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OF

CARL H. EIGENMANN

1863-1927

BY

LEONHARD STEJNEGER

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C. H. Eigenmann

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Carl H. Eigenmann was born on March 9, 1863, in Flehingen, a small village near Karlsruhe, Baden, Germany, the son of Philip and Margaretha (Lieb) Eigenmann. Little is known of his ancestry, but both his physical and his mental characteristics, as we know them, proclaim him a true son of his Suabian fatherland. When fourteen years old he came to Rockport, southern Indiana, with an immigrant uncle and worked his way upward through the local school. He must have applied himself diligently to the English language and the elementary disciplines as taught in those days, for two years after his arrival in America we find him entering the University of Indiana, bent on studying law. At the time of his entrance the traditional course with Latin and Greek still dominated, but in his second year in college it was modified, allowing sophomores to choose between Latin and biology for a year's work. It is significant that the year of Eigenmann's entrance was also that of Dr. David Starr Jordan's appointment as professor of natural history. The latter had already established an enviable reputation as an ichthyologist, and had brought with him from Butler University several enthusiastic students, among them Charles H. Gilbert who, although only twenty years of age, was associated with him in preparing the manuscript for the "Synopsis of North American Fishes," later published as Bulletin 19 of the United States National Museum. Eigenmann's teacher in the classic curriculum is said to have been "uninspiring" so it is small wonder that when the choice came to his students, the best ones took advantage of the opportunity to follow the new trend, and as Jordan tells us "the leader of these, Carl H. Eigenmann, found in Zoology the passion of his life." Realizing that

*According to Dictionary of American Biography, "Eigenmann's middle initial did not stand for a name."

"his work was of the highest order" Jordan later made him instructor in his department.

This was a period of great activity in American vertebrate systematic taxonomy and faunistic studies, which has rightly been called the Bairdian Period, beginning with the reports on the zoological collections of the Pacific Railroad Surveys and the Mexican Boundary Commission, with headquarters at the Smithsonian Institution under Spencer Fullerton Baird. At that time there was gathered in Washington a circle of specialists such as Gill, Tarleton Bean, Brown-Goode, Ridgway, Dall, True, Coues and others with whom Jordan was in close cooperation.

The zoology of these men and zoology as it was taught at the Indiana University at that time, is now referred to as taxonomy and zoogeography. Jordan defined taxonomy as "technical classification of organisms—an attempt to express as well as possible by different categories (order, family, genus, species) the lines of descent and ramification through which animals and plants have acquired their present forms. A classification truly natural—that is, based on structure, embryological development, geological history, and genetic descent—is a transcript of our actual knowledge of the evolution of the forms in question. From this point of view, taxonomy is the perfected product of all Natural History research." Jordan's method was to take up one of these categories, the species of a genus, or the genera of a family, for study with the student and embody the results in a paper under their joint authorship, or to turn the material over to the student to be worked up alone or jointly with another student. Thus in taking up the study of the darters with a view to ascertaining their relationship to the true perches, he had Eigenmann prepare skeletons of 20 species of the subfamily *Etheostomatinae*. The result of their studies was embodied in a joint paper concluded in March 1885 and published in the Proceedings of the National Museum, Eigenmann's first publication the year before he received his bachelor's degree. Now followed in quick succession numerous papers by the young ichthyologists. In 1885 they submitted no less than fourteen

papers to the Philadelphia Academy of Natural Sciences, and Jordan, either alone or jointly with Eigenmann, Gilbert, Meek, or Hughes, submitted to the United States National Museum fourteen papers on fishes. Among Eigenmann's papers of that year may be mentioned his first "Review" paper, in conjunction with Morton W. Fordice, giving full "synonymy of the genera and species of the *Eleotridinae* found in the waters of America with analytical keys by which they may be distinguished," based on specimens belonging to the University of Indiana mostly collected by Professor Jordan.

Before the end of the year Eigenmann finished another similar paper on the *Diodontidae*, Porcupine-fishes, which was published the following year over his own name only. In this early paper the 23-year old ichthyologist demonstrated the painstaking, careful, deliberate qualities which distinguish all his later work. The object of the investigation was "to ascertain the number and valid species and their correct nomenclature" the main problem before him being the question of the distinctness of the two Linnean species *Diodon hystrix* and *holocanthus*. Point for point he analyzed the literature, quoting it *verbatim*; point for point he examined the whole series of specimens by number and origin, so that his statement can be verified and used by future investigators. He found gaps and uncertainties both in the literature and in the material, yet although he had become fairly convinced that the two forms were identical, he was satisfied with leaving them separate for the time being. No hasty judgment, no juvenile self-assertion, no dogmatic insistence on his own view! It is interesting to note that he acknowledged himself "indebted to Miss Rosa Smith for the description of two specimens from La Paz, at San Diego."

An interesting side of Eigenmann's mental activity at this time is revealed in a little sketch entitled "Folk-lore of a German Village" in *The Current* of May 1, 1886, a Chicago weekly, in which he not only tells a charming story of the reported origin of the names of his own native village and of the neighboring Sickingen, but through some Suabian folklore about death and

Faust is led into a discussion of the latter, revealing considerable familiarity with the literature.

Eigenmann received his bachelor's degree in 1886. In the fall, Dr. Myers tells us, an opportunity for the principalship of a school in Santa Paula, California, came to him through his classmate, Barton W. Evermann. He arrived too late for the position but remained for a while in the state. In San Diego he met Miss Rosa Smith, who was already becoming known as a competent ichthyologist by her papers on west coast fishes. They were married in that city on August 20, 1887, and thus was started under joint authorship that series of ichthyological papers which soon made the "Eigenmann and Eigenmann" authority familiarly known on two continents. The opportunity had come for the newlyweds to attend Harvard University and under Alexander Agassiz, Garman and Mark to study the large collections of fishes gathered by Louis Agassiz and his assistants during the Thayer Expedition in Brazil, and by Alexander Agassiz and Dr. Steindachner during the Hassler Expedition around South America. Having received his master's degree at Bloomington, Eigenmann and his wife were soon at work at the Museum of Comparative Zoölogy, Cambridge, Massachusetts, and with short intervals there appeared a series of important papers along two distinct lines, some on embryological and evolutionary subjects, others on faunistic or purely taxonomic questions, too numerous to be specified here, but the appearance of their first report on the South American fishes, the precursor of the many later publications which were the crowning success of Eigenmann's life work, shall be mentioned.

The "Preliminary Notes on South American *Nematognathi*" or Catfishes, was issued as early as July 18, 1888, an impressive paper of 52 pages treating of 296 species, 36 of which were described as new, belonging in 61 genera and 5 families. Practically simultaneously there appeared in the *American Naturalist* an article giving a key to the families and showing that the enclosure of the airbladder in a bony capsule in the *American Nematognathi* is the rule rather than the exception. There can be no doubt that the year spent at Harvard, with a brief summer

course at Woods Hole was of the utmost importance in molding Eigenmann's scientific individuality. While greatly taken up with taxonomic studies of the South American fish fauna, he was assiduously pursuing those other zoological disciplines which were to become his main working field for the next ten years.

By the middle of December 1888 the Eigenmanns were back in San Diego, where as curator of the local Natural History Society he was instrumental in establishing the San Diego Biological Laboratory. The fishes of the coast became the immediate objects of Eigenmann's investigations but not merely from the purely systematic standpoint. The study of variation was one of the principal lines of research laid out in establishing the station, but the life histories, development and evolution of the San Diego fishes were receiving equal attention, as demonstrated in the paper entitled "Fishes of San Diego" published by the United States National Museum in 1892. Besides the purely taxonomic matter, this article contains his observations on the spawning habits and seasons, the embryology and migrations of the fishes of southern California. Among many important contributions it also contains a full account of the development of the Point Loma blind fish, *Typhlogobius californiensis*, with the promise of a minute description of the eye to follow. This is noteworthy from the fact that when Mrs. Eigenmann guided him to the blind fish rock at the base of Point Loma, according to his own statement, the first definite plans for the study of evolution by degeneration took hold of him.

Perhaps the most important work done by Eigenmann on the Pacific Coast was his contribution to the ontogeny of viviparous fishes based on the study of *Cymatogaster aggregatus*, and when the final paper was published in 1894 in the Bulletin of the United States Commission of Fisheries for 1892 (98 pages, 27 plates) it was at once recognized as an outstanding achievement.

However, the problems of the South American fish fauna were not abandoned. The elaborate review of the catfishes, *Nematognathi* (508 pp.) was finished and published in July 1890 by the California Academy of Sciences with which both

Eigenmanns had become closely associated. The various problems were being worked out and embodied in a comprehensive "Catalogue of the Fresh-water Fishes of South America" which was published in July 1891. It enumerates 1135 specific names under 240 genera, but in addition under separate headings discusses the peculiarities of the South American fauna, its origin and its geographical distribution, representing a summary of all that was known of the fauna up to that time. Realizing the inadequacy of the material in museums and the necessity for studying the territory in person, Eigenmann hoped to take the field himself and had planned a trip of exploration to Colombia in 1891, but other events intervened and compelled the relegation of such plans to an indefinite future.

The University of Indiana conferred the degree of Doctor of Philosophy on Eigenmann in 1889, and when in 1891 Jordan was called to Stanford University as its first president, he appointed Eigenmann professor of zoology at Bloomington.

With characteristic energy Eigenmann took hold of his new duties. With many of his contemporaries he realized the inadequacy of merely descriptive taxonomy as practically the only university discipline in zoology. As he himself put it, they had "ceased to content themselves with the cataloguing of specimens" and were now to "study the method, whys and wherefores of the things about them." On the other hand, studies, the materials for which were reasonably near at hand, would have to be devised, and the study of the variation, development and evolution of the species composing the local fauna suggested itself. He consequently became a zealous promoter and director of the Biological Survey of Indiana established in 1892 by the Indiana Academy of Sciences, and in 1899 he supplemented it by the establishment of the biological freshwater station at Turkey Lake, northern Indiana (later removed to Winona Lake). Naturally fishes retained their status as the principal material for study, and located as the station was, an intimate knowledge of the freshwater fish fauna of both the east-flowing and west-flowing river systems of the whole continent became of the utmost importance.

As early as 1892 Eigenmann was in the field, making a comparative study of the fishes of the Pacific and Atlantic slopes. The trip extended from Winnipeg to Vancouver and from Oregon to Montana, and during August and part of September he covered the headwaters of the Red River of the North, the Saskatchewan, the Columbia, the Fraser River and the Missouri. The trip was financed by Dr. Günther as a collecting expedition for the British Museum but the results were published in the Bulletin of the United States Fish Commission for 1894. The number of species collected was 65, about 20 per cent of which were new.

Another field of research was beckoning almost at the very door of his laboratory, viz. the complex of Indiana caves with their blind inhabitants. The interest awakened in him by his studies of the Point Loma blind fish now spurred him on. One of his earliest discoveries greatly encouraged further research. Eigenmann found that the blind fish which inhabits the underground waters of western Missouri and which had previously been regarded as identical with the one long known from the Mammoth Cave in Kentucky, was not only a different species, but that it represented a distinct genus with an epigean ancestry different from that of the Mammoth Cave *Typhlichthys*. He named it *Troglichthys rosae* after his wife "the re-discoverer of the California *Typhlogobius*." But his researches were not limited to the fishes. In the nineties of the last century several sensational discoveries of blind cave salamanders were made, *Typhlotriton* in Missouri, and *Typhlomolge* in Texas, which attracted Eigenmann's attention. Even the blind woodrat of the Mammoth Cave was included in his investigations. Numerous excursions were undertaken during these years, exploring caves and underground water courses. As a result "a veritable stream of papers by himself and his students issued from the laboratory in Bloomington" during the next decade.

Eigenmann's intensive studies of "degenerate evolution" of the vertebrates were now attracting the attention of the scientific world. Grants from the Elizabeth Thompson Science Fund and the American Association for the Advancement of Science

enabled him to extend his excursions in search of material to Missouri, Texas and Kentucky. In 1902 through a grant from the Association he was able to visit the blind fish caves of Cuba and subsequently the Carnegie Institution of Washington made it possible for him to make additional investigations in Cuba. Accompanied by students and volunteer assistants he made several visits to the island between 1902 and 1904 and succeeded in gathering females both of *Lucifuga* and *Stygicola* with young.

During the winter 1906-1907 we find him in Europe attending the lectures of Weissmann and of Wiedersheim at the University in Freiburg. At the Anatomical Institute Professor Wiedersheim placed his laboratory at Eigenmann's disposal for his studies of the eyes of the cave vertebrates and there he had the drawings made which later appeared in his monograph. The discussions and close contacts with these men could not be without great influence on the development of his own theories on heredity and evolution.

The researches on the cave faunas came to a conclusion with the publication in 1909 by the Carnegie Institution of Washington of the splendid quarto volume "Cave Vertebrates of North America, a study of degenerative evolution." As "conclusions of general import" he prefaced it by the following statement: "(1) The bleached condition of animals living in the dark, an individual environmental adaptation, is transmissible and finally becomes hereditary, fixed. (2) Ornamental secondary sexual characters not being found in blind fishes are, when present, probably due to visual selection. (3) Individual degeneration of the eye may begin in even earlier stages of development until nearly the entire development becomes affected, that is, functional adaptations are transmissible."

During his trip to Europe, Eigenmann also visited the museums in London, Paris and Vienna for the particular purpose of examining type specimens of South American freshwater fishes, for in spite of all the busy university work and the exploration of the caves, he had not entirely laid aside nor forgotten his first love, the study of the neotropical fish fauna, though it naturally was kept in the background. However, in 1903 he

resumed work on the Brazilian *Characidae* based upon the collections of the Indiana University and of the United States National Museum, a monograph being actually completed in 1906. The following year the study of the Thayer Expedition collections in the Museum of Comparative Zoölogy was renewed, with the result that the entire monograph had to be rewritten. During this work, however, it became apparent that plentiful as was the material for the time and the region covered by the early explorers, it was not sufficient for a really fundamental work such as Eigenmann had intended it to be.

As early as 1904 he began agitating for a biological survey of the Panama region by the Smithsonian Institution. Dr. Rathbun expressed sympathy with the idea and the purpose of "a complete natural history investigation." Requests that the authorities in charge of the construction of the Panama Canal organize such a survey fell on deaf ears, but Eigenmann did not lose courage. On his initiative, the American Microscopical Society in 1905 passed a resolution urging the survey, and a similar resolution was introduced by the section of zoogeography to the general session of the International Zoological Congress at Boston in 1907, and was passed unanimously. The reasons for such a survey were stated as follows: "It is certain that the Pacific slope fresh-water fauna of South and Middle America was derived from the Atlantic slope fauna. The Isthmus of Panama is one of the possible routes of migration. The Panama Canal, when completed, will destroy natural barriers and cause the faunas of the two slopes to mingle to a great extent. It will thus permanently obliterate the natural and primitive conditions, and it is highly desirable that a biological survey of this region be made before the completion of the canal."

At the next meeting of the American Association for the Advancement of Science in December of the same year, the resolution adopted was addressed directly to the President and Congress urging that provision be made for such a survey. Three years later it was announced that with the approval of President Taft the plan would be carried out by cooperation of such Government agencies as the Bureaus of Fisheries, Biolog-

ical Survey, Entomology, etc., under the direction of the Smithsonian Institution. Although the result of his initiative and energetic agitation, Eigenmann was not to take an active part in its field work as in the interim of the long delay he had formed other connections.

At the reorganization of the graduate school of Indiana University in 1908, Eigenmann was made its dean and relieved of his teaching duties when needed for field work and the preparation of reports.

In 1907 arrangements had been made for one of Eigenmann's former students, John D. Haseman, to go to South America on a collecting expedition for the Carnegie Museum at Pittsburgh. Between November of that year and January, 1910, he brought together a very large series of South American fresh-water fishes, mostly from areas not covered by the Thayer Expedition.

Eigenmann had for some time been working with a collection of fishes brought back by the Princeton University Expeditions to Patagonia, and in preparing the report had been led into a discussion of von Ihering's Archhelenis theory of a former land-connection between South America and Africa. The Guiana ichthyic province was supposed to have been part of this connection, and as he found indications in the literature that the fish fauna of the lowlands differed from that of the table land of Guiana, where remnants of the original fauna might be expected to persist, he considered it necessary that the rivers of that region "should be explored *above* and *below* falls that are impassable barriers for the ascent of fishes." Having made this suggestion it was quite natural that he should desire to undertake this suggestion himself if arrangements could be made.

In the summer of 1908, having been refused assistance by various institutions he started on his own resources accompanied by Mr. E. S. Shideler as volunteer assistant, but visiting Dr. Holland at Pittsburgh on the way out he obtained the latter's pledge that the Carnegie Museum would help. He arrived in Georgetown on September 6 during the dry season when the upper portions of the rivers are lowest and the fishes consequently concentrated in the channels of the streams. His object

in undertaking the expedition was a double one, best stated in his own words: "First to observe, photograph and incidentally collect as many species as possible for my monograph of the characins; second, in connection with my general faunal study of the fishes of South America to determine, if possible, the relation of the fish fauna of the Guiana plateau to that of the lowlands, more particularly the relationship existing between the faunas of the upper and the lower Potaro." Another quotation will illustrate some of Eigenmann's personal characteristics and methods which contributed to his success:

"If seeing and recording a lot of 'specimens' which have been disintegrating for longer or shorter periods in alcohol can be called acquaintance, I have been acquainted with South American fresh-water fishes for many years. In contrast to such an acquaintance I recall standing one exciting morning on the brink of a small pool, which my Indians said contained fishes. It was not more than fifty feet across and was back-water left by the receding Essequibo. The Indians pounded poisonous hiari roots, tied them into bundles, and the boys then swam through the pool with them over their backs and thus mixed the poison. Soon one species, then another, and still others which I had only known as mummies, were resurrected from the depths of that pool and I danced about its margin with delight to see them in their living vivid colors and incidentally to embalm them in their turn for future reference . . . I do not know how long we stayed there, not over two hours, in which we caught fifty-five different species of fishes, six of which were not secured elsewhere."

Notwithstanding the fact that Eigenmann was taken ill with a fever, the trip was a huge success. He was back in Georgetown before the middle of November and arrived in New York with an unprecedented collection of about 25,000 specimens. Of these 18,300 odd specimens represented the ichthyic fauna of the area covered by the expedition, furnishing an enormous amount of material for most intensive work during the next couple of years. Apart from the general conclusions drawn from the study of the collection and the suggestions for the conduct of future expeditions, the trip yielded 28 new genera and 128 new species.

The following years were devoted to reports on the Guiana collection and others. Several important works finished earlier were published in 1909. "The Cave Vertebrates of North America," already alluded to, was followed three days later by his equally important "Fresh-water Fishes of Patagonia and an examination of the Archiplata-Archhelenis Theory" in volume 3 of the Reports of the Princeton University Expeditions to Patagonia, 1896-1899.

In this report which was practically finished in 1906, after showing that the fish fauna of the Archiplata, or Patagonia, is not related to the typical American fishes, he defined four main "regions" of unequal value of Middle and South America, viz. the Transition, the Mexican, the Andean and the Brazilian regions. The Brazilian region is again divided into 10 "provinces." He then discusses the origin of these different faunas based on detailed lists of species giving their geographical distribution. The Archhelenis theory is treated in a special chapter entitled "The Necessity and Evidence of a Former Land Connection between Africa and South America" (p. 363 *seqv.*). After noting that the "North American fauna is entirely distinct from the tropical American fauna" he analyzes the constituents of the two groups of families which Tropical Africa and Tropical South America have in common. One by one he discusses the availability of each family as proof of a hypothetical land connection. Some of them he rejects outright as of recent marine origin; the distribution and relationship of others, he finds, do not absolutely require a land connection to account for their presence in both continents though "such a connection would be very convenient." But when he comes to the *Cichlidae* and *Characidae* he reaches the conclusion that "there is no known means by which these two forms could have crossed the existing gap between Africa and South America. There has been no exchange of species in recent times, for there is no species or genus common to the two continents. The South American and African elements of these two families must have been derived from some intermediate land-mass or must have gone from one continent to the other over a land bridge." He argues

further that this land connection which he regards as "imperative" must have been obliterated before the Tertiary, before the origin of existing genera and before many of the existing families.

He winds up with a statement in which we clearly discern a well planned program which he had already laid for his future work. As such it merits to be quoted in full: "The points of strategic importance for ichthyic chorology in South America are, therefore, (a) western Colombia and Panama; (b) Guayaquil and Peru to the Amazon, across the Andes; (c) the table land of Guiana, Archiguiana; (d) the Rio San Francisco, with the Rio Parahyba and the headwater of the Tieté and Rio Grande, in Archamazona; and (e) the area between the Rio Negro and the La Plata."

It will be noted that this was written in 1906 before his expedition to Guiana and that consequently point *c* was already carried out before the program was published.

The connection established with the Carnegie Museum in Pittsburgh was tightened after his return from Guiana by Eigenmann being made an honorary curator of fishes in the Museum, though still residing in Bloomington—a position he held until 1918. There thus fell under his immediate charge the great collection of South American fishes made by Haseman, already alluded to. The working up of this and the Guiana spoils occupied the next couple of years and required a second visit to Europe in the summer of 1910 to examine types in the museums in London, Leiden, Amsterdam, Berlin, Vienna, and Paris during which he established most cordial relations with the leading ichthyologists abroad.

By 1912 he was again in the field, this time in an attack on point *a* of his program, viz. "western Colombia and Panama." Panama, it will be remembered, had already been covered by the Smithsonian Institution. Eigenmann, therefore, in order to carry the work southward arrived at Cartagena, Colombia, on January 3, 1912. The route of the expedition was up the Magdalena River to Girardot, from where a side trip was made to Bogotá. From Girardot the Cordillera was crossed by pack

train, eventually reaching the upper Atrato River and the party was back in Cartagena on April 2. The collection was acquired by the Carnegie Museum. The Colombia collections were supplemented at the end of the year by a trip of two Indiana University undergraduates financed by two Indianapolis gentlemen. One of them was enabled to continue all through 1913 and part of 1914, extending his collecting excursions into Ecuador.

The world war period was passed in writing and publishing either alone or jointly with students, numerous papers on South American fishes, notable reviews of peculiar families. But most important was the appearance in 1917 and 1918 of the first two parts of his *magnum opus*, the monograph "The American Characidae" in the Memoirs of the Museum of Comparative Zoölogy. Begun, as we have seen, by the newly-wed Eigenmanns in Cambridge in 1888, resumed in 1903 at Bloomington, manuscript finished in 1906, rewritten and partly finished in 1908, it was postponed in anticipation of additional material in order to satisfy the author that his work might be so fundamental that his conclusions would remain unassailable. These first installments included six subfamilies embracing 52 genera and 312 species, one-half of which were described as new during the preparation of the work, and accompanied by 38 plates splendidly illustrating this unique fauna. I call special attention to plate 1, which is a map of South America showing the routes of his predecessors in the exploration of the South American fish fauna, not only because it is of great help to students in other special fields, but chiefly because it demonstrates Eigenmann's strong geographic sense which renders his work so trustworthy and so helpful.

But his program for the survey was as yet only partly carried out, and much more material was needed. In 1918, heading the expedition made possible by the generosity of the Hon. Will J. Irwin under the auspices of the Universities of Indiana and Illinois and aided by grants of the National Academy of Sciences from the Bache Fund and of the American Association for the Advancement of Science, Eigenmann, accompanied by his daughter Adele, medical student of the University of Indiana

and by Mr. W. R. Allen, a traveling fellow of the University of Illinois, started in June by way of New Orleans, where the expedition was delayed five weeks waiting for passports from Washington, a postlude to the war—Eigenmann was born in Germany!—only ended by a direct appeal to President Wilson. The high Andes of Peru were first visited, where collections were made in the rivers and lakes reaching elevations up to 15,900 feet. They also visited La Paz in Bolivia and Mr. Allen surveyed Lake Titicaca from December to May. In February, 1919, Eigenmann went south to Chile where he was disappointed at the paucity of the fresh-water fish fauna of only 30 odd species belonging to 10 families. On the first of June, 1919, he returned. As usual he brought back with him a large and varied material the study of which resulted in important publications. According to Myers¹ “it was on this trip that the strain of the great altitudes broke the indomitable strength of Eigenmann, once before weakened by fever in Colombia and it is from this time that we must mark his decline in health.”

He had now completed the Pacific slope portion of his program with the exception of a few rivers in Peru and Chile, which as late as March 4, 1921 he still hoped to be able to visit. His field days were over and the exploration of the Atlantic slope he had to leave to others, but he had shown the way, he still had the enthusiasm and he saw to it that younger men carried on the work. Thus in 1920 he was instrumental in sending William R. Allen (Centennial Expedition of the University of Indiana) to the upper reaches of the Amazon, followed in 1921 by Nathan E. Pearson (of the Mulford Expedition). The last collection of importance was that of Dr. Carl Ternetz who from 1923 to 1925 traveled down the Rio Tocantins to the Amazon and up that river to Manáos, ascended the Rio Negro and finally crossed over to the Orinoco. According to competent authority his collections “richer than any brought from South America since those of the Agassiz Expedition and possibly even surpassing them” came to Bloomington.

¹ Nat. Hist., vol. 28, 1928, p. 100.

The work in the laboratory and museum continued, however, unabated, and reports on the expeditions making public the preliminary results of the work appeared within short intervals mostly in the "Indiana University Studies." Some of his more detailed and fundamental volumes were also published at this time, for instance in July 1921, part 3 of "The American Characidae" (100 pp. + 28 plates) and in January 1923 "The Fresh-water Fishes of Northwestern South America" (346 pp. + 38 plates and maps), the latter issued by the Carnegie Museum. At the symposium on geographical distribution of the American Society of Zoologists, the American Society of Naturalists and the Ecological Society of America, at Cambridge, December 1922, Eigenmann participated with a summary of his South American work, entitled "The Fishes of the Pacific Slope of South America and the Bearing of their Distribution on the History of the Development of the Topography of Peru, Ecuador and Western Colombia" in which he presents some of his general conclusions. On the Pacific slope between Panama and southern Chile there are two main faunas. That of Chile belonging to the south temperate Patagonian fauna is poor in species. The fishes north of Lima pertain to the Amazon-Orinoco and Central American fauna with but a few occasional north temperate "surprises," 385 species having been taken in this area which is divisible into several distinct regions. The highland fauna (above 7000 feet) in part overlaps the different lowland faunas.

Besides the great family of the Characidae, Eigenmann had from time to time finished and published monographs of some of the smaller families of the South American Catfishes, and even as late as 1925 the American Philosophical Society in its Transactions published his Review of the Doradidae (86 pp. + 27 plates) in which he was able to utilize material collected by Pearson during the Mulford Expedition.

The completion of the monograph on the American Characidae, however, was evidently a long way off, but he worked at it as long as his strength would permit, and then he called in younger help which he hoped might complete it. Dr. G. S.

Myers was selected and with his assistance the manuscript for parts 4 and 5 was finished in the summer of 1925, but he did not live to see them published. The "Fresh Water Fishes of Chile" published by the National Academy of Sciences as one of its Memoirs (vol. 22, Mem. 2, 63 pp. + 16 plates) in 1927 also appeared after his death.

The elimination of yellow fever by means of fishes eating the larvae of mosquitoes had interested him for many years and the studies of their habits and distribution was of great assistance when in later years his advice was sought by the authorities charged with the work of freeing the South American countries of the pest, and as late as April 1924 we find him presenting a suggestive paper on "Yellow Fever and Fishes in Colombia" to the Philosophical Society.

But Carl Eigenmann's working days had now come to an end and his broken health compelled him to seek the more congenial climate of Southern California, and on May 26, 1926, he and his wife left Bloomington never to return. After a long illness he died at a private hospital at Chula Vista in San Diego County, on April 24, 1927. "He lies at rest in San Diego, overlooking the waters he knew so well many years ago."

In Eigenmann, American zoology lost one of its most outstanding investigators. The National Academy of Sciences had honored him as such by electing him a member in 1923, for as one of his ablest pupils has expressed it "he was recognized as one of the foremost ichthyologists of the country and indeed we may place him as one of the four greatest of his time."

Many honors came to Eigenmann in testimony and recognition of his achievements as a scientific worker. He was a fellow of the American Association for the Advancement of Science; Honorary Member of the California Academy of Sciences and the Sociedad Ciencias Naturales, Bogota; Member of the Indiana Academy of Sciences, the Washington Academy of Sciences, the American Microscopical Society, the Society of American Naturalists, the Western Naturalists' Association, the American Zoological Society, Western Zoological Society, American Society of Anatomists, and American Geographical

Society. He was also a member of the Sigma Xi and the Phi Beta Kappa Societies.

Eigenmann's capacity for work was phenomenal, as proven by the many monumental quarto volumes which comprise only a small part of his 228 publications, nearly all devoted to critical, painstaking, detailed, important research.

But research was not the only field to occupy his time and energy. The University of Indiana proclaimed him a great and inspiring teacher. Not knowing this side of his activity, I shall quote a part of what one of his pupils, later assistant, finally colleague and always friend, Professor William J. Moenkhaus, said at the memorial service held at the University:

"As students we were a happy family—apprentices in his workshop in the days when this was in old Owen Hall. Working in the same room with him, each of us was happy in our own problems but none happier than he. He kept us continually informed of his findings and his readings with an informality and enthusiasm that easily convinced us that we were just as enthusiastic and doing something perhaps quite as important. There was no coddling, no prodding, no scolding. All this he left for us to do to ourselves. He was a student of Louis Agassiz, one generation removed, and inherited Agassiz' methods of letting students find things out for themselves and learn to stand on their own feet. He did not believe in the hot-house variety of zoölogist. I have reasons to believe that he liked the subsidized scholar about as well as we like the subsidized athlete. These things bore fruit. A few years ago some thirty of his former pupils from all parts of the country gathered in Cincinnati at a dinner given in his honor. It was most interesting to see that each man acknowledged that the greatest debt he owed him was that he had taught him to be self-reliant and independent in his work. Dr. Eigenmann taught by example.

"He was always direct in his work and went quickly and effectively to the heart of things. Whatever he attacked yielded something. In his work he was careless of the methods to be employed. Fancy instruments and complicated apparatus had no attraction for him. Anything that lay conveniently at hand would suffice. I often marveled at the dexterity of his short, thick fingers dissecting out the miniature teeth or cleaning the skeleton of the little fishes themselves often not larger than a nickel. He was careless of the trimmings of life. Appearances were of no importance to him. His concern was to get

things done. He always knew where he was going and was in a hurry to get there. Quite naturally he was careless of the way in which he dressed up his manuscripts. His editors had a difficult task in untangling them when in his earlier years they were written in longhand. Later he did them on the typewriter, but this did not seem to help the situation very much. Mrs. Eigenmann, herself a trained zoölogist, was invaluable to him not only in her counsel, which he highly prized, but also in the expert way in which she edited his writings and relieved him of these harrowing details. . . .

"He was productive throughout his life. For forty years there flowed from his pen a continuous stream of publications. The so-called wisdom which as a rule possesses one in later middle life did not slow him down. He never lost the enthusiasm and freshness of youth. He remained a boy."

The concluding words of Professor Moenkhaus' eulogy express the sentiments of all who came in contact with him and not least those of his fellow members of the Academy:

"We all admired him for his great scholarship, for his untiring application, and the great amount of work he accomplished under circumstances by no means always the most favorable. Those of us who knew him best loved him for his many first-rate personal qualities, for his splendid tolerance, and, too, for the fortitude with which he in secret bore the sorrows which we knew he had."

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