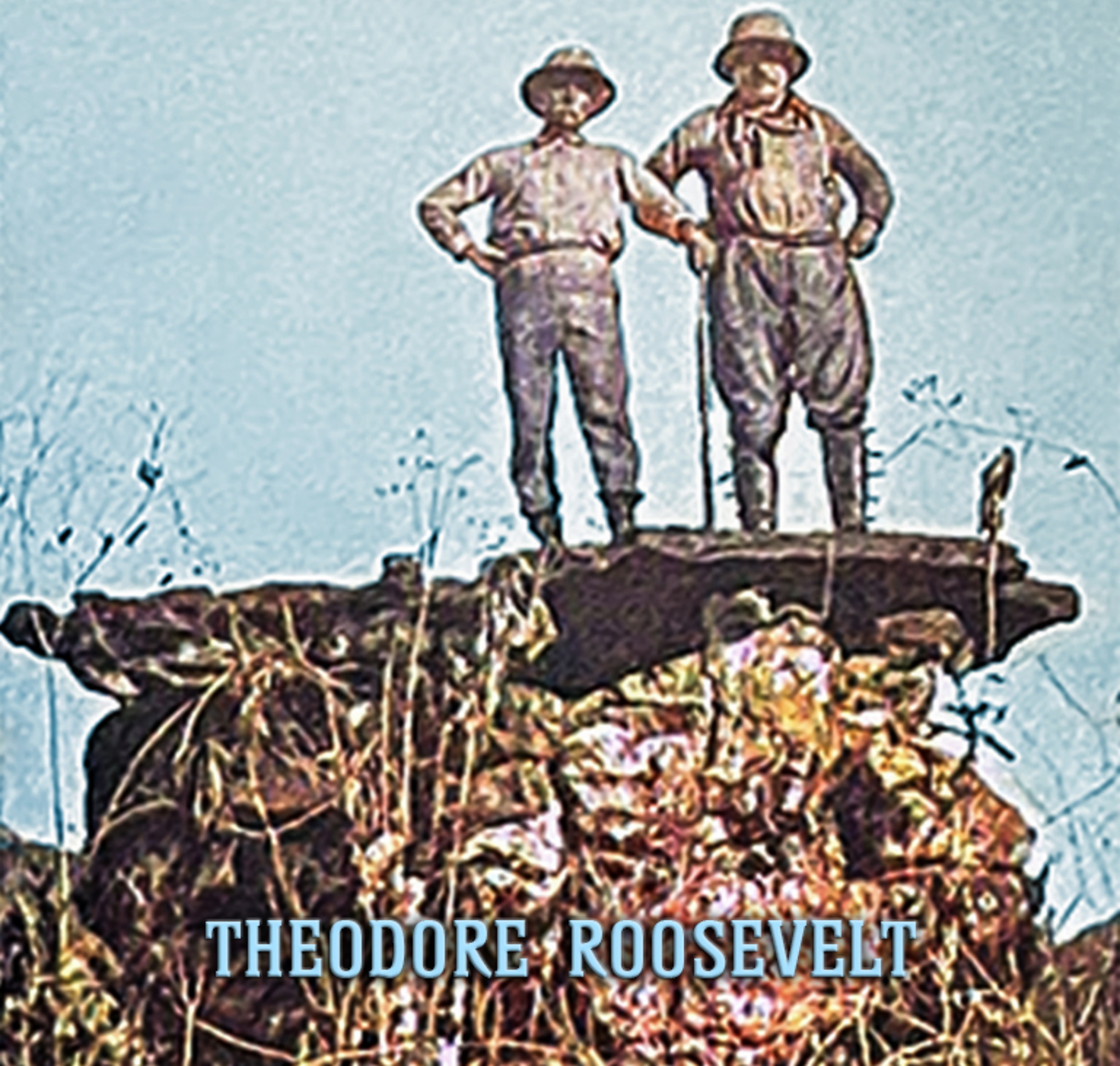
CLASSICS TO GO

THROUGH THE BRAZILIAN WILDERNESS



THEODORE ROOSEVELT

Through the Brazilian Wilderness

Theodore Roosevelt

I. THE START

One day in 1908, when my presidential term was coming to a close, Father Zahm, a priest whom I knew, came in to call on me. Father Zahm and I had been cronies for some time, because we were both of us fond of Dante and of history and of science—I had always commended to theologians his book, "Evolution and Dogma." He was an Ohio boy, and his early schooling had been obtained in old-time American fashion in a little log school; where, by the way, one of the other boys was Januarius Aloysius MacGahan, afterward the famous war correspondent and friend of Skobeloff. Father Zahm told me that MacGahan even at that time added an utter fearlessness to chivalric tenderness for the weak, and was the defender of any small boy who was oppressed by a larger one. Later Father Zahm was at Notre Dame University, in Indiana, with Maurice Egan, whom, when I was President, I appointed minister to Denmark.

On the occasion in question Father Zahm had just returned from a trip across the Andes and down the Amazon, and came in to propose that after I left the presidency he and I should go up the Paraguay into the interior of South America. At the time I wished to go to Africa, and so the subject was dropped; but from time to time afterward we talked it over. Five years later, in the spring of 1913, I accepted invitations conveyed through the governments of Argentina and Brazil to address certain learned bodies in these countries. Then it occurred to me that, instead of making the conventional tourist trip purely

by sea round South America, after I had finished my lectures I would come north through the middle of the continent into the valley of the Amazon; and I decided to write Father Zahm and tell him my intentions. Before doing so, however, I desired to see the authorities of the American Museum of Natural History, in New York City, to find out whether they cared to have me take a couple of naturalists with me into Brazil and make a collecting trip for the museum.

Accordingly, I wrote to Frank Chapman, the curator of ornithology of the museum, and accepted his invitation to lunch at the museum one day early in June. At the lunch, in addition to various naturalists, to my astonishment I also found Father Zahm; and as soon as I saw him I told him I was now intending to make the South American trip. It appeared that he had made up his mind that he would take it himself, and had actually come on to see Mr. Chapman to find out if the latter could recommend a naturalist to go with him; and he at once said he would accompany me. Chapman was pleased when he found out that we intended to go up the Paraguay and across into the valley of the Amazon, because much of the ground over which we were to pass had not been covered by collectors. He saw Henry Fairfield Osborn, the president of the museum, who wrote me that the museum would be pleased to send under me a couple of naturalists, whom, with my approval, Chapman would choose.

The men whom Chapman recommended were Messrs. George K. Cherrie and Leo E. Miller. I gladly accepted both. The former was to attend chiefly to the ornithology and the

latter to the mammalogy of the expedition; but each was to help out the other. No two better men for such a trip could have been found. Both were veterans of the tropical American forests. Miller was a young man, born in Indiana, an enthusiastic with good literary as well as scientific training. He was at the time in the Guiana forests, and joined us at Barbados. Cherrie was an older man, born in Iowa, but now a farmer in Vermont. He had a wife and six children. Mrs. Cherrie had accompanied him during two or three years of their early married life in his collecting trips along the Orinoco. Their second child was born when they were in camp a couple of hundred miles from any white man or woman. One night a few weeks later they were obliged to leave a camping-place, where they had intended to spend the night, because the baby was fretful, and its cries attracted a jaguar, which prowled nearer and nearer in the twilight until they thought it safest once more to put out into the open river and seek a new resting-place. Cherrie had spent about twenty-two years collecting in the American tropics. Like most of the field-naturalists I have met, he was an unusually efficient and fearless man; and willy-nilly he had been forced at times to vary his career by taking part in insurrections. Twice he had been behind the bars in consequence, on one occasion spending three months in a prison of a certain South American state, expecting each day to be taken out and shot. In another state he had, as an interlude to his ornithological pursuits, followed the career of a gun-runner, acting as such off and on for two and a half years. The particular revolutionary chief whose fortunes he was following finally came into power, and Cherrie

immortalized his name by naming a new species of ant-thrush after him—a delightful touch, in its practical combination of those not normally kindred pursuits, ornithology and gun-running.

In Anthony Fiala, a former arctic explorer, we found an excellent man for assembling equipment and taking charge of its handling and shipment. In addition to his four years in the arctic regions, Fiala had served in the New York Squadron in Porto Rico during the Spanish War, and through his service in the squadron had been brought into contact with his little Tennessee wife. She came down with her four children to say good-by to him when the steamer left. My secretary, Mr. Frank Harper, went with us. Jacob Sigg, who had served three years in the United States Army, and was both a hospital nurse and a cook, as well as having a natural taste for adventure, went as the personal attendant of Father Zahm. In southern Brazil my son Kermit joined me. He had been bridge building, and a couple of months previously, while on top of a long steel span, something went wrong with the derrick, he and the steel span coming down together on the rocky bed beneath. He escaped with two broken ribs, two teeth knocked out, and a knee partially dislocated, but was practically all right again when he started with us.

In its composition ours was a typical American expedition. Kermit and I were of the old Revolutionary stock, and in our veins ran about every strain of blood that there was on this side of the water during colonial times. Cherrie's father was born in Ireland, and his mother in Scotland; they came here

when very young, and his father served throughout the Civil War in an Iowa cavalry regiment. His wife was of old Revolutionary stock. Father Zahm's father was an Alsacian immigrant, and his mother was partly of Irish and partly of old American stock, a descendant of a niece of General Braddock. Miller's father came from Germany, and his mother from France. Fiala's father and mother were both from Bohemia, being Czechs, and his father had served four years in the Civil War in the Union Army—his Tennessee wife was of old Revolutionary stock. Harper was born in England, and Sigg in Switzerland. We were as varied in religious creed as in ethnic origin. Father Zahm and Miller were Catholics, Kermit and Harper Episcopalians, Cherrie a Presbyterian, Fiala a Baptist, Sigg a Lutheran, while I belonged to the Dutch Reformed Church.

For arms the naturalists took 16-bore shotguns, one of Cherrie's having a rifle barrel underneath. The firearms for the rest of the party were supplied by Kermit and myself, including my Springfield rifle, Kermit's two Winchesters, a 405 and 30-40, the Fox 12-gauge shotgun, and another 16-gauge gun, and a couple of revolvers, a Colt and a Smith & Wesson. We took from New York a couple of canvas canoes, tents, mosquito-bars, plenty of cheesecloth, including nets for the hats, and both light cots and hammocks. We took ropes and pulleys which proved invaluable on our canoe trip. Each equipped himself with the clothing he fancied. Mine consisted of khaki, such as I wore in Africa, with a couple of United States Army flannel shirts and a couple of silk shirts, one pair of hob-nailed shoes with leggings, and one pair of laced leather boots coming nearly to the knee.

Both the naturalists told me that it was well to have either the boots or leggings as a protection against snake-bites, and I also had gauntlets because of the mosquitoes and sand-flies. We intended where possible to live on what we could get from time to time in the country, but we took some United States Army emergency rations, and also ninety cans, each containing a day's provisions for five men, made up by Fiala.

The trip I proposed to take can be understood only if there is a slight knowledge of South American topography. The great mountain chain of the Andes extends down the entire length of the western coast, so close to the Pacific Ocean that no rivers of any importance enter it. The rivers of South America drain into the Atlantic. Southernmost South America, including over half of the territory of the Argentine Republic, consists chiefly of a cool, open plains country. Northward of this country, and eastward of the Andes, lies the great bulk of the South American continent, which is included in the tropical and the subtropical regions. Most of this territory is Brazilian. Aside from certain relatively small stretches drained by coast rivers, this immense region of tropical and subtropical America east of the Andes is drained by the three great river systems of the Plate, the Amazon, and the Orinoco. At their headwaters the Amazon and the Orinoco systems are actually connected by a sluggish natural canal. The headwaters of the northern affluents of the Paraguay and the southern affluents of the Amazon are sundered by a stretch of high land, which toward the east broadens out into the central plateau of Brazil. Geologically this is a very ancient region, having

appeared above the waters before the dawning of the age of reptiles, or, indeed, of any true land vertebrates on the globe. This plateau is a region partly of healthy, rather dry and sandy, open prairie, partly of forest. The great and low-lying basin of the Paraguay, which borders it on the south, is one of the largest, and the still greater basin of the Amazon, which borders it on the north, is the very largest of all the river basins of the earth.

In these basins, but especially in the basin of the Amazon, and thence in most places northward to the Caribbean Sea, lie the most extensive stretches of tropical forest to be found anywhere. The forests of tropical West Africa, and of portions of the Farther-Indian region, are the only ones that can be compared with them. Much difficulty has been experienced in exploring these forests, because under the torrential rains and steaming heat the rank growth of vegetation becomes almost impenetrable, and the streams difficult of navigation; while white men suffer much from the terrible insect scourges and the deadly diseases which modern science has discovered to be due very largely to insect bites. The fauna and flora, however, are of great interest. The American Museum was particularly anxious to obtain collections from the divide between the headwaters of the Paraguay and the Amazon, and from the southern affluents of the Amazon. Our purpose was to ascend the Paraguay as nearly as possible to the head of navigation, thence cross to the sources of one of the affluents of the Amazon, and if possible descend it in canoes built on the spot. The Paraguay is regularly navigated as high as boats

can go. The starting- point for our trip was to be Asuncion, in the state of Paraguay.

My exact plan of operations was necessarily a little indefinite, but on reaching Rio de Janeiro the minister of foreign affairs, Mr. Lauro Muller, who had been kind enough to take great personal interest in my trip, informed me that he had arranged that on the headwaters of the Paraguay, at the town of Caceres, I would be met by a Brazilian Army colonel, himself chiefly Indian by blood, Colonel Rondon. Colonel Rondon has been for a quarter of a century the foremost explorer of the Brazilian hinterland. He was at the time in Manaos, but his lieutenants were in Caceres and had been notified that we were coming.

More important still, Mr. Lauro Muller—who is not only an efficient public servant but a man of wide cultivation, with a quality about him that reminded me of John Hay—offered to help me make my trip of much more consequence than I had originally intended. He has taken a keen interest in the exploration and development of the interior of Brazil, and he believed that my expedition could be used as a means toward spreading abroad a more general knowledge of the country. He told me that he would co-operate with me in every way if I cared to undertake the leadership of a serious expedition into the unexplored portion of western Matto Grosso, and to attempt the descent of a river which flowed nobody knew whither, but which the best-informed men believed would prove to be a very big river, utterly unknown to geographers. I eagerly and gladly accepted, for I felt that with such help the trip could be made of much scientific

value, and that a substantial addition could be made to the geographical knowledge of one of the least-known parts of South America. Accordingly, it was arranged that Colonel Rondon and some assistants and scientists should meet me at or below Corumba, and that we should attempt the descent of the river, of which they had already come across the headwaters.

I had to travel through Brazil, Uruguay, the Argentine, and Chile for six weeks to fulfil my speaking engagements. Fiala, Cherrie, Miller, and Sigg left me at Rio, continuing to Buenos Aires in the boat in which we had all come down from New York. From Buenos Aires they went up the Paraguay to Corumba, where they awaited me. The two naturalists went first, to do all the collecting that was possible; Fiala and Sigg travelled more leisurely, with the heavy baggage.

Before I followed them I witnessed an incident worthy of note from the standpoint of a naturalist, and of possible importance to us because of the trip we were about to take. South America, even more than Australia and Africa, and almost as much as India, is a country of poisonous snakes. As in India, although not to the same degree, these snakes are responsible for a very serious mortality among human beings. One of the most interesting evidences of the modern advance in Brazil is the establishment near Sao Paulo of an institution especially for the study of these poisonous snakes, so as to secure antidotes to the poison and to develop enemies to the snakes themselves. We wished to take into the interior with us some bottles of the anti-venom serum, for on such an expedition there is always

a certain danger from snakes. On one of his trips Cherrie had lost a native follower by snake-bite. The man was bitten while out alone in the forest, and, although he reached camp, the poison was already working in him, so that he could give no intelligible account of what had occurred, and he died in a short time.

Poisonous snakes are of several different families, but the most poisonous ones, those which are dangerous to man, belong to the two great families of the colubrine snakes and the vipers. Most of the colubrine snakes are entirely harmless, and are the common snakes that we meet everywhere. But some of them, the cobras for instance, develop into what are on the whole perhaps the most formidable of all snakes. The only poisonous colubrine snakes in the New World are the ring- snakes, the coral-snakes of the genus elaps, which are found from the extreme southern United States southward to the Argentine. These coral-snakes are not vicious and have small teeth which cannot penetrate even ordinary clothing. They are only dangerous if actually trodden on by some one with bare feet or if seized in the hand. There are harmless snakes very like them in color which are sometimes kept as pets; but it behooves every man who keeps such a pet or who handles such a snake to be very sure as to the genus to which it belongs.

The great bulk of the poisonous snakes of America, including all the really dangerous ones, belong to a division of the widely spread family of vipers which is known as the pit-vipers. In South America these include two distinct

subfamilies or genera—whether they are called families, subfamilies, or genera would depend, I suppose, largely upon the varying personal views of the individual describer on the subject of herpetological nomenclature. One genus includes the rattlesnakes, of which the big Brazilian species is as dangerous as those of the southern United States. But the large majority of the species and individuals of dangerous snakes in tropical America are included in the genus lachecis. These are active, vicious, aggressive snakes without rattles. They are exceedingly poisonous. Some of them grow to a very large size, being indeed among the largest poisonous snakes in the world—their only rivals in this respect being the diamond rattlesnake of Florida, one of the African mambas, and the Indian hamadryad, or snake-eating cobra. The fer-de-lance, so dreaded in Martinique, and the equally dangerous bushmaster of Guiana are included in this genus. A dozen species are known in Brazil, the biggest one being identical with the Guiana bushmaster, and the most common one, the jararaca, being identical, or practically identical with the fer-de-lance. The snakes of this genus, like the rattlesnakes and the Old World vipers and puff-adders, possess long poison-fangs which strike through clothes or any other human garment except stout leather. Moreover, they are very aggressive, more so than any other snakes in the world, except possibly some of the cobras. As, in addition, they are numerous, they are a source of really frightful danger to scantily clad men who work in the fields and forests, or who for any reason are abroad at night.

The poison of venomous serpents is not in the least uniform in its quality. On the contrary, the natural forces—to

use a term which is vague, but which is as exact as our present-day knowledge permits— that have developed in so many different families of snakes these poisoned fangs have worked in two or three totally different fashions. Unlike the vipers, the colubrine poisonous snakes have small fangs, and their poison, though on the whole even more deadly, has entirely different effects, and owes its deadliness to entirely different qualities. Even within the same family there are wide differences. In the jararaca an extraordinary quantity of yellow venom is spurted from the long poison-fangs. This poison is secreted in large glands which, among vipers, give the head its peculiar ace-of-spades shape. The rattlesnake yields a much smaller quantity of white venom, but, quantity for quantity, this white venom is more deadly. It is the great quantity of venom injected by the long fangs of the jararaca, the bushmaster, and their fellows that renders their bite so generally fatal. Moreover, even between these two allied genera of pit-vipers, the differences in the action of the poison are sufficiently marked to be easily recognizable, and to render the most effective anti-venomous serum for each slightly different from the other. However, they are near enough alike to make this difference, in practice, of comparatively small consequence. In practice the same serum can be used to neutralize the effect of either, and, as will be seen later on, the snake that is immune to one kind of venom is also immune to the other.

But the effect of the venom of the poisonous colubrine snakes is totally different from, although to the full as deadly as, the effect of the poison of the rattlesnake or

jararaca. The serum that is an antidote as regards the colubrines. The animal that is immune to the bite of one may not be immune to the bite of the other. The bite of a cobra or other colubrine poisonous snake is more painful in its immediate effects than is the bite of one of the big vipers. The victim suffers more. There is a greater effect on the nerve-centres, but less swelling of the wound itself, and, whereas the blood of the rattlesnake's victim coagulates, the blood of the victim of an elapine snake—that is, of one of the only poisonous American colubrines— becomes watery and incapable of coagulation.

Snakes are highly specialized in every way, including their prey. Some live exclusively on warm-blooded animals, on mammals, or birds. Some live exclusively on batrachians, others only on lizards, a few only on insects. A very few species live exclusively on other snakes. These include one very formidable venomous snake, the Indian hamadryad, or giant cobra, and several non-poisonous snakes. In Africa I killed a small cobra which contained within it a snake but a few inches shorter than itself; but, as far as I could find out, snakes were not the habitual diet of the African cobras.

The poisonous snakes use their venom to kill their victims, and also to kill any possible foe which they think menaces them. Some of them are good-tempered, and only fight if injured or seriously alarmed. Others are excessively irritable, and on rare occasions will even attack of their own accord when entirely unprovoked and unthreatened.

On reaching Sao Paulo on our southward journey from Rio to Montevideo, we drove out to the "Instituto Serumtherapico," designed for the study of the effects of the venom of poisonous Brazilian snakes. Its director is Doctor Vital Brazil, who has performed a most extraordinary work and whose experiments and investigations are not only of the utmost value to Brazil but will ultimately be recognized as of the utmost value for humanity at large. I know of no institution of similar kind anywhere. It has a fine modern building, with all the best appliances, in which experiments are carried on with all kinds of serpents, living and dead, with the object of discovering all the properties of their several kinds of venom, and of developing various anti-venom serums which nullify the effects of the different venoms. Every effort is made to teach the people at large by practical demonstration in the open field the lessons thus learned in the laboratory. One notable result has been the diminution in the mortality from snake-bites in the province of Sao Paulo.

In connection with his institute, and right by the laboratory, the doctor has a large serpentarium, in which quantities of the common poisonous and non-poisonous snakes are kept, and some of the rarer ones. He has devoted considerable time to the effort to find out if there are any natural enemies of the poisonous snakes of his country, and he has discovered that the most formidable enemy of the many dangerous Brazilian snakes is a non-poisonous, entirely harmless, rather uncommon Brazilian snake, the mussurama. Of all the interesting things the doctor showed us, by far the most interesting was the

opportunity of witnessing for ourselves the action of the mussurama toward a dangerous snake.

The doctor first showed us specimens of the various important snakes, poisonous and non-poisonous, in alcohol. Then he showed us preparations of the different kinds of venom and of the different anti-venom serums, presenting us with some of the latter for our use on the journey. He has been able to produce two distinct kinds of anti-venom serum, one to neutralize the virulent poison of the rattlesnake's bite, the other to neutralize the poison of the different snakes of the lachecis genus. These poisons are somewhat different and moreover there appear to be some differences between the poisons of the different species of lachecis; in some cases the poison is nearly colorless, and in others, as in that of the jararaca, whose poison I saw, it is yellow.

But the vital difference is that between all these poisons of the pit- vipers and the poisons of the colubrine snakes, such as the cobra and the coral-snake. As yet the doctor has not been able to develop an anti-venom serum which will neutralize the poison of these colubrine snakes. Practically this is a matter of little consequence in Brazil, for the Brazilian coral-snakes are dangerous only when mishandled by some one whose bare skin is exposed to the bite. The numerous accidents and fatalities continually occurring in Brazil are almost always to be laid to the account of the several species of lachecis and the single species of rattlesnake.

Finally, the doctor took us into his lecture-room to show us how he conducted his experiments. The various snakes were in boxes, on one side of the room, under the care of a skilful and impassive assistant, who handled them with the cool and fearless caution of the doctor himself. The poisonous ones were taken out by means of a long-handled steel hook. All that is necessary to do is to insert this under the snake and lift him off the ground. He is not only unable to escape, but he is unable to strike, for he cannot strike unless coiled so as to give himself support and leverage. The table on which the snakes are laid is fairly large and smooth, differing in no way from an ordinary table.

There were a number of us in the room, including two or three photographers. The doctor first put on the table a non-poisonous but very vicious and truculent colubrine snake. It struck right and left at us. Then the doctor picked it up, opened its mouth, and showed that it had no fangs, and handed it to me. I also opened its mouth and examined its teeth, and then put it down, whereupon, its temper having been much ruffled, it struck violently at me two or three times. In its action and temper this snake was quite as vicious as the most irritable poisonous snakes. Yet it is entirely harmless. One of the innumerable mysteries of nature which are at present absolutely insoluble is why some snakes should be so vicious and others absolutely placid and good-tempered.

After removing the vicious harmless snake, the doctor warned us to get away from the table, and his attendant put on it, in succession, a very big lachecis—of the kind called

bushmaster—and a big rattlesnake. Each coiled menacingly, a formidable brute ready to attack anything that approached. Then the attendant adroitly dropped his iron crook on the neck of each in succession, seized it right behind the head, and held it toward the doctor. The snake's mouth was in each case wide open, and the great fangs erect and very evident. It would not have been possible to have held an African ring-necked cobra in such fashion, because the ring-neck would have ejected its venom through the fangs into the eyes of the onlookers. There was no danger in this case, and the doctor inserted a shallow glass saucer into the mouth of the snake behind the fangs, permitted it to eject its poison, and then himself squeezed out the remaining poison from the poison- bags through the fangs. From the big lachecis came a large quantity of yellow venom, a liquid which speedily crystallized into a number of minute crystals. The rattlesnake yielded a much less quantity of white venom, which the doctor assured us was far more active than the yellow lachecis venom. Then each snake was returned to its box unharmed.

After this the doctor took out of a box and presented to me a fine, handsome, nearly black snake, an individual of the species called the mussurama. This is in my eyes perhaps the most interesting serpent in the world. It is a big snake, four or five feet long, sometimes even longer, nearly black, lighter below, with a friendly, placid temper. It lives exclusively on other snakes, and is completely immune to the poison of the lachecis and rattlesnake groups, which contain all the really dangerous snakes of America. Doctor Brazil told me that he had conducted many experiments

with this interesting snake. It is not very common, and prefers wet places in which to live. It lays eggs, and the female remains coiled above the eggs, the object being apparently not to warm them, but to prevent too great evaporation. It will not eat when moulting, nor in cold weather. Otherwise it will eat a small snake every five or six days, or a big one every fortnight.

There is the widest difference, both among poisonous and non-poisonous snakes, not alone in nervousness and irascibility but also in ability to accustom themselves to out-of-the-way surroundings. Many species of non-poisonous snakes which are entirely harmless, to man or to any other animal except their small prey, are nevertheless very vicious and truculent, striking right and left and biting freely on the smallest provocation—this is the case with the species of which the doctor had previously placed a specimen on the table. Moreover, many snakes, some entirely harmless and some vicious ones, are so nervous and uneasy that it is with the greatest difficulty they can be induced to eat in captivity, and the slightest disturbance or interference will prevent their eating. There are other snakes, however, of which the mussurama is perhaps the best example, which are very good captives, and at the same time very fearless, showing a complete indifference not only to being observed but to being handled when they are feeding.

There is in the United States a beautiful and attractive snake, the king-snake, with much the same habits as the mussurama. It is friendly toward mankind, and not

poisonous, so that it can be handled freely. It feeds on other serpents, and will kill a rattlesnake as big as itself, being immune to the rattlesnake venom. Mr. Ditmars, of the Bronx Zoo, has made many interesting experiments with these king- snakes. I have had them in my own possession. They are good-natured and can generally be handled with impunity, but I have known them to bite, whereas Doctor Brazil informed me that it was almost impossible to make the mussurama bite a man. The king-snake will feed greedily on other snakes in the presence of man—I knew of one case where it partly swallowed another snake while both were in a small boy's pocket. It is immune to viper poison but it is not immune to colubrine poison. A couple of years ago I was informed of a case where one of these king-snakes was put into an enclosure with an Indian snake-eating cobra or hamadryad of about the same size. It killed the cobra but made no effort to swallow it, and very soon showed the effects of the cobra poison. I believe it afterward died, but unfortunately I have mislaid my notes and cannot now remember the details of the incident.

Doctor Brazil informed me that the mussurama, like the king-snake, was not immune to the colubrine poison. A mussurama in his possession, which had with impunity killed and eaten several rattlesnakes and representatives of the lachecis genus, also killed and ate a venomous coral-snake, but shortly afterward itself died from the effects of the poison. It is one of the many puzzles of nature that these American serpents which kill poisonous serpents should only have grown immune to the poison of the most dangerous American poisonous serpents, the pit-vipers, and

should not have become immune to the poison of the coral-snakes which are commonly distributed throughout their range. Yet, judging by the one instance mentioned by Doctor Brazil, they attack and master these coral-snakes, although the conflict in the end results in their death. It would be interesting to find out whether this attack was exceptional, that is, whether the mussurama has or has not as a species learned to avoid the coral-snake. If it was not exceptional, then not only is the instance highly curious in itself, but it would also go far to explain the failure of the mussurama to become plentiful.

For the benefit of those who are not acquainted with the subject, I may mention that the poison of a poisonous snake is not dangerous to its own species unless injected in very large doses, about ten times what would normally be injected by a bite; but that it is deadly to all other snakes, poisonous or non-poisonous, save as regards the very few species which themselves eat poisonous snakes. The Indian hamadryad, or giant cobra, is exclusively a snake-eater. It evidently draws a sharp distinction between poisonous and non-poisonous snakes, for Mr. Ditmars has recorded that two individuals in the Bronx Zoo which are habitually fed on harmless snakes, and attack them eagerly, refused to attack a copperhead which was thrown into their cage, being evidently afraid of this pit-viper. It would be interesting to find out if the hamadryad is afraid to prey on all pit-vipers, and also whether it will prey on its small relative, the true cobra—for it may well be that, even if not immune to the viper poison, it is immune to the poison of its close ally, the smaller cobra.

All these and many other questions would be speedily settled by Doctor Brazil if he were given the opportunity to test them. It must be remembered, moreover, that not only have his researches been of absorbing value from the standpoint of pure science but that they also have a real utilitarian worth. He is now collecting and breeding the mussurama. The favorite prey of the mussurama is the most common and therefore the most dangerous poisonous snake of Brazil, the jararaca, which is known in Martinique as the fer-de-lance. In Martinique and elsewhere this snake is such an object of terror as to be at times a genuine scourge. Surely it would be worth while for the authorities of Martinique to import specimens of the mussurama to that island. The mortality from snake-bite in British India is very great. Surely it would be well worth while for the able Indian Government to copy Brazil and create such an institute as that over which Doctor Vital Brazil is the curator.

At first sight it seems extraordinary that poisonous serpents, so dreaded by and so irresistible to most animals, should be so utterly helpless before the few creatures that prey on them. But the explanation is easy. Any highly specialized creature, the higher its specialization, is apt to be proportionately helpless when once its peculiar specialized traits are effectively nullified by an opponent. This is eminently the case with the most dangerous poisonous snakes. In them a highly peculiar specialization has been carried to the highest point. They rely for attack and defence purely on their poison-fangs. All other means and methods of attack and defence have atrophied. They neither crush nor tear with their teeth nor constrict with

their bodies. The poison-fangs are slender and delicate, and, save for the poison, the wound inflicted is of a trivial character. In consequence they are helpless in the presence of any animal which the poison does not affect. There are several mammals immune to snake- bite, including various species of hedgehog, pig, and mongoose—the other mammals which kill them do so by pouncing on them unawares or by avoiding their stroke through sheer quickness of movement; and probably this is the case with most snake-eating birds. The mongoose is very quick, but in some cases at least—I have mentioned one in the "African Game Trails"—it permits itself to be bitten by poisonous snakes, treating the bite with utter indifference. There should be extensive experiments made to determine if there are species of mongoose immune to both cobra and viper poison. Hedgehogs, as determined by actual experiments, pay no heed at all to viper poison even when bitten on such tender places as the tongue and lips and eat the snake as if it were a radish. Even among animals which are not immune to the poison different species are very differently affected by the different kinds of snake poisons. Not only are some species more resistant than others to all poisons, but there is a wide variation in the amount of immunity each displays to any given venom. One species will be quickly killed by the poison from one species of snake, and be fairly resistant to the poison of another; whereas in another species the conditions may be directly reversed.

The mussurama which Doctor Brazil handed me was a fine specimen, perhaps four and a half feet long. I lifted the smooth, lithe bulk in my hands, and then let it twist its coils

so that it rested at ease in my arms; it glided to and fro, on its own length, with the sinuous grace of its kind, and showed not the slightest trace of either nervousness or bad temper. Meanwhile the doctor bade his attendant put on the table a big jararaca, or fer-de-lance, which was accordingly done. The jararaca was about three feet and a half, or perhaps nearly four feet long—that is, it was about nine inches shorter than the mussurama. The latter, which I continued to hold in my arms, behaved with friendly and impassive indifference, moving easily to and fro through my hands, and once or twice hiding its head between the sleeve and the body of my coat. The doctor was not quite sure how the mussurama would behave, for it had recently eaten a small snake, and unless hungry it pays no attention whatever to venomous snakes, even when they attack and bite it. However, it fortunately proved still to have a good appetite.

The jararaca was alert and vicious. It partly coiled itself on the table, threatening the bystanders. I put the big black serpent down on the table four or five feet from the enemy and headed in its direction. As soon as I let go with my hands it glided toward where the threatening, formidable-looking lance-head lay stretched in a half coil. The mussurama displayed not the slightest sign of excitement. Apparently it trusted little to its eyes, for it began to run its head along the body of the jararaca, darting out its flickering tongue to feel just where it was, as it nosed its way up toward the head of its antagonist. So placid were its actions that I did not at first suppose that it meant to attack,

for there was not the slightest exhibition of anger or excitement.

It was the jararaca that began the fight. It showed no fear whatever of its foe, but its irritable temper was aroused by the proximity and actions of the other, and like a flash it drew back its head and struck, burying its fangs in the forward part of the mussurama's body. Immediately the latter struck in return, and the counter-attack was so instantaneous that it was difficult to see just what had happened. There was tremendous writhing and struggling on the part of the jararaca; and then, leaning over the knot into which the two serpents were twisted, I saw that the mussurama had seized the jararaca by the lower jaw, putting its own head completely into the wide-gaping mouth of the poisonous snake. The long fangs were just above the top of the mussurama's head; and it appeared, as well as I could see, that they were once again driven into the mussurama; but without the slightest effect. Then the fangs were curved back in the jaw, a fact which I particularly noted, and all effort at the offensive was abandoned by the poisonous snake.

Meanwhile the mussurama was chewing hard, and gradually shifted its grip, little by little, until it got the top of the head of the jararaca in its mouth, the lower jaw of the jararaca being spread out to one side. The venomous serpent was helpless; the fearsome master of the wild life of the forest, the deadly foe of humankind, was itself held in the grip of death. Its cold, baleful serpent's eyes shone, as

evil as ever. But it was dying. In vain it writhed and struggled. Nothing availed it.

Once or twice the mussurama took a turn round the middle of the body of its opponent, but it did not seem to press hard, and apparently used its coils chiefly in order to get a better grip so as to crush the head of its antagonist, or to hold the latter in place. This crushing was done by its teeth; and the repeated bites were made with such effort that the muscles stood out on the mussurama's neck. Then it took two coils round the neck of the jararaca and proceeded deliberately to try to break the backbone of its opponent by twisting the head round. With this purpose it twisted its own head and neck round so that the lighter-colored surface was uppermost; and indeed at one time it looked as if it had made almost a complete single spiral revolution of its own body. It never for a moment relaxed its grip except to shift slightly the jaws.

In a few minutes the jararaca was dead, its head crushed in, although the body continued to move convulsively. When satisfied that its opponent was dead, the mussurama began to try to get the head in its mouth. This was a process of some difficulty on account of the angle at which the lower jaw of the jararaca stuck out. But finally the head was taken completely inside and then swallowed. After this, the mussurama proceeded deliberately, but with unbroken speed, to devour its opponent by the simple process of crawling outside it, the body and tail of the jararaca writhing and struggling until the last. During the early portion of the meal, the mussurama put a stop to this writhing and

struggling by resting its own body on that of its prey; but toward the last the part of the body that remained outside was left free to wriggle as it wished.

Not only was the mussurama totally indifferent to our presence, but it was totally indifferent to being handled while the meal was going on. Several times I replaced the combatants in the middle of the table when they had writhed to the edge, and finally, when the photographers found that they could not get good pictures, I held the mussurama up against a white background with the partially swallowed snake in its mouth; and the feast went on uninterruptedly. I never saw cooler or more utterly unconcerned conduct; and the ease and certainty with which the terrible poisonous snake was mastered gave me the heartiest respect and liking for the easy-going, good-natured, and exceedingly efficient serpent which I had been holding in my arms.

Our trip was not intended as a hunting-trip but as a scientific expedition. Before starting on the trip itself, while travelling in the Argentine, I received certain pieces of first-hand information concerning the natural history of the jaguar, and of the cougar, or puma, which are worth recording. The facts about the jaguar are not new in the sense of casting new light on its character, although they are interesting; but the facts about the behavior of the puma in one district of Patagonia are of great interest, because they give an entirely new side of its life-history.

There was travelling with me at the time Doctor Francisco P. Moreno, of Buenos Aires. Doctor Moreno is at the present day a member of the National Board of Education of the Argentine, a man who has worked in every way for the benefit of his country, perhaps especially for the benefit of the children, so that when he was first introduced to me it was as the "Jacob Riis of the Argentine"—for they know my deep and affectionate intimacy with Jacob Riis. He is also an eminent man of science, who has done admirable work as a geologist and a geographer. At one period, in connection with his duties as a boundary commissioner on the survey between Chile and the Argentine, he worked for years in Patagonia. It was he who made the extraordinary discovery in a Patagonian cave of the still fresh fragments of skin and other remains of the mylodon, the aberrant horse known as the onohipidium, the huge South American tiger, and the macrauchenia, all of them extinct animals. This discovery showed that some of the strange representatives of the giant South American Pleistocene fauna had lasted down to within a comparatively few thousand years, down to the time when man, substantially as the Spaniards found him, flourished on the continent. Incidentally the discovery tended to show that this fauna had lasted much later in South America than was the case with the corresponding faunas in other parts of the world; and therefore it tended to disprove the claims advanced by Doctor Ameghino for the extreme age, geologically, of this fauna, and for the extreme antiquity of man on the American continent.

One day Doctor Moreno handed me a copy of The Outlook containing my account of a cougar-hunt in Arizona, saying

that he noticed that I had very little faith in cougars attacking men, although I had explicitly stated that such attacks sometimes occurred. I told him, Yes, that I had found that the cougar was practically harmless to man, the undoubtedly authentic instances of attacks on men being so exceptional that they could in practice be wholly disregarded. Thereupon Doctor Moreno showed me a scar on his face, and told me that he had himself been attacked and badly mauled by a puma which was undoubtedly trying to prey on him; that is, which had started on a career as a man-eater. This was to me most interesting. I had often met men who knew other men who had seen other men who said that they had been attacked by pumas, but this was the first time that I had ever come across a man who had himself been attacked. Doctor Moreno, as I have said, is not only an eminent citizen, but an eminent scientific man, and his account of what occurred is unquestionably a scientifically accurate statement of the facts. I give it exactly as the doctor told it; paraphrasing a letter he sent me, and including one or two answers to questions I put to him. The doctor, by the way, stated to me that he had known Mr. Hudson, the author of the "Naturalist on the Plata," and that the latter knew nothing whatever of pumas from personal experience and had accepted as facts utterly wild fables.

Undoubtedly, said the doctor, the puma in South America, like the puma in North America, is, as a general rule, a cowardly animal which not only never attacks man, but rarely makes any efficient defence when attacked. The Indian and white hunters have no fear of it in most parts of