VOL. IX. NO. 6 PRICE 10 CENTS

OLD PENN

WEEKLY · REVIEW OF THE VNIVERSITY · OF · PENNSYLVANIA

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PHILADELPHIA, PA., NOVEMBER 12, 1910

UNIVERSITY OF PENNSYLVANIA

FOUNDED BY BENJAMIN FRANKLIN IN 1740

Provost, CHARLES C. HARRISON, LL.D.

THE COLLEGE. *Dean,* DR. GEORGE E. FISHER.—This department comprises the following schools:

THE SCHOOL OF ARTS, in which are included the courses in Arts and Science, Psychology, Biology, and Music.

THE TOWNE SCIENTIFIC SCHOOL, which includes the courses in Architecture, Mechanical, Electrical, and Civil Engineering; Chemistry and Chemical Engineering.

In the College are also included the Wharton School of Finance and Commerce; the Evening School of Accounts and Finance; the Saturday Courses for Teachers; the Summer School, and the College Courses for Teachers.

All courses in College are open only to men with the exception of those in Biology, Music, Summer School and Teachers' Courses, which are open to men and women.

Students in the Arts and Science course may combine their course with that of Medicine so that both may be finished in seven years. In a similar way with Architecture, in six years. Tuition in the School of Arts is $150.

The following is a list of courses included in the College, the number of years in the course, the degree to which it leads, annual tuition, etc.

ARCHITECTURE.—Four years; B.S. in Architecture. Also special two-year course for qualified architectural draftsmen; also one graduate year, leading to master's degree. Tuition, $200.

MECHANICAL AND ELECTRICAL ENGINEERING.—Four years; B.S. in Mechanical or Electrical Engineering. Tuition, $200.

CIVIL ENGINEERING.—Four years; B.S. in Civil Engineering. Tuition, $200.

MUSIC.—Four years leading to a certificate of proficiency, and after one year, to the degree of B.M. Tuition, $30.

BIOLOGY AND ZOOLOGY.—Four years; B.S. in Biology. Two years' special course preparatory to Medicine; also another two years' special course in Biology, embracing Botany, Zoology and Anatomy, and leading to a certificate of proficiency. Tuition, $150.

CHEMISTRY AND CHEMICAL ENGINEERING.—Each extending over four years; B.S. in Chemistry or B.S. in Chemical Engineering. Tuition, $200.

WHARTON SCHOOL OF FINANCE AND COMMERCE.—Four years. For men entering a business career, public service, law, or social work. B.S. in Economics. Tuition, $150.

EVENING SCHOOL OF ACCOUNTS AND FINANCE.—Three years of University work, leading to a certificate. Tuition, $60.

SATURDAY COURSES AND THE COLLEGE COURSES FOR TEACHERS.—Courses similar to those in the School of Arts, leading to degree upon completion of required number of units. Open to both men and women. Tuition, $10 per year for each hour of instruction.

SUMMER SCHOOL.—Sessions daily for six weeks, beginning the second week of July. Courses in most college subjects. Open to men and women. Tuition, $15 for each lecture course; for two, $25; for three or more, $35. Laboratory courses, $20 to $30.

COURSES IN PSYCHOLOGY AND LABORATORY OF PSYCHOLOGY.—In addition to the regular academic work this laboratory conducts a Psychological Clinic for the study of various types of children, and offers special courses preparing students for work in Psychology as applied to practical social and educational problems. Tuition, $150.

GRADUATE SCHOOL. *Dean,* DR. HERMAN V. AMES.—Offers advanced instruction in the various branches of Literature and Science, leading to the degrees of M.A. and Ph.D.

Twenty-six fellowships, for men, awarded annually; free tuition, and a stipend of from $500 to $800.

Six fellowships for women, granting free tuition and stipend of $200 and $225.

Eight scholarships, for men, granting free tuition and $100.

Also thirty University fellowships and scholarships covering tuition fees.

Tuition, $12.50 per standard course of one hour a week throughout the year. Maximum, $150 per year.

LAW SCHOOL. *Dean,* DR. WILLIAM DRAPER LEWIS.—Course of three years leading to the degree of LL.B. The courses are so conducted that the student may acquire not only a knowledge of the rules of law, but also the ability to deal with legal problems. The "Case System" of instruction is used. Course fits students for practice in any State. Besides the regular curriculum, the student has an opportunity to attend a number of courses on special subjects given by the members of the auxiliary teaching force. Graduates may become candidates for the degree of LL.M. Tuition, $160.

MEDICINE. *Dean,* DR. ALLEN J. SMITH.—Course of four years, divided into two periods of two years each, the first period devoted to the fundamental medical sciences, Anatomy, Physiological Chemistry, Physiology and Pathology; the second period to the clinical subjects, Medicine, Surgery, Obstetrics and the specialties. The degree of M.D. is conferred upon all graduates. The teaching staff numbers 100, of whom 46 are professors or assistant professors. The facilities for instruction both in the laboratory and clinical subjects are unexcelled in point of equipment. Tuition, $200.

COURSES IN PUBLIC HEALTH, open to graduates of Medicine, extending over one academic session and leading to degree of C.S. (Certified Sanitarian). Tuition, $150.

HOSPITAL FACILITIES.—The University Hospital, in which there are fourteen wards with a total capacity of 350 beds; the University has special privileges for instruction at the Philadelphia General Hospital, which adjoins the University, and in which there are more than five thousand patients.

STUDENTS' WARD.—A special ward is maintained for the care of students, only a slight charge being made for board.

TRAINING SCHOOL FOR NURSES.—The course of instruction covers a period of three years.

WILLIAM PEPPER CLINICAL LABORATORY.—Devoted to graduate work for promoting the interest of patients by providing facilities for the prosecution of minute studies in original researches.

WISTAR INSTITUTE.—Devoted to research work in Anatomy, and containing the Wistar and Horner Museums of Biology and Anatomy. Publishes five scientific journals.

LABORATORY OF HYGIENE.—Devoted to special research work in Hygiene and Bacteriology.

THE PHIPPS INSTITUTE.—For the Study, Prevention and Treatment of Tuberculosis. Offers exceptional opportunity for observation along special lines.

DENTISTRY. *Dean.,* DR. EDWARD C. KIRK.—Course of three years. The laboratory method of instruction forms an important part of the training, not only in the practical dental branches, but in the elementary scientific subjects of Chemistry, Anatomy, Physiology, and Bacteriology, etc. The degree of D.D.S. is conferred upon graduates. Tuition, $150.

A NEW POST-GRADATE DEPARTMENT IN DENTISTRY, extending over a period of one year and open to graduates of Dentistry, was established in October, 1910.

VETERINARY MEDICINE. *Dean,* DR. LOUIS A. KLEIN.—Graded course of instruction, covering three academic years and leading to the degree of V.M.D.; it qualifies its graduates for general practice, for Federal, State and Municipal inspection of meat and milk, and for investigation of Veterinary problems and for teaching. Tuition, $100.

GENERAL UNIVERSITY ADVANTAGES

UNIVERSITY LIBRARY.—The collection contains more than 300,000 volumes and 50,000 pamphlets. It includes many special libraries, as well as a number of departmental libraries. The Biddle Law Library contains almost 45,000 volumes.

PHYSICAL EDUCATION.—The Gymnasium comprises Weightman Hall, three smaller exercising rooms, and a large swimming pool, with locker rooms and shower baths. It overlooks FRANKLIN FIELD, used for track and field sports. Provision is made for medical and physical examination of all students by the Director, and for the prescription of exercise in suitable cases.

Among the places of general interest are: THE UNIVERSITY MUSEUM OF ARCHAEOLOGY, which contains valuable Babylonian, Etruscan, Egyptian, and Mediterranean collections, and one of the most complete American and general ethnological collections; the FLOWER ASTRONOMICAL OBSERVATORY, on the West Chester Pike, which is fully equipped with modern telescopes and instruments; and the BOTANIC GARDENS AND GREENHOUSES. These are all open to the public.

MISCELLANEOUS ACTIVITIES.—Under the auspices of the Christian Association of the University. Services by eminent ministers are conducted each Sunday morning in Houston Hall, also daily voluntary Chapel exercises. The Association also conducts an employment bureau, maintains a settlement, several playgrounds and a farm for settlement work, and a medical school in China.

LECTURES, MUSICALES AND CONCERTS.—During each season several series of public lectures are given under various Foundations. The Philadelphia Orchestra gives a series of concerts at the University, and special privileges are granted to students for attending other events.

THE DORMITORIES consist of twenty-eight houses, inclosing three beautiful courtyards. The average price paid by students for board and lodging is $5.50 per week.

THE HOUSTON CLUB.—The Houston Club is the exponent of the social side of Pennsylvania student life. Its home is Houston Hall, the geographical center of the University group of buildings.

CAMPUS AND EQUIPMENT.—The campus of the University covers more than a hundred acres and is only six minutes from City Hall, the center of a population of a million and a half. The equipment consists of about seventy buildings.

For general information address Bureau of Publication, U. of Pa., Philadelphia.
For special information about courses, etc., address the heads of the departments.

Valley and Town of Cartago from the Hills North.

Felipe Martin's Store, Cartago, After the Earthquake of May 4.

Shelf in our room at Cartago with the jars of larvae in rearing. Decorations from the "Old Home" on the wall. This wall fell in the earthquake of May 4, breaking and burying the jars and their contents.

Store of Felipe Martin, Cartago, across the street from our hotel. The ox-cart is a typical one and is universally used in Costa Rica and in adjacent countries.

ZOOLOGICAL RESEARCHES IN COSTA RICA.

By Philip P. Calvert, Ph.D., Assistant Professor of Zoology in the University.

Illustrations from photographs by Mrs. Calvert.

For ten years, 1899-1908, the writer devoted nearly all his research time to the preparation of the account of the Odonata, or Dragonflies, of Mexico and Central America, which fills almost the whole of the volume "Neuroptera" in the series "Biologia Centrali-Americana." This series, edited by Dr. Frederic Du Cane Godman, a trustee of the British Museum of Natural History, and the late Osbert Salvin, comprises upward of fifty quarto volumes published in London between 1879 and the present year and not yet completed. The scope of the "Biologia" embraces little more than the geographical distribution and the classification of the plants and animals of the countries mentioned. Notwithstanding the labors of naturalists for more than a century, our knowledge of these two branches of the natural history of the region between the Rio Grande and the Isthmus of Darien is scanty in many respects, while still less is known of the early stages of many groups or of their habits and relations to their surroundings. This paucity of information was very noticeable while the study of the dragonflies was in progress, so, prompted by his interest in these insects as a specialist, the writer planned a visit to Costa Rica to study those features of the life and habits of which so little was known.

Costa Rica, one of the six republics of Central America, lies between Nicaragua on the north and Panama on the south, and its shores are bathed by the waters of two oceans. It has an area of 23,000 square miles and thus approaches West Virginia, of all the United States, most nearly in extent. The latest estimates credit it with a population of from

300,000 to 335,000. Costa Rica seemed to be very favorable for the projected investigations on account of its proximity to the equator (ten degrees, north latitude) and consequent large South American element in its fauna, its narrowness from ocean to ocean and the existence of an almost complete transcontinental railroad, whereby comparisons between conditions on Atlantic and Pacific slopes can be made in a short time and at relatively slight expense. Moreover, although the greatest elevations in Costa Rica (12,000 feet) are considerably less than those of Mexico (18,000 feet) or of South America and there is no snow line, they are sufficiently great to lie within the *tierra fria* and so give opportunity for examining the effects of different climatic conditions. As contrasted with the other Central American republics, Costa Rica has enjoyed a more peaceable existence, freer from political revolution, while sanitary conditions have been improved to a greater extent. Finally, competent authorities had asserted that Costa Rica was one of the richest countries in the world, in proportion to its area, in certain groups of plants and animals, and there was already some evidence that this held true for the Odonata also.

The University, through Provost Harrison, granted a leave of absence until October 1, 1910, and, sailing from New York, Mrs. Calvert and the writer landed in Port Limon, May 1, 1909, and soon after fixed our headquarters at Cartago, near the top of the Atlantic slope.

We came to Costa Rica with three principal topics for research on the Odonata definitely in mind, viz.: 1. The determination of the existence or non-existence of seasonal distribution. 2. The discovery or identification of the early (larval) stages. 3. The accumulation of data bearing on the habits of both adults and larvae.

1. To determine the existence or non-existence of seasonal distribution, observations and collections were made at intervals during the year in the same localities and a complete list of all species observed each day was kept. The seasons concerned are the wet and the dry, the latter, on the Pacific side of the country extending from December to April or May. On the Atlantic slope the seasonal difference is less marked for the prevalent winds coming from the east and northeast, loaded with water vapor as they pass over the Caribbean, reach the high mountain masses in the centre of the country, become cooled and discharge their moisture on the Atlantic slopes of the mountains, so that when they reach the Pacific slope they are dry.

The principal points in the country where our work was done were:

On the Atlantic slope—Banana River region, 50 feet, November; Guapiles, 984 feet, June, November; Peralta, 1,088 feet, August, March; Turrialba, 2,000 feet, July; Juan Viñas, 2,500-4,000 feet, June, August, October, December, February, March, April; Cachi, 3,600 feet, March; Cartago, 4,750 feet, every month; volcano Irazu, 4,750-11,000 feet, July, September, March.

On the Pacific slope—Tres Rios, 4,260 feet, and La Carpintera to 5,700 feet, December, March; Alajuela, 3,100 feet, September, December; Turrucares, 1,800-2,200 feet, August, December, April; Surubres, 800 feet, October; Puntarenas, 10 feet, February; Province of Guanacaste (chiefly near Liberia and Santa Cruz), 0-2,200 feet, January.

Incidentally, these observations, not yet tabulated, will also add greatly to our knowledge of geographical distribution far beyond that given in the "Biologia" volume which summarized all the then known data. Thus we found that the Costa Rican fauna includes species hitherto known only from countries farther north, or only from South America, and also species possibly still undescribed. Some previously known from the Atlantic slope only are now proven to occur also on the Pacific slope, and vice versa. The study of the data accumulated on seasonal distribution will lead undoubtedly to the consideration of many other related problems also.

2. The discovery and identification of the larval stages was attempted along three lines. Egg-laying females were caught and often induced to lay their eggs in vials of water. The vials were then taken to Cartago and on hatching of the eggs, the young larvae (consequently of known species) were sketched from life, some preserved, some reared to later stages when possible. One species (*Argia extranea*) was reared from egg to adult, the period occupied being eight months; all the successive exuviae (shed skins) have been preserved, so that a detailed account of the larval form and changes will be possible. This was the first time that any dragonfly had been reared from egg to adult in any part of the world so far, at least, as was indicated by the literature on the subject up to the time of our departure from Philadelphia, although during our absence an English investigator, Mr. F. Balfour-Browne, has described a successful attempt of the same sort with an English species.

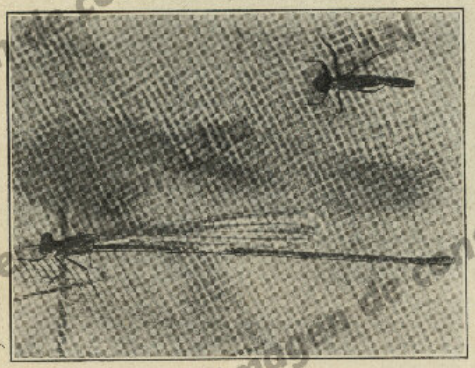
The usually older larvae which we met were likewise brought to Cartago, and by rearing them to the adult stage, another series of identifications was obtained.

Thirdly, we often found adults transforming, or just transformed, from the larval stage with the exuviae from which they emerged near by. Since the exuvia retains the shape of the larva almost perfectly, it is quite adequate for description and identification. No list of such finds has been made yet, but they form an important part of our data.

In all localities visited search was made for larvae and exuviae, even when rearing or the capture of the adult was impossible, for since it will be possible ultimately to identify most of them specifically, they will fix the breeding places much more accurately than the collection of the winged adults can possibly do, since the latter are often carried, no doubt, by winds from their true habitats.

It is among the larvae of the dragonflies that our chief novelties are to be found. There is a group of these insects, limited to tropical America, remarkable for the length and slenderness of body and wings of the adults, the abdomen being as much as four and a half inches long and the spread of the wing six or seven inches in some species. Nothing was known of the early stages of this group, but Mr. O. W. Barrett had suggested, in 1900, that possibly the larvae lived in the water which is retained between the leaf-bases of bromeliads, members of the pineapple family. Acting on this suggestion and learning from a letter from Mr. F. Knab, of the United States National Museum, that he had recently raised dragonfly larvae from such a source in Mexico, much time was spent in examining these plants. On the moister Atlantic slope of Costa Rica, bromeliads are quite abundant, growing on the branches and trunks of trees in the hedgerows around Cartago, in the cool woods of mountains like Irazu, 11,000 feet above the sea, and in the warm tropical forests of much lower

elevation. Sometimes they are situated close to the ground, often they are attached to an unbranched trunk thirty or forty feet from the soil, or may be lodged among the branches at a still greater height. Their leaves, often two or more feet long, taper gradually to near the tip, are toothed or spined on their straight edges, bright green or beautiful pink or red, and spring from a very short stalk so that their bases are pressed closely together. Between the leaf-bases rain water is usually present, and in all localities various forms of animal life take refuge there. Cockroaches, earwigs, katydid-like insects, larvae of beetles, of moths, of flies and of mosquitos, ants with long jaws that snap together with an appreciable sound, snails, earthworms, scorpions both true and false, centipedes and even snakes of poisonous repute are common *bromeliadicoli* which we met in our examinations. The length and toughness of the leaves and their sharp spines made it necessary to carry a heavy knife to investigate these plants properly. In October, 1909, we were gladdened by the discovery of undoubted dragonfly larvae, in a bromeliad below Juan Viñas, which were carried carefully to Cartago



Mecistogaster Modestus and its Exuvia.

and placed in jars each containing a little water and a small bromeliad. We fed them with "blood worms," the bright red young of certain flies, readily obtained from a dirty ditch near the town. The first lot of larvae died out in about two months, but a second lot from nearly the same locality in December found our jars sufficiently endurable to complete their growth and to transform into the winged insects in early April. Two of them made this change about 8 o'clock on two bright mornings, so that we could photograph them in the act and one of the illustrations herewith presented shows the fully expanded dragonfly (*Mecistogaster modestus*) and the exuvia from which it has emerged. The latter, and also the larva when within it, was four-fifths of an inch long, and when the dragonfly first detached itself it likewise had the same length, but in one and a half hours expansion, due, some believe, to inspired and also swallowed air, increased the length of its body to three and one-eighth inches and of each wing to two inches. The larva of Mecistogaster is not longer than those of many other insects, but the adult is conspicuously longer, and this great increase in length is thus a matter of a relatively short time at the period of transformation.

Another interesting larval "find" was that of the remarkable dragonfly Thaumatoneura. The adult insect was first made known by Mr. Robert McLachlan, F.R.S., of London, in 1897. His description was made from a single specimen, bearing no label, obtained at a sale, so that Mr. McLachlan was unable to say whence it came, "but as the pin (or rather skewer!) was similar to those used for some other insects in the same collection which were of Chinese or Japanese origin," he hazarded "the conjecture that it may belong to the same region." In 1900, Mr. McLachlan was able to announce that the real habitat of the insect was Chiriqui in Panama. About 1903, Mr. C. F. Underwood collected two species of Thaumatoneura at Carrillo in Costa Rica, and his specimens coming into Dr. Godman's possession, were sent to me and included in the "Biologia" volume. On the first day of our arrival at Juan Viñas in June, our entomological friends, Messrs. W. Schaus and J. Barnes, presented me with a couple of Thaumatoneura which they had just collected at a small waterfall nearby. Thereafter our visits to Juan Viñas always included one or more examinations of the small streams which fall almost vertically over the steep rock faces of the canyon of the Rio Reventazon. The sides of the canyon are covered almost everywhere with vegetation, including trees of a hundred or more feet in height, and the descending streams are bordered with a great variety of plants. Close to and within the spray of some of these small waterfalls lives Thaumatoneura. It is not an actively moving insect. We have watched the same individual remain motionless for half an hour upon a leaf or twig, even at midday, the spray collecting upon its body and hanging in a drop from the hind end. The eggs are laid apparently within the roots or stems of plants which hang vertically within the waterfall, but we were never able to find them. In June we found a larva which we strongly suspected to be that of Thaumatoneura, and, as usual, transported it to Cartago, but it did not live long. All through the following year we sought for Thaumatoneura larvae until, in late April, we found them transforming at the foot of what we knew as our "high waterfall." This was a nearly vertical fall descending from the top of the canyon, but about one hundred feet above the railroad track (which occupies a narrow ledge cut out of the cliff-face) the water usually disappeared beneath a mass of boulders and flowed underground through loose soil to reappear on the hillside far below the track. After exceptionally heavy rains in the hills above, the stream flowed over the surface almost as far as the track. Up over these boulders we climbed to the foot of the actual fall, where there was a vertical rock wall thickly overgrown with moss and Commelina, and on this rock face we found our long-sought larvae. Two days after our discovery, a landslide occurred—it was after the earthquakes of mid-April—large masses of rock falling and changing all the details of this spot, and leaving the approach so dangerous that we did not dare to climb to our favorite locality again. But we had our Thaumatoneura!

3. The data on habits which have been obtained are of very diverse character, and embrace notes on methods of pairing and egg-laying, physiographic character of habitats, association of different species, photographs of the habitats of various species, etc.

BIOLOGICAL HALL.

Cartago was a clean and healthy town of perhaps 10,000 people, with well-paved streets in its central part, an abundance of clear water piped to the houses, an underground drainage system and was lighted with electricity. It was a vacation resort for those employed on the Panama Canal and contained a number of hotels. In one of these we had our headquarters, and to its managers, Mr. and Mrs. Joseph Weldon, we were indebted for many kindnesses and comforts. Situated on the railroad and nearly midway between the Atlantic and the Pacific, Cartago furnished a convenient starting point for excursions in many directions. To the north was the great volcanic mass of Irazu, whose southern slopes are now covered with pastures and cultivated fields, but its northern side is still largely forest-clad. Its great crater, 3,936 feet in diameter according to Dr. Karl Sapper, contains two large daughter craters and nine grand-daughter craters. One of the last-named discharges steam and sulphurous vapors intermittently. The summit is about twelve miles from Cartago, and the slope is sufficiently gradual to enable one to make the entire journey on horseback. A magnificent panorama is visible from the top when the mountain is free from clouds, but favorable weather conditions are quite uncertain, as our three visits in July, September and March distinctly showed. The biological interests of Irazu proved to be botanical rather than zoological.

On the Atlantic side of Costa Rica Juan Viñas was our most productive locality. The frequency of our visits there was determined in large part by the facilities for food and shelter, which we owe to Mrs. Clyde Ridgway. Many a favorable locality for a naturalist in Costa Rica is discounted by the lack of such accommodations, unless, indeed, he is able to bear the considerable expense of transporting tents and provisions to the place where he would be. Juan Viñas is accessible by the railroad; the station lies at one edge of the floor of an old crater. From the level of the track, a zig-zag cart road took us through the forest of the canyon side to the turbulent, rock-filled Rio Reventazon, 800 feet below. The village of Juan Viñas and the top of the canyon are 600 to 700 feet above the railroad, so that we had a vertical range of 1,500 feet for exploration within easy reach.

Peralta, where Mr. B. M. Hess took me in at the railroad station, thanks to Mr. John M. Keith, will always be remembered as the place where I saw my first monkey, my first armadillo, my first basilisk, my first toucan and other interesting creatures in the wild state. The forest is still close to the railroad and the Reventazon here and these animals

were probably not more than half-a-mile away from the trains and locomotives.

In the banana country, along the Atlantic coast and up to an altitude of 1,000 feet, Mr. E. F. Hitchcock, of the United Fruit Company, opened to us the opportunity of examining a fauna quite different from that of the higher central parts of Costa Rica and in which the South American representatives were more in evidence. When the railroad connecting Limon with the capital, San Jose, was first projected, the line was intended to pass to the north of the two great volcanos Turrialba and Irazu and was actually constructed as far as Currillo on the northern slope of the latter. Frequent floods and changes in the river courses compelled the abandonment of this plan and the road now ascends the valley of the Reventazon River to the south of the two mountains. The northern railway is in operation as far as Guapiles and here and at near-by La Emilia, Messrs. E. W. F. Reed and R. E. Woodbridge, Superintendents of the Fruit Company, made us welcome. Mr. Schaus and Mr. Barnes were at Guapiles in June at the same time that I was, and among the dragonflies which Mr. Barnes caught was the first representative of the subfamily Cordulinae ever recorded from Central America. It is a member of a genus hitherto known only from Brazil and has been described as Neocordulia longipollex. To the west of Guapiles, the Florida road, passable on horseback or on foot, leads through a virgin forest into which we penetrated for a short distance. There were the tall trees whose trunks rose straight fifty or more feet from the ground before branching, which attract the attention of every traveler in the tropics. The foliage meeting that of other trees shut out the view of the sky except where a clearing had been made by lightning or storm and then, far above our heads, one could see a crown of red or orange flowers surrounded by brightly colored butterflies. The trees and shrubs were of numerous kinds and many of them bore a profusion of epiphytes. Here and there through the forest trickled streams of clear water, into which a bright-hued humming bird darted ever and anon. Occasionally there was the onion-like odor of peccaries although we did not succeed in seeing the animals. The many unfamiliar plants and insects which met our gaze at every step was so distracting at first that I turned from one thing to another, not able to concentrate my attention on any one. It was my first experience in a truly tropical forest and although we had many opportunities to visit similar scenes later, that day's excursion still seems, as I recall it, like a peep into some mysterious fairyland.

Some ten miles south of Limon is the Banana River region and here I had the pleasure of staying with Mr. and Mrs. C. J. Veitch. The country is only a few feet above sea-level and quite flat. Some of the Fruit Company's farms here bear the familiar-sounding names of Philadelphia North and Philadelphia South. It was early November and there had been an exceptionally long dry spell. Small brightly colored frogs were quite conspicuous in the banana plantations, one species bright red, another bright blue with irregular black spots.

Mr. and Mrs. C. H. Lankester made us welcome at Cachi, farther up the Reventazon than Juan Viñas, where the valley widens out. One day's excursion with them was to the fine Orosi waterfall, 250 feet high, which took us through a cool damp forest with tree ferns.

San Jose, the capital of Costa Rica, lies on the Pacific side of the country, thirteen miles west of Cartago, at an altitude of 3,800 feet. Professor J. Fidel Tristan, Director of the College for Young Ladies here, was our untiring friend, aiding us with advice and information, accompanying us on many an excursion, procuring maps, guides, shelter and friends for us, which made our stay in the country far more productive than it otherwise would have been. A naturalist himself, he did all in his power to further our researches. Professor Anastasio Alfaro, Director, and M. Ad. Tonduz, botanist, at the Museo Nacional, respectively, were most kind in identifying animals and plants for us, and another good friend was the ornithologist, Señor Don Jose Zeladon.

It was doubtless due to Professor Tristan that, with the approval of the then President of the Republic, Señor Don Cleto Gonsalez Viquez, and his Minister of Education, Señor Don Ricardo Fernandez Guardia, I was permitted to accompany a Commission for examining the qualifications of teachers of the public schools to the Province of Guanacaste in January. The members of the Commission, Professors Obregon, Perez Martin, Orozco and Tristan and Señor Villar, were most agreeable and courteous companions and the month spent with them was highly interesting and instructive.

Guanacaste is the northwestern of the Provinces of Costa Rica and borders the Pacific and Nicaragua. It has been visited by but few naturalists. From San Jose we went by train forty-one miles to Orotina, thence by horse and mule fifteen miles to Esparta—a gap in the transcontinental railway here—thence by rail again to Puntarenas on the Gulf of Nicoya, an arm of the Pacific. A small steamboat took us northwestwardly to the head of the Gulf and up the Rio Tempisque to Puerto Ballena. Here we mounted horses and reached another Filadelfia where we spent the night. A hot ride for six hours through a mostly open country brought us to Liberia, the capital of the province, on the following day. While the Commission held examinations, I was busied in collecting insects, finding here, as everywhere in Costa Rica, many hitherto unknown for this country. An interesting side trip with Professor Tristan was to the foot of the almost eternally cloud-veiled volcano Rincon de la Vieja and its solfataras. From Liberia we went to Santa Cruz in the upper part of the Peninsula of Nicoya, thence to Bolson, and back to Puntarenas by the steamer. Monkeys, especially the deep-voiced howlers, whose calls, when I first heard them, I took for the bellowings of bulls, and parrots, including brightly colored macaws, are common in Guanacaste, and it was a frequent occurrence to meet them as we passed through the forests or even more open roads. It is said that the abundance of monkeys here is largely due to their not being used as food for man to the same extent as on the Atlantic side.

While I was in Guanacaste, Mrs. Calvert was with our good friends, Mr. and Mrs. J. B. Clark, near Alajuela, whose house we had come to regard as our second home in Costa Rica. We can not lightly express our thanks for all that they did for us. They lived some ten miles from the Volcano Poas and it was during this visit that Mrs. Calvert witnessed a picturesque eruption of ashes. Accompanying her hosts to the crater on the following day, for the eruption lasted but half an hour, they found all the vegetation

ash-covered as if with snow and all the birds and insects flown from the mountain slopes."

The Diana Hunting Club of San Jose by its President, Herr Assman, granted Professor Tristan and me the privilege of staying in its hunting lodge at Turrucares, an excellent locality for my work. Not far from Turrucares the Pacific Railroad crosses the steepsided canyon of the Rio Grande de Tarcoles by a long, iron, arched bridge nearly five hundred feet above the river below, and this canyon I examined also.

The late Professor Paul Biolley, a native of Switzerland, who died in San Jose in 1908, was an active naturalist in Costa Rica for twenty-three years. To him many a student in Europe and the United States was indebted for material for study, and I, too, am glad to acknowledge my obligations to him. Vacation from school in Costa Rica is in December, January and February, and in these months Professor Biolley frequently visited the lower portions of the Pacific slope. For the sake of being able to compare data from another time of the year with his results, we made a visit to one of his collecting grounds, Surubres, in October, a possibility due to Professor Tristan and to Señor Don Pedro Bonnefil and his sister Señorita Bonnefil. Their charmingly situated hacienda, with a large higueron (Ficus tree) before the door, shedding its leaves at this time as new leaf buds were opening; with the little Rio Surubres near by, reached by a steep path down through a patch of forest, where our feet sank into a thick carpet of maiden-hair ferns, selaginellas and wild begonias with delicate pink blossoms; and, far off toward the sunset, the gulf and the peninsula of Nicoya, and beyond the latter the shining Pacific are memories which are rendered still brighter by the recollection of the hospitality which we enjoyed.

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Eleven and a half months had passed in our paradise and our appreciation of its charms was increasing daily. Yet we never valued it so highly, of course, as we did after we were driven out of it.

The thirteenth of April, 1910, came. I was near Turrucares; Mrs. Calvert at Cartago, thirty-five miles apart. At about half-past 12 in the morning began a series of earthquakes of varying intensity and interval. Although I was awakened by them, they did not seem sufficiently severe to induce me to leave my bed in the second story of a frame house, but at San Jose and Cartago they were stronger and everyone fled to the streets, where Mrs. Calvert and others from Weldon's Hotel passed the night. Walls were cracked, plaster fell, the universal tile roofs were disarranged or thrown off and poorly-built adobe houses were demolished. It was a nerve-racking experience, and it is now difficult, for those of us who passed through the sequel three weeks later, to understand how we continued to live there in the intervening time.

Earth tremors continued, not a day passing without them, but as they were generally of decreasing intensity, we hoped that the worst was over. About 185 were recorded by the seismograph at San Jose between April 13 and May 3. We went to Juan Viñas again, with most successful results for our investigations. Mrs. Calvert returned to Cartago on April 30, I on May 4, reaching there about 5.30 P. M. We had dinner as usual and, having gone back to our room, had seated ourselves to look over the mail that had arrived during our absence. While so engaged, at 6.50 P. M., without the slightest preliminary sound or tremor, came a most terrific earthquake. The electric lights within and without were instantly extinguished, owing to the derangement of the dynamos. As we tried to escape we were thrown to the floor, which seemed to rise and fall under us. There was a roar of falling walls, the air was filled with the dust of plaster. We could do nothing but lie where we had fallen until the shaking ceased. Then we rose and, climbing over the piles of debris, made our way to the window opening on the street and so escaped. Three walls and the ceiling of our room were still in place, a fourth, of brick, fell but, fortunately, not on us. We remained in the street all night, the ground quivering incessantly with now and then a sharp shock, but less severe than the first. We realized that the town was utterly destroyed, but not until morning broke could we see how much and how little was left that we could recognize. The number of lives lost in Cartago and the surrounding villages was given later as between 1,500 and 1,800; in Cartago one in every eight is said to have perished.

The full story of such an event is too long for this place. We lost the shelf-full of larvae that we were rearing, but, wonderful to relate, little else, although some of our trunks were buried out of sight under fallen bricks and mortar. We spent May fifth in rescuing all that we could from the ruins and slept in the street that night. The railroad to Limon having been reopened on the sixth, we took the first train to the coast that day. It was hard to lose the three more months that we had expected to stay in Costa Rica; it was sadder to see the fearful ruin of a country we had come to love so well. Although Cartago and its environs had suffered most, the whole central portion of Costa Rica had been shaken severely, and for weeks afterward the inhabitants were afraid to return to their houses, and spent most of the time in open places, under tents and all sorts of makeshift shelters. Under such circumstances, with the approach of the rainy season, the fear of further earthquakes and of pestilence resulting from the decay of bodies buried in the ruins, it seemed best that we should depart and we sailed from Limon on May 9 for New York.

——And yet ever since there has been the regretful thought; perhaps we *could* have stayed and not suffered further loss of our material or of our lives.

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There remains the pleasant duty of acknowledging the assistance which we received from others who gave us letters of introduction or information and advice as to the equipment we should take with us—His Excellency the Costa Rican Minister in Washington, Señor J. B. Calvo, who arranged for the free entry of all our belongings at Limon; Señor Don Alfredo Volio, then Minister of Foreign Affairs in San Jose; Dr. E. Echeverria, in Limon, Señor J. F. Echeverria, in San Jose, Miss Edith M. Bickman; Dr. W. P. Wilson, Mr. Robert Ridgway, Professor Lawrence Bruner, Mr. H. Pittier, Mr. M. A. Carriker, Jr., Dr. R. E. E. McKenney and Dr. D. Rivas.

*Pous has lately been described and pictured by Professors Pittier and Tristan in the National Geographic Magazine for June, 1910.

The University Library has now passed beyond the 300,000 mark in the number of books on its shelves, placing it in the first rank of university libraries in this country.