whose personal charms have endeared him to two generations of students. His views are that a methodical, mechanical bibliochretic survey cramps his imagination, that it often turns him from profitable paths of research, that he has never been able to duplicate exactly any one's results and, finally, that to him the never-ending joy in scientific work is in finding something he did not know before, even though it might have been found previously by many other workers. Few of us can attain to his heights. As time goes on and the various fields become more and more thoroughly worked over, genius will find it increasingly difficult to assert itself.

It seems to us that the attitude of mind of the man who can achieve continuous research success without using the literature systematically is susceptible to further analysis. He has a profound knowledge of his specialty and he keeps in touch with current progress, although in a desultory fashion. His self-confidence is maintained by his achievements as well as by his grasp of the field. He can therefore plan new work by visualization with reasonable accuracy. Self-satisfaction with his procedure comes to him through his success.

All of us sympathize with this attitude, but it is more than questionable whether it should be encouraged as a matter of general practice. The position of the scientist in the world has changed; he is no longer an unimportant person following the vagaries of researchful imagination, but an important factor in the economic life of a country. Neither industrial laboratories nor research institutions would subscribe to the view that a scientist has fulfilled his duty if he gratifies his personal curiosity by rediscovering old facts merely because he has been too unsystematic to search the literature.

An aspect of bibliochresis seldom emphasized is that, in the hands of a specialist endowed with imagination, trends in research can be analyzed and forecasts can be made with a reasonable degree of probability. The worker can avoid fields in which, from a survey of the literature, it appears that too many groups of workers are engaged to give promise of marked success if he starts in, far behind, to catch up with the others. On the other hand, a particularly keen man can sometimes perceive an important goal which the mass of workers have been too preoccupied to see.

The scientist, scorner of riches though he may be, almost invariably has a certain respect for the acumen and enterprise of the successful business man. The world of affairs, on the other hand, although somewhat awed by the researcher, usually regards him as impractical. It is somewhat paradoxical that the great strides made in business practices during the present generation are in large measure due to the introduction of the scientific method into managemental procedure. Library research has played an important part in all such changes.

Nor has scientific management been neglected by the industries based on science. Before the war there were few persons who could qualify, for example, as chemical economists, but in this respect other fields of management were no further advanced. Now we find in every branch of industry economic surveys of unsurpassed excellence, and the technique of collecting and analyzing such important data is advancing continuously.

Organization is characteristic of the age. All human activities are becoming more and more a matter of coordinated regulation. The dietetically chosen food we buy on a budget plan from a chain store has been systematically approved by city, state and national health officers; it has been distributed, with or without intermediaries, to the retailer according to his calculated sales volume by the manufacturer, who has prepared its reception by scientifically executed advertising; it has been transported over railroads whose interrelations are controlled by governmental regulation based on economic reasoning; the raw materials were selected by means of standardized tests; even the ultimate producers are now being more and more firmly knit together by the economic necessity for management on scientific principles.

The same spirit of organization hovers over the research laboratory, which creates such products. The haphazard methods of the inventor will experience increasing difficulty in competing with organized research, both in pure and applied science. As the literature increases, more and more critical studies will be required, and still larger research units will be obliged to correlate their efforts to avoid duplication. It is not the time to urge less use of the library, but to encourage research workers to follow the literature as never before.

OBITUARY

STEPHEN ALFRED FORBES—A TRIBUTE

ON March 13 Professor Stephen Alfred Forbes passed away at Urbana, Illinois, after a brief illness. His end was no doubt hastened by the death of his wife, which occurred on January 24. Despite his eighty-six years, Dr. Forbes was active until within a few days of the end and at the time was the oldest servant of the state of Illinois, which he had served

in varied capacities for some sixty years. In his lifetime he had done distinguished work as a soldier, teacher, administrator and researcher such as to command recognition not only at home but also in scientific circles in this country and abroad as well.

Stephen Alfred Forbes was born on a farm in Stevenson County, Illinois, on May 29, 1844. He was of Scottish ancestry, his forbears having come to America before 1660 and his greatgrandfather having been a soldier in the Revolutionary War. When the Civil War broke out he, then a lad of seventeen, enlisted in September, 1861, in the Seventh Illinois Cavalry as a private and was promoted rapidly until made a captain at twenty years of age. While carrying dispatches in 1862 he was captured and spent four months in prison. After a three months' hospital term recuperating from the illness acquired in prison he rejoined his command and served to the end of the war. It was a source of great delight to hear the story of those days when on rare occasions he could be persuaded to relate to younger friends some of his experiences in the field.

Dr. Forbes's interest in nature was no doubt innate but was stimulated in early life by the contact with woods and wild life along Silver Creek, a beautiful stream near his home. The opportunity for formal education was not given there at that time, and the death of his father when he was only ten years old threw added difficulties in his way so that he enjoyed but a brief period of study at Beloit Academy. However, in his early years he was enamored of languages, and by private study he had learned to read French, Spanish and Italian before the war broke out. He took up the study of Greek while in prison.

At the close of the war his mind turned at once to education and he entered immediately on study at Rush Medical College, where he almost completed the course in medicine. But a change of plans led him to teach school in southern Illinois. His own studies in natural history ardently pursued at the same time led in 1870 to the publication of his first scientific articles in the *American Entomologist and Botanist.*

Through the attention attracted by these articles Forbes was named in 1872 curator of the Museum of the State Natural History Society at Normal, Illinois, the seat of the then most prominent educational institution in the state. Three years later he was appointed instructor in zoology at the normal school. In 1877, when the present State Museum was established at Springfield, the Normal Museum, which had become the property of the state, was made the Illinois State Laboratory of Natural History, and Forbes was appointed its director. In 1884 he was called to Urbana as head of the department of zoology and entomology in the young and rapidly developing state university. The State Laboratory of Natural History was transferred by legislative enactment to the University of Illinois, and he remained director until in 1917, with a revision of the state code, it became the Illinois Natural History Survey and he was appointed its chief. This position he held at the time of his death. He was also state entomologist from 1882 to 1917, when the position was merged in the survey. Under his hands the work grew in volume and power until at present it has a staff of fourteen permanent workers and numerous other helpers.

Though carrying large extra time-consuming responsibilities in these state positions he discharged educational duties in the university of major importance. From 1884 to 1909 he was in charge of both entomology and zoology, and after that head of the department of entomology alone until his retirement as emeritus professor in 1921. He served also as dean of the College of Science from 1888 to 1905, and until his retirement was retained by the university senate as chairman of the important committee on university educational policy. He brought about the introduction of natural history into Illinois schools and of laboratory study in its secondary school curriculum.

Despite these heavy official duties, he found time to answer special calls for public service in other directions. At the time of the Chicago Exposition in 1893 he prepared an extensive exhibit of the natural history of Illinois, he served as director of the aquarium and exhibit of the U. S. Fish Commission, and as chairman organized the National Congress of Zoologists held in connection with the exposition. Locally, his influence was steadily exercised in behalf of significant movements. Chief among these ranks the establishment of the Champaign County Tuberculosis Sanatorium, a movement organized and despite serious obstacles carried to a successful outcome under his leadership. Only two years ago the Urbana Association of Commerce had presented him with a special testimonial "in recognition of long, faithful and brilliant public service."

It would be impossible to enumerate here all the civic and scientific organizations at home and abroad in which he held membership or those which had bestowed upon him honorary membership. He joined the American Association early, having been secretary of the section on zoology in 1883, and was also for many years a member and officer of the leading entomological societies. He was a charter member of the Illinois Academy of Science, which had already planned to pay him special honor at the coming meeting to be held in Urbana, May 2. The National Academy of Sciences and the American Philosophical Society had also elected him to membership. A more

recent honor was his selection in 1928 as an honorary member of the Fourth International Congress of Entomologists. Among academic honors may be recorded his election to Phi Beta Kappa and Sigma Xi.

Since retiring from active participation in the work of the university, Dr. Forbes has devoted his attention exclusively to the State Natural History Survey and has built up an organization which is widely recognized for its scientific work. The outstanding feature of the work of the survey has been a study of the biological resources of the state. While still teaching he directed an important series of theses on the freshwater organisms to furnish a basis for the accurate determination of the forms present in Illinois. He himself contributed two magnificent volumes on the fishes of the state, as well as a host of other contributions in the form of reports and discussions of the fauna of Illinois rivers. In fact, his chief work was the elaboration of those relations between organisms and the environment which constitute the basis of the new and rapidly growing field of ecology. In cooperation with his assistants in the Natural History Survey, extensive studies were made of the aquatic organisms of the Illinois River and to him we owe an accurate picture of the changes produced in that stream by the construction of the Chicago drainage canal and the diversion of the current of the Chicago River into the basin of the Illinois River. Because of his work the Illinois River has been declared the best-known stream in the world.

The scientific work of Professor Forbes was diverse in character and conspicuous in all its varied aspects. His publications, which number more than five hundred, cover topics in entomology, ornithology, ichthyology, limnology, ecology and other phases of biology. In many directions he opened up new lines of work and nowhere did he handle his subject in mere routine fashion. The generally high character of his writing was early recognized, and in 1886 the Société d'Acclimatation de France awarded him its premier medal for his scientific publications. His series of eighteen entomological reports contains an immense volume of carefully amassed data regarding the insects of Illinois in their relation to the welfare of the state and includes also extensive studies on methods of combating their attacks which have served to protect the agricultural interests of the state and to profit its workers. While directly useful in a practical way, these reports have embraced also much work of high scientific value. He will always be looked upon as the first and the leading worker in America on aquatic biology. When he started on his studies of freshwater organisms the inland waters of our country were practically unknown. He was the first man to write on the fauna of the Great Lakes, and to contribute to a knowledge of the food of fishes, a fundamental piece of work for the proper understanding of the factors concerned in solving questions that are involved in the preservation of our commercial fisheries.

Starting at an early date with studies on the food of birds, Dr. Forbes conducted for many years observations on the bird life of Illinois, so well planned and executed that the survey has given an accurate conception not merely of the species occurring in the state, but also of their frequency and exact distribution, which together form a basis for a conception of their true value to agriculture and in the conservation of natural resources also.

The career of Dr. Forbes was unique in several ways. First of all he had enjoyed very little formal education. Unaided he gained command of languages to an extent very unusual in his day and age. He never received a bachelor's degree, and yet Indiana University, under the leadership of David Starr Jordan, granted him the Ph.D. degree on examination and the presentation of a thesis. While teaching he carried on studies in natural history, which were independently developed not merely in a single field but in several to an extent that made men speak of him as the first economic entomologist in America, as the leader in the study of aquatic biology and as the founder of the science of ecology. He was not only a pioneer in these and other fields, but one whose pioneer work laid out intuitively the roads to be followed in future cultivation of those fields. Finally, it was no chance matter that though a pioneer in many new fields he never dropped back as the field opened up and the workers became many. He was always at work and his mind was strong enough and clear enough to grow *pari passu* with the growth of the field, so that in later days he still led the workers engaged there. He maintained his alertness and mental vigor to the last.

In all his writings he manifested a beauty of style that made them unusually appealing, an accuracy of statement that gave them reliability and a keenness of analysis that stimulated the reader and student to mark out his own research along productive lines. He ranks not only as the greatest of Illinois naturalists, but among the few leading students of natural history which our country has produced.

Personally, Dr. Forbes was a man six feet in height, of powerful build, and he walked with a firm military bearing. His speech was quiet and unassuming, his voice clear and pleasant. Before an audience he appeared at ease, and without effort spoke with power enough to reach and hold the largest group in interested attention. While an indefatigable worker, he still had many general interests in life and

found time to be the president of the first golf club organized at the university. Later in life driving an automobile was his favorite pastime, and he often chuckled at a comment on his arrest for speeding on his eightieth birthday. He was married in 1873 to Clara Shaw Gaston, whose death only a few weeks ago was a heavy blow to him. His son, Dr. E. B. Forbes, of State College, Pennsylvania, has already achieved distinction in science. Three daughters also survive, Mrs. B. R. Herring, of Chicago; Mrs. F. W. Scott, of Boston, and Miss Winifred Forbes, of Berkeley, California.

HENRY B. WARD

UNIVERSITY OF ILLINOIS

SCIENTIFIC EVENTS

THE UNIVERSITY FILM FOUNDATION OF HARVARD UNIVERSITY

THERE has been established at Cambridge a University Film Foundation, by the aid of a gift made last fall by Mr. John D. Rockefeller, Jr. The foundation is able to make completely both silent and talking films in their plant. A sound-proof studio has been installed, and in connection with it a complete sound-on-film recording equipment, loaned to them by the R. C. A. Photophone. The studio could serve as a center for radio broadcasting, since the acoustic treatment it has received fits it for this purpose.

In addition, the foundation is installing a disc-recording machine which will be employed for transferring the sound-on-film to discs, so that the films will be available with both methods. This machine can be used for making phonograph records and records for broadcasting.

A well-equipped laboratory has been built for developing and printing the films, both standard-width and 16-millimeter size. Mr. Rockefeller's gift has also enabled the provision of more adequate working quarters, editorial rooms and offices for the staff.

During the past six months the foundation has nearly doubled its staff, which now numbers more than twenty persons. In addition to a personnel with college background, specially trained for production and editorial work, the foundation has specialists, such as a sound-engineer, projectionists and a laboratory man.

With this staff and equipment the foundation stands in a position where it can apply modern inventions and technical processes to educational methods. Already, with its previous limited facilities, the foundation has made a large number of educational films in a number of fields. By last September, after one year of existence, the foundation had released twenty reels of films in the fields of geography, biology, anthropology and the fine arts.

The foundation is about to start making a photographic record of eminent professors and personalities connected with the university. This is in line with their work on the Harvard Film, a general descriptive film of the university which they completed last year. That film was, however, silent, and the new films will be talking films. It is planned not only to record the professors' speaking, but also to show them illustrating their experiments and making demonstrations of scientific materials. A talking film on Massachusetts history, with Professor Albert Bushnell Hart depicting the development of the commonwealth, is now all but completed.

THE U. S. PUBLIC HEALTH SERVICE

A BILL for the reorganization of the U. S. Public Health Service has passed both houses of Congress and now goes to the President. Another bill has just been passed by the Senate, but has not yet been passed by the House, providing for the creation of a National Institute of Health, which would greatly expand the facilities for health work by the U. S. Public Health Service. A system of fellowships and provision for accepting donations for special work, such as research work on cancer, is a part of this National Health Institute plan.

Science Service reports that the Jones bill provides for putting the federal health service on a basis which will make it one of the best public health services in the world. There will be more regularly commissioned public health officers and a better chance for a young man in the service to look for promotion. A number of those now under the civil service would be given commissions. The bill aims to put all the public health work of the government departments under one coordinated management as well as to increase the number and kind of commissioned public health officers. Among the provisions of the bill are:

1. That whenever some branch of the government wishes to carry on a public health activity, the Secretary of the Treasury shall detail officers and employees from the Public Health Service to cooperate and direct the work.

2. Whenever special health problems should be studied and certain research or educational institutions have facilities for this study, the Surgeon-General may detail health officials and scientists from his staff to take up their quarters in such laboratories and work there.

3. Great expansion of the Hygienic Laboratory in the District of Columbia.