees. The giraffe eats up more than 35 kilograms of plant food every day, preferably spiky acacias that it can chew painlessly thanks to hardened skin covering its cheeks, lips, and tongue. At night, giraffes ruminate continuously.

Giraffe

Cool Fact

A giraffe's heart, which can weigh up to 12 kilograms, has to generate around double the normal blood pressure for a large mammal in order to maintain blood flow to the brain against gravity. In the upper neck, a complex pressure-regulation system called the rete miribale prevents excess blood flow to the brain, when the giraffe lowers its head to drink. This ensures that a giraffe won't faint.

PROFILE

GIRAFFE

SCIENTIFIC NAME
Giraffa camelopardalis

Size
Height up to 5.70 m
TOP SPEED
Up to 60 km/h
WEIGHT
1,900 kg
LIFE SPAN
20-25 years
DIET
Herbivore; buds, shoots and leaves of trees and shrubs
PREDATORS
Lions, leopards, hyenas
DISTRIBUTION
Africa
HABITAT
Wooded savannah and grasslands
PROTECTION STATUS
Least Concern (IUCN Red List www.iucnredlist.org)

The **Gorilla**

Primates are those mammals that most resemble humans in their anatomy and behaviour. The imposing lowland gorilla shown in ANIMAL INSIDE OUT weighs more than 200 kilograms and measures 1.85 metres in height. In May 2000, “Artis” died at the Hanover zoo, tragically drowning in a water ditch. Zoo director Klaus-Michael Machens had been so impressed by his visit to the BODY WORLDS exhibition that he donated the popular animal to Gunther von Hagens. “We really wanted to preserve Artis for posterity,” said Machens. Dr. von Hagens enthusiastically worked on the 17 year old male gorilla. Together with his team, he dissected the animal over 3,500 hours of work.

Lowland Gorilla

PROFILE

WESTERN LOWLAND GORILLA

SCIENTIFIC NAME
Gorilla gorilla gorilla

Size
Standing height up to 1.85 m

TOP SPEED
Up to 40 km/h

WEIGHT
Up to 275 kg

LIFE SPAN
35-50 years

DIET
Herbivore; roots, shoots, fruit, tree bark and pulp

PREDATORS
None

DISTRIBUTION
Cameroon, Central African Republic, Congo

HABITAT
Rainforest and dense jungle

PROTECTION STATUS
Critically Endangered
(IUCN Red List www.iucnredlist.org)

Cool Fact

Chest beating might be the most well-known gorilla behaviour. Gorillas usually stand upright in order to chest slap. They don't usually beat their chest with their fists but they do it with open cupped hands and they always make a lot of noise. The sound of which can carry up to 1.6 kilometres away. Chest beating is used to show stature, scare off opponents or even to prevent a fight.

The muscular body of the gorilla measures 1.55 metres around the chest, its arms span 2.4 metres. On its back, silver fur may form, that is characteristic of male gorillas and that has earned them the name "silver backs." While arm and leg muscles of the gorilla are virtually identical with those of humans, their foot anatomies differ greatly. The gorilla with its long toes has a much better grip and can hold on better with his feet, too. Walking upright, however, is hard for gorillas due to their less curved spines. Most of the time, gorillas move on all fours. For this so called "knuckle walk" they use the second and third phalanxes of their fingers. Their arms are so long that they reach below their knees when standing tall. The gorilla's head is characterized by a short snout with large nostrils, small eyes and ears, and bulging bones of the forehead.

The internal organs of the gorilla, including its heart, lungs, and diaphragm, as well as the digestive tract, including the stomach and the long intestines typical of plant eaters, are shown separately in the exhibition. Gorillas primarily live in hilly woods and feed on 35 kilograms of leaves and greens daily. Depending on the season, lowland gorillas include up to 50% fruit in their meals that they pick up from the ground and from up to 40 metres high trees. Compared to their frightening eye teeth the gorilla's incisors are relatively small. As gorillas spend half their waking time eating they have very strong masticatory muscles.

The **Brown Bear**

The plastinated brown bear (Ursus arctos) at a height of 2.5 metres and a weight of 275 kilograms is a strapping specimen. The body size of brown bears varies with the region of the earth they inhabit. Males weigh roughly 250 kilograms on average. Thanks to its majestic appearance and its legendary strength, the brown bear is depicted in many coats of arms.

Front and hind legs of the bear are almost equal in length and end in powerful paws equipped with five non-retractable claws each. The bear's soles are cushioned with fibrous connective tissue, providing it with a soft gait on all fours. One characteristic of this species is the hump across its shoulders, bestowing even more strength to the front legs. The radius and ulna, the bones of the forearm, as well as the tibia and fibula of the lower legs, are separated. This bone structure enables the massive bear to move flexibly with high precision. The wide head with its fluffy ears and set of 42 teeth twists unusually easily due to the structure of the cervical vertebrae. A common feature of all male bears is their penis bone, an anatomical peculiarity they share with dogs.

Brown bears are omnivores. They eat grass, honey, roots, and berries, and also salmon, insects, and small rodents.

PROFILE

BROWN BEAR

SCIENTIFIC NAME
Ursus arctos

SIZE
Shoulder height 1.50 m
Standing height 2.50 m

TOP SPEED
Up to 40 km/h

WEIGHT
Up to 600 kg

LIFE SPAN
20-30 years

DIET
Omnivore; fish, mammals, grass and other plants.

PREDATORS
Wolves, mountain lions

DISTRIBUTION
Europe, North America, Asia

HABITAT
Temperate broadleaf forests

PROTECTION STATUS
Least Concern (IUCN Red List www.iucnredlist.org)

In the North American mountains, a grown bear may even kill elk, reindeer, or sheep. They do so by biting their prey in the neck, or with deadly hits by their paws to the head or nape of the neck.

Because bears like to eat innards, they will cut open the abdominal or chest cavity of their prey with their knifelike claws. During the cold months of the year, bears do not find sufficient food and hibernate in dry caves. In order to do so, bears eat enough in fall to grow additional fatty tissues, a "winter flab." Their hibernation period begins, depending on the region where the bear lives, between October and December and lasts until between March and May.

Gunther von Hagens was content and satisfied having completed the bear's Plastination in 2009, "I have been fascinated with bears since my childhood. Plastinating such an animal was the fulfilment of a long-time dream of mine," he said. After 6,300 hours of work, the colossus was finished, using 5,000 litres of acetone and one ton of silicone in the plastination process.

Cool Fact

Brown bears give birth during winter rest, usually to a pair of cubs. They are born blind, helpless, and without fur, weighing only about 350 grams which is the size of a guinea pig.

Brown bear cubs nurse on their mother's milk until spring. Mother and cubs then venture outside to explore their habitat and find food to eat.

Brown Bear

The **Ostrich**

The African ostrich (Struthio camelus) is the world's largest bird. Thanks to its long neck, the male ostrich, at a height of up to 2.5 metres, towers even over humans.
Even though the ostrich has large wings, like those of other running birds, they are not suited for flying. The bird's weight at 160 kilograms is too much to take to the air.

While other birds have a bony protrusion of the breastbone to which the strong flight muscles are attached, in the ostrich, the breastbone is too flat and its flight muscles are too weak to fly. Instead, the ostrich uses its wings to balance when running at speeds of up to 80 kilometres per hour. This high speed, which the ostrich can effortlessly sustain for half an hour, is enabled by its very strong muscles of the back and legs. Their elastic ligaments act as springs that return energy to the ostrich with each step.

The natural habitat of the ostrich is primarily in South and East Africa, preferably in savannahs with low grasses. Even though they are mainly herbivores (plant eaters), ostriches are occasionally omnivores, eating insects such as grasshoppers or caterpillars, but mostly they feed on grass, fruit, flowers, and grains. With its long, pointed beak, the ostrich prefers to pick up its food from the ground, only rarely off trees and shrubs. One anatomical peculiarity is the 14 metre long intestine of the ostrich.

PROFILE

OSTRICH

SCIENTIFIC NAME
Struthio camelus

Size
2.50 m
TOP SPEED
Up to 80 km/h
WEIGHT
160 kg (353 lb)
LIFE SPAN
50-70 years
DIET
Mainly Herbivores; plants, roots, seeds, sometimes insects or lizards
PREDATORS
Hyena, lion, cheetah
DISTRIBUTION
Africa
HABITAT
Savannah or grassland, scrub forest
PROTECTION STATUS
Least Concern (IUCN Red List www.iucnredlist.org)

Longitudinal section of an ostrich

The bird will ingest up to 1,300 grams of food at a time that is ground up in its muscular stomach with the help of small stones and sand that the ostrich has swallowed for this purpose.

Female ostriches lay the biggest eggs of all animal species alive today. At a weight of about 1,900 grams, one ostrich egg is equivalent to about 24 chicken eggs. Because ostriches tolerate even long periods of drought, they have no trouble crossing a desert. During their nightly rest periods the diurnal birds remain in their typical upright pose. Only during short periods of deep sleep do they rest their heads on the soft feathers of their backs.

Cool Facts

Ostrich eggs are so hard and strong that an adult human can stand on one and it will not break. You have to use a hammer to break the shell. Because ostriches lack an egg tooth they have to rely on muscular spasms to break from their shells, this can take 9 hours. Ostrich chicks are far developed and strong enough to break the eggshell by movements alone.

Ostrich

The **Shark**

Sharks inhabit almost all areas of the oceans and some types can even live in rivers and lakes. There are over 500 different shark species, which vary tremendously in size and shape.

Biologically, sharks are part of the cartilaginous fish group. That means that their skeleton is made of cartilage, in contrast to other fish that have bones. Other major differences from most bony fish include:

- Sharks have no swim bladder.
- They have gill slits rather than gill plates.
- Rather than scales they have dermal denticles.
- They reproduce by internal fertilisation and, depending on the species, their litter size can range from 2 to 100 pups – no comparison to the millions of eggs produced by bony fishes that are usually fertilised externally.

Sharks have extremely well-developed sensory organs. Their field of vision spans 320 degrees and they see better than cats in the dark. Through their sensitive ears, they can determine the exact location of prey several miles away. Their exceptionally good sense of smell allows them to detect blood in a concentration of 1:10 billion parts. This is like noticing a drop of wine in a medium sized swimming pool. In some shark species, the olfactory centre can even account for up to two-thirds of their brain mass. Like almost all fish, sharks have very sensitive sensors in the skin, the lateral line organs, through which they can perceive touch, water currents and changes in temperature. But by far the most amazing sensory organs of sharks are the ampullae of Lorenzini. Sharks can sense even the weakest electric fields with these receptors and can therefore detect heartbeats, muscle movements or brain waves produced by other living things.

Gill slits

Most shark species can only breathe when they swim. Their gill slits are not equipped with gill plates, found in other fish, which support the intake of breathing water. A shark must constantly move to flush water through its gills and filter enough oxygen. The water flows through the mouth into the gills and out again through the gill slits. The highly vascularised gills are clearly visible on each side of the head.

PROFILE

MAKO SHARK

SCIENTIFIC NAME
Isurus

SIZE
Up to 3.80 m

TOP SPEED
40 km/h with bursts up to 70 km/h

WEIGHT
Up to 135–150 kg

LIFE SPAN
Up to 30 years

DIET
Carnivore; fish, squid

PREDATORS
White sharks, orcas

DISTRIBUTION
Pacific, Atlantic, and Indian Oceans

HABITAT
Marine, open ocean areas, temperate and tropical waters

PROTECTION STATUS
Vulnerable
(IUCN Red List www.iucnredlist.org)

Cool Facts

Sharks have very thick skin. It is made of a matrix of tiny, hard, tooth-like structures called dermal denticles or placoid scales. These structures are shaped like curved, grooved teeth and make the skin a very tough armour with a texture like sandpaper. They have the same structure as a tooth with an outer layer of enamel, dentine and a central pulp cavity. They also aid in streamlining the fish while it glides through the water as they reduce turbulence.

Mako Shark

QUESTIONS & ANSWERS

What is the purpose of the exhibition?
The purpose of ANIMAL INSIDE OUT is to inspire a deeper appreciation and respect for the animal world. The exhibition will allow visitors the unique opportunity to explore the intricate biology and physiology of some of the world's most spectacular creatures, using the amazing science of Plastination. A visit to ANIMAL INSIDE OUT will go beyond what is seen in zoos, aquariums and animal parks. Visitors will be better able to understand the inner workings of animals and compare them to human anatomy, resulting in a new understanding of the amazing beauty of both animals and humans.

What kinds of specimens are displayed in this exhibition?
ANIMAL INSIDE OUT includes full body plastinates as well as cross-sections, skeletons, blood vessel configurations and organs. The inclusion of a human plastinates allows for the comparison of human anatomy to that of other animals in the exhibition, resulting in a new understanding and appreciation of the similarities between animals and humans.

Are there human plastinates in the exhibition as well?
ANIMAL INSIDE OUT features a few human organs and body parts, as well as a full male body plastinate. These specimens are included for the comparison of human anatomy to that of animals.

Cross-section of a Crocodile

Is this exhibition appropriate for children?
ANIMAL INSIDE OUT was designed for visitors of all ages to better understand animal anatomy. Children and adults will be delighted when they discover curiosities of certain animals – such as the reason reindeers are able to navigate icy ground, what the giraffe's tongue is capable of, and why bulls have such strength. This exhibition provides an opportunity to see and learn about animals like never before.

What is Plastination?
Invented by scientist and anatomist Dr. Gunther von Hagens in 1977, Plastination is the ground-breaking method of halting decomposition to preserve anatomical specimens for scientific and medical education. Plastination is the process of extracting all bodily fluids and soluble fat from specimens, replacing them through vacuum-forced impregnation with reactive resins and elastomers, and then curing them with light, heat or certain gases, which give the specimens rigidity and permanence. For more information about Dr. von Hagens, the inventor of the Plastination technique and creator of the BODY WORLDS exhibitions and ANIMAL INSIDE OUT, please visit **www.animalinsideout.com** and **www.bodyworlds.com.**

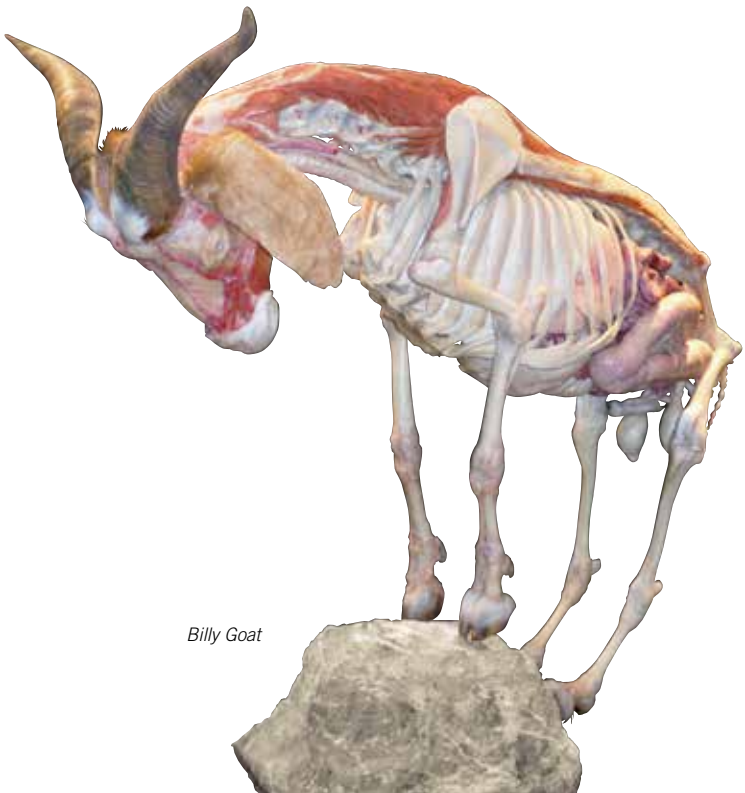
Where do the exhibited animals come from?
ANIMAL INSIDE OUT is made possible through cooperation between various university veterinary programmes, zoos and animal groups. No animal was harmed or killed for this exhibition.
Among the animals in the exhibition, are human specimens, originating from the Institute for Plastination's body donation programme. The generosity of these individual donors has made it possible to present human specimens in this and all of the BODY WORLDS exhibitions.

Dr. Gunther von Hagens and Dr. Angelina Whalley, creators of ANIMAL INSIDE OUT, are honoured to be able to conserve and present these biological wonders of nature for anatomical study. They hope that this exhibition will show visitors the similarities between humans and animals, leading to a greater respect and appreciation for all animals.

Where have the animal plastinates been shown before?
There are currently two versions of ANIMAL INSIDE OUT on display, one version is in North America and the other is touring Europe. More than 100 animal plastinates are shown in each unique exhibition. The majority of the specimens had never been seen before. Each collection of specimens is presented for the first time together. Some animal plastinates had been previously incorporated in some BODY WORLDS exhibitions. The popularity of these animal specimens prompted curator, Dr. Angelina Whalley to compose ANIMAL INSIDE OUT. The exhibition has been on display in venerable museums in Frankfurt, Vienna, London and other historic venues in Europe. In North America the exhibition has toured acclaimed science and natural history museums in cities such as Chicago, Philadelphia, Dallas, Ottawa and Vancouver.

What will be the subsequent exhibition locations?
ANIMAL INSIDE OUT, also recognized as BODY WORLDS of Animals, began its tour of Europe in 2011. Since the Spring of 2013, a second version of the exhibition began to tour North America. The exhibitions will continue to tour North America and Europe, at zoos, museums and science centres. Please check the Exhibition tab on the website for updates on current and future locations at, **www.bodyworlds.com** or **www.animalinsideout.com.**

How long will I need to fully appreciate the exhibition?
These comprehensive exhibitions include detailed information on the specimens shown and further explorations of the animal kingdom. Average duration of a visit to ANIMAL INSIDE OUT is one hour. Guests are welcome to remain in the exhibition as long as they wish, within opening hours. Reentry to the exhibition is not allowed, once you exit.



Billy Goat

"We cannot expect humans to treat other beings with care and respect unless they thoroughly understand the wonders and characteristic features of their nature. I hope for ANIMAL INSIDE OUT to sharpen our sense of the extraordinary by looking at the self-evident."

Gunther von Hagens

BODY WORLDS

ANIMAL INSIDE OUT

www.animalinsideout.com