Several of the relations mentioned in the kinematic description can be derived without introduction of new empirical constants, which relations have been verified by observations. An important consequence is that of the equivalence between mass (matter) and energy. Since motion is dependent upon space-time structure, which in its turn is dependent on matter, it must of necessity be relative to matter or rather to the metrical field associated with matter. By arbitrary transformations of coordinates we can introduce new acceleration fields, which are identical with gravitation fields, except that they are not associated with matter. For an *actual* freely moving observer the actual field equations must be used, and we then always find matter associated with the acceleration fields.

(To be concluded)

OBITUARY

WILLIAM PATTEN

STILL vigorous and actively engaged in scientific research at the age of 71, Dr. William Patten suddenly and peacefully passed away at Hanover, New Hampshire, on October 27, 1932. He had just returned from an expedition to the Baltic Island of Oesel, Esthonia, where during the summer with a large corps of workmen he had exhumed and shipped to Dartmouth College a large collection of primitive fossil fishes, chiefly small, delicate Ostracoderms. It had been a successful expedition, and he felt that, after three seasons of intensive work, the region visited had been thoroughly explored.

His enthusiastic, day-and-night application to the preliminary survey of his fossils was too strenuous. Six days before his death a painful heart attack struck him down. He rallied and hoped soon to return to his work, when suddenly, by coronary thrombosis, the end came.

Born at Watertown, Massachusetts on March 15, 1861, the youngest son and next to the youngest child in a family of 14 children, his bent toward zoology was shown, even before he entered the Lawrence Scientific School of Harvard University, by his interest in ornithology and anatomy. While in college he paid his expenses in part by work at taxidermy and the illustration of scientific books. As a freshman he won the Walker Prize of the Boston Society of Natural History by a paper on the "Myology and Osteology of the Cat," work which had been done mostly before entering college.

Professor E. L. Mark, under whom he studied zoology at Harvard, found him a brilliant student, independent and energetic. He was also under Professor Shaler's stimulating influence. His perennial interest and skill in athletics was shown by his position as catcher on the Watertown baseball team; his love of music by his membership as a tenor in the Harvard College choir and glee club.

He received the B.S. degree in 1883, was awarded a Parker traveling fellowship and married Mary Elizabeth Merrill, of Bradford, Massachusetts, who became his lifelong companion.

Studying at the University of Leipzig under the distinguished zoologist, Leuckart, he received the degree Ph.D. at the end of the first year (1884). Two years of research followed, first at the Zoological Station at Trieste, then at Naples. Returning to America in 1886, he was for three years assistant to Dr. C. O. Whitman at the Allis Lake Laboratory at Milwaukee. His son, Dr. Bradley Merrill Patten, associate professor of histology and embryology at the Western Reserve University School of Medicine, was born at Milwaukee in 1889. From 1889 to 1893 William Patten was professor of biology at the University of North Dakota.

Coming to Dartmouth College as professor of biology in 1893, he brought with him a strong urge toward research. Soon there were graduate students working under his instruction on *Limulus* and arachnid embryology. While teaching comparative anatomy of vertebrates and embryology, which he did for 25 years, he organized a course centered about organic evolution.

Desirous of contacts with younger students, he undertook in 1920–21 the organization and became the director of the freshman course in evolution, which he conducted with the cooperation of several associates until his retirement from teaching in June, 1931, at the age of 70, at which time he received from Dartmouth the honorary degree of Sc.D.

His scientific publications between 1884 and 1889 were upon the embryology of insects (Phryganids) and mollusca (*Patella*) and upon the eyes of mollusks and arthropods, described in extensive papers with clear and beautiful illustrations. From 1889 to 1900 his work centered about the king crab, *Limulus*, especially its nervous system and embryology. The first statement of the theory which dominated his later research, "On the Origin of the Vertebrates from Arachnids," appeared in the *Quarterly Journal of Microscopical Science* in 1889. This hypothesis was also elaborately developed and illustrated with a wealth of new observations in his book, "The Evolution of the Vertebrates and Their Kin," published in 1912.

Since 1900 his numerous papers have followed two quite different lines, paleontology of primitive fishes,

the Ostracoderms, and those on social philosophy. The latter were the outcome of the idea that harmonious cooperation is a necessary factor in evolutionary progress, which he developed in his book, "The Grand Strategy of Evolution; the Social Philosophy of a Biologist," published in 1920. That year he organized the freshman course in evolution at Dartmouth, in which he at first used this as a text-book but later wrote and published for the use of his students a series of pamphlets in which his social philosophy was further developed and various principles of biology were discussed.

As a paleontologist he scoured the world for new material. Seven summers between 1902 and 1914 were spent in field work and collection of fossil fishes in northern New Brunswick, a search which extended into Newfoundland and Labrador and was the source of the fine collection of *Bothriolepis* at Dartmouth College, of which he made an exhaustive study.

In search of scorpions and other arachnids, he visited, with Mrs. Patten in 1912, New Guinea, Australia, Java, and sought the far-eastern representative of *Limulus* in Japan. In 1912 he traveled in Costa Rica and Cuba. During the last seven years of his life he made in all four trips to the Baltic countries after ostracoderms, and in 1925 went on to Spitzbergen.

With extraordinary talent as an artist, he had an artist's impulsive temperament and keen imagination. Infinitely patient in the search for structural details of an organism, he never failed to find in these facts a meaning. To him *Bothriolepis,* for example, was no mere fossil, but the embodiment of a cherished ideal, a link between two great phyla. Fortunately, he found this primitive fish so perfectly preserved that it needed no restoration but awaited only patient, skilful investigation and an interpretation.

His tenacity of purpose was unflinching; he attacked his work with the vigor and strategy of a general at war, almost fiercely. Never dependent upon others for ideas, he occupied himself very little with the discoveries of his predecessors, but pushed on independently, boldly. His thought was stimulating, whether one agreed with him or not.

The importance of harmonious cooperation as a *sine qua non* to evolutionary and social progress, brought out in his book, "The Grand Strategy of Evolution," appealed to him as a fresh discovery, for he was emphatically a rugged individualist.

But this philosophy, as he dwelt upon it, probably had more than a little to do with the development of that genial, friendly spirit which was always latent in him, even at that earlier period when he went fiercely to his work.

A fine physique and fondness for outdoor and indoor games kept him perennially young. Still a graceful figure skater at 70, it was his great delight in winter to teach his neighbors' daughters to waltz upon the ice. At carnival competitions his services as judge were always in demand.

He was never more happy than when explaining his work to those who showed interest and appreciation; it was a pleasure to follow the progress of his anatomical and paleontological research, presented with drawings and plastic models of remarkable clearness and beauty.

An independent, original thinker and stimulating teacher, he seemed at 70 still at his prime. His scholarship expanded and ripened with advancing years; grim determination gave way to broader human sympathies. A many-sided, vigorous, imaginative thinker, he had the vision and talent of an artist and sculptor, combined with extraordinarily keen and infinitely painstaking powers of observation.

JOHN H. GEROULD

SCIENTIFIC EVENTS

THE HARVARD ANTHROPOLOGICAL SURVEY OF THE IRISH FREE STATE

HARVARD anthropologists have begun a five-year study of the Irish Free State. They hope to include in it surveys of the social and economic life of the Irish people of the present and the past, their material civilization and their racial characteristics. These researches will be correlated in an attempt to produce some sort of scientific interpretation of the Irish nation.

In the summer of 1931 two experts were sent to Ireland to make a preliminary survey in order to determine the most suitable areas for the concentration of research and to ascertain whether such a study would be welcomed by the Irish people. The project was cordially received by all classes and parties and this year has been accorded the official approval of the President of the Irish Free State.

County Clare has been selected as the focus of sociological research because it seems to blend most typically the new and old strata of Irish Gaelic culture, being neither over-modernized nor ultra-conservative. During the past year, Conrad Arensberg, a graduate student in anthropology at Harvard, has been preparing himself for sociological work in Ireland by studying at the National University. This summer W. Lloyd Warner, assistant professor of sociology in Harvard University, began with the help of Mr. Arens-