science and the unrest, the bravado that is so ill-disguised, of what some call 'life.' Science knows that it does not know, that it can not know, that even conscious man has always moving within him another relation to his world than that of knowledge; and life, as apart from knowledge, shows that it does not live. So again I say that the real danger of positivism, of a blind or forgetful positivism, is that the naturalistic or scientific point of view and the volitional point of view will not interfere with each other. Certainly within the laboratory and the study to keep them apart, to separate theory and experiment, would be fatal to both; the life that we call science needs their constant interference, and with every one of its experiments shows that they are not as incongruous as they seem; but what is the world, if not a great laboratory that is related to the smaller as real life to the theater, as nature to the conservatory, as an unaided vision to the microscope?

Agnosticism is another name for positivism. The positivist, the devotee of pure, objective, special science, cannot but believe in an unknowable, and this belief, in its turn often forgotten, needs always to be recognized as a part, a very important part, of the scientific consciousness, for it is only one other way in which thought conserves its universe. Thus the unknowable, whether seen as compensating for science's aloofness from life or for the dreaming that specialism induces, is a constant safeguard against the abuse of knowledge.

The unknowable is a negative that bears constant witness, not to another sphere which some mind quite different from our own might consciously comprehend, and which we, being intellectually outside, and so only creatures of faith, can merely blindly will, but to another relation than that of mere knowledge, which we *as knowing creatures* have to reality. There is, in short, an unknowable for the single reason that to know is also to will. Or, again, the unknowable is not for knowledge, but for action.

Let us be blindly scientific, insisting on science being only for science's sake, recognizing nothing as worth while but great learning about a Greek particle or a minute insect or a mysterious element, and like a dark cloud there arises and spreads over our view the unknowable, and from this cloud a voice comes: "Only the All is and the All is One and the One is not for knowledge." But as we apply our science, breaking through the walls of specialism, and liberating the will that was for the time their not unwilling prisoner, the sky clears. The one is not for knowledge, but for life; knowledge is not for knowledge, but for will, its natural fulfillment. "The end of man is action, not thought, though it were the noblest."

Alfred H. Lloyd.

TRUMAN HENRY SAFFORD.

A long, active, busy life, devoted without reserve to teaching, to research, to cares of family—such a life of science as that which closed on June 12, in Newark, cannot receive adequate appreciation in the brief space available here. But the friendship of years crowding one upon another will not let pass in silence the death of Truman Henry Safford. A few words of personal sorrow demand immediate expression; leaving a more complete summary of his life's tribute to astronomy to await dignified publication in the annals of those learned societies of which he was a distinguished member.

The friendship of years is no light thing. It was in the latter part of 1884 that Safford paid his first visit to the modest observatory of Columbia College, then situated in 49th Street, N. Y. He found there a stripling engaged in testing a level. The

youngster noticed a kindly face appearing in the doorway; conversation began about the level—and from that day on, no year has passed without the interchange of friendly visits between Safford and the writer of these words. Often and often have we sat far into the night in his 'den' at Williamstown, our talk always of astronomy and its masters. And well he knew the masters, ever recommending and emphasizing that they be studied at first-hand, not through editorially emasculated translations and editions. Gauss was an especial favorite; for Safford was first of all a teacher, and believed that mathematical instruction should always include concrete examples, especially numerical ones. The 'Theoria Motus,' with its endless ramifications of trigonometrical applications and its orbit computations, was beloved by him both for personal reading and as a text for his students. Bessel's works, even those less frequently read, like the 'Tabulæ Regiomontanæ,' he had at his fingers' ends. Text-books attracted him less. He did not use Chauvenet's astronomy, that *vade mecum* of the younger generation; it is doubtful if he owned a copy.

Indeed, a rich fund of anecdote might be collected to illustrate Safford's lovable quaintness of character. One of the cherished dreams of his life was his plan of an extended visit to Europe, its astronomers, observatories and places of historic or scenic interest. Circumstances always prevented this voyage; yet, though he was never abroad, he possessed a most intimate acquaintance with foreign countries. Few Londoners could equal his knowledge of the geography of their city. The interminable intricacies of its streets he had studied from maps until, as his friends said, he could have found his way anywhere without a guide. 'Bradshaw,' the incomprehensible British railway time-table, was an unsealed book to him. A copy was always close at hand in his library at Williamstown, and he was never tired of extracting from it new and difficult railway problems with their solutions, to the huge amusement of his family and friends.

This ungratified longing for foreign travel showed itself in still another amusing way. On the occasions of his visits to New York, he would often go to parts of the city frequented by foreigners, and afterwards entertain his friends with odd experiences, especially in the foreign restaurants. On one occasion, in the year of the Chicago Exposition, it fell to Safford to act for a day as *cicerone* in New York to two distinguished Englishmen, one a professor, the other an admiral. All three returned from their day delighted; it had been passed at an island much liked by excursionists. Here Safford had discovered, to his great glee, a place called *Klein Deutschland*, and could imagine himself for the moment in Germany. Afterwards, it always gave him indescribable enjoyment to talk of this trip, and especially how acquaintance had been made with a man who insisted on explaining the men-of-war lying in the Brooklyn Navy Yard, and was even led on to go a little into astronomy. Neither the two professors nor the admiral made known to their informant that they had even so much as heard of stars or ships before. Safford had an inexhaustible love for the humorous and the quaint; to those who knew how to understand him, he could be most entertaining. He was passionately fond of music, and could appreciate the best.

But we must not give too much space to those characteristics which attracted his friends so strongly, to the neglect of that which the world of science owes him. Born January 6, 1836, at Royalton, Vt., he showed already in his early boyhood the extraordinary arithmetical powers which distinguished him through life; for he could

at all times multiply mentally very large numbers, knew off-hand the multiplication table to 1,000, and most of the logarithmic tables to three figures. At fourteen he is said to have calculated a cometary orbit, and he graduated from Harvard at eighteen. For some years he was observer at that university under Bond, and for a short time was acting director. In 1865 he took charge of the Chicago Observatory, where he began as his serious work the observation of one of the *Astronomische Gesellschaft* zones. But his work was cut short and his position lost through the great Chicago fire. He then entered Wheeler's astronomical survey in the far West, and worked during several years for the government scientific bureaus of Washington. It was not until 1876 that he finally settled down for life as professor of astronomy in Williams College, Williamstown, Mass.

Here was done his principal work, which related especially to star positions and star catalogues. He made an elaborate discussion of all existing observations of the stars most suitable for determining geographical latitudes in the United States. This resulted in a catalogue of 2018 stars, which was published by the Engineer's Department, U. S. Army. Later, he made a similar catalogue of 612 stars, and upon it has been based the new boundary between the United States and Mexico. This was published in the report of the Mexican Boundary Commission, Washington, 1898. Safford built at Williamstown a meridian observatory which is a model of its class. In it he installed a Repsold circle, with which he made extensive observations of the close polar stars. He liked these stars especially, and the unusually lengthy numerical calculations connected with them did not frighten him. He needed no observing list, as his memory never failed to give him the instrumental setting for each of his beloved polars in every possible position of his instrument. These polar observations were collected and published by him in the 'Williams College Catalogue of North Polar Stars.'

But all this work belongs to a class important to pure science, though comparatively uninteresting to the general public; for Safford possessed especially that kind of devotion which can give generously to science without hope of public notice. More striking, perhaps, was his confident prediction in 1861 of the minute unseen companion of the bright star Sirius. Basing laborious calculations on the tiny irregularities in existing observations, he was able to show just where the little *comes* must be. And there it was found in January, 1862, by Alvan Clark, of Cambridgeport, Mass., while he was testing the 18-inch glass now mounted at Evanston, Ill.

Safford was a frequent contributor to astronomical and educational publications, and a member of many learned bodies. The Royal Astronomical Society, of London, honored him with an election as associate in 1866, when he was but thirty years of age. Great as were his abilities in astronomy, he was yet at his best as a teacher. Those who came under his influence at Williamstown can bear witness to this; his ablest pupils profited most from his stored learning, and some from among them are laboring for astronomy today. He was a loving and dearly loved husband and father. To him were granted these priceless blessings: a devoted wife, a united family, a few time-tested friends. A man of genuine piety, the conflict of science and religion had no terrors for him. He knew that no such conflict exists; that the foundations of belief rest not upon ponderous tomes of logic, but on simple faith. Such faith he had, as of a little child; and, like a child asleep, so shall God's acre rest him.

Harold Jacoby.