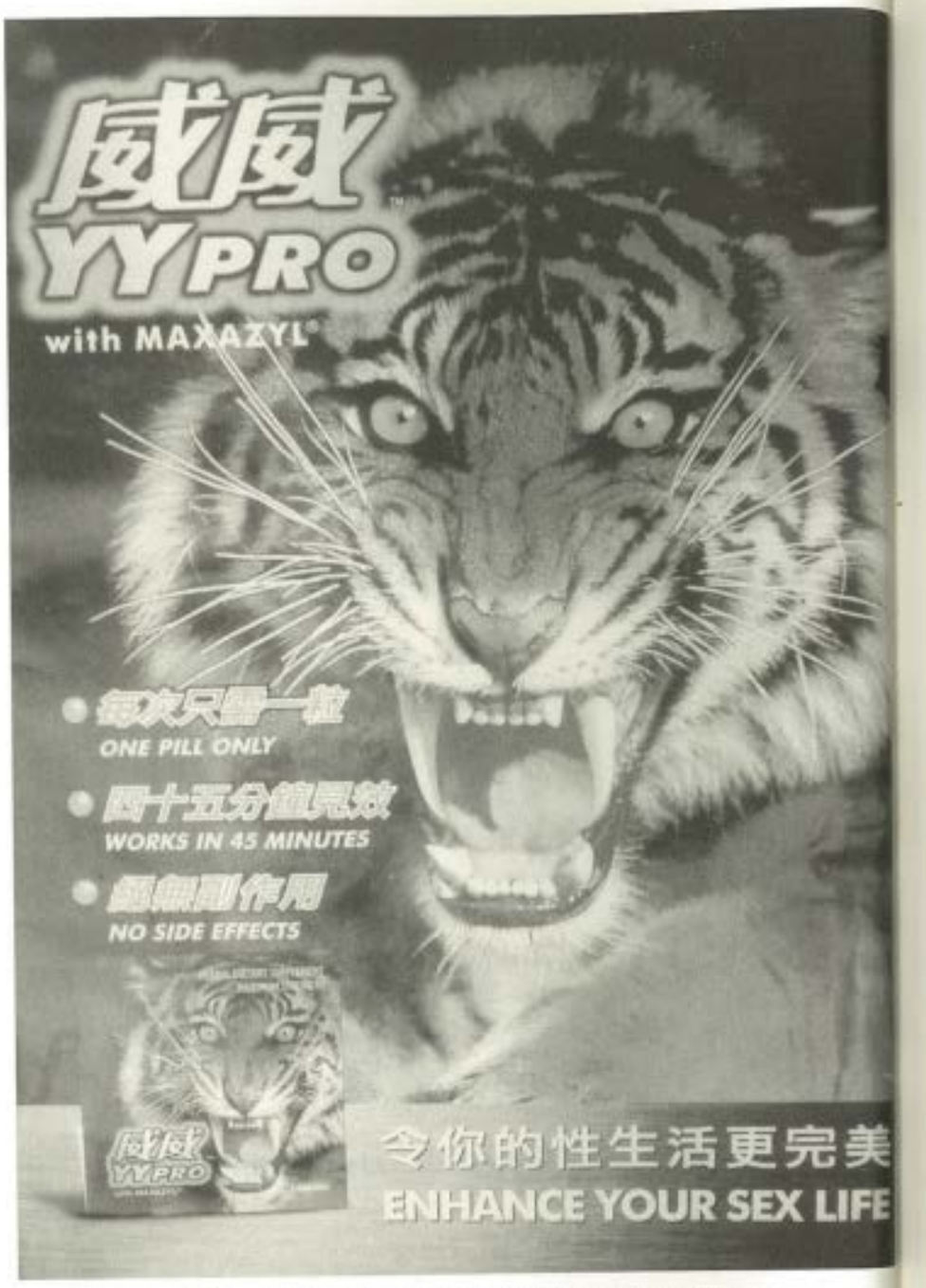


Although this is an herbal medicine and contains no tiger parts, the package suggests that by using it, one can acquire the tiger's potency.

Tiger Bone & Rhino Horn

The Destruction of Wildlife for Traditional Chinese Medicine

Richard Ellis

ISLANDPRESS / Shearwater Books
Washington • Covelo • London

Also by Richard Ellis

The Book of Sharks

The Book of Whales

Dolphins and Porpoises

Men and Whales

Great White Shark (with John McCosker)

Monsters of the Sea

Deep Atlantic

Imagining Atlantis

The Search for the Giant Squid

Encyclopedia of the Sea

Aquagenesis

Sea Dragons: Predators of Prehistoric Oceans

The Empty Ocean

No Turning Back: The Life and Death of Animal Species

Tiger Bone & Rhino Horn

A Shearwater Book
Published by Island Press

Shearwater Books is a trademark of The Center for Resource Economics.

Library of Congress Cataloging-in-Publication data.

Ellis, Richard, 1938-

Tiger bone & rhino horn : the destruction of wildlife for traditional Chinese medicine / Richard Ellis.

p. cm.

Includes bibliographical references and index.

ISBN 1-55963-532-0 (hardback : alk. paper)

1. Medicine, Chinese. 2. Poaching. I. Title: Tiger bone and rhino horn. II. Title.

R601.E44 2005

610'.951—dc22 2005002489

British Cataloguing-in-Publication data available.

Printed on recycled, acid-free paper ♾

Design by Joyce C. Weston

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

With a seemingly never-ending demand for the keratinous horn in the Orient, the Greater One-Horned Rhinoceros is facing the biggest threat ever to its existence. . . . This is a testament to the fact that rhinoceros horn, more than any other animal-derived medicine . . . is considered a life-saving traditional Chinese medicine.

Vivek Menon, *Under Siege*

The most serious threat presently to tigers' survival is the use of their bones in Oriental medicine. . . . As wild tiger populations have declined owing to trophy hunting, pest control, and habitat loss, human populations in East Asia have increased dramatically while their per capita expendable income has risen at record rates. At the same time, there has been a resurgence of interest in traditional Asian cures such as tiger bone, the use of which is seen as a status symbol, as a way to retain old customs in the face of rapid change, and as an alternative to the fallibilities of Western medicine.

Judy Mills and Peter Jackson, *Killed for a Cure*

China was the first country to utilize bear bile and gall bladder in traditional medicinal products, and this use was adopted by Korea and Japan centuries ago. Today the use of TCM [traditional Chinese medicine] is widespread not only in Asia but also throughout Asian communities in other areas of the world, including Europe and America. Many of these consumers buy bear bile products, either because they believe it to be a traditional medicine, or because the products are marketed well by local TCM pharmacies. The trade in gall bladders from wild bears has been extensive over the past few decades. Tens of thousands of bears have been killed in the wild to obtain the gall bladders and other parts, including the paws (a delicacy in some Eastern countries), hide, claws, meat, fat and bones. But the gall bladder has been the prize as it has the greatest commercial value.

Tim Phillips and Philip Wilson, *The Bear Bile Business*

Contents

Preface

Nagarahole, India. February, 1997

We are in a small boat on the Kabini River in southern India. It's just me and Stephanie and the boatman. We have come to the Kabini River Lodge to look at wildlife and have already taken several jeep rides into the bush where we've seen elephants, sambar and chital deer, monkeys, monitor lizards, peacocks, and the huge wild ox known as the gaur. The lodge is empty except for us, so the guide, whose name is Sundar Raj, offers to take us out on the river in a small boat after dinner.

We cruise slowly past a large crocodile, immobile on the shore. I take a picture. Sundar cuts the engine so we will make no noise. After about five minutes, he says, "Did you hear that? It was the alarm call of the monkeys. It means a tiger is near." We are silent, listening. A guttural cough. "The tiger," whispers Sundar. We are about 100 feet from shore. We drift closer. The forest trees tower over the narrow strand of the shoreline. An unexpected flicker of movement to the left, and an adult tiger materializes from the forest. It could be a young male, but I decide it's a female. Tigers fear little, and there is no reason for her to look out over the river; either she doesn't see our boat or she sees it and doesn't care. We watch spellbound as she strolls along the strand. I don't want to disturb her with the camera's alien click, and besides, it's getting too dark for photographs. We watch her for what feels like an hour but was probably closer to ten minutes. As darkness falls, she begins to fade, demonstrating how easy it is for a bright orange animal to disappear. Has she reentered the forest or is she still walking? She is gone. We finally exhale. We cheer as if we have found a buried treasure or won the lottery. It is—to me, anyway—the ultimate triumph of tourism. We have traveled halfway around the world and seen temples, dancers, peacocks, giant lizards, wild elephants, even a rhino swimming in the river, but no leopards and, until now, no tigers.

It is difficult to describe the thrill of seeing a wild tiger. Other people in different circumstances or in more light have surely had better sightings. But for me, this event marked the beginning of a yearning for tigers that would not be satisfied until I could write this book—and probably not even then. Although I have in the past written almost exclusively about whales, sharks, and other marine animals, I confess to a secret vice: I love tigers.

When I saw the Kabini River tiger, I was overwhelmed by the great cat's twilight appearance on the strand, and I didn't think for a moment about tiger bones being used in the practice of traditional Chinese medicine. That came later. The tiger was such a living part of its environment that it would have been impossible at that moment to recognize that all tigers—even this one—were endangered by poachers who would kill them and sell their bones to be ground up to make aphrodisiacs and other medicines.

Fish taken from the ocean are typically eaten, more or less in their entirety, but there is one glaring exception: large numbers of sharks of all species are being killed just for their fins to make shark's fin soup. Only the fins are saved; the rest of the shark is discarded. The first dorsal, pectorals, and lower lobes of the tail fin are used in the preparation of this delicacy. The skin is removed, and all muscle tissue as well, leaving only the inner cartilaginous fin rays to soak. The fibers are boiled in water for hours, then the water is changed and the fibers boiled again and again, a process that may take as long as five days. The glutinous mass that results is served in a thick broth of chicken stock seasoned with soy sauce, ginger root, onions, vinegar, mushrooms, and other ingredients. After the soup is drunk, the gelatinous fibers of the shark's fin are eaten.

Shark's fin soup is a prized dish in many parts of Asia and is widely served at Chinese weddings as a symbol of generosity and wealth. As many as forty sharks are killed to supply each wedding, and a bowl of the soup can cost $100. All told, around 100 million sharks are caught each year for their fins, and the hunting has depleted some shark populations by as much as 90 percent. Drinkers of this soup may believe that consuming shark fins transfers to the drinker some of the legendary ferocity of the shark—but it's hard to see why the fins would work that way and

not the meat. In many cultures, Western as well as Asian, it is believed that certain foods (or herbs or drugs) can bestow psychological and physical benefits on the consumer far beyond mere nutrition. A great number of plants have indeed been found to have positive medicinal effects—think of the use of quinine, from the bark of the cinchona tree, for the treatment of malaria—and animals (rats, mice, rabbits) are used extensively for medical testing. While Western medicine has moved mainly to synthetics, Chinese medical practice emphasizes the use of "natural" products—animal, vegetable, and mineral—in its 3,000-year-old quest for the cures and prevention of disease.

Practitioners of traditional Chinese medicine often prescribe specific parts of various animals as cures for disease or other malfunctions of the human body or psyche. As we shall see, there are some animals whose various parts are prepared as medicine and whose entire species is endangered by the practice.

This book, like each I've written, grew out of something that I was writing for another. While working on *No Turning Back: The Life and Death of Animal Species*, published in 2004, I was investigating the threat of extinction of rhinos, tigers, and bears in Asia when I realized that many of these species were being killed for their body parts—ingredients for potions used in traditional Chinese medicine. As I later learned, the decline in populations for these species is astounding: where there had been 65,000 black rhinos in East Africa in 1970, there were now 3,600. At the turn of the twentieth century, there may have been 100,000 tigers in India; there were now about 5,000. I wanted to sound the alarm: if the necessary steps are not taken quickly, we will lose forever some of the most charismatic animals on earth. This book is the result.

I am especially indebted to TRAFFIC, an organization that has conducted extensive surveys on the consumption of animals parts throughout the world and summarized its findings in comprehensive reports. I have cited many of these reports in the pages that follow and have acknowledged their authors, but this book could not have been written without TRAFFIC's dedicated field workers, who have made so much critical information available. TRAFFIC—whose acronym stands for Trade Records Analysis of Flora and Fauna in Commerce—is a

worldwide organization with headquarters in England that monitors international trade and commerce in wildlife products and is funded in part by the International Union for the Conservation of Nature (IUCN) and by the World Wildlife Fund, whose primary headquarters are in Switzerland.

Because the subject is so far removed from my usual bailiwick, I needed to find people especially knowledgeable about rhinos, tigers, and bears, and I pestered them incessantly with questions, requests for information and papers, and reassurances. Among those who responded to my badgering were John Seidensticker of the National Zoological Park, Washington, D.C.; Peter Jackson and Kristin Nowell of the IUCN Cat Specialist Group; George Amato, Joel Berger, K. Ullas Karanth, and Alan Rabinowitz of the Wildlife Conservation Society (WCS); Jeannie Thomas Parker of the Royal Ontario Museum; Eleanor Milner-Gulland of Imperial College, London; Nigel Leader-Williams of the University of Kent; Rajesh Gopal, director of Project Tiger; Mark Norell and Mike Novacek of the American Museum of Natural History; Jill Robinson of Animals Asia; Rodney Jackson and Darla Hillard of the Snow Leopard Conservancy; Peter Boomgaard of the University of Amsterdam; Clifford Steer of the University of Minnesota Medical School; and Esmond Bradley Martin, Geoffrey Ward, Kees Rookmaaker, Michael Martin, Frank Petito, Kirsten Conrad, and Philip Nyhus.

The results of so much research consultation, together with my almost uncontrollable inclination to quote experts, has probably produced a book that is heavier on quotes than it might have been. I plead guilty to this charge, but with an explanation. I am not a field biologist, and I must depend on the science, descriptions, experiences, and even, in some cases, opinions of others for my text. If I had visited pharmacies in China, tracked moon bears in Thailand, or waited for a glimpse of a snow leopard in the high Himalayas, this would have been a completely different book. Would it have been a better one? Maybe, but I hope I've at least done justice to the investigative work others, and more important, I hope that together we've alerted the world to the plight of the rhinos, tigers, and bears—and the myriad other, less conspicuous species whose parts also make up a large part of the traditional Chinese pharmacopoeia.

Sy Montgomery, a new friend and fellow enthusiast on the subjects of tigers and bears, read the manuscript in an early form, and her suggestions greatly improved what I had written. I sent the bear chapter to Jill Robinson of Animals Asia so that she could read it and correct any of my misinterpretations of her astonishing accomplishments. She carefully read my chapter and made the necessary corrections and updates, and, like the bears she rescued, I am deeply grateful to her. Elizabeth Bennett of the WCS read the manuscript with great care and made more suggestions and corrections than I could have imagined—almost all of which were implemented so I could bring the book up to her high standards of accuracy and professionalism. Like *The Empty Ocean*, this book was edited by Jonathan Cobb, whose deep concern and boundless curiosity about the subject matter—not to mention his superb editing skills—resulted in a much better book than I could have written by myself.

This book, like everything else I do, is for Stephanie.

1

Tyger, Tyger

Wherever wild tigers live, they are revered. Alive they are affiliated with gods or admired for their striking appearance; dead they provide trophies or a pharmacological bounty for consumers. In his book *The Tiger Hunters*, Reginold Burton (born in 1864, so presumably active around 1890) described what happened to the carcass of a tigress that he had shot in India:

> The "lucky bones" were cut out of the chest by Nathu. These are clavicles or rudimentary collar-bones found in all the cat-tribe, about four inches long and hatchet-shaped in the tiger. They are much prized, and, as well as the claws, often mounted in gold and hung round the necks of children to keep off evil. Great care was taken to collect all the fat from the tigress; this was boiled down in a pot over the fire and stored in bottles. The villagers also carried off not only bits of flesh and the liver, but the whole legs and quarters. On being questioned, the Subadar said that the fat was most valuable as a remedy for rheumatism and to make men strong when rubbed into the patient. This is a universal belief throughout the whole of India, where the fat of tigers is everywhere highly prized. He added that the villagers would eat the flesh and especially the liver, the latter being supposed to impart to those who partook of it some of the courage of the tiger.

For centuries, medical traditions throughout Asia have called for the use of exotic-animal parts in healing. However, in the last two decades, the demand for tiger parts has skyrocketed while the population of wild tigers has begun to collapse.

"Beginning about 1986," wrote Geoffrey Ward in *National Geographic* magazine, "something . . . began to happen, something mysterious and deadly. Tigers began to disappear. It was eventually discovered that they were being poisoned and shot and snared so that their bones and other body parts could be smuggled out of India to supply the manufacturers of traditional Chinese medicines."

Until recently, habitat loss was thought to be the largest single threat to the future of wild tigers in India, but while the danger of habitat loss is as great as ever, the trade in tiger bones, destined for use in Asian medicine outside India's borders, is posing an even larger threat. As the Chinese tiger population declined toward extinction, the suppliers or manufacturers of traditional medicines turned to India for tiger bones. The poaching of tigers for the Chinese medicine industry started in India's southern region during the mid-1980s but has now spread to all areas where large number of tigers have been recorded, particularly in the states of Madhya Pradesh, Uttar Pradesh, West Bengal, Bihar, Maharashtra, Andhra Pradesh, and Karnataka. Firearms are sometimes used, but where shooting is impractical, poison or traps are employed. Poison is usually placed in the carcasses of domestic buffaloes and cows; forest pools that serve as water sources may also be poisoned. Steel traps, made by nomadic blacksmiths, are also used and are immensely strong; in a tiger-poaching case near Raipur in 1994, it took six adult men to open a trap. In one area in central India, investigators found that so many steel traps had been set, villagers were afraid to enter that part of the forest.

Major traders operate sophisticated and well-organized supply routes, sometimes to distribute poison, but always to collect tiger bones from even the remotest villages. It is the traders and other middlemen who make most of the substantial profits to be gained from the illegal trade in tiger parts. A tiger can be killed for as little as just over a dollar for the cost of poison, or $9 for a steel trap. Much of the tiger poaching is done by tribal peoples who know the forests well. They are usually paid a meager amount; in a case near Kanha Tiger Reserve, in May 1994, for example, a trader paid four poachers just $15 each for killing a tiger. Sometimes the animals are killed as a result of livestock predation and the body parts are kept in hope of an opportunity to sell them. As the

illicit skins move up the commodity chain, from poacher to trader, the potential profits increase exponentially. Although the couriers receive more than the poachers, the real money is made by the traders at the top of the chain, who direct the smuggling syndicates and have links to the buyers. The value of a 2003 Tibet seizure of 31 tigers, 581 leopards, and 778 otters was 6.52 million yuan, or US$787,000. In Tibet, international Environmental Investigation Agency (EIA) examiners were told that a tiger skin was worth US$10,000, a leopard skin was offered for $850, and an otter skin was valued at $250 (Banks and Newman, 2004).

The scale of tiger poaching is enormous considering how relatively few there are left. According to investigations carried out by the Wildlife Protection Society of India (WPSI), a total of 36 tiger skins and 667 kilograms (1,470 pounds) of tiger bones were seized in northern India in 1993–94 alone. In January 2000, officials in Khaga, in the north Indian state of Uttar Pradesh, arrested four people who had 4 tiger skins, 70 leopard skins, and 221 otter skins as well as 18,000 leopard claws, 132 tiger claws, and 175 kilograms (385 pounds) of tiger bones. Up to that time, it was the largest seizure of its kind in India. Because the skins had no bullet holes or snare wounds in them, it was determined that the cats had been poisoned. In the raid on a taxidermy shop south of the city of Lucknow, officials also recovered 1,800 tiger and leopard claws, and 200 skins of the blackbuck, a highly endangered Indian antelope. For the decade between 1994 and 2003, the WPSI documented the poaching and seizure of 684 tigers, 2,335 leopards, and 698 otters in India alone. In *Cat News* (2004), Belinda Wright, Executive Director of WPSI, noted that "Between 12 June and 10 July 2004, 10 tiger skins, 4 sacks of fresh tiger bones, and the claws of 31 tigers and leopards were seized in 11 cases throughout India and Nepal."

The Wildlife Protection Society of India works with government enforcement agencies to apprehend tiger poachers and traders throughout India. It also investigates and verifies reports of unnatural tiger deaths and seizures of tiger parts. The following statistics, supplied by the WPSI, for documented cases of tiger kills in recent years indicate how persistently tiger killings are carried out, though the figures represent only a fraction of the actual poaching and trade in tiger parts in India.

Year	*Number of tigers killed*
1994	95
1995	121
1996	52
1997	88
1998	44
1999	81
2000	53
2001	72
2002	43

The WPSI also tracks reports of tigers described only as "found dead." Many of these deaths are likely due to poaching, but given a lack of clear evidence that this is true, they have not been included in the above figures. Furthermore, since the central and state Indian governments do not systematically compile information on tiger poaching, the WPSI must initially rely on reports from enforcement authorities and other sources, which also underestimate the total. "To reach an estimate of the magnitude of the poaching of tigers in India," WPSI concludes, "it may be interesting to note that the Customs authorities multiply known offenses by ten to estimate the size of an illegal trade." Thus for the years 2000 to 2002, the total number might not be 168, but closer to 1,680.

In a 2004 article about wildlife poaching in the popular magazine *India Today*, Murali Krishnan wrote that not much happens to poachers even when they're caught:

> Besides the inaction in setting up a task force to check poaching, the law too has been lax in imposing penalties or convicting those who have been caught. This has provided poachers the motivation to carry on with their activities unhindered. According to the WPSI, between 1994 and 2003, there were 784 cases of seizure of tiger, leopard, or otter skins. Over 1,400 individuals were accused in connection with these cases, but there were only 14 records of conviction and sentencing.

In 1997, Peter Jackson of the IUCN Cat Specialist Group estimated the total number of tigers left throughout Asia. The most numerous is

the "Bengal" (Indian) tiger, with a total population ranging from 3,060 to 4,375. It is found in Bangladesh (300–460), Bhutan (50–240), China (30–35), Myanmar (no information available), Nepal (180–280), and India (2,500–3,750). The Caspian, Javan, and Bali subspecies are extinct. There are also between 437 and 506 Siberian (Amur) tigers, 400 to 500 Sumatran tigers, and 1,180 to 1,790 Indochinese tigers in Cambodia, China, Laos, Malaysia, Myanmar, Thailand, and Vietnam.

Poaching constitutes the most direct threat to India's tigers by targeting ever-dwindling numbers of individual animals, but habitat loss due to growing numbers of humans and their expanding settlements—India's immense population is now over a billion and climbing—exacerbates the problem. When people live in or near places where tigers live, proximity might occasionally end badly for a person, and it almost always ends badly for the tiger. The Panna Preserve, in the central state of Madhya Pradesh, is tropical dry forest, which characterizes some 45 percent of India's tiger habitat. From 1996 to 1997, three researchers, Raghundan Chundawat, Neel Gogate, and A. J. T. Johnsingh (1999), collared and radio-tracked tigers to evaluate their activities and range, and approached feeding tigers on elephant back to see what they were eating. The researchers found that the dry forest habitats support a relatively low population of large ungulates, such as deer and wild pigs, and have a high level of human disturbance. The scarcity of large ungulates means that the Panna tigers have to eat smaller prey such as monkeys to survive, but they are also likely to take cattle, which does not endear them to the local herders. "Tigers in fact take less than 1% of the available cattle each year, but taking cattle on any scale places tigers at the risk of poisoning and creates bad feeling towards them," the authors wrote, urging the creation of areas within the preserve that would be off limits to humans in order to save the remaining tiger population.

Nepal's Royal Chitwan National Park, located just north of the Indian border and incorporating some 360 square miles of the Terai floodplain at the foot of the Himalayas, is the scene of both increased human presence and the threat of poaching. In 1973, fresh out of graduate school (where he had studied radio-tracking mountain lions in Idaho), John Seidensticker first visited Chitwan to collar and track the tigers as a member of the Smithsonian-Nepal Tiger Project. The area had just been designated

a park, and the adjacent town of Sauraha (pop. 8,338) was, he observed in his 1996 book, "a sleepy collection of reed houses plastered with cow dung. There were no hotels, inns or restaurants." By 1996, the human population immediately outside the park had grown to 300,000, and the sleepy collection of reed houses had become a tourist center with dozens of hotels, inns, and bars, and viewing platforms from which tourists could watch rhinos and occasionally tigers. There were two lodges, Temple Tiger Camp and Tiger Tops, from which one might venture out on elephant back to see the great cats, as well as rhinos, leopards, various types of deer, monkeys, sloth bears, and blackbuck antelopes.

It's clear that poaching—of tigers and their prey—is reducing the tiger population, but in 1995, John Kenney, James Smith, Anthony Starfield, and Charles McDougal decided to find out by how much. They studied data collected over a twenty-year period in Chitwan National Park and analyzed the survival, fecundity, and dispersal pattern of a population of tigers estimated at between 119 and 210. (As with most tiger populations, those in Chitwan can only be estimated; because the tigers are rarely seen, the estimates are based on comparisons with other populations on the Indian subcontinent, which themselves are unreliable because they are based on the analysis of footprints [pugmarks], which may—or may not—differ from tiger to tiger.) The researchers' computer models showed that "a critical zone exists at which a small, incremental increase in poaching greatly increases the probability of extinction. The implication is that poaching may not at first be seen as a threat but could suddenly become one." In a 1999 follow-up study of Chitwan, another set of researchers, Smith, McDougal, et al., estimated a total of about forty tigers, suggesting that the original estimates of between 119 and 210 were either much too high, or—more likely—that poachers had managed to kill off as many as three-quarters of the Chitwan tigers in four years.

In 1969, when it appeared that the world's tiger populations were already becoming dangerously low, the IUCN held a conference in New Delhi to discuss the problems. Three years later, in conjunction with the World Wildlife Fund, the IUCN initiated "Project Tiger," with the intention of raising support for tiger conservation programs in India. Prime Minister Indira Gandhi set aside nine national parks—Manas,

Palamau, Similipal, Corbett, Ranthambhore, Kanha, Melghat, Bandipur, and Sundarbans—for the protection of India's tiger population, then estimated at about 1,500 animals. India's Project Tiger was set up in 1973, and its first director was Kailash Sankhala. In the early years of Project Tiger, every reserve showed a decrease in hunting and an increase in tigers, leading Dr. Sankhala to write in 1977, "I am greatly encouraged by the response of the habitat, the tigers, and their prey in the Tiger Reserves. It may be too early to predict the outcome of this effort, but it is surely not too much to hope that ultimately the tiger will be restored to a less precarious position than he is at present."

Alas, it was not to be. The tiger is now in a *more* precarious position than he was in 1977. Since the inception of Project Tiger three decades ago, the population of India has increased by 300 million people and livestock numbers have risen by 100 million. Indira Gandhi was assassinated in 1984, and without her support, Project Tiger all but evaporated, largely because it was not given the resources required to be effective. Although the project still exists—and now oversees another eighteen reserves—almost all the reserves were invaded by settlers who needed food and fodder, and who regarded the tigers as a nuisance or, in some

cases, a threat. Tigers were killed because they interfered with farming, and some because they interfered with the very lives of the farmers. And starting in the late 1980s, they were increasingly killed for use in traditional Chinese medicine.

In a report published in 1998, the director of Project Tiger, P. K. Sen, commented on these tiger killings (as quoted in Valmik Thapar's *The Secret Life of Tigers*):

> It is my considered opinion, after more than one and a half years as Director [of] Project Tiger, that the tiger and its ecosystem is facing its worst ever crisis. I feel that the figures of one tiger death every day may even be an underestimate and there are many reasons to say so. If one out of every ten tigers poached, poisoned or crushed under the wheels of a vehicle, three are tigresses who have cubs, all the cubs will die unnoticed because they are totally dependent on the mother. The death of three resident male tigers will result in new males occupying the vacant ranges, and in the first instance they will kill all cubs in order to father their own litters. Thus for every ten tigers killed, sometimes as many as fifteen additional tigers die. . . . On the occasion of 25 years of Project Tiger, unless revolutionary steps are taken immediately, there is little hope for the future and we could be reaching the point of no return.

When Richard Perry published *The World of the Tiger* in 1964, tigers had been hunted for centuries throughout their range, and only the Balinese tiger was known to have been driven to extinction. The Caspian tiger would be seen for the last time four years after Perry's book appeared, and the Javan tiger was still hanging on. Though the world's tiger population was only about 15,000, according to Perry, few people had begun to worry that the entire species would become extinct. Perry himself, however, was all too aware of the unresolved conflict between human and animal populations, and he wrote: "One suspects that in the end it will probably be solved in a manner disastrous for both men and animals; but we must continue trying to solve it humanely."

Humans are not to be defined by their humane behavior, especially to animals. In the decades following publication of Perry's book, the

Javan tiger disappeared and tiger populations seemed to be falling everywhere in India, so "Project Tiger" was initiated to protect them. Just when it looked as if they might recuperate, however, poachers began killing them with such celerity that the remaining Indian tigers have careened toward extirpation. White hunters and maharajas behaved as if their goal was to eliminate the tiger by their wanton hunting, and in their wake, the poaching brigade, attracted in large part by the lucrative trade in animal parts for traditional Chinese medicine, is nearing dubious success in wiping wild tigers off the face of the earth.

Accidentally or intentionally, the conflict between human and animal populations that Perry referred to is leading to the imminent extinction of many species. Habitat destruction, hunting, fishing, pollution, global warming, and numerous other factors have been identified as significant threats to the world's wildlife. The demand of traditional Chinese medicine for animal parts is emblematic of this conflict. The reasons for killing bears, rhinos, elephants, seals, sea horses, and numerous other species are sometimes different than the reasons for killing tigers, but extinction is extinction, no matter what the rationale or explanation.

2

Suffer the Animals

> At another stall, we found the head of a Hoolock's gibbon alongside a shoulder bag made from the animal's torso and arms. Its brain was good for headaches, the owner said. Then he showed us more animal parts and pointed me in the direction of other stalls selling wildlife. Within the first hour I had a species list that included parts ranging from Himalayan black bear, black serow, wild dog, and leopard cats to some of the rarest, most unusual species in the world—takin, musk deer, red goral, and red panda.
>
> *Alan Rabinowitz in Putao, Myanmar (Beyond the Last Village, 2001)*

Over time, humans developed a very special relationship with the so-called higher vertebrates (the warm-blooded birds and mammals): some we domesticated, others we killed off in vast numbers. There are those who argue that we killed off *all* the "charismatic megafauna" of the North American Pleistocene: the mammoths, mastodons, wooly rhinos, saber-toothed cats, mega-hyenas, and almost every other large mammal species that lived in North America thirteen thousand years ago. (Not everybody believes this; some think that climate change or disease did them in, or at least were strong contributing factors, but whatever the cause, they are extinct.)

In more recent times, *Homo sapiens* the not-so-wise has succeeded in eliminating the dodo, the passenger pigeon, the Carolina parakeet, the great auk, the ivory-billed woodpecker, Steller's sea cow, and dozens of other less-familiar animals. In its wisdom, the Australian government condoned and even encouraged the eradication of the Tasmanian wolf (*thylacine*), because officials believed (wrongly) that these marsupial carnivores were a threat to sheep, but the extinction of the species was not intentional policy. Nobody in authority decided that it would be a good idea to eradicate the passenger pigeon, at one time the most numerous bird in North America. The number of birds and mammals on the "endangered" list is enormous, and the list grows longer every day. Huge numbers of animals have been killed for commerce; if we didn't kill off all the fur seals and sea otters for their luxurious coats, or the whales for their baleen and oil, it was not for want of trying.

For some reason, very large terrestrial mammals with strange protrusions from their faces have always been targeted by collectors and in some instances avidly sought for what were believed to be their medicinal properties. The rhinoceros has "horns" growing atop its nose, while some other large creatures are blessed with huge ivory teeth. Those with the most prominent teeth are elephants, walruses, and the narwhal, a little Arctic whale with a single ivory tooth that projects straight out in front of it, which would play an important part in the story of the fabled unicorn. In *Love, War, and Circuses*, Eric Scigliano's 2002 book about humankind's relationships with elephants, we find this vivid description of ivory's nonmedical qualities:

> Unlike useful meat and hide, ivory holds largely aesthetic and symbolic value. Although it has been used throughout the ages to make utilitarian objects ranging from arrowheads and fishhooks to spoons and horns, it is not the only or even the best material for any. It is harder and much harder to work than clay or wood, but not so hard or readily sharpened as stone and metal. It cannot be molded, bent, cast, or flaked into shape; it must be painstakingly carved. But for carving it is matchless, taking detail like no other substance, glowing with an inner luster that deepens with age, warm as wood and fine as metal.

"The tusks fetch a vast price," wrote Pliny, "and supply a very elegant material for images of the gods." The Greek sculptor Phidias made a 40-foot-high statue of the goddess Athena for the Parthenon (the *Athena Parthenos*), which was dedicated to her in 438 BC. The statue, like Phidias' earlier *Zeus*, which is now considered to be one of the Seven Wonders of the Ancient World, was a colossal figure of chryselephantine

workmanship—draperies of beaten gold, flesh parts encrusted with ivory. To the Romans, ivory symbolized wealth and power. The mad emperor Caligula (AD 12–41) even kept his favorite horse inside the palace in a stable box of carved ivory, dressed in purple blankets and collars of precious stones. (The horse, who was made a senator, was often invited to dine with the emperor.)

With the fall of the Roman Empire, the flow of ivory into Europe was reduced to a trickle, largely because the elephants had been eliminated from North Africa and Asia Minor. The scarcity of elephant ivory made it that much more desirable, and in the Middle Ages it was a popular material for combs, mirror backs, chessmen, small boxes, jewelry, religious icons, small caskets (known as reliquaries), carvings of the Virgin, and the spectacular twelfth-century cross of Bury Saint Edmunds. Ivory was used in China for decorative objects, fans, chopsticks, and model houses and boats; and in Japan for the small toggles known as *netsuke* and *okimono*, which are larger carved sculptures, the latter most often of a human form. Elsewhere, ivory was used extensively in the manufacture of piano keys and billiard balls. Ivory was also collected from already-dead mammoths frozen into the tundras in Alaska, Canada, and Siberia, but nothing could match the great tusks of the elephants of Africa, which were slaughtered in unimaginable numbers for the ivory trade and carried to the coast by captives who were then themselves sold as slaves.

There is no way to obtain elephant ivory without killing its original owner. As elephants became scarcer, so too did their ivory, and carvers and manufacturers had to look elsewhere for approximations of the creamy white substance so familiar that it has given its name to a color. Although they are not as large or as fine as the ivory from elephants, the canine teeth of hippopotamuses, the tusks of walruses, the spiral tooth of the narwhal, the peglike teeth of the sperm whale (from which authentic scrimshaw is derived), and even the bones of large mammals such as cows and horses have been carved into "ivory" objects. The casque of the large tropical bird known as the helmeted hornbill (*Buceros vigil*) can be carved into small objects, and the inner lining of the seed of the tagua palm (*Phytelephas macrocarpa*) can be sliced like real ivory and made into ivory-like buttons.

Elephants have been used as beasts of burden and as sources of ivory for centuries, but they also play a part in traditional Chinese medicine. As with many other creatures—rhinos, particularly—that are not found in China, suppliers for traditional medications had to range far afield for their sources. In Li Shih-chen's 1597 materia medica* *Pen Ts'ao Kang Mu* (Compendium of Materia Medica), one of the fundamental texts for Chinese medicine, we find the Indian elephant prominently listed as a source of various medicinal potions. For example, the tusks, when ground or pared, are "sweet, cooling, and nonpoisonous," and can be used to remove foreign bodies from the throat and to cure epilepsy, osteomyelitis, and smallpox. Eating elephant flesh will make a person heavy. Elephant bile will clarify the vision and can be applied to the gums at night for halitosis. Ashed elephant skin can be applied with oil to heal injuries from metal weapons. Elephant bone is a general antidote to poisons; the bone ash is good for weakness of the stomach, heartburn, vomiting, cholera, diarrhea, colic, and poor appetite. The small horizontal bone in the chest, ashed and taken with wine, will cause a man to float.

The use of elephant products for medicinal purposes did not end in the sixteenth century, when some people floated and others clarified their vision with elephant bile. It goes on today, as described in a 2002 TRAFFIC report by Caitlin O'Connell-Rodwell and Rob Parry-Jones. Ivory powder collected from carving factories is still sold in pharmacies and used to warm the liver. We do not know how much elephant skin is traded without detection, but the skin of twenty elephants was seized by officials in Yunnan Province in 2001, and later that year, another 15 tons—for which some 260 elephants died—was seized by the Guangzhou Forestry Police. Modern uses are not confined to bones and skin. Cited in Alan Rabinowitz's *Chasing the Dragon's Tail* is a *Bangkok Post* article of November 11, 1987, describing "the discovery of nearly a dozen elephant carcasses in the forests of Kanchanaburi [Thailand], a province adjacent

* *Materia medica*, literally translated, is "medical material." The term is used to describe drugs and other substances that physicians prescribe to cure illness. A *pharmacopoeia* is a book containing a list of drugs and other medicinal substances with directions for their preparation and identification, but it can also be a stock of these substances.

to the Burmese border. Their penises had all been cut off. Elephant penises, which can weigh nearly forty-five pounds, are worth nine to ten dollars a pound on the black market, and are purchased by the Chinese as an aphrodisiac."

Tusks also characterize another animal that figures in traditional Chinese medicine, but the tusks have no medical value. If you were to find a musk deer skull in an Asian market, unless you were a zoologist you might think it belonged to a miniature saber-toothed tiger. Of course, it would be altogether the wrong shape and would not have the cat's carnassial (shearing) teeth, but 4-inch tusks on a 2 ½-foot-tall deer are more than a little odd. Both males and females have tusks, but neither sex has antlers. With tusks and no antlers, deer of the genus *Moschus* (there are five poorly defined species) are so unusual that it is not surprising to learn, as Valerius Geist informs us in *Deer of the World*, that "musk deer climb trees and cliffs." With its rounded, fuzzy ears, a musk deer's head looks remarkably like that of a kangaroo. One species or another is found in the high-elevation forests and brushlands of Siberia, India, Pakistan, Vietnam, China, Mongolia, Korea, and Myanmar. Habitat destruction has been responsible for a crash in all musk

Musk Deer (*Moschus moschiferus*).

deer populations, but far more pernicious has been the harvesting of the deer for the gland that gives them their name. Under the adult male's tail is a walnut-sized gland that secretes a yellowish, waxy substance that is believed to influence the estrous cycle in females and therefore plays an important part in the deer's reproductive cycle. The musk, which has a powerful and penetrating odor, has been employed for centuries in the manufacture of perfumes—more for men than women. Even today, many colognes and other scents for men emphasize "musk," but it is more than likely to be artificial, because the real thing is so expensive. Musk is reputed to be the most expensive animal product in the world, "fetching up to $65,000 per kilogram [2.2 pounds] on the international market" (Macdonald 2001).

In the traditional Chinese medicine (TCM) pharmacopoeia, musk has always played an extremely important role. In Li Shih-chen's 1597 materia medica, we read that the musk can be used "for acute pain and swelling of the abdomen, for constipation, difficult labor . . . for snake and rat bites. For caries . . . For restoring a lost sense of smell, for opening up the functions of the body orifices." And that was in the sixteenth century. In Bensky and Gamble's 1993 *Chinese Herbal Medicine Materia Medica*, musk is a miracle drug that "opens the orifices, relieves the spirit, and unblocks closed disorders; because of its intensely aromatic, penetrating nature this substance is used in treating a wide variety of problems that impair consciousness . . . Invigorates the blood, dissipates clumps, reduces swelling and alleviates pain. " In his 1999 TRAFFIC report on the musk deer, Volker Homes observed that, aside from its centuries-old use in the West for perfume, "the most important market for musk products is now Asia, for traditional East Asian medicine. Musk is included in about 300 pharmaceutical preparations in traditional Chinese and Korean medicine as a sedative and a stimulant, to treat a variety of ailments of the heart, nerves, breathing and sexuality and is therefore one of the most commonly used animal products in this type of medicine."

According to a 1998 TRAFFIC report by Judy Mills, the annual demand for musk in China alone is estimated to be 500–1,000 kilos (1,100–2,200 pounds), which would require the glands from at least one

hundred thousand deer. While it has been estimated that some seven hundred thousand musk deer remain in the wild, no one knows how long these species can withstand the current levels of hunting to meet commercial demands. It is possible to remove the musk gland surgically, which allows the deer to survive, and there are even musk deer farms in China, but for the most part, populations of the deer are hunted and killed in substantial numbers, and they are now endangered—or in some cases, extinct—wherever they live (or lived). Homes, for example, tells us that Russia's musk deer populations have been halved in the last decade as a result of poaching and illegal trading.

Animals that are killed illegally are said to be "poached," a term defined by the *Oxford English Dictionary* as "to catch or carry off (game or fish) illegally; to capture by illicit or unsportsmanlike methods such as a poacher uses." In many regions, wild animals are killed for food, and it is more than a little awkward to raise the issue of poaching where hungry people have to hunt to eat. In the modern trade for animal parts, the line between poaching and food-hunting is often blurred, but both are deadly. (Much noncommercial subsistence hunting is sustainable, of course, and does not threaten endangered species.) Joel Berger, in *Horn of Darkness*, the story of his rhino research in southwest Africa, explains:

> The fact that people are famished does not justify breaking laws, but it is far easier to understand that type of motivation than large-scale commercial poaching operations, often run through organized gangs. A barter economy, including the trade and sale of wildlife products, has gone on for centuries. Today's story is different. Modern weapons coupled with the lure of money from foreign markets drive unscrupulous traders to exploit impoverished people. The result has been the decimation of animal populations. Ostrich feathers were once fancied as ornaments in Europe and the Americas. Gall bladders and tiger bones are used medicinally in Asia.

The scope and breadth of interest in animal parts for Chinese medicine is staggering. In Bernard Read's 1931 translation of the sixteenth-century Chinese materia medica *Pen Ts'ao Kang Mu*, Li Shih-chen incorporated four categories of "Animal Drugs": domestic

animals; wild animals; rodentia, monkeys, and supernatural beings; and man as a medicine. Among the domestic animals are pigs, dogs, horses, asses, cows, and geese; listed with the monkeys are gibbons and orangutans, as well as sea horses, sprites, dryads, and naiads; and those parts of humans that can be used medicinally are hair, bones, placenta, bile, penis, and umbilical cord. The wild animal list is the longest and includes lions, tigers, leopards, tapirs, elephants, rhinoceroses, yaks, wild boars, porcupines, bears, deer, elk, civets, badgers, rabbits, otters, and wolves. Lions, elephants, and tapirs are not found in China now and probably were not in the sixteenth century, so they had to be harvested elsewhere, and sea horses, those tiny fishes that swim upright and look like miniature horses, are so strange looking that they seemed a natural for inclusion in the traditional Chinese zoomorphic pharmacopoeia.

There are some thirty-five species of sea horses, ranging in size from the tiny pygmy (*Hippocampus zosterae*), the mature adults of which are less than a half-inch long, to the 8-inch-long *H. ingens*. While a single pygmy sea horse wouldn't make much of a meal for a kitten, thousands of them would do, even for people. In her 1994 article in *National Geographic*, Amanda Vincent, an authority on sea horses, wrote that she had found "wok-fried-sea horses" on a menu in Hobart, Tasmania. Dried sea horses are used to make key chains, jewelry, paperweights, Christmas tree ornaments, and other souvenirs. Sea horses found in Indonesian and Philippine waters are used also in these island nations for folk medications. Shrimp trawlers using small-mesh nets often collect sea horses as a bycatch, and these little creatures ultimately find their way into apothecaries or souvenir shops.

By far the largest number of sea horses harvested are shipped to China (and to a lesser extent, to Korea and Japan), where practitioners of traditional Chinese medicine have been using sea horses for the past five centuries to cure impotency and asthma, lower cholesterol, prevent arteriosclerosis, and even enhance virility. In *Fundamentals of Chinese Medicine* (Zhōng Xī Xué Jīi Chǔ), the 1996 Wiseman and Ellis translation of a textbook used in several Chinese medical schools, the entry for "sea horse" (*hǎi mǎ*) reads as follows:

Sea horse (*Hippocampus* sp.).

> Warm, sweet, nontoxic. Enters the liver and kidney channels. Supplements the kidney and strengthens yang, regulates qi and quickens the blood. Treats impotence, enuresis, vacuity panting, difficult delivery; conglomerations and accumulations; toxin swelling of cold sores. . . . *Caution*: Contraindicated in pregnancy and effulgent yin vacuity fire.

The 1986 *Chinese Herbal Medicine: Materia Medica*, as translated by Dan Bensky and Andrew Gamble (1993), adds: "Tonifies the kidney and fortifies the yang; for impotence, urinary incontinence, deficiency wheezing, and debility in the elderly. Invigorates the blood: for bleeding and pain from blood stasis, and swelling due to sores and boils. Also used for abdominal masses. . . . Often steeped in wine when treating impotence. Good quality is whole, big, and firm."

Amanda Vincent and her colleagues at Project Seahorse have been instrumental in bringing to light the plight of sea horses and the trade that has developed around them. "Vincent is an energetic advocate for a beguiling but beleaguered group of fishes that derive their name from their startling resemblance to horses," wrote Floyd Whaley in the August 2004 issue of *Wildlife Conservation*. "As director of Project Seahorse, she has almost singlehandedly put seahorses and their relatives on the radar screens of the world's scientific and conservation communities." The size of the world's sea horse population remains a mystery, but it is difficult to imagine a population of animals—even if it is composed of numerous species—that can withstand the removal of 20 million per year, but that appears to be the number taken annually. In her Project Seahorse report, Vincent is quoted as saying that "in the year 2000, more than 20 million seahorses were traded globally, a dramatic increase from years past. With mainland China's growing economy and population, demand will probably climb."

Project Seahorse estimates that "total global consumption of seahorses was at least 21 million seahorses in 2001 (more than 60 metric tons) . . . [but] this now appears to be an underestimate; new and very incomplete data from Hong Kong show imports of nearly 13.5 tons from that region alone." In the Web pages entitled "Seahorse Biology and Conservation," Vincent and Hall summarize what is known (and not known) about the sea horse population:

> Extracting seahorses at current rates appears to be having a serious effect on their populations. The impact of removing millions of seahorses can only be assessed indirectly because global seahorse numbers are unknown, taxonomic identities are unclear, geographic ranges are undefined, and fisheries undocumented. Nonetheless, most participants in established seahorse fisheries reported that catches were dwindling markedly.

Other sea creatures have also played a part in the traditional medical practices of China. In his 1874 book, Captain Charles Melville Scammon, who was a sealer before he turned to whaling (and later opposed the killing of seals and whales), wrote about a herd of sea lions that were killed on Santa Barbara Island in 1852:

> The herd at this time numbered seventy-five, which were soon dispatched, by shooting the largest ones, and clubbing and lancing the others, save one Sea Lion, which was spared to ascertain whether it would make any resistance by being driven over the hills beyond. The poor creature only moved along through the prickly pears that covered the ground, when compelled by his cruel pursuers; and at last, with an imploring look and writhing in pain, it held out its fin-like arms, which were pierced with thorns, in such a manner as to touch the sympathy of the barbarous sealers, who instantly put the sufferer out of his misery by the stroke of a heavy club. As soon as the animal is killed, the longest spires of its whiskers are pulled out, then it is skinned, and its coating of fat cut in sections from the body and transported to the vessel, where, after being "minced," the oil is extracted by boiling. The testes are taken out, and, with the selected spires of the whiskers, find a market in China—the former being used medicinally, and the latter for personal ornaments.

In California in the early 1900s, Steller's sea lions (*Eumetopias jubatus*) were killed in large numbers because fishermen complained that the sea lions were eating the fish that belonged to the fishermen, and later, in the Aleutians, pups were killed for their skins to make clothing. Most male pinnipeds (seals, sea lions, and walruses) have a baculum or penis bone, and it is not surprising to learn that these bones were ground up and the powder sold as an aphrodisiac in certain Asian countries. In *The War Against the Seals*, an aptly named study of North American sealing, Briton Cooper Busch discusses "trimmings," which were composed of the genitals of bull seals, the gall bladder, and the whiskers. The penis and testicles were powdered and used to impart virility to men, the gall bladder was used for medicine, and the whiskers made wonderful toothpicks or opium-pipe cleaners. The whole "set"—genitals, gall bladder, and whiskers—brought $2 to $5 in San Francisco's Chinatown. Because the pelts were not particularly useful, the animals were often killed just for the "trimmings" and the carcasses left to rot on the beach.

Steller's sea lions are "ursine" (bearlike) seals, as are northern fur seals (*Callorhinus ursinus*). Although they look quite different, their ranges overlap, particularly in the western North Pacific, and those who

killed them for their "parts" probably didn't care which was which. Seal and sea lion parts are still being used in traditional Chinese medicine. *Rare Chinese Materia Medica*, published by the Shanghai University of Traditional Chinese Medicine in 1989, more than a century after Scammon's discourse on seals' testes, contains the following:

PREPARATION

> Cleaned ursine seal's penis and testes are dried and ground into powder, or they are moistened with liquor first, then roasted and ground into powder.

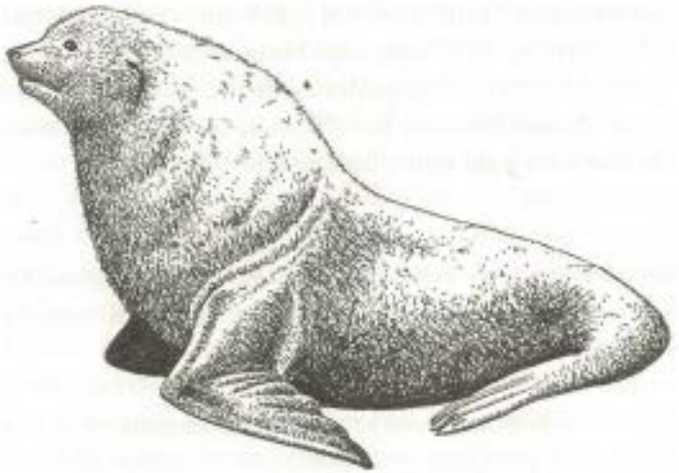
NATURE, TASTE AND CHANNEL TROPISM

> The medicine is salty in taste and hot in nature. Its therapeutic action is released to the channels of the liver and kidney.

ACTIONS AND INDICATIONS

> The medicine can warm the kidney to invigorate *yang* and replenish the vital essence to reinforce the marrow. It is efficacious in the treatment of consumptive disease, impotence, cold sperm, lassitude in the loins and legs due to the deficiency of the kidney-*yang*, etc.

Wiseman and Ellis (1996) on "Seal's Genitals" (*hǎi gǒu shèn*): "Hot; salty; nontoxic. Enters the liver and kidney channels. Warms the kidney and strengthens yang; boosts the essence and supplements marrow. Treats vacuity detriment taxation; impotence; limp wilting (*wěi*) lumbus and knees." In *Chinese Herbal Medicine* (1993), Bensky and Gamble suggest that for best results, seal penis should be combined with the fungus *Cordyceps sinensis*. In Chinese, this substance, *dōng chóng xià cǎo* ("winter-worm, summer-grass"), is actually the fruiting body of a parasitic fungus that invades the bodies of caterpillars and eats the soft tissue. One TCM Web site selling *Cordyceps* says, "In Traditional Chinese Medicine, *Cordyceps* has long been used as an aphrodisiac. Recent research in China and Japan has shown a 64% success rate among men suffering from sexual dysfunction, vs. 24% in the placebo group." In his 1987 article on wild animal products used as aphrodisiacs, Esmond Bradley Martin comments:



Steller's Sea Lion (*Eumetopias jubatus*).

> Asians consume incredible amounts and varieties of animal products and herbs for medicinal purposes, and they consider some especially useful for enhancing their love lives . . . seal pills—made from top-quality testicle and penis of seals, ground into a powder and pilled in form convenient for intake, stimulate male virility. (1987a)*

Evidently, the mutilation of seals in North America for pharmacological purposes did not end in the nineteenth century either; it is still going on. In an article in the *Portsmouth Herald* for October 30, 2003, Karen Dandurant reported on five harbor seals that were found skinned and mutilated on New Hampshire beaches. Dandurant quotes National Marine Fisheries Service agent Chris Shoppmeyer:

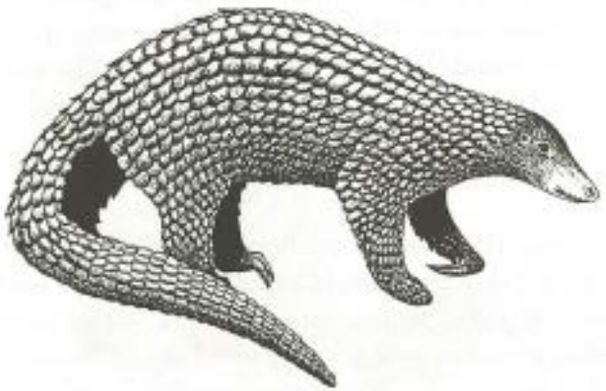
> They were professionally skinned, with no damage to the internal organs. Whoever did this was skilled with a knife. As to the other

* Martin wrote this in 1987; Western pharmacology has now also provided a treatment for "erectile dysfunction" in the form of Viagra and other prescriptions.

> mutilation, there is a big black market for the male genitalia of seals. In some Asian countries it is thought to be a powerful aphrodisiac, bringing in several hundred dollars per ounce. . . . The market for wildlife and their body parts is second only to the drug trade. . . . If I catch these guys [the cases] are going criminal. We're seeing a clear intent of commercialization.

Seal genitals, tiger bones, rhino horn, and the musk gland of a little deer all play a role in traditional Chinese medicine. We tend to think of scales as comprising the integument of fishes, snakes, and lizards, so the pangolin, a *mammal* with scales, is weird enough to earn a place in the TCM pharmacopoeia. There are seven species of pangolin, also known as "scaly anteaters": four in Africa and three in southern Asia. Among the African pangolins is the giant, *Manis gigantea*, which can measure six feet from the tip of its nose to the end of its thick, scaly tail, but most species are smaller, less than three feet overall. They exist almost exclusively on ants and termites, which they harvest with their incredibly long, sticky tongues, after digging up the anthills with their powerful foreclaws. (Anteaters too have long, sticky tongues, powerful foreclaws, and no teeth, but pangolins and anteaters are not closely related; their similarities are attributable to convergence, the evolutionary process in which unrelated species develop similar modifications that allow them to function more or less in the same fashion.) Some pangolin species live in ground burrows, whereas some are arboreal and shelter in hollow trees; the tree-climbing pangolin can hang from branches with its prehensile tail. When disturbed, pangolins can roll up in a tight ball, their scales providing an almost impervious defense against predators such as leopards, and they are also capable of exuding a foul-smelling liquid from their skin.

Not many animals would try to unroll a smelly, heavy-scaled pangolin, but *Homo sapiens*, the most efficient predator the world has ever known, has figured out that pangolins can be unrolled when they're dead, and the very scales that would have protected the pangolins in life are the main reason they are being killed. In a 1937 report, G. A. C.



Chinese pangolin (*Manis pentadactyla*)

Herklots wrote, "A stranger to Hong Kong might wonder why this harmless, inoffensive nocturnal creature, which lives largely on 'white ants,' the worst pest of the tropics, should need protection. Unfortunately for the animals, however, the Chinese believe that its scales have remarkable medicinal properties, and the animal itself is also eaten." Another of Bernard Read's twentieth-century publications of Li Shih-chen's 1597 *Chinese Materia Medica* was devoted to "Dragons and Snakes," one of which was the pangolin. (Others were crocodiles, lizards, and whales.) Pangolin scales were prescribed for "excessive nervousness and hysterical crying in children. For women possessed by devils and ogres. . . . Given with aconite and oyster shells for paralysis of the hands and feet; scales from the right side of the animal are given for affections [sic] on the left side of the body and vice versa." Ash from a big piece is "mixed with oyster shell, seven scorpion's tails, a little musk, linseed oil, and wax to form a small rod which is wrapped in cotton and rammed into the ear for ringing sounds and deafness due to sexual weakness. . . . For two months the powdered ash blown into the nose while the patient holds water in the mouth is used to cure eyelashes which curve inwards."

In modern TCM, the scales are still alleged to be powerful medicine, and the 1989 *Chinese Materia Medica* of Zhang Enquin tells us that the scales, "washed clean, dried in sunlight, stir-baked with sand, soaked in vinegar and dried for use," can be ground into a powder that will promote blood circulation, stimulate milk secretion, subdue swelling, and ease sores, carbuncles, and skin infections. Because pangolins figure prominently in Southeast Asian traditional medicine, it is convenient that three species are found in the very area where their scales can be utilized. "From 1958 to 1965," according to Ronald Nowak (1991), "over 60 tons of scales were exported legally from Sarawak, mainly to Singapore, and are estimated to have represented over 50,000 animals that were taken almost entirely in Kalimantan (Indonesian Borneo). . . . From 1980 to 1985, an estimated 3,000 to 5,000 pangolins were imported annually to Taiwan and South Korea." More recently, in 2002, some 600 pangolins were seized at Hanoi's airport after being illegally smuggled in from Malaysia en route to China, and the following year, more than 6,600 pounds of pangolins and more than 1,100 pounds of tortoises were discovered in 240 cargo cases from a Singapore Airlines flight. In the 1990s, the high volume of largely unregulated trade, including illegal shipments, brought about a measure of protection: all Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) parties decided to adopt a "zero quota" for Asian pangolins, which effectively bans all international trade. Since 2000, all trade in Asian pangolins has been illegal.

Many rare animals are killed for the pharmacological requirements of traditional Chinese medicine. The valuable gall bladder and bile of endangered bears are used to treat a variety of inflammations, infections, and pain. There are "bear farms" that supply bile to Chinese practitioners, where steel catheters are surgically implanted into caged bears' gall bladders, enabling handlers to regularly "milk" the bears for their bile. North and South American bears are also being killed for their gall bladders, which are then smuggled into China. Other endangered species, such as the various rhinos, are killed for their horns, which, when ground into a powder, are said to cure diverse ailments. Tigers, endangered throughout their range, are killed for their bones, which are made

into a "tiger bone wine" said to give the drinker the strength of the tiger. Tiger penis-bone soup is thought to be an aphrodisiac; eyeballs rolled into pills are thought to cure convulsions; whiskers protect one against bullets. Musk deer are killed for a special gland. Russian hunters have decimated huge herds of saiga antelope for their horns. Tons of dried sea horses enter the TCM trade each year. Throughout the world's oceans, sharks of all species are being slaughtered and their fins cut off to make ridiculously expensive ($100 a bowl) shark's fin soup, which is believed to confer the savagery of the shark on the drinker. Ever since people developed the notion that the horn of the unicorn could detect poison or cure various ailments, people have killed animals to obtain "medicine" from various parts. Modern medicine, although far from available worldwide, still provides cures for many diseases and infirmities. It is a terrible anachronism that so many people today rely on largely ineffectual animal-related remedies, but the real tragedy is that large numbers of animals have to die to provide these nostrums.*

The great majority of medicinals prescribed in TCM are of a vegetable or herbal origin; only a few originate in animal parts. Of these, many are from domestic animals such as pigs, cows, horses, camels, goats, and sheep. But a few come from wild animals, such as lions, leopards, porcupines, deer, monkeys, rabbits, otters, and beavers. Lions are now extremely rare in Asia (there is still a small population in the Gir Forest of northwestern India), but some Asian mammals whose body parts are desired commodities for TCM are critically endangered, and it

* As long as there remain crippling and fatal diseases, there will be individuals willing to try alternatives to scientific treatment. Among today's "incurable" diseases are AIDS, arthritis, cardiovascular disease, some cancers, multiple sclerosis, and amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease. In many cases where Western medicine cannot provide a cure, patients turn to alternative solutions, which often take the form of herbal remedies. In the 1970s, laetrile, a substance derived from apricot pits, was heralded by some as a "natural" cure for cancer. Movie star Steve McQueen, diagnosed with a rare form of lung cancer, went to Mexico for laetrile treatments, which failed to save him, and the laetrile phenomenon subsided. His case is an example of people willing to try anything when they learn that the wonders of modern (Western) medicine have failed them. Die of cancer or try something—anything—that might save you?

is toward these—particularly tigers, rhinos, and bears—that later chapters are directed. This is in no way to be considered a blanket criticism of the principles or practices of traditional Chinese medicine, but rather it points out that some irresponsible people, often perverting the fundamentals of this venerable tradition, bear a large responsibility for the destruction of some increasingly endangered species. Of course there are millions of people in China, Southeast Asia, and elsewhere with little or no access to education on science who are ignorant of the composition of the potions they so eagerly consume and who know very little about the endangerment of animals. A wider understanding of the traditions, the medications, and the status of the endangered species might possibly save even more lives—human and animal.

3

Chinese Medicine, Western Medicine

When an American doctor named Benjamin Hobson (1808–71) arrived in Canton in 1851, he publicly deplored the sorry state of Chinese medicine as contrasted with Western "scientific" practice. Between 1851 and 1868 Hobson became a sort of medical missionary, trying to blend the two traditions by combining the spirituality of the Chinese with the science of the West. He published five textbooks, including one on gynecology and obstetrics, but his emphasis on surgical intervention rendered his procedures irrelevant to the practices of elite Chinese doctors, who totally rejected the idea of invasive surgery.

Almost a century later, in 1942, the young Mao Zedong was highly critical of Chinese medical practice as well. He wrote that "old doctors, circus entertainers, snake oil salesmen, and street hawkers are all of the same sort," a line that would have a truly devastating impact on traditional medicine twenty-five years later when Mao's words became the one and only source for the country's definition of political truth. This line was quoted in millions of copies of the red "Mao Bibles," serving as the Red Guard's main license for persecuting traditional Chinese medicine practitioners and criticizing their traditions. Mao nevertheless seems to have reversed himself during the period when he actually ruled China, and from 1954 to 1976, he reestablished traditional Chinese medicine, but combined it with Western influences. In some areas, Western medicine now appears to be supplanting traditional Chinese medicine, but the shift has been gradual, and many traditional practitioners remain. In a 1999 article in the *Journal of Chinese Medicine*,

Heiner Fruehauf, an authority on Chinese medicine, wrote of medical education at the bachelor's level:

> By far the most extensive classes are dedicated to Western medicine contents such as anatomy, physiology, immunology, parasitology, and other topics that are unrelated to the diagnostic and therapeutic procedures of classical Chinese medicine. From both a quantitative and a qualitative perspective, therefore, it would not be entirely inappropriate to state in slightly dramatized terms that the Chinese medicine portion in the contemporary TCM curriculum has been reduced to the status of a peripheral supplement—approximately 40% or less of the total amount of hours. . . . None of the specialty students, including acupuncture department graduates, are required anymore to familiarize themselves with the realm of original teachings, not even in the radically abridged form of classical quotations that still serve to bestow an air of legitimacy on most official TCM textbooks.

While Chinese medical practices now include elements of Western medicine, it is clear that a substantial number of courses will be devoted to traditional Chinese medicine (TCM), and there are still many practitioners who rely heavily on older, time-honored practices, such as acupuncture, herbal remedies, diet, exercise, and massage.

Traditional Chinese medicine is thousands of years older than its Western counterpart and founded on completely different principles. TCM looks at the bodily system as a whole; Western medicine looks at the structure and function of the parts. Western medicine manages disease; TCM works to maintain health. Western medicine is standardized; TCM is individualized. Western medicine is the result of laboratory experimentations; TCM is a summary of clinical observations. Western medicine mainly relies on medication and procedures; TCM emphasizes the role of the body in healing. Where TCM prescribes herbs and natural agents, practitioners of Western medicine emphasize chemical compounds—often derived from natural agents. While Western medicine is intended to be strictly science-based, TCM is considered a healing art. In the modern era of science and technology, it is not surprising that Western medicine has become the predominant system while TCM is regarded as an alternative or complementary form of healing. But

Western practitioners now recognize the validity of certain TCM practices and have incorporated them into established medial contexts.

Within Chinese cosmology, all of creation is a function of two polar principles, *yin* and *yang*: Earth and Heaven, winter and summer, night and day, cold and hot, wet and dry, inner and outer, body and mind. Harmony of these principles means health, good weather, and good fortune, whereas disharmony leads to bad luck, disease, and disaster. In Chinese medicine, the concepts of yin and yang are infinitely divisible but inseparable: one cannot exist without the other. In medicine, the concept of the necessary interdependence of yin and yang is used in explaining physiology, pathology, and treatment. Every person has a unique terrain to be mapped, a resilient yet sensitive ecology to be maintained. Just as a gardener uses irrigation and compost to grow robust plants, the doctor uses acupuncture and medicinals to recover and sustain health. Just as nature contains air, sea, and land, the human body is composed of Qi (pronounced "chee"); Moisture, and Blood. Qi is the animating force that gives humans the capacity to move, think, feel, and work. Moisture is the liquid medium that protects, nurtures, and lubricates tissue. Blood is the material foundation out of which bones, nerves, skin, muscles, and organs are created.

In TCM, the goal of treatment is to adjust and harmonize yin and yang—wet and dry, cold and heat, inner and outer, body and mind. This is achieved by regulating the Qi, in the Organ Networks: weak organs are strengthened, congested channels are opened, excess is dispersed, tightness is loosened, agitation is calmed, heat is cooled, cold is warmed, dryness is moistened, and dampness is drained. The duration of treatment depends on the nature of the complaint, its severity, and how long it has been present. Response varies; some need only a few sessions, whereas others need sustained care to reverse entrenched patterns established over time, practitioners say.

In origin, Chinese medicinals can be animal, vegetable, or mineral, in most cases simply prepared. Their properties are traditionally understood in terms of their Qi and flavor. The Qi of an agent is either warm/hot or cool/cold; warm and hot agents are used to treat cold patterns, and cool and cold agents are used to treat heat patterns. A neutral agent is one that is neither hot nor cold. The five flavors are acrid, sour, salty, bitter, and sweet; these flavors correspond to wood, metal, water, fire, and earth, and

are often found to act upon the liver, lung, kidney, heart, and spleen, respectively. Medicinals are said to "enter" one or more channels. The substances affect the parts of the body through which the channels are believed to pass and can affect other agents in those regions. Functions of the medicinal agents are described in terms of restitution of aspects of the body (e.g., fortifying the spleen, supplementing the kidney) and in terms of eliminating evils (e.g., dispelling dampness, extinguishing wind).

Tiger bones, for example, are occasionally included in traditional Chinese prescriptions, but their uses are not particularly notable. Today, TCM does not actually equate tiger bones with sexual virility or shark's fin soup with ferocity. Here, for example, is the entire entry for tiger bone found in the section on "Wind-damp-dispelling medicinals" in the 1996 revision of Wiseman and Ellis's *Fundamentals of Traditional Chinese Medicine*:

> Warm, acrid, non-toxic. Enters the liver and kidney channels. Chases wind and settles pain; fortifies the bones and settles fright. Treats joint-running wind pain; hypertonicity of the limbs, limp lumbus and knees; fright palpitations; epilepsy; hemorrhoids and fistulas; prolapse of the rectum. *Directions*: Oral: decoct (9–15g), steep in wine, or use in pills or powders. *Caution*: Contraindicated in exuberant blood vacuity fire.

Nothing about enhanced virility. Evidently, the use of tiger penis as the "bone" creates a direct connection between the tiger's ferocity and the amorous capabilities of the consumer of the wine, pills, or powders. And because the cartilaginous fibers used in shark's fin soup are not a part of TCM at all—at least they have not appeared in any book I have consulted—any connection made between the soup and a man's performance is solely in the mind of the chef or the soup drinker.*

* In the West, when it was thought that sharks had some mysterious quality that prevented them from getting cancer, some enterprising entrepreneurs began killing sharks for their cartilage and marketing shark-cartilage pills as an anticarcinogen. They made a lot of money until a couple of researchers pointed out that sharks do get cancer—they even get cartilage cancer—and besides, taking shark-cartilage extract to prevent cancer was a little like eating the sawdust from redwood trees to make yourself taller.

In 1989, Zhang Enquin published the *English-Chinese Rare Materia Medica*, a handbook of herbal and animal drugs that are prescribed today in TCM, which he introduced in this way:

> Involving more than just the great contributions to the flourishing and prosperity of the Chinese nation, [the traditional medical pharmacy] represents an important chapter in the annals of Oriental civilization. Its unique theories and miraculous therapeutic effects have fascinated more and more people in the world. Included in this book are fifty clinically proved, valuable, and world-famous traditional Chinese drugs, of which twenty-seven are herbal drugs, twenty are animal drugs, and three are of other categories. [The three "other categories" are Chinese caterpillar, donkey-hide gelatin, and amber.]

To a Westerner, the use of animal parts as cures or preventatives may sound peculiar, but for people whose menu includes almost everything that can be raised or caught, animals such as sea horses, palm civets, raccoon dogs, and badgers as food or medicine are culturally quite acceptable.* David Kellogg, an American who moved to China in the early 1980s, wrote of his experiences in Hong Kong in his 1989 book, *In Search of China*:

> About a block from my hotel is the food market where you may buy roasted pangolins (a kind of scaly anteater that is really delicious), live Chinese raccoons, owls, parrot-like blue and green birds with straight beaks, monkeys, soft-shell turtles of all kinds, skinned, dried, and spiced rats, swans and geese, and, of course, dogs, usually split down the middle or hung by a hook through the throat.

* While many Westerners find badgers or civets unappetizing, they do not have a problem with animal parts *transplants*, technically known as xenotransplants from *xenos*, which means "strange" or "foreign" in Latin. In 1984, "Baby Fae" received a baboon heart and lived for three weeks before her immune system rejected it; baboon livers were given to two patients in 1992. Since then, the donor animal of choice has been the pig, and human patients have received pig liver transplants—usually a "bridge" until a human liver could be found—and experimental heart and kidney transplants have also been tried. Xenotransplant technology is still in the research stage, but if and when it is perfected, it will establish a further link between Western high technology and traditional Chinese use of animal parts in medicine.

The outbreak of SARS (Severe Acute Respiratory Syndrome) in Hong Kong, China, and Taiwan in the spring of 2003 brought to Western attention some of the more unusual food items on the Chinese menu, as it was suspected early on that the source might lie in the markets of southern China. On May 12, 2003, in response to the reports of SARS in palm civets, investigators from Animals Asia, a nonprofit conservation group based in Hong Kong, went through the Hua Nan Wild Animal Market in Guangzhou in southern China and found "cages and crate loads of masked palm civets, ferret badgers, barking deer, wild boars, hedgehogs, foxes, squirrels, bamboo rats, various species of snakes and endangered leopard cats, together with dogs, cats, rabbits and gerbils. As some of the traders attempted to hide their stash of wild animals, others insisted that theirs were captive bred—seemingly ignoring the fact that many animals showed bloody stumps, where their limbs had been severed in leg-hold traps in the wild."

From various sources, I have been able to find these additional animals eaten by the Chinese, but the list is hardly exhaustive; if an animal has four legs, wings, or even no legs at all, it can, it seems, find its way to the Asian dinner table: porcupines, silver foxes, badgers, squirrels, bamboo rats, common palm civets, spotted linsangs, wild boars, flying squirrels, flying foxes, mongooses, leopard cats, raccoon dogs, nutria, chipmunks, guinea pigs, horses, gerbils, donkeys, goats, chickens, peacocks, geese, ducks, quail, cobras, king cobras, rat snakes, water snakes, bamboo snakes, banded kraits, pythons, soft-shelled turtles, frogs, salamanders, and water monitors. The Chinese seem to have a special fondness for turtles; the Hong Kong and Guangzhou markets have special sections devoted to the display of various species, all of which are sold as food. In an Asian market in Cleveland, I saw live turtles and frogs offered as food items. In a market in Cambodia, writer Sy Montgomery asked a Cambodian biologist if there was any animal that people didn't eat there. "The vulture," he answered solemnly.

Some patterns of animal consumption may change in response to the threat of SARS. By the summer of 2003, civets, raccoon dogs, and many of the other exotic species that are staples of Guangdong's eclectic cuisine were gone from the markets, but it is unlikely that the ban will last beyond the SARS scare. Their disappearance doesn't mean the end of SARS;

indeed, it is not obvious that it originated in palm civets at all. The civets more than likely contracted the disease from other, more exotic species in the markets or some other place where they were in close contact. According to an article in *Science* for August 22, 2003, China lifted the four-month ban on selling masked palm civets and fifty-three other exotic species, because the Chinese government "did not find any evidence of a connection to SARS among those species." But then, in early 2004, when a man was diagnosed with SARS in Guangdong, the Chinese government decided that palm civets indeed harbored the SARS coronavirus and called for the destruction of ten thousand civets (Bradsher 2004).

Chinese eating habits, developed over thousands of years, are not based on the popularity or "cuteness" of the animal or what others may regard as exotic. As a matter of fact, neither are Western eating habits: those who would condemn the eating of badgers or porcupines should remember that Americans and Europeans have always hunted and eaten deer, wild sheep, rabbits, ducks, and other game birds such as pheasants and grouse; in medieval Europe, songbirds—like the "four and twenty blackbirds" baked in Old King Cole's pie—were regularly consumed. "White hunters" in Africa traditionally shoot and eat various antelopes, zebras, and other game animals when on safari.

A wide variety of vertebrate species are used in commercial trade in China's cities, especially in south China, Li Tining and David Wilcove (2004) point out, and they estimate that over 1,500 animal species are used in TCM. The consumption of wild animals is not analogous to traditional Chinese medicine, however, although both have been practiced for ages. TCM is three thousand years of carefully researched and tested practices. Though some of these may understandably appear strange to Western eyes, many of the innovations usually ascribed to Western physicians or medical researchers may actually have occurred in ancient China. For example, most Westerners believe that William Harvey discovered the circulation of the blood. But in *The Genius of China*, Robert Temple (1998) commented, "Harvey was, however, not even the first European to recognize the concept, and the Chinese had made the discovery two thousand years before." Temple maintained that "the ancient Chinese conceived of two separate circulations of fluids in the body.

Blood, pumped by the heart, flowed through the arteries, veins, and capillaries. *Ch'i*, an ethereal, rarified form of energy, was pumped by the lungs to circulate through the body in invisible tracts. The concept of this dual circulation of fluids was central to the practice of acupuncture."

The view that Chinese medicine understood the basics of heart circulation long before Western medicine is still contentious. In *Medicine: An Illustrated History*, Albert Lyons wrote, "Ideas in the *Nei Ching* concerning movement of the blood ('All the blood is under control of the heart'; 'The blood flows continuously in a circle and never stops'), have been thought to approach an understanding of its circulation antedating Harvey by thousands of years; however, some body vessels were thought to convey air, and there is little evidence that commentators perceived the blood-carrying vessels as a contained system." Temple, on the other hand, believes that the Chinese fully understood the system, drawing on this comment in *Nei Ching*: "What we call the vascular system is like dykes and retaining walls forming a circle of tunnels which control the path that is traversed by the blood so it cannot escape or find anywhere to leak away."*

Early Chinese Medicine

The *Huang-ti Nei Ching* (The Yellow Emperor's Classic of Internal Medicine) is generally considered the first discussion of Chinese medicine. It is reputed to have been compiled by Huang-ti, the "Yellow Emperor," around 2,600 BC, transmitted orally for centuries, and finally committed to writing around the third century AD. Joseph Needham (1900–95), the foremost Western authority on the history of science in China and author of a detailed history of Chinese medicine, believed there really was no

* William Harvey (1578–1657) was fluent in Greek and Latin, but not Chinese, so he would have had no access to the earlier Chinese studies. He was instead originally influenced by Galen's idea that there were two types of blood, venous and arterial, that followed different pathways and served different functions. In his 1628 *Anatomical Essay Concerning the Movement of the Heart and the Blood in Animals*, he deduced that there was only one circulatory system and that the blood was circulated through the heart muscle by the ventricles, and not absorbed and replenished by the liver, as Galen had suggested.

Yellow Emperor. Similarly, in the introduction to her translation of the *Huang-ti Nei Ching*, Ilza Veith suggests that "modern historiography tends to relegate him to the realm of legend." Controversy surrounds estimates of *when* the *Huang-ti Nei Ching* was written. Some authorities cling to the 2697 BC date, but research by Chinese medicine scholar Wang Chi-min suggests that it was composed around 1000 BC, which would make its author (or authors) contemporaries of Hippocrates. Veith again:

> If the history of the *Yellow Emperor's Classic* is to be compared with that of the *Corpus Hippocraticum*, which originated at about the same time, a curious and somewhat contradictory development may be noted. The works of the Greek tradition were composed to serve as text-books for the practitioner, yet the practical value of their contents was superseded centuries ago. Apart from their significance for the medical historian, the value of these works has for centuries consisted in creating for the Western physician the moral and ethical concept of the ideal physician. On the other hand . . . China's earliest book concerned with the art of healing was never meant to be a mere text-book of medicine, but rather a treatise on the philosophy of health and disease; and yet it was taken over by the physician, not as a guide towards an ideal life, but as a help for the actual practice of medicine.

However and whenever it was written, the *Nei Ching* consists of questions asked by the (legendary) emperor with long answers provided by Ch'i Po, his (also legendary) prime minister. All phases of health and illness are discussed, including prevention and treatment, ethics, and daily regimens, incorporated into an inclusive system that combines the Tao, yin and yang, and the theory of the five elements (Metal, Water, Wood, Earth, and Fire). Veith summarizes:

> Man, according to the system propounded in the *Nei Ching*, was subdivided into a lower region, a middle region, and an upper region, and each of these regions was subdivided three times, each subdivision containing an element of heaven and an element of man. This scheme of subdivisions was concurrent with another

> scheme according to which each of the three main subdivisions was held to be composed of one part Yin and one part of Yang; i.e., the human body was regarded as consisting of three parts of Yin and three parts of Yang. Since treatment of a specific disease or a specific organ depended largely on its location within a particular part of Yin or Yang, knowledge of these subdivisions was very important for diagnosis as well as for treatment.

It was in the *Nei Ching* that the seats of the particular "spiritual resources" were identified: happiness dwells in the heart, thought and ideas in the spleen, "inferior spirit" (sorrow) in the lungs, the will controlled in the kidneys, and the liver houses anger as well as the soul. The practice of Chinese medicine consisted of diagnosing illness—primarily by a meticulous analysis of the pulse—and attempting to rectify the imbalances in the five spiritual resources; the five climates (heat, cold, wind, humidity, dryness); the five viscera (heart, lungs, liver, spleen, kidneys); and, as we've seen, the five flavors (salty, bitter, pungent, sour, sweet) by rebalancing the perceived discrepancies. Many other factors were considered in the diagnosis, including the direction of the wind, the season of the year, the color of the patient's skin, and even the patient's dreams.

The four diagnostic procedures a practitioner would use, according to Needham (2000), are physical inspection of the patient, listening to the sounds of the body (auscultation) through a stethoscope or similar instrument, taking the patient's medical history, and examining the body by touch (palpation). Except in marriage, contact between the sexes was prohibited, and doctors, all of whom were men, were forbidden to examine women. The female patient would often extend her arm through the bed curtains for the doctor to take the pulse, which was by far the most important element in Chinese diagnosis. (In some instances, the doctor carried an ivory figure of a woman so that the patient could point to the area where the pain was felt.)

The Chinese philosopher Confucius (actually *K'ung Fu-tse*), who lived some five hundred years before the birth of Christ, forbade violation of the human body, so many Chinese medical practices relied upon reasoning and assumption rather than dissection or even direct observations.

"It was not entirely the superiority of Chinese internal medicine that made surgery unnecessary," Veith comments, "but the Confucian tenets of the sacredness of the body, which counteracted any tendency toward the development of anatomical studies and the practice of surgery."

The use of needles was not considered a violation of the body, and acupuncture and what was called *moxibustion* were held to be the primary forms of applied treatment, but neither is explained in the *Nei Ching*, suggesting that these practices existed even before the appearance of the Yellow Emperor's book or didn't come along until later. As still practiced today, acupuncture consists of inserting sharp needles of various sizes into particular points of the body along twelve channels or "meridians" that occur in pairs arranged symmetrically on the left and right sides of the body and are believed to be related to the various organs. The channels are deeply embedded in the muscles but come to the surface at 365 points that are available for "needling." The needles are inserted with a twirling motion, and the depth, angle, and duration of the insertion are left to the judgment of the acupuncturist. Sometimes acupuncture is combined with moxibustion, which consists of holding a stick of burning moxa (a variety of mugwort, *Artemisia vulgaris*) over the needled area, or when applied alone, placing on the skin powdered leaves of moxa, which are then ignited. This can be effected with the leaves directly on the skin or in a closed capsule that is heated and applied to the affected area.

Perhaps the most important idea contained in Chinese medicine is the one that suggests that prevention is more important than cure. In the *Nei Ching* we read: "To cure disease is like waiting until one is thirsty before digging a well, or to fabricate weapons after the war has commenced." Diet was also an important component in maintaining the body's balance, and chapter 22 of the *Nei Ching* ("Treatise on the Seasons as Patterns of the Viscera") specifies that the five flavors—pungent, sour, sweet, bitter, salty—have softening, dispersing, gathering, retarding, and strengthening effects, respectively. An example:

> Those who suffer from a disease of the kidneys are quick-witted and active at midnight, and their spirits are heightened during the entire days of the last months of Spring, Summer, Fall, and Winter, and

> they become calm and quiet toward sunset. Sick kidneys have the tendency to harden; then one should eat bitter food to strengthen them. One uses bitter food to supplement and to strengthen them and one uses salty food to drain them and to make them expel.

Along with acupuncture, the pharmacopoeia served as the foundation of Chinese medicine, and many of the precepts delineated in the ancient *Huang-ti Nei Ching* are in practice today, not only in China, but around the world. Interestingly, there is nothing in the *Nei Ching* about the use of herbs or animal parts as medicine, and indeed, there is nothing in the Yellow Emperor's book that discusses the ingestion of anything other than known food substances to correct imbalances. Centuries would pass before the subject of using herbs and animal substances for medicinal purposes was published, but it is likely that it had been going on long before it was encoded in books.

Sometime during the Han Dynasty (206 BC to AD 220), the *Divine Husbandman's Classic of the Materia Medica* (*Shen nong ben cao jing*) was published, the first Chinese text to focus on the medicinal use of various substances and not only the atmospheric, anatomical, and philosophical dialogues of the *Nei Ching*. The *Divine Husbandman's Classic* contains 364 entries, one for each day of the year, 252 of which were botanical, 45 mineral, and 67 zoological. It would be another one thousand years before the *Shen Nung Materia Medica* was written, detailing the pharmacological use of three hundred substances, including antipyretics, cathartics, diuretics, emetics, sedatives, stimulants, digestive remedies, antidiarrheal medicaments, and mercury and sulfur for skin diseases.

The Imperial Institute of Physicians, set up by the Tang Dynasty emperors in the seventh century AD, was the world's first medical school. It had an enrollment of some 350 students, specializing in medicine, surgery, or acupuncture—then considered the three divisions of traditional medicine. By this time, invasion of the body was no longer prohibited, as the medical profession recognized that for skin diseases, hemorrhoids, and the treatment of fractures, wounds, and septic conditions, some part of the body might have to be "violated." China's first hospital was established in AD 510 to cope with an epidemic in Shansi

Province, and during the following centuries a number of government-organized hospitals for lepers and the poor were set up.

In 1597, after twenty-seven years of research, the great pharmacologist Li Shih-chen published the *Pen Ts'ao Kang Mu* (Compendium of Materia Medica), which listed 1,892 drugs and some ten thousand prescriptions. One thousand of the drugs were of vegetable origin, four hundred were zoological, and the remainder were mineral. The *Pen Ts'ao Kang Mu* contains more than five hundred suggestions to strengthen and maintain the body, many of which were evidently developed by Li Shih-chen himself. Among the "zoological" drugs were pig's epiglottis, buffalo's nose, porcupine's urine, the meat of animals killed by thunder, and just about every part of a tiger.

The Origins of Western Medicine

At the outset, early Chinese and early Western medicine were not that different; for the most part, the origins of diseases were a mystery, and we have no way of knowing how effective either system actually was. In the West, clinically similar to the teachings of the *Nei Ching* were those of Hippocrates, the Greek physician and scholar born around 460 BC on the island of Kos near the western coast of Asia Minor. His writings—collectively known as the "Hippocratic Corpus"—have come down to us in the form of sixty books, originally housed in the great Library of Alexandria, but copied and rewritten countless times. It is unlikely that the *Corpus Hippocraticum*, which includes sections on anatomy, physiology, pathology, therapy, diagnosis, prognosis, surgery, gynecology and obstetrics, mental illness, and ethics, was written by one man, however. The books of the *Corpus*, the social historian of medicine Roy Porter (1997) tells us, "derive from a variety of hands, and, as with the books of the Bible, they became jumbled up, fragmented, and then pasted together in antiquity. . . . Scholarly ink galore has been spilt as to which were authentic and which spurious; the controversy is futile."

Hippocrates believed that disease resulted from an imbalance of the four bodily humors and that the goal of medicine was to restore the bal-

ance through appropriate diet and hygiene, turning to more drastic treatment only as a last resort. As Sherwin Nuland wrote in *Doctors*:

> The Hippocratic physicians saw diseases as events that happen within the context of the life of the entire patient, and they oriented their treatment toward restoration of the natural conditions and defenses of the sick person and the re-establishment of his proper relationship to his surroundings. . . . It was the basically holistic clinical approach of Hippocrates that provided the clear light which led Greek medicine out of the mire of theurgy and witchcraft.

Hippocrates taught that nature seeks an equilibrium of the four "humors"—blood, yellow bile, black bile, and phlegm—which were constantly renewed by the food one ate. These humors were mixed and moved in the body by "innate heat," which was a form of energy generated by the heart and the essential ingredient in human composition. Furthermore, the four humors corresponded to the four elements—fire, air, earth, and water—which represent the qualities of heat, dryness, cold, and dampness. (This, of course, was not very different from the precepts of early Chinese medicine, even though the details were different.) The Greeks, with few available pharmacological remedies, believed in diagnosing the condition of the patient and, where necessary, prescribing such things as purgatives, emetics, baths, bloodletting, wine, bland drinks, and a calm atmosphere, all designed, as Nuland points out, to aid nature in its attempts to rid the body of excessive humors.

Despite his elaborated view of bodily processes, Hippocrates recognized that there was more unknown than known about healing. His famous aphorism "Art is long, but life is short" (*Ars longa, vita brevis*) is now applied to any and all arts, but Hippocrates meant that the art of healing has a much longer life than that of its practitioners.* Of course, what he is best known for is the vow that bears his name. The Hippocratic

* The complete statement is "Life is short, and art is long; opportunity fleeting, experience delusive, judgment difficult, and the crisis grievous. It is necessary for the physician not only to provide the needed treatment but to provide for the patient himself, and for those beside him, and to provide for his outside affairs."

oath, sworn to even today by graduating medical students, as Albert Lyons concisely put it in a 1987 book, "contains both affirmations and prohibitions. It begins with pledges to the gods and to teachers as well as future students. The prohibitions are against harm to the patient, deadly drugs, abortion, surgery, sexual congress with the patient or his household, and revelation of secrets discovered while ministering to the sick. The duties are to act with purity and holiness."

Although the oath endures, the most influential of the ancient doctors was not Hippocrates but Galen, a Greek born at Pergamum in AD 129, during the reign of the Roman emperor Hadrian. In his teens, Galen became a *therapeutes*, an attendant upon the healing god Asclepius, and upon the death of his father, he inherited enough money to allow him to travel and broaden his medical horizons. When Galen returned home, he was named to the prestigious post of physician to the gladiators, and he learned much about the human body from his examination of gladiators' wounds. In 168, he left Pergamum for Rome, where he continued to write, lecture, and practice medicine, numbering the emperors Marcus Aurelius and Commodus among his patients. Unlike the works ascribed to Hippocrates, those of Galen seem to have been written by him, and his place in the history of medicine is assured by the realization that, as Porter wrote, "he was an erudite man and an accomplished philosopher, particularly in constructing an image of the organism as a teleological unity open to reasoning. For him, anatomy proved the truth of Plato's tripartite soul, with its seats in the brain, heart and liver; and Aristotelian physics with its elements and qualities explained the body system."

Galen's views were to dominate Western medicine for 1,500 years. In addition to summarizing the state of medicine at the height of the Roman Empire, Galen reported his own important advances in anatomy, physiology, and therapeutics. He made a special study of the pulse and showed that arteries carried blood, not air as many believed, and he made important discoveries about the spinal cord and nervous system that would not be appreciated until the nineteenth century. He elaborated on the four humors by classifying all personalities into four types: choleric, sanguine, phlegmatic, and melancholic—terms still in

use today to characterize dispositions if not physiological conditions. He advocated large-scale use of medications and often prepared his own prescriptions, mixing agents whose properties he identified as hot, cold, dry, or moist. (Lyons gives an example of one of his recommendations, in which "an illness categorized as hot required a drug that was in the cold category"—a view also at the root of Chinese prescriptive medicine.) One of Galen's favorite remedies was theriac—the word comes from the Greek *therion*, which means "beast"—a potpourri of ingredients he prescribed to combat everything from inflammations to poisons and pestilence. One of the ingredients was probably the flesh of poisonous snakes. Like the Chinese, Galen believed in the use of animal parts as well as herbs in treating illness.

By the sixth century, many of Galen's works had been translated into Latin, and with the rise of Arab-Muslim power in the Mediterranean, they were translated into Arabic as well. Muslim science was a repository upon which Western societies drew again and again. Physicians such as Rhazes (born in Persia), Avicenna, Albucasis, Averroës, and Maimonides (all Spanish-born) devised new treatments but employed many of the same criteria for diagnosing an illness as Hippocrates did: behavior, excreta, bodily effluvia, swellings, and the location and character of pain. Islamic medicine favored cauterization for internal and external diseases and prescribed drugs of all kinds, many of which—for example, nutmeg, ambergris, camphor, cloves, tamarind, myrrh, and senna—had to be imported from India or China. "The value of Arab contributions to medicine," wrote Porter, "lies not in their novelty but in the thoroughness with which they preserved and systematized existing knowledge."

It was not until the Muslim invasions of Africa, Spain, and parts of France that medicine replaced prayer as a means of curing the sick in Europe. Throughout the Middle Ages, during which the Europeans seemingly avoided any reminiscences of the ancient world, they prayed to God and to assorted saints, who sometimes let them down. Despite their prayers, smallpox was rampant throughout Europe, and in 1347, the bubonic plague, or Black Death, killed at least one-quarter of the population of Europe. "In the earlier Middle Ages, abbeys and monasteries

were the repositories of medical knowledge," the historians Joseph and Francis Gies tell us in *Life in a Medieval City*. "The principal effect of their regime was to repeal Hippocrates' law that illness is a natural phenomenon and to make it appear to be a punishment from on high." And Robert Lacey and Daniel Danziger, in their 1999 study of first-millennium England, commented:

> The sign of the cross was the antiseptic of the year 1000. The person who dropped his food on the floor knew that he was taking some sort of risk when he picked it up and put it in his mouth, but he trusted in his faith. Today we have faith in modern medicine, though few of us can claim much personal knowledge of how it actually works, and we also know that the ability to combat quite major illnesses can be affected by what we call "a positive state of mind"—what the Middle Ages experienced as "faith."

Belief in divine intervention, however, did not stop the Anglo-Saxons from applying potions of all sorts to afflicted unfortunates. Citing a tenth-century Winchester document known as "Bald's Leechbook," Lacey and Danziger provide a vivid example:

> Bald's prescription for dysentery showed a particularly well-balanced combination of folk remedy, religious conviction, and tender loving care—which probably constituted the most efficacious ingredient in the recipe: "Take a bramble of which both ends are in the earth, take the newer root, dig it up, and cut nine chips on your left hand, then sing three times: *Miserere mei dens* [Psalm 56] and nine times the Our Father. Take then mugwort and everlasting and boil these three in several kinds of milk until they become red. Let him then sup a good bowl full of it, fasting at night, sometime before he takes other food. Make him rest in a soft bed and wrap him up warm.

The leading pharmacological text for sixteen centuries and the foremost classical source of modern botanical terminology was *De materia medica*, the work of Dioscorides (c. AD 40–90), a first-century Greek physician and pharmacologist. Dioscorides' travels as a surgeon with the armies of the Roman emperor Nero provided him an opportunity to study the features, distribution, and medicinal properties of many plants

and minerals. Written in five volumes around the year 77, *De materia medica* contains excellent descriptions of nearly six hundred plants, including cannabis, colchicum, water hemlock, and peppermint, and includes descriptions of approximately one thousand simple drugs.

In medieval Europe, accumulated experiences of the curative powers of various plants were often codified into books known as *herbals*. Along with painstakingly accurate illustrations of various botanicals were found descriptions of their medicinal or magical properties much like their Chinese counterparts. Often incorporated into these herbals was the "doctrine of signatures," based on the resemblance of certain plants or plant parts to specific human organs or parts. Thus, heart-shaped leaves were thought to relieve heart disease; the convoluted walnut resembled the human brain and was therefore employed to relieve brain disorders; and the deep-throated figworts were recommended for scrofula, the swelling of the glands in the throat. Mandrake (*Atropa mandragora*), a member of the nightshade family, which includes belladonna, henbane, and tobacco, however, was the plant most infused with magical properties. The long root, which can sometimes resemble a human form, has been used since ancient times to arouse ardor, overcome infertility, and even increase wealth. It is poisonous, a narcotic, an anesthetic, and a preventative against demonic possession. It was reputed to grow only under the gallows of murderers. It screamed like a human when pulled from the ground, and whoever heard it was killed or driven mad. The only way to pull it out of the ground was to tie a dog to it; the dog would die, but at least you had the root. In *Romeo and Juliet*, Shakespeare's line is, "And shrieks the mandrake torn out of the earth, that living mortals hearing them run mad," and the Elizabethan poet John Donne (1571–1631) wrote:

> Go, and catch a falling star,
> Get with a child a mandrake root,
> Tell me, where all past years are,
> Or who cleft the Devil's foot.

Because magic, religion, and philosophy as well as the scientific disciplines of biology, medicine, and botany all originally coexisted and evolved together over time, each contributed to the elaborate rituals that

developed around the gathering and use of plants and herbs. How they were used was important too. To fend off demons or cure diseases, herb drinks were mixed with ale, milk, or vinegar; many of the potions were made with herbs mixed with honey. Ointments concocted with herbs and butter were prescribed for common ailments such as bleeding noses, baldness, sunburn, loss of appetite, and dog bites. Herbs were also utilized as amulets or charms against evil and diseases. One might hang them from the door (usually with red wool), to preserve one's eyesight, cure lunacy, prevent one from fatigue while traveling, or even protect cattle.

One of the most important herbals of the Elizabethan era was *Historie of Plants* by John Gerard (1545–1612). For his botanical descriptions and remedies, Gerard depended on his own observations, but he also consulted earlier authorities. Of the plant he called "Solomon's Seale" (*Polygonatum multiflorum*), for example, which produces clusters of greenish white, tubular flowers and dark, shiny berries in the fall, he wrote:

> Especially among the vulgar sort of people in Hampshire, *Galen*, *Dioscorides*, or any other have not so much as dreamed of; which is, that, if any of what sex or age soever chance to have any bones broken, in what part of their bodies soever, their refuge is to stampe the roots hereof and give it unto the patient in ale to drinke, which sodoreth and glues together the bones in very short space, and very strangely, yea, although the bones be but slenderly and unhandsomely placed and wrapped up. . . . The root stamped and applied in the manner of a pultesse, and laid upon members that that have beene out of joynt, and newly restored to their places, driveth away the paine, and knitteth the joynt very firmely, and taketh away the inflammation if there chance to be any.

Artfully blending herbalism, alchemy, and astrology, Nicholas Culpeper (1616–54) gave us an insightful, often amusing glimpse of European medicine in the seventeenth century. His dependence on his predecessors can be seen in his admonition: "I shall desire thee, whoever thou art, that intendest the noble (though too much abused) study of physic, to mind heedfully these following rules; which being well understood, shew thee the Key of *Galen* and *Hippocrates* their method of physic: he that useth their method, and is not heedful of these rules, may

soon cure one disease, and cause another more desperate." In a potent potpourri of cures, Culpeper suggests defenses not only against disease and infirmity, but against witchcraft, lustfulness, melancholy, intemperate dreams, vipers, serpents, mad dogs, and the plague.

Like those in medieval China, most Western herbals emphasized botanical preparations. Culpeper's 1653 *The Complete Herbal and English Physician Enlarged* is predominantly botanical, but it also contains a section on the use of "Living Creatures," such as millipedes, scorpions, earthworms, and ants; and another section headed "Parts of Living Creatures, and Excrements," which are prescribed for specific ailments. For example, "The brain of *Sparrows* being eaten, provokes lust exceedingly," and "A flayed *Mouse*, dried and beaten into a powder, and given at a time, helps such as cannot hold their water, or have a *Diabetes*, if you do the like three days together." Even a rare commodity such as *Ivory* or *Elephant's tooth*, "binds, stops the *Whites*, it strengthens the heart and stomach, helps the yellow jaundice, and makes women fruitful." *Whey*, a coagulation of milk still used in cheese-making, can be used to cure as many ailments as any Chinese medicament, as it "attenuates and cleanses both choler and melancholy; wonderfully helps melancholy and madness coming from it; opens stoppings of the bowels; helps such as have the dropsy and are troubled with stoppings of the spleen; rickets and hypochondriac melancholy: for such diseases you may make up your physic with whey. Outwardly it cleanses the skin of such deformities as come through choler or melancholy, as scabs, itch, morphew, leprosies, &c."

Lest you assume that it was only Chinese pharmacies that stocked animal parts, here is Culpeper's catalogue of the "Parts of Living Creatures and Excrements" that British apothecaries had to keep on hand:

> The fat, grease, or suet of a Duck, Goose, Eel, Boar, Herron, Thymallows (if you know where to get it), Dog, Capon, Beaver, wild Cat, Stork, Coney, Horse, Hedgehog, Hen, Max, Lion, Hare, Pike, or Jack (if they have any fat, I am persuaded 'tis worth twelve-pence a grain), Wolf, Mouse of the mountains (if you can catch them), Pardal, Hog, Serpent, Badger, Grey or brock, Fox, Vulture (if you can catch them), Album Graecum, Anglice, Dog's dung, the hucklebone of a Hare and

a Hog, East and West Bezoar, Butter not salted and salted, stone taken out of a man's bladder, Vipers flesh, fresh Cheese, Castorium, white, yellow, and Virgin's Wax, the brain of Hares and Sparrows, Crabs' Claws, the Rennet of a Lamb, a Kid, a Hare, a Calf, and a Horse, the heart of a Bullock, a Stag, Hog, and a Wether, the horn of an Elk, a Hart, a Rhinoceros, an Unicorn, the skull of a man killed by a violent death, a Cockscomb, the tooth of a Bore, an Elephant, and a Sea horse, Ivory, or Elephant's Tooth, the skin a Snake hath cast off, the gall of a Hawk, Bullock, a she Goat, a Hare, a Kite, a Hog, a Bull, a Bear, the cases of Silk-worms, the liver of a Wolf, an Otter, a Frog, Isinglass, the guts of a Wolf and a Fox, the milk of a she Ass, a she Goat, a Woman, an Ewe, a Heifer, the stone in the head of a Crab, and a Perch, if there be any stone in an Ox Gall, the Jaw of a Pike or Jack, Pearls, the marrow of the Leg of a Sheep, Ox, Goat, Stag, Calf, common and virgin Honey, Musk, Mummy, a Swallow's nest, Crabs Eyes, the Omentum or call of a Lamb, Ram, Wither, Calf, the whites, yolks, and shells of Hen's Eggs, Emmet's Eggs, bone of a Stag's heart, an Ox leg, Ossepir, the inner skin of a Hen's Gizzard, the wool of Hares, the feathers of Partridges, that which Bees make at the entrance of the hive, the pizzle of a Stag, of a Bull, Fox Lungs, fasting spittle, the blood of a Pigeon, of a Cat, of a he Goat, of a Hare, of a Partridge, of a Sow, of a Bull, of a Badger, of a Snail, Silk, Whey, the suet of a Bullock, of a Stag, of a he Goat, of a Sheep, of a Heifer, Spermaceti, a Bullock's spleen, the skin a Snake hath cast off, the excrements of a Goose, of a Dog, of a Goat, of Pigeons, of a stone Horse, of a Hex, of Swallows, of a Hog, of a Heifer, the ankle of a Hare, of a Sow, Cobwebs, Water thells, as Blatta Baxantia, Buccinae, Crabs, Cockles, Dentalis, Entails, Mother of Pearl, Mytuli Purpurae, Os sepiae, Umbilious Marinas, the testicles of a Horse, a Cock, the hoof of an Elk, of an Ass, of a Bullock, of a Horse, of a Lyon, the urine of a Boar, of a she Goat.

Most of these animal parts, while they sound exotic to us, were not uncommon in medieval England (well, maybe the rhinoceros, elephant, and unicorn were not so easily found in British farmyards), and the parts could be collected from animals that died of natural causes or were

butchered for food. By and large, Culpeper's animal pharmaceuticals did not endanger animal species. (Neither, at the time, did those of the Chinese, given the scale of medications prescribed and the number of animals that would have to be killed to provide them.)

The second half of Culpeper's *Complete Herbal and English Physician Enlarged* is described by its author as "an astrologo-physical discourse of the common herbs of the nation; containing a complete Method or Practice of Physic, whereby a Man may preserve his Body in Health, or cure himself when sick, with such things only as grow in England, they being most fit for English Constitutions." We find directions for making familiar concoctions such as syrups, conserves, oils, plasters, poultices, and pills, but also more arcane applications such as juleps, decoctions, electuaries, lohochs, and troches. Culpeper's purpose in delineating all these cures is "to preserve in soundness and vigour, the mind and understanding of man; to strengthen the brain, preserve the body in health, to teach a man to be an able co-artificer, or helper of nature, to withstand and expel Diseases." Just as in the Chinese herbals, the *English Physician Enlarged* identifies certain conditions that can be treated or cured with specific preparations. For example, "to stop fluxes of the blood, the menses, the haemorrhoids or piles, [and] also help ulcers in the breast or lungs," you must make a troche (lozenge) thus:

> Take of Amber an ounce, Hart's-horn burnt, Gum arabic burnt, red Coral burnt, Tragacanth, Acacia, Hypocistis, Balaustines, Mastich, Gum Lacca washed, black Poppy seeds roasted, of each two drams and two scruples, Frankincense, Saffron, Opium, of each two drams, with a sufficient quantity of mussilage of the seeds of Fleawort drawn in Plantain Water, make them into troches according to the art.

While both English and Chinese apothecaries used a surprising abundance of animal parts (and excrements), it was still the botanicals that dominated both materiae medicae. Of course, the plants differed according to what was available. Where the English materia medica included bracken, cowslip, elm, heather, lavender, and woad, the Chinese version includes ginseng, lotus root, mung bean, sandalwood, cinnamon, and gardenia. Regardless of the geographical differentiation,

however, the English herbals often read as if the cures were lifted from a book of Chinese medicine, indicating a surprising overlap of the two systems, if not as often in their specific claims. Here, for example, are the medieval medicinal uses of common wormwood (*Artemesia absinthium*) from *Brother Cadfael's Herb Garden*, Rob Talbot and Robin Whiteman's authoritative study of medieval plants and their uses: "Prescribed for stimulating the appetite, aiding digestion, treating jaundice, constipation and kidney disorders, reducing fevers, expelling worms from the intestine, remedying liver and gall bladder complaints, curing flatulence and improving blood circulation." And now the uses of sweet wormwood (*Artemesia* sp.) from Wiseman and Ellis's *Fundamentals of Traditional Chinese Medicine*: "Clears heat, resolves summerheat . . . treats warm disease, fever, malaria, dysentery, jaundice, scab, and itching."

While the practice of herbals and faith healing were in full flower, another strand was developing, which would ultimately come to dominate curative practices in the West and for which there was no real corollary in China at the time. Galen was not translated into Latin until 1476. The medical faculty of the University of Paris adopted his works as their standard text and stuck to his words as if they were gospel. But the man known as Paracelsus soon completely changed the way medicine was taught in Europe. Born in Switzerland around 1493 as Theophrastus Philippus Aureolus Theophrastus Bombast von Hohenheim, Paracelsus was well-versed in alchemy, chemistry, and metallurgy, but his fame lies in his boisterous and argumentative rejection of traditional theories of medicine. Teaching in German instead of Latin and wearing a leather apron instead of academic robes, Paracelsus refuted the teachings of Galen and Hippocrates, and ridiculed Galen's humoral theory of disease, advocating instead the use of specific remedies for specific diseases, many of which included chemicals such as laudanum, mercury, sulfur, iron, silver, gold, and arsenic. In their summary of Western medicine in *Chinese Herbal Medicine*, Bensky and Gamble accuse Paracelsus (whom they dub "a magician of the Renaissance") of being responsible for the decline of herbalism in the West, because he felt "that the action of a remedy did not depend on its hypothetical qualities (such as hot or cold) but rather on its specific healing virtue. Herbs were too imprecise or crude. . . .

There was a powerful drug for each disease just waiting to be discovered." Many of his remedies employed the popular doctrine of signatures, in which a plant that resembled an organ was used to cure a disease, such as the plant known as "eyebright" (*Euphrasia officinalis*), which was used to treat eye problems. He rejected dissection of cadavers as providing no information on how living systems actually worked, and although he died in 1541, "before Vesalius published his *Fabrica* . . . he would probably have deemed it not worth a sausage" (Porter 1997).

If Paracelsus had not led the way, Andreas Vesalius (1514–64), professor of medicine at the University of Padua, would never have overthrown Galen's dogma. Vesalius' emphasis on dissection and anatomy radically changed the direction of medical examination and pushed Western medicine further from the precepts of traditional Chinese practices. At Paris, Vesalius studied medicine in the Galenic tradition, and although he acquired great skill in dissection, he remained under the influence of the master's misguided concepts of human anatomy. But where his predecessors had watched from on high while a barber-surgeon pulled organs out of a cadaver, Vesalius performed his own dissections and eventually produced four large anatomical charts. In 1539, he produced *Institutiones anatomicae*, an anatomical manual for his students, in which he began to question some of the Galenic precepts. By 1540, he was certain that Galen's research described the anatomy of an ape and not of a human, and he argued that Galen's errors could only be repudiated by active dissection and observation of the human corpus. In 1543, the twenty-nine-year-old Vesalius produced what Joseph Petrucelli (1978) called "one of the greatest books in the history of man," *De Humanis Corporis Fabrica* (Structure of the Human Body), with illustrations by Vesalius himself and students from Titian's studio, in which the discrepancies between Galen's descriptions (of an ape) and his own (of a human) were delineated.

Was there cross-fertilization between Western and Chinese medicine before the modern age? Did Marco Polo bring back news of Chinese medicine when he returned to Europe in 1295? Probably not (there is no mention of doctors or medicine in his *Travels*), but about a century after Polo's accounts were published, the Chinese themselves decided to explore the

world outside their kingdom. Under the leadership of admiral Cheng Ho (1371–1433), fleets were sent far and wide on voyages of exploration, trade, and tribute collecting. Known as the "Three-Jewel Eunuch," Cheng Ho was born a Muslim in Yunnan Province, captured when he was ten, and brought to the court of the newly established Ming dynasty, where he was castrated and sent into the army as an orderly. Eventually a confidant and advisor to Zhu Di, the emperor who built the Forbidden City in Peking, he was appointed commander of missions to the "Western Oceans." From 1405 to 1433, fleets of Chinese armed warships, some more than 400 feet long, made seven epic voyages through the seas of China and the Indian Ocean. They carried cargoes of silks, porcelains, and lacquerware to trade for ivory, pearls, and spices, but their main purpose was to impress local rulers with the riches of the Chinese empire and the grandeur of its emperor. The expeditions visited such far-flung ports of call as Sumatra, Calicut, Ceylon, Siam, Malacca, the Maldives, the Ryukyus, Brunei, and Mombasa and Malindi on the east coast of Africa. The seventh expedition (1431–33) was the most ambitious of all, carrying forty thousand men to every port from Java to Mecca and returning with tributes collected from the Asian and Arab states, including horses, elephants, and a giraffe, but without Cheng Ho, who had died at sea.

Zhu Di's successors had no interest in replicating his grandiose naval demonstrations, however. They forbade all overseas travel, curtailed foreign trade, shunned contact with other nations, and disbanded the fleet, along with China's policies of outward expansion. As Louise Levathes wrote in her 1994 *When China Ruled the Seas*:

> The period of China's greatest outward expansion was followed by the period of its greatest isolation. And the world leader in science and technology in the early fifteenth century was soon left at the doorstep of history, as burgeoning international trade and the beginning of the Industrial Revolution propelled the Western world into the modern age.

By the middle of the fifteenth century, China, a nation then of about 100 million people—which, as Robert Temple has pointed out, had already invented gunpowder, the compass, paper money, the stirrup, the decimal system, and the seismograph—had walled itself off physically,

psychologically, and economically from the Western world. With medicine, as in other areas, the Europeans would have to work things out for themselves. In his chapter on Chinese medicine, Roy Porter wrote:

> From the wider perspective there is a key difference between the eastern and western medical traditions. Both initially shared common assumptions about the balanced and natural operations of the healthy body and these were inscribed in hallowed texts. Western medicine alone radically broke with this. An entirely new medicine grew up in the West—scientific medicine—building upon the new sorts of knowledge, programme and power that followed from anatomy and the investigations of the body it opened.

Contrasting early Greek and early Chinese science, Geoffrey Lloyd and Nathan Sivin (scholars of each, respectively) together wrote *The Way and the Word* (2002), a book in which they discuss how knowledge of the natural world was acquired, propagated, and disseminated in each of the two cultures. Greek scholars "focused on nature and on elements, concepts that seem familiar and obvious to those educated in modern science," but the Chinese had an altogether "different set of fundamental concepts, not nature and the elements, but the *tao*, *ch'i*, yin-yang, and the five phases. Where Greek inquirers strove to make a reputation for themselves as new-style Masters of Truth, most Chinese Possessors of the Way had a very different program, namely to advise and guide rulers." Because the realms of heaven, Earth, and man were united in the person of the emperor, the role of his advisors was to keep these elements in balance; a virtuous emperor meant that no untoward calamities would befall heaven or earth. Treatises like the *Huang-ti Nei Ching*, therefore, were as much cosmological as medical, while comparable Greek scholars, such as Hippocrates (who did not seek a position at court but rather strove to have his ideas accepted over those of competing teachers), with no patrons to please, had to "fall back on their own resourcefulness in building a reputation and in making a living."

Among the concepts that didn't make it successfully into China until much more recently was that of medical bacteriology—the idea that disease is caused by miniscule invasive creatures. Somewhere around 50 BC, the Roman writer Varro (116–27 BC) associated fever

with "marsh insects," though probably not with flies and mosquitoes: "in swampy places minute creatures live that cannot be discerned with the eye and they enter the body through the mouth and nostrils and cause serious diseases," he wrote. Although most Europeans believed that bubonic plague, which ravaged Europe from 1347 to 1350 and arose sporadically until 1670, was caused by bad air (miasmas) or bad faith, there was an inkling of belief that it might be spread by contagion. (The word malaria also means "bad air.") While besieging the city of Caffa, on the Black Sea, in 1347, Tartars catapulted corpses of plague victims over the walls of the city—the first recorded instance of biological warfare. According to Paul Ewald's 1994 *Evolution of Infectious Disease*, in 1546, Girolomo Fracastro published the idea that diseases were caused by disease-specific germs that could multiply within the body and be transmitted directly from person to person or indirectly on contaminated objects; moreover, he proposed that variations in the intensity of epidemics could be attributed to changes in the virulence of germs. It would be another three hundred years, however, before the germ theory of disease would become prevalent in the West.

What caused diseases in the early Chinese view? In the recent textbook *Basic Theory of Traditional Chinese Medicine* (Wu 2002), the chapter "Causes of Disease" begins with this definition:

> The pathogenic factors in TCM can be divided into four categories: (1) exogenous pathogenic factors including six climatic factors and pestilence. (2) endogenous pathogenic factors including seven emotions, improper diet and overstrain, etc. (3) secondary pathogenic factors including phlegm, retention of fluid and blood stasis. (4) other pathogenic factors including various traumatic injuries, injuries due to physical and chemical factors and injuries caused by insects and animals.

In other words, disease might be caused by an emotional breakdown, improper diet, overwork, retention of fluids, or any number of factors that can, in fact, precipitate illnesses, but because the germ theory of disease had not yet been developed, the Chinese—as well as Westerners—attributed disease to everything but pathogens, the actual cause of many

diseases. For example, in the 1741 *Chou hou pei chi fang* cited in Joseph Needham's 2000 study of medicine in China we read that:

> Smallpox is a congenital poison rooted in the conjugation of yin and yang at the very beginning of conception. Once the temporal cycles of susceptibility to illness and the seasonal epidemic *chhi* stimulate it, the disease will unfailingly break out. If one waits to deal with it until it has broken out, because epidemic *chhi* is already rampant the symptoms will generally be unmanageable.

Although without the germ theory, the Chinese nevertheless seem to have invented *variolation*, the practice of implanting live variola into an incision, which often resulted in a milder form of the disease with a much lower fatality rate than if the disease had been transmitted through the respiratory tract. Robert Temple tells us in *The Genius of China*, "The technique first came to public attention when the eldest son of the Prime Minister Wang Tan (957–1017) died of smallpox. Wang desperately wished to prevent its happening to other members of his family, so he summoned physicians, wise men and magicians from all over the Empire to try to find some remedy. One Taoist hermit came from O-Mei Sand, and brought the technique of inoculation and introduced it to the capital." Because it was such a devastating disease, there were more than fifty ancient Chinese treatises written on smallpox, and according to Joshua Horn (1969), "by the sixteenth century, over 200 years before Jenner's epoch-making discovery, a form of inoculation against smallpox, consisting of extracting and drying the contents of a pustule from a smallpox victim and blowing the powder into the nose, gained wide acceptance in China." The Chinese recognized that survivors of smallpox became immune, and physicians tried to infect healthy people in the hope that a mild infection would create immunity.

The Western version of variolation came later, probably not influenced by the Chinese. In 1715, English noblewoman Lady Mary Wortley Montagu had survived an attack of "the speckled monster," but she was permanently scarred and her eyelashes had fallen out. Her husband had been appointed ambassador to Constantinople, and while there, she had her own children successfully inoculated. In

1721, Lady Montagu introduced the idea of "inoculation" to England, and in what became known as the "Royal Experiment," six condemned prisoners at Newgate Prison were inoculated and promised a full pardon if and when they recovered. They all became free men. With variolation, the fatality rate was reduced from 30 percent to about 1 percent. And the procedure spread to America, where John Adams was successfully variolated in 1764 and Thomas Jefferson likewise in 1766. It was not until 1796, when Edward Jenner inoculated eight-year-old James Phipps with cowpox (which was harmless to humans) and found that the lad became immune to smallpox that vaccination was accepted in England and western Europe. Western belief in person-to-person transmission (as distinct from miasmatic transmission) was also strengthened by the introduction of smallpox to Europe by returning crusaders and by the later introduction of syphilis to Europe by travelers to the New World.

The interesting parallels of variolation aside, while Chinese medicine maintained continuity over the centuries to the present, the further development of Western medicine of bacteriology led to increasing divergence between the two practices. In Europe, the Dutchman Antoni van Leeuwenhoek (1632–1723) was the first to discover bacteria, free-living and parasitic microscopic protists, sperm cells, blood cells, microscopic nematodes and rotifers, and much more. Leeuwenhoek had learned to grind lenses, made simple microscopes (though the more powerful compound microscopes had already been invented), and began observing with them. On September 17, 1683, he wrote to the Royal Society of London about his observations on the scurf between his own teeth, "a little white matter, which is as thick as if 'twere batter." He repeated these observations on two ladies (probably his own wife and daughter) and on two old men who had never cleaned their teeth in their lives. Looking at these samples with his microscope, Leeuwenhoek found "an unbelievably great company of living animalcules, a-swimming more nimbly than any I had ever seen up to this time. The biggest sort . . . bent their body into curves in going forwards. . . . Moreover, the other animalcules were in such enormous numbers, that all the water . . . seemed to be alive." These were among the first observations on living bacteria ever recorded.

Experimenting with bacteria in the mid-nineteenth century, the French chemist Louis Pasteur (1822–95) conclusively disproved the theory of spontaneous generation (which held that living organisms could arise from nonliving substances) and led the way to the germ theory of infection. But even by the end of the nineteenth century, when European medical advances had become well known (and well publicized) in the West, traditional Chinese practitioners had not acknowledged germ theory and were still attributing disease simply to an imbalance of the body's humors.

German bacteriologist Robert Koch (1843–1910) made a number of advances in understanding of germs and codified the principles of germ study. He identified the bacterial causation of anthrax disease and demonstrated publicly the life cycle of the anthrax bacillus, and he described the significance of spores in transmission of the disease; his study, published in 1877, well before the century was out, was a landmark in the history of the germ theory. Five years later, Koch revealed before the Berlin Physiological Society the bacillus that causes tuberculosis, *Mycobacterium tuberculosis*, and in 1883, in India, he demonstrated that *Vibrio cholerae*, the bacillus that causes cholera, was communicated by polluted water. Koch's four postulates form the basis of modern bacterial epidemiology:

1. The specific organism should be shown to be present in all cases of animals suffering from a specific disease but should not be found in healthy animals.
2. The specific microorganism should be isolated from the diseased animal and grown in pure culture on artificial laboratory media, over several generations.
3. The freshly isolated microorganism, when inoculated into a healthy laboratory animal, should cause the same disease seen in the original animal.
4. The microorganism can be retrieved from the inoculated animal and cultured anew.

By the early twentieth century, many of the common killer diseases—smallpox, plague, influenza, whooping cough, measles, tuberculosis—

were known to be caused by pathogens, and yellow fever and malaria were known to be caused by microbes delivered by mosquitoes. It would have been impossible for Chinese doctors to ignore this information, and only die-hard traditionalists could continue to prescribe herbs or acupuncture for killers such as influenza, measles, and tuberculosis. (But, as we shall see, a cure for malaria came straight out of the pharmacopoeia of China.)

Herbal and animal-based substances continue to be prescribed in China for a wide range of conditions, based largely on the ancient principles of TCM. Among the more commonly treated disorders are skin diseases, including eczema, psoriasis, acne, and rosacea; gastrointestinal disorders, including irritable bowel syndrome, chronic constipation, and ulcerative colitis; gynecological conditions, including premenstrual syndrome, dysmenorrhea, and infertility; respiratory conditions, including asthma, bronchitis, chronic coughs, and allergic and perennial rhinitis and sinusitis; rheumatological conditions such as rheumatoid arthritis; urinary conditions such as chronic cystitis; psychological problems such as depression and anxiety; and chronic fatigue syndrome. Chinese herbals describe the use of every plant from ginseng and alfalfa to sassafras, cloves, myrrh, frankincense, cannabis, parsley, sage, rosemary, and thyme; and of course, various parts of various animals are still high on the list of curative substances. A list of the substances used in TCM and the conditions for which they are applicable occupies most of the 532-page *Fundamentals of Chinese Medicine*.

There was one widespread and deadly disease for which TCM provided no treatment; indeed, the Chinese government was even reluctant to acknowledge its existence. It was not until August 2001 that the Chinese government finally admitted that the country was facing a crisis with AIDS, a disease that has already claimed 23 million lives around the world and appears to be on the rise in heavily populated countries such as China and India. Chinese government officials now estimate that the total number of people infected with HIV is about six hundred thousand, but many experts working in China believe that even this figure is a serious underestimate and that the epidemic is much more widely spread, with the true number of people living with HIV being closer to 1.5 million. There is no known cure for HIV or AIDS, either

in Western or traditional Chinese medicine, but researchers have found that TCM can be of particular use to persons with HIV who are experiencing symptoms of diarrhea, loose stools, weight loss, abdominal pain, nausea, headaches, and enlarged lymph nodes. Studies in China and Thailand, where TCM has almost universal acceptance and a record of use going back several thousand years, have found that many people have successfully used TCM for addressing other HIV factors including fatigue, general energy loss, and declining mental powers.

In addition to some relief from HIV symptoms, some promising results have been obtained in TCM treatment of Hepatitis C. What does TCM say about cancer? One TCM Web page that I consulted noted that cancer can be caused by air pollution, food, and radiation—in agreement with Western medicine. The Cameron Clinic of Chinese Medicine (www.camclinic.com) says that cancer, like other diseases. is a manifestation of imbalance or disharmony in the body:

> In Chinese Medicine, illness is an energy imbalance, an excess or deficiency of the vital substances. Qi or vital energy controls the body's working as it travels along the channels or meridians. A person is healthy when there is a balanced, sufficient flow of Qi, which keeps the blood and body fluids circulating and fighting disease. If Qi is blocked for any reason or is excessive or deficient, disease may result. The flow of energy may be disrupted by an unblanced diet or lifestyle, overwork, stress, repressed or excessive emotions, lack of exercise, external pathogenic factors, etc. . . . The Chinese medicine practitioner determines the individual's pattern of disharmony rather than a condition such as breast cancer or colon cancer. The prescribed treatment depends on the individual's specific imbalance. Once the pattern of disharmony is identified a treatment plan is formulated to restore balance.

On the "Traditional Chinese Medicine Information Page" (www.tcmpage.com), I found this discussion of breast cancer:

> Chinese medicine believes that the fundamental cause of breast cancer is emotional disturbances such as excessive thinking or anger, which lead to functional disorders of the Liver and Spleen. A com-

mon causative pattern is that excessive Heat from a deficient Liver, combined with Phlegm Dampness due to Spleen dysfunction, results in the blockage of Chi and Blood, which then "condenses" into breast cancer. Another common causative pattern is when Liver Deficiency and Kidney Deficiency lead to Chi and Blood Deficiency. Chronic Chi and Blood deficiency then leads to Qi Stagnation and Blood Stasis, which causes the formation of lumps in the breast. A third pattern is when Qi Stagnation and Phlegm accumulation lead to excessive Heat toxins, which then turn to hard breast lump masses.

Cancer has always been one of humankind's most frightening diseases. It has been found in fossilized bone tumors in ancient Egyptian mummies, and the term *cancer*, which means "crab" in Greek, was coined for the disease by Hippocrates because of the spreading, fingerlike projections of some visible cancers. Hippocrates believed that an excess of black bile in various organs caused cancer, and Galen's misguided theories of the causation of disease held sway until the revised teachings of Paracelsus overturned them in the sixteenth century. Despite theories that cancer was caused by irritation, trauma, and parasites (a Nobel Prize was awarded in 1926 to Johannes Fibiger of Denmark who demonstrated that cancer in mice was caused by a worm), clinical experimentation has shown that the disease could be caused by carcinogens such as coal tar, benzene, aniline dyes, asbestos, radiation (including sunlight), hydrocarbons (particularly in tobacco smoke), and, most recently, viruses.

In any discussions, Chinese or Western, the reasons that cancer strikes some people and not others is largely unknown. We know that cancer develops when cells in a part of the body begin to grow out of control, and instead of dying, as normal cells do, cancer cells continue to form abnormal cells. The process known as *metastasis* occurs when cancer cells get into the bloodstream or lymph nodes and begin to replace normal tissue. Cancer cells develop because of damage to the cell's DNA, but exactly how this happens is not clear. Galen considered cancer incurable, but by the early twentieth century, the (sometimes successful) removal of tumors by surgery was the prevailing treatment in Western medicine. Hormone therapy and radiation followed, and chemotherapy was discovered to kill proliferating cancer cells by damaging their DNA. It has now been shown that a diet high in vegetables, fruits, whole grains, and beans, when combined with regular exercise, reduces the risk of cancer. Not smoking, staying out of the sun, and avoiding excessive radioactivity (such as nuclear explosions) do the same. If a balanced diet can reduce the risk of cancer, it now appears that the TCM theory about correcting an imbalance of yang and yin can presumably also have validity after all. Arguments about risk and cause aside, the application of the right animal, vegetable, or mineral pharmaceuticals could probably cure a number of diseases or ameliorate the symptoms, even if the explanation is 2,000 years old.

For example, *Artemesia annua*, known in English as sweet wormwood and in Chinese as *qinghao*, has been shown to be a cure for malaria. As Andy Coghlan wrote in a 2003 article in *New Scientist*, "a hitherto unknown but vital weakness in the malaria parasite has been exposed by studying extracts from ancient Chinese anti-fever remedies." This plant contains the active ingredient artemisinin, which kills the parasitic protozoan *Plasmodium falciparum*, transmitted to humans via the malaria mosquito, *Anopheles gambiae*. It was only in a recent study by scientists at St. George's Hospital Medical School in London (Eckstein-Ludwig et al. 2003) that the way in which artemisinin kills *Plasmodium falciparum* was identified, but the molecular composition of *Artemisia* was not important to early Chinese practitioners—they just knew it worked.

In an article in *Science* in 1985, Daniel Klayman introduced "*Qinghaosu* (Artemisinin): a new antimalarial drug from China." The drug may have been new to Western medicine, but *qinghao* (sweet wormwood) was known in China as far back as 168 BC, when, wrote Klayman, "its earliest mention occurs in the *Recipes for 52 Kinds of Diseases*, found in the Mawangdui Han dynasty tomb dating from 168 BC." The plant is also mentioned in the AD 340 *Zhou Hou Bei Ji Feng* (Handbook of Prescriptions for Emergency Treatments), which provides a recipe for *qinghaosu* (pronounced "ching-how-sue") in an infusion for treating fever. More than 1,200 years later, Li Shih-chen realized that *qinghaosu* could be used for treating the symptoms of malaria and included the

treatment in the 1597 *Pen Ts'ao Kang Mu*. There things sat until 1972, when Chinese scientists successfully extracted the plant's active compound, calling it *qinghaosu*—which was *artemisinin* in conventional scientific terminology, after the plant's Latin name, *Artemesia annua*.

Since the discovery of artemisinin, wrote Klayman, "the compound has been used successfully in several thousand malaria patients in China, including those with both chloroquine-sensitive and chloroquine-resistant strains of *Plasmodium falciparum*." (Chloroquine is a traditional treatment for malaria.) Further studies in China and Vietnam have confirmed that it is a highly effective compound with close to 100 percent response rate for treating malaria. It has the ability to destroy the malaria parasite by releasing high doses of free radicals that attack the cell membrane of the parasite in the presence of high iron concentration. In fact, over one million malaria patients have been cured via this method. Their symptoms also subsided in a matter of days.

Research is now being conducted on claims that *Artemisia* may also kill cancer cells. So far, the most extensive study on the use of artemisinin as an anticancer agent has been carried out by bioengineering scientists Narenda Singh and Henry Lai of the University of Washington, as reported in 2001 in the journal *Life Sciences*. They concluded that artemisinin kills malaria but it can also be used to treat various cancers. Singh and Lai wrote, "Since it is relatively easy to increase the iron content inside cancer cells in vivo, administration of artemisinin-like drugs and intracellular iron-enhancing compounds may be a simple, effective, and economical treatment for cancer."

Iron is required for cell division, and it is well known that many cancer cell types selectively accumulate iron for this purpose. Most cancers have more iron-attracting transferring receptors on their cell surface than normal cells. In laboratory studies of radiation, resistant breast cancer cells that have a high propensity for accumulating iron revealed that artemisinin shows 75 percent cancer-cell-killing properties in eight hours and almost 100 percent killing properties within twenty-four hours when these cancer cells are "preloaded" with iron after incubation. On the other hand, the normal cells remained virtually unharmed. In *Fundamentals of Traditional Chinese Medicine*, sweet wormwood (*Artemisia*) "clears heat, resolves summerheat . . .

treats warm disease, fever, malaria, dysentery, jaundice, scab, and itching."

Klayman's article on *qinghaosu* concludes with the following words: "Scientists in the People's Republic of China have not only contributed to a structurally novel and well-tolerated class of rapidly acting antimalarial agents but have also encouraged the investigation of folk medicine." But because artemisinin derivatives are expensive to produce and degrade quickly, a synthetic form was developed by University of Nebraska pharmacologist Jonathan Vennestrom and his colleagues that was cheaper to make and easily manufactured.* Like natural artemisinin, the synthetic form kills malarial parasites by producing free radicals, and although it is still being tested, it's possible that "a three-day dose should be sufficient to completely cure malaria" (Avasthi 2004). Perhaps, in this instance at least, the combination of TCM and modern science can accomplish what neither could accomplish separately.

There is, then, some overlap in the principles and practices of Chinese and Western medicine. While an arthritis patient in New York who saw a Western-trained doctor would probably not find himself with a prescription for alfalfa, nutmeg, or horseradish, more and more Westerners are recognizing the known beneficial properties of some plant constituents and have learned of positive uses of acupuncture, thereby crossing over to at least some of the precepts of traditional Chinese medicine. Although acupuncture had a small following in nineteenth century France and Britain, only in the last generation has it made great inroads into some aspects of Western treatment. This is due partly to a new multiculturalism and partly to rejection in some quarters of high-tech values; but it also results from explanations of acupuncture anesthesia in terms of endorphins and other neurotransmitters.

Many Westerners choose the herbal route because of its reliance on "natural" materials as opposed to those manufactured in a laboratory.

* In *Science* (January 7, 2005), however, Martin Enserink reports that there aren't nearly enough of the new drugs to go around, and artemisinin-based therapy is too expensive for the malaria patients, particularly in Africa, who need it most. In December 2004, the Bill and Melinda Gates Foundation announced a $40 million investment to develop a bacterium to churn out artemisinin, but it unfortunately may take years for this to be accomplished.

Herbs are typically prescribed in combination, which herbal practitioners believe balances them, allowing them to act together in a way that increases their efficacy. As with all traditional Chinese medications, herbal medicine seeks primarily to correct internal imbalances rather than to treat symptoms alone, and therapeutic intervention is designed to encourage the self-healing process. Of course, Western medicine is not the polar opposite to this. Using medication to correct imbalances—in thyroid production or vitamin deficiencies—is standard practice. And not all Western medications are synthesized "unnaturally" in the lab; quinine, a long-standing antimalarial medication, is derived from the bark of the cinchona tree (*Cinchona pubescens*), while scopolamine, used extensively for motion sickness, comes from the jimsonweed, *Datura stramonium*. Furthermore, some plants that are known to have beneficial medicinal effects are employed by both schools: the clear gel from the leaves of aloe vera is used for healing wounds and burns; cloves are used for flavoring food, but they are also used in Western medicine and TCM as anesthetics and antispasmodics; eucalyptus leaves are used around the world to relieve coughs and colds; belladonna (also known as "deadly nightshade" because it is poisonous) contains atropine, used in conventional medicine to dilate the pupils for eye examinations and as an anesthetic and in TCM to relieve intestinal colic, treat peptic ulcers, and relax distended organs, especially the stomach and intestine.

Despite such overlaps in the principles and practices of Chinese and Western medicine, many differences remain, largely because of the rationales that created them and in the way they developed. For some centuries, practitioners of early European and Chinese medicine were nonetheless roughly analogous, emphasizing herbal treatments and a number of humors or elements that had to be kept in equilibrium. Joseph Needham (2000) identifies the strengths and weaknesses of the two systems:

> When we turn to look at traditional Chinese medicine, we have to recognize at once that the concepts with which it works—the yin and the yang, and the Five Elements—are all more suited to the times of Hippocrates, Aristotle and Galen, than to modern times.

> . . . A feature in which traditional Chinese medicine is extremely good is its organic approach to illness. Two patients with identical symptoms may be given quite different treatments, depending on their backgrounds, which the physician has enquired about, and the general pictures of their body processes as ascertained in the examination. Another excellent feature of traditional Chinese medicine is the notion of disease as a process that passes through several stages. This can lead to some very sophisticated cures. Generally speaking, a strength of traditional Chinese medicine lies in curing chronic diseases.

How innovations were absorbed into the two systems made a substantial difference in the way medicine was practiced. The organization of the profession in Europe around medical schools may have been decisive in producing more systematic responses to new diseases. Hospitals provided opportunities for repeated observations of the patient's symptoms, whereas Chinese physicians often visited the patient once and provided a course of treatment. In a hospital, a cure that worked once could be tried again on the next patient, and professional colleagues were on hand to observe the result. European practitioners, therefore, were encouraged to try new cures. If the cures didn't work, they might then try something else. It is not, therefore, surprising that European doctors reacted to new diseases by altering major elements of the older theory and practice. By contrast, Asian medical experts, who did not operate in hospital environments, met new disease experiences by holding fast to ancient authorities—or claiming to do so even when something new crept in (McNeill 1996).

Of the substances prescribed potions work as well, say, as aspirin, but some probably don't work at all, relying though, in some cases, on the "placebo effect," where symptoms are alleviated because the patient believes he is receiving medication that will alleviate his symptoms. Aspirin, which is composed of acetylsalicylic acid, is an important element in modern Western medicine, but for a long time its employment was closer to that typical of a TCM substance. People took aspirin simply because they knew it worked. Only recently have scientists begun to

understand its workings and its range of medical effects, ranging from pain relief to reducing the likelihood of blood clot formation.

There is no question that prescriptions in Western medicine often do not accomplish what they are prescribed for, or that even with a substance as ubiquitous as aspirin, there are sometimes unexpectedly serious side effects. In contrast, there is a popular impression that TCM therapies, even if they don't always work, at least do no harm. After all, they are derived from "natural" substances, and how much harm can herbs, plants, or powdered animal parts do? Lots, as it turns out. Eating the bulbs of hyacinth, narcissus, or daffodils can be fatal; the branches of oleander are extremely poisonous; the leaves of foxglove can cause dangerously irregular heartbeats; all parts of laurels, azaleas, and rhododendrons are deadly; jasmine, mistletoe, and yew berries can kill you; and everybody knows what Socrates drank to commit suicide.

There are many people in Asia and elsewhere who believe that "alternative" medical treatments and practices are superior to those of Western medicine, which typically rely on artificial drugs and focus on repairing damage only after it has occurred. So it may come as a surprise to learn how enormously popular "unconventional" medicine is in the United States. A survey conducted in 1993 by David Eisenberg and his colleagues found that 33.8 percent of the respondents reported using at least one unconventional therapy, including herbal medicines, massage, megavitamins, folk remedies, and homeopathy, in the past year. In a follow-up survey, published five years later, Eisenberg and colleagues found that the percentage of those using an alternative therapy had increased to 42.1 percent, while the number of users visiting an alternative medicine practitioner jumped from 36.3 percent to 46.3 percent.

Doctors of Western medicine must be government certified to practice, but, with the exception of osteopathy or chiropractic, holistic practitioners are largely unregulated and do not have to be certified or even trained. Almost anybody can set himself up as a "therapist," and many "natural" health products are unregulated and marketed simply as food supplements. The supplements may thus be mis- (or self-) prescribed, and some may contain undetected toxic material. Debora MacKenzie in 1998, for example, told of 2,000 women in Belgium who signed up for

slimming treatments, but because the wrong herb was prescribed, more than 120 of them developed kidney failure. A study conducted by Robert Saper and his colleagues, including Dr. Eisenberg, in the *Journal of the American Medical Association* in 2004, found that "one of five Ayurvedic herbal medical products, produced in South Asia, and available in Boston area stores, contains potentially harmful levels of lead, mercury, and/or arsenic." (Ayurvedic medicine originated in India more than 2,000 years ago and relies heavily on herbal medicine products.) Eisenberg, a professor at Harvard Medical School, commented, "In order to investigate the efficacy of commonly used dietary supplements including Ayurvedic remedies we need to test high-quality standardized products free of contaminates and dangerous toxins. . . . Over-the-counter herbs and supplements with high levels o heavy metals are simply dangerous."

Traditional Chinese medicine has had a long and noble history over two millennia of Asian history, and in many parts of the world it is actively practiced today. There is no question that many components of the TCM pharmacopoeia are successful in suppressing fever, reducing swelling, curing headaches, nausea, dizziness, and toothache, eliminating pain, assuaging the agony of gallstones, or easing childbirth. TCM probably cannot cure cancer, heart disease, AIDS, tuberculosis, cholera, typhoid, typhus, dengue fever, influenza, measles, or chickenpox. There does not appear to be any evidence to support the claims that various substances listed in the Chinese materia medica can enhance one's virility, detect poisons, or make one live longer.

There are arguments to be made—not all of them convincing—that it is necessary (and morally acceptable) to use animals like mice, rats, rabbits, or monkeys in tests that might have beneficial applications for human medical needs. These animals are sacrificed for a "higher purpose," namely the production and testing of vaccines, hormone preparations, or even cosmetics. The number of laboratory mice and rats that die every year in the name of medical research must be astronomical. Within the precepts of today's TCM, however, some animals are killed to provide what practitioners are convinced are cures for ailing people, or people who might be sexually dysfunctional. In many cases, these prescriptions do not work, or do not work as well as some synthetic pharmaceuticals.

But it is not, after all, the use of animal parts *per se* that is the problem—it is the slaughter of the animals for what might be specious applications, or worse, the slaughter of critically endangered species.

Not all animal-based prescriptions of TCM require that an animal die. There are some parts of some animals that may or may not work as pharmaceuticals, but at least do not require that the animal be killed. "Antler velvet," the soft covering of maturing deer antlers, for example, appears to be the TCM analog of aspirin. Deer of all species begin their annual antler growth in the spring when their antlers are soft and covered in a thin skin, which bears short, fine hairs and resembles velvet. The growing antlers are warm to the touch and very sensitive. By late summer the antlers have attained their maximum size, and the thin skin

Package of deer antler. The large tuber to the left of the tree is ginseng. This packet was bought in a shop in New York City's Chinatown that also sold dried sea horses and a variety of herbal preparations. Deer antler and deer antler velvet are said to cure joint stiffness and arthritis, boost energy levels, aid muscle recovery, balance cardiovascular activity, strengthen the immune system, increase libido, and heighten general vitality.

with the velvety hair dries, loosens, and is rubbed off on shrubs and small trees, leaving the bony antlers uncovered. Because the "velvet" is supplied with blood vessels and contributes to the growth of the antlers, it is not surprising that for centuries, Chinese practitioners attributed special qualities to this substance. For example, the *Pen Ts'ao Kang Mu*, written by Li Shih-chen in 1597, gives this as the medicinal properties of antler velvet, known as *Lu rong*:

> For vaginal bleeding, convulsions with feverish cold. It benefits the vitality and strengthens the mind. It assists the growth of permanent teeth. A good tonic for weak people. For arthritis and backache. It is a diuretic. . . . For vesicular calculi, osteomyelitis. To quieten the placenta. For nymphomania, menorrhagia.

Was this just some weird sixteenth-century prescription? Hardly. Here's what the 1986 *Chinese Herbal Medicine Materia Medica* says about the same substance:

> Tonifies the governing vessel, augments essence and blood, and strengthens sinews and bones; used especially in cases of deficient essence and blood in children with such physical and/or mental developmental disorders as failure to thrive. Mental retardation, learning disabilities, insufficient growth, or skeletal deformities (including rickets).

A commercial Web site advertising antler velvet says, "velvet antler is a natural nutritional supplement used to relieve joint stiffness, increase bone density, boost energy levels, aid muscle recovery, balance cardiovascular activity, strengthen the immune system, increase libido activity, and heighten general vitality. Today, new research has highlighted the supplement's powerful benefits for osteoarthritis, rheumatoid arthritis, and osteoporosis sufferers."

In order to obtain the velvet for medicinal uses (it is prepared as slices through the antler, which look like poker chips, or dried and ground into a powder) the deer does not have to be killed. The sika deer (*Cervus nippon*), common in Japan and China, is widely farmed in China and various parts of the former Soviet Union for antler velvet

production, wrote Valerius Geist in 1998. The deer are raised on special farms where, in the spring, their velvet antlers are sawed off; and as with all deer, the antlers will grow back the next year.

Plants can be picked; leaves can be plucked, fruits, vegetables, and nuts can be harvested, and seeds can be collected without threatening the species, but some animals must be killed in order that the valuable parts can be harvested for use in TCM. To obtain shark fins, the sharks must be killed, and because sea horses are used in their entirety, they are killed wholesale. You cannot remove the bones or skin of a tiger, or the gall bladder of a bear, without killing the animal, and while some clever entrepreneurs have figured out how to obtain bear gall from a living bear, the technique is so awful that death for the bear might be preferable. It is possible to anesthetize a rhino and saw its horn off, but it is a difficult, cumbersome, and dangerous process that might result in the death of the rhino anyway, so poachers take the easier path and just shoot the rhino. So that some might make use of their fins, bones, horns, or gall bladders, some of our most charismatic wild animals are in danger of being wiped off the face of the earth.

4

Horn of Plenty

As we've seen, there are many parallels between the development of Western and Chinese medical practices. Both systems were holistic in that they involved the treatment of the whole person, not just the symptoms, and sought somehow to restore the natural balance of the body. Similar systems of treatment developed, where maladies were often treated with specific preparations derived from plants and animals that might be found in the garden, the barnyard, or the surrounding countryside. But because some exotic conditions called for exotic remedies, medical practitioners sought unusual animals whose parts might have uncommon curative powers. There are few animals stranger than a rhinoceros, a lumbering giant with horns growing where no other animal has horns, so it is not surprising that rhino horn became an integral part of early Chinese medicine. The use of rhino horn, however, can be traced to the unicorn, another animal with a horn growing from a totally unsuspected place.

The Fabulous Unicorn

There never actually *was* a unicorn, but many people thought there was, and that's almost as good. "There is no doubt," wrote Willy Ley in 1948, "that the unicorn is the most glorious of all the mythical creatures to be found in books before and also after Pliny." Before Pliny, a Greek physician named Ctesias, in the service of Darius II, King of Persia, returned to his homeland in 398 BC and wrote *Indica*, a book containing stories he had collected during his seventeen years in Persia. One of his tales describes certain wild asses that are as large as horses, and larger. Their

This spirited beast appeared in Conrad Gesner's 1551 *Historia Animalium* in the days when people had no difficulty believing in the existence of unicorns.

bodies are white, their heads dark red, and their eyes dark blue. They have a horn on the forehead about a foot and a half in length. The dust filed from this horn is administered in a potion as a protection against deadly drugs. The base of the horn, for some two hands' breadth above the brow, is pure white; the upper part is sharp and of a vivid crimson; and the remainder, or middle portion, is black. Those who drink out of these horns, made into drinking vessels, are not subject to the holy disease (epilepsy). Indeed, they are immune even to poisons if, either before or after swallowing such, they drink wine, water, or any liquid from these beakers.

After Ctesias—and probably based largely upon his description—other authors included the unicorn in their studies of natural history. Aristotle, about a half—century later, asserted, "There are . . . some animals that have one horn only, for example, the oryx, whose hoof is cloven, and the Indian ass, whose hoof is solid. These creatures have a horn in the middle of their head." Then there was Pliny (the Elder),

who was born in AD 23 and killed in 79 at Pompeii while trying to observe the eruption of Mt. Vesuvius. In *Historia Naturalis*, considered one of the most important of all early natural history books, Pliny makes no mention of any special powers of the horn but tells us, "The Orsaean Indians hunt an exceedingly wild beast called the monoceros, which has a stag's head, elephant's feet, and a boar's tail, the rest of the body being like that of a horse. It makes a deep lowing noise, and one black horn two cubits [about 40 inches] long projects from the middle of its forehead. This animal, they say, cannot be taken alive."

Somehow, a vaguely horse-shaped quadruped with a single horn managed to insinuate itself into the world's natural (and unnatural) histories, without what we might today consider a necessity—a direct sighting. Of course, much of ancient natural history was based on twice-told tales, because so few people were able to travel far in search of wild animals they had heard about. As Odell Shepard put it in his brilliant study of the unicorn, "The fact that no one ever saw a unicorn did not disturb belief in the slightest degree. No one in mediaeval Europe ever saw a lion or an elephant or a panther, yet these beasts were accepted without question upon evidence in no way better or worse than that which vouched for the unicorn." A unicorn wasn't really such a strange idea anyway; it was just an animal with a single horn where most other hoofed animals have two. There are a lot of mammals much more unlikely: the platypus, the giraffe, the elephant, the kangaroo, the armadillo, the anteater, the manatee and the narwhal are much too weird to exist—and yet they do. Indeed, there is a living animal that does have a single horn—or maybe even two—growing out of its nose, and few people question the validity of the rhinoceros.

There are several places in the Bible where unicorns are mentioned: Numbers 23:22 says, "God brought them out of Egypt; he hath as it were, the strength of an unicorn." And Job 39:9–11: "Will the unicorn be willing to serve thee, or abide by thy crib? Canst thou bind the unicorn with his band in the furrow? Or will he harrow the valleys after thee? Wilt thou trust him because his strength is great?" "One thing is evident in these passages," writes Shepard. "They refer to some actual animal of which the several writers had vivid if not clear impressions.

. . . Nothing about it suggests that it was supernatural, a creature of fancy, for it is linked with the lion, the bullock and the calf, yet it was mysterious enough to inspire a sense of awe, and powerful enough to provide a vigorous metaphor." In later years, the absence of the unicorn would be attributed to its missing the ark and drowning in the flood.

Long before the unicorn achieved its preeminence in Europe, it was thriving in China. In his 1977 *Unicorn: Myth and Reality*, Rüdiger Robert Beer asked if China could have been its original home: "The first notice of the beast in China has been placed as far back as 2697 BC. Extant descriptions of *chi-lin*, the Chinese unicorn, remind one of European conceptions of the animal: a body like an axis deer, horse's hoofs, an oxtail, as well as a horned, wolf-like head. King of the 360 animal species then recognized, *chi-lin* was reputed to reach 1000 years of age." An exhibition of treasures from the Silk Road, mounted by New York's Asia Society in October 2001, featured no fewer than three unicorn sculptures from the pre-Han and Han dynasties, beginning in 206 BC and ending in AD 221.

On her marvelous Web site, "The Mythic Chinese Unicorn *Zhi*," Jeannie Thomas Parker of the Royal Ontario Museum introduces the viewer to a wooden carving depicting a powerful animal, built along the lines of a fighting bull, with a single, tapered horn protruding from its forehead; it was also found in Gansu Province, dated from the Han Period, about 200 BC. This figure does not represent *chi-lin* at all, she writes, but rather *zhi*, a one-horned, goatlike creature that had long been represented in pictographs and statues of a male and female guarding the entrances of the courts of law; later, they were used as guardians of underground burial chambers. "Implacable and incorruptible, the tomb guardians *zhi* were intended to serve through all eternity to avert or ward off any bad influences or evil spirits that might attempt to violate the underground abode of the deceased."

In Pleistocene times, twenty thousand years ago, gigantic, one-horned rhinoceroses roamed throughout Europe and Asia, but with a more traditional placement of the horns—on the nose. The woolly rhinoceros, *Coelodonta antiquitatis*, for example, inhabited the steppes of Europe. It stood nearly six feet high at the shoulder and resembled the modern white

rhino in general proportions, but if the drawings on the walls of Chauvet Cave in France are to be believed, these rhinos of the Ardèche had enormous horns. Discovered in 1994, the walls of Chauvet are covered with more than three hundred paintings of horses, lions, bears, mammoths, hyenas—and spectacular long-horned rhinos. In their 1996 book about the caves, Jean-Marie Chauvet (for whom the cave was named), Étienne Brunel Deschamps, and Christian Hillaire wrote:

> Chauvet cave was startling in many respects—no decorated cave of such size had ever been found in this part of France; it was completely intact, with its varied traces of human and animal visitors . . . and it has so many images of so many different species, most notably rhinoceroses, big cats, and bears—animals that were hitherto unknown in this region's Ice Age art, but were also rare anywhere else, and certainly not depicted with such prominence on main panels. For example, less than twenty rhinos were previously

As long as thirty thousand years ago, rhinos walked the plains of Europe. This drawing was found on the wall of Chauvet Cave, in the Ardèche region of southeastern France.

known in European cave art, whereas Chauvet contains two or three times that many.

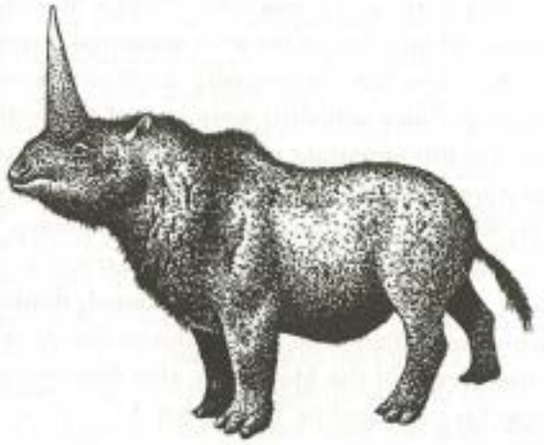
The art of Chauvet has been dated at approximately thirty thousand years of age; the same approximate date applies to a hardy band of Stone Age people that settled in northern Siberia's Yana River Valley and left behind numerous artifacts that enable anthropologists to get an idea of how they managed to live in the High Arctic, as described by Richard Stone and by V. V. Pitulko in the January 2, 2004, issue of *Science*. There were plentiful bone fragments of hunted animals (mammoth, bison, musk ox, horse, reindeer, wolf, fox, lion, and bear), as well as flaked stones, choppers, scrapers, and other tools, three of which were "foreshafts," used to replace the point of a spear quickly when it was broken or damaged. Two of the foreshafts were made of mammoth ivory, but one was of rhino horn, an 18-inch-long, gracefully curved shaft with a beveled point. Not only did early Europeans celebrate the great rhinos in their cave paintings, they used rhino horn as an aid in hunting big game—perhaps even rhinos.

The largest known prehistoric rhino was *Elasmotherium*, reaching a length of 20 feet and weighing as much as 4 tons—a rhino as big as an elephant. From nostrils to orbits, the skull was crowned with a large, bony dome, which served as a base for the single horn, leading paleontologists to reconstruct the horn of *Elasmotherium* as a very tall, very broad-based cone. This shape appears regularly in the Chinese sculptures from Gansu Province but has been found nowhere else. "Together with other archaic species of giant mammals, the unicorn *Elasmotherium* probably survived in the East Asian refugia until it was hunted to extinction in the late Pleistocene period," Parker speculates. There is no reason why a distant memory of this "unicorn" in Asia could not have survived into early Chinese history, contributing to the contention that the unicorn is indeed a Chinese invention.

The conical shape of the horn lent itself nicely for use as a drinking cup, and it was not long before the curative powers attributed to the powdered horn were transferred to the cup, meaning that a liquid drunk from a rhino-horn cup came to be seen as healthier than, say, a liquid drunk from a ceramic vessel. If there was poison in the drink, the rhino-

horn cup would cause it to bubble and fizz. If the horns of *Elasmotherium* were not available for medicinal uses in early China, the horns of living rhinos at the time certainly were. During the Bronze Age (around 3000 BC), when China was warmer than it is today, all three types of Asian rhino were found in China: the Indian (or one-horned) rhino, the Sumatran, and the Javan rhino. The horns, dried and powdered, were (and still are) believed by the Chinese to be a "cold drug," a preventative against hot ailments, such as poisons and fevers.

The properties of "unicorn horn" were recognized in China long before they occurred to Europeans, probably because there were "unicorns" in China long before there were any in the West. In his fifty-volume pharmacological encyclopedia, the fourth-century Chinese author Li Chih-chen stated that the main ailments that could be treated with rhinoceros horn were snakebites, hallucinations, typhoid fever, headaches, boils, carbuncles, vomiting, food poisoning, and "devil possession," but in addition, "the unicorn horn is a safe guide to tell the presence of poison: when poisonous medicines of liquid form are stirred with a horn, a white foam will bubble up, and no other test is necessary."



Elasmotherium lived in north-central Europe and eastern China twenty thousand years ago. Is this gigantic fossil rhinoceros responsible for the myth of the unicorn?

(In their 2002 book *Rhinos*, Ann and Steve Toon suggested that, "improbable as it sounds, there may be some justification for the belief, as the alkaloids present in some poisons do react strongly with the keratin and gelatin in horn.")

Belief in the alexipharmic (poison-antidote) qualities of unicorn horn are as ancient as the earliest unicorn sightings. In *De natura animalium*, a miscellany of facts and fantasies gleaned from various Greek writers, the Roman writer known as Aelian (AD 170–230) had this to say about the horn of the unicorn:

> India produces horses with one horn, they say, and the same country fosters asses with a single horn. And from these horns they make drinking-vessels, and if anyone puts a deadly poison in them and a man drinks, the plot will do him no harm. For it seems that the horn both of the horse and of the ass is an antidote to the poison.

Some time between the second and the fourth centuries, the *Physiologus*, a book of animal legends, was produced in Alexandria and subsequently translated into Syrian, Arabic, Armenian, Ethiopian, Latin, German, French, Provençal, Icelandic, Italian, and Anglo-Saxon. This was not, however, a single work in serial translations but rather an ongoing work-in-progress with no single author, with material being added and modified as the work wandered through time and geography. The *Physiologus* eventually metamorphosed into the medieval bestiary. Since unicorns were one of the animals prominently featured in this important work, their place in history, mythology, and literature was assured. In his translation of a twelfth-century bestiary, T. H. White describes two unicorns, explaining, "The reason there are two unicorns described in this Bestiary is that Aelian believed there were two species—a solid-footed, donkey-sized one identified with the 'Indian Asse,' and a cloven-footed creature identified with the oryx." Of the *Monoceros*, this description appears in the *Physiologus* (as translated by T. H. White):

> A horn sticks out from the middle of its forehead with astonishing splendour to the distance of four feet, so sharp that whatever it charges is easily perforated by it. Not a single one has ever come alive into the hands of man, and, although it is possible to kill them, it is not possible to capture them.

Of the Unicorn:

> *Unicornis* the Unicorn, which is also called Rhinoceros by the Greeks, is of the following nature. He is a very small animal like a kid, excessively swift, with one horn in the middle of his forehead, and no hunter can catch him. But he can be trapped by the following stratagem. A virgin girl is led to where he lurks, and there she is sent off by herself into the wood. He soon leaps into her lap when he sees her, and embraces her, and hence he gets caught.

Through its appearance in bibles and bestiaries, we can trace the prominent tracks of the unicorn through the historical thickets of the Middle Ages. No less respectable an observer than Leonardo da Vinci wrote, "In its lack of moderation and restraint and the predilection it has for young girls, it completely forgets its shyness and wildness; it puts aside all distrust, goes up to the sitting girl and falls asleep in her lap. In this way hunters catch it." The actual "horns" that had begun to appear in Europe seemed ready validation for the convictions of those who believed in the fabulous unicorn. These "horns" were beautiful ivory shafts, wider at the base and tapering to a graceful point. What other animal could produce such a lovely object? In his 1560 *Historia Animalium*, Conrad Gesner had no problem; he saw the "horns" as incontrovertible evidence of the existence of the unicorn: "one has to trust the words of wanderers and far-going travelers, for the animal must be on earth, or else its horns would not exist."

In many early depictions of the unicorn, the animal is shown dipping its horn into a stream, ostensibly to purify the water of the poison that serpents have spewed into it. Several other illustrations included in Sutherland Lyall's *The Lady and the Unicorn* show the beast engaged in this unambiguous activity, and one from a fifteenth-century French manuscript shows the unicorn cleansing the water, while camels, leopards, lions, bears, and monkeys wait patiently until the water is pure enough to

drink. In the second panel of the "Unicorn Tapestries," displayed in the Cloisters in New York, part of the Metropolitan Museum of Art, the animals also wait patiently to drink. Adolfo Cavallo sees the allegory in the European tradition as obvious: "Christ takes on the sins of Man, and so purifies him, in order to bring about his redemption. The serpent is the devil; the poison he introduces into the world (the water) is sin." If the unicorn used its horn for such eleemosynary purposes, it should come as no surprise that people—usually less charitable than unicorns—might use the horn in the same fashion, but to protect themselves, not their fellow creatures. Thus we read in Edward Topsell's 1658 *Historie of Foure-Footed Beasts* (with original spelling and punctuation retained):

> The ancient writers did attribute the force of healing to cups made of this horne, wine being drunke out of them: but because we cannot have cups, we drinke the substance of the horn, either by it selfe or with other medicines. I happily made some of this Sugar of the horne, as they call it, mingling with the same Amber, ivory dust, leaves of gold, Corall, and certain other things, the horne being included in silke, and beaten in the decoction of razens and Cinamon, I cast them in water, the rest of the reason of healing in the meantime not being neglected. It is moreover commended of Physitians of our time against the pestilent fever, against the bitings of ravenous Dogs, and the strokes or poysonsome stings of other creatures: and privately in rich mens houses against the belly or mawe worms; to conclude it is given against all poyson whatsoever, as against many grievous diseases.

Medieval Europeans, like their medieval Chinese counterparts, recognized the very special properties of some animal parts, but where the Chinese could attribute magical qualities to rhino horns, the Europeans had to make do with a mythological beast—until a real unicorn came along.

There are two sets of sixteenth-century "unicorn tapestries": one in the Cloisters and the other in the Musée de Cluny in Paris. In both sets, wherever the unicorn appears, his horn is a perfect narwhal tusk; long, white, tapered, and spirally twisted, which has suggested to some that there was some suspicion that the magical horn did not come from a terrestrial quadruped at all. Topsell quotes several authorities, one of whom says that "there be Birds in Ethiopia having one horn on their foreheads, and are therefore called Unicornus: and Albertus saith, there is a fish cald *Monoceros*, and hath also one horn." Topsell dismisses those who believe this nonsense as "vulgar sort of infidell people," but it is evident that the myth of the graceful, blue-eyed equine was threatened.

By the seventeenth century, a proper description of the narwhal had been obtained: it was (and still is) a smallish Arctic whale with a single elongated canine tooth that sticks straight out in front of its head to a length of eight feet. Only male narwhals grow this tooth; females are toothless. This tusk, unique in all the animal kingdom, was certainly known to Eskimos but was probably found by early Norse seafarers, and because it is solid ivory, it was used as a prow decoration for war galleys, used for sword hilts, and carved into small items like combs and chessmen. Brought to Europe by Elizabethan explorers and later by commercial whalers, the narwhal tusk contributed mightily to the myth of the unicorn, for it was much easier to believe that this elegant white horn came from a graceful hoofed animal than from a dumpy Arctic whale.

Even if it came from a dumpy little whale and not a snow-white quadruped, *Unicornum verum*—the true unicorn's horn—had some very special properties. A broadside published by a London doctor in the seventeenth century (reproduced in Beer's 1977 book *Unicorn*) specified the ailments that could be cured by partaking of drink that passes through the horn—a narwhal tusk that could be viewed by visitors to the doctor's house in Houndsditch:

> A Most Excellent Drink made with a true Unicorns Horn, which doth Effectively Cure these Diseases: Scurvy, Old Ulcers, Dropsie, Running Gout, Consumptions, Distillations, Coughs, Palpitations of the Heart, Fainting Fits, Convulsions, Kings Evil, Rickets in Children, Melancholly or Sadness, The Green Sickness, Obstructions, And all Distempers proceeding from a Cold Cause.

In addition to "drinking it warm at any time of the Day," the doctor has "prepared twelve Pils in a Box to be taken in three Doses, according to Directions therewith given, the Price is 2s. the Box."

In both sets of the unicorn tapestries—one in New York and one in Paris—the unicorn is shown with a tapering, spiral horn that closely resembles the tooth of a male narwhal.

It is unclear who first identified the narwhal as the progenitor of the unicorn. It could have been Olaus Magnus (1490–1558), the brother of the archbishop of Uppsala (who is remembered for his insistence upon the existence of sea serpents, drawing them into his map of 1539). He said that "the monoceros is a sea-monster that has in its brow a very large horn wherewith it can pierce and wreck vessels and destroy many men." Regardless of who first made the identification, the tooth of the narwhal was one of the most desirable objects of the Middle Ages, endowed with magical properties, collected by royalty, and worth more than its weight in gold. In his book *The Narwhal* (1993), Fred Bruemmer tells us that "the immensely lucrative trade in unicorn horns began in the late 18th century when a trader brought to Japan a collection of curios, among them a narwhal tusk from Greenland." Traders continued to bring narwhal tusks to Japan and China, where they were used as decorations and also ground up for medicinal or magical purposes. It appears that the tusks were so valuable that some whalers went north not to kill whales but only to trade for the ivory spires. The Danes, who bought them to sell in foreign countries, certainly had no reason to declare them to be fishes' teeth, and because no one could deny the corporeal existence of these splendid ivory shafts, the unicorn myth was kept alive by unscrupulous merchants.

During the eighteenth and nineteenth centuries, and into the twentieth, hundreds of tons of narwhal tusks found their way into the trading rooms of Europe and Asia, some from animals that had been harpooned by Arctic whalers, but mostly by way of barter with Eskimos. Because the bowhead whalers were eliminating the object of their fishery, they turned increasingly to ventures that would supply them with valuable narwhal ivory, as well as polar bear skins, sealskins, and walrus ivory, for which they traded tobacco, firearms, and ammunition. In 1912, some six hundred narwhal tusks, weighing approximately 3 tons, were taken out of just Pond Inlet by traders. In addition, closing ice conditions, known as *savssats*, trapped thousands of narwhals in the winter of 1914–15, and they were easily killed by hunters who simply stood by the holes and harpooned them as they surfaced to breathe. Randall Reeves and Edward Mitchell estimate that between 1915 and 1924, some eleven thousand

narwhals were removed from the Baffin Bay and Davis Strait region, but the number of animals killed was undoubtedly higher.

Eskimos traditionally hunted narwhals for their own use by harpooning them and then killing them, resulting in few losses, but when high-powered rifles took the place of harpoons, many narwhals were wounded and dived under the ice to die uncollected. Females have no tusks and were killed as often as males, so the number of tusks collected represents only a proportion of the narwhals killed.

The tusk of the narwhal is but one of the elements in the myth of the unicorn. As we have seen, the unicorn has been represented in Chinese iconography for thousands of years. In Europe the myth predates the Vikings; Ctesias, Aristotle, and Pliny wrote about it before anyone had ever seen a narwhal tusk, and their works were well known in medieval Europe. Once the tusks began to appear, it was easy enough to fit the tusk to the fable. Only the narwhal possesses this tapered ivory shaft, but rhinoceroses, antelopes, and goats also contributed to unicorn mythology. In

A Greenland Eskimo narwhal hunt. The tapered ivory shaft that protrudes from the skull of the narwhal looks to our eyes as if it belongs on the forehead of a graceful quadruped rather than this dumpy Arctic whale.

Africa and Arabia there are several species of antelopes with straight black horns prominently ringed at the base, the oryxes and the gemsbok. An antelope with a pair of black horns does not look much like a unicorn with a single white horn, but the myth did not necessarily have to derive from actual sightings. From disparate sources, similar unicorn myths arose and persisted in Western and Eastern mythologies, and were somehow translated into pharmacological imperatives.

Were it not for their anomalous dentition, narwhals would probably have been ignored by everyone except the Greenland and Canadian Eskimos, who would have killed them—and still do—for their meat, sinews, and blubber, all of which they make good use of. But alas for *Monodon monoceros*, this innocent inhabitant of Arctic waters became the object of a concentrated hunt that goes on to this day, even without the attendant mythology of the horn's magical properties. Narwhal tusks, still traded by Eskimos, no longer command a king's ransom, but they are still valuable, perhaps because they are so scarce, but also because they are among the most beautiful of all natural objects. (One was sold in the 1980s at a New York auction house for $10,000.) The horn Martin Frobisher found on a 1577 voyage to Baffin Island was "reserved as a jewel by the Queen Majesty's Commandment, in her wardrobe of robes," and in the collection of Prince Takamatsu of Japan there are two "unicorn horns." At the Abbey of Saint Denis in Paris there is a 6-foot, 7-inch tusk that was said to have been presented to Charlemagne, and there is another in Strasbourg Cathedral.

The religious significance of the unicorn may have protected it, for despite the enormous value placed on its horn, there are no depictions of a unicorn hunt where the horn is removed from the dead animal. A unicorn could be captured with the assistance of a virgin, but what happens next was never explained. This suggests to Adolfo Cavallo (1998) "that people who believed in unicorns in the Middle Ages, and apparently most of them did, were not prepared to reduce it to the status of just another game animal." No such constraints affected those who hunted narwhals, the little whales that provided the horns that confirmed the medieval existence of the unicorn; and by the time rhinoceros horn was found to fulfill the same pharmacological functions, the hunters declared an all-out war on the rhinos and regarded them not

even as "game animals" but as disposable impediments to the horn-collecting business.

There is little resemblance between a snow-white, delicate unicorn and a hulking, dirty-gray rhinoceros, but both sprout horns where few other animals have horns, and while the unicorn has proven to be more than a little elusive, rhinos are not that difficult to locate. Rhino horn is not ivory but rather compacted keratin fibers, the stuff of which hair and fingernails are made, so it would be just as efficacious to drink a potion made of powdered fingernails. It is not so much the composition of the substance that makes it magical, however, but rather its point of origin and its historical connection with the unicorn in Chinese and Western mythology. It was Marco Polo who introduced the rhinoceros to Europeans and helped make that connection.

Around 1265, two Venetian brothers named Niccoló and Maffeo Polo became the first European merchants to reach the Mongol court of Kublai Khan in China. They returned to Europe in 1269 and set out again for the East two years later, accompanied by Marco, Niccoló's teenaged son. Marco Polo (1254–1324) remained in China until 1292 and then returned to Venice, where he joined the Venetian forces fighting Genoa and was taken prisoner. During his two-year incarceration (1296–98), he dictated his memoirs to a Pisan writer named Rustichello, who transcribed the traveler's amazing adventures during seventeen years at the Mongol court, including visits to much of Asia and the Arab world. There are some who doubt the accuracy of some of Marco Polo's accounts, but his description of the "unicorn" rings true, for no other reason than it is a fair description of a Sumatran rhinoceros, likely the first ever seen by a European. Here is Marco Polo's account:

> They have wild elephants and plenty of unicorns, which are scarcely smaller than elephants. They have the hair of a buffalo and feet like an elephant's. They have a single large, black horn in the middle of the forehead. They do not attack with their horn, but only with their tongue and their knees; for their tongues are furnished with long, sharp spines, so that when they want to do any harm to anyone they first crush him by kneeling upon him and then lacerate him with their tongues. They have a head like a wild boar's and always carry it stooped towards the ground. They spend their time by preference wallowing in mud and slime. They are very ugly brutes to look at. They are not at all such as we describe them when we relate that they let themselves be captured by virgins, but contrary to our notions.

Although it is made of compacted hair fibers, rhinoceros horn can be carved with intricate detail. This example, from the Qing Dynasty of eighteenth-century China, shows that the horn could be used for purposes other than medicinal.

Marco Polo described the Sumatran rhinoceros as a unicorn, but not the kind that could be captured by a virgin. (Indeed, while a somnolent unicorn might be carried away, it is more than a little difficult to imagine how one might haul away a snoozing rhino.) Nevertheless, the dainty unicorn, which never actually existed, and the ponderous rhinoceros, which exists today (but only barely), have been pharmacologically conjoined for at least eight centuries.

Willy Ley (1906–69), the Berlin-born scientist and a prolific author on such subjects as space travel and romantic zoology, was particularly interested in the transmogrification of the ethereal unicorn into the

more prosaic rhinoceros, and in *The Lungfish, the Dodo, and the Unicorn*, he wrote:

> Rhinoceros horn might be passed off for "true" alicorn [he used the term *alicorn* to avoid the cacophonous "unicorn horn"]. . . . In Northern Europe *unicornum verum* and *unicornum falsum* were strictly distinguished. The former "true alicorn" was usually found in the earth—actually mammoth tusks—while the false alicorn came from the north—actually the tusk of the narwhal.

By the eighteenth century, as alicorn was disappearing from European pharmacies, it was beginning to appear on the shelves of their Chinese equivalents, as it was an important element in Chinese medicine: Unlike the horn of the unicorn, the horn of the rhinoceros was relatively easy to collect; the animal now known to science as *Rhinoceros unicornis* used to be found throughout the northern Indian subcontinent. There are rhinos clearly depicted on Harappan sealstones from Mohenjo Daro (now in southern Pakistan) that have been dated as far back as 2000 BC. Curiously, in the Indian culture whose religious iconography includes elephants, monkeys, cattle, and snakes, the rhinoceros, a large and visible creature whose nose-horned visage suggests mystery, appears mostly in hunting scenes. The same is true of tigers, but tigers were a threat to humans, while rhinos, for the most part, were not.

Indeed, the opposite was true: poachers turned out to be the greatest threat to the world's rhinos, and there was nowhere on earth that the great beasts were safe from the predation of humans, who now hunt them primarily for their horns. If you thought that modern medicine has no place for something as archaic as rhinoceros horn, you would be sadly, tragically, wrong.

The Nose-Horns

Of the five living species of rhinoceros, three in Asia and two in Africa, all are threatened by the relentless demands of traditional Chinese medicine. The Asian rhinos are the great Indian (*Rhinoceros unicornis*), the

Taken from Albrecht Dürer's famous drawing of 1515, Conrad Gesner's rhinoceros was published in his 1551 *Historia Animalium*. Like Dürer's rhino, Gesner's also has a tiny horn protruding from its withers, where no proper rhino has a horn.

Javan (*Rhinoceros sondaicus*), and the Sumatran (*Dicerorhinus sumatrensis*). African rhinos are the white rhino (*Ceratotherium simum*) and the black (*Diceros bicornis*). The Indian and Javan rhinos have a single horn on the nose, while the Sumatran and both African species have two. (The scientific names of the various rhino species are helpful in determining the number of horns on the nose: *Rhinoceros* means "nose-horn," *unicornis* means "one horn," and *bicornis* means "two horns.")

Male African rhinos often use their horns for fighting, and in David Macdonald's *Encyclopedia of Mammals*, we read that "black rhinos have the highest incidence in mammals of fatal intraspecies fighting: almost 50 percent of males and 33 percent of females die from wounds." Like African rhinos, Indian rhinos have no natural enemies in the wild, but they use their teeth rather than their horns to fight with each other, according to Stanley Breeden and Belinda Wright in *Through the Tiger's Eyes*. All rhinos have a massive body, a large head, and short stumpy legs. Their eyesight is poor, but their hearing is acute and their sense of smell is excellent. Like the elephants with

which they share most of their habitats, rhinos are "megaherbivores" and require prodigious amounts of food to support their great bulk.

The horn of each species, as already mentioned, is composed not of ivory but of fibrous keratin, the same stuff as your hair and fingernails. But it would be wrong to see the horn as simply a mass of densely packed hair. Toward the tip, rhino horn can be worn smooth and shiny; held up to the light, it has a translucent amber glow, which makes it a highly desirable material for carvings. Ground into powder, rhino horn is one of the most valuable substances in the world. Today, the Javan and Sumatran rhinos are on the brink of extinction, and the Indian, and the African (black and white) rhinos are in serious trouble, thanks in recent decades almost entirely to the desire for those horns, mainly, but not exclusively, for use in traditional Chinese medicine. The pressure on each of the five rhino species is somewhat different.

The Rhinos of Africa

The Black Rhino

"The black rhino," wrote Carol Cunningham and Joel Berger in 1997, "is nature's tank. A charging rhino can gallop at 50 kilometers per hour, chug through dense thornbush, and scatter a herd of elephants. . . . Stalking lions will break off a hunt to detour around them. . . . At the turn of the century, there may have been 100,000 in Africa, scattered from below the Sahara to the Cape. Now in the entire continent, only one unfenced population of more than 100 animals remains."

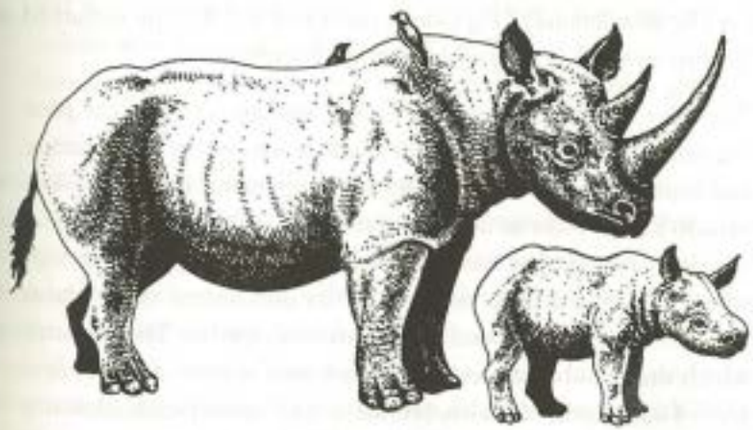
Not actually black, but brownish gray, the black rhino grows to a length of 12 feet, stands close to 5 feet high at the shoulder, and can weigh almost 2 tons. It is recognizable by its long, pointed, prehensile upper lip and two prominent horns, the longest of which averages 20 inches, but in some animals the forward horn may grow to be much longer. The longest black rhino horn on record—nearly 5 feet in length—belonged to a female nicknamed Gertie, who lived in the Amboseli Reserve in Kenya in the 1950s and was a darling of photographers. Her forward horn, as described by Guggisberg in 1966, "was certainly not under forty inches, probably quite a bit longer, inclined

forward at an acute angle, and showing a slight, but graceful curve at the tip." C. A. Spinage (1962) put together the evidence for its length this way:

> From a study of photographs taken in 1952 Gertie's horn must have then been around forty inches long. The major portion which was recently broken off was recovered and found to be thirty-nine and a half inches in length; this was matched against photographic enlargements of the intact horn in life and its total length was thus estimated at fifty-four and a quarter inches. So it would appear to have grown about eighteen inches in six to seven years.

The black rhino inhabits the acacia scrub that grows at the edge of the plains where it browses off the ground on a wide variety of plants, especially regenerating twigs, which it gathers into its mouth with the prehensile upper lip. The two horns typical of both black and white rhinos grow continuously throughout the animal's life; horns that are broken off can regrow. Because of their notoriously poor eyesight, black rhinos sometimes charge a disturbing sound or smell, and they have been known to toss people into the air and upend cars.

Major A. Radclyffe Dugmore, an American wildlife photographer, painter, and printmaker who turned from hunting to capturing his sub-



African Black Rhino (*Diceros bicornis*).

The longest measured forward horn of a black rhino was 44 inches in length. At their current rate of extirpation, it will not be long before the only way to see black rhinos in a "natural" setting will be in a museum diorama, such as this one in the American Museum of Natural History in New York.

jects on paper, saw and photographed East African wildlife in 1909–10, and in *The Wonderland of Big Game*, published in 1925, he remarked on the decline even then in the black rhino population:

> The most notable decrease among the animals is that of the poor old rhino, notwithstanding what anybody may say to the contrary, and some observers may challenge my statement. During my first visit to Kenya I saw as many as thirteen in sight at one time, and groups of four or five were not uncommon. During my last trip, when I covered a large area of country and visited many places where rhino used to abound I saw thirteen altogether. The ease with which the stupid creatures may be shot must account for this, coupled of course with the idea, prevalent with many people, that it is a noteworthy feat to kill the wretched brute. Unless very stringent laws are made for their protection, it is safe to predict their early extermination, except possibly in forest country, where they still live more or less unmolested.

In his 1966 book *S.O.S. Rhino*, C. A. S. Guggisberg blamed the decline in rhino numbers not on its stupidity, but on ours: "In the case of the rhino the illogicality and stupidity of mankind has resulted in a situation in which the world is in danger of losing the improbable but altogether fascinating rhinoceros forever." Guggisberg summarized the status of black rhinos in various regions of Africa:

> In 1960 the number of black rhinos surviving in Kenya was estimated at 2,500. . . . As far as Uganda is concerned, a few black rhinos lived in the Masaka and Ankole Districts within the memory of early residents. . . . By 1957 the rhinos of Northern Acholi had been practically exterminated by poachers coming over from the Sudan, and the stronghold of the species was definitely in the Kidepo Valley of North Karamoja. . . . In the eastern Sudan . . . the animals had become rare by 1912, and could only be found much farther to the south, along the Dinder River. . . . Moving westwards we find the same dismal story everywhere. Incredible numbers must have been butchered during the last fifty years in all the countries lying between the Sudan and Northern Nigeria. . . . Rhinos have become scarce in Central and North East Cameroon, very rare in the Lake Chad area and may be extinct in Nigeria. . . . On the Ivory Coast the last individuals were shot near Bouna in 1905. . . . No European is known to have seen a rhinoceros in the former French territory of Niger.

At one time, black rhinos were considered premier big-game trophy animals, along with the other four creatures that made up the "big five": lion, leopard, buffalo, and elephant. In *Green Hills of Africa*, Ernest Hemingway described a black rhino he has just shot: "There he was, long-hulked, heavy-sided, prehistoric-looking, the hide like vulcanized rubber and faintly transparent looking, scarred with a badly healed horn wound that the birds had pecked at, his tail thick, round, and pointed, flat, many-legged ticks crawling on him, his ears fringed with hair, tiny pig eyes, moss growing at the base of his horn that grew outward from his nose. . . . This was a hell of an animal."

People have always killed rhinos, but not always for sport or even for medicinal purposes. In his 1952 book *Hunter*, the Scotsman J. A. Hunter claimed to have killed a thousand rhinos, but the actual number is probably much higher. In the chapter entitled "The Great Makueni Rhino Hunt," he explained that he was hired to kill the rhinos because the tsetse flies made it impossible to raise cattle, and the only way to eliminate the flies was first to clear the bush of rhinos so that the labor gangs could safely work there. Peter Beard's *The End of the Game* contains a reproduction of Hunter's notebook page for Makueni, in which we see that he actually killed 165 rhinos between August 29 and November 28, 1944; from June 29 to December 31, 1945, he killed 221 more; and from January 1 to October 31, 1946, he killed another 610, for a total of 996. (The land proved to be too poor for agriculture, so 996 rhinos died for nothing.) If he killed 996 rhinos just between August 1944 and October 1946 in what he called "the biggest rhino hunt in history," then he must have killed far more than a thousand, for he was hunting for more than forty years.

According to Clifton Fadiman's commentary in the Book-of-the-Month Club brochure advertising the book's initial publication, the killing didn't stop there. Hunter had "joined the Kenya Game Department as a control officer, charged with the extinction of animals that were endangering native holdings or upsetting the region's ecological balance by becoming too numerous for their environment. In the course of his duties he has shot more than 1,400 elephants, and is said to hold the world's record for rhinos and possibly lions."

Because their scrubland habitat has remained largely unoccupied by settlers and has not been much in demand for agriculture—except occasionally by the Kenya Game Department—black rhinos were not seriously threatened until the 1970s, when the demand for horn began in earnest, first for dagger handles and then for the larger market that was traditional Chinese medicine. As Guggisberg wrote, "Up to that time, the horns of the two African species had mainly served for the carving of drinking cups, snuff boxes, handles for knives, swords and war-axes, no superstitious significance whatever being attached to them by any of the indigenous people of Africa." When it was discovered that rhino

horn could be sold for huge amounts of money to suppliers of Asian traditional medicines, the onslaught began: no African rhino was safe.

Now there are so few rhinos left in parts of Africa that many are literally kept under armed guard. They forage during the day, accompanied by guards with rifles, and they are locked up at night. Yet rhino horn is so valuable that poachers have killed guards to get at the animals. "Around 1900, the savannas and woodlands of sub-Saharan Africa may have supported more than 1 million black rhinos," Eric Dinerstein (2003) suggests, but recently, their numbers have been in free fall. Through the pages of the journal *Pachyderm* (the journal of the African Elephant, African Rhino, and Asian Rhino Specialist Groups of the IUCN), we can track the precipitous decline of the black rhino population. David Western and Lucy Vigne (1984) estimated that in 1984 there were 8,000–9,000 black rhinos left. In 1987 Esmond Bradley Martin (1987b) wrote, "One must remember that in 1970 there were 65,000 and by 1980 only 15,000 were left." Western (1989) wrote that "since 1970 its numbers throughout Africa have declined . . . to around 3,800 in 1987."

There are now about 3,600 black rhinos in all of Africa, in small pockets in Zimbabwe, South Africa, Kenya, Namibia, and Tanzania. "The black rhinoceros," noted Milliken, Nowell, and Thomsen in 1993, "has declined at a faster rate than any other large land mammal in recent times, making a rapid transition from abundant to endangered." It is impossible to exaggerate the magnitude or the significance of the collapse of the black rhino population. In the definitive *Mammals of the World*, Ronald Nowak (1991) called it "the greatest single mammalian conservation failure of the twentieth century."

Living in Africa has provided no special protection for the black rhino from Asian pharmacological prescribers, especially since the stock of Asian rhinos was greatly depleted; its horns are collected by African poachers and sold to dealers to be converted to traditional medicines in Asia. In addition, because young men in the Arab country of Yemen covet rhino horn for the handles of their elaborately carved daggers called *jambiyas*, another major threat to the already beleaguered African rhinos began to arise when Yemeni incomes rose. When a Yemeni boy approaches manhood, he is given his own dagger, more as a weapon

than as an ornament. Especially in and around the capital city of Sanaa, nothing is thought to make a better jambiya handle than the horn of a rhino; it takes a high polish and improves with age. Before about 1970, few men could afford these status symbols, but during the oil boom of the 1980s, many Yemeni men traveled north to work in the lucrative Saudi oil fields, where they were able to earn more money in a year than they had earned in their entire lives, so they were now able to buy the heretofore prohibitively expensive jambiyas. There was a sevenfold increase in the per capita income in Yemen during that time and a *twenty-fold* increase in the price of rhino horn.

The increased price of rhino horn made it enormously profitable to poach rhinos and sell the horns on the black market, and Yemen suddenly became the world's largest importer of rhino horn. East African customs records show that from 1970 to 1976, 634 kilograms (1,394 pounds) were exported each year to Yemen, while North Yemen's official statistics show 2,878 kilograms (6,331 pounds) being imported annually, according to a 1997 article written by two indefatigable investigators of the plight of the rhinos, Esmond Bradley Martin and Lucy Vigne. In 1990, they tell us, the two horns from a single black rhino brought $50,000, while in 1992, the Sheikh of the Bakils, Yemen's largest and most powerful tribe, paid a million dollars for a jambiya that had been owned by a previous North Yemen ruler. A collapse in oil prices in the mid-1980s, along with a government ban on the import of rhinoceros horn, resulted in the official decline of the dagger-handle trade, but substantial amounts are still being smuggled in.

Like poaching for elephant ivory, poaching for rhino horn is simply too profitable for many subsistence farmers and herders to resist. In a 1985 article on Yemeni dagger handles, E. B. Martin wrote, "During the past 15 years, the decline of the rhino has probably been more acute than that of any other large mammal in Asia or Africa. It is almost ironic that international conservation organizations have, in the same period, spent very large sums to help control the ivory trade. There are at least 750,000 elephants in Africa, as compared to 12,500 rhinos" (1985b). (That was in 1985; as of 2005, there were 3,600 black rhinos left.)

After a decline in the 1990s, for reasons not clearly understood, the popularity of rhino-horn dagger handles took another upturn in 2000.

A Yemeni man proudly displays his jambiya with a rhino-horn handle in the market at Sanaa, where most jambiyas are made. The most expensive one ever recorded sold for a million dollars in the early 1990s.

In *Pachyderm*, Martin and Vigne noted that the price of rhino horn in Yemen had increased once again (2003). The Environmental News Service (http://ens-news.com) quotes Russel Taylor of the World Wildlife Fund (WWF) office in Harare, Zimbabwe, as saying in 2003 that "rhinoceros horn is the most highly priced commodity in the world." From 1998 to 2002, a total of forty-six rhinos were killed in the Democratic Republic of the Congo, Kenya, and Tanzania, while poaching increased in East Africa as well, resulting in more rhino horn sold

in Yemen, even though many of the shops were offering jambiyas with water buffalo-horn handles alongside those with the traditional rhino-horn handles.

All worldwide trade in rhino horn is now prohibited, because rhinos are protected under Appendix 1 of CITES (the Convention on International Trade in Endangered Species of Wild Flora and Fauna) but the ban has not been very successful because of the thriving black market. In 1993, the United States threatened to ban legal imports of wildlife from China, which has a large wildlife trade with the United States, if China did not start taking measures to stop illegal wildlife trade. In response, China made it illegal to sell, buy, trade, or transport rhino horns and tiger bones. Illegal stockpiles of rhino horns and tiger bones remain, however, and can be sold for astonishing prices.

Despite the Chinese ban, however, the trade in rhino horn continues. Because a jambiya handle is not shaped at all like a rhino horn, there is a lot of waste in the carving process. "Wastage in making rhino horn handles for jambiyas runs to over 60%," wrote Martin and Vigne in 2003. "Large quantities of rhino horn chips and powder since the 1970s have been sent from Yemen to Chinese pharmaceutical factories." Nothing is wasted in this process—except of course, the rhino.

The White Rhino

Whether the African rhino was white or black (or any color in between), its horns were required for dagger manufacture and the practice of TCM. White rhino horns are just as desirable for jambiyas as black; they are both shaved and powdered for traditional Asian medicines. Like those of other species, white rhino horns can be hollowed out, polished and made into cups, or carved into small statues, buttons, hairpins, combs, and walking-stick handles; the feet have been made into the (mercifully obsolete) ashtrays and umbrella stands.

The white rhino is no more white than the black rhino is black. Its name has long been held to be a corruption of the Dutch word *wijdt*, which means "wide," and refers to its broad muzzle. Standing more than 6 feet high at the shoulder and weighing as much as 3 tons, the white

rhino is the largest living land animal after the African and Indian elephants. Like the black rhino, the white rhino has two horns, and the front one is usually much longer than the rear one. Also like the black rhino, the record length for the front horn is a little less than 5 feet. Unlike the black rhino, however, the white has a pronounced hump between the shoulders and a long, squarish head, which is so disproportionately large that the animal appears unable to hold it up, and it is often seen with the muzzle close to the ground. An animal of open grasslands, *Ceratotherium simum* was once widely distributed throughout sub-Saharan Africa, wherever there was suitable savanna country. White rhinos are true grazers, feeding on short grasses that grow close to the ground. Like other rhino species, the white was shoved off its land by people who wanted to raise cattle on the plains and was slaughtered for its horns.

There are two recognized subspecies of white rhinoceros, the northern (*Ceratotherium simum cottoni*) and a southern (*C. s. simum*); they have been shown to be genetically distinct, and where the northern subspecies is nearly extinct, the southern still thrives. (It is the only rhinoceros—species or sub—that is not critically endangered.) The northern subspecies was once found in southern Chad, the eastern

African White Rhino (*Ceratotherium simum*).

Central African Republic, Sudan, and the Democratic Republic of the Congo. In 1960, there were more than one thousand northern rhinos in Garamba National Park, but in 1963, rebel forces entered the park from Sudan, occupied virtually the entire park, and killed more than nine hundred of them, according to Fisher, Simon, and Vincent, in their 1969 book, *Wildlife in Danger*. More recently, Sudanese marauders known as "horsemen" have killed almost one thousand elephants and are on the verge of eliminating the last of the northern white rhinos. The heavily armed poachers use pack animals to carry out the ivory tusks and rhino horns, and leave the entire carcass behind. The gravity of the situation was pointed out by Andrew Revkin in a *New York Times* article of August 7, 2004:

> The continent's last known wild population of northern white rhinoceroses has been halved by poaching in the last 14 months, according to aerial surveys done in July of Garamba National Park in Congo. The survey estimated that 14 to 19 rhinos were shot in the park, cutting the overall population despite the birth of four calves this year, said scientists of the World Conservation Union (IUCN). . . . Armed poachers who slaughter them smuggle the horns to Asia, where they are coveted for purported medicinal properties.

In the months that followed, suggestions were made to airlift some of Garamba's rhinos to a safe haven in Kenya. Quoted in a Reuters report by David Lewis, rhino specialist Kes Hillman Smith said it was "the safest means of securing the subspecies from extinction." But after authorizing the plan, the Congolese government reversed its field and decided that the issue was one of "national sovereignty and it should look after its own" (Anon 2005). The remaining rhinos of Garamba are stuck in the middle of a human territorial dispute, and even if the last rhino is not killed by poachers, this unfortunate incident demonstrates how precarious a population can be if its numbers are greatly reduced.

The southern subspecies has fared much better. Formerly found throughout southeastern Angola, central Mozambique, Zimbabwe, Botswana, eastern Namibia, and northern South Africa, the southern white rhino was the target of an organized hunt in the nineteenth century and was nearly elimi-

nated. Unlike the often belligerent black rhino, the white is a docile creature, and hunters were able to walk right up to some of them and shoot them where they stood. Others were trapped in spike-floored pits, while still others were speared from horseback. Whatever the method, thousands of white rhinos were killed, and their horns hacked off and shipped to Asia. Most of Africa's white rhinos are now confined to protected areas and game farms, and there has been a resurgence in their numbers. There are well over ten thousand white rhinos in the south, and they are no longer considered endangered. In addition, there are more than seven hundred southern white rhinos in zoological parks around the world. (For some reason, northern white rhinos do not do well in captivity, and as of 2002, there were only nine individuals in two zoos, one in the Czech Republic and the other in San Diego.) The white rhino population is larger today than that of all other rhino species combined, and the rescue of the southern white rhino is the only success in the largely negative history of the modern interaction of rhinos and men.

The Rhinos of Asia

> Although modern rhinos are far more restricted in distribution and diversity than was the group in the geological past, it would be wrong to think that they are inevitably doomed to a natural extinction. Even in the nineteenth century they occurred in large numbers over much of Africa and Asia. The subsequent population crashes have been entirely the fault of relentless killing and habitat usurpation by people. Nearly all parts of rhinoceroses are used in folk medicine, but by far the greatest demand is for the horn, which in powdered form is reputed to cure numerous physical problems and which whole is used for artistic carving.
>
> *Ronald Nowak, Walker's Mammals of the World (1991)*

The Sumatran Rhino

"Although modern rhinos are far more restricted in distribution and diversity than was the group in the geological past," wrote Ronald Nowak in *Walker's Mammals of the World*, "it would be wrong to think

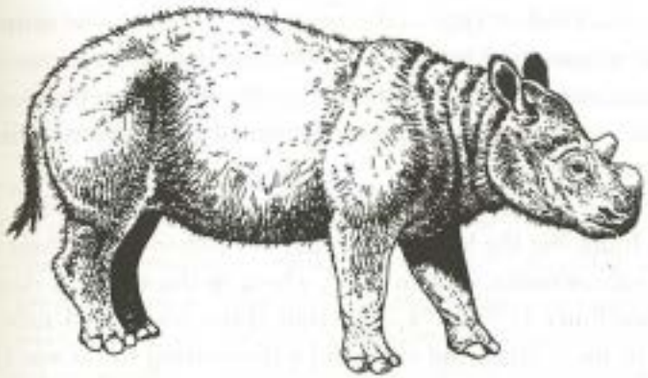
that they are inevitably doomed to a natural extinction. . . . The subsequent population crashes have been entirely the fault of relentless killing and habitat usurpation by people. Nearly all parts of rhinoceroses are used in folk medicine, but by far the greatest demand is for the horn, which in powdered form is reputed to cure numerous physical problems and which whole is used for artistic carving." It is the fate of the three Asian rhino species to live in the very regions where their horns are considered essential elements in traditional medicine—and more valuable than gold.

In his 1929 *Field-Book of a Jungle-Wallah*, British naturalist Charles Hose (1863–1929) wrote of his earlier adventures in Sarawak:

> The Borneo [Sumatran] rhinoceros is a smallish species, and quite the most grotesque of his kind: he has two horns and his hair is rough and bristly, almost like fine wire. He frequents the foot-hills below the mountains, and comes down in the heat of the day to take his ease in what are called "salt-licks," muddy baths formed by springs of saltish water. The clearing in the mud and the bushes were, I was told, caused by the creature's trampling movements to his lair higher up the hills.

Later, G.T.C. Metcalfe summed up the status of the Sumatran rhino, known in Malaysia as *badak* in this way: "Persistent persecution of this rhinoceros in the past has driven it into the most inaccessible, uninhabited, and usually hilly tracts, with the result that it is extremely difficult to obtain accurate information as to its whereabouts." In what must be seen as an attempt to protect this bedeviled creature from further poaching, he added:

> The supposed medicinal value of any part of a rhinoceros is yet to be substantiated and a number of other beliefs relating to the value of the horn as an aphrodisiac and to its nullifying effect on poisons is entirely erroneous. . . . Since the destruction of the rapidly declining rhinoceros population is entirely to obtain parts for their supposed medicinal properties, a ban on the import, export, and possession of all rhinoceros parts, especially the horn, which cannot be positively identified and proved to be covered by a specific certificate for the Game Department (or its equivalent) in the country of origin, would do much to stop the illegal killing of animals, not only in Malaya but elsewhere.



Sumatran Rhino (*Dicerorhinus sumatrensis*).

After 1963, "Malaya" became Malaysia, Singapore broke away to become a separate nation in 1965, and a ban on the import, export, or possession of rhino parts was passed. But because this species of rhino has the misfortune to live in some of the most densely populated countries in the world, where a large proportion of the populace believes that rhino horn has powerful medicinal properties, its future is grim indeed.

The Sumatran rhino (*Dicerorhinus sumatrensis*), also known as the hairy rhino because of its furry coat, is the smallest of the living rhinos, weighing a maximum of 1,000 kilograms (about a ton), compared with the Indian or white rhinos, which can weigh more than twice as much. This species has two horns, but the forward one is sometimes so small as to be inconspicuous. Sumatran rhinos prefer dense rainforests and are usually found close to water; their diet consists of shoots, twigs, young foliage, and fallen fruit. Originally found in India and Bangladesh, south to the Malay Peninsula and Vietnam, they are now found in low numbers on the island from which they take their common name; there may also be twenty to thirty in the deep rainforests of Indonesian Borneo (Kalimantan), and another six or seven animals in Burma (Myanmar).

Even with animals as large as rhinoceroses, it is not easy to count them in dense jungles, and it has been estimated that there are now fewer than three hundred Sumatran rhinos living anywhere in the world, and those in very small and highly fragmented populations, with little improvement in sight.

In historic times, the hairy rhino was found throughout northeastern India, but the last two records of its presence anywhere on the Indian subcontinent were in 1967, when, in the words of Anwaruddin Choudhury (1997), "a Sumatran rhino was killed near Cox's Bazaar in the Chittagong area, and a [Sumatran] rhino was seen by local people in the Punikhal area of Sonai . . . southern Assam." In Way Kambas National Park, at the southern tip of Sumatra, what was thought to be the last Sumatran rhino there was shot in 1961, but in a survey conducted from 1991 to 1994, Joanne Reilly, Guy Spedding, and Apriawan indicated that a few of these elusive animals might still be found in the lowland rainforests of the park. In 1996, Dwiatmo Siswomartono and colleagues published a color photograph of a Sumatran rhino taken with an infrared camera trap in the park, unequivocally confirming the occurrence of at least one rhino in this Sumatran preserve.

In Myanmar, when Alan Rabinowitz, George Schaller, and U Uga surveyed the Tamanthi Wildlife Sanctuary in 1994, they found evidence of twenty-one species of medium-to-large mammals, including elephants, tigers, leopards, gaurs, bears, sambar, and barking deer—but no sign of the Sumatran rhino. Sightings of the species had been reported up to the 1980s, but after that there were only rumors, they learned.

In response to the calamitous decline of the Asian rhinos, the Asian Rhino Specialist Group was created in the 1980s by the Species Survival Commission of the IUCN. From this came a plan to capture the "doomed" rhinos and remove them to various breeding facilities in Asia, Europe, and North America. This was done, with some disastrous results. The Sumatran Rhino Trust (SRT) was established to facilitate the export of animals for the foreign breeding programs, but protests over shipping Sumatran rhinos to Western zoos resulted in the dissolution of the proposed agreement and the establishment of two separate

programs in Malaysia. A new agreement was reached, and the rhinos were captured for transportation. In a June 1995 report in *Conservation Biology*, tellingly entitled "Helping a Species Go Extinct," Alan Rabinowitz tore into the plan:

> In 1993, the SRT was dissolved after five years and a cost of more than US$2.5 million. Virtually none of the money went to improving the protection and management of wild rhinos in existing protected areas. This program, along with the similar efforts in Sabah and Peninsular Malaysia to catch doomed rhinos for breeding, were expensive failures resulting in the capture of 35 rhinos and the deaths of 12 rhinos between 1984 and 1993. The failure was partly a result of the skewed sex ratio of captured animals. Still, as of 1993, the surviving 23 rhinos (14 females, 9 males) were being held in 10 separate areas in Indonesia, Peninsular Malaysia, Sabah, the United Kingdom, and the United States. Other than one facility in Peninsular Malaysia with five rhinos, no more than three rhinos were at any of the other facilities. Because adult males and females were never together in the same place for a significant amount of time, there have been no births from captive Sumatran rhinos to date, except one female who was pregnant when captured.

Rabinowitz concluded his report with these words: "Meanwhile, the decline of the Sumatran rhino continues. In August 1994, 12 more Sumatran rhino horns were confiscated in Taiwan that had been smuggled on a fishing boat from Malaysia (The *Jakarta Post*, August 9, 1994). After all these years, do we know how many Sumatran rhinos we are dealing with? No, but soon we might have a nice round figure."

Not surprisingly, Rabinowitz's scathing condemnation brought out a flurry of responses, both positive and negative, printed as Letters to the Editor in the journal. Among the criticisms, three IUCN biologists said that Rabinowitz had committed "several serious errors of commission and omission"; the Director of Conservation for the Indonesia Ministry of Forests complained that the author had made "a number of allegations in relation to Indonesia that misrepresent the current situation"; and an official of the Sabah Wildlife Department loyally defended the actions of his department. The last word belongs to Rabinowitz, who finishes his letter with this:

> Frankly, there is only one fact that is important right now—the Sumatran rhino is in desperate trouble and, to the best of our knowledge, is still sliding toward extinction. Good intentions and the most articulate of excuses mean nothing in this light. If this species is lost, after having watched its decline for so long, we have only ourselves to blame.

In his 2003 book about Asian rhinos, Eric Dinerstein also criticizes what he refers to as the "disastrous captive-breeding attempt financed by the Sumatran Rhino Trust, which left many rhinos dead in breeding stations. Even worse, recruitment in captivity was zero until the calf was born at the Cincinnati Zoo in 2001." When that 72-pound Sumatran rhino calf was born, it was an event of such importance in the annals of rhino preservation that its photograph appeared in color on the cover of the 2001 issue of *Pachyderm*.* Mohid Khan, Thomas Foose, and Nico van Strien, the authors of the accompanying journal article, commented: "The species is neither safe in the forest, nor, more figuratively, yet out of the woods. A single birth is a significant breakthrough but in itself does not ensure the survival of the species." Tajuddin Abdullah, however, who was instrumental in starting Malaysia's rhino conservation program, now believes that sending rhinos to a captive center is tantamount to killing them. "We now hold the world's worst record for rhino conservation," he said in a December 2003 interview for the *Malaysia Star*. "If we capture more rhinos in the wild just to continue the breeding programme, we are just sending this rare species to their death cell." (By 2004, all Sumatran rhinos held in captivity by the Peninsular Malaysian Wildlife Department had died of disease. It is rumored that the department plans to capture more from the wild to replace those that died, maybe in a new facility, but this would be an invitation to repeat disaster.) The debacle

* On July 30, 2004, the Cincinnati Zoo announced that Emi, the female Sumatran rhinoceros, became the first Sumatran rhino in history to produce two calves in captivity. In her indoor stall, she delivered her second, a healthy female calf, at 12:51 p.m. "This is a historic birth. It is proof that the science of breeding Sumatran rhinos has been developed at the Cincinnati Zoo and the first birth was not a one-time wonder," said Dr. Terri Roth, Vice President of Animal Sciences. "Because Sumatran rhinos are on the brink of extinction, this calf serves as a lifeline for a species clinging desperately to survival" (*Cincinnati Zoo Newsletter*).

Female Sumatran rhino "Emi" with her second calf, "Suci" (pronounced "sue-chee"), born on July 30, 2004, at the Cincinnati Zoo. The breeding program at the Ohio zoo is more successful than any that have been tried in Asia.

with the Sumatran rhino project made many conservationists rethink the idea of preserving rhinos by distributing small numbers to various widely spaced zoos; it appears a much better idea to leave them in their own habitat, and, somehow, prevent people from killing them.

The Sumatran rhino, *Dicerorhinus*, according to Colin Groves and Fred Kurt (1972), "is the genus that gave rise to all living Rhinocerotidae; in that sense it can be considered a 'living fossil.'" In *The Future of Life* (2002), E. O. Wilson chose the Sumatran rhino as one of the paradigms for the current worldwide extinction crisis:

> Can the Sumatran rhino, like the California condor and the Mauritius kestrel, be pulled back from the grave? Of the two standard methods, captive breeding has been so far unproductive, while protection against poachers in existing reserves seems tenuous at best. The small circle of rhino experts working on the problem agree that *Dicerorhinus sumatrensis* has entered the endgame. Whatever the solution, they say, it must be found now or never.

Eric Dinerstein has found that the other rhino species, in many instances, are not faring so well either:

> The course of conservation, particularly in Thailand, Laos, Cambodia, and Vietnam, is quite different from what I have experienced on the Indian subcontinent. In Indochina wildlife reserves exist in name only; intense poaching has decimated the large mammal populations of this region. One is lucky to encounter tracks of large vertebrates in protected areas, let alone be blessed with an actual sighting. Why is this so? In stark contrast to the Indian subcontinent, Southeast Asia has no tradition of strict protection within nature reserves. But without strict protection, large mammals continue to disappear.

The Sumatran rhino is so close to extinction that the removal of a single animal brings them that much closer to the edge. They were brought to this precipice by poachers who hunted them for their horns and by loggers who destroyed their habitat. An October 2003 report that Myanmar's hardwood forests are being liquidated by Chinese timber companies from neighboring Yunnan Province does not bode well for the remaining rhinos there. Will the Sumatran rhino become the first animal to disappear completely because of traditional Chinese medicine?

The Javan Rhino

The Javan rhino (*Rhinoceros sondaicus*), the other rhino species found in Indonesia (with a remnant population in Vietnam), is somewhat larger than the Sumatran rhino. Sometimes known as the lesser Indian rhino because of its proportionally smaller head, no "rivets" on its leathery skin, and a slightly different pattern of folds making up its body armor, the Javan rhino is among the rarest large mammal species in the world. With no more than sixty individuals in the wild and none in captivity, it is on the very brink of extinction. Reports of local people and explorers indicate that *Rhinoceros sondaicus* was quite numerous during the late nineteenth and early twentieth centuries in India, Bhutan, Bangladesh, China, Myanmar, Thailand, Laos, Cambodia, Vietnam, and Malaysia, and on the islands of Sumatra and Java. As an indication of the species' former abundance, Noel Simon and Paul Géroudet quote (but do not further identify) a "Pollack who spent seven years in Assam in the 1860s" (presumably the Fitzwilliam

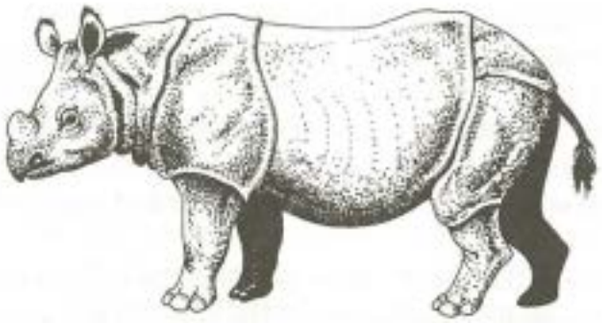
Thomas Pollock, described by Martin and Martin in 1982). "I never shot the lesser rhinoceros on the right bank of the Brahmaputra and I have no doubt that it still exists," wrote Pollack, "but it is fairly plentiful on the left bank south of Goalparah, where I have killed it. . . . I may here mention that in Assam I shot 44 to my own gun, and probably saw some 60 others slain, and lost and wounded fully as many as I killed."

At 5½ feet at the shoulder, the single-horned Javan rhinoceros cannot easily be mistaken for the Sumatran. The brownish gray skin hangs in heavy folds on the neck, shoulders, and hindquarters, giving the impression that the animal had been assembled piece by piece, jigsaw fashion.

By the 1930s, Udjong Kulon, the preserve at the western end of Java that encompasses some 300 square kilometers (186 square miles), was the "only area where *Rhinoceros sondaicus* still managed to survive," according to Andries Hoogerwerf's 1970 book *Udjong Kulon: The Land of the Last Javan Rhinoceros*. Despite a 1969 Hollywood film entitled *Krakatoa, East of Java*, the volcano that erupted so cataclysmically in 1883 is actually *west* of Java; in fact, what's left of Krakatoa is just off the peninsula of Udjong Kulon. In his otherwise accurate book about the eruption of Krakatoa, Simon Winchester wrote:

> The Krakatoa archipelago is a detached part of Udjong Kulon National Park, most of which includes the peninsula in Java to the south of the islands known as Java Head. The one-horned Javan rhinoceros is plentiful in the park. One of the long-term benefits of the 1883 eruption has been the reluctance of superstitious people to live and settle in large numbers anywhere near the volcano—a reluctance that has protected a very rare species from what would otherwise have been, in the face of population pressure, almost certain extinction.

Although early estimates of the Udjong Kulon rhino population are unreliable, the current numbers hover around twenty, no longer what one would call "plentiful." The declining numbers of *R. sondaicus* led Eric Dinerstein in 2003 to write, "A population of fewer than ten individuals also hangs on in Vietnam. . . . A few Javan rhinoceros may live in the wild, hiding during the day, feeding secretly at night. But for all



Javan Rhino (*Rhinoceros sondaicus*).

intents and purposes, the species in question are as good as extinct because they no longer play a functional ecological role." Hopes for the survival of one of the world's rarest large mammals were raised by reports that four Javan rhinos have been born since 2001 in Udjung Kulon. The new births were confirmed through an eighteen-month survey carried out by the World Wildlife Fund and the Udjung Kulon national park authority, using camera traps set deep in rhinoceros habitat, DNA analysis of droppings, and tracking to determine the number of animals living in the park.

In Vietnam, "an unpleasant legacy of the prolonged war with the USA is the ready availability of guns and rifles," Charles Santiapillai commented in 1992, and the most serious threat to Javan rhinos is still poaching. During the war, much of the local rhino habitat was contaminated by Agent Orange and other defoliants, evidence of which still exists. The small population of Javan rhinos is still imperiled, but the dense forests might provide some protection.

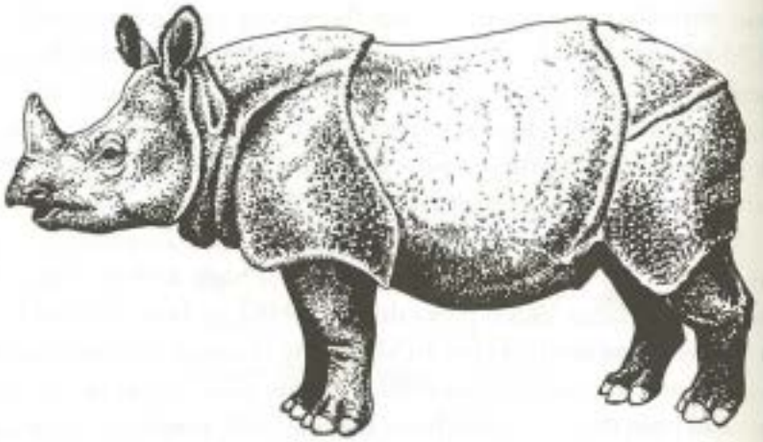
There were once Javan rhinos also in the Sundarbans, that great swampy, tidal region at the mouth of the Ganges in India and Bangladesh. Swamp deer, wild buffalo, and wild pigs are found there, as are the semi-aquatic Sundarbans tigers. There are many records of Javan rhinos in the Sundarbans, dating from eighteenth- and nineteenth-century hunters, but also from observers who came from Calcutta, the great Indian city that is actually in the Indian Sundarbans, on the Hooghly River. Although the horns of Javan rhinos are usually small, those of the Sundarbans rhinos

were virtually nonexistent, making them poor candidates indeed for TCM-related poachers. "They had no trophy worth having, and shooting them was without excuse," said a French sportsman quoted by Kees Rookmaaker (1997b). Horns or no, enough hunters shot the subspecies of the Javan rhino known as *R. sondaicus inermis* in the Sundarbans that they were gone by the beginning of the twentieth century.

Human population pressures in the two protected areas that Javan rhinos are known to exist are now extremely high, with poaching an ever-present threat. A few Javan rhinos live in Cat Tien National Park in Vietnam, just north of Ho Chi Minh City (formerly Saigon). George Schaller and his colleagues in 1990 told of an adult female Javan rhino that had been shot by a tribal hunter in late 1988, northeast of the city. When the hunter brought the horn and hide to town he was arrested and sentenced to a year in jail, which was commuted after two months. The Javan rhinos of Cat Tien, the only ones on the Asian mainland, are considered so important that a study was recently commissioned to assess the status of the remaining rhinos, which are now believed to number only seven or eight. In a 1999 report in *Pachyderm*, Gert Polet and others reported that automatic cameras were set along known rhino routes, resulting in the first-ever pictures of *Rhinoceros sondaicus annamiticus* in the wild. Given the encroachments on habitat and hunting pressure over the past few centuries and the recent increases, it is not surprising that Javan and Sumatran rhinos are endangered; it is more surprising there are any left at all.

The Great Indian Rhino

The Great Asian One-Horned Rhinoceros is especially threatened by the demands of traditional Chinese medicine. Commonly known as the Indian rhino, it is probably the most familiar of all rhinoceroses, with its massive body; short, powerful legs; splayed, three-toed feet; and above all, its "armored" appearance, seemingly comprised of various "plates" and knobs that look more like rivets than any sort of skin formation. In his *Just-So Story* of "How the Rhinoceros Got His Skin," Rudyard Kipling tells of the Parsee who saw that the rhino ("with a horn on his nose, two piggy eyes, and few manners") had eaten his cake, so when the



Indian Rhino (*Rhinoceros unicornis*).

rhino takes off its skin to take a bath, the Parsee fills the skin with cake crumbs, much to the rhino's discomfort:

> Then he wanted to scratch, but that made it worse; and then he lay down on the sands and rolled and rolled and rolled, and every time he rolled the cake crumbs tickled him worse and worse and worse. Then he ran to the palm-tree and rubbed and rubbed and rubbed himself against it. He rubbed so much and so hard that he rubbed his skin into a great fold over his shoulders, and another fold underneath, where the buttons used to be (but he rubbed the buttons off), and he rubbed some more folds over his legs. And it spoiled his temper, but it didn't make the least difference to the cake-crumbs. They were inside his skin and they tickled. So he went home, very angry indeed and horribly scratchy; and from that day to this every rhinoceros has great folds in his skin and a very bad temper, all on account of the cake-crumbs inside.

A big male Indian rhino can be 12 feet long, 6 feet high at the shoulder, and weigh 2½ tons. Both males and females have nasal horns; in Walker's 1991 *Mammals of the World*, the record length for an Indian rhino horn was 20.6 inches. As with all rhinos, the horn of the Indian rhino is a cemented mass of hair that grows on top of the snout. Because

it is not actually a part of the skull, the horn can be more easily broken and lost, but it can also be regrown. A rhino's horns are not organs of defense, nor offense, nor for digging. Unlike their African cousins, Indian rhinos normally use their teeth as a major weapon of offense, but they can also charge and trample a person.

By and large, though, Indian rhinos are inoffensive creatures, preferring flight to fight. Though hunted for centuries, there are few records of an Indian rhino attacking a hunter, even when wounded. Their reputed antagonism toward elephants is largely apocryphal; in the wild, at least in Africa, elephants are more likely than rhinos to do the attacking. In captivity, Indian rhinos can become amazingly tame, but male Indian rhinos fight each other for dominance, an inclination some nineteenth-century Indian rulers exploited by staging "rhinoceros fights." One such encounter took place when the Maharajah of Baroda entertained the Prince of Wales in 1875. As described by Rookmaaker, Vigne, and Martin (1998): "[The rhinos] came nose to nose as if to exchange civilities, but the attendants began to excite ill-feelings by poking and patting them alternately, and by horrid yells, and one rhinoceros made a thrust at his friend. . . . They were deluged with cold water to keep up their courage by the attendants, but to no avail, they could not be made to fight each other again. Exeunt two degraded rhinoceroses."

At one time, these behemoths were found throughout the alluvial plains of Pakistan, northern India, Bangladesh, Bhutan, and Nepal, but the population has steadily and steeply declined in the past four hundred years. Throughout the nineteenth and much of the twentieth centuries, Europeans and Asians hunted the great rhinos for sport. In West Bengal and Assam, from 1871 to 1907, the Maharajah of Cooch Behar shot 207, "almost single-handedly sending the Greater One-Horned Rhinoceros to its doom," according to Vivek Menon, a commentary not only on the maharaja's profligacy, but also on how greatly the rhino population had already been reduced. To supply the insatiable thirst for tea in Britain, planters in Assam appropriated vast tracts for tea plantations, eliminating the resident rhinos in the process. Although the Indian government established Kaziranga as a forest reserve in 1908 and officially abolished rhino hunting in 1910, poaching for sale of the horns to TCM practitioners has remained a persistent threat to the rhino population.

What remains is considered endangered and is highly restricted to preserves, but as the price of rhino horn continues to escalate, the number of remaining rhinos—even in protected areas—continues to fall. For people nearby, the temptation is huge. As Geoffrey Ward commented in 1997, "Rhino horn is used in traditional Chinese medicine, and a single horn can bring more than $8,000 on the black market—many times the average income of the people who live around the park."

"To the north of India, for religious, medicinal, and decorative purposes, the Nepalese use more parts of the rhino than any other people in the world, but only a very few rhinos have recently been killed there," E. B. Martin wrote in 1985. Rhino skin was used to make bracelets, earrings, and walking sticks, and in the recent past, more such items, some utilitarian, some decorative, were in vogue. Martin gives this example: "In 1938, when Kiran Shumsher Rana, the son of the Prime Minister then, shot a rhino in southern Nepal, he gave almost all of its skin to a craftsman in Patan to make a spice container, a flowerpot, picture frames, two table lamps, a chandelier, a bowl and a jewel box, all of which he still keeps as very special treasures" (1985a).

The Nepalese believe that drinking rhino urine will relieve asthma attacks, congestion, and stomach disorders. After the horns, hoofs, and hide have been removed from a dead rhino, local villagers converge on the carcass to hack off hunks of meat, which is eagerly brought home, cooked with spices, and eaten to fend off serious diseases. Rhino liver is eaten to cure tuberculosis, and the bones of the kneecap are fashioned into oil lamps to be used in religious ceremonies. Martin again: "Other bones are carved into finger rings to keep away evil spirits. Some are made into charcoal, the fumes of which are believed to cure diseases among penned cattle. In some cases the penis from a dead rhino is taken. I saw a few dried ones for sale in Kathmandu, and I was told that old men boil them in water and eat them to try to cure their impotence." Rhino *penis* may be used for impotence in TCM, but rhino *horn* never is.

By 1968, the rhino population in the Valley of Nepal had fallen to about one hundred animals, and in 1973, the Nepalese government carved out the 600-square-mile Royal Chitwan National Park, about 100 miles southeast of Kathmandu, and posted a special "rhino patrol" to the region. Because the available habitat in Chitwan was found to be

The horn of an Indian Rhino, rescued from poachers in Kaziranga National Park, India.

insufficient for the number of rhinos there, from 1986 to 1999, forty-three rhinos were relocated to the Royal Bardia National Park in the more remote southwest part of Nepal. Crop raiding by rhinos in the adjoining fields led to the occasional rhino-related human casualties in the park, and the foraging animals often faced retaliatory actions by affected farmers. Rhino conservation efforts, including relocation, have generally been a success, however, and as of the turn of the twenty-first century, there were more than five hundred rhinos in Chitwan and fifty-two in Bardia. According to the International Rhino Foundation's Web site (www.rhinos-irf.org) in 2003, "With strict protection from Indian and Nepalese wildlife authorities, Indian rhino numbers have recovered from under 200 earlier in the 20th Century to around 2,400."*

In 1990, the government of Nepal collapsed. Bloody violence ensued, and a state of emergency was declared. It soon became evident that the rhinos in Nepal's national parks were also once again under the gun. From May to November 2000, for example, twenty-nine Indian rhinos were found dead in Chitwan and four in Royal Bardia. To fight the Maoist insurgents, security guards originally detailed to protect the rhinos had been removed from their posts in the national parks, leaving the rhinos at the mercy of poachers who took hides and horns to sell for use in traditional Chinese medicine. By this time, the price for rhino horn had reached 100,000 Nepalese rupees ($1,418) per 100 grams, or 300,000 rupees for a horn that weighed 722 grams (Martin 2001). In mid-2000, however, Gopal Uphadhyay was appointed chief warden, and the main buyer of rhino horn in the Chitwan Valley was arrested. With no outlet for the horn, poaching was virtually halted, and from mid-2000 to February 2001, only one rhino was killed by hunters. Some seven thousand people died from 1997 to 2003 as a result of rebel-government struggles, and the country's tourist-dependent economy was paralyzed. In the summer of 2003, the seven-month cease-fire between

* Eric Dinerstein, now chief scientist and vice president for science of the World Wildlife Fund in Washington, has been described by George Schaller as "the best friend [the rhinos of Chitwan] ever had" for his years of research and rhino conservation efforts. Dinerstein has written a book about the Indian rhino, *The Return of the Unicorns*, which, fortunately, was published while I was working on this one, allowing me to reap the benefits of his scholarship and his dedication to the rhinos.

German seventeenth-century rhinoceros-horn cup, mounted on a silver base with ivory fittings. On one side of the carved horn, an elephant hunt is depicted; on the other, a battle between a rhino and an elephant. The little ivory rhino is a removable stopper. Though this elaborately carved cup could be used for drinking, it was primarily a decorative object.

the Maoists and the government of Nepal was suspended, and hostilities began again. In a Reuters report dated October 7, 2004, we read that "both Nepali government troops and Maoist rebels are abducting, torturing, and killing ordinary people as an eight-year-old conflict escalates across the impoverished kingdom." Bad news for Nepalis; bad news for Maoists—and very bad news for rhinos.

Most of the remaining Indian rhinos not in Nepal can be found in northern India, in the region known as the Terai, at the foot of the Himalayas. In a 1996 TRAFFIC report called "Under Siege: Poaching and Protection of the Greater One-Horned Rhinoceros in India," Vivek Menon tracks the history of poaching since the official ban on rhinoceros hunting was enacted in 1910. There were enough rhinos in India by the 1960s that poachers found it easy to find and kill them: "Between 1968–72 . . . Jaldapara and Gorumara lost 32 rhinoceroses to poaching or a third of the rhinoceroses present in these protected areas; Kaziranga lost 53 rhinoceroses between 1965–69, the first large number lost to poachers, roughly 15% of its population average for the decade." In the 1970s, the figures were lower, but the poachers continued to kill rhinos, especially in protected areas like Jaldapara, Gorumara, and Kaziranga, but the 1980s "marked a resurgence in poaching" and the introduction of two new methods, electrocution and poisoning. From 1980 to 1984, 251 (out of a known total of 1,125) rhinos were killed by poachers, including 61 in the sanctuary of Laokhawa and 125 in Kaziranga. In the next five years, another 232 rhinos were killed for their horns, bringing the total for the 1980s to 483. In the 1990s, the poaching rates accelerated again. From 1990 to 1993, 209 rhinos were killed, almost 15 percent of the remaining population. With the exception of the "black year" of 1983, when the country lost 93 rhinoceroses, never before had more than 60 rhinoceroses been killed in one year, yet in 1992 and 1993, 66 rhinoceroses were poached annually. The most seriously affected reserve of this half-decade was Manas National Park, which officially lost 41 rhinoceroses, 68 percent of its population.

After Assam's Kaziranga and Laokhawa, the rhino population in the West Bengal sanctuaries of Jaldapara and Gorumara is the highest in India. From 1974 to 1989, poaching in West Bengal averaged only one rhino a year, but five rhinos were killed by poachers who lived in the

impoverished outskirts of the two sanctuaries. In 1993 the price for rhino horn ranged from $640 to $896 per kilogram. From West Bengal, the contraband horn was often brought to Bhutan, from there to be smuggled into mainland China or Taipei. In 1993, a Bhutanese princess, Dekichoden Wangchuck, the aunt of the king, was arrested at Taipei's Chiang Kai-shek airport, in possession of twenty-two rhino horns. (She had tried to sell the horns in Hong Kong, but when she failed to find a buyer there, she tried Taipei.)

Armed patrols may curtail hunting, but there is little that can be done to counteract the irrepressible forces of nature, such as the devastating floods that ravaged Kaziranga a few years ago. Kaziranga covers some 473 square kilometers (293 square miles) on the floodplain of the Brahmaputra, and in the summer of 1998, heavy rains caused the river to rise, with disastrous results. By September, almost all of the highlands were submerged and most of the antipoaching camps were ruined. Some animals sought refuge on higher dry ground, but many drowned, and others left the park and were killed crossing roads or by villagers and plantation laborers. The drowned carcasses of thirty-nine rhinos were recovered, and another eighteen were found dead of other causes, including one that had been killed by a tiger. It is difficult to determine which is more threatening to the rhinos of Kaziranga, the sporadic but deadly calamities wrought by nature, or the relentless predation of the poachers. The rhinos were nearly obliterated, and six years ago, it was estimated that there were no more than five left in Assam's Manas National Park (Vigne and Martin 1998). Poachers continue to have access to Manas and other parks in Assam, so the best long-term hope for Indian rhinos in India is still Kaziranga, where upward of 1,500 rhinos live. Efforts to combat poaching there have reportedly been vigorous, according to Lucy Vigne and Esmond Martin (1998), and B. K. Talukdar (2002).

Rhino Medicine

"The Indian rhino," wrote Breeden and Wright in their 1996 study of India's wildlife, "is probably the most coveted animal in history. Every part of the anatomy is desired, as a magical cure for a long list of diseases,

as an unfailing charm, and in India as an aphrodisiac. To many people in Asia the rhino is a walking apothecary that could cure them of all diseases and keep them so vital they would stay young and potent forever. To the Chinese, the Indian rhino is much better medicine than rhinos from Africa and other parts of Asia." As Alan Rabinowitz wrote in 1995, "It is no small miracle that rhinos still walk the face of the earth. No other group of animals has been so highly prized for so long yet managed to survive human onslaught. The focus of our obsession with this animal has revolved around the protuberance of hardened hair on the animal's head known as rhino horn. Rhino horn played an important role in medieval Chinese medicine, a role that it continues to play in traditional Chinese practices of today."

The use of rhino parts for medicine goes back a long way. In Bernard Read's 1931 translation of Li Shih-chen's 1597 materia medica *Pen Ts'ao Kang Mu*, we read:

> The rhinoceros has a head and belly like a pig. Short feet with 3 toes like an elephant. It is black and the tongue is barbed. There are 3 hairs to each follicle like a pig. There are single-horned, double-horned, and triple-horned species. The *Erh Ya* says the female is like a cow and the male is like a pig. *Kuo P'u* says that the female has only one horn, it is dark colored and weighs 1,000 catties. The male is like a buffalo with the 3 horns in line from the nose, forehead and cranium. . . . The *T'ung T'ien Chüeh* is hollow and the animal can breathe and squirt water through it. . . . The animals were caught by rigging up a rotten wood fence which the animals like to lean against, and falling down as the wood breaks they cannot rise quickly and are easily killed. It is said to shed its horn each year, and bury it in the ground. If carefully replaced by wooden imitations 3 times the animal will continue to plant its horn in the same place year by year.

In his 1974 *Introduction to the Mammals of Singapore and Malaya*, John Harrison repeats these qualities of rhino horn but says, "Such accounts, which appear in Chinese herbals, are clearly muddled hearsay, but the material of the horn was, and is, obviously used." Relying largely

on Read's translation of the materia medica, Harrison commented, "Gossip says that it is a powerful aphrodisiac, but the uses listed are as an antidote to poison, to cure possession by devils; to keep away evil spirits and miasmas; to remove hallucinations, bewitching nightmares, infantile convulsions and dysentery. . . . All this for a few hundred dollars an ounce! No wonder the market is flooded with imitation rhino horn."

Even though many Westerners believe that rhino horn is used as an aphrodisiac in certain Asian countries, it is in fact used to cure almost everything *but* impotence and sexual inadequacy. In Read's translation of *Pen Ts'ao Kang Mu*, the complete section on rhinoceros horn ("the best is from a freshly killed male animal") reads as follows, with no mention of any aphrodisiac qualities:

> It should not be taken by pregnant women; it will kill the foetus. As an antidote to poisons (in Europe it was said to fall to pieces if poison were poured into it). To cure devil possession and keep away all evil spirits and miasmas. For gelsemium [jasmine] and snake poisoning. To remove hallucinations and bewitching nightmares. Continuous administration lightens the body and makes one very robust. For typhoid, headache, and feverish colds. For carbuncles and boils full of pus. For intermittent fevers with delirium. To expel fear and anxiety, to calm the liver and clear the vision. It is a sedative to the viscera, a tonic, antipyretic. It dissolves phlegm. It is an antidote to the evil miasma of hill streams. For infantile convulsions and dysentery. Ashed and taken with water to treat violent vomiting, food poisoning, and overdosage of poisonous drugs. For arthritis, melancholia, loss of the voice. Ground up into a paste with water it is given for hematemesis [throat hemorrhage], epistaxis [nosebleeds], rectal bleeding, heavy smallpox, etc.

"People from northern India, Burma, and northern Thailand," wrote Martin (1987a), "consume rhino blood, urine, and penises as aphrodisiacs. Rhinos are capable of copulating for as long as 90 minutes, with the male having orgasms at two-minute intervals. Perhaps this 'feat' is the basis for belief in the aphrodisiac powers of the rhino's penis." Because

it was believed to provide such a pharmacological bounty, it is perhaps superfluous for rhino horn also to serve as a love potion. How then did rhino horn acquire its aphrodisiacal reputation? Probably from Western writers who had only a passing acquaintance with Chinese traditional medicine, such as the great white hunter with the eponymous name, who, in 1952, wrote:

> The horns are worth thirty shillings a pound or more—ten shillings more than the finest grade of ivory. These horns are used for a curious purpose. Orientals consider them a powerful aphrodisiac and there is an unlimited demand for them in India and Arabia. No doubt any man who has a harem of thirty or more beautiful women occasionally feels the need for a little artificial stimulant.

In his 1962 study of the animals of East Africa, C. A. Spinage seemed to share the belief that Asians were interested in the horn as an aphrodisiac and were willing to pay handsomely for it: "On account of mysterious aphrodisiac properties attributed to the horn by certain Asiatic peoples, the Rhino has been sorely persecuted. . . . With its horn fetching the present high price the prospects of its continued survival in the face of the poachers' onslaught are not very bright."

The anthropologist Louis Leakey also shared this misunderstanding. In his 1969 book on African wildlife, he commented that rhinos were "in grave danger from poachers because rhino horn commands a high price in the Far East, where it is rated as an aphrodisiac." Similarly, in their 1970 book *Last Survivors*, Noel Simon and Paul Géroudet wrote, "It is impossible to shake the firmly held belief, prevalent throughout the East, in the infallibility of rhino horn as a powerful aphrodisiac, and most Asians will go to any length and pay almost any price to obtain it." And in *S.O.S. Rhino*, C. A. W. Guggisberg asserted that "the superstition that has done more harm to the rhinoceros family than all others is undoubtedly the Chinese belief in the powerful aphrodisiac properties of the horns. Through the centuries untold generations of aged gentlemen have been imbibing powdered rhino horn in some appropriate

drink, hoping to feel like a twenty-year-old when next entering the harem!"*

Of this sample of writers, Hunter was hardly a conservationist, but Leakey, Spinage, Guggisberg, and Simon and Géroudet believed in protecting animals, so if they were responsible for spreading the myth of rhino horn as a sexual amplifier, it would countermand everything they stood for. Nevertheless, wrote Martin and Martin in *Run Rhino Run*, "it seems that the myth from East Africa moved to Asia via the conservationists. Having heard or read that that the aphrodisiac value ascribed to rhino horn was the reason why the Chinese were buying it in vast quantities from East Africa, they offered the same explanation for the poaching of Asiatic rhinos, which were even more in demand on the Chinese market."

Make no mistake: those people who use rhino horn to cure medical ailments really believe it works. That's what drives up the demand on which the poachers thrive. As Ann and Steve Toon commented in 2002, "For practitioners of traditional Asian medicine, rhino horn is not perceived as a frivolous love potion, but as an irreplaceable pharmaceutical necessity." And Eric Dinerstein (2003), concurs: "In fact, traditional Chinese medicine never has used rhinoceros horn as an aphrodisiac: this is a myth of the Western media and in some parts of Asia is viewed as a kind of anti-Chinese hysteria."

In the 1960s and 1970s, Hong Kong was the world's largest importer of rhino horn. Although the government officially banned all imports in 1979, rhino horn was smuggled in from Macao, Burma, Indonesia, Malaysia, India, Taiwan, and South Africa. At the 1987 CITES meeting in Ottawa, participating parties agreed to abate the rhino crisis by closing down the trade in rhino products completely. British Prime Minister

* "When we returned to camp," wrote Hunter, "I tried some of the horn myself to test its powers. I closely followed the recipe given me by an Indian trader: take about one square inch of rhino horn, file it into a powder form, put it in a muslin bag like a tea bag, and boil it in a cup of water until the water turns dark brown. I took several doses of the concoction but regret to report that I felt no effects. Possibly I lacked faith. It is also possible that a man in the bush, surrounded by nothing by rhinos and native scouts, does not receive the proper inspiration to make the dose effective."

Margaret Thatcher promised the ban would take effect later that year. This never happened in an effective way, of course, but there were suggestions that substitutes for actual rhino parts might suffice for TCM. Scientists at the China Pharmacological Institute proposed using buffalo horn (made of keratin, as are rhino horns), for example, and the general manager of China National Health Medicines Products told Esmond Martin that all their new medicines now used buffalo horn instead of rhino horn. "Regrettably," he wrote, "not all the factories in China have switched to water buffalo horn . . . and they were still utilizing old stocks of rhino horn" (Martin 1989a). In the section on "Heat-clearing, blood-cooling medicinals" in Wiseman and Ellis's 1996 *Fundamentals of Traditional Chinese Medicine*, we find the admission that all those rhinos didn't have to be killed at all. After a list of all the symptoms that rhinoceros horn (*xi jiao*) can alleviate, there is this note: "The rhinoceros is an endangered species. Please use water buffalo horn as a substitute."

Chryssee and Esmond Martin observed in a 1991 book that "Taiwanese self-made millionaires are notorious for their conspicuous consumption of rare and exotic wildlife, and the Chinese traditional adage that animals exist primarily for exploitation is nowhere more pronounced than on this island." During a visit to Taiwan three years earlier, they found that most of the rhino horn for sale there had come from South Africa. Two years later, they found that, despite a ban on imports, domestic sales of smuggled horn were still high. The demand for Asian horn in particular was "increasing and wealthy Taiwanese, aware that prices will rise even higher as rhinoceros numbers decline, are buying it as an investment." In those regions where rhino-horn products are dispensed—legally or illegally—the most popular medicines are used for tranquilizers, relieving dizziness, building energy, nourishing the blood, curing laryngitis, or simply, as the old snake-oil salesmen would have it, "curing whatever ails you."

In Bensky and Gamble's 1993 *Chinese Herbal Medicine*, we read that cow bile may be substituted for bear bile, "because of the endangered status of many bear species," but rhino horn (*cornu rhinoceri*) can be obtained from any species of rhinoceros, "most commonly the Asian species *Rhinoceros unicornis*, *R. sondaicus*, or *R. sumatrensis* are used;

sometimes the African species *R. simus* and *R. bicornis* are used." To such Chinese herbal medicine specialists, the rarity of some species of rhinoceros may be unimportant (and the misidentification of their names of no consequence), and while some practitioners might allow a substitute for bear bile, nothing, it appears, can take the place of *cornu rhinoceri*.

The Rhino-Horn Trade

Since the late 1970s, Esmond Bradley Martin has taken the lead in research on the rhino-horn trade. Born in 1941 in New York City and educated at the universities of Arizona and Liverpool, he went to Africa in 1971 to study the dhow trade for a doctorate in geography. Even before his numerous papers on rhinos appeared, he and his wife, Chryssee, published the influential *Run Rhino Run* in 1982, with an introduction by Elspeth Huxley.

"It was largely because of Bradley Martin," wrote Raymond Bonner in 1993, "whose shock of unruly and prematurely white hair makes him instantly noticeable in any crowd, that the rhino had been declared an endangered species under CITES, and international trading in rhino horn became illegal in 1973." Now based in Nairobi, Martin has made a career out of rhino research; he has seen living rhinos wherever they can be seen and has visited medicine factories, shops, and pharmacies for firsthand observations in such places as Mombasa, Yemen, Taipei, Hong Kong, Macao, Singapore, Kuala Lumpur, Bangkok, Borneo, Japan, Beijing, and various other cities in China. Indeed, *Run Rhino Run* would have been an ideal primer for the study of rhinos in today's world—if only things hadn't got a lot worse since its 1982 publication. Through Martin's voluminous publications—often in *Pachyderm* but in other international journals as well—one can follow the trails of crass commercialism, international intrigue, pharmacological preparations, and the valiant efforts to rescue rhinos by various conservationists, one of the most important of whom is Martin himself. In the early 1990s, Martin was named the United Nations Special Envoy for Rhino Conservation, and he has worked with (and his efforts have been supported by)

Kes Hillman Smith and Esmond Bradley Martin measure rhino horns collected by officials of South Africa's Pilanesberg National Park in 1981. Soon after this picture was taken, these horns were stolen and probably ended up in East Asia.

virtually every conservation organization in the world, from the WWF and the IUCN to the Wildlife Conservation Society and the National Geographic Society.

Even before the recent increase in demand for rhino horn for TCM, rhinos were slaughtered en masse in Africa for their horns, which had backed them toward the precipice of extinction in the wild. For *Run Rhino Run*, the Martins researched the history of what they called "The Rhino Business" and uncovered some astonishing statistics. Seyyid Said, the sultan of Muscat, moved his capital to Zanzibar in 1840, and he and his successors "presided over a massive slaughter of rhinos never equaled before or since. . . . One of the foremost Zanzibar historians has estimated that the towns of Mafia and Bagamoyo used to receive from the interior of East Africa between 5,500 and 8,000 kilos [5.5 to 8.8 tons] of rhino horn per year in the 1840s." All told, the Martins estimated that

"between 1849 and 1895, an average of 11 tons of rhino horn a year was exported from East Africa, which meant that 170,000 rhinos must have been killed to supply the trade during this 49-year period." Most of these horns went to India to be carved, or to China to be incorporated into medicines, but a startling 30 percent in the early twentieth century went to Britain. What in the world did the Brits do with all that rhino horn? They used it, it turns out, for everything from decorative carvings to the tops of riding crops, walking sticks, door handles, and interior fittings in carriages. "Polished rhino horn looks almost like amber and is not difficult to carve," wrote the Martins. "It had a prestige value too: since rhinos were still regarded by most Europeans as exotic beasts, a dandy with something made from rhino horn could almost certainly count on attracting the attention of his peers."

The scarcity of rhinos today, and the corresponding intermittent availability of rhino horn, only drives the price higher, and intensifies the pressure on the declining rhino populations. For people whose annual income is often far below the subsistence level, the opportunity to change one's life by killing a large, ungainly, and otherwise seemingly "useless" animal must be overwhelming. How much is rhino horn worth? In Nowak's 1991 revision of *Walker's Mammals of the World*, we read: "*R. unicornis* is jeopardized by loss of habitat to the expanding human population and illegal killing, especially in response to the astonishing rise in the value of the horn. The wholesale value of Asian rhino horn increased from US $35 per kg [2.2 pounds] in 1972 to $9,000 per kilogram in the mid-1980s. The retail price, after the horn has been shaved or powdered for sale, has at times in certain East Asian markets reached $20,000–$30,000 per kilo. In contrast, in May 1990, pure gold was worth about $13,000 per kilo."

Estimates of price for rhino horn used to make Yemeni daggers is controversial. A letter from Esmond Martin in the July 2004 issue of *National Geographic* took issue with a previously published article that cited $60,000 as the price for a kilogram of black rhino horn used to make Yemeni daggers. The going price was actually far lower, $1,200, Martin said. By "stating this very high price for rhino horn," he went on, "poachers and traders will have a great economic incentive to kill rhi-

nos and send the horns to Yemen." Even if the lower figure is correct, $1,200 is a huge amount of money by third-world standards. In his many publications on the rhino horn trade, Esmond Martin himself has quoted different prices at different times, and in different countries. For example, in Yemen in 1987, he found that traders would pay from $800 to $1,000 per kilogram for rhino horn. In a 1989 paper about the rhino trade in Borneo, Martin tells of a poaching gang in Sarawak—the rhinos there are Sumatran—that received $7,300 for a pair of horns, nails, and a good portion of hide and a few bones. In Taiwan in 1989, customers were willing to spend $40,000 per kilogram, "the highest retail price in the world," and in a 1990 study of rhino-horn consumption in South Korea, Martin wrote that the price in 1980 was $1,436 per kilogram; and by 1988, it had risen to $4,410.

As living rhinos become increasingly unavailable in the wild, those who would market horn products must turn to other sources. In April 1990, Martin visited Beijing's largest pharmaceutical factory, Tong Ren Tang, where he found more than 10 tons of rhino horn stockpiled for future use. When he was shown the storerooms—the Chinese do not think that what they are doing is wrong and are not reluctant to have Westerners see their operations—he also saw "plastic bags, crates and boxes containing chips, powder, whole horns, together with the most amazing form of stock to be used for making medicine, that of antique rhino horn carvings . . . antique plates, cups, libation bowls, brush holders and figurines. [He] even saw quite a few Sumatran, Indian, and Javan carved horns" (Martin 1990).

Keratin—the major protein components of hair, wool, nails, horn, hoofs, and the quills of feathers—in rhinoceros horn is chemically complex and contains large quantities of sulfur-containing amino acids, particularly cysteine, but also tyrosine, histidine, lysine, and arginine, and the salts calcium carbonate and calcium phosphate. Rhino horns are composed primarily of keratin, but so too are rhino nails. Three to a foot, for a grand total of twelve per rhino, the nails can also be shaved or powdered for pharmaceuticals. You cannot carve a jambiya handle from a toenail, but shaved or powdered rhinoceros keratin, with all its believed powers, might be beneficial regardless of which part of the

rhino it comes from. In a Bangkok medicine shop, Lucy Vigne and Esmond Martin (1991) found that "a large collection of rhino products, usually from the Sumatran rhino . . . occasionally nails and even dried penises are for sale." A year later, in a study of the Bangkok market for rhino products, Martin noticed a dramatic increase in the price of Sumatran rhino nails, from $1,487 per kilogram in 1986 to $13,905 per kilogram in 1992. The horn, however, remains the ne plus ultra of rhino products; its favored status built of long tradition is attributable in part to a strong historical continuum with the original myth of the unicorn.

Unicorn or rhino, the horn is used in TCM because people believe it works. Westerners have largely rejected the TCM notion that it can reduce fevers, but it has been demonstrated that in very large quantities it can indeed reduce fever in rats (But et al. 1990), and the rats obviously cannot be influenced by the placebo effect. As long as people believe in the medicinal properties of rhino horn they will continue to use it. That the medicines may not cure or ameliorate the conditions for which they are prescribed in TCM cannot be accurately assessed by a Western-only perspective, say many TCM adherents, so an argument on grounds of efficacy will likely fall on deaf ears. But the argument that killing rhinos for their horns or toenails endangers the species is a powerful one, and it is probably the only one that has a chance of saving the remaining rhinos.

Tibetan medicine, somewhat different from Chinese, also employs rhino horn, even though the Dalai Lama has expressly condemned the illegal killing of animals. Vivek Menon's comprehensive 1996 report (*Under Siege: Poaching and Protection of Greater One-Horned Rhinoceros in India*) concludes that "the poached rhinoceros horn is used to a small extent in the domestic market in India, for Tibetan medicinal and other uses, but that the main demand is medicinal use in the markets of East Asia and Southeast Asia." Throughout those markets, the trade in rhino horn for medicinal purposes is a very big business, but because much of it is conducted through various black markets, its true magnitude may never be known.

In a 1989 article in *Pachyderm*, Lucy Vigne and Esmond Martin suggested that "Taiwan may have become the world's largest entrepot for

It is not immediately evident what this object was made to contain, but whatever its function, its cost was one rhino foot. The bronze rhino finial was sculpted by James L. Clark of the American Museum of Natural History.

African and Asian rhino horn." Lacking United Nations recognition, Taiwan cannot sign CITES. According to a 1992 TRAFFIC report by Kristin Nowell, Chyi Wei-Lin, and Pei Chia-Jai, "7,281 kg (16,000 pounds, or 8 tons) of rhino horn were legally imported between January 1972 and August 1985. It is likely that over the same period additional quantities were brought in undeclared in order to avoid customs duties." Most of it is consumed—in very small quantities—to reduce fever, because many among the 20 million Taiwanese prefer the remedies offered by Chinese traditional medicine to those of modern medicines with their uncertain side effects, or choose to use both types. Although medicines made from Asian rhinos are preferred by Taiwanese, pharmacies are also stockpiling the cheaper African horn as a hedge against the time when the Asian rhinos become too rare to harvest. But, Menon wrote, "Asian rhinoceros horn is far more porous and soft than African horn. . . . A number of dealers . . . claim that it is almost impossible to carve an Indian rhinoceros horn (and it would, in any case, be much more likely to be sold for Oriental medicine), whereas an African one may be carved with relative ease. Conversely, it is easier to powder Indian horn than African horn."

The Taiwanese make up much of the market for horn imported to Asia from South Africa, Mozambique, Tanzania, and Zimbabwe—wherever black rhinos can still be found. Threats of jail time or stringent fines apparently do not have much of an effect on rhino poaching in Africa; in a 1989 article in *Pachyderm*, conservationist David Western wrote, "The unabated decline in African rhinos during the 1980s shows that poaching has defied all efforts to ban the horn trade. . . . The prospects are likely to worsen as the task of detecting fewer and fewer horns entering the market becomes more formidable and price incentives rise."

Like the Taiwanese, many Koreans are devoted practitioners of traditional medical arts and are prepared to import substantial amounts of substances not naturally found in their country. Korean traditional medicine is based on the Chinese version, which is said to have come to Korea during the sixth century. "Rhinoceros horn," wrote Judy Mills in 1993, "is an ingredient in five . . . medicines still popular among doctors of Oriental medicine in Korea today. These rhinoceros horn derivatives are used to treat maladies including stroke, nosebleeds, dermatitis,

headache, facial paralysis, high blood pressure, and coma. The most popular of these medicines is *Woo Hwang Chang Shim Won*, a medicine ball made from rhinoceros horn, musk, cow gallstones, and a number of herbs." In 1992, the U.S. government threatened to impose sanctions via the Pelly Amendment* on South Korea for failure to police the trade in rhino horn. In response to the threat—the Pelly Amendment was not actually employed—the price of rhino horn in South Korea doubled. Among the some seven thousand doctors licensed to practice Korean medicine in South Korea (no figures are available for North Korea), there was little diminution of prescriptions written for *Woo Hwang Chang Shim Won* after 1992. In fact, it is not clear that the use of rhino horn for medicinal purposes has decreased at all.

Rhino horn has been an integral component of TCM for thousands of years. It matters little where the rhinos come from; the horn of a rhinoceros from any continent may be used for medical purposes. In East Africa—primarily Kenya, Uganda, and Tanganyika (now Tanzania)—statistics on rhino-horn harvesting have been kept since 1926. Over this period, most of the rhinos killed were black rhinos, although the "harvesters" would not pass up a white rhino if it appeared in their gunsights. During the 1930s, according to Nigel Leader-Williams (1992), declared exports from East Africa (then under British rule) averaged about 1,600 kilograms (3,520 pounds) per year, which meant the death of some 555 black rhinos annually. During World War II, the numbers soared to 2,500 kilograms (5,500 pounds), for which approximately 860 rhinos died each year. During the 1950s and 1960s, the auction houses reported about 1,800 kilograms (3,960 pounds) per year, which would have entailed the death of about 600 rhinos every year in that period. In the 1970s, the numbers skyrocketed again, to 3,400 kilograms (7,480

* The Pelly Amendment—officially the Pelly Amendment to the Fishermen's Protective Act of 1967—is a restriction on importation of fishery or wildlife products from countries that violate international fishery or endangered or threatened species programs. It has been used in fisheries and in whaling disputes, but because it can be applied to any "threatened species programs," it can be used against any country that the United States determines is in violation of international treaties such as CITES.

pounds), and every year in that decade, 1,180 rhinos died. Leader-Williams identifies the Far East's primary consuming nations as Hong Kong (which was separate from the People's Republic of China until 1997), mainland China, Taiwan, Singapore, Japan, South Korea, Peninsular Malaysia, Sabah Malaysia, Brunei, Macau, and Thailand, while the major Asian importers of African rhino horn were, not surprisingly, the first three on this list—mainland China, Hong Kong, and Taiwan.

More or less at the same time that Judy Mills was compiling her report on the rhino-horn trade in South Korea, Leader-Williams (now director of the Durrell Institute for Conservation and Ecology at the University of Kent) was assembling a review of the world trade in rhino horn and determining successes in attempts to halt it. Curiously, he buys into the fallacious notion that rhino horn is (or was) common as an aphrodisiac, for he writes, "The pharmacological efficacy of rhino horn as an aphrodisiac can only be guessed at. However, its psychological value may well be all important and has some basis both in the shape of rhino horns and in the long courtship and staying power of copulating rhinoceroses, which take up to an hour from intromission to ejaculation" (1992). Even without aphrodisiacal properties, however, rhino horn is one of the mainstays of TCM, and its collection has been responsible for the death of tens of thousands of rhinos around the world.

Dehorning the Rhino

When African rhinos were considered big-game animals or an impediment to settlement, the slaughter was enormous. Indeed, so many rhinos were killed during the colonial era that protecting the small percentage that survives has assumed a much greater importance. Documenting the poaching and illegal trade in Namibia's Etosha National Park from 1980 to 1990, Esmond Martin learned that poachers had shot fifteen animals in the park in 1984, another seven in 1987, and twenty-three in 1989. Another seven rhinos were poached in 1989 in northwestern Namibia's Kaokoveld district, for a total during the ten-year period of what was estimated as at minimum sixty-four black rhinos and a few white rhinos. In his 1994 paper on rhino poaching in Namibia, he wrote:

> About five small gangs, usually consisting of only two people, spent between one and three days in the park. They shot the animals during the day; and as well as the horns, for the first time in recent years, they also took some skin. The contact men hoped to sell a pair of horns to Portuguese and Angolans in Windhoek for 2,000 to 4,000 rands ($760 to $1,520.)

If there is no effective way to limit or control the illegal Asian trade in rhino horn for TCM, perhaps there is a way to keep the poachers from killing the rhinos in the first place. What if they had no horns? The idea of removing the horns of rhinos so that poachers would have no cause to kill them has been circulating for some time. In 1989 Leader-Williams noted that

> dehorning has been discussed as a measure to prevent poaching since the 1950s, [but] until now it has been discarded in most areas of Africa for several reasons. First, the cost of dehorning several thousand rhinos over tens of thousands of square kilometers would be extremely expensive. Second, the two African species, the black and the white rhino, use their horns in sparring and to defend calves against predators such as lions and spotted hyenas. Hence, hornless rhinos may be unable to maintain their social status or to rear their calves successfully. As important, most black rhinos live in thick bush, and a poacher sighting only a part silhouette could shoot before finding out his quarry is hornless.

Despite such warnings, in 1989, conservation officials in Namibia's Damaraland dehorned twelve rhinos to see whether it would reduce poaching. This region was chosen as the site of the experiment because it has none of the rhino's natural predators, and there were sufficient tribesmen to act as game guards. In *Run Rhino Run*, Martin and Martin described the process as a hare-brained scheme that would be "fantastically expensive and would also have to be extremely thorough—and repeated at intervals since rhino horns do grow back," but in 1994, Esmond Martin wrote that in fact "the dehorning exercise has been successful . . . two attempts were made to kill rhinos, but once [the poachers] saw that the rhinos had no horns, the poachers left them alone." And Leader-Williams suggested now that a program of cauterizing the horn could be tried, to prevent regrowth of the horns.

Poachers and other "harvesters" of rhino horn usually kill the rhino and saw off the horn. But if the horn can be removed without otherwise harming the rhino, doesn't that suggest harvesting the horns and not the rhinos? There are no nerves in rhino horn, so there is no pain necessarily affiliated with its removal, but of course the animal has to be forcibly immobilized or shot with a tranquilizing dart before the horn can be sawn off. From the rhino's point of view, the stress involved in dehorning might be preferable to death. Along with dehorning, the question of a legalized trade in rhino horn, where the horns would be collected and then the animals released, was also suggested.

In an attempt to find out if this controversial process was practicable, biologists Joel Berger and Carol Cunningham went to Namibia to see for themselves if dehorning would actually protect rhinos from poachers. They also wanted to learn if the removal of a male rhino's horn would affect its breeding potential: would a hornless male become subordinate to horned males and thus be less available for breeding? Over three field seasons from 1991 to 1993, Berger and Cunningham studied the Namib rhinos, often dodging lions, elephants, and even the rhinos themselves. They had wondered if the dehorning process would backfire because hornless mother rhinos would be unable to defend their calves against lions or hyenas. They noted "that dehorned animals have thwarted the advance of dangerous predators"(1994b). They also wrote that "on the basis of over 200 witnessed interactions between horned rhinos and spotted hyenas and lions, we saw no cases of predation." But Berger and Cunningham concluded that hornless mothers—or those with regenerating horns—were less capable of protecting their offspring than those with horns. Perhaps more useful than dehorning, they wrote, would be the isolation of breeding populations of black rhinos far from poachers, which would allow the decimated rhino populations to recover, rather like the efforts that resulted in the rescue of two

otherwise critically endangered species, Père David's deer and Przewalski's horse.*

In a 1993 paper with Malan Lindeque, the director of Etosha's Ecological Institute, and A. A. Gasuweb, Berger and Cunningham noted that "horn regrowth is rapid, averaging nearly 9 cm of total horn per year, and because poachers fail to discriminate between large- and small-horned rhinos, recently dehorned animals might not be immune from poaching." So dehorning didn't necessarily protect rhinos from poachers, but it didn't do them any harm either. According to a 1991 *National Geographic* article by Des and Jen Bartlett, "At least 250 rhinos roamed Kaokoveld [Namibia] until the early 1970s. By then poachers, primed by world demand from people who still believe in rhino horn as a medicinal panacea, had gone on a rampage that left only about 65 rhinos standing. . . . To help save their lives a controversial technique renders them valueless to poachers: In two high risk areas rhinos have been tranquilized and their prized horns cut off and stored away." In a review of Cunningham and Berger's book, *Horn of Darkness*, Brian Bertram wrote, "The answer to the question 'Does rhino dehorning work?' is a gloomy one. So far, nothing has been shown to work that will prevent these magnificent animals from being needlessly slaughtered. . . . Cunningham and Berger can at least show that they tried, and did so valiantly."

If hunting was once the main cause of rhino population decline, in recent times, poaching rhinos for their horns has become the primary cause of the worldwide decline. But what if there were a *legal* market for rhino horn? Michael 't Sas-Rolfes of South Africa (1997) believes that

> it is wrong to assume that establishing a legal market is risky. It may in fact be riskier to leave the rhino horn trade solely in the hands of illegal operators. Establishing a legal market could provide a further advantage: a substantial source of revenue for conservation agencies. Even more so than with ivory, the potential to fund field protection with the proceeds from legal rhino horn sales is considerable, and could be of great benefit to conservation generally. Conversely, if poaching pressure increases, and conservation budgets continue to shrink, the outlook for rhino protection is bleak.

* Père David's deer, originally an inhabitant of China, was saved from extinction by a breeding program in Europe, led by the Duke of Bedford; a thriving population developed, and recently a small group has been reintroduced to a reserve in China (Hu and Jiang 2002). Przewalski's horse, found in the Mongolian steppes and deserts, was saved from extinction by a captive breeding program (also led by the Duke of Bedford) and, like the Chinese deer, has now been reintroduced in its original habitat.

"Legal trade" in rhino horn may be an oxymoron. It would function as a conservation measure only if it was rigorously controlled, with a clear chain of custody and full control at all points, from source to final sale. But if the Asian wildlife trade, rife with corruption at every level, is any example, no amount of government intervention can circumvent the black market that has been shown to control every aspect of supply and demand. As long as a single rhino horn is worth as much as two years' normal wages, poachers will continue to operate outside the law.

In their 1997 book, Cunningham and Berger noted that as of 1992, Zimbabwe had the largest surviving numbers of black rhinos in the world—approximately 2,000 animals. Within a year, the number had fallen to 300–500, and no one knew why. Poaching was the most credible possibility, but others existed, including drought and starvation. Black rhinos were under siege, horned and dehorned alike. To forestall the extinction of the black rhinos of Zimbabwe, the government decreed that all rhinos in that country would be dehorned and the horns stored for safekeeping. But within a year, the program was abandoned when it was seen that dehorning did not deter poachers, and Zimbabwe's remaining rhinos were moved to smaller areas known as Intensive Protection Zones.

The current government of Zimbabwe might not be the best custodian for rhinos or rhino horns. In an October 25, 2003, article in the *New York Times*, Michael Wines wrote:

> Hunting and tourism once pumped millions of dollars into Zimbabwe's economy each year, sustaining wildlife management programs on millions of acres of private scrubland too arid or rocky for commercial farming, but ideal for photographic safaris and big-game hunts. Zimbabwe's decision to confiscate most of that land from its white owners, and then redistribute it to peasants and political supporters has had an unexpected result: thousands of hungry families

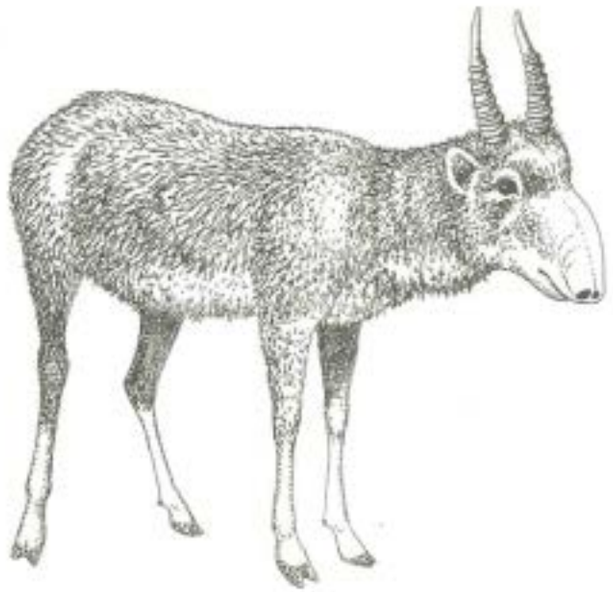
> on land too poor to support crops have turned to poaching as their prime source of food and income. . . . Precise figures do not exist. But by estimates from several conservationists, former landowners and opposition politicians, as many as two-thirds of the animals on Zimbabwe's game farms and wildlife conservancies have been wiped out.

Whether they were horned or dehorned, nothing seemed to work to protect Africa's rhinos from poachers. But decades earlier, when somebody learned that there was an animal, not endangered, whose horns might be substituted for those of rhinos in TCM, it appeared that the rhinos might be offered a reprieve.

Can the Saiga Save the Rhino?

Around the late 1980s, when it was recognized that rhinos were being slaughtered out of existence, conservationist groups like the WWF actively encouraged the hunting of the saiga, promoting its horn as an alternative in traditional Chinese medicine to the horn of the endangered rhino. The results were disastrous.

What is a saiga? It is *Saiga tatarica*, a funny-looking antelope of the Russian and Mongolian steppes, with a bulging proboscis like that of a tapir, a chunky body, spindly legs, and a yellowish gray coat that turns lighter in winter. Only the males bear horns, and these are 8 to 10 inches long, semitranslucent, flesh-colored, and ringed on the lower two-thirds. The saiga's exaggerated nasal passages are an adaptation to the swirling dust of its arid habitat; the nostrils point downward and the passages are lined with a complex arrangement of hair, glands, and mucous membranes that filter, warm, and moisten the air as it is inhaled. Saigas wander for miles every day, marching with their heads low to the ground, their specialized noses filtering out the stirred-up dust. At the end of April, the males start their seasonal spring migration, forming herds of up to two thousand animals and setting out northward. In the meantime, females wander in huge congregations to a suitable birthing ground where they drop all their calves within about a week of one



Saiga (*Saiga tatarica*).

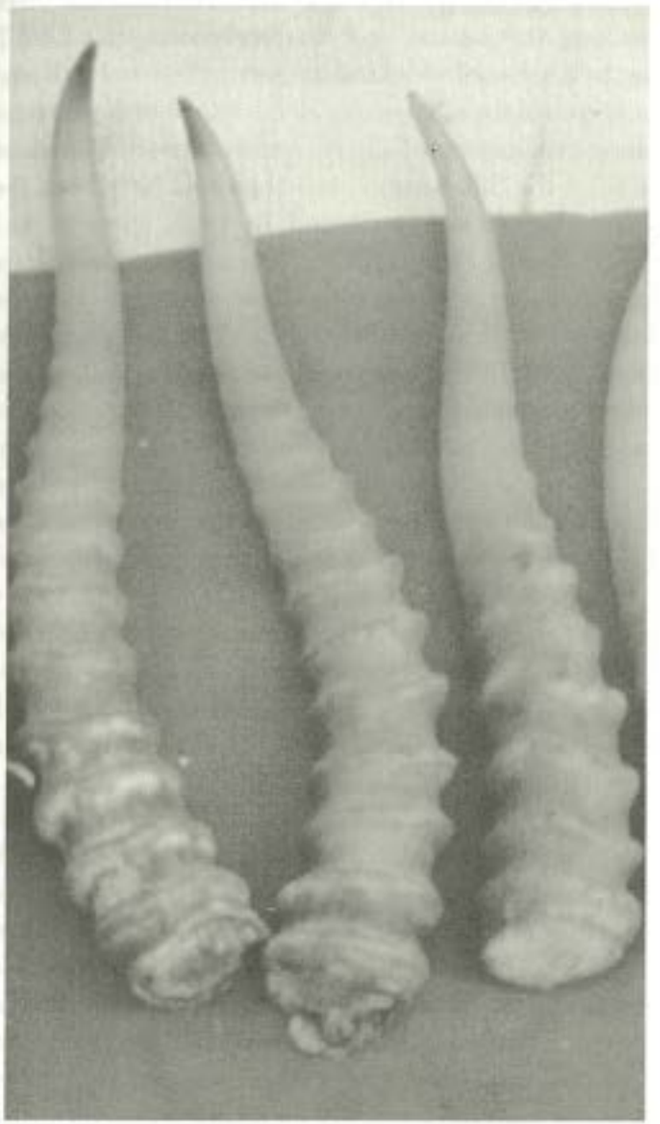
another. Eight to ten days after the calves are dropped, the females and new babies set off after the males, in groups that may exceed one hundred thousand animals. Once the migration is finished, the saigas disperse in smaller herds, only to recongregate in the autumn and move en masse back south. A timid species, the saiga can be easily startled, precipitating a panicked stampede, even in the huge migrating herds. Saigas flock together even when being shot at, so they are particularly easy to kill in large numbers.

Hunters on the steppes killed them for meat and furs, and by the time of the Soviet revolution, there were only a few thousand saigas left. To forestall their total eradication, the Soviets protected saigas in Europe in 1919 and in Soviet Central Asia in 1924 by banning individual hunting and commercial harvests, but in the 1950s, commercial harvests by local groups began again. Saigas were shot from vehicles, which spooked them and worked poorly for large-scale harvesting. In some

cases, they were "jacklighted" at night; dazed by bright spotlights and shot with buckshot. Despite such practices, the antelopes made a remarkable comeback, and by 1957 a loose herd estimated to number between 150,000 and 200,000 animals was observed east of the Caspian Sea. Although the saiga population on the steppes in 1993 had risen to over a million, Fred Pearce noted in a *New Scientist* article that fewer than 30,000 were left in 2003, most of those females (2003a). The males were being killed for their horns, which can fetch as much as $100 per kilogram (three pairs of horns weigh about a kilogram), helping to fill the almost insatiable demand among Chinese who believe the horns have beneficial pharmacological properties.

There are four populations of saiga in Kazakhstan: Kalmykia, Ural, Ustiurt, and Betpak-Dala; a small population also exists in western Mongolia. The Kazakhstan populations were not helped by a biological weapons experiment—probably at Stepnogorsk, the most notorious of the Soviet Union's germ warfare testing facilities—where thirty thousand saigas were killed when the wind shifted unexpectedly (Miller, Engelberg, and Broad 2001). All saiga populations are declining, but in Betpak-Dala the numbers plummeted from half a million in 1993 to four thousand in 2000, a drop of 99 percent. Between 1993 and 1998, the million-plus population was essentially halved as the horn-bearing males were hunted, and, as Eleanor Milner-Gulland and her colleagues concluded in 2001, the lack of males in Kalmykia is causing dramatically reduced conception rates, which, in addition to the high hunting mortality, could lead to population collapse.

Ironically, rhino advocate Esmond Bradley Martin had spearheaded the movement to substitute saiga horn for rhino horn. But when he realized that the saiga was close behind the rhino on the fast track to extinction, he publicly recanted. As Milner-Gulland et al. wrote in *Nature* in 2003: "Horns are borne by males and are highly favored in traditional Chinese medicine, which has led to heavy poaching since the demise of the Soviet Union, when the Chinese-Soviet border was opened." It has now been estimated that less than 5 percent of the population survives, and that may have taken the saiga beyond the point of no return. As of 2002, with the wild Bactrian camel and the Iberian lynx, the saiga has been classified as "critically endangered" by the World Conservation Union (formerly the IUCN).



From the cover of the 1994 TRAFFIC report on the trade in saiga horns. The report found that saiga antelope were being harvested unsustainably, driven by the demand for traditional Chinese Medicine.

The saiga is not mentioned in the Chinese materia medica of 1597 (*Pen Ts'ao Kang Mu*), because at that time, according to a 1995 TRAFFIC report by Chan et al., "the real Saiga Antelope and its horn [were] largely unknown to the Chinese, let alone utilized in any way . . . there is no historical record of any Saiga horn trade between China and Central Asia along the Silk Road . . . [which] would have been the most likely route for trade in Saiga horn." By 1989, however, in Zhang Enquin's *Rare Chinese Materia Medica*, an entire section is devoted to *Lingyangjiao*, the horn of *Saiga tatarica*. We are warned to be on the lookout for counterfeits, such as the horn of the Mongolian gazelle (*Procapra subgutturosa*) or the Tibetan antelope (*Pantholops hodgsoni*), which might be processed to simulate the horn of the saiga. "After being soaked, dried, and ground to a powder, the horn can be used to check hyperactivity of the liver and relieve convulsion, treat the up-stirred liver wind, infantile convulsion and epilepsy; calm the liver and suppress hyperactivity of the liver-*yang*; it is efficacious in the treatment of dazzle and vertigo due to hyperactivity of the liver-*yang*; it improves acuity of vision, cures headache and conjunctival congestion; clears away heat and toxic material; and can be used to treat unconsciousness, delirium and mania in the course of epidemic febrile diseases." Like rhino horn, saiga horn is classified as a product "salty-cold in character and which can detoxify the body and reduce 'heat'" (Chan et al. 1995).

It did not require much effort to eliminate the unicorn from the earth—it never really existed in the first place—but some other horned animals, such as rhinos and saigas, have fared badly at the hands of hunters who would fill the demands of traditional Chinese pharmacological suppliers. The attempt to substitute saiga horn for rhino horn hasn't saved many rhinos and clearly has had tragic results for the saiga. Where Western medicine prescribes synthetic compounds such as aspirin and ibuprofen for reduction of swelling, pain relief, and headache—and has even developed a synthetic stimulant (Viagra) for erectile dysfunction in men—TCM cleaves to natural drugs, massage, and acupuncture. If and where the drugs are available, many people can get the same results with aspirin and ibuprofen, but believers in TCM

prefer genuine rhino horn, and with the collaboration of the suppliers, species are being sacrificed in the process. But a certain hornless animal, celebrated for its majesty, vitality, and beauty, is scheduled to join the rhinos on the short list of animals threatened with extinction in the wild by the requirements of traditional Chinese medicine.