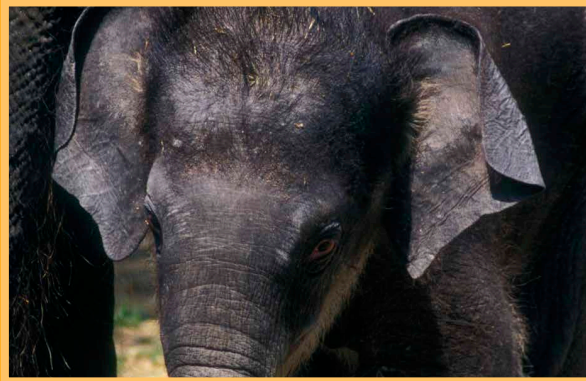


BioEd<sup>SM</sup>



# The Index Elephant



By  
Gregory L. Vogt, Ed.D.  
Advisor  
Paul D. Ling, Ph.D.

Baylor  
College of  
Medicine



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**“Tiny” Kumari with her mother Shanthi.**

## Chapter 1

# Meet Kumari

**O**ur story begins with Kumari, a baby Asian elephant. You may not have heard of her, but she was famous to zookeepers, veterinarians, and wildlife researchers around the world. Kumari was a hero of sorts. She was known as the “index elephant.” You’ll soon find out what that means.

Kumari was born in the Smithsonian National Zoo in Washington, DC on April 26, 1994. She was the first Asian elephant born at the National Zoo in 105 years, and that is where she lived her entire life. Kumari’s mother, Shanthi, carried her for almost two years before giving birth. The newborn Kumari weighed 260 pounds!

Kumari had some health problems as a baby, including a lack of weight gain and a weak immune system. She even had a blood transfusion. Gradually, though, she grew and strengthened. Visitors to the Zoo loved watching her. It was fun to see the playful baby imitate the things her mother did.

Before going on with our story, it would be good to know some interesting things about elephants.

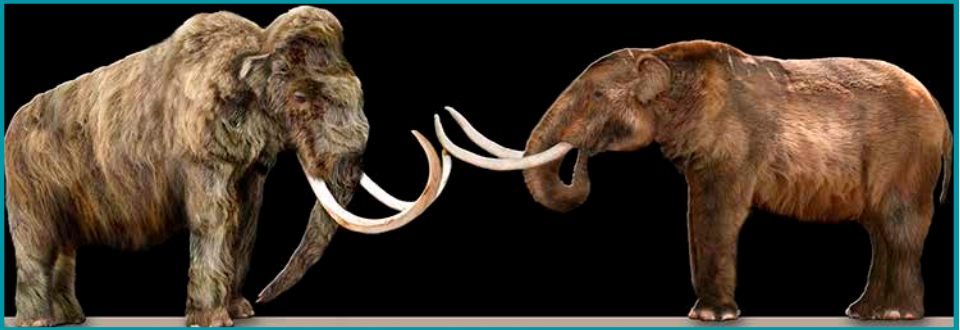
**Kumari’s mother, Shanthi, came to the National Zoo from the country of Sri Lanka. When Shanthi was a baby, she accidentally fell into a shallow well and couldn’t get out. While in the well, she was attacked by a leopard. Shanthi still has scars from the attack on her trunk. She was rescued and taken to an elephant orphanage where abandoned babies are raised by hand. In 1977, the children of Sri Lanka gave Shanthi to the children of the United States. She has been living at the National Zoo ever since.**

**Kumari’s father was a bull elephant named Indy, who lived at the Burnett Park Zoo in Syracuse, New York.**

## Chapter 2

# Two Kinds of Elephants

A long time ago, many different kinds of elephants walked the Earth. The most famous prehistoric elephants—woolly mammoths and mastodons—lived about five million years ago. Both kinds of elephants had furry hides and long curved tusks. The last of their kind died out at the end of the last ice age (10,000 years ago). Other prehistoric elephants were much smaller, and some were only about as tall as you when you stand up. Gradually, most elephant groups became extinct.



**A comparison of the woolly mammoth (left) and the American mastodon (right).**

Only two kinds of elephants remain today: African and Asian. Asian elephants are sometimes called Indian elephants because many are found in India. The African elephant's scientific name is *Loxodonta africana*. Scientists call the Asian elephant *Elephas maximus*.

It is easy to tell the two species apart. Just look at their ears. African elephants have very large stout ears. Asian elephants have





**African elephant ear shape**



**Asian elephant ear shape**

smaller ears that tend to curl and flop at the edges. If you look closely, you will notice another interesting thing about the shape of elephant ears. By coincidence, an African elephant's ear resembles the continent of Africa, while an Asian elephant's ear is similar in shape to the country of India.

There are, of course, other differences between African and Asian elephants. When fully grown, African elephants can be 13 feet high at their shoulders and weigh 14,000 pounds. Asian elephants can reach 11,000 pounds and usually have a shoulder height of about 10 feet. Look at the pictures that follow to see if you can notice

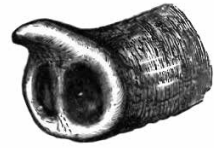
other differences between these two kinds of elephants.

There is another big difference between Asian and African elephants, but you have to get close to see

it. Both elephants have finger-like projections at the end of their trunks, which make it easier for them to grab things. The African elephant has two “fingers,” while the Asian elephant only has one.



African elephant



Asian elephant

**Watch an elephant’s trunk in action! Visit <http://www.houstonzoo.org/animals/asian-elephant/>**



**How are individual elephants in the wild identified? Like humans, elephants are individuals, each with its own personality. To understand elephants’ behavior and learn about them in their natural habitats, it is important to be able to tell them apart. Did you know that the shape of the ear varies from one elephant to another? Notches and tears in elephants’ ear flaps are very distinctive. Variation in pigment loss (see trunk and ears on the center Sumatran elephant, above) and hide color also can help to identify individual elephants.**



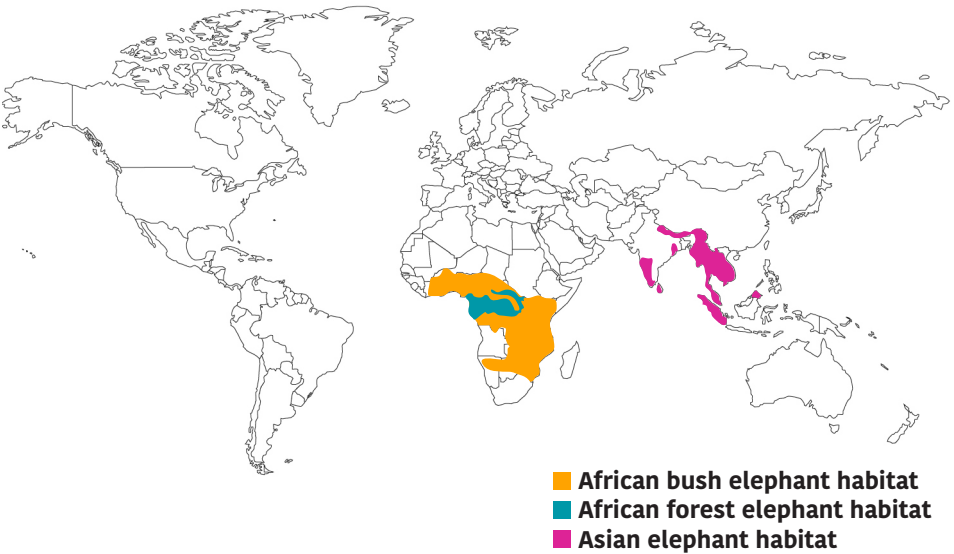
**You should be able to notice several differences between the African and Asian elephants. For example, have you compared the shape of their backs and the shape of the top of their heads?**



## Chapter 3

# What Is It Like to Be an Elephant?

Aside from elephants living in zoos and wildlife preserves, or those performing in circuses, most elephants live in Africa or in Southeast Asia. The map below shows the regions in which elephants live in the wild.



### The African Elephant

There are actually two varieties of African elephant: bush elephants and forest elephants. The bush elephant, *Loxodonta africana*, is the world's largest land animal. Its habitat stretches across Africa's open bushy plains, called savanna. The forest elephant, *Loxodonta cyclotis*, lives in the densely wooded rainforests of west and central



**A mother and calf (African forest elephants) in the Mbeli River, Congo.**

Africa. It is smaller than the Asian elephant, making the forest elephant the world's third largest land animal.

Elephants are very intelligent and communicate with sounds, some of which humans cannot hear. Also, they often touch trunks to explore and express affection for each other.

African elephants live in family units, not unlike human families. An elephant family, or herd, usually consists of about ten closely related females and their calves. Older female elephants serve as herd leaders. When male calves get old enough, they leave the family and form friendships with other males. Occasionally, a scarcity of food will cause herds to split up. However, they still stay in touch with their calves and meet at watering holes.

African elephants only eat plants. They use their trunks to break down tree branches, and they are voracious eaters of leaves and grass. Most adult African elephants eat about 300 to 400 pounds



**A female African bush elephant stands her ground in Tanzania.**

each day! Only 40% of that food is actually used by the elephant. The rest passes right through to become nutrient-rich elephant dung (poo). It is so rich, in fact, that insects and birds will dine directly on the dung. African elephants also drink between 20 and 50 gallons of water per day.

African elephants can eat so much because they have four large molar teeth that are very efficient at grinding up vegetation. These teeth weigh about 11 pounds each! Elephants also have a pair of tusks that are used for digging, stripping bark from trees, and fighting off predators. Unfortunately, the tusks cause elephants a lot of problems.

Elephant tusks are made of ivory, which once was used for the white keys of pianos. Now, it is illegal to import elephant ivory into the United States and many other nations. However, ivory still is used in some countries to make carved figurines, chopsticks and other items, mostly for sale in China. Poachers (illegal hunters) kill tens of thousands of elephants each year, just to cut away their ivory. This practice is causing African and Asian elephants to become endangered. In time, they could become extinct in the wild.



**Illegal ivory figurines seized by the United Kingdom's Border Force, 2013.**

## The Asian Elephant

The Asian elephant, *Elephas maximus*, is the largest land animal in Asia. Worldwide, it is second in size only to the African bush elephant. There are three subspecies of Asian elephants. The Sri



**Sri Lankan elephants often gather in a river.**

Lankan elephant, *E.m. maximus*, lives in Sri Lanka. The Indian elephant, *E.m. indicus*, lives in India, Laos, Nepal, Thailand and Vietnam. The third subspecies of Asian elephant, *E.m. sumatranus*, lives in Sumatra.

Asian elephants live on grasslands and in forests, near sea level and up in highlands that climb to almost 10,000 feet. Sometimes, these elephants range on farmland, and problems can arise when families of elephants raid croplands for food. Indeed, Asian elephants eat about 300 pounds of plant matter per day.

Asian elephants tend to be most active in the twilight hours, when the sun is setting. They can also be active in the middle of the day. They can drink up to 50 gallons of water per day, so they try to stay near water sources. Draughts can be especially hard on Asian



**An Asian elephant debarking a tree. Elephants eat bark, leaves and grass.**



**Are elephants intelligent? Meet Kandula, a remarkable young Asian elephant born and raised at Smithsonian's National Zoo. Join his caretakers as they demonstrate his incredible problem-solving skills and shed light on this endangered species facing extinction in the wild.**

**View the Smithsonian Channel video at <http://www.smithsonian-channel.com/shows/wild-inside-the-national-zoo/elephant-intelligence/1003507/3411823>.**

**Incredibly, there are over 150,000 muscle units and tendons in an elephant's trunk. But what do these animals use one of their most distinctive physical features for? Caretakers at Smithsonian's National Zoo fill us in.**

elephants, forcing them to migrate long distances to find new water sources. Sometimes, elephants dig holes into the ground to find subsurface water.

Asian elephant “families” tend to be smaller than those of African elephants. A typical group may consist of three female elephants and their offspring. But herds of up to 15 adult females can form. At various times of year, multiple groups may join temporarily into very large herds of 100 elephants.

Asian elephants generally are timid. Occasionally, though, they “go rogue” and make unprovoked attacks on any human or other animal that crosses their path. At all times, it is dangerous to approach females with calves.

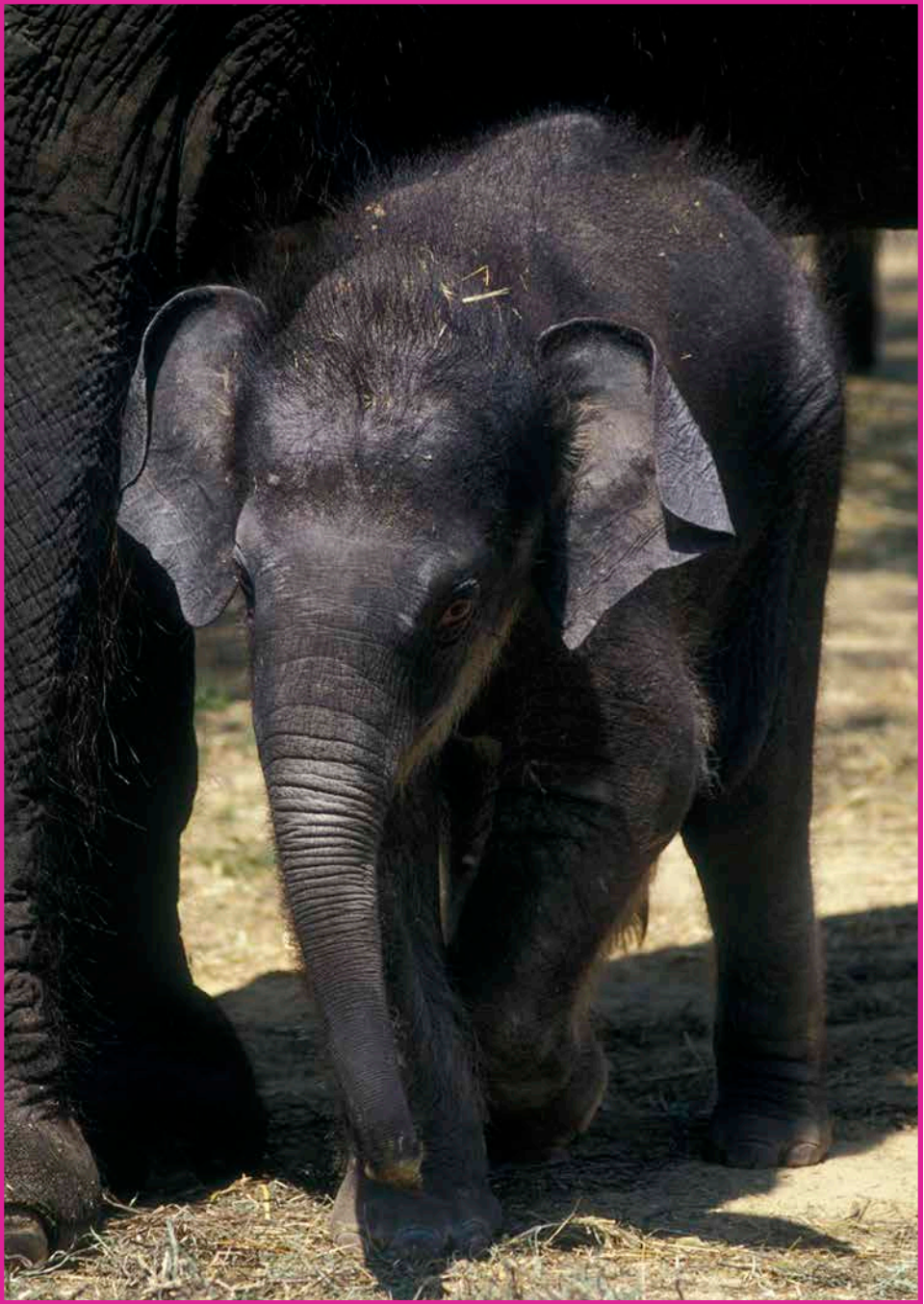
As with African elephants, poachers hunt Asian elephants for their ivory tusks. This illegal practice endangers Asian



**Asian elephants of the Coimbatore Forests in India.**

elephant populations. Asian elephants are also threatened by the destruction of their habitat and primary food source when forests are cleared for cropland.

There also is another threat to Asian elephant survival—and that is where Kumari comes in.



**Baby Kumari with her mother Shanthi.**

## Chapter 4

# Kumari's Story

Spring days in Washington, DC are warm and sunny, with light breezes coming off the Potomac River. Tourists flock to the nation's capitol to see the historic buildings and museums. One of the most popular places to visit is the Smithsonian National Zoo, and one of most interesting areas in the zoo is the elephant compound. On April 22, 1995, a 16-month-old Asian elephant calf named Kumari was out and about.



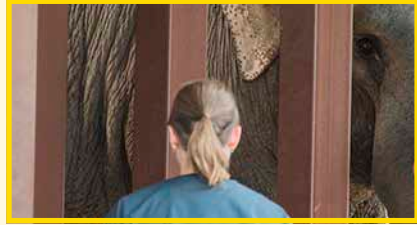
**Aerial view of the elephant compound at the Smithsonian's National Zoo. Google Earth View, 2010.**

Since her birth the year before, Kumari was a favorite among the Zoo's visitors. Her earlier health problems seemed to be over. She was a sweet, playful and mischievous 1,100-pound elephant toddler.



It was Saturday and crowds of visitors enjoyed watching Kumari and other members of the Zoo's elephant herd. Marie Galloway, the Zoo's elephant manager, was making a routine check of the compound. Galloway was responsible for the elephants' care, and she knew her "family" very well. She was the first to notice that something was not quite right with Kumari.

The change was very slight. At times Kumari seemed lethargic—



**Elephant keepers are important members of a zoo's staff. Working with the zoo's largest animals, they have many duties. They feed and clean the elephants, maintain their living spaces, protect the elephants, and make sure they remain healthy. Listed below are some jobs of an elephant keeper.**

- **Prepare food and water by cutting and measuring diet portions.**
- **Feed the elephants.**
- **Maintain feed intake records and a keeper logbook.**
- **Closely monitor the elephants' general appearance, diet and consumption levels, condition of fecal matter, etc.**
- **Record daily observations on the elephants' health and behavior.**
- **Assist veterinarian staff. This is an especially important duty because without keepers, veterinarians would have difficulty collecting needed samples and treating sick animals.**
- **Clean animal exhibits, yards, pools, night enclosures and service areas.**
- **Clean and disinfect utensils, work tools and containers.**
- **Maintain plant life in and around elephant enclosures.**
- **Provide elephant exhibit security.**
- **Participate in daily keeper talks to educate zoo visitors about elephants.**
- **Respond to questions from the public about the elephants.**

tired and slow—and not interested in food. Then, she would snap back and return to being her usual exuberant self.

The next day, Galloway returned to check on Kumari. Unfortunately, Kumari was worse. She was barely eating and seemed more sluggish than the day before. A veterinarian took a blood sample from Kumari, hoping to discover the cause for her behavior change. The sample did not provide an answer.

Greatly concerned, Galloway and other zookeepers worked hard to keep Kumari standing. Lying down on her belly would make it difficult for her to breathe. Kumari's mother, Shanthi, was frantic and stayed close to her baby.

Kumari was monitored closely for several days. She wouldn't nurse and her trunk and legs began to swell. Whenever Kumari tried to lie down, her mother would make her stand up.

On Wednesday, Galloway noticed that Kumari's tongue had turned purple. While waiting for the veterinarians to arrive, she took Kumari and Shanthi to the outer area of the compound. Galloway hoped that socializing with Ambika, one of the herd's older elephants, would help raise Kumari's spirits.

Instead, Kumari lay down. Had she been healthy, she would not have done in this. She was still new to the herd, and lying down in the presence of other herd elephants would not have been proper.

Shanthi took a long look at Kumari and then turned and walked away. Galloway knew this was a very bad sign. Kumari tried to get up and walk a few more feet, but she collapsed. Kumari had died.



**Shanthi**

## Chapter 5

# Finding the Culprit

The loss of Kumari was heartbreaking to the zookeepers, and to the thousands of visitors who watched Kumari grow day to day. There were many questions.

- *What caused Kumari to die?*
- *Could she have been saved?*
- *Did the zookeepers do something that led to her death?*

Sadly, it was not uncommon for baby elephants to die at a zoo. In 1983, an 18-month-old male elephant, named Astor, died at the Bronx Zoo in New York. Between that time and 1996, 34 Asian elephants were born in zoos in the United States and Canada. Of those, nine died of unknown causes. Zookeepers, veterinarians and scientists worked tirelessly to discover the reasons for these deaths and learn how to prevent further losses.

Pathologists collect samples from all animals in the zoo and save the samples in freezers.

When an animal becomes sick, his or her samples are compared with previous ones, to see if there are any differences. That is what happened with Kumari.

After Kumari died, a team of a dozen doctors hurriedly assembled and worked on her throughout the night. The team discovered



thousands of tiny hemorrhages, or small leaks from blood vessels, in Kumari's heart, liver, tongue, and intestines. The evidence pointed to a viral or bacterial infection.

One doctor on the team, Laura Richman, Ph.D., was in the middle of a two-year residency at the Zoo. As a part of her investigation, Dr. Richman began an intensive study of medical

journals, looking for other reports of elephant deaths. She came across the case of a circus elephant that had died in Switzerland.

Using a powerful microscope to check samples from this elephant, scientists noticed something called inclusion bodies, but they could not explain what killed the animal. (Inclusion bodies are dark spot-like objects, produced by viruses, and found in cells where they should not be. They are visible only under extreme magnification.)

To view the cells taken from Kumari, Dr. Richmond used an electron microscope, capable of magnifying samples millions of times. She noticed inclusion bodies that appeared to be caused by a herpesvirus. Herpesviruses are common in animals and people. They usually are harmless, but sometimes can be dangerous.

The National Zoo pathology team investigating Kumari's death contacted other zoos around the world where elephants had died. Ultimately, the team identified nine more elephants that appeared to have died from the virus that killed Kumari.

By 1999, that virus was identified. It was named the Elephant Endotheliotropic Herpesvirus, or EEHV. This was exciting news! Now, the enemy was known and the search for a cure, a vaccine that would control EEHV, could be developed.

**The future does not look good for Asian elephants. One source, the International Union for Conservation of Nature and Natural Resources, classifies Asian elephants as endangered. Their most recent estimate is that 41,000-52,000 Asian elephants remain in the wild. The population is decreasing because of poaching, habitat destruction and disease. This is one reason why it is so important to keep healthy herds of elephants in zoos. For more information, visit <http://www.iucnredlist.org/>.**

## Chapter 6

# EEHV: A Deadly Virus

In the beginning of the story, we called Kumari the “Index Elephant,” and promised to explain what this means. In medical research terms, it means that Kumari was the elephant in which scientists first discovered elephant endotheliotropic herpesvirus, or EEHV.

In a way, Kumari is a hero because the diagnosis of her disease has helped to save other baby elephants. Since the initial research began, scientists have made great progress in understanding EEHV and protecting elephants from this virus.



**EEHV strikes baby Asian elephants the hardest.**





**Elephants trunks are constantly moving, and serve as a way to show affection.**

Both African and Asian elephants can have EEHV. Unless the virus kills the elephant, it becomes latent (meaning the virus is present without symptoms). This usually is what happens with young African elephants. Most cases of EEHV infection in African elephants produce sores on the skin and other body parts. Asian elephants are not as fortunate. For them, an EEHV infection can be fatal.

At first, it was believed that EEHV originated in Africa and was passed from African to Asian elephants through contact in zoos and circuses. This hypothesis was found to be false. In 2011, scientists from Baylor College of Medicine in Houston, Texas and Johns Hopkins University School of Medicine in Baltimore, Maryland traveled to India to learn more about EEHV. One of their most important findings was that the virus exists in wild elephants as well as those in zoos, indicating that it has been around for a long time.

It is now known that the EEHV strikes hardest in elephants between the ages of 2 and 7. Since baby elephants are weaned from their mothers' milk at age 2—just as the disease becomes dangerous—it is thought that antibodies in elephant milk may protect



nursing calves from EEHV. Antibodies are special proteins in the blood that block viruses or bacteria and prevent them from causing harm.

Adult carriers of EEHV pass it on to their

young, possibly through fluids in their trunks. Watch an elephant and you will see that his/her trunk is constantly moving, touching and probing. When elephants snort, sneeze or just spray water from their trunks, any virus particles present can be spread to, and invade elephant calves. Some calves are not strong enough to survive the infection. Those that survive go on to live as normal healthy adults, but they become carriers of the disease and can pass it to the next generation of Asian elephants.

Herpesviruses are fairly common. There are at least eight known, commonly recognized forms of herpesviruses that affect humans with symptoms such as cold sores and chickenpox. EEHV does not affect humans. However, in Asian elephants, the virus attacks the lining of blood vessels, causing weaknesses and holes that can lead to internal bleeding, swelling of organs, and death.

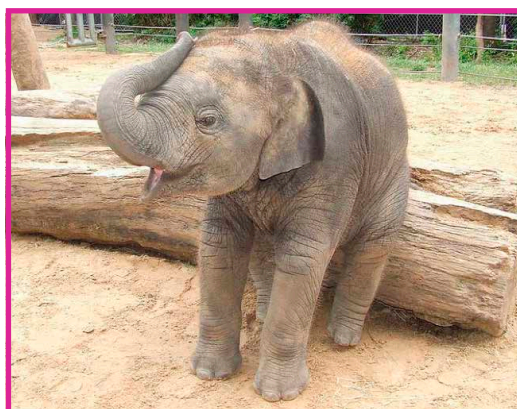
Identifying the herpesvirus harming Kumari and other Asian elephants made it possible to develop treatments and medications that are saving elephants today. One such drug, called Famciclovir, has been used successfully for years to treat herpesviruses in many animals, including humans.

**While Famciclovir is used to treat the herpesvirus, it cannot cure the disease.**

## Chapter 7

# Bench to Barn

In 2008, an especially popular elephant calf, named Mac, died suddenly at the Houston Zoo. Mac wasn't the first elephant to die at the zoo, and his death caused zookeepers to question if they should continue their captive elephant-breeding program. Before making a decision, they consulted with a variety of experts, including those at Baylor College of Medicine, just a few blocks away.



**Baby Mac at the Houston Zoo.**

Paul Ling, Ph.D., an associate professor in Baylor's department of Molecular Virology and Microbiology, visited the elephant compound at the Houston Zoo. Dr. Ling had been researching human herpesvirus and associated diseases, such as chicken pox and shingles, for many years. His expertise made him a valuable source of information about Mac's case. Remember, after Kumari's death at the National Zoo, scientists discovered the connection between the elephant herpesvirus and baby elephant deaths.

Fortunately, Dr. Ling was eager to use his research to help save baby Asian elephants. When asked why, he replied, "Who doesn't want to save baby elephants?"

Of course, this wasn't a complete change in Dr. Ling's laboratory

investigations. His small laboratory team simply began to divide its time between two research projects: human herpesvirus and the elephant endotheliotropic herpesvirus (EEHV).

To start, they devised a three-part plan—testing, treatment, vaccine—to solve EEHV. Dr. Ling called this plan “Bench to Barn,” which refers to the common phrase, “Bench to Bedside” (discoveries made at a laboratory bench can eventually lead to new treatments for patients in hospital beds). In this case, the patients were elephants who spent their nights in a large barn at the zoo.

The first part of Dr. Ling’s plan involved developing a quick and reliable test that could diagnose EEHV before elephants became too sick to be helped. The second step was to



**Dr. Paul Ling in his laboratory.**

develop a workable treatment protocol, or procedure, to cure infected elephants. Third, the team sought to develop a vaccine that would prevent elephants from getting sick in the first place.

Dr. Ling and his team began by looking for a test to quickly identify infected animals. The sooner EEHV could be detected, the sooner the treatment could start, and the more likely the elephant could be saved. Eventually, Dr. Ling settled on a test called by the big name, Quantitative Real Time Polymerase Chain Reaction (qPCR).

The qPCR searches for fragments of EEHV DNA (“deoxyribonucleic acid”) in elephant blood samples. DNA, found in the cells of living things and viruses, contains the genetic code with all the information about how an organism will look and function.

The test that Dr. Ling chose increases the amount of EEHV DNA fragments present in elephant blood samples, making the virus easier to detect. Equally important, the test is accurate and quick. Once a blood sample is received, it takes only two or three hours to complete. This means zookeepers can begin treatment on elephants infected with EEHV almost immediately.

Another critical step taken by the Baylor research team was to have the elephant herpesvirus genome analyzed. (The genome is like an organism's DNA "recipe.") Genome analysis showed that there are multiple strains, or varieties, of EEHV. The strains are numbered. EEHV 1-1 $\alpha$ , 1b, 4 and 5 primarily affect Asian elephants. African elephants, on the other hand, are most affected by EEHV 2, 3 and 6. The most deadly strains, 1 $\alpha$  and 1b, target only Asian elephants.

Now that scientists knew the makeup of the elephant herpesvirus strains, they could begin developing an effective vaccine. Dr. Ling's team hopes to have this work completed in the next 5 to 10 years.

## Treating Infected Elephants

Dr. Ling's team at Baylor is working with a team led by Gary Hayward, Ph.D., at Johns Hopkins University School of Medicine in Baltimore, Maryland to study different medicines and treatment strategies. Dr. Hayward's team also is working on the vaccination development project.

Of course, the sooner EEHV is detected, the sooner zookeepers can begin treating elephants with anti-herpes medicines and other therapies. In Houston, zookeepers and the Baylor team have created a detailed protocol for treating infected elephants. The first step is to collect blood samples from elephant calves each week and test for the elephant herpesvirus. Any infected calf is isolated from the herd and started on an aggressive antiviral therapy.

Hydration therapy (giving the calf extra fluids) begins

**Here's a trick for painlessly collecting samples from elephants. It just takes a little bit of training to get the elephant to cooperate. First, the handler squirts a syringe full of saline (salty) water up the elephant's trunk. Next, the handler helps the elephant to raise its trunk and swish the water around, thereby picking up mucus. As the elephant brings its trunk down, the handler quickly surrounds the end of the trunk with a plastic bag. The elephant snorts and... wham! Out comes saline water, mucus and any bacteria and viruses present in the trunk. After that, the sample is sent to the lab for analysis.**

**In the lab, trunk wash samples are studied for signs of bacterial infection, other potential health problems, and general information about the herd to which the baby elephant belongs. During the inspection, lab workers can detect even minute quantities of latent EEHV, and may be able to identify the strains of EEHV present within the herd. These details are highly valuable, but trunk wash tests are not effective for rapid detection of EEHV infection in an individual elephant. To determine whether a patient needs treatment, blood samples are much quicker and more reliable.**

**To see a video of the procedure, visit <https://www.facebook.com/nationalzoo/posts/10153334537752902>**

immediately. An intravenous ("IV") solution is administered through a needle into a big vein behind the calf's ear. The solution contains electrolytes (mineral ions such as sodium, calcium chloride and potassium). If the calf wants to walk around, a zookeeper must walk with the calf, using a pole to hold the IV bag above the elephant and allow fluids to flow into the vein. It takes some strength to do this, because the bag initially weighs about 5 kilograms (11 pounds). Additional fluids may be administered through a garden hose, without its metal end, inserted into the calf's behind. If necessary, the elephant will undergo blood transfusions as well.

Simultaneously, zookeepers begin to administer antiviral medications like Famciclovir and Ganciclovir. These drugs originally were developed for humans, but at least one also seems to slow EEHV's effects and/or prevent the virus from doing more damage. More research is needed to confirm this conclusion.

If begun early enough, the Houston Zoo's EEHV treatment protocol works. We know this because the Zoo and Dr. Ling's Baylor team were able to test it on two more Asian elephant calves that became infected.

## Chapter 8

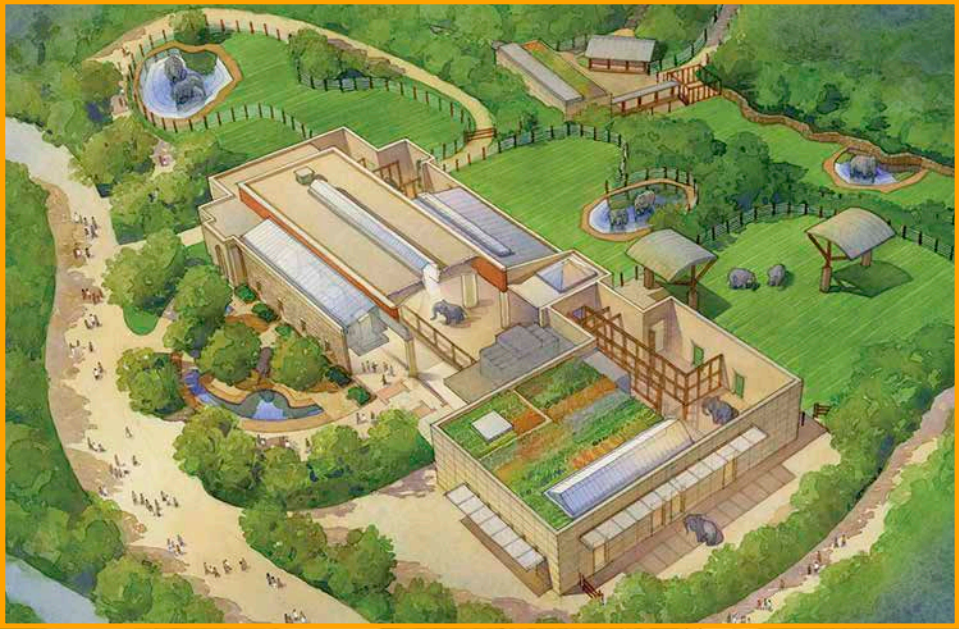
# Kandula, Baylor, Tupelo and Duncan

**N**ovember 25, 2001 was a good day at the National Zoo in Washington, DC. Just three days after Thanksgiving, Shanthi delivered her second calf, a strapping 324-pound baby male. He was named Kandula, after a famous Sri Lankan elephant, gifted to an infant prince more than 2,100 years ago. The first Kandula was honored for his courage, strength and loyalty, and this name was fitting for the National Zoo's newest Asian elephant.

Since Kandula's arrival, the Zoo's elephant compound has undergone major renovations. The new 2.2-acre habitat, called Elephant



**Kandula plays at bathtime.**



**Architectural drawing of Elephant Trails at the Smithsonian's National Zoo.**

Trails, is spacious and comfortable. It includes a barn, outside exercise areas, and a wading pool with a shower that elephants can turn on themselves. There is plenty of room for Kandula and his herd to explore and play.

Kandula has thrived at the National Zoo. At 13 years old, he weighed more than 7,000 pounds! He is still growing and ready for breeding.

**Between 1978 and 2008, EEHV killed at least 22 Asian zoo elephants in the US and Europe.**

Nine years later, in 2010, Houston zookeepers were ready for more baby elephants. With new tools, a treatment protocol for EEHV, and the security of the nearby Baylor College of Medicine support team, they were better prepared than ever to ensure the elephant's wellbeing. Good thing, too, because two more Asian elephant cows were pregnant.

On May 4, 2010, Shanti (almost the same name as Shanthi at the



National Zoo) delivered a 348-pound male calf. Shanti carried the calf for 22 months before giving birth! Naming the calf was easy. In honor of Baylor College of Medicine's research and progress on EEHV, the calf was named Baylor.

At the same time, a second Asian elephant, Tess, was preparing to deliver her own baby. The happy day arrived on October 5, 2010, when a 273-pound female calf, named Tupelo, was born. The father for both Baylor and Tupelo was Thailand, the Houston Zoo's 44-year-old bull Asian elephant.



**Baby Baylor is just a little bit bigger than Tupelo.**

And that was not the end to the excitement, because the Houston Zoo, like the National Zoo in Washington DC, had built a new elephant compound. Called the McNair Asian Elephant Habitat, the three-acre space has an 80,000-gallon pool and a spacious elephant barn.

**In the years since losing Kumari, the Smithsonian’s National Zoo created the National Elephant Herpesvirus Laboratory. The lab is committed to preserving Asian and African elephants living in captivity and in the wild. It investigates diseases that afflict elephants and has become the prime worldwide center for information, sample testing, and research on various strains of EEHV.**

**The National Elephant Herpesvirus Laboratory is studying ways that EEHV is transmitted from animal to animal, developing improved treatments, and working on a vaccine. The lab works with scientists from around the world—including those from Baylor College of Medicine and Johns Hopkins University School of Medicine—and it has adopted Baylor’s tests and procedure for quick and accurate EEHV identification in the samples it receives.**

Today, it is home to eight Asian elephants, including Duncan, a male calf born on February 7, 2014. Duncan weighed 385 pounds at birth. His mother is Shanti (her fourth calf) and his father is Thailand.

The battle against elephant endotheliotropic herpesvirus is not over. There is still a need for an effective vaccine for all newborn



**Duncan peeks out from the safety of his mother’s side.**

Asian elephants in zoos and wildlife preserves, and possibly even in the wild. Happily, the EEHV treatment protocol developed at the Houston Zoo is beginning to work. Both Baylor and Tupelo have been infected with EEHV twice, but their infections were detected in the earliest stages. Treatment began immediately and both elephants have recovered.

## Epilogue

It is another good day at the National Zoo. Kandula is healthy and almost fully grown. Still, he is checked frequently. The Zoo's team is ready to jump into action if they see any signs of illness.

At the Houston Zoo, Baylor and Tupelo are doing well, even though both have been infected twice by EEHV. They and Duncan are growing strong. All three young elephants have their own distinct personalities. Daryl Hoffman, the Houston Zoo's curator of large mammals, says Baylor is very methodical and thinks everything through. Tupelo is a few months younger than Baylor, but wild. Hoffman says, "She gets into everything. Baylor is afraid of everything. She is afraid of nothing." Baby Duncan likes to act silly and perform a little dance, much to the delight of Zoo visitors.

And so it goes in zoos across the country. Thanks to Kumari, the "index elephant," and the human teams that study and care for them, Asian zoo elephants have a better chance than ever of growing up and becoming parents of their own healthy elephant calves.



**Duncan playing with sand.**

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## Websites

Baylor College of Medicine

<https://www.bcm.edu/>

Houston Zoo

<http://www.houstonzoo.org/>

Smithsonian's National Zoo

<https://nationalzoo.si.edu/>



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# The Index Elephant

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