

every one knows who ever operated an air compressor or had to deal with a badly lubricated axle.

But motion, whether it be furnished by water rushing from a waterfall, or by a steam or gas engine, or by a windmill, can be made to turn a dynamo and produce electrical energy. The latter, in turn, can be changed into motion, heat or light. Or again, we can bridge directly that jump between a chemical reaction and light by simply burning oil, gas, acetylene, or magnesium, and thus produce any range of even the most intense light. Or, in other cases, we use heat or electricity to decompose the most refractory substances in their elements, and some of our largest electro chemical industries in Niagara Falls are based on this. Or we may use either one of these forms of energy in chemical reactions which build up; which, in other words, bring about chemical synthesis.

But when it comes to transforming light energy into chemical synthesis, we have left thus far the monopoly of this agent to Nature; we have been acting as Rip Van Winkles.

In the museum of the Franklin Institute in Philadelphia exists an electrical machine which was used by Benjamin Franklin for his experiments. It was one of the very best electric machines of his day. Yet, at that time, it was a mere clumsy toy. When the weather was not too damp and all other conditions were propitious, the operator, after turning that glass globe until he was red in the face, could draw some insignificant sparks, or charge a Leyden jar, or give a harmless shock to the person who touched it. All this was not so very long ago. Yet that toy was the forerunner of our enormous electrical industries, and all the astounding modern applications of electrical energy; our electric generating stations which give us light, power and transportation, which move our trains, our ships, our factories, which generate power far beyond anything which unscientific man of antiquity, or of a few years ago, was able to dream of. That same electricity which gave us wireless telegraphy and the wireless telephone; which has made the world bigger, and, at the same time, smaller,

by rendering every nook and corner more accessible.

Let those who at present lay off their research chemists, their physicists, their research engineers, remember that the tremendous gap between that toy electric machine of Franklin and the present electrical industry, would never have been bridged but for research, invention and good engineering.

I. H. BAEKELAND

COLUMBIA UNIVERSITY

#### HERBERT HAVILAND FIELD

ON April 5 there died in Zurich, Switzerland, from heart failure following influenza, one to whom science and especially zoology owes a great debt. Herbert Haviland Field was not only a man of marked ability and personal charm but he also possessed unusual breadth of vision as well as the power to make his visions realities. By virtue of these traits he made contributions of fundamental and permanent value to the progress of science though he was known to relatively few because of his modesty and self-elimination.

Born in Brooklyn, N. Y., April 25, 1868, of Quaker ancestry which included some of the prominent citizens of that municipality a century ago, young Field had his early education in that city, was graduated from the Brooklyn Polytechnic and went to Harvard. There he took his bachelor's degree in 1888 and kept on until he had won his M.A. in 1890 and his Ph.D. in 1891. His doctor's thesis, a masterful study of the early development of the urogenital organs in Amphibia, gave him at once a high place in the esteem of workers in zoology.

On going to Europe in the following year, he met a cordial reception at the Universities of Freiburg in Baden, Leipzig, and Paris, at each of which he was given the doctor's degree. Even at the start of his studies he was impressed with the failure of investigators to give due attention to the work of the past and recognized that this neglect was due in large part to the lack of means for obtaining an adequate record of the volumi-

nous and widely scattered literature. As he studied this problem in various countries, the need grew upon him and the thought he had, even in student days, of some agency to handle the material in broad and comprehensive fashion took form gradually in the great Concilium Bibliographicum which he conceived, founded, and organized, an enterprise which testifies eloquently to his successful efforts for the advancement of science and the assistance of his coworkers in biology.

Dr. Field was a fine-looking man. Of large size and good figure, with dignified bearing, he attracted attention in any group even though in later years he had manifested a tendency to increase in weight which was, in fact, a trait inherited from his father. Two physical defects are worthy of note. He suffered from a constantly recurring migraine of great intensity. In the early days his friends and associates noted a marked tendency to stammer which became painful at times when he was involved in a vigorous argument. He studied the situation intensively to rid himself of the defect and it did largely disappear. It was, however, striking to those who had noted this peculiarity, to find that his conversation in other languages was entirely free from the difficulty. He spoke withal in an easy, flowing style which was vivid and sparkling, commanding the attention of the listener and carrying conviction to those with whom he was conversing.

His gift of tongues was indeed extraordinary, for in his college days he utilized Latin, German, French, Italian, Dutch, and Russian with apparently equal ease, and he is said to have been accustomed to write his diary in the last-named language. When the seventh International Zoological Congress met in this country it held a session at Cold Spring Harbor, and the delegates were received at Sagamore Hill by then President Roosevelt. At that time Dr. Field, who had known most of them for years, was called upon to introduce the foreign delegates to the President. He conversed readily with those whom he did not know, addressing each in his own

language and telling Mr. Roosevelt about them. His exceptional memory was conspicuous to every one who came into contact with him, but most of all, perhaps, to those of us who were his associates day after day in the laboratory at the Museum of Comparative Zoology. He would not only repeat paragraph after paragraph from various lectures but would dazzle us by a record of scientific facts from papers and references to out-of-way publications with a completeness and precision that were remarkable in fields outside of the particular territory in which he was doing his own work. I have been told that his musical memory was even more remarkable. It is said that he would listen to a symphony concert and on returning home would play on any sort of a musical instrument not only the motif and its numerous variations but also whole sections of the composition even though he had just heard it for the first time.

Combined with this fine endowment of a precise and retentive memory was a sense of order and system that was equally conspicuous because of its contrast with the habits of the ordinary man. He was fond of system and had remarkable power for outlining and installing a plan, to organize any given material; this was coupled with unusual power in following out the system and applying it in detail to complex series of data. It must be confessed that in his own work he was not always so systematic. In the laboratory at the Agassiz Museum he worked with the greatest pertinacity and concentration, often not even stopping for lunch. But after some days of such effort, he might absent himself for two or three days at a stretch and would be found visiting or reading at home with equal intensity. Furthermore, he sometimes manifested that absent-mindedness, which some attribute to genius and which affects the little things of everyday life that seem of importance to a smaller man. He would lose one object or another and, after failing to find the thing for which he was looking, would exclaim: "Never mind! I think I left it on the train," or somewhere

else, and go on with the main object of life at that time with absolute unconcern. In this, he manifested the calm that may rightly be regarded as an inheritance from his Quaker ancestry and that undoubtedly carried him through many difficult and awkward situations with an unruffled mind. His exactitude of action was labelled by some as a tendency to procrastinate for he would always turn up just to the moment when a train was leaving or was even already in motion. Such precise punctuality resulted in unfortunate failure sometimes when circumstances beyond his control resulted in minor delays on the way.

His dogged determination is well illustrated by a comment made in personal correspondence from Dr. C. B. Davenport, who was an intimate friend of Field's and to whom I am indebted for great assistance in preparing this sketch. Dr. Davenport writes:

An exceedingly valuable trait was his pertinacity. I have occasion to remember that, having put my hand to the plow of civil engineering, I was loathe to turn back; but Field had set his heart on my coming to Harvard and he was irresistible. I owe my entrance into biology as a profession to him. This pertinacity showed itself in the way he upheld the Concilium through many dark years and declined alluring invitations to continue his work elsewhere under more favorable auspices. None of these suggestions or appeals seemed to make any impression on him, if they involved a relinquishment of his well-thought-out plans.

Field's greatest work, and the one for which he will always be remembered and through which science has incurred to him an obligation that never can be discharged, was, of course, the Concilium Bibliographicum. To it he devoted his energies with intensity and rare persistence in the face of apparently insurmountable difficulties. Indeed, it would not be in the least an exaggeration to say that the load, which he had been carrying, especially in these months since the end of the war when it seemed as if the project might be put upon a permanent basis, even though it met opposition in some quarters and indifference in others, laid a tremendous burden upon his shoulders. In fact, his in-

timates had noticed for some months conspicuously that he was overworked even though they had not suspected the collapse which came so suddenly.

While a graduate student at Harvard under the leadership of Professor E. L. Mark, Field became deeply impressed with the need for the systematic rearrangement of the scientific publications where, in the field of zoology, a multitude of articles in hundreds of scattered periodicals were unknown even by title to the workers in the field and could be brought together only at an entirely unreasonable outlay of time and energy. It was computed at one time that there appeared annually upwards of ten thousand notes and articles, distributed through at least fifteen hundred periodicals in different languages. The unsystematic condition of the literature and the delays he saw in work repeated and in time and energy wasted in hunting out the records of the student's predecessors in order that the investigator might start at least on a level with those who had gone before, provoked in his mind the insistent inquiry as to the means for the improvement of the situation and the elimination of this waste. I think there is no doubt that he was stimulated also by the general development of systematic bibliography in the United States. He planned to reorganize the field of zoology and related sciences and to apply the decimal system of classification, then recently developed and published by Dewey. Furthermore he felt that the arrangement of records of the literature in book form fell short of the best plan available, and he proposed to substitute for it an analytical card catalogue through which every new publication would naturally and promptly drop into its proper place, and the student thus be able in a moment's time to gather together all of the publications on a given topic instead of hunting for them through volume after volume of an annual catalogue. Every zoologist is familiar with the splendid way in which this idea was developed and the unparalleled success with which the literature of the subject was indexed, for the Concilium cards have

included a much larger percentage of references in the literature of zoology than has ever been brought together by any other agency. Furthermore, this record has been furnished with a promptness that stands in striking contrast with the leisurely appearance of other bibliographic information. With the rapidly growing literature in this field, it was inevitable that the catalogue, especially in its full form with special cross references, began to assume considerable size, and some critics failed to recognize in this the true condition—the inevitable advancement of a growing field—and commented on the space required as if it were a defect of the system employed.

I recall vividly hearing Field on one occasion respond to such a comment by saying that despite its increase, the catalogue would not in a century reach the dimensions necessary to house a mounted elephant and yet no museum would hesitate to devote much more than that space to the representation of that single species. Field was not only the first to develop these ideas in a practical way, but he assumed the even greater burden of converting the unbelievers and the indifferent, and of securing adequate moral and financial support for the project. He visited the leaders in this country and abroad, secured the unqualified and enthusiastic endorsement of such men as Dohrn in Naples, Carus in Leipsic, Arnold Lang in Zurich, and, especially, of the French zoologists. In connection with the Institut International de Bibliographie in Brussels, he undertook to carry out part of the plan to utilize the Dewey system in the entire range of bibliography, until in the Third International Zoological Congress in Leyden at the instigation of the delegate of the Société Zoologique de France approval and support were enthusiastically pledged to the foundation of the Concilium Bibliographicum to be located at Zurich under his directorship. Subventions were given it officially by Switzerland, the canton and city of Zurich, and by several European governmental and institutional agencies, so that finally in the fall of 1895, Field took up his

residence in Zurich and officially opened the work of the Concilium. An American can not view with any large degree of pride the attitude of this country towards the enterprise. While it was receiving vigorous official and personal support in Europe and Field was himself devoting all of his time and a very considerable amount from moderate means to its maintenance, financial cooperation was unfortunately exceedingly limited here. It was a cause of constant regret to Field as his friends knew by his personal communications that so rich and generous a country, which he was always proud to claim as his own, had contributed in such a meager degree to an international enterprise, organized and led by one of its own citizens.

At first, Field was the entire Concilium. He did all its work, cared for its interests, sought out and developed its support, and carried its burdens. Gradually it grew despite indifference and opposition until it had its own printing press and staff of expert workers. Zoologists were forced to recognize the efficiency of the organization and the success of its work. The indomitable energy of its leader, his supreme confidence in its value, and his ability to present its claims in clear and convincing fashion, overcame every obstacle, and year by year it grew to be more extensive and more indispensable until, finally, the war broke. Then all such enterprises were thrown aside and the activities of the Concilium were temporarily suspended. It is worthy of mention that during this period, Field turned with equal energy and devotion to the solution of the problems that presented themselves in the social world and performed important services for his native country and for the mountain republic in which he had found his home. With the close of the war, however, he went back with the greatest eagerness to the work of the Concilium, and in 1920, made a visit to the United States for the purpose of arousing again the interest in the project and securing the necessary financial support. Encouraged by his reception, he returned to Switzerland confident that a new era of opportunity

for himself and the Concilium had opened. But though his sudden and unexpected death has taken him away from this work, no one can believe that men of science will be so lacking in foresight and so blind to their own interests that the great work which he did and the institution which he founded will be permitted to perish.

Field displayed constantly a deep devotion to principles and while easy to work with and ready to yield where the matter in question was only a difference of opinion, he stood like a rock when what he regarded as fundamental issues were at stake. When the project of preparing a general bibliography of science was developed by the Royal Society of London, backed with large subsidies and immense prestige through its official governmental affiliations, the directorship was offered to Field through Sir Michael Foster. It was, however, set as a *condicio sine qua non* that the decimal system of notation should be abandoned in favor of another employing Latin titles. After careful consideration, Field felt that this was a step backward and would introduce confusion. Consequently, he declined the post despite its alluring features. It is interesting to note that despite the immense resources at the disposal of the Royal Society it never published an annual bibliography anything like as complete as that issued by the Concilium and the references came regularly also a year late. So determined was the opposition to his project, however, that pressure was brought upon universities abroad to bring them to cancel subscriptions to the Concilium, and representations were even made to the Smithsonian Institution and to private foundations in this country that the Royal Society regarded it as an unfriendly act to extend help to the Zurich enterprise. In England, Manchester University protested against this attitude and with characteristic independence the *Manchester Guardian* came out in vigorous defense of the Concilium. In this country, Professors Henry Fairfield Osborn, E. L. Mark, C. B. Davenport, and G. H. Parker were vigorous in their defense of the methods and results

of the work done by the Concilium. The American Association for the Advancement of Science made for many years a contribution to the work of the Concilium which, despite the doubts of some members, was taken from the research fund at the urgent request of a large body of working zoologists who asserted emphatically that this institution and its work were the most valuable single adjunct to investigation at the command of the American investigator.

His work won recognition for Field from many sources. He was honorary assistant of the Museum of Comparative Zoology at Cambridge, Mass., trustee of the International Institute of Bibliography at Brussels, Belgium, editor of the *Bibliographia Zoologica*, fellow of the American Association for the Advancement of Science, and had been elected to honorary membership in a long list of prominent scientific societies.

He was married in 1903 in London to Nina Eschwege, who with their four children is still living in Zurich. Two brothers and a sister are residents of Brooklyn.

Few men have devoted themselves so incessantly and unselfishly to the service of others. If he had withdrawn in his own laboratory and had concentrated on his individual researches his unusual mental endowment would unquestionably have produced conspicuous results. He chose rather to devote himself to the improvement of conditions for his fellow workers. He threw himself into this work with all the powers at his command and what he accomplished has been of inestimable service to a multitude of workers.

HENRY B. WARD

UNIVERSITY OF ILLINOIS

#### SCIENTIFIC EVENTS

##### WINTHROP ELLSWORTH STONE

THE Associate Alumni of the Massachusetts Agricultural College through their executive committee has adopted the following minute:

Winthrop Ellsworth Stone, an honored member of the class of 1882 of the Massachusetts Agricultural College and since 1900 President of Pur-