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A Hunter-Naturalist in the Brazilian Wilderness

Up the Paraguay

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 Alsatian 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 Müller, 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 Cáceres, 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 Cáceres and had been notified that we were coming.

More important still, Mr. Lauro Müller—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 Corumbá, 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 fulfill 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 Corumbá, 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 *Lachesis*. 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 São Paulo on our southward journey from Rio to Montevideo, we drove out to the "Instituto Serumthérápico," 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 someone 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 worthwhile 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 utterly 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 the country, and its harmlessness to man is proverbial. But there is one particular spot in southern Patagonia where cougars, to the doctor's own personal knowledge, have for years been dangerous foes of man. This curious local change in habits, by the way, is nothing unprecedented as regards wild animals. In portions of its range, as I am informed by Mr. Lord Smith, the Asiatic tiger can hardly be forced to fight man, and never preys on him, while throughout most of its range it is a most dangerous beast, and often turns man-eater. So there are waters in which sharks are habitual man-eaters, and others where they never touch men; and there are rivers and lakes where crocodiles or caymans are very dangerous, and others where they are practically harmless—I have myself seen this in Africa.

In March, 1877, Doctor Moreno with a party of men working on the boundary commission, and with a number of Patagonian horse-Indians, was encamped for some weeks beside Lake Viedma, which had not before been visited by white men for a century, and which was rarely visited even by Indians. One morning, just before sunrise, he left his camp by the south shore of the lake, to make a topographical sketch of the lake. He was unarmed, but carried a prismatic compass in a leather case with a strap. It was cold, and he wrapped his poncho of guanaco-hide round his neck and head. He had walked a few hundred yards, when a puma, a female, sprang on him from behind and knocked him down. As she sprang on him she tried to seize his head with one paw, striking him on the shoulder with the other. She lacerated his mouth and also his back, but tumbled over with him, and in the scuffle they separated before she could bite him. He sprang to his feet, and, as he said, was forced to think quickly. She had recovered herself, and sat on her haunches like a cat, looking at him, and then crouched to spring again; whereupon he whipped off his poncho, and as she sprang at him he opened it, and at the same moment hit her head with the prismatic compass in its case which he held by the strap. She struck the poncho and was evidently puzzled by it, for, turning, she slunk off to one side, under a bush, and then proceeded to try to get round behind him. He faced her, keeping his eyes upon her, and backed off. She followed him for three or four hundred yards. At least twice she came up to attack him, but each time he opened his poncho and yelled, and at the last moment she

shrank back. She continually, however, tried, by taking advantage of cover, to sneak up to one side, or behind, to attack him. Finally, when he got near camp, she abandoned the pursuit and went into a small patch of bushes. He raised the alarm; an Indian rode up and set fire to the bushes from the windward side. When the cougar broke from the bushes, the Indian rode after her, and threw his bolas, which twisted around her hind legs; and while she was struggling to free herself, he brained her with his second bolas. The doctor's injuries were rather painful, but not serious.

Twenty-one years later, in April, 1898, he was camped on the same lake, but on the north shore, at the foot of a basaltic cliff. He was in company with four soldiers, with whom he had travelled from the Strait of Magellan. In the night he was aroused by the shriek of a man and the barking of his dogs. As the men sprang up from where they were lying asleep they saw a large puma run off out of the firelight into the darkness. It had sprung on a soldier named Marcelino Huquen while he was asleep, and had tried to carry him off. Fortunately, the man was so wrapped up in his blanket, as the night was cold, that he was not injured. The puma was never found or killed.

About the same time a surveyor of Doctor Moreno's party, a Swede named Arneberg, was attacked in similar fashion. The doctor was not with him at the time. Mr. Arneberg was asleep in the forest near Lake San Martin. The cougar both bit and clawed him, and tore his mouth, breaking out three teeth. The man was rescued; but this puma also escaped.

The doctor stated that in this particular locality the Indians, who elsewhere paid no heed whatever to the puma, never let their women go out after wood for fuel unless two or three were together. This was because on several occasions women who had gone out alone were killed by pumas. Evidently in this one locality the habit of at least occasional man-eating has become chronic with a species which elsewhere is the most cowardly, and to man the least dangerous, of all the big cats.

These observations of Doctor Moreno have a peculiar value, because, as far as I know, they are the first trustworthy accounts of a cougar's having attacked man save under circumstances so exceptional as to make the attack signify little more than the similar exceptional instances of attack by various other species of wild animals that are not normally dangerous to man.

The jaguar, however, has long been known not only to be a dangerous foe when itself attacked, but also now and then to become a man-eater. Therefore the instances of such attacks furnished me are of merely corroborative value.

In the excellent zoological gardens at Buenos Aires the curator, Doctor Onelli, a naturalist of note, showed us a big male jaguar which had been trapped in the Chaco, where it had already begun a career as a man-eater, having killed three persons. They were killed, and two of them were eaten; the animal was trapped, in consequence of the alarm excited by the death of his third victim. This jaguar was very savage; whereas a young jaguar, which was in a cage with a young tiger, was playful and friendly, as was also the case with the young tiger. On my trip to visit La Plata Museum I was accompanied by Captain Vicente Montes, of the Argentine Navy, an accomplished officer of scientific attainments. He had at one time been engaged on a survey of the boundary between the Argentine and Paraná and Brazil. They had a quantity of dried beef in camp. On several occasions a jaguar came into camp after this dried beef. Finally they succeeded in protecting it so that he could not reach it. The result, however, was disastrous. On the next occasion that he visited camp, at midnight, he seized a man. Everybody was asleep at the time, and the jaguar came in so noiselessly as to elude the vigilance

of the dogs. As he seized the man, the latter gave one yell, but the next moment was killed, the jaguar driving his fangs through the man's skull into the brain. There was a scene of uproar and confusion, and the jaguar was forced to drop his prey and flee into the woods. Next morning they followed him with the dogs, and finally killed him. He was a large male, in first-class condition. The only features of note about these two incidents was that in each case the man-eater was a powerful animal in the prime of life; whereas it frequently happens that the jaguars that turn man-eaters are old animals, and have become too inactive or too feeble to catch their ordinary prey.

During the two months before starting from Asuncion, in Paraguay, for our journey into the interior, I was kept so busy that I had scant time to think of natural history. But in a strange land a man who cares for wild birds and wild beasts always sees and hears something that is new to him and interests him. In the dense tropical woods near Rio Janeiro I heard in late October—springtime, near the southern tropic—the songs of many birds that I could not identify. But the most beautiful music was from a shy woodland thrush, sombre-colored, which lived near the ground in the thick timber, but sang high among the branches. At a great distance we could hear the ringing, musical, bell-like note, long-drawn and of piercing sweetness, which occurs at intervals in the song; at first I thought this was the song, but when it was possible to approach the singer I found that these far-sounding notes were scattered through a continuous song of great melody. I never listened to one that impressed me more. In different places in Argentina I heard and saw the Argentine mocking-bird, which is not very unlike our own, and is also a delightful and remarkable singer. But I never heard the wonderful white-banded mocking-bird, which is said by Hudson, who knew well the birds of both South America and Europe, to be the song-king of them all.

Most of the birds I thus noticed while hurriedly passing through the country were, of course, the conspicuous ones. The spurred lapwings, big, tame, boldly marked plover, were everywhere; they were very noisy and active and both inquisitive and daring, and they have a very curious dance custom. No man need look for them. They will look for him, and when they find him they will fairly yell the discovery to the universe. In the marshes of the lower Paraná I saw flocks of scarlet-headed blackbirds on the tops of the reeds; the females are as strikingly colored as the males, and their jet-black bodies and brilliant red heads make it impossible for them to escape observation among their natural surroundings. On the plains to the west I saw flocks of the beautiful rose-breasted starlings; unlike the red-headed blackbirds, which seemed fairly to court attention, these starlings sought to escape observation by crouching on the ground so that their red breasts were hidden. There were yellow-shouldered blackbirds in wet places, and cow buntings abounded.

But the most conspicuous birds I saw were members of the family of tyrant flycatchers, of which our own king-bird is the most familiar example. This family is very numerous in Argentina, both in species and individuals. Some of the species are so striking, both in color and habits, and in one case also in shape, as to attract the attention of even the unobservant. The least conspicuous, and nevertheless very conspicuous, among those that I saw was the *bientevido*, which is brown above, yellow beneath, with a boldly marked black and white head, and a yellow crest. It is very noisy, is common in the neighborhood of houses, and builds a big domed nest. It is really a big, heavy kingbird, fiercer and more powerful than any northern kingbird. I saw them assail not only the big but the small hawks with fearlessness, driving them in headlong flight. They not only capture insects, but pounce on mice, small frogs, lizards, and little snakes, rob birds' nests of the fledgling young, and catch tadpoles and even small fish.

Two of the tyrants which I observed are like two with which I grew fairly familiar in Texas. The scissor-tail is common throughout the open country, and the long tail feathers, which seem at times to hamper its flight, attract attention whether the bird is in flight or perched on a tree. It has a habit of occasionally soaring into the air and descending in loops and spirals. The scarlet tyrant I saw in the orchards and gardens. The male is a fascinating little bird, coal-black above, while his crested head and the body beneath are brilliant scarlet. He utters his rapid, low-voiced musical trill in the air, rising with fluttering wings to a height of a hundred feet, hovering while he sings, and then falling back to earth. The color of the bird and the character of his performance attract the attention of every observer, bird, beast, or man, within reach of vision.

The red-backed tyrant is utterly unlike any of his kind in the United States, and until I looked him up in Sclater and Hudson's ornithology I never dreamed that he belonged to this family. He—for only the male is so brightly colored—is coal-black with a dull-red back. I saw these birds on December 1 near Barilloche, out on the bare Patagonian plains. They behaved like pipits or longspurs, running actively over the ground in the same manner and showing the same restlessness and the same kind of flight. But whereas pipits are inconspicuous, the red-backs at once attracted attention by the contrast between their bold coloring and the grayish or yellowish tones of the ground along which they ran. The silver-bill tyrant, however, is much more conspicuous; I saw it in the same neighborhood as the red-back and also in many other places. The male is jet-black, with white bill and wings. He runs about on the ground like a pipit, but also frequently perches on some bush to go through a strange flight-song performance. He perches motionless, bolt upright, and even then his black coloring advertises him for a quarter of a mile round about. But every few minutes he springs up into the air to the height of twenty or thirty feet, the white wings flashing in contrast to the black body, screams and gyrates, and then instantly returns to his former post and resumes his erect pose of waiting. It is hard to imagine a more conspicuous bird than the silver-bill; but the next and last tyrant flycatcher of which I shall speak possesses on the whole the most advertising coloration of any small bird I have ever seen in the open country, and moreover this advertising coloration exists in both sexes and throughout the year. It is a brilliant white, all over, except the long wing-quills and the ends of the tail-feathers, which are black. The first one I saw, at a very long distance, I thought must be an albino. It perches on the top of a bush or tree watching for its prey, and it shines in the sun like a silver mirror. Every hawk, cat, or man must see it; no one can help seeing it.

These common Argentine birds, most of them of the open country, and all of them with a strikingly advertising coloration, are interesting because of their beauty and their habits. They are also interesting because they offer such illuminating examples of the truth that many of the most common and successful birds not merely lack a concealing coloration, but possess a coloration which is in the highest degree revealing. The coloration and the habits of most of these birds are such that every hawk or other foe that can see at all must have its attention attracted to them. Evidently in their cases neither the coloration nor any habit of concealment based on the coloration is a survival factor, and this although they live in a land teeming with bird-eating hawks. Among the higher vertebrates there are many known factors which have influence, some in one set of cases, some in another set of cases, in the development and preservation of species. Courage, intelligence, adaptability, prowess, bodily vigor, speed, alertness, ability to hide, ability to build structures which will protect the young while they are helpless, fecundity—all, and many more like them, have their several places; and behind all these visible causes there are at work other and often more potent causes of which as yet science can say nothing. Some species owe much to a given attribute which may be wholly lacking in influence on other species; and

every one of the attributes above enumerated is a survival factor in some species, while in others it has no survival value whatever, and in yet others, although of benefit, it is not of sufficient benefit to offset the benefit conferred on foes or rivals by totally different attributes. Intelligence, for instance, is of course a survival factor; but to-day there exist multitudes of animals with very little intelligence which have persisted through immense periods of geologic time either unchanged or else without any change in the direction of increased intelligence; and during their species-life they have witnessed the death of countless other species of far greater intelligence but in other ways less adapted to succeed in the environmental complex. The same statement can be made of all the many, many other known factors in development, from fecundity to concealing coloration; and behind them lie forces as to which we veil our ignorance by the use of high-sounding nomenclature—as when we use such a convenient but far from satisfactory term as orthogenesis.

II--Up the Paraguay

ON the afternoon of December 9 we left the attractive and picturesque city of Asuncion to ascend the Paraguay. With generous courtesy the Paraguayan Government had put at my disposal the gunboat-yacht of the President himself, a most comfortable river steamer, and so the opening days of our trip were pleasant in every way. The food was good, our quarters were clean, we slept well, below or on deck, usually without our mosquito-nettings, and in daytime the deck was pleasant under the awnings. It was hot, of course, but we were dressed suitably in our exploring and hunting clothes and did not mind the heat. The river was low, for there had been dry weather for some weeks—judging from the vague and contradictory information I received there is much elasticity to the terms wet season and dry season at this part of the Paraguay. Under the brilliant sky we steamed steadily up the mighty river; the sunset was glorious as we leaned on the port railing; and after nightfall the moon, nearly full and hanging high in the heavens, turned the water to shimmering radiance. On the mud-flats and sandbars, and among the green rushes of the bays and inlets, were stately water-fowl; crimson flamingoes and rosy spoonbills, dark-colored ibis and white storks with black wings. Darters, with snakelike necks and pointed bills, perched in the trees on the brink of the river. Snowy egrets flapped across the marshes. Caymans were common, and differed from the crocodiles we had seen in Africa in two points: they were not alarmed by the report of a rifle when fired at, and they lay with the head raised instead of stretched along the sand.

For three days, as we steamed northward toward the Tropic of Capricorn, and then passed it, we were within the Republic of Paraguay. On our right, to the east, there was a fairly well-settled country, where bananas and oranges were cultivated and other crops of hot countries raised. On the banks we passed an occasional small town, or saw a ranch-house close to the river's brink, or stopped for wood at some little settlement. Across the river to the west lay the level, swampy, fertile wastes known as the Chaco, still given over either to the wild Indians or to cattle-ranching on a gigantic scale. The broad river ran in curves between mud-banks where terraces marked successive periods of flood. A belt of forest stood on each bank, but it was only a couple of hundred yards wide. Back of it was the open country; on the Chaco side this was a vast plain of grass, dotted with tall, graceful palms. In places the belt of forest vanished and the palm-dotted prairie came to the river's edge. The Chaco is an ideal cattle country, and not really unhealthy. It will be covered with ranches at a not distant day. But mosquitoes and many other winged insect pests swarm over it. Cherrie and Miller had spent a week there collecting

mammals and birds prior to my arrival at Asuncion. They were veterans of the tropics, hardened to the insect plagues of Guiana and the Orinoco. But they reported that never had they been so tortured as in the Chaco. The sand-flies crawled through the meshes in the mosquito-nets, and forbade them to sleep; if in their sleep a knee touched the net the mosquitoes fell on it so that it looked as if riddled by birdshot; and the nights were a torment, although they had done well in their work, collecting some two hundred and fifty specimens of birds and mammals.

Nevertheless for some as yet inscrutable reason the river served as a barrier to certain insects which are menaces to the cattlemen. With me on the gunboat was an old Western friend, Tex Rickard, of the Panhandle and Alaska and various places in between. He now has a large tract of land and some thirty-five thousand head of cattle in the Chaco, opposite Concepcion, at which city he was to stop. He told me that horses did not do well in the Chaco but that cattle thrived, and that while ticks swarmed on the east bank of the great river, they would not live on the west bank. Again and again he had crossed herds of cattle which were covered with the loathsome bloodsuckers; and in a couple of months every tick would be dead. The worst animal foes of man, indeed the only dangerous foes, are insects; and this is especially true in the tropics. Fortunately, exactly as certain differences too minute for us as yet to explain render some insects deadly to man or domestic animals, while closely allied forms are harmless, so, for other reasons, which also we are not as yet able to fathom, these insects are for the most part strictly limited by geographical and other considerations. The war against what Sir Harry Johnston calls the really material devil, the devil of evil wild nature in the tropics, has been waged with marked success only during the last two decades. The men, in the United States, in England, France, Germany, Italy—the men like Doctor Cruz in Rio Janeiro and Doctor Vital Brazil in Sao Paulo—who work experimentally within and without the laboratory in their warfare against the disease and death bearing insects and microbes, are the true leaders in the fight to make the tropics the home of civilized man.

Late on the evening of the second day of our trip, just before midnight, we reached Concepcion. On this day, when we stopped for wood or to get provisions—at picturesque places, where the women from rough mud and thatched cabins were washing clothes in the river, or where ragged horsemen stood gazing at us from the bank, or where dark, well-dressed ranchmen stood in front of red-roofed houses—we caught many fish. They belonged to one of the most formidable genera of fish in the world, the piranha or cannibal fish, the fish that eats men when it can get the chance. Farther north there are species of small piranha that go in schools. At this point on the Paraguay the piranha do not seem to go in regular schools, but they swarm in all the waters and attain a length of eighteen inches or over. They are the most ferocious fish in the world. Even the most formidable fish, the sharks or the barracudas, usually attack things smaller than themselves. But the piranhas habitually attack things much larger than themselves. They will snap a finger off a hand incautiously trailed in the water; they mutilate swimmers—in every river town in Paraguay there are men who have been thus mutilated; they will rend and devour alive any wounded man or beast; for blood in the water excites them to madness. They will tear wounded wild fowl to pieces; and bite off the tails of big fish as they grow exhausted when fighting after being hooked. Miller, before I reached Asuncion, had been badly bitten by one. Those that we caught sometimes bit through the hooks, or the double strands of copper wire that served as leaders, and got away. Those that we hauled on deck lived for many minutes. Most predatory fish are long and slim, like the alligator-gar and pickerel. But the piranha is a short, deep-bodied fish, with a blunt face and a heavily undershot or projecting lower jaw which gapes widely. The razor-edged teeth are wedge-shaped like a shark's, and the jaw muscles possess

great power. The rabid, furious snaps drive the teeth through flesh and bone. The head with its short muzzle, staring malignant eyes, and gaping, cruelly armed jaws, is the embodiment of evil ferocity; and the actions of the fish exactly match its looks. I never witnessed an exhibition of such impotent, savage fury as was shown by the piranhas as they flapped on deck. When fresh from the water and thrown on the boards they uttered an extraordinary squealing sound. As they flapped about they bit with vicious eagerness at whatever presented itself. One of them flapped into a cloth and seized it with a bulldog grip. Another grasped one of its fellows; another snapped at a piece of wood, and left the teeth-marks deep therein. They are the pests of the waters, and it is necessary to be exceedingly cautious about either swimming or wading where they are found. If cattle are driven into, or of their own accord enter, the water, they are commonly not molested; but if by chance some unusually big or ferocious specimen of these fearsome fishes does bite an animal—taking off part of an ear, or perhaps of a teat from the udder of a cow—the blood brings up every member of the ravenous throng which is anywhere near, and unless the attacked animal can immediately make its escape from the water it is devoured alive. Here on the Paraguay the natives hold them in much respect, whereas the caymans are not feared at all. The only redeeming feature about them is that they are themselves fairly good to eat, although with too many bones.

At daybreak of the third day, finding we were still moored off Concepcion, we were rowed ashore and strolled off through the streets of the quaint, picturesque old town; a town which, like Asuncion, was founded by the conquistadores three-quarters of a century before our own English and Dutch forefathers landed in what is now the United States. The Jesuits then took practically complete possession of what is now Paraguay, controlling and Christianizing the Indians, and raising their flourishing missions to a pitch of prosperity they never elsewhere achieved. They were expelled by the civil authorities (backed by the other representatives of ecclesiastical authority) some fifty years before Spanish South America became independent. But they had already made the language of the Indians, Guaraný a culture-tongue, reducing it to writing, and printing religious books in it. Guaraný is one of the most wide-spread of the Indian tongues, being originally found in various closely allied forms not only in Paraguay but in Uruguay and over the major part of Brazil. It remains here and there, as a *lingua geral* at least, and doubtless in cases as an original tongue, among the wild tribes. In most of Brazil, as around Para and around Sao Paulo, it has left its traces in place-names, but has been completely superseded as a language by Portuguese. In Paraguay it still exists side by side with Spanish as the common language of the lower people and as a familiar tongue among the upper classes. The blood of the people is mixed, their language dual; the lower classes are chiefly of Indian blood but with a white admixture; while the upper classes are predominantly white, with a strong infusion of Indian. There is no other case quite parallel to this in the annals of European colonization, although the Goanese in India have a native tongue and a Portuguese creed, while in several of the Spanish-American states the Indian blood is dominant and the majority of the population speak an Indian tongue, perhaps itself, as with the Quichuas, once a culture-tongue of the archaic type. Whether in Paraguay one tongue will ultimately drive out the other, and, if so, which will be the victor, it is yet too early to prophesy. The English missionaries and the Bible Society have recently published parts of the Scriptures in Guaraný; and in Asuncion a daily paper is published with the text in parallel columns, Spanish and Guaraný;—just as in Oklahoma there is a similar paper published in English and in the tongue which the extraordinary Cherokee chief Sequoia, a veritable Cadmus, made a literary language.

The Guaraný-speaking Paraguayan is a Christian, and as much an inheritor of our common culture as most of the peasant populations of Europe. He has no kinship with the wild Indian, who hates and fears him. The Indian of the Chaco, a pure savage, a bow-bearing savage, will never come east of the Paraguay, and the Paraguayan is only beginning to venture into the western interior, away from the banks of the river—under the lead of pioneer settlers like Rickard, whom, by the way, the wild Indians thoroughly trust, and for whom they work eagerly and faithfully. There is a great development ahead for Paraguay, as soon as they can definitely shake off the revolutionary habit and establish an orderly permanence of government. The people are a fine people; the strains of blood—white and Indian—are good.

We walked up the streets of Concepcion, and interestedly looked at everything of interest: at the one-story houses, their windows covered with gratings of fretted ironwork, and their occasional open doors giving us glimpses into cool inner courtyards, with trees and flowers; at the two-wheel carts, drawn by mules or oxen; at an occasional rider, with spurs on his bare feet, and his big toes thrust into the small stirrup-rings; at the little stores, and the warehouses for matté and hides. Then we came to a pleasant little inn, kept by a Frenchman and his wife, of old Spanish style, with its patio, or inner court, but as neat as an inn in Normandy or Brittany. We were sitting at coffee, around a little table, when in came the colonel of the garrison—for Concepcion is the second city in Paraguay. He told me that they had prepared a reception for me! I was in my rough hunting-clothes, but there was nothing to do but to accompany my kind hosts and trust to their good nature to pardon my shortcomings in the matter of dress. The colonel drove me about in a smart open carriage, with two good horses and a liveried driver. It was a much more fashionable turnout than would be seen in any of our cities save the largest, and even in them probably not in the service of a public official. In all the South American countries there is more pomp and ceremony in connection with public functions than with us, and at these functions the liveried servants, often with knee-breeches and powdered hair, are like those seen at similar European functions; there is not the democratic simplicity which better suits our own habits of life and ways of thought. But the South Americans often surpass us, not merely in pomp and ceremony but in what is of real importance, courtesy; in civility and courtesy we can well afford to take lessons from them.

We first visited the barracks, saw the troops in the setting-up exercises, and inspected the arms, the artillery, the equipment. There was a German lieutenant with the Paraguayan officers; one of several German officers who are now engaged in helping the Paraguayans with their army. The equipments and arms were in good condition; the enlisted men evidently offered fine material; and the officers were doing hard work. It is worth while for anti-militarists to ponder the fact that in every South American country where a really efficient army is developed, the increase in military efficiency goes hand in hand with a decrease in lawlessness and disorder, and a growing reluctance to settle internal disagreements by violence. They are introducing universal military service in Paraguay; the officers, many of whom have studied abroad, are growing to feel an increased *esprit de corps*, an increased pride in the army, and therefore a desire to see the army made the servant of the nation as a whole and not the tool of any faction or individual. If these feelings grow strong enough they will be powerful factors in giving Paraguay what she most needs, freedom from revolutionary disturbance and therefore the chance to achieve the material prosperity without which as a basis there can be no advance in other and even more important matters.

Then I was driven to the City Hall, accompanied by the *intendente*, or mayor, a German long settled in the country and one of the leading men of the city. There was a breakfast. When I

had to speak I impressed into my service as interpreter a young Paraguayan who was a graduate of the University of Pennsylvania. He was able to render into Spanish my ideas—on such subjects as orderly liberty and the far-reaching mischief done by the revolutionary habit—with clearness and vigor, because he thoroughly understood not only how I felt but also the American way of looking at such things. My hosts were hospitality itself, and I enjoyed the unexpected greeting.

We steamed on up the river. Now and then we passed another boat—a steamer, or, to my surprise, perhaps a barkentine or schooner. The Paraguay is a highway of traffic. Once we passed a big beef-canning factory. Ranches stood on either bank a few leagues apart, and we stopped at wood-yards on the west bank. Indians worked around them. At one such yard the Indians were evidently part of the regular force. Their squaws were with them, cooking at queer open-air ovens. One small child had as pets a parrot and a young coati—a kind of long-nosed raccoon. Loading wood, the Indians stood in a line, tossing the logs from one to the other. These Indians wore clothes.

On this day we got into the tropics. Even in the heat of the day the deck was pleasant under the awnings; the sun rose and set in crimson splendor; and the nights, with the moon at the full, were wonderful. At night Orion blazed overhead; and the Southern Cross hung in the star-brilliant heavens behind us. But after the moon rose the constellations paled; and clear in her light the tree-clad banks stood on either hand as we steamed steadily against the swirling current of the great river.

At noon on the twelfth we were at the Brazilian boundary. On this day we here and there came on low, conical hills close to the river. In places the palm groves broke through the belts of deciduous trees and stretched for a mile or so right along the river's bank. At times we passed cattle on the banks or sand-bars, followed by their herders; or a handsome ranch-house, under a cluster of shady trees, some bearing a wealth of red and some a wealth of yellow blossoms; or we saw a horse-coral among the trees close to the brink, with the horses in it and a barefooted man in shirt and trousers leaning against the fence; or a herd of cattle among the palms; or a big tannery or factory or a little native hamlet came in sight. We stopped at one tannery. The owner was a Spaniard, the manager an "Oriental," as he called himself, a Uruguayan, of German parentage. The peons, or workers, who lived in a long line of wooden cabins back of the main building, were mostly Paraguayans, with a few Brazilians, and a dozen German and Argentine foremen. There were also some wild Indians, who were camped in the usual squalid fashion of Indians who are hangers-on round the white man but have not yet adopted his ways. Most of the men were at work cutting wood for the tannery. The women and children were in camp. Some individuals of both sexes were naked to the waist. One little girl had a young ostrich as a pet.

Water-fowl were plentiful. We saw large flocks of wild muscovy ducks. Our tame birds come from this wild species and its absurd misnaming dates back to the period when the turkey and guinea-pig were misnamed in similar fashion—our European forefathers taking a large and hazy view of geography, and including Turkey, Guinea, India, and Muscovy as places which, in their capacity of being outlandish, could be comprehensively used as including America. The muscovy ducks were very good eating. Darters and cormorants swarmed. They waddled on the sand-bars in big flocks and crowded the trees by the water's edge. Beautiful snow-white egrets also lit in the trees, often well back from the river. A full-foliaged tree of vivid green, its round surface crowded with these birds, as if it had suddenly blossomed with huge white flowers, is a sight worth seeing. Here and there on the sand-bars we saw huge jabiru storks, and once a flock of white wood-ibis among the trees on the bank.

On the Brazilian boundary we met a shallow river steamer carrying Colonel Candido Mariano da Silva Rondon and several other Brazilian members of the expedition. Colonel Rondon immediately showed that he was all, and more than all, that could be desired. It was evident that he knew his business thoroughly, and it was equally evident that he would be a pleasant companion. He was a classmate of Mr. Lauro Müller at the Brazilian Military Academy. He is of almost pure Indian blood, and is a Positivist—the Positivists are a really strong body in Brazil, as they are in France and indeed in Chile. The colonel's seven children have all been formally made members of the Positivist Church in Rio Janeiro. Brazil possesses the same complete liberty in matters religious, spiritual, and intellectual as we, for our great good fortune, do in the United States, and my Brazilian companions included Catholics and equally sincere men who described themselves as "libres penseurs." Colonel Rondon has spent the last twenty-four years in exploring the western highlands of Brazil, pioneering the way for telegraph-lines and railroads. During that time he has travelled some fourteen thousand miles, on territory most of which had not previously been traversed by civilized man, and has built three thousand miles of telegraph. He has an exceptional knowledge of the Indian tribes and has always zealously endeavored to serve them and indeed to serve the cause of humanity wherever and whenever he was able. Thanks mainly to his efforts, four of the wild tribes of the region he has explored have begun to tread the road of civilization. They have taken the first steps toward becoming Christians. It may seem strange that among the first-fruits of the efforts of a Positivist should be the conversion of those he seeks to benefit to Christianity. But in South America Christianity is at least as much a status as a theology. It represents the indispensable first step upward from savagery. In the wilder and poorer districts men are divided into the two great classes of "Christians" and "Indians." When an Indian becomes a Christian he is accepted into and becomes wholly absorbed or partly assimilated by the crude and simple neighboring civilization, and then he moves up or down like any one else among his fellows.

Among Colonel Rondon's companions were Captain Amilcar de Magalhães, Lieutenant João Lyra, Lieutenant Joaquin de Mello Filho, and Doctor Euzebio de Oliveira, a geologist.

The steamers halted; Colonel Rondon and several of his officers, spick and span in their white uniforms, came aboard; and in the afternoon I visited him on his steamer to talk over our plans. When these had been fully discussed and agreed on we took tea. I happened to mention that one of our naturalists, Miller, had been bitten by a piranha, and the man-eating fish at once became the subject of conversation. Curiously enough, one of the Brazilian taxidermists had also just been severely bitten by a piranha. My new companions had story after story to tell of them. Only three weeks previously a twelve-year-old boy who had gone in swimming near Corumbá was attacked, and literally devoured alive by them. Colonel Rondon during his exploring trips had met with more than one unpleasant experience in connection with them. He had lost one of his toes by the bite of a piranha. He was about to bathe and had chosen a shallow pool at the edge of the river, which he carefully inspected until he was satisfied that none of the man-eating fish were in it; yet as soon as he put his foot into the water one of them attacked him and bit off a toe. On another occasion while wading across a narrow stream one of his party was attacked; the fish bit him on the thighs and buttocks, and when he put down his hands tore them also; he was near the bank and by a rush reached it and swung himself out of the water by means of an overhanging limb of a tree; but he was terribly injured, and it took him six months before his wounds healed and he recovered. An extraordinary incident occurred on another trip. The party were without food and very hungry. On reaching a stream they dynamited it, and waded in to seize the stunned fish as they floated on the surface. One man, Lieutenant Pyrineus, having his

hands full, tried to hold one fish by putting its head into his mouth; it was a piranha and seemingly stunned, but in a moment it recovered and bit a big section out of his tongue. Such a hemorrhage followed that his life was saved with the utmost difficulty. On another occasion a member of the party was off by himself on a mule. The mule came into camp alone. Following his track back they came to a ford, where in the water they found the skeleton of the dead man, his clothes uninjured but every particle of flesh stripped from his bones. Whether he had drowned, and the fishes had then eaten his body, or whether they had killed him it was impossible to say. They had not hurt the clothes, getting in under them, which made it seem likely that there had been no struggle. These man-eating fish are a veritable scourge in the waters they frequent. But it must not be understood by this that the piranhas—or, for the matter of that, the New-World caymans and crocodiles—ever become such dreaded foes of man as for instance the man-eating crocodiles of Africa. Accidents occur, and there are certain places where swimming and bathing are dangerous; but in most places the people swim freely, although they are usually careful to find spots they believe safe or else to keep together and make a splashing in the water.

During his trips Colonel Rondon had met with various experiences with wild creatures. The Paraguayan caymans are not ordinarily dangerous to man; but they do sometimes become man-eaters and should be destroyed whenever the opportunity offers. The huge caymans and crocodiles of the Amazon are far more dangerous, and the colonel knew of repeated instances where men, women and children had become their victims. Once while dynamiting a stream for fish for his starving party he partially stunned a giant anaconda, which he killed as it crept slowly off. He said that it was of a size that no other anaconda he had ever seen even approached, and that in his opinion such a brute if hungry would readily attack a full-grown man. Twice smaller anacondas had attacked his dogs; one was carried under water—for the anaconda is a water-loving serpent—but he rescued it. One of his men was bitten by a jararaca; he killed the venomous snake, but was not discovered and brought back to camp until it was too late to save his life. The puma Colonel Rondon had found to be as cowardly as I have always found it, but the jaguar was a formidable beast, which occasionally turned man-eater, and often charged savagely when brought to bay. He had known a hunter to be killed by a jaguar he was following in thick grass cover.

All such enemies, however, he regarded as utterly trivial compared to the real dangers of the wilderness—the torment and menace of attacks by the swarming insects, by mosquitoes and the even more intolerable tiny gnats, by the ticks, and by the vicious poisonous ants which occasionally cause villages and even whole districts to be deserted by human beings. These insects, and the fevers they cause, and dysentery and starvation and wearing hardship and accidents in rapids are what the pioneer explorers have to fear. The conversation was to me most interesting. The colonel spoke French about to the extent I did; but of course he and the others preferred Portuguese; and then Kermit was the interpreter.

In the evening, soon after moonrise, we stopped for wood at the little Brazilian town of Porto Martinho. There are about twelve hundred inhabitants. Some of the buildings were of stone; a large private house with a castellated tower was of stone; there were shops, and a post-office, stores, a restaurant and billiard-hall, and warehouses for *matté*, of which much is grown in the region roundabout. Most of the houses were low, with overhanging, sloping eaves; and there were gardens with high walls, inside of which trees rose, many of them fragrant. We wandered through the wide, dusty streets, and along the narrow sidewalks. It was a hot, still evening; the smell of the tropics was on the heavy December air. Through the open doors and windows we

caught dim glimpses of the half-clad inmates of the poorer houses; women and young girls sat outside their thresholds in the moonlight. All whom we met were most friendly: the captain of the little Brazilian garrison; the intendente, a local trader; another trader and ranchman, a Uruguayan, who had just received his newspaper containing my speech in Montevideo, and who, as I gathered from what I understood of his rather voluble Spanish, was much impressed by my views on democracy, honesty, liberty, and order (rather well-worn topics); and a Catalan who spoke French, and who was accompanied by his pretty daughter, a dear little girl of eight or ten, who said with much pride that she spoke three languages—Brazilian, Spanish, and Catalan! Her father expressed strongly his desire for a church and for a school in the little city.

When at last the wood was aboard we resumed our journey. The river was like glass. In the white moonlight the palms on the edge of the banks stood mirrored in the still water. We sat forward and as we rounded the curves the long silver reaches of the great stream stretched ahead of us, and the ghostly outlines of hills rose in the distance. Here and there prairie fires burned, and the red glow warred with the moon's radiance.

Next morning was overcast. Occasionally we passed a wood-yard, or factory, or cabin, now on the eastern, the Brazilian, now on the western, the Paraguayan, bank. The Paraguay was known to men of European birth, bore soldiers and priests and merchants as they sailed and rowed up and down the current of its stream, and beheld little towns and forts rise on its banks, long before the Mississippi had become the white man's highway. Now, along its upper course, the settlements are much like those on the Mississippi at the end of the first quarter of the last century; and in the not distant future it will witness a burst of growth and prosperity much like that which the Mississippi saw when the old men of today were very young.

In the early forenoon we stopped at a little Paraguayan hamlet, nestling in the green growth under a group of low hills by the river-brink. On one of these hills stood a picturesque old stone fort, known as Fort Bourbon in the Spanish, the colonial, days. Now the Paraguayan flag floats over it, and it is garrisoned by a handful of Paraguayan soldiers. Here Father Zahm baptized two children, the youngest of a large family of fair-skinned, light-haired small people, whose father was a Paraguayan and the mother an "Oriental," or Uruguayan. No priest had visited the village for three years, and the children were respectively one and two years of age. The sponsors included the local commandante and a married couple from Austria. In answer to what was supposed to be the perfunctory question whether they were Catholics, the parents returned the unexpected answer that they were not. Further questioning elicited the fact that the father called himself a "free-thinking Catholic," and the mother said she was a "Protestant Catholic," her mother having been a Protestant, the daughter of an immigrant from Normandy. However, it appeared that the older children had been baptized by the Bishop of Asuncion, so Father Zahm at the earnest request of the parents proceeded with the ceremony. They were good people; and, although they wished liberty to think exactly as they individually pleased, they also wished to be connected and to have their children connected with some church, by preference the church of the majority of their people. A very short experience of communities where there is no church ought to convince the most heterodox of the absolute need of a church. I earnestly wish that there could be such an increase in the personnel and equipment of the Catholic Church in South America as to permit the establishment of one good and earnest priest in every village or little community in the far interior. Nor is there any inconsistency between this wish and the further wish that there could be a marked extension and development of the native Protestant churches, such as I saw established here and there in Brazil, Uruguay, and Argentina, and of the Y. M. C. Associations. The bulk of these good people who profess religion will continue to be

Catholics, but the spiritual needs of a more or less considerable minority will best be met by the establishment of Protestant churches, or in places even of a Positivist Church or Ethical Culture Society. Not only is the establishment of such churches a good thing for the body politic as a whole, but a good thing for the Catholic Church itself; for their presence is a constant spur to activity and clean and honorable conduct, and a constant reflection on sloth and moral laxity. The government in each of these commonwealths is doing everything possible to further the cause of education, and the tendency is to treat education as peculiarly a function of government and to make it, where the government acts, non-sectarian, obligatory, and free—a cardinal doctrine of our own great democracy, to which we are committed by every principle of sound Americanism. There must be absolute religious liberty, for tyranny and intolerance are as abhorrent in matters intellectual and spiritual as in matters political and material; and more and more we must all realize that conduct is of infinitely greater importance than dogma. But no democracy can afford to overlook the vital importance of the ethical and spiritual, the truly religious, element in life; and in practice the average good man grows clearly to understand this, and to express the need in concrete form by saying that no community can make much headway if it does not contain both a church and a school.

We took breakfast—the eleven-o'clock Brazilian breakfast—on Colonel Rondon's boat. Caymans were becoming more plentiful. The ugly brutes lay on the sand-flats and mud-banks like logs, always with the head raised, sometimes with the jaws open. They are often dangerous to domestic animals, and are always destructive to fish, and it is good to shoot them. I killed half a dozen, and missed nearly as many more—a throbbing boat does not improve one's aim. We passed forests of palms that extended for leagues, and vast marshy meadows, where storks, herons, and ibis were gathered, with flocks of cormorants and darters on the sand-bars, and stilts, skimmers, and clouds of beautiful swaying terns in the foreground. About noon we passed the highest point which the old Spanish conquistadores and explorers, Irala and Ayolas, had reached in the course of their marvelous journeys in the first half of the sixteenth century—at a time when there was not a settlement in what is now the United States, and when hardly a single English sea captain had ventured so much as to cross the Atlantic.

By the following day the country on the east bank had become a vast marshy plain dotted here and there by tree-clad patches of higher land. The morning was rainy; a contrast to the fine weather we had hitherto encountered. We passed wood-yards and cattle-ranches. At one of the latter the owner, an Argentine of Irish parentage, who still spoke English with the accent of the land of his parents' nativity, remarked that this was the first time the American flag had been seen on the upper Paraguay; for our gunboat carried it at the masthead. Early in the afternoon, having reached the part where both banks of the river were Brazilian territory, we came to the old colonial Portuguese fort of Coimbra. It stands where two steep hills rise, one on either side of the river, and it guards the water-gorge between them. It was captured by the Paraguayans in the war of nearly half a century ago. Some modern guns have been mounted, and there is a garrison of Brazilian troops. The white fort is perched on the hillside, where it clings and rises, terrace above terrace, with bastion and parapet and crenellated wall. At the foot of the hill, on the riverine plain, stretches the old-time village with its roofs of palm. In the village dwell several hundred souls, almost entirely the officers and soldiers and their families. There is one long street. The one-story, daub-and-wattle houses have low eaves and steep sloping roofs of palm-leaves or of split palm-trunks. Under one or two old but small trees there are rude benches; and for a part of the length of the street there is a rough stone sidewalk. A little graveyard, some of the tombs very old, stands at one end. As we passed down the street the wives and the swarming

children of the garrison were at the doors and windows; there were women and girls with skins as fair as any in the northland, and others that were predominantly negro. Most were of intervening shades. All this was paralleled among the men; and the fusion of the colors was going on steadily.

Around the village black vultures were gathered. Not long before reaching it we passed some rounded green trees, their tops covered with the showy wood-ibis; at the same time we saw behind them, farther inland, other trees crowded with the more delicate forms of the shining white egrets.

The river now widened so that in places it looked like a long lake; it wound in every direction through the endless marshy plain, whose surface was broken here and there by low mountains. The splendor of the sunset I never saw surpassed. We were steaming east toward clouds of storm. The river ran, a broad highway of molten gold, into the flaming sky; the far-off mountains loomed purple across the marshes; belts of rich green, the river banks stood out on either side against the rose-hues of the rippling water; in front, as we forged steadily onward, hung the tropic night, dim and vast.

On December 15 we reached Corumbá. For three or four miles before it is reached the west bank, on which it stands, becomes high rocky ground, falling away into cliffs. The country roundabout was evidently well peopled. We saw gauchos, cattle-herders—the equivalent of our own cowboys—riding along the bank. Women were washing clothes, and their naked children bathing, on the shore; we were told that caymans and piranhas rarely ventured near a place where so much was going on, and that accidents generally occurred in ponds or lonely stretches of the river. Several steamers came out to meet us, and accompanied us for a dozen miles, with bands playing and the passengers cheering, just as if we were nearing some town on the Hudson.

Corumbá is on a steep hillside, with wide, roughly paved streets, some of them lined with beautiful trees that bear scarlet flowers, and with well-built houses, most of them of one story, some of two or three stories. We were greeted with a reception by the municipal council, and were given a state dinner. The hotel, kept by an Italian, was as comfortable as possible—stone floors, high ceilings, big windows and doors, a cool, open courtyard, and a shower-bath. Of course Corumbá is still a frontier town. The vehicles ox-carts and mule-carts; there are no carriages; and oxen as well as mules are used for riding. The water comes from a big central well; around it the water-carts gather, and their contents are then peddled around at the different houses. The families showed the mixture of races characteristic of Brazil; one mother, after the children had been photographed in their ordinary costume, begged that we return and take them in their Sunday clothes, which was accordingly done. In a year the railway from Rio will reach Corumbá; and then this city, and the country roundabout, will see much development.

At this point we rejoined the rest of the party, and very glad we were to see them. Cherrie and Miller had already collected some eight hundred specimens of mammals and birds.